The 11th

IFEA

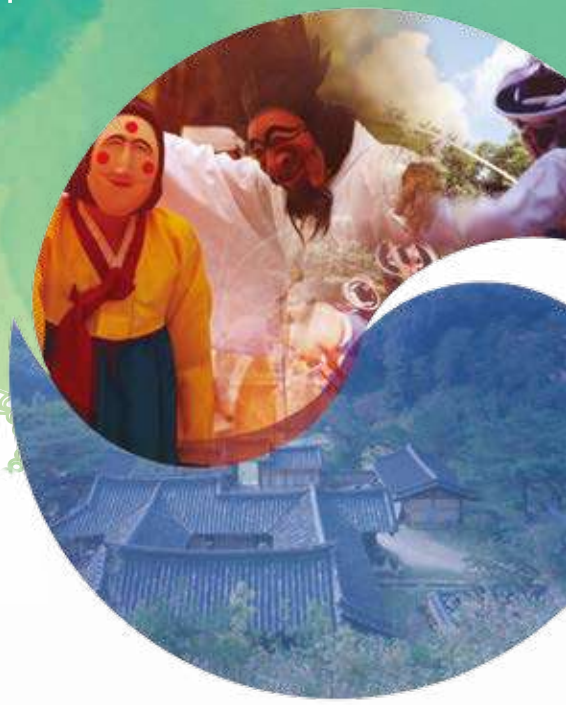
World Endodontic Congress

2018 Seoul

October 4|Thu| **-7**|Sun|, 2018

Coex, Seoul, Korea

www.ifea2018korea.com



PROGRAM & ABSTRACT BOOK

Supplement of Endodontics & Dental Rehabilitation

In conjunction with the 2018 Korean Academy of Endodontics Scientific Congress and the 15th Joint Scientific Meeting between JEA and KAE.

2018 IFEA SEOUL KOREA
The 11th World Endodontic Congress

IFEA International Federation of Endodontic Associations

KAE Korean Academy of Endodontics

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*compared to WaveOne®

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October 4-7, 2018**
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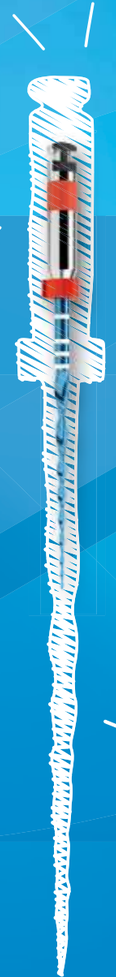
Same cutting efficiency and simplicity of use



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만곡근관 커버리지 확대

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2018 IFEA
SEOUL KOREA
The 11th World Endodontic Congress

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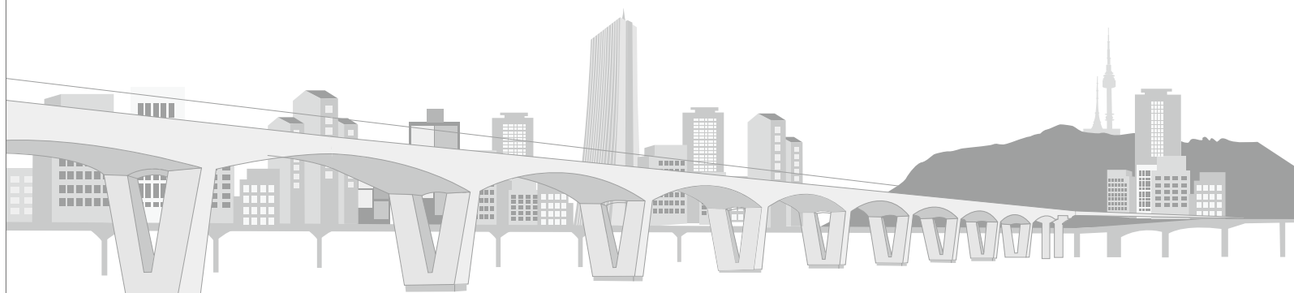
CONTENTS



PROGRAM AT A GLANCE

Time axis: 7:30, 8:00, 8:30, 9:00, 9:30, 10:00, 10:30, 11:00, 11:30, 12:00, 12:30, 13:00, 13:30, 14:00, 14:30, 15:00, 15:30, 16:00, 16:30, 17:00, 17:30, 18:00, 20:00

October 4 (Thu)

Room: Auditorium | R1 | R2 | Hall E3+4 | Hall E5 | Hall E6 | Hall E1 | Hall E2 | Hall D1

- 7:30 Registration
- **Auditorium:** 9:30–10:30 Invited Lectures 1 (Seung Jong Lee); 11:00–12:00 Invited Lectures 2 (Nobuyuki Tani-Ishii); Lunch & Learn (BL); 13:30–14:30 Invited Lectures 3 (Tara Mc Mahon); 15:00–16:10 Invited Lectures 4 (Samuel O. Dorn); 17:30–20:00 Opening Ceremony & Welcome Reception
- **R1:** OP 1; OP 3; OP 5; OP 7; OP 9
- **R2:** OP 2; OP 4; OP 6; OP 8; OP 10
- **Hall E3+4:** Free Lectures 1; Free Lectures 2; Free Lectures 3; Free Lectures 4
- **Hall E5:** CRS 1; CRS 3; CRS 5; CRS 7; CRS 7
- **Hall E6:** CRS 2; CRS 4; CRS 6; CRS 8; CRS 8
- **Hall E1:** Hands-on Martin Trope (FKG); Hands-on Franck Diemer (MM)
- **Hall E2:** Master class Sergio Kuttler (Dentsply Sirona); Master class Cliff Ruddle (Dentsply Sirona)
- **Hall D1:** Declaration of the IFEA WEC 2018; Exhibition & Poster Exhibits
- 10:30–11:00 Coffee break(Hall D1)
- 14:30–15:00 Coffee break(Hall D1)

October 5 (Fri)

Room: Auditorium | R1 | R2 | Hall E3+4 | Hall E5+E6 | Hall E1 | Hall E2 | 205 (2F) | Hall D1

- 7:30 Registration
- **Auditorium:** Invited Lectures 5 (Gianluca Plotino/ Nick Grande); Invited Lectures 7 (Ghassan Yared); Lunch & Learn (MM); Invited Lectures 9 (Sergio Kuttler); Invited Lectures 11 (Yoshitsugu Terauchi); Invited Lectures 13 (Martin Trope)
- **R1:** OP 11; OP 13; FL 6; FL 7; FL 8
- **R2:** OP 12; OP 14; OP 15; OP 16
- **Hall E3+4:** CRS 9; CRS 10; CRS 11; CRS 12
- **Hall E5+E6:** Invited Lectures 6 (Eudes Gondim Jr.); Invited Lectures 8 (Antonis Chaniotis); Invited Lectures 10 (Hagay Shemesh); Invited Lectures 12 (Franck Diemer); Invited Lectures 14 (Filippo Cardinali)
- **Hall E1:** Hands-on Martin Trope (FKG); Hands-on Sung Geun Cho (MM)
- **Hall E2:** Master class Cliff Ruddle (Dentsply Sirona)
- **205 (2F):** Hands-on Ghassan Yared (VDW)
- **Hall D1:** Exhibition & Poster Exhibits
- 10:30–11:00 Coffee Break(Hall D1) / Poster Presenation
- 14:30–15:00 Coffee Break(Hall D1) / Poster Presenation

October 6 (Sat)

Room: Auditorium | R1 | Hall E3+4 | Hall E5+E6 | Hall E1 | Hall E2 | 205 (2F) | Hall D1

- 7:30 Registration
- **Auditorium:** Invited Lectures 15 (Mo K. Kang); Invited Lectures 17 (Syngcuk Kim); Lunch & Learn (Ray); Invited Lectures 19 (Cliff Ruddle); Invited Lectures 21 (Anil Kishen); Invited Lectures 23 (Asgeir Sigurdsson)
- **R1:** General Assembly Meeting / AGM
- **Hall E3+4:** Free Lectures 9; Free Lectures 10; Free Lectures 11; Free Lectures 12; Free Lectures 13
- **Hall E5+E6:** Invited Lectures 16 (Frank Setzer); Invited Lectures 18 (Zvi Metzger); Invited Lectures 20 (Paul Abbott); Invited Lectures 22 (Gustavo De-Deus); Invited Lectures 24 (Gianluca Gambarini)
- **Hall E1:** Hands-on Jung Hong Ha (MM); Hands-on Antonis Chaniotis (Coltene)
- **Hall E2:** Master class Cliff Ruddle (Dentsply Sirona)
- **205 (2F):** Hands-on Jenner Argueta (Meta Biomed); Hands-on Jenner Argueta (Meta Biomed)
- **Hall D1:** Exhibition & Poster Exhibits
- Coffee Break(Hall D1) / Poster Presenation
- Coffee Break(Hall D1) / Poster Presenation
- Gathering Time 17:00-17:30
- 18:00–20:00 Gala Dinner (Floating Island, Han River)

October 7 (Sun)

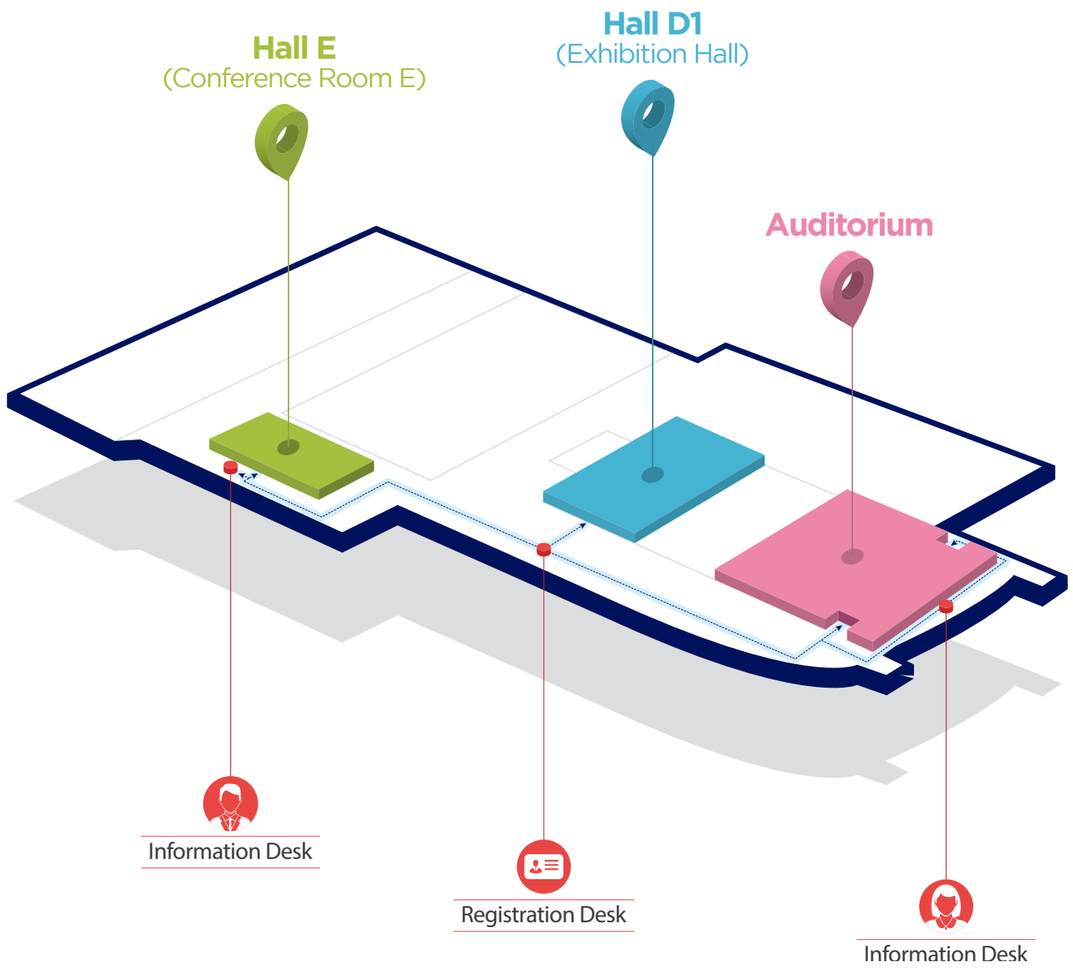
Room: Hall E3+4 | Hall E5+E6 | Hall E1 | Hall D1

- 7:30 Registration
- **Hall E3+4:** Live Endo; Live Endo (Discussion); Coffee Break (Hall D1); Special Lecture
- **Hall E5+E6:** Invited Lectures 25 (Andreas K. Braun); Coffee Break (Hall D1); Invited Lectures 26 (Francesco Maggiore); Invited Lectures 26 (Yosef Nahmias); Lunch; Invited Lectures 27 (Ibrahim Abu Tahun); Invited Lectures 27 (Michael Solomonov); Invited Lectures 27 (Ahmed Abdel Rahman Hashem); Closing Ceremony
- **Hall E1:** Hands-on Jenner Argueta (Meta Biomed); Coffee Break (Hall D1)
- **Hall D1:** Exhibition & Poster Exhibits

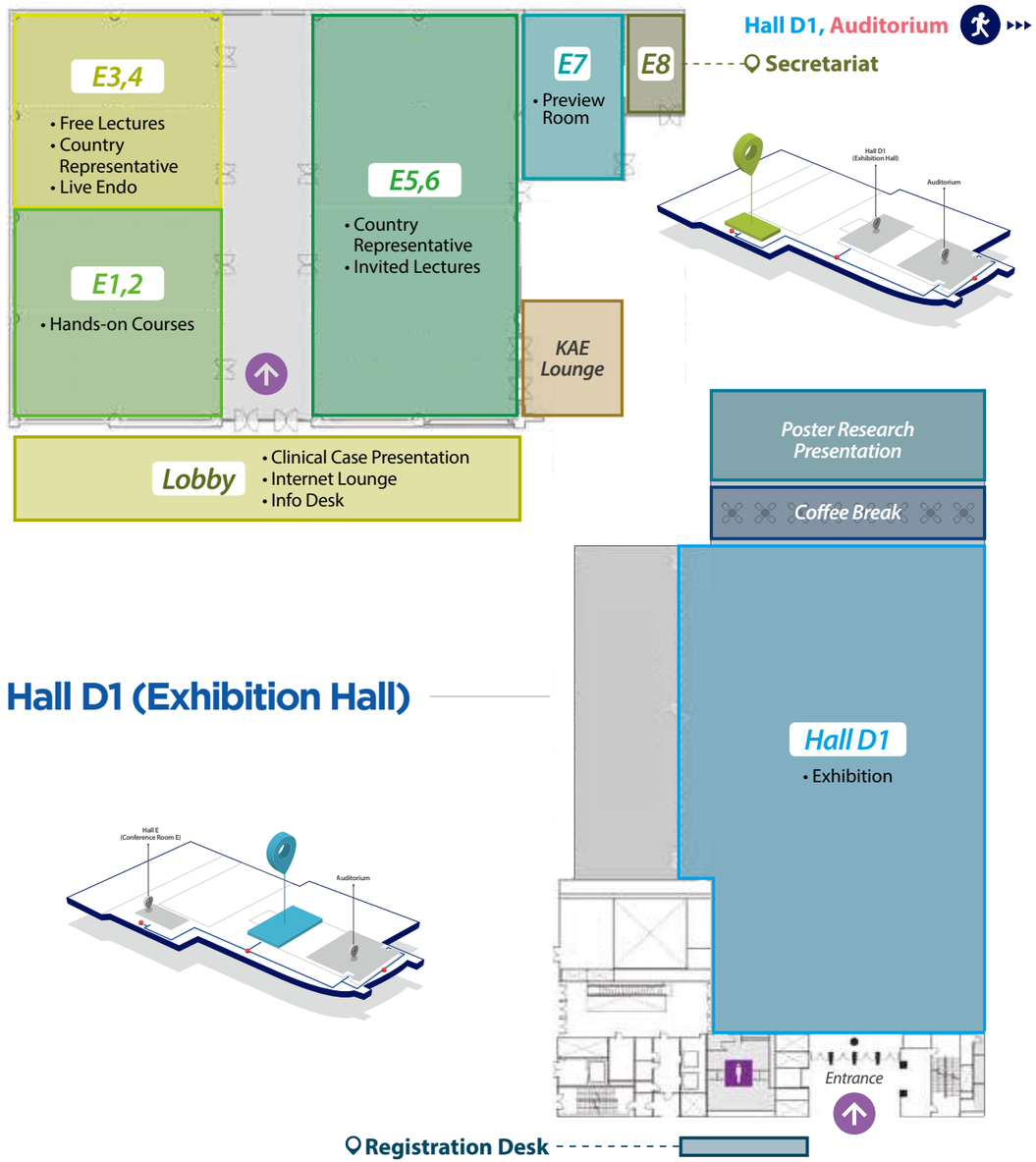
Legend:
- Instrumentation
- Interdisciplinary
- Minimal Invasive Endodontics
- Regenerative Endodontics
- Solving Problem
- Surgical Endodontics
- Trend in Endodontics
- Country Representative Speakers (CRS)
- Korean Session
- Free Lectures (FL)
- Oral Research Presentations (OP)

Floor Plan

3F, COEX

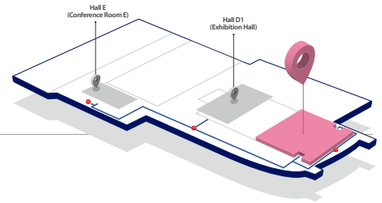


Hall E (Conference Room E)



Hall D1 (Exhibition Hall)

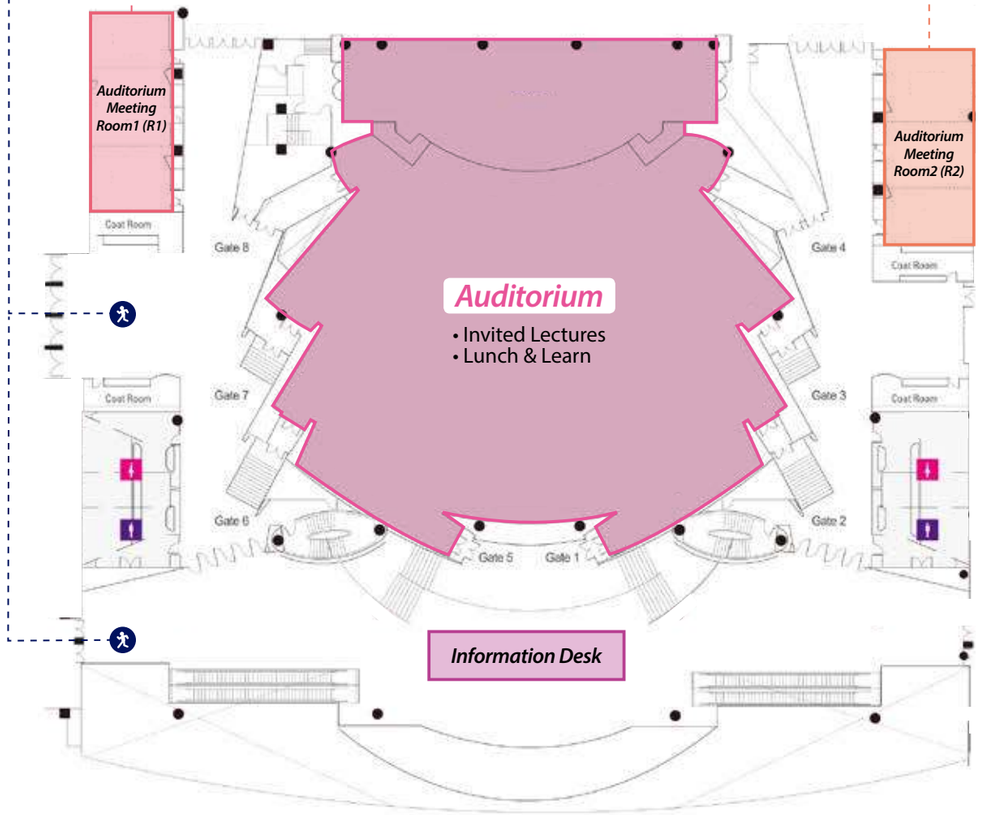
Auditorium



Hall E
Hall D1

Auditorium
Meeting Room1(R1)
- Oral Research Presentations
- Free Lectures
- General Assembly

Auditorium
Meeting Room2(R2)
- Oral Research Presentations



Welcome Messages

President of IFEA

Dr. Mark F Wotzke

President
International Federation of Endodontic Associations

Welcome to the IFEA 11th World Endodontic Congress 2018, Seoul, Korea.

Dear Colleagues,

It's with much pride that I invite all dentists worldwide interested in the field of endodontics, and endodontists to the IFEA 11th World Endodontic Congress in Seoul, Korea on October 4-7, 2018.

The Congress host, The Korean Academy of Endodontics, has a most enthusiastic and esteemed Organising Committee chaired by Professor Euiseong Kim, with Professor Hyeon-Cheol Henry Kim as chair of the Scientific Committee. The Congress will feature renowned international speakers, both clinicians and researchers, and introduce the emerging endodontic stars from IFEA member countries, ensuring a stimulating, varied and enriching program to benefit all delegates.

By participating in this Endodontic Congress, you will be at the forefront of world endodontic practice. However, this is also a rare opportunity for you and your family to engage with the warm, welcoming hospitality of the Korean people, their age-old customs and fascinating history. A history that has shaped this high tech vibrant city and formed its cutting-edge architecture. The Congress venue (COEX) is testament to Seoul's commitment to providing state of the art facilities. By staying a little longer, you can further expand your horizon. Korea's serenely beautiful countryside awaits to share with you her wonderful cuisine and wealth of culture. An opportunity too good to miss.

The 11th World Endodontic Congress promises to inspire you, update your endodontic knowledge and hone your endodontic skills. It shall also be a life experience that you will very fondly remember – however, only if you are there!

So, I very much look forward to sharing the wonderful experiences of this Congress with you in Seoul, October 2018.

Congress President of The IFEA WEC 2018 Seoul Organizing Committee

Dr. Euiseong Kim (Andy)

Congress President, Local Organizing Committee
Yonsei University College of Dentistry

Dear Colleagues,

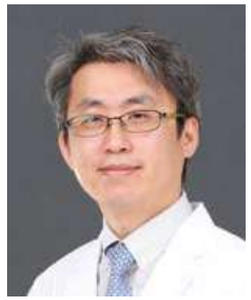
On behalf of the organizing committee of the IFEA WEC 2018, I am delighted to welcome all delegates and their guests to the 11th IFEA World Endodontic Congress in Seoul, Korea, October 4th-7th, 2018.
The LOC would like to express our deepest appreciation to the endodontic societies from all over the world which promoted the Seoul congress, which resulted in the participation of 2000 registrants. We would also like to thank our distinguished invited speakers who shared their time and knowledge to make this congress the most fruitful and substantial in its history.

This congress is intended as a forum to share opinions and meet experts in the many areas of endodontic dentistry as well as encourage communication and collaboration with colleagues from all over the world. We hope you can actively participate in this meeting by interacting with colleagues old and new.

While you are here I recommend that you explore some of Korea's rich and varied cultural attractions — palaces, mountains, shopping, food and people. Fall is the best season in which to visit Korea. As the temperature drops and the trees transition into beautiful shades of yellow, orange and red, nearly every part of the country is a picture-perfect scene which you wouldn't want to miss.

Once again, I would like to thank each and every one of you for attending and contributing your expertise to this prestigious congress.
I wish you a very enjoyable and entertaining stay in Seoul.

Congress President of The IFEA WEC 2018 Seoul Organizing Committee



Dr. Hyeon-Cheol Kim (Henry)

Scientific Director, Local Organizing Committee
Pusan National University School of Dentistry

Dear Friends and Colleagues,

It's been almost two years since the local organizing committee of the IFEA 11th WEC 2018 Seoul formed. With the congress just around the corner, I'm looking back on these days we've been through. As the representative who made the presentation at the competition to host the congress, I can vividly recall the feelings I've had from experiencing failure and success.

The Korean Academy of Endodontics were eager to host the world biggest Endodontic congress and we tried twice to host the IFEA WEC. And finally and actually we won the bid to host the 12th congress, planned for 2022.

Meanwhile, the IFEA World Endodontic Congress was changed to a biennial congress, and Istanbul, where the 11th congress was to be held in 2018, was unable to host the congress. Korea had the opportunity to host the IFEA 11th WEC 2018 in Seoul.

We devoted two years to attracting the congress and another two years to preparations and organization it after it was decided.

Thanks to the dedication and hard work of local organizing committee members in their fields, from Andy Kim, the president of LOC, on, the number of member countries of IFEA also increased, and we are about to hold the biggest congress ever.

I believe this congress will not only enhance the position of the Korean endodontic society, but it will also become the center of academic exchange within the world of endodontics.

I want to express my sincere gratitude to my endodontic friends all over the world for your enthusiastic cooperation and support.

I would like to start the festival of endodontic treatment with all the member countries celebrating that the IFEA 11th WEC 2018 is held in Seoul, Korea, a country of culture, passion, kindness, and world-class endodontics.

Welcome to WEC in passionate Korea

Congress Overview

About Congress

○ The IFEA 11th World Endodontic Congress Overview

Main Theme	Endodontics: The Utmost Values in Dentistry
Dates	Oct. 4 (Thu) – 7 (Sun), 2018
Venue	COEX convention center, Seoul, Korea
Participants	Approx. 2,000 attendees from 64 countries
Number of Exhibitions	58 Countries, 98 Booths
Hosted by	International Federation of Endodontic Associations (IFEA)
Organized by	The Korean Academy of Endodontics (KAE)
Official Language	English
Official Website	www.ifea2018korea.com
Facebook	www.facebook.com/ifea2018korea

Local Organizing Committee

○ Host Society

Korean Academy of Endodontics (KAE) is pleased to host the IFEA 11th World Endodontic Congress. Since its founding in 1991, the KAE have hold Spring and Fall scientific meetings every year and published the semestral scientific journal 'Endodontics and Dental Rehabilitation' for collaboration in dental research and contributing to clinical dentistry, especially in endodontics.
The KAE has participated in the Korean-Japan joint scientific meeting of Endodontics every year and hold the Asian-Pacific Endodontic Confederation in 2013.

○ Local Organizing Committee

Congress President		
	Euiseong Kim	Professor, Yonsei University

Scientific Committee		
Director	Henry Hyeon-Cheol Kim	Professor, Pusan National University
Associate Director	Miri Kim	Associate Professor, University of Ulsan
	Kyung-San Min	Professor, Chonbuk National University
	Yun-Chan Hwang	Professor, Chonnam National University
	Minju Song	Assistant Professor, Dankook University

Financial Committee		
Director	Woocheol Lee	Professor, Seoul National University
Associate Director	Won-Jun Shon	Associate Professor, Seoul National University
	Seok-Woo Chang	Associate Professor, Kyunghee University
	Bin-Na Lee	Assistant Professor, Chonnam National University
	Sunil Kim	Assistant Professor, Yonsei University

Sponsorship & Exhibition Committee

Director	Jin-Woo Kim	Professor, Gangneung-Wonju National University
Associate Director	Se-Hee Park	Associate Professor, Gangneung-Wonju National University
	Sung-Baek Choi	Private Practice, Pastel Dental Clinic
	Jung-Hong Ha	Assistant Professor, Kyungpook National University
	Hyoung Hoon Jo	Assistant Professor, Chosun University

Promotion Committee

Director	Su-Jung Shin	Associate Professor, Yonsei University
Associate Director	Mi Kyung Yu	Professor, Chonbuk National University
	Pyung-Sik Kim	Private Practice, Chois Dental Clinic
	Yoon Lee	Associate Professor, Yonsei University
	Min-Seok Seo	Associate Professor, Wonkwang University
	Ji-Hyun Jang	Assistant Professor, Kyunghee University

Social Program Committee

Director	Il-Young Jung	Professor, Yonsei University
Associate Director	Dong-Ryul Shin	Private Practice, Luden Dental Clinic
	Sung-Eun Yang	Associate Professor, Catholic Univeristy
	Sang-Won Kwak	Assistant Professor, Pusan National University
	Sin-Yeon Cho	Faculty, National Health Insurance Ilsan Hospital

Executive Advisor

	Dong-Sung Park	Professor, Samsung Medical Center

President-elect IFEA

	Luke Sung-Kyo Kim	Professor, Kyungpook National University

Venue

○ Convention Center

The Coex Center is comprised of four stories above ground with a total of 36,007㎡ of exhibition space and a floor area of 460,000㎡. It also presents an attractive destination for overseas visitors not only in terms of its convention and exhibition facilities and in-house services, but also in the many cultural assets and tourist amenities on-site and nearby such as SM Town K-Pop experience zone, Coex Mall, and the Bongeunsa Buddhist Temple.

Address	COEX, 159 Samseong dong, Gangnam-gu, Seoul 135-731, South Korea
Telephone	02-6000-0114
Homepage	http://www.coex.co.kr/index.asp
Convenient facilities	Coex Mall, Art Hall, Aquarium, Megabox Theatre, Bookstore, Kimchi Museum and so on.

Bongeunsa

SM Town

Coex Mall

Aquarium

Congress Information

On-site Information

Registration

Place : Exhibition Hall D1 Lobby
Operating Hours : Oct. 4(Thu)-Oct. 7(Sun), 07:30-18:00

The registration desk is located in the lobby of Exhibition Hall D1. Credit cards and cash are the only forms of payment accepted for on-site registration. If registering in the trainee or post-graduate student category, valid proof of status must be presented at the time of registration. The registration desk will be open throughout the Congress.

Participant		Accompanying Person
· Access to all Scientific Sessions · Access to Exhibition Hall · Congress Kit · Program and Abstract Book · Coffee Breaks	· Lunches · Welcome Reception · Opening/Closing Ceremony	· Access to Exhibition Hall · Coffee Breaks · Lunches · Welcome Reception · Opening/Closing Ceremony

• Name badges will be used as passes in all aspects of the Congress. Please wear your name badge throughout the Congress. Please note that admission to the scientific session rooms is strictly limited to registered participants wearing their badges. If you lose your name badge, ask the registration desk for a replacement.

NEW Certificate of Attendance Printing Service

All participants may receive a certificate of attendance on-site. Please visit the pre-registration desk after lunch (13:00-18:00) and then scan the QR code on your name badge. Each attendee's certificate of attendance will be available for printing.

○ Congress Kit

The Congress kit will be given to each fully registered participant at the designated kit desk. Each kit contains an important congress program, abstract book, and others materials. The kit desk will be located near the registration desk.

○ Hotel / Tour Desk

For questions or to receive assistance regarding Congress hotel reservations (for official Congress hotels only) as well as the tour program, please visit the hotel and tour desk next to the registration desk.

○ Information Desk

Place : Hall E Lobby / Auditorium Lobby

If you have any inquires or need assistance, please find the information desk, and if you have to sign for the CDE credits, please visit the information desk located in the auditorium lobby.

Preview Room

Place : Hall E7
Operating Hours : Oct. 4(Thu)-7(Sun), 07:30-18:00

Each invited speaker and presenter are highly encouraged to check in and submit their PowerPoint presentations and materials to ensure that everything is satisfactory. We highly recommend that you visit the Preview Room two hours before your lecture. Two hours will be necessary to verify presenter participation and inform everyone of any last-minute instructions or changes concerning the sessions.

- If your presentation file contains animations or video clips, you are advised to carefully review all your materials and the technical setup at least three hours prior to your session.
- Please bring your PowerPoint presentation file with you on a USB memory stick so that edits and updates can be made easily.

Mobile App

Step1 Download "IFEA World Endodontic Congress"

1. Scan this QR code or search for "IFEA World Endodontic Congress" in the Apple App Store or Google Play Store.
2. INSTALL and OPEN the app, then "SEARCH" for "IFEA 2018"
3. CLICK to launch.

Step2 Log in to the IFEA 2018 event app.

New Users: Click **'Create Account'** and enter the event code below. Enter your name and email address to create an account and log in to the app. **Event Code: IFEA2018**
If you have already created an account, click 'Log in' and enter the password that was emailed to you.

Step3 Take notes on presentation slides

Find the presentation you need and interact with the presentation by drawing on slides or highlighting text. Use the note-taking mode to type your notes next to each slide. Notes are housed in the "Online Personal Summary" website. Click My Notes and then Access My Notes to launch that website or click Email my Notes to have the URL emailed to you.

No mobile device? No problem.
As long as you have an internet connection, you can take notes on presentations through your laptop via this link: **http://tinyurl.com/IFEA2018App**

Free Wi-Fi

Wi-fi service will be available at the COEX. Please connect your mobile device to "COEX Free Wi-fi" from the list of available networks.

Internet Lounge

Place : Hall E Lobby

Four laptops with internet connectivity will be available. You may charge your mobile phone here.

Secretariat Office

Place : Hall E8
Operating Hours : Oct. 4(Thu)-Oct. 7(Sun), 08:00-18:00

Prayer Room

Place : Hall E
Operating Hours : Oct. 4(Thu)-7(Sun), 07:30-18:00

The prayer room can be found on the 3rd floor of COEX. Separate rooms for men and women are available.
To accommodate daily prayer schedules, the room is open from 07:30 to 18:00.
Other tools for prayer, including a Qibla, clocks, Qu'rans, and carpets are available.

First Aid Service

Staff will be available at the registration desk from 07:30 to 18:00 on each day of the Congress to provide first aid, and on the first floor near the West Gate, COEX operates a medical room to provide immediate assistance with medical emergencies from 10:00 to 18:30.

Coffee Breaks

Place : Hall D1 (Exhibition Hall)
Operating Hours : Oct. 4(Thu)-5(Fri) AM 10:30-11:00 / PM 14:40-15:10
Oct. 6(Sat) AM 10:30-11:00 / PM 14:20-14:50
Oct. 7(Sun) AM 10:00-10:30 / PM 15:00-15:30

Lunch & Learn

Place : Auditorium
Operating Hours : Oct. 4(Thu)-Oct. 6(Sat) 12:20-12:50

Place : Hall E
Operating Hours : Oct. 7(Sun) 12:20-12:50

Lunch boxes will be provided for registered participants. Please come to the lobby and submit a lunch coupon to receive your lunch from the staff. Lunch coupons are in your name badge. If you have any special dietary needs, please line up along the signs.

Simultaneous Interpretation

Place : Auditorium
Operating Hours : Oct. 4(Thu)-Oct. 6(Sat)

Place : Hall E3+E4
Operating Hours : Oct. 7(Sun) 12:20-12:50 **Korean ➡ English only*

Simultaneous interpretation – English to Korean, Chinese, and Japanese – will be provided at Auditorium only.

Hands-on Courses

If you would like to attend the hands-on courses, please come to the registration desk and ask the staff whether there are any remaining spaces available.

CDE Credits

Participants who have already applied for CDE credits need to sign each sign-in roster in order to receive CDE credit for the lectures they register to attend. Please come to the information desk in front of the auditorium lobby. If there is no signature on the sign-in roster of your attended session, you will NOT be able to claim CDE credits.

After the congress, participants will receive an email to complete the Congress evaluation (this is required to receive CDE credits). Upon completing the evaluation, you will receive a second email with a link to your credit letter.

This continuing education activity has been planned and implemented in accordance with the standards of the ADA Continuing Education Recognition Program (ADA CERP) through joint efforts between the University of Texas School of Dentistry at Houston PACE Center and the Continuing Dental Education and International Federation Endodontic Association.

Didactic session attendants can earn a maximum of 13.87 lecture credit hours. The AGD Code: 070 Endodontics and 200 Orofacial Pain.

Social Events

IFEA WEC 2018 GRAND OPENING & RIBBON CUTTING CEREMONY

Place Hall D1 Lobby (3F, COEX)
Date & Time Oct. 4(Thu) 09:00-09:30

Be a part of the grand opening celebration.

OPENING CEREMONY & WELCOME RECEPTION

Place Auditorium & Auditorium Lobby (3F, COEX)
Date & Time Oct. 4(Thu) 17:30-20:30
Dress Code National attire is encouraged

All participants are welcome. Mingle with old friends and new at the reception.

GALA DINNER

Don't miss out on this fantastic opportunity. Enjoy the beautiful saturday night scenery along the Han River flowing through the heart of Seoul.

Date & Time Oct. 6(Sat) 18:30-20:30
Location Floating Island at Han River (Sebitseom)
Gathering Time 17:00-17:30 at the North Gate of COEX (1st Floor, Grand Ballroom Lobby)

Last coach will depart at 17:30. Please do not forget to bring your entrance ticket. Tickets will be issued at the registration desk along with your name badge.

Morning Walk

Let's walk Seonjeongneug!

Start your day with a refreshing walk in this beautiful and peaceful area.

Gathering Time 06:30 at the Inter Continental Seoul Coex lobby
Date & Time Oct. 6 (Sat) 06:30-08:30

It houses the burial mounds of the Joseon Dynasty's King Seongjong, his wife Queen Jeonghyeon, and their son King Jungjong. It takes only an hour to explore, and you will absolutely love it.

Other Meetings

Board of Directors Meeting

Date & Time Oct. 5(Fri) 10:00-14:00
Place Conference Room 206(North), Coex 2F

IFEA AGM (Annual General Meeting)

Date & Time Oct. 6(Sat) 13:00-16:30
Place Auditorium Meeting Room1(R1), Coex 3F

Useful Information about Korea

Banks / ATM (Automated Teller Machines)

Banks are open Monday through Friday from 9am to 4pm. ATM service is typically available until 10pm, although some ATMs offer service after 10pm with additional fees.

Climate

The climate in Seoul in October ranges approximately **between 17-20 degrees.**

Credit Cards

VISA, MasterCard and JCB are accepted at establishments throughout Korea. **AMEX** is also accepted at some major hotels and department stores.

Currency Exchange and Taxes

- **Currency** : The unit of the Korean currency is the Won (₩). Coin denominations are ₩10, ₩50, ₩100 and ₩500. Banknotes are ₩1,000, ₩5,000, ₩10,000 and ₩50,000.
- **Tax** :Value-Added Tax (VAT) is levied on most goods and services at a standard rate of 10% and is included in the retail price. In tourist hotels, this 10% tax applies to rooms, meals and other services and is included in the bill.

Electricity

In Korea, 220 volt outlets are common. But please check the power supply before use, because some hotels provide 110 volt outlets for the convenience of their customers.

Emergency Numbers

Dial 119 for the fire department and medical assistance, and 112 for the police. A hotel staff or hotel manager can arrange for a doctor or an ambulance in an emergency (though most Korean operators speak little or no English).

Liability and Insurance

The Organizing Committee will take no liability for personal injuries sustained by, or for loss or damage to property belong to meeting participants, either during or as a result of the meeting. It is, therefore, advised that participants arrange their own personal health, accident and travel insurance.

Phone Calls to Seoul

The country code for Korea is +82 and the area code for Seoul is 2. For example, to call 1234-5678 or 010-1234-5678 from the US, one must dial: 011 (US exit code)-82-2-1234-5678 or 011(US exit code)-82-10-1234-5678.

Telephone Calls

For international calls, first dial the international dialing code (001, 002 or 008), then the country code, followed by the area code, and then the phone number. You can rent a cell phone at the airport.

Time Differences

Korea's standard time zone is **GMT +9 hours.**

Tipping

Tipping is not customary in Korea. Sometimes, expensive restaurants and luxury hotels may add a service charge of 10%. Thus, you do not necessarily have to prepare for extra charges since it will be included in the bill.

Exhibition

Sponsors Acknowledgements

The IFEA WEC 2018 congress organizing committee would like to express their gratitude to all those who have generously contributed and actively participated to make this Congress happen.

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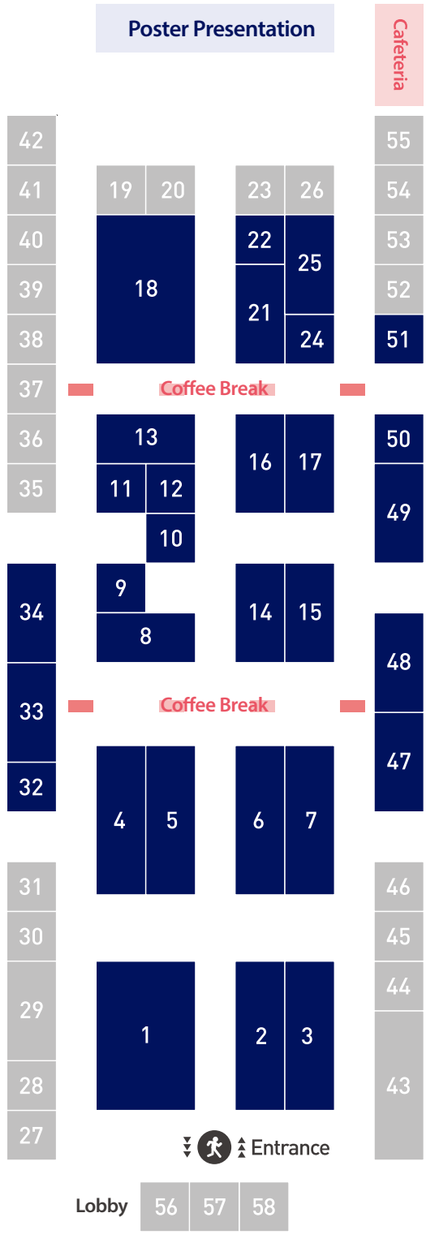

*Company name in alphabetical order.

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Paul Abbott
University of Western Australia
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Filippo Cardinali
Private Practice
Italy

Franck Diemer
Toulouse Dental Surgery's University
France

Eudes Gondim Jr.
Associação Paulista dos Cirurgiões Dentistas (APCD)
Brazil

Mo K. Kang
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Ghassan Yared
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Andreas K. Braun
Academic Centre for Dentistry Amsterdam (ACTA)
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Hagay Shemesh
Academic Centre for Dentistry Amsterdam (ACTA)
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Ibrahim Abu Tahun
University of Jordan
Jordan

Martin Trope
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Country Representative Speakers

Liliana Artaza
Argentina

Gus Jang
Australia

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Brian Jafine
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Dorothee Louis Olszewski
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Iraq

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Jordan

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Prof. Sangwon Kwak	Republic of Korea	Prof. YeonJee Yoo	Republic of Korea
Prof. Yoon Lee	Republic of Korea	Dr. Tai Cheol Yoon	Republic of Korea
Dr. Tara Mc Mahon	Belgium		

Scientific Program

○ Day 1 (October 4, Thursday)

Invited Lectures 1 - The 15th Joint Scientific Meeting between JEA and KAE				*Auditorium*
Chairperson		Samuel O. Dorn, USA		
09:30-10:30	IS-001	Are the viable cells the only predictor for delayed replantation?	Seung Jong Lee	Republic of Korea
Country Representative Speakers 1				*E5*
Moderator		Yoon Lee, Republic of Korea		
09:20-10:00	CR-001	New perspective in clinical monitoring of pulp &/or periapical status and outcomes of therapy "Potential role of molecular markers"	Ghada ElHilaly Eid	Egypt
10:00-10:40	CR-002	CBCT in Endodontics: How and Why	Roberto Fornara	Italy
Country Representative Speakers 2				*E6*
Moderator		Seungho Baek, Republic of Korea		
09:20-10:00	CR-010	Management of the open apex – Challenges and treatment strategies	Garry Myers	USA
10:00-10:40	CR-011	3R – Retrograde Root-canal Retreatment	Amir Weissman	Israel
Free Lectures 1				*E3+E4*
Moderator		DongHoon Shin, Republic of Korea		
09:30-10:00	FL-001	Performance of electronic apex locators in 3D-printed tooth models	Sin-Yeon Cho	Republic of Korea
10:00-10:30	FL-002	Bone regeneration of endo-perio lesion following combined endodontic and periodontal treatment approach: A case report	Rio Suryantoro	Indonesia
Oral Research Presentations 1				*R1*
Moderator		Sangwon Kwak, Republic of Korea		
09:30-09:45	OP-001	Relationship between dentinal defects and endodontic chemo-mechanical instrumentation: A cadaver study using Micro-CT	Vui Tan	Australia
09:45-10:00	OP-002	Investigation of intracanal moisture conditions on closure property of four root canal sealers	Hantang Sun	China
10:00-10:15	OP-003	Comparison of apical transportation & centering ability of ProGlider, Path File & G File using CBCT – An in vitro study	Padmini Chandrasekhar	India
10:15-10:30	OP-004	Cyclic fatigue resistance of Hyflex controlled memory nickel - Titanium files after two different types of heat treatment	Vasfiye Isik	Turkey
Oral Research Presentations 2				*R2*
Moderator		Endang Suprastiwi, Indonesia		
09:30-09:45	OP-022	SEM & TEM analysis of MTA monoblock canal obturation and long term outcomes	Jun Sang Yoo	Republic of Korea
09:45-10:00	OP-024	The effect of chitosan nanoparticle as a final irrigation solution on the micro-hardness of root canal dentin	Diatri Nari Ratih	Indonesia
10:00-10:15	OP-025	Analysis of interleukin-1β expression in inflamed rat dental pulp after capped with trigona sp. propolis from Indonesia	Ardo Sabir	Indonesia
Hands-on Course - FKG				*E1*
09:30-12:30	HC-101	Anatomically Directed Endodontics	Martin Trope	USA
Masterclass - Dentsply Sirona				*E2*
10:00-12:00	HC-102	The importance of technological advancements for the improvement of outcomes in your practice	Sergio Kuttler	USA
10:30-11:00		*Coffee Break*		*Hall D1*
Invited Lectures 2 - The 15th Joint Scientific Meeting between JEA and KAE				*Auditorium*
Chairperson		Chan-Ui Hong, Republic of Korea		
11:00-12:00	IS-002	Non-surgical retreatment of cracked teeth	Nobuyuki Tani-Ishii	Japan

Country Representative Speakers 3				E5
Moderator		Soram Oh, Republic of Korea		
11:00-11:40	CR-003	The use of CBCT and microscope for diagnoses, treatment and follow up of root resorption	Elena Lipatova	Russian Federation
11:40-12:20	CR-004	Technological Innovations in endodontic practice	Bun San Chong	UK
Country Representative Speakers 4				**E6**
Moderator		Mark Wotzke, Australia		
11:00-11:40	CR-012	Clinical decision making after instrument separation	Vivek Hegde	India
11:40-12:20	CR-013	Strategic considerations in treatment planning: Deciding when to treat, or extract a questionable tooth	Dorothee Louis Olszewski	France
Free Lectures 2				**E3+E4**
Moderator		Sin-Yeon Cho, Republic of Korea		
11:00-11:30	FL-003	CBCT for detecting vertical root fracture in endodontically treated teeth: How solid is the evidence?	Amir Azarpazhooh	Canada
11:30-12:30	FL-004	The molecular mechanism of MTA-induced biological activities	Jin Man Kim	Republic of Korea
Oral Research Presentations 3				**R1**
Moderator		Hussain Al-Huwaizi, Iraq		
11:00-11:15	OP-005	Evaluation of the smear layer removal and sealer penetration after use of 2 modified sodium hypochlorite solutions	Shalini Aggarwal	India
11:15-11:30	OP-006	Comparative study of apically extruded debris by ProTaper Next (PTN) system and K3 endodontic rotary files	Mannu Vikram	Nepal
11:30-11:45	OP-007	Effect of intracanal medicaments on the push out bond strength of two biocermic root filling materials	Kranthi Raja	Malaysia
11:45-12:00	OP-008	Comparison of single cone, vertical and lateral condensation obturation methods based on radiographic observation	Noor Hafida Widyastuti	Indonesia
Oral Research Presentations 4				**R2**
Moderator		Minseock Seo, Republic of Korea		
11:00-11:15	OP-026	The effect of sodium ascorbate on odontoblast layer of dental pulp after in office bleaching using hydrogen peroxide	Yulita Kristanti	Indonesia
11:15-11:30	OP-027	Accuracy of different electronic apex locators in determination of minimum root perforation diameter	Simay Koc	Turkey
11:30-11:45	OP-028	Antimicrobial activity of herbal extract and oils against common endodontic pathogens using MBC/MIC ratio	Chetana Makade	India
Lunch & Learn - B&L Biotech				***Auditorium***
12:20-12:50	LL-001	Endodontic Microsurgery: Development of instruments and materials	Syngcuk Kim	USA
Invited Lectures 3			**Sponsored speaker*	***Auditorium***
Chairperson		Luke Sung Kyo Kim, Republic of Korea		
13:30-14:40	IS-003	Does heat treated NiTi facilitate endodontic therapy?	Tara Mc Mahon	Belgium
Country Representative Speakers 5				**E5**
Moderator		Catherine Ricci, France		
13:30-14:10	CR-005	Current and future challenges of Regenerative Endodontic Procedures (REP)	Mohammad Hossein Nekoofar	Iran (Islamic Republic of)
14:10-14:50	CR-006	Concept of IDEPS – New way of eliminating bacterial biofilm	Alexandar Koval	Ukraine
Country Representative Speakers 6				**E6**
Moderator		Won-Jun Shon, Republic of Korea		
13:30-14:10	CR-014	Flowable bioceramic materials in endodontics. Clinical application and 3D reality	Saulius Drukteinis	Lithuania
14:10-14:50	CR-015	Cracks in teeth: How to find and manage cracks in teeth with pulp and periapical disease	Gus Jang	Australia

Free Lectures 3				E3+E4
Moderator		Hyeon-Cheol Henry Kim, Republic of Korea		
13:30-14:00	FL-005	Antibacterial action of ultrasonic and laser-activated irrigation in the apical third of root canals	Gary S.P. Cheung	Hong Kong
14:00-14:30	FL-006	Rotate or Reciprocate in the era of heat treatment	Walid Nehme	Lebanon
Oral Research Presentations 5				**R1**
Moderator		Gopi Krishna, India		
13:30-13:45	OP-009	Assessment of the XP - endo Finisher efficacy on cleaning residual fillings from the walls of previously treated canals	Ahmed Elhakim	Egypt
13:45-14:00	OP-010	Comparing the contact percentage, dentin removal and apical debris extrusion of various rotary and reciprocating files	Rajkumar Kothandaraman	India
14:00-14:15	OP-011	Quantitative analysis of dentin resin interface of luted fibre post after active and passive irrigation: A confocal study	Pratima Shenoi	India
14:15-14:30	OP-012	Effectiveness of irrigation techniques on sealer penetration in curved roots	Dilek Helvacioglu-Yigit	Turkey
14:30-14:45	OP-013	Confocal laser scanning microscopic evaluation of the depth of penetration of five root canal sealers	Gaurav Kulkarni	India
Oral Research Presentations 6				**R2**
Moderator		Viresh Chopra, Oman		
13:30-13:45	OP-030	Bioactive glass in endodontics	Tugce Yuca Ozturk	Turkey
13:45-14:00	OP-031	Antibacterial effect of arginine on enterococcus faecalis	Margareta Rinastiti	Indonesia
14:00-14:15	OP-032	Biocompatability of three perforation repair materials	Mohamed Salem	Egypt
14:15-14:30	OP-033	Comparative bioactivity of two bio ceramic indirect pulp capping materials - An ex-vivo study	Aakriti Saini	India
14:30-14:45	OP-034	Effect of resin solvents on the dislodgement resistance of root canal fillings	Gamze Nalci	Turkey
Hands-on Course - Micro-Mega				**E1**
14:00-17:00	HC-103	2Shape: Two files to Shape with a Safe and efficient new innovative file system	Franck Diemer	France
Masterclass - Dentsply Sirona				**E2**
15:00-17:00	HC-104	Featuring Gold Glider & WaveOne Gold	Cliff Ruddle	USA
14:40-15:10		***Coffee Break***		***Hall D1***
Invited Lectures 4				***Auditorium***
Chairperson		Asgeir Sigurdsson, USA		
15:10-16:20	IS-004	Extraction-Replantation: An alternative surgical technique	Samuel O. Dorn	USA
Country Representative Speakers 7				**E5**
Moderator		Marie Antoniette Veluz, Philippines		
15:10-15:50	CR-007	Current trends in endodontology	Serge Bouillaguet	Switzerland
15:50-16:30	CR-008	Challenges of endodontic miscalls	Margaret Tiu	Philippines
16:40-17:20	CR-009	Dynamic activated irrigation: A plus or a must?	Carla Zogheib	Lebanon
Country Representative Speakers 8				**E6**
Moderator		Jung-Hong Ha, Republic of Korea		
15:10-15:50	CR-016	Pain: Etiology, prevention and management in clinical endodontics	Miguel Miñana	Spain
15:50-16:30	CR-017	Healing periapical lesions by non surgical endodontics	Hussain Al-Huwaizi	Iraq
16:40-17:20	CR-018	Therapeutic replantation	António Ginjeira	Portugal

Free Lectures 4				E3+E4
Moderator		Kyoung-Kyu Choi, Republic of Korea		
15:10-15:40	FL-007	Laser-assisted endodontic micro-surgery: Maximum impact, minimum collateral damage and optimal healing	Nguyen Nguyen	USA
15:40-16:10	FL-008	Clinical consideration of antiresorptive drugs in endodontics	Minju Song	Republic of Korea
16:10-16:40	FL-009	Outcomes of vital pulp therapy in permanent teeth with different medicaments: Comprehensive review literature	Abbasali Khademi	Iran (Islamic Republic of)
Oral Research Presentations 7				R1
Moderator		Alper Kustarci, Turkey		
15:10-15:25	OP-014	Accuracy of endoscopes to detect middle mesial root canals branching from coronal third of mesial root canals of mandibular molar teeth	Ali Keles	Turkey
15:25-15:40	OP-015	A 3D finite element analysis on relationship between Mineral Trioxide Aggregate thickness and pulp perforation width	Zeynep Ozkurt Kayahan	Turkey
15:40-15:55	OP-016	Effect of 35% sodium ascorbate on the calcium and phosphorus loss in dentin bleached with 35% hydrogen peroxide	Tunjung Nugraheni	Indonesia
15:55-16:10	OP-017	Lateral thinking in endodontic diagnosis	Rupal Vaidya	India
16:10-16:25	OP-018	The limitations of indications for nonsurgical endodontic retreatment	Burcu Serefoglu	Turkey
Oral Research Presentations 8				R2
Moderator		Yun-Chan Hwang, Republic of Korea		
15:10-15:25	OP-035	Determination of pulp vitality in Oropharyngeal cancer patients undergoing radiotherapy: A clinical study	Sonali Kapoor	India
15:25-15:40	OP-036	Regenerative endodontic protocols in immature teeth should be performed with complete biomechanical preparation	Alicia Caro	Chile
15:40-15:55	OP-037	Lithium containing S-PRG fillers enhanced tertiary dentin formation via Wnt/β-catenin pathway activation	Manahil Ali	Japan
15:55-16:10	OP-038	Stem cells isolated from dental tissues	Fatma Kaplan	Turkey
16:10-16:25	OP-039	Impact of minimal root canal taper on the fracture resistance of endodontically treated bicuspids	Germain Sfeir	Lebanon
Oral Research Presentations 9				R1
Moderator		Kyung San Min, Republic of Korea		
16:55-17:10	OP-020	Smear layer removal in the apical third using four different irrigation systems. FESEM evaluation in an Ex Vivo study	Pietro Palopoli	Italy
17:10-17:25	OP-021	Clinico - histopathological comparison of pulpal changes following direct pulp capping procedures using Endosequence Root Repair, Mineral Trioxide Aggregate and calcium hydroxide – A pilot study	Saravanan Poorni	India
Oral Research Presentations 10				R2
Moderator		Sunil Kim, Republic of Korea		
16:40-16:55	OP-040	Nurturing the nature: A novel approach with PRF in management of deep carious lesions	Vaishali Parekh	India
16:55-17:10	OP-041	Adhesion of pulp stem cells on biomaterials and dentin: Effect of human-derived concentrated growth factor	Tugba Turk	Turkey
17:10-17:25	OP-042	Evaluation of surface integrity of root end cavities prepared using conventional and piezoelectric device – A SEM Study	Sreenath Narayanan	India
17:40-20:30		Opening Ceremony & Welcome Reception		Auditorium

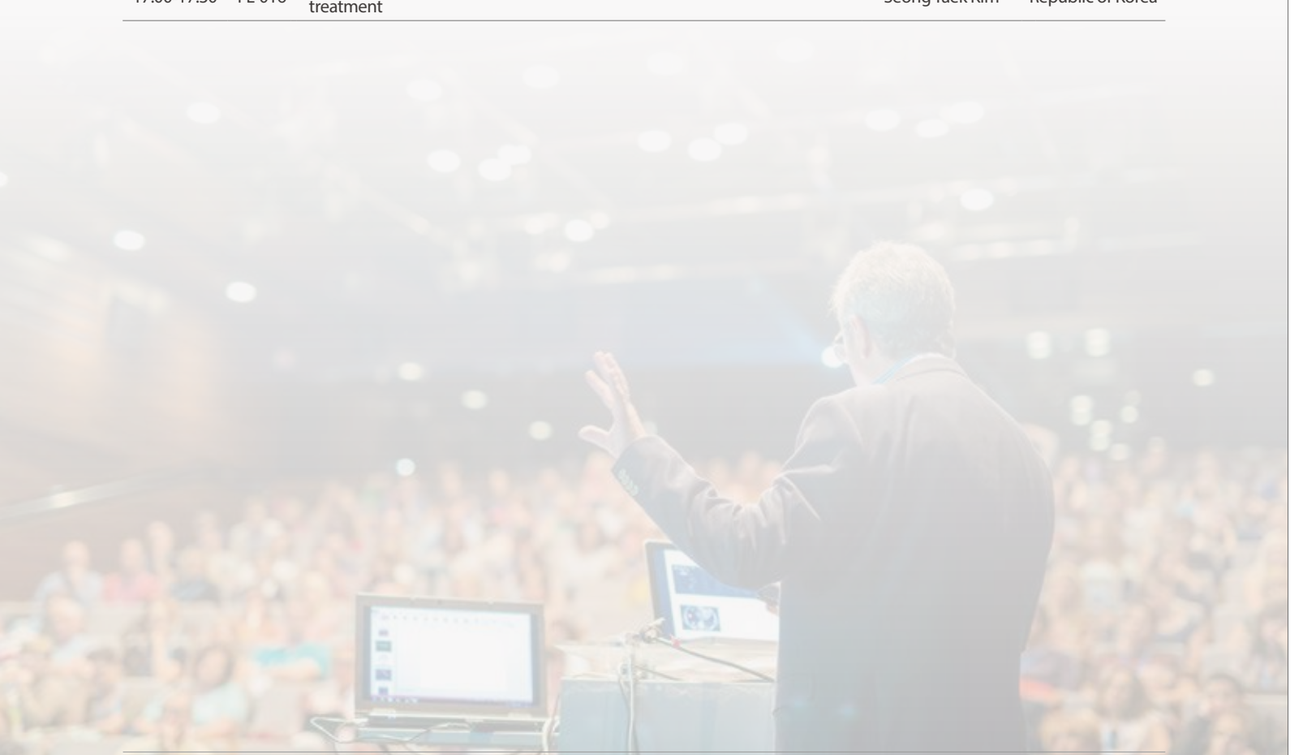
○ Day 2 (Friday, October 5)

Invited Lectures 5				Auditorium
Chairperson		Kwang Won Lee, Republic of Korea		
09:20-10:30	IS-005	The paradigm shift of minimal invasive endodontics	Gianluca Plotino, Nick Grande	Italy
Invited Lectures 6				E5+E6
Chairperson		Kee-Yeon Kum, Republic of Korea		
09:20-10:20	IS-006	Critical issues in defining clinical outcomes and treatment success. From micro access to restorative treatment	Eudes Gondim Jr.	Brazil
Country Representative Speakers 9				E3+E4
Moderator		Tai Cheol Yoon, Republic of Korea		
09:20-10:00	CR-019	Biological perspectives and clinical applications of calcium silicate-based bioceramics	Kyung-San Min	Republic of Korea
10:00-10:40	CR-020	Translational research for future, advanced, and present endodontic therapies	Chiaki Kitamura	Japan
Oral Research Presentations 11				R1
Chairperson		Minju Song, Republic of Korea		
09:30-09:45	OP-043	Non surgical management of rare anomaly: Dens invaginatus	Sweta Bhandari	India
09:45-10:00	OP-044	Depletion rate of hydrogen peroxide and intracoronal bleaching efficacy of sodium perborate mixed with water	Mohamed Amer	Australia
10:00-10:15	OP-045	Evaluation of PUFA index in screening for endodontic disease: Reliability and accuracy	Lay Ann Teh	Malaysia
10:15-10:30	OP-046	Effect of the retrograde filling on bacterial penetration and proliferation in the apical part of the root - CLSM study	Shlomo Elbahary	Israel
Oral Research Presentations 12				R2
Chairperson		Hisashi Anan, Japan		
09:30-09:45	OP-052	Effect of Laser photodynamic therapy towards phenotype character at cps 1, 2 and 5 genotype of Persistent Intra Radicular Infection Enterococcus faecalis Isolates	Dewa Ayu N.P.A.	Indonesia
09:45-10:00	OP-053	Current trends in irrigant agitation methods among endodontist in India - A KAP based survey	Velmurugan Natanasabapathy	India
10:00-10:15	OP-054	Comparison of success rate of different anesthesia protocols in mandibular first molars with symptomatic irreversible pulpitis	Shahriar Shahi	Iran (Islamic Republic of)
10:15-10:30	OP-055	How do we deal with the geriatric patients?	Fatima Basturk	Turkey
Hands-on Courses - FKG				E1
09:00-12:00	HC-201	Anatomically Directed Endodontics	Martin Trope	USA
Masterclass - Dentsply Sirona				E2
10:00-12:00	HC-202	Featuring ProGlider and ProTaper Gold	Cliff Ruddle	USA
10:30-11:00		Coffee Break		Hall D1
Invited Lectures 7			*Sponsored speaker	Auditorium
Chairperson		Hyeon-Cheol Henry Kim, Republic of Korea		
11:00-12:10	IS-007	Management of second mesio-buccal, narrow and curved canals with only one reciprocating instrument	Ghassan Yared	Canada
Invited Lectures 8			*Sponsored speaker	E5+E6
Chairperson		Seok-Woo Chang, Republic of Korea		
11:00-12:10	IS-008	Management of severe curvatures and complex anatomy with controlled memory files: A new approach	Antonis Chaniotis	Greece

Country Representative Speakers 10				E3+E4
Moderator		Byeong-Hoon Cho, Republic of Korea		
11:00-11:40	CR-021	Evaluation of the premixed bioceramic in comparison to the other calcium silicate based materials used in vital pulp therapy and root repair	Ahmad Al-Hiyasat	Jordan
11:40-12:20	CR-022	Management of broken instruments: A review with three case reports with different approaches	Sirawut Hiran-us	Thailand
Oral Research Presentations 13				R1
Chairperson		Se-Hee Park, Republic of Korea		
11:00-11:15	OP-047	Evaluation of flow patterns of various irrigants in the canal isthmus using modified Endovac technique: A CFD analysis	Dhanasekaran Sihivahanan	India
11:15-11:30	OP-048	Diagnosis and treatment of cracked tooth - A clinical case series	Medha Jain	India
11:30-11:45	OP-049	Impact of different activation techniques in reducing intracanal Enterococcus faecalis populations: An in vitro study	Wajih Al Hajj	Lebanon
11:45-12:00	OP-050	The effect of osmotic stress on Enterococcus faecalis and Streptococcus sanguinis viability and NaOCl biocidal activity	Giampiero Rossi-Fedele	Australia
12:00-12:15	OP-051	Enhanced antimicrobial infiltration into radicular dentin via electrokinetic flow	Anna Hwayoung Yi	USA
Oral Research Presentations 14				R2
Chairperson		Hyoung Hoon Jo, Republic of Korea		
11:00-11:15	OP-056	Difference of fracture toughness of nanohybrid resin composite with Fiber Reinforced Composite (FRC)	Chandra Sari Kurniawati	Indonesia
11:15-11:30	OP-057	In-vitro assessment of free active chlorine in sodium hypochlorite solution mixed with lidocaine hydrochloride with adrenaline	Charanya Chandrasekaran	India
11:30-11:45	OP-058	The use of micro-computed tomography in assessing root canal filling quality in endodontic research	Asiye Dincer	Turkey
11:45-12:00	OP-059	Apicoectomy using Er,Cr: YSGG laser versus conventional methods for microsurgical retrograde endodontic treatment: A comparative retrospective investigation	Thanh An Hong	Vietnam
12:00-12:15	OP-060	Comparison of mechanical properties of reciproc, reciproc blue and T-endo must nickel-titanium reciprocating instruments	Taha Özyürek	Turkey
Lunch & Learn - Micro-Mega				Auditorium
12:20-12:50		Heat treated NiTi and efficient single file, yes it's possible	Tara Mc Mahon	Belgium
Invited Lectures 9			*Sponsored speaker	Auditorium
Chairperson		Hyeon-Cheol Henry Kim, Republic of Korea		
13:30-14:40	IS-009	"Past, present and future of endodontic files": Where science meets technology	Sergio Kuttler	USA
Invited Lectures 10				E5+E6
Chairperson		Anil Kishen, Canada		
13:30-14:40	IS-010	A realistic look at root canal fillings. Trends, evidence and clinical performance	Hagay Shemesh	The Netherlands
Country Representative Speakers 11				E3+E4
Moderator		Nobuyuki Tani-Ishii, Japan		
13:30-14:10	CR-023	Dental inlays among the preHispanic mayas. Pathologic effects and cement characterization	Marco Ramirez-Salomon	Mexico
14:10-14:50	CR-024	Looking through the retrospective scope- How I would have done it differently	Brian Jafine	Canada

Free Lectures 6				R1
Moderator		YeonJee, Republic of Korea		
13:30-14:00	FL-011	Vital pulp therapy, When, Why and How? Long follow-up case series presentation	Jenner Argueta	Guatemala
14:00-14:30	FL-012	Utlrasonic vibration & thermo-hydrodynamic obturation method for root canal filling: New concept & technical overview	Yongsik Cho	Republic of Korea
Oral Research Presentations 15				R2
Chairperson		Vasfiye Isik, Turkey		
13:30-13:45	OP-061	Healing of periapical lesions in children and adult patients following endodontic treatment	Iris Slutzky Goldberg	Israel
13:45-14:00	OP-062	Comparison of the shaping abilities of XP-endo Shaper and ProTaper Universal in oval-shaped canals: A micro-CT analysis	Handan Ersev	Turkey
14:00-14:15	OP-063	Role of needle gauge and topical anaesthesia on pain perception during intra-pulpal injection- Double blinded randomized	Nandini Suresh	India
14:15-14:30	OP-064	Dentinal microcrack formation during root canal preparations by different rotary instruments	Ezekiel Barretto	India
14:30-14:45	OP-065	Comparison of fracture resistance of endodontically treated teeth restored with various post-core applications	Can Topkara	Turkey
Hands-on Courses - Micro-Mega				E1
14:00-17:00	HC-203	Experience the simple, fast, and safe way of root canal shaping with 2Shape and One Curve	Sung Geun Cho	Republic of Korea
Hands-on Courses - VDW				Conference Room 205 (2F)
14:00-17:00	HC-204	VDW endo easy efficient concept: Shape, clean and obturate	Ghassan Yared	Canada
14:40-15:10		Coffee Break		Hall D1
Invited Lectures 11				Auditorium
Chairperson		Frank Setzer, USA		
15:10-16:20	IS-011	Predictable and minimally invasive method to retrieve a separated file	Yoshitsugu Terauchi	Japan
Invited Lectures 12				E5+E6
Chairperson		Woocheol Lee, Republic of Korea		
15:10-16:10	IS-012	How asymmetric geometry and heat-treatment influence the behavior of rotary root canal instruments	Franck Diemer	France
Country Representative Speakers 12				E3+E4
Moderator		Tara Mc Mahon, Belgium		
15:10-15:50	CR-025	Saving the hopeless tooth	Mehmet Baybora Kayahan	Turkey
15:50-16:30	CR-026	Activation and agitation of endodontic irrigation solutions: Evidence and a critical assessment of the clinical attainments	Roeland De Moor	Belgium
16:30-17:10	CR-027	The sinus tract, a symptom or an illness?	Liliana Artaza	Argentina
Free Lectures 7				R1
Moderator		Fugen Dagli Comert, Oman		
15:10-15:40	FL-013	Bibliometric analysis of endodontic journal: A global perspective of 5 years	Lora Mishra	India
15:40-16:10	FL-014	Laser-assisted endodontics and safety	Eleftherios Terry Farmakis	Greece

Oral Research Presentations 16				R2
Chairperson		Ji-Hyun Jang, Republic of Korea		
15:10-15:25	OP-066	Characteristic features and pulp-tooth volume ratio of C-shaped canals evaluated by CBCT	Abdulkadir Ozsahin	Turkey
15:25-15:40	OP-067	Root canal anatomy of south Asian Indian teeth	Shishir Singh	India
15:40-15:55	OP-068	Clinical application of 3D technology in endodontics	Cemre Koc	Turkey
15:55-16:10	OP-069	Evaluation of filling ability of two different root canal sealers used with two different root canal filling techniques	Etienne Medioni	France
Invited Lectures 13			*Sponsored speaker	Auditorium
Chairperson		Won mann Oh, Republic of Korea		
16:30-17:40	IS-013	From vital pulp therapy to anatomically directed root treatment - Everything is changing!	Martin Trope	USA
Invited Lectures 14				E5+E6
Chairperson		Rashid El Abed, United Arab Emirates		
16:30-17:40	IS-014	Solutions to simplify shaping and cleaning: Improving the quality of the root canal treatment	Filippo Cardinali	Italy
Free Lectures 8				R1
Moderator		Sungeun Yang, Republic of Korea		
16:30-17:00	FL-015	How it is the outcome of apical periodontitis influenced by different factors: The missing link	Elisabetta Cotti	Italy
17:00-17:30	FL-016	Pharmacologic management of mandibular nerve injury after Endodontic treatment	Seong Taek Kim	Republic of Korea



○ Day 3 (October 6, Saturday)

Invited Lectures 15				Auditorium
Chairperson		Ho Keel Hwang, Republic of Korea		
09:20-10:30	IS-015	Pulp tissue regeneration: Challenges and mew outlook	Mo K. Kang	USA
Invited Lectures 16				E5+E6
Chairperson		Tae Seok Oh, Republic of Korea		
09:20-10:30	IS-016	Management of iatrogenic errors by non-surgical and surgical retreatment	Frank Setzer	USA
Free Lectures 9				E3+E4
Moderator		Margaret Tiu, Philippines		
09:30-10:00	FL-017	Efficacy of ultrasound doppler in assessing pulp vitality in traumatized teeth and long-term prognosis of pulpal status	Sungho Park	Republic of Korea
10:00-10:30	FL-018	Herpes zoster and endodontics	Jale Tanalp	Turkey
Hands-on Course - Micro-Mega				E1
09:00-12:00	HC-301	Experience the simple, fast, and safe way of root canal shaping with 2Shape and One Curve	Jung Hong Ha	Republic of Korea
Hands-on Course - Meta Biomed				Conference Room 205 (2F)
09:00-12:00	HC-304	Objective analysis and application of current trends on root canal cleaning, shaping and filling	Jenner Argueta	Guatemala
Masterclass - Dentsply Sirona				E2
10:00-12:00	HC-302	Featuring Gold Glider & WaveOne Gold	Cliff Ruddle	USA
10:30-11:00		Coffee Break		Hall D1
Invited Lectures 17				Auditorium
Chairperson		Euiseong Kim, Republic of Korea		
11:00-12:10	IS-017	Endodontics Microsurgery A to Z	Syngcuk Kim	USA
Invited Lectures 18				E5+E6
Chairperson		Michael Solomonov, Israel		
11:00-12:20	IS-018	Early diagnosis and biomechanics of vertical root fractures	Zvi Metzger	Israel
Free Lectures 10				E3+E4
Moderator		Lora Mishra, India		
11:00-11:30	FL-019	Contemporary Endodontics: From access cavity to shaping and cleaning, a minimal invasive concept	Jean Philippe Mallet	France
11:30-12:00	FL-020	Endodontics retreatment: Decision making and outcomes	Ayman Mandorah	Saudi Arabia
Lunch & Learn - Ray				Auditorium
12:20-12:50		Application of the Ray CT in root canal therapy	MinJeong Hong	Republic of Korea
Invited Lectures 19			*Sponsored speaker	Auditorium
Chairperson		Yong-Bum Cho, Republic of Korea		
13:20-14:30	IS-019	Endodontic disinfection: 3D irrigation	Cliff Ruddle	USA
Invited Lectures 20				E5+E6
Chairperson		Dong Sung Park, Republic of Korea		
13:20-14:30	IS-020	Is there still a role for medicaments in endodontics?	Paul Abbott	Australia

Free Lectures 11				E3+E4
Moderator		Ibrahim Abu Tahun, Jordan		
13:20-13:50	FL-021	Minimally invasive endodontics: Bye-bye nickel-titanium! Hello stainless-steel!	Ghassan Yared	Canada
13:50-14:20	FL-022	Mechanical properties of glide-path preparation instruments with different pitch length: G-file & new generation G-file	Dana Al Raeesi	United Arab Emirates
Hands-on Course - Coltene				E1
14:00-17:00	HC-303	Making the endodontic management of complicated canal systems simple, safe and predictable. A new approach with Hyflex CM and EDM files	Antonis Chaniotis	Greece
Hands-on Course - Meta Biomed				Conference Room 205 (2F)
14:00-17:00	HC-304	Objective analysis and application of current trends on root canal cleaning, shaping and filling	Jenner Argueta	Guatemala
14:20-14:50		Coffee Break		Hall D1
Invited Lectures 21				Auditorium
Chairperson		Mo K. Kang, USA		
14:45-15:55	IS-021	Nanomaterials in endodontics: A potential game changer	Anil Kishen	Canada
Invited Lectures 22				E5+E6
Chairperson		Gary S.P. Cheung, Hong Kong		
14:45-15:55	IS-022	The relationship among reciprocation, glidepath and canal scouting	Gustavo De-Deus	Brazil
Free Lectures 12				E3+E4
Moderator		Ibrahim Abu Tahun, Jordan		
14:50-15:20	FL-023	Outcome of full pulpotomy in symptomatic permanent teeth with carious exposure using a calcium silicate based material	Nessrin Taha	Jordan
15:20-15:50	FL-024	Maginfication - A holistic approach to predictable endodontics	Viresh Chopra	Oman
Invited Lectures 23				Auditorium
Chairperson		Yun-Chan Hwang, Republic of Korea		
16:00-17:10	IS-023	Is it really toothache? Non-odontogenic pain presenting as dental pain	Asgeir Sigurdsson	USA
Invited Lectures 24				E5+E6
Chairperson		Jin-Woo Kim, Republic of Korea		
16:00-17:10	IS-024	3D endodontics: Shaping root canals in 3 dimensions	Gianluca Gambarini	Italy
Free Lectures 13				E3+E4
Moderator		Dana Al Raeesi, United Arab Emirates		
16:00-16:30	FL-025	Broken Instrument Management, bypass Vs removal	Talal Alnahlawi	Syrian Arab Republic
16:30-17:00	FL-026	Computer-aided design and 3D printing: A new era in minimally invasive endodontics	MoatazBellah Ahmed Mohamed Ahmed Soliman Alkhawas	Egypt
18:30-20:30		Gala Dinner		Floating Island, Han River

○ Day 4 (October 7, Sunday)

Invited Lectures 25				E5+E6
Chairperson		Miri Kim, Republic of Korea		
09:00-10:00	IS-025	Root resorption after dental trauma - findings and treatment possibilities	Andreas K. Braun	The Netherlands
Hands-on Course - Meta Biomed				E1
09:00-12:00	HC-401	Objective analysis and application of current trends on root canal cleaning, shaping and filling	Jenner Argueta	Guatemala
10:00-10:30		Coffee Break		Hall D1
Live Endo - Korean Session				E3+E4
Chairpersons		Dong-Ryul Shin, Republic of Korea / Sung-Baek Choi, Republic of Korea		
10:00-12:00	KS-001	[Live Endo] Practical endodontics in real world	Pyung Sik Kim	Republic of Korea
Invited Lectures 26				E5+E6
Chairperson		Il Young Jung, Republic of Korea		
10:30-11:30	IS-026	Current concepts in endodontic microsurgery: Esthetic management of the soft tissue	Francesco Maggiore	Germany
11:30-12:30	IS-027	How to prevent instrument breakage by creating a mechanical reproducible Glide Path (Don't rotate, reciprocate)	Yosef Nahmias	Canada
Live Endo Discussion - Korean Session				E3+E4
13:30-15:00		[Discussion] Live Endo behind stories-Panel discussion - Pyung-Sik Kim, Republic of Korea - Dong-Ryul Shin, Republic of Korea - Sung-Baek Choi, Republic of Korea - Ho Keel Hwang, Republic of Korea - Yong-Bum Cho, Republic of Korea		
15:00-15:30		Coffee Break		Hall D1
Invited Lectures 27				E5+E6
Chairperson		Rashid El Abed, United Arab Emirates		
13:30-14:30	IS-028	Re-establishing biological order: A Call for action	Ibrahim Abu Tahun	Jordan
14:30-15:30	IS-029	Contemporary approaches to instrumentation of non-round root canals	Michael Solomonov	Israel
15:30-16:30	IS-030	Prognosis of apical periodontitis: Does size really matters	Ahmed Abdel Rahman Hashem	Egypt
Special Lectures - Korean Session				E3+E4
Chairperson		Su-Jung Shin, Republic of Korea		
15:30-16:15	KS-003	Long-term prognostic evaluation of my root canal treatment	Luke Sung Kyo Kim	Republic of Korea
16:15-17:00	KS-004	Nonsurgical vs. Surgical retreatment after failure of initial root canal treatment	SeungHo Baek	Republic of Korea
17:00-18:00		Closing Ceremony		E5+E6

Hands-on Courses

If you would like to attend the Hands-on courses on site, please come to the registration desk and ask the staff whether the seats are available or not.

Day 1 (October 4, Thursday)				
FKG	09:30-12:30	Hall E1	Anatomically Directed Endodontics	Martin Trope
Dentsply Sirona Endodontics	10:00-12:00	Hall E2	[Masterclass] The Importance of technological advancements for the improvement of outcomes in your practice	Sergio Kuttler
MM	14:00-17:00	Hall E1	2Shape: Two files to Shape with a Safe and efficient new innovative file system	Franck Diemer
Dentsply Sirona Endodontics	15:00-17:00	Hall E2	[Masterclass] Featuring Gold Glider & WaveOne Gold	Cliff Ruddle
Day 2 (October 5, Friday)				
FKG	9:00-12:00	Hall E1	Anatomically Directed Endodontics	Martin Trope
Dentsply Sirona Endodontics	10:00-12:00	Hall E2	[Masterclass] Featuring ProGlider and ProTaper Gold	Cliff Ruddle
MM	14:00-17:00	Hall E1	Experience the simple, fast, and safe way of root canal shaping with 2Shape and One Curve	Sung Geun Cho
VDW	14:00-17:00	Conference Room 205 (2F)	VDW Endo Easy Efficient concept: Shape, clean and obturate	Ghassan Yared
Day 3 (October 6, Saturday)				
MM	9:00-12:00	Hall E1	Experience the simple, fast, and safe way of root canal shaping with 2Shape and One Curve.	Jung Hong Ha
META BIOME	9:00-12:00	Conference Room 205 (2F)	Objective analysis and application of current trends on root canal cleaning, shaping and filling	Jenner Argueta
Dentsply Sirona Endodontics	10:00-12:00	Hall E2	[Masterclass] Featuring Gold Glider & WaveOne Gold	Cliff Ruddle
COLTENE	14:00-17:00	Hall E1	Making the endodontic management of complicated canal systems simple, safe and predictable. A new approach with Hyflex CM and EDM files	Antonis Chaniotis
META BIOME	14:00-17:00	Conference Room 205 (2F)	Objective analysis and application of current trends on root canal cleaning, shaping and filling	Jenner Argueta
Day 4 (October 7, Sunday)				
META BIOME	9:00-12:00	Hall E1	Objective analysis and application of current trends on root canal cleaning, shaping and filling	Jenner Argueta

Lunch & Learn

Place : Auditorium

Operating Hours : Oct. 4(Thu)-Oct. 6(Sat) 12:20-12:50

Day 1 (October 4, Thursday)		
B&L BIOTECH	Endodontic Microsurgery: Development of instruments and materials	Syngcuk Kim
Day 2 (October 5, Friday)		
MM	Heat treated NiTi and efficient single file, yes it's possible	Tara Mc Mahon
Day 3 (October 6, Saturday)		
Ray	Application of the Ray CT in root canal therapy	MinJeong Hong

Poster Research Presentations

○ All presentations will take place in the Exhibit hall D1.

P1			*Presentation Date & Time: Oct. 5, 10:30~11:00*
P1-001	Effectiveness of rotary instruments and hand files in removing gutta percha from root canals during retreatment	Abeir Mansour	Egypt
P1-002	The effect of technique and time in sonic activation on the extrusion of sodium hypochlorite - An In vitro study	Natalia Iskandar Setiawan	Indonesia
P1-003	Effect of autoclave cycles on surface characteristics of S-file using scanning electron microscopy	Pedram Iranmanesh	Iran (Islamic Republic of)
P1-004	Effect of up-and-down speeds on canal centering ability and stress generation of NiTi rotary instruments	Keiichiro Maki	Japan
P1-005	Effect of light activated disinfection on the adhesion of endodontic sealers to dentin	Kathryn Diane Joy Ilagan-Manzano	Philippines
P1-006	Comparison of smear layer removal using 40% citric acid with or without surfactant. A SEM study	Mariusz Lipski	Poland
P1-007	Effect of autoclave sterilization on torsional fracture resistance of NiTi instrument	Woo Young Kim	Republic of Korea
P1-008	The effect of different application time of sonic irrigation and passive ultrasonic irrigation techniques on intracanal	Hernika Harperiana	Indonesia
P1-009	Evaluation of XP-endo Finisher efficiency in removing smear layer	Alexandr Mitronin	Russian Federation
P1-010	Effect of vibration frequency in ultrasonic cleaning on removal of the root canal smear layer	Miyako Ono	Japan
P1-011	Factors affecting cyclic fatigue resistance between tapering and metallurgic improvement of NiTi rotary files	Panupong Jiradechochai	Thailand
P1-012	Cyclic fatigue resistance of XP-Endo shaper, K3XF and ProTaper gold nickel-titanium instruments	Elif Kalyoncuoglu	Turkey
P1-013	Centering ability of two rotary instruments- WaveOne and ProTaper Universal-in simulated canal shaping	Anh Hong Le	Vietnam
P1-014	Evaluation of the efficacy of XP-endoFinsher file to reduce bacterial count in canals prepared to different apical sizes and tapers (in vitro study)	Mohamed Hamed	Egypt
P1-015	Comparision of antimicrobial efficacy of lasers, chlorine dioxide, sodium hypochlorite against enterococcus faecalis	Sunil Rao	India
P1-016	Screening of a representative gene related to thalamic neuronal activation following dental pulp inflammation in rats	Hiroki Murano	Japan
P1-017	Comparison of antimicrobial efficacy of silver nanoparticles and chlorhexidine when used alone and in combination – A pilot study	Duraivel Dasarathan	India
P1-018	The potency of arrowleaf sida (Sida rhombifolia L.) root extract as an alternative agent in endodontic treatment	Maria Tanumihardja	Indonesia
P1-019	Fish collagen stimulates the proliferation and differentiation of pre-osteoblast cells	MarkLuigi F Capati	Japan
P1-020	Comparison of antimicrobial activity of traditional and new developed root sealers against pathogens related root canal	Joo-Hee Shin	Republic of Korea
P1-021	Bacterial leakage and marginal adaptation of various bioceramics as apical plug in open apex model	Patcharachol Lertmalapong	Thailand
P1-022	The effect of chelating agents on the push-out bond strength of proroot MTA and endosequence root repair material	Mevlut Kayabasi	Turkey
P1-023	Working width and shape of the apical third in the maxillary lateral incisors in the population of Chennai, T.N., India	Nyklesh Vijayakumar	India
P1-024	Evaluation of smear layer removal and lubrication effect by prototype EDTA gel conditioner	Ryuji Fujimaki	Japan
P1-025	Anatomicalconsideration of C-shaped canal in mandibular second molars: A micro-CT study in Thai subpopulation	Chuta Kooanantkul	Thailand
P1-026	Asessment of cuspal deflection in root canal treated mandibular molar teeth using conservative access cavity	Mohammad Hossein Malekipour	Iran (Islamic Republic of)

P2			*Presentation Date & Time: Oct. 5, 14:40~15:10*
P2-001	Stress analysis according to retrograde preparation designs in the mandibular molar: Finite element analysis	So-Young Park	Republic of Korea
P2-002	Viability of fibroblast cells with antiseptic solution (Chlohexidine, Alkalize Water, Acid Water, and Sodium Hipochloride)	Hesti Witasari Jos Erry	Indonesia
P2-003	Evaluation of reducing torsional stress by prototype EDTA: An In Vitro measurement	Jiro Suzuki	Japan
P2-004	Investigation of apical foramen changes after endodontic treatment using micro-computed tomography	Jongki Lee	Republic of Korea
P2-005	Long term survival and decision making for the retention of endodontically treated cracked teeth (A 10-15 years study)	Pei Yuan Chan	Singapore
P2-006	Middle mesial canals in mandibular first molars - An Illustrated Systematic Review	Joao Meirinhos	Portugal
P2-007	Study of novel dental endoscopic system with intraoral camera and image probe for the observation of root canal	Masataka Fujimoto	Japan
P2-008	Obturation via hydraulic condensation of bioceramic sealer ; A five-year survival rate study	Sara Hoge	USA
P2-009	Assessment of postoperative pain following one-visit root canal treatment: Comparison of different obturation materials	Melis Sila Cetin	Turkey
P2-010	Antibacterial activity of silver nanoparticles activated by photodynamic therapy in infected root canals	Kursat Er	Turkey
P2-011	Antibacterial effect of calcium hydroxide nanoparticles on enterococcus faecalis	Pitchanun Lungkapinth	Thailand
P2-012	Effect of S-PRG root canal dressing on the healing of periapical lesions in rat	Bin Xiong	Japan
P2-013	Comparative analysis of irrigation activation techniques in root canals during endodontic treatment	Maria Sukhikh	Russian Federation
P2-014	Effect of the new root canal sealer containing low concentration of eugenol on the polymerization of resin composite	Munehiro Maeda	Japan
P2-015	Evaluating electromagnetic interference of communication devices with Root ZX Mini apex locator	Foad Iranmanesh	Iran (Islamic Republic of)
P2-016	The TRPV4 mechanosensor contributes to mineralization in the KN-3 odontoblast-like cell line	Junko Hatakeyama	Japan
P2-017	Root reinforcement from root canal obturation with bioceramic cone and sealer	Sittichoke Osiri	Thailand
P2-018	Long-term survival of avulsed anterior teeth up to 10 years	Dohyun Kim	Republic of Korea
P2-019	Impact of final restoration on the coronal seal of root treated teeth: A preliminary report	Norazlina Mohammad	Malaysia
P2-020	Periapical status of non- root- filled teeth with coronal restorations, among a sample of Jordanian population	Aladdin Al-qudah	Jordan
P2-021	Effect of the microscope blue light on the visual function	Noriko Muto	Japan
P2-022	Assessment of novel ex vivo biofilm models using oral sample	Kittipit Klanliang	Japan
P2-023	Effect of massage on the pain and success of anesthesia in maxillary central incisors: Double-blind, crossover trial	Saber Khazaei	Iran (Islamic Republic of)
P2-024	Comparative evaluation of microlakage at enamel and dentin margins of two different class ii basis restoration	Priska Lasari	Indonesia
P2-025	Assessment of radicular morphology of mandibular molars in Indian population- A retrospective CBCT analysis	Amandeep Kaur	India
P2-026	The importance in determining the Working Length (WL) in endodontics: Attitudes and practices of Ivorians dental surgeon	Aline Krah-Sinan	Cote d'Ivoire
P3			*Presentation Date & Time: Oct. 6, 10:30~11:00*
P3-002	Do smart phones interfere with working length determination using electronic apex locators?	Nishanthine Cruz Irudhayaraj	India
P3-003	Effect of erbium, chromium-doped yttrium, scandium, gallium and garnet laser on human apical papilla cell proliferation	Apichaya Srisathian	Thailand
P3-004	Irisin induces angiogenesis and odontoblastic differentiation in human dental pulp cells	Bin-Na Lee	Republic of Korea

P3-005	Enzyme activity of human dental pulp as a diagnostic marker of pulp inflammation	Diana Ostanina	Russian Federation
P3-006	A chitosan as a potential for tissue engineering in endodontics	Dian Agustin Wahjuningrum	Indonesia
P3-007	Basket File (BF): A new hollow concept	Ajinkya Pawar	India
P3-008	The ability of Lysate- PRF induces proliferation of fibroblast cells in endodontic regenerative therapy	Endang Suprastiwi	Indonesia
P3-009	Long-term effect of acidic pH on the surface microhardness of ProRoot MTA, Biodentine and TotalFill Root Repair Material	Dilek Turkaydin	Turkey
P3-010	Rheological and physical properties of phyllosilicate clay added tricalcium silicate	Donghoon Kang	Japan
P3-011	Effectiveness of irrigations with two sonic activation equipments in cleaning the $Ca(OH)_2$ residual in the apical third	Adelia Mutia Indah	Indonesia
P3-012	Micro-CT evaluation of dentinal microcrack formation after using rotary, hybrid and reciprocating NiTi instruments	Saulius Drukteinis	Lithuania
P3-013	Evaluation of different irrigation techniques in pig's infected root canal: In vivo study	Toshinori Tanaka	Japan
P3-014	Pulpal responses after direct pulp capping with two calcium-Silicate cements in rat model	Panruethai Trongkij	Thailand
P3-015	The effect of endodotic treatement on the outcomes of cyst enucleation	Daesoon Kim	Republic of Korea
P3-016	Impact of excessive use of oral antiseptics on the incidence of cardiovascular events	Bader AlOtaibi	Saudi Arabia
P3-017	A plasma jet system for disinfection of enterococcus faecalis	Kanruethai Saleewong	Thailand
P3-018	Cyclic fatigue resistance of WaveOne Gold Glider, One G and ProGlider nickel-titanium glide path files in artificial canals with double (S-shaped) curvature	Damla Kırıcı	Turkey
P3-019	Customised framework for three-dimensional reconstruction and measurement in endodontic research	Young Bin Bok	USA
P3-020	Assessment of the quality of endodontic treatment performed on a postgraduate teaching clinic in Dubai, UAE	Hessa Fezai	United Arab Emirates
P3-021	Effectiveness of irrigation techniques for the removal of calcium hydroxide from simulated internal resorption cavity	Alper Kustarci	Turkey
P3-022	An in vitro comparison of bond strength of different sealers/obturation systems to root dentin using push out test	Zeti Adura Che Ab Aziz	Malaysia
P3-023	Consideration of access cavity to root canal by using the preparation guides	Taro Nishida	Japan
P3-024	The difference effect of caseinphospopeptide-amorphous calcium phosphate and soy milk on bleached enamel roughness	Hanny Aryani	Indonesia
P3-025	The expressions of NF-Kb and TNF-A on BHK-21 culture cell exposed Lta lactobacillus acidophilus induced by curcumin	Juniarti Devi Eka	Indonesia
P3-026	A comprehensive analysis of the effects of BMP-1 on glyco-alteration in human dental pulp cells	Koichiro Muromachi	Japan
P4			*Presentation Date & Time: Oct. 6, 14:20~14:50*
P4-001	Integrin subunit expression by human cementoblast	Taiki Koba	Japan
P4-002	The effect of acidic level condition as pain transmission inhibition	Jenny Sunariani	Indonesia
P4-003	Endodontic management of autotransplanted teeth	Zedgenidze Alena	Russian Federation
P4-004	Prevalence of apical periodontitis in endodontically treated teeth and associated prognostic factors in Thai	Panupong Thampibul	Thailand
P4-005	Effects on smear layer removal with 0,5% phytic acid after sonic agitation: A SEM study	Ismail Omer Yeniyurt	Turkey
P4-006	Emergency Pulpotomy vs Pulpectomy: Pain relief for symptomatic irreversible pulpitis	Hayoung Kim	USA
P4-007	Effect of Aloevera Gel on the Expression of TNF-αTGF-β, osteoblast and osteoclast in alveolar bone post avulsion	Yuli Nugraeni	Indonesia
P4-008	Effects of dopamine on odontoblastic differentiation	Shoko Fujino	Japan

P4-009	Wound healing potential of pueraria mirifica extracts on human dental pulp cells	Uthaiwan Arayatrakoollikit	Thailand
P4-010	Influence of endodontic treatment on alveolar bone in treatment of periodontitis	Dina Galieva	Russian Federation
P4-011	The effects of ethylenediaminetetraacetic acid on Blood Clot in Regenerative Endodontic Procedures	Peerapohn Taweewattanapaisan	Thailand
P4-012	Effect of light curing unit and thickness of RMGICs bioactive and conventional GICs: A compressive strength assessment	Daryono Daryono	Indonesia
P4-013	Alternative treatment methods of chronic apical periodontitis: Practical dentistry trends	Maria Ilina	Russian Federation
P4-014	Flexural strength comparison of nanohybrid and nanoceramic composite resin with fiber reinforced composite resin base	Hendro Malimas	Indonesia
P4-015	Mineralization potential of human apical papilla cells after exposure to either ProRoot® MTA or BiodentineTM	Kunlada Wattanapakkavong	Thailand
P4-016	Level of root filling density filling using $Ca(OH)_2$ sealer plus nano chitosan	Dewa Made Wedagama	Indonesia
P4-017	Flavonoid extract of propolis 26% potential against Streptococcus mutans glucan attachment	Setyabudi Goenharto	Indonesia
P4-018	The pure bioceramic sea part 1: Efficacy of 3 different sealer application techniques	Christian Holscher	Luxembourg
P4-019	Effect of root canal irrigation regimen on APC attachment and transforming growth factor (TGF-ß) release from dentin	Tanida Srisuwan	Thailand
P4-020	Damp response in pulp complex induction by resin bonding agent	Widya Saraswati	Indonesia
P4-021	CBCT and micro-CT in detection of radiographically undetected canals	Chayaporn Sirinimitpol	Thailand
P4-022	Prevalence of a second canal and root canal morphology of mesiobuccal root of Thai maxillary molars: A CBCT study	Saranya Srisuma	Thailand
P4-023	Treatment outcomes of C-shaped canal in mandibular second molars: A retrospective study	Jeeraphat Jantarat	Thailand
P4-024	Effect of sodium thiosulfate on bond strength of an epoxy resin–based sealer to NaOCl- and citric acid-treated dentin	Ezgi Doganay Yildiz	Turkey
P4-025	S1P signaling is a positive regulator of bone formation and is required for osteoblast differentiation	Etsuko Matsuzaki	Japan

Clinical Case Presentations

○ All presentations will take place in the Lobby of Hall E.

C1			*Presentation Date & Time: Oct. 5, 10:30~11:00*
C1-001	Six months follow up of one visit endodontic treatment	Arisandi Husni	Indonesia
C1-002	Endodontic therapy of maxillary second molar and mandibular second molar fused with paramolar tubercles	Joo Hyun Hong	Republic of Korea
C1-003	Management of tooth with horizontal root fracture due to traumatic injury	Joo-Yeong Lee	Republic of Korea
C1-004	Endodontic surgery: Is it an archaic clinical procedure?	Srinivasan Manali Ramakrishnan	India
C1-005	Anesthetic efficacy of supplemental intraligamentary injection with 4% articaine versus 2% lidocaine	Nazanin Zargar	Iran (Islamic Republic of)
C1-006	Treatment of open apex using revascularization versus MTA apexification	Sangmi Ahn	Republic of Korea
C1-007	Regenerative Endodontic Procedure (REP) of immature necrotic tooth using Platelet-Rich Fibrin (PRF)	Sung Hyeon Choi	Republic of Korea
C1-008	Surgical management of extruded gutta percha through a root perforation using Mineral Trioxide Aggregate: A Case Report	Abhishek Anil	India
C1-009	Survive for VRF tooth by using intracanal adhesive with intentional replantation	Masaru Igarashi	Japan
C1-010	Simplified management of severely dilacerated root with separated instrument and perforation: A Case report	Suman Gautam	Nepal
C1-011	Cemental tear treated with intentional replantation	Il Hwa Lee	Republic of Korea
C1-012	Periapical surgery of fused palatal and distobuccal roots of maxillary first molar aided by CBCT and 3D printed model	Chia-Lun Tsai	Taiwan
C1-013	Palatally approached micro-surgery on the palatal root of maxillary first molar with persistent sinus tract: Case report	Chang Gi Cho	Republic of Korea
C1-014	Unusual complication following replantation of an avulsed immature permanent incisor	Seunghye Kim	Republic of Korea
C1-015	Management of a tooth which has internal/cervical/apical resorptions together: A case report	Nilay Ayaz	Turkey
C1-016	Root canal treatment of a maxillary first premolar with three root canals	Ye-rim Lee	Republic of Korea
C1-017	Treatment of C-shaped canal in mandibular first premolars with the aid of cone-beam computed tomography	Seong-Ju Lee	Republic of Korea
C1-018	Aesthetic improvement of teeth with calcific metamorphosis	Ilda Budiwati	Indonesia
C1-019	A favorable healing case of idiopathic external root resorption	Soo Jung Kim	Republic of Korea
C1-020	Separated surgical needle in the root canal: An uncommon case report	Mehtap Salman	Turkey
C1-021	Treatment of dens invaginatus by removal of invaginated hard tissue	Bo Ra Song	Republic of Korea
C1-022	Root canal treatment of two rooted mandibular canine	Yi san kim	Republic of Korea
C1-023	Internal bleaching on the discolored lower incisive: A case report	Aidasriwaty Gasma	Indonesia
C1-024	Non surgical management of complex root canal anatomies using unconventional treatment modalities	Shalu Mahajan	India
C2			*Presentation Date & Time: Oct. 5, 14:40~15:10*
C2-001	Broken instrument caused by inadequate canal enlargement	Andi Wisda Martianti Mayasari	Indonesia
C2-002	Platelet-Rich Fibrin (PRF) as an autologous biomaterial in Apical Surgery: Case reports	Priyanka Sawant	India
C2-003	Nonsurgical endodontic treatment of the maxillary second molar with an unusual positioning of mesio-palatal canal : A case report	Seungjae Do	Republic of Korea
C2-004	Endodontic management of middle mesial/distal canal in mandibular molars using ultrasonic and Ni-Ti rotary instruments	Goeun Lim	Republic of Korea
C2-005	Management of an inflammatory internal root resorption in a radix entomolaris with 5 canals: A case report	Yuksel Eren	Turkey
C2-006	Mandibular first molar with six separate canals	Se Ra Jung	Republic of Korea
C2-007	MTA (Mineral Trioxide Aggregate) - The biological healer	Sanhita Goswami	India
C2-008	Mineral trioxide aggregate as apical plug in non-surgical approach of trauma-induced apical root resorption	Aqilla Tiara Kartikaning Tyas	Indonesia
C2-009	The orthograde application of mineral trioxide aggregate for treatment of internal root resorption	Hyunjin Jo	Republic of Korea
C2-010	Repair of iatrogenic furcal perforation with fast-setting calcium silicate cement	Jae-Heon Jung	Republic of Korea
C2-011	Tooth discoloration induced by white mineral trioxide aggregate	Rupam Tripathi	Nepal
C2-012	Blunderbuss root canal therapy with collagen membrane and MTA: A case report	Sulistiya Hastuti	Indonesia
C2-013	Management of radicular cyst with endodontic surgery	Gita Tarigan	Indonesia
C2-014	Restoring hemisected mandibular first molar with mini dental implant	Azizah Arifati	Indonesia
C2-015	Diagnostic dilemma in endodontic imaging – A case report	Pavithra Ravindra	India
C2-016	Management of a foreign body material in the periradiular area	Changho Yun	Republic of Korea
C2-017	Root resection of mandibular first molar: Two case reports	Jiwon Jeong	Republic of Korea
C2-018	Autogenous transplantation of third molar to replace hopeless tooth	Ilseok Song	Republic of Korea
C2-019	Autogenous tooth transplantation of third molar to replace an endodontically unfavorable molar	Yongmin Kim	Republic of Korea
C2-020	Management of compromised periapical lesion with regenerative techniques endodontic surgery: Report of two cases	Dini Asrianti Bagio	Indonesia
C2-021	Management of open apices with periapical lesions in central maxillary insisor using MTA as an apical plug	Shalina Ricardo	Indonesia
C2-022	Regenerative endodontic treatment of immature permanent tooth with pulpal necrosis: 1-year follow up	Jinjoo Han	Republic of Korea
C2-023	Management of external perforating cervical resorption using Biodentine and a regenerative surgical approach	Jassada Panyasorn	Thailand
C2-024	Partial pulpotomy on mandibular 1st molar with cariously exposed pulp	Wonhuy Choi	Republic of Korea
C3			*Presentation Date & Time: Oct. 6, 14:20~14:50*
C3-001	Non-surgical management using MTA of Tooth with open apex and external resorption in relation to impacted canine	Cyntia Dewi Maharani	Indonesia
C3-002	Comparison between two bio-active materials in furcation perforation management : Case reports	Anggraini Margono	Indonesia
C3-003	One-step apexification with MTA: A non-surgical approach for traumatised immature permanent tooth	Raras Ajeng Enggardipta	Indonesia
C3-004	Sealing furcal perforations using Biodentine (Two case report)	Ratna Indriutami	Indonesia
C3-005	Large-sized furcation perforation repair with collagen membrane & MTA	Taeuk Sun	Republic of Korea
C3-006	Resolution of bifurcation involvement after non-surgical root canal treatment: Application of CBCT	Masahiko Minakami	Japan
C3-007	Endodontic treatment of a mandibular first molar with radix entomolaris	Ara Cho	Republic of Korea
C3-008	Latex fragment as an etiological factor in resistant chronic periapical inflammation	Heejin Kim	Republic of Korea
C3-009	Treatment of horizontally root fractured Maxillary incisors	Jihye Yoon	Republic of Korea
C3-010	Diagnosis and multidisplinary treatment planning for traumatized central incisors: A Clinical Case	Victoria Sansalvador	Spain

C3-011	Surgical treatment of the severe radicular grooves by intentional replantation with 2-segments restoration method	Hanguo Wang	China
C3-012	Multi-disciplinary treatment of young-permanent traumatized upper incisor. A clinical case presentation	Jorge Moreno	Canada
C3-013	Internal bleaching on traumatized discolored upper right central incisor: A case report	Uci Ernawati	Indonesia
C3-014	Retreatment of untreated canal: Case report	Farida Rahim	Indonesia
C3-015	Effect of length LED and plasma arc in extra coronal bleaching hydrogen peroxide 35% on enamel microhardness	Rozyta Karunia Hakim	Indonesia
C3-016	A perfect seal for a better heal	Aseng Tangu	India
C3-017	Retreatment using reciprocal technique on endodontic treatment of the posterior tooth	Yonathan Yonathan	Indonesia
C3-018	Traumatic occlusion (Deep bite) as possible reason of endodontic abscess: A case report	Busra Serce	Turkey
C3-019	Gingival fenestration defect healing on mandibular second premolar treated with orthograde MTA filling and surgical treatment	Gilsu Kang	Republic of Korea
C3-020	Surgical endodontic treatment of persistent apical periodontitis with an extraradicular infection	Ji Hye Sim	Republic of Korea
C3-021	Intentional replantation to repair an iatrogenic root perforation caused by orthodontic procedure	Sujitha Ramaraj	Republic of Korea
C3-022	Apicoectomy as upper central incisivus with large periapical lesion treatment	Nia Wijayanti	Indonesia
C3-023	Management of lateral root canal perforation of the upper central incisivus	Erma Sofiani	Indonesia
C3-024	Treatment of root perforation with gingival fenestration	Yoojin Ha	Republic of Korea
C4		***Presentation Date & Time: Oct. 6, 14:40~15:10***	
C4-001	Anterior aesthetic rehabilitation caused by dental trauma – A case report	Revina Ester Iriani Marpaung	Indonesia
C4-002	Inferior alveolar nerve paresthesia caused by periapical lesion on mandibular second molar	Hyeon Wook Jang	Republic of Korea
C4-003	The management of complicated-crown-fractured teeth using different pulp treatment	Sangsu Lee	Republic of Korea
C4-004	Dentigerous cyst mimicking a lesion of endodontic origin: A case report	Jeen-Nee Lui	Singapore
C4-005	Treatment of necrotic premolars with the anomaly of a gemination and concrescence	Sergio Irazusta	Spain
C4-006	One visit endodontic treatment of the mandibular first molar with four canals and periapical lesion	Desi Wadianawati	Indonesia
C4-007	Assessment of healing of large cyst-like lesion after non-surgical root canal treatment	Huibae Yang	Republic of Korea
C4-008	Aesthetic enhancement with external bleaching on the first degree of tetracycline discoloration: A case report	Asrianti Fattah	Indonesia
C4-009	Determination and multidiciplinary management of endo-perio lesion	Afniati Rachmuddin	Indonesia
C4-010	Regenerative endodontic treatment of immature necrotic mandibular premolar using MTA	Ja Yeon Lee	Republic of Korea
C4-011	Management of necrotic immature teeth by Revascularization	Junwoo Baek	Republic of Korea
C4-012	Bicuspidization: A surgical approach to furcation involvement in mandibular first molar with true combined lesion	Aldila Ceasy Prameswari	Indonesia
C4-013	Hemisection – A surgical approach to iatrogenic complication of endodontics therapy: Case report	Selvia Martinova	Indonesia
C4-014	Management of invasive cervical resorption with combination technique using RMGI-MTA: A case report	Nurtiara Oktaviana	Indonesia
C4-015	Root canal treatment of type IV vertucci configuration on left mandibular first premolar	Paulus Alexander	Indonesia
C4-016	Management of failed root canal treated incisor by orthograde filling with MTA prior to the surgical treatment	Praman Kundacha	Thailand
C4-017	Hemisection: A modern endodontic approach as an alternative treatment for the extraction of molar teeth: Case series	Oguz Tavsan	Turkey
C4-018	On time clinical management of an anterior dens evaginatus, talon cusp	Nandy Acevedo	Guatemala
C4-019	Nonsurgical endodontic treatment of maxillary premolar with three canals	Se Yeong Han	Republic of Korea
C4-020	Treatment of complicated crown fracture by reattachment using fiber post: A case report	Esra Ulukoylu	Turkey
C4-021	Endodontic management of traumatic teeth with open apex and wronged treatment by illegal dental technician using MTA	Fresynandia Karyneisa Putri	Indonesia
C4-022	The aesthetic complex treatment for multiple caries with occlusion restoration	Latief Mooduto	Indonesia
C4-023	Management of third molar teeth from an endodontic perspective	Shekhar Bhatia	Malaysia
C4-024	Endodontic treatment and esthetic rehabilitation of anterior maxillary teeth with periapical lesions	Ervita Kholestyana	Indonesia

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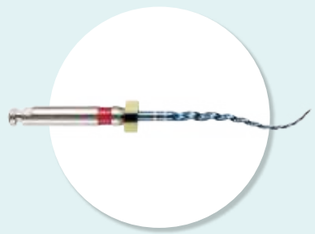

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Invited Lectures

IS-001 *The 15th Joint Scientific Meeting between JEA and KAE*

Are the viable cells the only predictor for delayed replantation?

Seung-Jong Lee
Yonsei University, Republic of Korea

The main concerns undermining the use of tooth replantation are posttreatment complications, such as ankylosis and external root resorption. These complications can be even more serious when the tooth is replanted after a certain time delay. In traumatic avulsion cases, the periodontal ligament with extra-oral dry time over 60 minutes is regarded necrotic and not expected to heal. However, previous occasional successes after delayed replantation suggest that the presence of viable cells may not be the only factor for successful periodontal regeneration in delayed replantation. Various other factors such as proteins or extracellular matrix (ECM) may play a role in this process. The purpose of this presentation is to characterize changes in the proteome components of PDL tissue after hypothermic preservation of the tooth.

Prof. Seung-Jong Lee, DDS, PhD

Professor Emeritus, Yonsei University
Diplomate, American Board of Endodontics

IS-002 *The 15th Joint Scientific Meeting between JEA and KAE*

Non-surgical retreatment of cracked teeth

Nobuyuki Tani-Ishii
Kanagawa Dental University, Japan

Although many options are proposed for the treatment of cracked teeth, there are few reports of treatment follow-up for long-term. Non-surgical retreatment of cracked teeth performed with new materials under dental operative microscope is a predictable treatment option. This presentation shows the clinical outcomes of adhesive teeth with cracked teeth after being repaired intra-orally.

Dr. Nobuyuki Tani-Ishii, DDS, PhD

Nobuyuki Tani-Ishii received his dental degree from Kanagawa Dental University (KDU), in 1983. He received his PhD degree from Graduate School of KDU in 1988. He is a professor and chairman of Graduate School of KDU, Dept. of Endodontics from 2007 to the present, and he is a currently vice dean of Japan Endodontic Association from 2014.

IS-003

Does heat treated NiTi facilitate endodontic therapy?

Tara Mc Mahon
Université Libre de Bruxelles (ULB), Belgium

Endodontic treatments are intimately linked to nickel titanium since the past 25 years and the arrival of the first NiTi rotary files for canal preparation.

Since Dr. John McSpadden designed the first rotary file in 1992, the files have undergone intensive changes.

The manufacturing of NiTi rotary files evolved immensely over the last few years with the arrival of heat treated NiTi. Since heat treatment technology is mastered by industrialists, a lot of improvement have being made. Indeed, nowadays they can apply a specific heat treatment to a specific file. According to the design of the file, its core diameter, cross section, cutting angles etc, each file will respond differently to NiTi heat treatment.

Finding the precise heat treatment is a real challenge in order to improve cyclic fatigue, centering ability while maintaining the cutting ability of the file. It is also a challenge, to have a file in martensite configuration at room temperature that will sustain these characteristics at body temperature.

The aim of the lecture is to go over the evolution of heat treatment and describe the advantages and the limits provided by heat treated NiTi, in our everyday practice.

Dr. Tara Mc Mahon

Tara Mc Mahon obtained her Master in Dental Science (MSD) at Université Libre de Bruxelles (ULB) in Belgium in 2011. After which she first followed an advanced Master in Dental Science focused on Endodontics and Aesthetic Dentistry and then she completed a two year course of specialization in Endodontics at ULB. Since 2014, Tara is an academic and clinical instructor for undergraduate students at the Brussels University (ULB) and became in 2017 a lecturer for the undergraduate endodontics course. Tara is also actively involved in training the post-graduate students during their endodontics specialisation (ULB). She works in her private practice limited to endodontic and microsurgery in Brussels - Belgium.

Dr. Tara Mc Mahon wrote several scientific articles and is a board member of « Quintessence Endo, revue française d'endodontie » . She has performed lectures and hands on courses during national and international congresses.

IS-004

Extraction-Replantation: An alternative surgical technique

Samuel O. Dorn
University of Texas at Houston, USA

There are instances when a patient desires to save a previously treated tooth, but conventional surgery is impractical. The technique of extracting such a tooth, correcting the problem, and replacing it in the socket will be investigated and described in detail. In addition, the speaker will discuss the various materials available to repair the tooth either apically or laterally, and the evidence based literature that is involved in the decisions being made.

Objectives:

- To understand indications and contraindications for extraction-replantation.
- To understand the techniques used in this procedure for the best outcomes.
- To understand the various materials used and why they are used.
- To understand the evidence for the procedure.

Prof. Samuel O. Dorn

Dr. Samuel Dorn is an endowed Professor at the University of Texas at Houston and the former department chair. He taught at the University of Florida from 1992 until 1997 when he became the Director of Postgraduate Endodontics and Co-Chair at Nova Southeastern University in Ft. Lauderdale.

Dr. Dorn was the President of the American Association of Endodontists in 2002-2003 and has previously served as a Director of the American Board of Endodontics and of the American Association of Endodontists and a Trustee of the AAE Foundation. He is now serving as Immediate Past President of the International Federation of Endodontic Associations after serving as its president from 2014 to 2016.

Dr. Dorn is a Diplomate of the American Board of Endodontics and Fellow of the American College of Dentists, and was the President of the Florida Chapter from 2000 to 2002. He is also a Fellow of the International College of Dentists, and Pierre Fauchard Academy.

Dr. Dorn has received numerous awards including the 2013 Coolidge Award for lifetime achievement, the highest award presented by the American Association of Endodontists.

Dr. Dorn has lectured extensively throughout the United States, Asia, Europe and Latin America. He has authored many articles and textbook chapters including the chapter on Emergency Treatment in the latest edition of Pathways of the Pulp.

IS-005

The paradigm shift of minimal invasive endodontics

Gianluca Plotino[1] & **Nicola M. Grande**[2]
[1]GPT Dental Clinic, Italy
[2]Catholic University of Sacred Heart, Italy

Clinical studies demonstrate that long term prognosis of the root filled teeth is influenced by the quality of the restoration as well as by the quality of the root canal treatment itself. The most recent trends in restoration of endodontically treated teeth are following the concept of minimally invasive dentistry, proposing more conservative, less expensive and bio-economic restorations, based mostly on adhesive dentistry and the introduction of new materials and technologies. Following these trends, the access procedures in endodontics and the root canal preparation are changing in a conservative way, sometimes drastically if compared with the traditional concepts of cavity outline opening and coronal straight-line access to reach the apical region. Endodontic literature appears to be poor on demonstrating how these minimal invasive access procedures can influence the quality and prognosis of root canal treatment.
The present lecture will analyze the technical procedures of minimal invasive access in different clinical situations and the possible mechanical improvements derived from it. Moreover the limits of these procedures will be critically analyzed to define how much minimal invasive clinicians should be in order to ensure gold standard endodontic treatments. At conclusion, participants should be able to evaluate the real 3D anatomy of teeth, describe the basic concepts of access cavity preparation and orifice location, perform new strategies for optimize access cavity preparation and orifice location, understand the importance of the different tooth structures on the mechanical resistance of the tooth, perform new strategies for optimize glide path management and root canal instrumentation, understand the importance of an apical refinement of preparation on the long-term outcome of endodontic treatment and evaluate critically the advantages and disadvantages of present technologies, instruments and techniques.

Dr. Gianluca Plotino

Gianluca Plotino was born in 1978 in Rome, Italy. He graduated in dentistry from the Catholic University of Sacred Heart in 2002, obtained his PhD in 2009 and received the certification to be Professor of II level in 2017. He received several international prizes, published more that 80 articles in scientific peer-reviewed journals on different endodontic and restorative topics and contributed with numerous chapters in textbooks. Gianluca Plotino is Associate Editor of the Italian Journal of Endodontucs and part of the Editorial Board of several other journals. He is certified member of the European Society of Endodontology (ESE), International Member of the American Association of Endodontists (AAE), active member of the Italian Academy of Endodontics (AIE) and the Italian Society of Conservative Dentistry (SIDOC). Dr. Plotino gives lectures and courses worldwide and he also works in his own private practice limited to endodontics and restorative dentistry in Rome, Italy.

Dr. Nicola M. Grande

Nicola M Grande received his degree in Dentistry (DDS) from the Catholic University of Sacred Heart, Rome, Italy in 1999. From 2013, he is Assistant Professor of Endodontics at the Catholic University of Sacred Heart (UCSC). He completed his PhD program at the Catholic University of Sacred Heart, in 2009. He is certified member of the European Society of Endodontology (ESE), International Member of the American Association of Endodontics (AAE), active member of the Italian Society of Conservative Dentistry (SIDOC) and of the Italian Academy of Endodontics (AIE). Dr. Grande has published extensively in international peer-reviewed journals, he is contributor in several books of endodontic interest, member of the Editorial board of international peer reviewed journals and he is lecturing both nationally and internationally as keynote speaker in the fields of endodontics, microsurgery and restorative dentistry. He works in private practice limited to endodontic and microsurgery in Rome – Italy.

IS-006

Critical issues in defining clinical outcomes and treatment success. From micro access to restorative treatment

Eudes Gondim Jr.
Associação Paulista dos Cirurgiões Dentistas (APCD), Brazil

In many instances, endodontic treatment modalities including nonsurgical root canal therapy, nonsurgical retreatment and surgical root canal therapy offer predictable means for dentists to save natural dentition. This presentation will discuss expected outcomes as well as factors that impact prognosis in a statistically significant manner. Clinical experience and exposure to various advanced situations helps the endodontist challenge cases requiring complicated decision-making skills and identify factors impacting prognosis of root canal treatment. The advent of more sophisticated digital (3D analysis) and readily retrievable patient treatment documentation has created an intense opportunity to record and measure single operator treatment outcome parameters. This will not be a “how to” presentation, but rather a “why to” presentation focusing on the decision-making process applying an evidenced based approach.

Dr. Eudes Gondim Jr.

Received his masters degree and doctoral degree from the Endodontic Unit, School of Dentistry of Piracicaba, State University of Campinas-UNICAMP in 1999 and 2003 respectively, where he has organized in 1996 the first microscope center for dentistry in South America. He has worked in private practice since 1992. He is currently an Adjunct Assistant Professor at the Department of Endodontics of the University of Pennsylvania and the chief of Micro Endodontic Specialization Program- Sao Paulo Association of Dental Surgeons (APCD). Dr. Eudes Gondim Jr. is a member of the American Association of Endodontists (AAE), Past President of the Academy of Microscope Enhanced Dentistry (AMED) and Fellow of the International College of Dentistry (FICD).
He has published several articles and is a current reviewer for the Journal of The American Dental Association (JADA), International Endodontic Journal (IEJ), International Journal of Micro Dentistry (MICRO) and Brazilian Journal of Dental Traumatology (BJDT). Past President of the Brazilian Association of Microscope Dentistry-ABRAMO-SP. Dr. Gondim is also an international lecturer, his special interests are in topics related to conventional and surgical endodontics.

IS-007

Management of second mess-buccal, narrow and curved canals with only one reciprocating instrument

Ghassan Yared
Endodontist, Private Practice, Toronto, Canada

This presentation will describe the preparation of severely curved and heavily calcified canals with only one instrument without an initial canal negotiation and without the creation of a glide path. The efficiency and safety, and the limitations of this technique will be discussed.

Objectives and/or educational:

1. Discuss the challenges associated with the initial canal negotiation / canal scouting.
2. Discuss the limitations of glide path instruments.
3. Discuss the limitations of canal shaping procedures in continuous rotation.
4. Discuss the concept of managing second mesio-buccal canals with only one instrument used in reciprocation and without an initial scouting and without creating a glide path.
5. Discuss the concept of managing severely curved and narrow canals with only one instrument used in reciprocation and without an initial scouting and without creating a glide path.

Dr. Ghassan Yared

Dr. Ghassan Yared is an endodontist practicing in Guelph and Waterloo, Ontario, Canada.

Dr. Yared has been extensively involved in teaching. He joined the Department of Endodontics at the University of Toronto in 1999 for a full-time position as Assistant Head and Director of the Endodontic Undergraduate Programme. He remained at that position as Associate Professor until summer 2004. Dr. Yared has been elected for 4 consecutive years as the "Best Teacher of the Year", and has received the "Master Bruce Howard Award for Excellence in Teaching" the highest teaching award at the Faculty of Dentistry, University of Toronto. Dr. Yared has supervised the research projects of graduate endodontic students at the University of Toronto.

He has published extensively in peer-reviewed international endodontic journals. He has also given numerous lectures and continuing education courses worldwide. Dr. Yared is a reviewer for the International Endodontic Journal, Journal of Endodontics, Oral Surgery Oral Medicine Oral Pathology Oral Radiology and Enddontics, and the Endodontic Topics. He is also a Fellow of the Royal College of Dentists of Canada, and a member of the Canadian Academy of Endodontology and the American Association of Endodontists.

IS-008

Management of severe curvatures and complex anatomy with controlled memory files: A new approach

Chaniotis Antonis
Private Practice –microEndodontics, Greece

The root canal system is often a highly complicated canal network of multi-planar curvatures and anastomoses. Reaching the biological and design objectives of instrumentation in severely curved canals, deep apical splits and complicated canal systems can be an extremely challenging aspect of root canal treatment. The aim of this lecture is to introduce a novel instrumentation concept with Hyflex CM and EDM files for the predictable and safe enlargement of extremely challenging root canal systems.

Learning objectives

Upon completion of this course the participant should be able to:

1. Understand the design and biological objectives of canal instrumentation
2. Understand the anatomical complexity of the root canal systems
3. Investigate the minimum instrumentation requirements for effective disinfection
4. Implement a new instrumentation method with Hyflex CM and EDM files for the predictable management of challenging anatomies

Dr. Chaniotis Antonis, DDS, MDSc

Chaniotis Antonis graduated from the University of Athens Dental School, Greece (1998). In 2003, he completed the three-year postgraduate program in Endodontics at the University of Athens Dental School.
Since 2003, he owns a limited to microscopic Endodontics private practice in Athens, Greece.
For the last ten years, he served as a clinical instructor affiliated with the undergraduate and postgraduate programs at the University of Athens, Athens Dental School, Endodontic department, Greece.
In 2012, he was awarded the title of Clinical fellow teacher at the University of Warwick, Warwick dentistry UK.
He lectures extensively nationally and internationally and he has published articles in local and international Journals.
He currently serves as an active member of the Hellenic Society of Endodontology (ESE full member society), a board member of the Academy of Microscope Enhanced Dentistry (AMED), a certified member of the European Society of Endodontology (ESE) and international member of American Association of Endodontists (AAE).

IS-009

“Past, present and future of endodontic files”: Where science meets technology

Sergio Kuttler
International Dental Institute Forever Learning (IDIFL), Fort Lauderdale & Palm Beach Gardens, USA

Since Dr. Walia’s introduction of the benefits and advantages of the use of NiTi as endodontic files in 1988, an overwhelming different types of hand as well as mechanized files has populated the market, some of them with a very short appearance in the marketplace due to the lack of scientific science behind the product and others due to the its impracticality, but the remaining bulk of them that has survive the demanding daily use, have become “standards” in the Endodontic World. Since the Science Of Refining Metals (2007 & 2015) endodontists worldwide have adopted the transformation of this NTi’s files for better treatment for their patients.

Dr. Sergio Kuttler, BS, DDS, CAGS

Dr. Sergio Kuttler received his Dental Degree in 1978, from the Universidad Tecnologica De Mexico, Mexico City, Mexico. He was in practice of General and Pediatric Dentistry for a number of years; in 1984 Dr. Kuttler received his Endodontic Certificate from the University of Southern California. He has been involved in academics since his graduation from USC, and practicing exclusively Endodontics. His major areas of scientific research interest include the performance of nickel-titanium endodontic instruments, three dimensional obturation of the root canal space; root canal irrigation and restoring endodontically treated teeth. Dr. Kuttler is Co-Developer of endodontic instruments, irrigation systems and post system (WaveOne, WaveOne Gold and WaveOne Gold ProGlider, SyAct and ProSafe Post), also he is a world-renowned endodontist and internationally recognized lecturer, he has presented over 550 national and worldwide courses and lectures in over 47 countries throughout 6 continents. He is the author of numerous scientific papers published in peer-reviewed journals, and contributor author in six endodontic textbooks. He serves/served on several editorial boards of journals (JOE, ENDODONTIC TOPICS, ENDODONTIC PRACTICE (US), ROOTS, Endo Tribune, Journal of The Mexican Dental Association). Dr. Kuttler is former Chair of the Endodontic Department and Associate Dean for Advanced Education Programs at Nova Southeastern University College of Dental Medicine; presently he is Co-Founder of the International Dental Institute and President/CEO International Endodontic Institute in Fort Lauderdale and Palm Beach, Florida, USA.

IS-010

A realistic look at root canal fillings. Trends, evidence and clinical performance

Hagay Shemesh
Academic Centre for Dentistry Amsterdam (ACTA), The Netherlands

This lecture will discuss the relationships between of root canal filling and the whole endodontic treatment. Different filling methods and their advantages and limitations will be presented, highlighting situations where they could best be used. A special attention will be given to modern developments in endodontology and how their implementation could influence the choice of filling methods.

Dr. Hagay Shemesh, PhD

Dr. Hagay Shemesh is a tenured Associate Professor and Chair of the division of Endodontology in ACTA, Amsterdam, the Netherlands. He received his DMD degree from the Hebrew University in Jerusalem, Israel. In 1990 and a specialty postgraduate diploma in Endodontics from the same faculty. He then immigrated to the Netherlands and started teaching the undergraduate endodontic course at the Academic Centre for dentistry Amsterdam (ACTA). He then started his PhD project and graduated in 2009 cum laude from the University of Amsterdam defending his PhD thesis “new insights into the root canal wall”. He is now chair of the department of Endodontology in ACTA, Dutch representative to the European Association of Endodontology, and is a member of the scientific referee board of the Journal of Endodontics and the International Endodontic Journal.

IS-011

Predictable and minimally invasive method to retrieve a separated file

Yoshitsugu Terauchi
CT & Microendodontic Center, Japan

One of the iatrogenic accidents in endodontic treatment is an instrument fracture within the root canal system. The majority of instruments fractured in root canals are reported to be NiTi. The literature shows the majority of NiTi instruments fracture, unfortunately, in the apical one-third or beyond a curve in the canal because of the superelastic property. An instrument fracture is very frustrating and instrument retrieval is considered to be even more challenging in endodontics than any other part of endodontic procedure. In addition, the instrument fracture immediately hinders the clinician from performing further treatment, and thus the outcome of the treatment will be compromised. Although the success rates of instrument retrieval with ultrasonics are in the range of 80 to 90%, ultrasonic retrieval has never been 100% successful and it is deemed to be unpredictable in terms of time and dentin sacrifice. Ultrasonic removal attempts especially from the apical one third of a curved canal often result in a significant amount of dentin sacrifice. On top of that, aggressive use of ultrasonics could lead to perforation and secondary fracture especially around a curve because there is no standardized technique for successful instrument retrieval. Therefore, In the lecture a standardized technique is suggested to retrieve a broken file to both maximize the success and minimize dentin sacrifice without causing iatrogenic events. The recent literature has shown that the instrument retrieval with this technique was predictable and was significantly more successful and more conservative in dentin sacrifice than that with ultrasonics. The unique procedures in combination with CBCT for instrument retrieval will also be shown and discussed using contemporary concepts.

Dr. Yoshitsugu Terauchi, D.D.S., PhD.

Dr. Terauchi is a part-time lecturer at Tokyo Medical & Dental University and maintains a private practice limited to endodontics since 1998.

He earned his DDS in 1993 and completed his residency at Tokyo Medical & Dental University in 1995, where he also received his PhD from the Department of Endodontics. He has published several articles in peer- reviewed journals nationally and internationally. He also authored in several chapters in textbooks including the 11th edition of " Pathways of the Pulp". He has lectured nationally and internationally and was exposed twice on National TV for modern endodontics.

IS-012

How asymmetric geometry and heat-treatment influence the behavior of rotary root canal instruments

Franck Diemer
Toulouse University, France

Current concepts in root canal system preparation still largely rely on mechanical instrumentation. Two major factors affect the choice of instruments for root canal preparation: its ability to achieve the root canal shaping and its safety.
The file accuracy is linked to its resistance to fracture, its lack of threading in dentinal walls when used in continuous rotary motion and its ability to respect the initial canal path in curved canals. The original canal anatomy must be maintained. Most of these factors depend on the profile of the instrument and so, on the design of its active part.
When used in a continuous rotating motion, even at low speed, Ni-Ti shaping instruments may absorb lots of constraints: torsional stresses, cyclic fatigue, and cutting fatigue. Decreasing those constraints increase the security of shaping. For this purpose, managing the initial constraints at the junction of crown and root with an opener to create sufficient space or glide path for file's tip is strongly recommended.
In the last decade the geometry of the instruments evolved tremendously. In 2008, the emergence of an asymmetrical cross section with the Revo-S® has reduced the constraints and improved the cleaning ability of endodontic instruments. In their quest to increase flexibility of NiTi alloy without compromising its super elastic properties, Micro Mega introduced an innovative cross section and a post machining thermo mechanical treatment called T wire. These improvements were used to produce a new opener One Flare® and a new file sequence. This short sequence, 2Shape®, will allow clinicians to shape almost all canal anatomies with only two files. The new asymmetric section will be described and its mechanical behavior will be extensively explained.
At the end of the presentation, the participants will be able to describe the different advantages of asymmetric files and will be able to use OneFlare®, and 2Shape®, safely and easily in the widest range of canal anatomy.

Dr. Franck Diemer

Dr. Diemer earned his dental surgery's doctorate in 1995 at the University of Toulouse. He also has a Master in Science and Medical Biology (1998), a postgraduate diploma in pedagogy (2001), and a PhD from the Paul Sabatier University (2006). He is full professor in the Toulouse Dental Surgery's University, at the head of Endodontics department. He is a member of the French National College of Teachers in Dentistry (CNEOC) and the vice-president of the French Society of Endodontics (SFE). He is member of the scientific comitee of Toulouse Dental Surgery's University, CNEOC and SFE. Dr. Diemer has full hospital practice and is attached to the Clement Ader Institute (Surface, Machining, Materials and Tools team – UMR CNRS 5312). He has presented numerous lectures and continuing education, and published many national and international articles.

IS-013

From vital pulp therapy to anatomically directed root treatment - Everything is changing!

Martin Trope
University of Pennsylvania, USA

New materials and technologies enable us now to consider treatments that were previously considered impossible.

This talk will cover how bioceramic materials have changed our definition of irreversible pulpitis and also how we think about single cone hyraulic obturation techniques. In addition new designs of root canal instruments make Shilder's "envelope of motion" an attainable goal with resultant better contact of the wider parts of the canal while maintaining maximal tooth structure.

- Understand the requirements for successful vital pulp therapy and root canal therapy.
- Understand the advantages of bioceramic materials.
- Understand new techniques for vital pulp therapy and root canal filling.
- Understand the advantages of virtual core adaptable instruments for superior cleaning with minimal destruction of the tooth.

Dr. Martin Trope, DMD

Dr. Martin Trope was born in Johannesburg, South Africa where he received his BDS degree in dentistry in 1976. From 1976 to 1980 he practiced General Dentistry and Endodontics. In 1980 he moved to Philadelphia to specialize in Endodontics at the University of Pennsylvania. After graduating as an Endodontist he continued at the University of Pennsylvania as a faculty member until 1989 when he became Chair of Endodontology at Temple University, School of Dentistry. In 1993 he accepted the JB Freedland Professorship in the Department of Endodontics, UNC at Chapel Hill. Named in honor of one of the founding fathers of Endodontics, the Freedland Professorship recognizes significant contributions to the specialty. In 2014, he was awarded the Jens Ove Andreasen Lifetime Achievement Award by the International Association of Dental Traumatology.

Dr. Trope is Clinical Professor, Department of Endodontics, University of Pennsylvania. He is also in private practice.

IS-014

Solutions to simplify shaping and cleaning: Improving the quality of the root canal treatment

Filippo Cardinali
Private Practice, Italy

Shaping, cleaning of the root canal system are essential phases of orthograde root canal treatment. Their correct execution allows the clinician to hit the goals of endodontic treatment and achieve the success of the therapy.

In nonsurgical endodontics the difficulties encountered by the practitioner are almost exclusively of anatomical type, and the endodontic anatomy is together with bacteria the real challenge to the success. During the shaping, the original anatomy respect allows the operator to prepare the endodontic space saving radicular dentine, with an ideal shape for receiving an efficient volume of irrigant and the three-dimensional obturation. The execution of shapes that fit and meet the original anatomy decreases the risk of creating alterations in the morphology of the root canal itself, such as ledges or transport, regarded by the international scientific literature as factors predisposing to failure of the therapy.

Cleaning is a key part of successful root canal treatment: the debridement of all vital or necrotic tissue, microorganisms, and their products from the root canal system is essential to prevent the reinfection and to get a positive outcome of the therapy: in fact in endodontic failures, microbes are always present in the root canal system. The activation of irrigating solutions using ultrasonic dedicated devices, improves the cleaning even in irregular and oval canal cross-sections, accessory canals, isthmuses, anastomoses, curves and apical delta thanks to cavitation and acoustic streaming effect.

Clinically, the ideal situation for the operator is to achieve the objectives of endodontic therapy in the easiest possible way and with less stress possible, that means to get shaping with an high respect of the original endodontic anatomy using a limited number of rotary files without the fear of separation of the rotary files and to get a good cleaning in less time as possible.

This lecture has three main goals: the first one is to underline how endodontic anatomy, shaping and cleaning are closely related to each other, and also how rotary NiTi files can create alterations that may result in a failure of the endodontic therapy if misused. The second goal is to highlight how nowadays in nonsurgical endodontics, thanks to the new system, a totally mechanical shaping can be safely performed by the clinician, getting high quality and original anatomy respectful shaping, even in complex anatomies and even using a reduced number of instruments.

The third last but not least goal is to highlight how nowadays it is possible to improve the quality of the cleaning using technique and devices within everyone's reach.

Dr. Filippo Cardinali

Graduate in Dentistry and Dental Prosthesis at the University of Ancona in 1992.
Active Member of the Italian Society of Endodontics.
Certified Member of the European Society of Endodontology.
Associate Member of American Association of Endodontists.
Gold Member of Styleitaliano Endodontics.

In the Italian Society of Endodontics (SIE), currently holds the position of Treasurer and of Country Representative of the Italian Society of Endodontics at the ESE. Co-author of the book "Text atlas of anatomy endodontic" published by Tecniche Nuove in 2011. Co-author of the book " Isolation of the operative field: how to streamline the clinical and improve their professional quality life "published by ANDI Servizi in 2013. Co-author of the book "Manuale di Endodonzia" published by Elsevier Masson Italy in 2013. Co-author of the iBook "The Isolation Game: rubber dam use in endodontics and restorative" published and available on Apple iBook Stores. Lecturer in theoretical and practical courses on subjects related to the isolation of the operative field and endodontics, has participated as a speaker at courses and conferences in Italy and abroad. Private practice, concentrating mainly endodontics and restorative and author of publications on journals of national and international sector.

IS-015

Pulp tissue regeneration: Challenges and new outlook

Mo K. Kang
UCLA School of Dentistry, USA

Pulp tissue regeneration, such as revascularization, has gained tremendous clinical and scientific interest over the past decades. Recent studies uncovered the challenges with revascularization, including frequent root canal calcification and lack of functional pulp tissue regeneration. Thus, the future endeavors will be geared towards cell-based approaches, in which regeneration of pulp-dentin complex would circumvent the clinical challenges associated with pulp tissue regeneration. The lecture will highlight the current state of pulp regeneration approaches and ways in which dentin-pulp complex may be regenerated in otherwise necrotic pulp tissues. One of the main issues dealing with success of endodontic regeneration is control of inflammation. In the current lecture, I will also discuss new developments in our understanding of apical inflammation, in light of development in the area of epigenetic regulation of inflammatory cytokines.

Dr. Mo K. Kang, DDS, PhD

Dr. Mo K. Kang, DDS, PhD is a graduate of D.D.S./Ph.D. dual degree program at the UCLA School of Dentistry, where he also received specialty training in Endodontics. Dr. Kang has been appointed faculty at the UCLA School of Dentistry since 2003 and is currently Professor and Chairman of the Section of Endodontics at UCLA. Dr. Kang is a diplomate of the American Board of Endodontics (ABE) and has served as Associate Editor of the Journal of Endodontics since 2014. Dr. Kang is actively engaged in research programs in oral cancer, oral inflammation, and pulp regeneration studies at UCLA with more than 100 scientific publications, book chapters, and review articles in various areas of his studies.

IS-016

Management of iatrogenic errors by non-surgical and surgical retreatment

Frank C Setzer
University of Pennsylvania, USA

This presentation will systematically discuss treatment of perforations, removal of instrument fragments and other foreign objects from the root canal system, as well as contemporary treatment approaches for other introgenic errors such as transportations or ledges. In addition, it will be reviewed how to successfully prevent instrument separations, or other iatrogenic errors that may occur throughout the instrumentation of complex root canal systems or posts and carrier based obturation removal attempts, with a focus on minimally invasive approaches.

Dr. Frank C Setzer, DMD, PhD, MS

Diplomate, American Board of Endodontics
Assistant Professor of Endodontics, University of Pennsylvania

Graduated from the Dental School of the Friedrich-Alexander-University Erlangen-Nuremberg, Germany in 1995. Received the doctoral degree also from the Friedrich-Alexander-University in Erlangen in 1998 with magna cum laude. Pursued specialty training at the University of Pennsylvania after working for nine years in a multi-specialist private practice as associate and partner. Graduated from the endodontic program in 2006, with the Richard F. Weiss Award for Excellence. Received a Master of Science degree in oral biology in 2008 and DMD degree in 2010. Clinic and Pre-Doctoral Director at the Department of Endodontics of the University of Pennsylvania in Philadelphia. Diplomate of the American Board of Endodontics. Published in national and international peer-reviewed journals, lectures nationally and internationally on various endodontic topics with a focus on endodontic microsurgery and treatment planning implant versus natural tooth supported restorations. Serving as an associate editor for Quintessence International, reviewer for the Journal of Endodontics (JOE), International Endodontic Journal (IEJ), JADA and others. Active member of several national and international professional societies, board member of AMED (Academy of Microscope Enhanced Dentistry) and VDZE (Society of German Certified Endodontists).

IS-017

Endodontics Microsurgery A to Z

Syngcuk Kim
University of Pennsylvania, USA

Modern endodontic practice must provide both nonsurgical and surgical treatment options. It has been our observation that there are too many nonsurgical retreatments of cases that should have been treated micro-surgically in the first place. The basics of endodontic microsurgery will be presented, so that more endodontists will consider this option when faced with failed cases.

Modern Endodontic microsurgery is fundamentally different from the old apical surgery or apicoectomy in terms of instruments, materials, biological principles and, most importantly, the success rate. In this presentation I will illustrate 8 basic steps in microsurgery, so that the participants will have a clear understanding of the surgical procedures. These 8 steps are: esthetic flap management, effective hemostasis, a small osteotomy, skillful management of the mental nerve and the sinus, identification of complex root canal anatomy visible on the resected root surface, precise root-end preparation with ultrasonic tips and root-end filling with Bioceramic and flap closure with microsutures. In the end the long term outcome assessment will be presented.

Dr. Syngcuk Kim, D.D.S., M.Phil, Ph.D., M.D. (hon.)

Prof. Syngcuk Kim graduated from Columbia University, School of Dental & Oral Surgery in 1976. He completed the residency at the Department of Endodontics, Columbia University in 1987 and earned Ph.D. degree of Circulatory Physiology from the Department of Physiology, College of Physicians and Surgeons, Columbia University in 1981. He joined the Dental School at the University of Pennsylvania in 1992 as chairman of the Department of Endodontics. Currently, he is Louis I. Grossman Professor at the Department of Endodontics, associate dean for global affairs & advanced dental education at the University of Pennsylvania. Dr. Kim has published many valuable research and review papers in esteemed journals and is the author of a textbook entitled, "Color Atlas of Microsurgery in Endodontics" published in 2017.

IS-018

Early diagnosis and biomechanics of Vertical Root Fractures

Zvi Metzger
Tel Aviv University, Israel

Vertical root fractures (VRFs) are often undiagnosed or misdiagnosed for a rather long time, thus frustrating both the patient and his dentist. At early stage VRFs cannot be detected with periapical radiographs. The “typical radiographic appearance of VRF”, which is commonly mentioned in papers and quoted in textbooks, often represents unjustified failure to diagnose the VRF in time, before a major damage to the surrounding bone has occurred. The most pathognomonic early sign of VRF is a unique type of periodontal pocket, which is very narrow and deep, which may appear with or without a sinus tract that is located more coronally than expected from a sinus tract emerging from a periapical lesion, even at the attached gingiva. CBCT cannot usually demonstrate the early VRF itself, however it may be very useful to identify the pattern of bone destruction that occurs along the VRF. The aim of this presentation will be to make each of the audience an expert in early diagnosis of VRFs.
To minimize the risk of VRFs it is essential to understand the biomechanics of VRFs and the predisposing factors that may lead to such fractures. Some of these are naturally occurring factors, such as the shape of the root and pre-existing naturally occurring micro-cracks. Nevertheless, other predisposing factors are iatrogenic in nature and thus depend on the endodontic procedure that was carried out on this tooth. These include excessive instrumentation of the canal, instrumentation that results in uneven thickness of the canal walls, type of spreader used for lateral compaction and above all the creation of iatrogenic micro-cracks by using large taper rotary and reciprocating files. The predisposing factors will be reviewed in details, including suggesting ways how to minimize or avoid the iatrogenic contribution to the creation of VRFs.

Prof. Zvi Metzger

Prof. Zvi Metzger graduated from the Hebrew University School of Dental Medicine in Jerusalem in 1970. Since 1973 he has been on the faculty at the Tel Aviv University School of Dental Medicine, where he served as Dean in the years 1987-1991. Prof. Metzger was Chairman of the National Board of Endodontics in Israel and Chairman of the Israeli Endodontic Society (2000-2002). He was an Associate Professor of Oral Biology and Professor of Endodontology at Tel Aviv University. Prof. Metzger was a visiting fellow at the National Institute of Dental Research, NIH, Maryland (1978-1981) and a visiting professor at the University of North Carolina at Chapel Hill (1995-1996). He served as Director of Research Laboratories (1981-2009) and recently (2008-2012) as Chairman of the Department of Endodontology at the School of Dental Medicine at Tel Aviv university, where he serves now as Professor Emeritus. He retains a private endodontic practice in Tel Aviv.
Prof. Metzger has been involved in development of several innovative endodontic instruments, such as Apexum and the SAF System. He has published intensively on biological and clinical endodontic topics and has authored many chapters in leading textbooks, including a recent chapter on the topic of his current presentation in the textbook Pathways of the Pulp.

IS-019

Endodontic disinfection: 3D irrigation

Cliff Ruddle
Advanced Endodontics®, USA

There is great controversy in opinion regarding the ability to achieve complete treatment, yet predictably successful endodontics is dependent on fulfilling the objectives for shaping canals, 3D cleaning, and filling root canal systems. This lecture will emphasize the clinical importance of active irrigation and its role in cleaning both the instrumentable and uninstrumentable portions of root canal systems. Evidence-based research will be presented to compare and contrast new methods intended to improve debridement, smear layer removal, and the disruption of Biofilms.

Dr. Cliff Ruddle, DDS

Dr. Clifford J. Ruddle is Founder and Director of Advanced Endodontics. Additionally, he maintains teaching positions at various dental schools, is a fellow in both the American and International Colleges of Dentistry, and has authored numerous articles and chapters for leading textbooks. As an inventor, Dr. Ruddle has designed and developed several instruments and devices that are widely used internationally. He is best known for providing superb education through his lectures, instructional DVDs, and "ONE-ON-ONE" training courses in Santa Barbara, California. To learn more about Dr. Ruddle, visit www.endoruddle.com.

IS-020

Is there still a role for medicaments in endodontics?

Paul V. Abbott
The University of Western Australia, Australia

Much debate occurs within the dental profession about whether root canal treatment can, or should, be done in one or more appointments. Traditionally, multiple appointments were always used but over the last three decades the idea of a single appointment procedure has gained popularity amongst some practitioners. Proponents of the one-visit approach justify their ideas in many ways – for example, some will say that there are no bacteria in pulpitis cases and therefore the canals can be filled immediately whilst in cases with infected canals, the remaining bacteria will be “entombed” within the root filling and therefore will not survive. However, is there any evidence to support these approaches, and if so, is there sufficient or adequate evidence? Such a major change in treatment philosophy must be supported by scientific evidence and therefore this lecture will explore the literature in order to answer these questions and to provide background information to enable dentists to make an informed decision about their own treatment philosophy. In this era of great emphasis on the technical aspects of root canal treatment, the role of medicaments is often forgotten. When considering that pulp, root canal and periapical conditions are mainly due to bacteria in the root canal system, a biological approach must over-ride the mechanics. Hence, medicaments are extremely important for predictable treatment outcomes. They also have other essential functions such as reducing inflammatory resorption and post-operative pain control.

Prof. Paul V. Abbott, AO, BDSc, MDS, FRACDS(Endo), FPFA, FADI, FICD, FACD, FIADT

Prof. Paul Abbott is the Winthrop Professor of Clinical Dentistry at The University of Western Australia. He is a Specialist Endodontist and works in private practice on a part-time basis. Prior to taking a full-time University position in 2002, he spent 17 years in private specialist endodontic practice in Perth and Melbourne. He was Dean of the School of Dentistry at The University of Western Australia and Director of the Oral Health Centre of WA from 2003-2009. He has presented over 770 lectures and courses in 42 countries. He has published 160 articles in refereed journals and 23 textbook chapters. In 2015, he was appointed as Editor-in-Chief of the international journal Dental Traumatology. He has received numerous awards for excellence in teaching and for service to the dental profession, particularly in education and research. In 2015, he was appointed as an Officer of the Order of Australia.

IS-021

Nanoparticles in endodontics: Potential game changer

Anil Kishen
University of Toronto, Canada

Endodontic technologies and biomaterials have witnessed substantial advances in the last decade. In spite of these advances, some of the integral limitations in endodontic treatment still persist. Development of minimally invasive techniques that predictably disinfect the infected teeth, reverse disease mediated changes in dentin, improve mechanical characteristics of dentin and promote biologically based treatment will have the potential to shift the current paradigm in endodontic therapy. Bioactive nanoparticles have received significant interest in biomedicine and health care in the recent times. This lecture will cover the application of multifunctional bioactive nanoparticles for the treatment of teeth with apical periodontitis.

Dr. Anil Kishen

Dr. Kishen is Professor of Endodontics and Principal Investigator of the Nanoparticle Guided Functional Tissue Engineering Lab at the University of Toronto. He has published over 120 peer-reviewed articles with over 10 invention disclosures to his credit. Dr. Kishen has pioneered novel technologies for endodontic treatments and is a strong advocate for high-quality translational research benefiting patient care.

IS-022

The relationship between reciprocation, glidepath and canal scouting

Gustavo De-Deus
Universidade Federal Fluminense, Brazil

- The biological and mechanical limitations of the current technology for canal preparation
- Reciprocation and canal scoutability: a critical relationship
- The drivers that lead to the choice of the glide path
- Advantages and limitations of the glide path
- The current status of the Pathfinder instruments
- Future perspectives

Dr. Gustavo De-Deus, PhD

Dr. Gustavo De-Deus received his DDS degree in 1996 and his Certificate in Endodontics in 1998 from Rio de Janeiro State University. In 2004, Dr. De-Deus received his Master Science degree in Materials Science and Engineering from Catholic University of Rio de Janeiro and his PhD was done at Rio de State University in Endodontics (2009). Dr. De-Deus has more than 200 scientific studies published (~120 studies in the JOE and IEJ) and has more than 100 lectures in 25 countries about Endodontic Infection, Single-visit Endodontics, MTA, Instrumentation Techniques, Irrigating Solutions, Root-Filling materials and Contemporary Endodontic Treatment. His studies had received over 5,500 citations in the Google Scholar database up to July 2018 (https://scholar.google.com.br/citations?user=N7MSoo8AAAAJ&hl=pt-BR). He is an associate Editor for Root Fillings studies and Biomaterials of the International Endodontic Journal. Dr. De-Deus is Adjunct Professor from University Grande Rio and Federal Fluminense University. Dr. De-Deus maintains a private practice limited to Endodontics in Ipanema, Rio de Janeiro, Brazil, since 1999.

IS-023

"Is it really toothache?" Non-odontogenic pain presenting as dental pain

Asgeir Sigurdsson
New York University College of Dentistry, USA

Being able to correctly diagnose what ails a patient with facial pain is something almost every dentist does daily. Fortunately, most often it is an easy task, however on occasion it can be difficult, especially when pain is referred to a remote site or is caused by non-odontogenic diseases that mimic odontogenic pain. The first aim of this lecture is to review the most common diagnostic tools for diagnosing the offending tooth and how they are best used. The second aim of this lecture is review some of the more common non-odontogenic sources of pain that could be confused with pain of dental origin. Many case histories will be included in the lecture to illustrate different manifestations of these diseases.

The participants will:

- Understand the fundamental mechanisms for referred pain.
- Know about the most common diseases that mimic toothache pain.
- Know about diagnostic tests that will aid in differentiating between odonto and non-odontogenic pain.
- Recognize if the pain is indicating a life-threatening disease.

Dr. Asgeir Sigurdsson

Born and raised in Reykjavik, Iceland. Received his DDS from University of Iceland in 1988. Graduated from University of North Carolina (UNC) in 1992, with certificate in endodontics and Master of Science.

Full time faculty at UNC from 1992 until 2004, was the Graduate Program Director of Endodontics 1997 to 2004. From 2004 to 2012 he was in a private endodontic practice in Reykjavik and London.

In 2012, he became the Chairman of the Department of Endodontics, NYU College of Dentistry. Additionally he holds the following academic positions: adjunct Associate Professor at UNC, and Honorary Clinical Teacher in Endodontology, UCL Eastman Dental Institute, London, UK.

Dr. Sigurdsson is past President of the International Association for Dental Traumatology and is on the editorial board of Dental Traumatologia. In 2014 Dr. Sigurdsson was appointed by AAE as a Director of the American Board of Endodontics.

Dr. Sigurdsson has been invited numerous times to lecture in 44 countries all over the World, on the topics of pain, endodontics, dental trauma and/or forensic sciences. He has written or co-written over 70 per-reviewed articles and 19 textbook chapters on same topics.

IS-024

Understanding anatomy in 3 dimensions

Gianluca Gambarini
University of Rome, Italy

For may decades endodontics has been a two-dimensional discipline, being evaluated and assessed mainly by 2d periapical radiographs. Nowadays the use of CBCT is becoming more frequent in dentistry and images can be used profitably also in endodontics. 3d preoperative images allow not only a more precise diagnosis and treatment planning, but also a better understanding of the complexities of root canals. Such a knowledge becomes fundamental to understand anatomical features that may affect quality of shaping and cleaning procedures, minimizing the risks of iatrogenic mistakes. Such a preliminary understanding will not only reduce the risks of missed canals and missed treatments, but will also allow to plan a correct approach to the different canals based on the 3d case assessment. Hidden curvatures are always present in 3d and the lecture will focus on the rules of 3d anatomy. Moreover new softwares and 3d rendering of cases will be presented to help analyzing 3d CBCT images in a more precise and detailed way.

Prof. Gianluca Gambarini, MD, DDS

International lecturer and researcher, he is an author of more than 380 scientific articles, two books and chapters in other books. He has lectured all over the world (more than 240 presentations) and has been invited as a main speaker in the most important international (AAE, IFEA, ESE) and national endodontic congresses in Europe, North and South America, Asia, Middle East, Australia and South Africa. He has also lectured in many Universities worldwide.
He has focused his interests on endodontic materials and clinical endodontics. He is actively cooperating with many manufacturers all over the world to develop new technologies, operative procedures and materials for root canal treatment.
Official Italian member of ANSI/ADA and ISO Committees for Endodontic Materials. Active member of IADR, Italian Society of Endodontists (SIE) and European Society of Endodontology (ESE), Associate member of AAE. Scientific editor of the Italian Journal of Endodontics (G.It. Endo), official Journal of Italian Society of Endodontists (SIE).

IS-025

Root Resorption after dental trauma - Findings and treatment possibilities

Andreas Braun
Academic Centre for Dentistry Amsterdam (ACTA), The Netherlands

Dental trauma has often devastating consequences. Soft tissue injuries, in most cases, heal very quickly, while the hard tissues, especially the teeth and surrounding bone, could have long-lasting sequelae. Injured teeth can become necrotic or discolored, but more difficult and unpredictable are resorption processes.

This lecture will give a clinical overview on different resorption processes and relevant treatment possibilities as well discuss the diagnosis, prognosis and alternative approaches.

Dr. Andreas Braun, DDS, MSc

Andreas was born in Germany and graduated in 1990 his dental studies at ACTA (Academic Centre for Dentistry Amsterdam, the Netherlands).

From his graduation on until 1999 he worked part-time in a general dental practice and as lecturer at ACTA. He followed the postgraduate training Endodontology at ACTA (1999 – 2002, course-director: Prof. Dr. P.R. Wesselink). Since then he works in a private practice limited to Endodontics and as a senior staff member at the department of Endodontology at ACTA mainly for under- and postgraduate programs in Endodontology.

His primary interests are Dental Traumatology and its application in aesthetic dentistry (orthodontic and restorative modalities), diagnostics and treatment of (severe) endodontic problems and treatment of endodontic failures.

He has written several articles in Dutch and English papers and is co-author of the book: Endodontologie (Red. Thoden van Velzen & Wesselink), 2010.

IS-026

Current concepts in endodontic microsurgery: Esthetic management of the soft tissue

Francesco Maggiore
University of Pennsylvania, Private Praxis in Aschaffenburg, Germany

Esthetic soft tissue management is one of the most important aspects in current Endodontic Microsurgery. The final esthetic outcome relies on several factors such as proper flap design and incision, gentle flap elevation and retraction, precise repositioning and suturing.

The primary purposes of flap design and elevation are to provide adequate surgical access to the underlining bone and root structure and to promote a scar-free soft tissue healing.

Proper soft tissue management should prevent any unesthetic complication and any potential damage to adjacent critical anatomical entities.

The ultimate esthetic result of the soft tissue healing also depends on tissue bio-type, the instruments used to incise, elevate and retract the flap as well as the careful reapproximation and proper closure technique.

The presentation focuses on each single aspect of soft tissue manipulation and describes in details the main principles of soft tissue handling during Endodontic Microsurgical procedures.

Dr. Francesco Maggiore

Dr. Francesco Maggiore graduated from “La Sapienza” University of Rome, School of Dentistry, Italy. In 1999, he completed his full time Postgraduate Program in Endodontics and Endodontic Microsurgery at the University of Pennsylvania, Philadelphia, USA, obtaining his Certificate of Advanced Graduate Study (CAGS) in Endodontics. From the same institution he received the “Award for outstanding case presentation class 1999” and the Award for “Contribution in teaching Microendodontics and Endodontic Microsurgery”. Dr. Maggiore has been teaching as Clinical Assistant Professor in the Endodontic Department at the University of Pennsylvania and currently he serves as Adjunct Assistant Professor. He has been lecturing on endodontic topics in Europe, USA, Asia, and published scientific articles in international journals. In 2002, he received the award for “The best endodontic clinical case” from the Italian Academy of Endodontics and in 2009 he received the award for “The best Clinical Video Documentation” from the Italian Association of Endodontics. He has been teaching as Visiting Professor at the University of Ancona, School of Dental Medicine, Italy.

He is a speaker and a member of several scientific associations.

He maintains a private praxis limited to Endodontics and Endodontic Microsurgery in Aschaffenburg, Germany.

IS-027

How to prevent instrument breakage by creating a mechanical reproducible Glide Path (Don’t rotate, reciprocate)

Yosef Nahmias
Alliance Dental Specialists, Canada

Instrument breakage remains one of the most frustrating and tragic events that we have to face in our daily practices. This lecture will describe a technique that involves the use of mechanical instruments to create a reproducible Glide Path that will prevent the separation of instruments in the root canal system even in the most challenging of cases

At the conclusion, participants will be able to:

- Define what a Reproducible Glide path is
- Explain the use of Mechanical instruments to create a Glide Path
- Learn how to prevent instrument breakage in the root canal system
- Incorporate this strategy in their day to day practice

Dr. Yosef Nahmias

Dr. Nahmias was born and raised in Mexico City. After graduating from Dental School in 1980 he decided to advance his education and chose endodontics as his specialty. He earned his Master of Science degree in 1983 from Marquette University in Milwaukee, Wisconsin.
Dr. Nahmias has authored and published many articles. He continues to lecture in Canada and across the world. The University of Toronto, Faculty of Dentistry has involved him in teaching their postgraduate level students in endodontics. Dr. Nahmias resides in Toronto, Canada and has maintained a private practice limited to Endodontics for over 35 years.

IS-028

Re-establishing biological order - Call for action

Ibrahim H. Abu Tahun
The University of Jordan, Jordan

Dentistry and endodontics are changing at an ever increasing speed and conventional methods of work are rapidly being replaced by new work flows. The profession can now do a lot better than it does and the potential of endodontic treatment in saving natural tooth is much higher than what the profession actually gets out of it.

An even bigger paradigm shift than moving from just old to new is “going BIOLOGY”. The traditional concept of replacing diseased tooth/pulp tissues by inert materials is being challenged by recent advances in pulp biology. There have been remarkable changes in the field of endodontics in recent years, resulting in “a shift from mechanically oriented treatment to a more biologically focused approach” to maintain the original healthy tissue that has the best biologic value.

The time has come for dentistry and dentists to distinguish between truth and fact. Without undermining the efficacy of traditional endodontic therapies, this presentation will discuss dentistry’s preferred future in an attempt to cultivate future potentials in this field as a strategic priority to cast away subjective self-limiting beliefs and assumptions that keep us tied to the status quo and to position practitioners at the forefront of this field.

Dr. Ibrahim H. Abu Tahun, DDS, PhD

Dr. Ibrahim H. Abu Tahun is Associate Professor of Endodontics, Department of Conservative Dentistry, School of Dentistry, The University of Jordan. He is a 1982 graduate of University of Athens, Greece and received his PhD in endodontics at the Department of Endodontics at the same university in 1987.
Dr. Tahun served in many capacities, such as founding president of the Jordanian Endodontic Society, founding president, Pan Arab Endodontic Society and President of Asia Pacific Endodontic Confederation and currently Chairman of the Educational Committee of APEC.
As an active member of several organizations, Dr. Abu Tahun has received honors & appreciations and awarded the" International Globe Award" in Endodontics.
He also served as Chairman of Higher Education Committee of the Jordan Medical Council, Chairman of the Scientific Committee and Chairman of Planning and Training committee of the Jordanian Board in Endodontics. Currently, Dr. Tahun is Honorary Diplomat of Indian Board of Endodontics.

He is Editorial Board Member of several International Dental & Endodontic Journals and acted as external examiner, cognate and reviewer of (M.Sc. thesis), reviewer of several articles and published a number of scientific articles in elute international endodontic journals.

Dr. Tahun has also lectured extensively within Jordan and worldwide as invited and guest speaker and has presented a large number of hands-on courses in the field of root canal treatment.

IS-029

Contemporary approaches to instrumentation of non-round root canals

Michael Solomonov
Sheba Medical Center, Israel

Today it is clearer than ever that irregularly-shaped root canals – oval, flat, C-shaped, with isthmuses and recesses – are not a rare situation, but rather the common case, and that they pose a daily challenge to clinicians. Pathological aberrations, such as internal resorption cases, add to this complexity, and make the instrumentation of the root canal system even more challenging. In the light of this updated knowledge, in the last few years several new instruments and instrumentation techniques have targeted these types of canals in an attempt to achieve better results in cleaning and shaping.
Such instruments have been challenging some old paradigms, by changing the metallurgy, the design and even the mode of operation. They include instruments such as XP-Endo Shaper and Finisher, TruShape, the Self-Adjusting File (SAF), and GentleFile.
These new instruments will be reviewed and analyzed in an evidence-based approach, focusing on their ability to cope with the challenge of irregular root canals, by analysis of data - including manufactures' claims, recent researches and scientific literature. Some of our clinical experience at the Sheba Medical Center post-graduate endodontic department in Israel will be presented, to illustrate and clarify the method of work with these instruments.
In this lecture I aim to put some order to the new instrumentation techniques, and to form a helpful guide for clinicians in choosing the appropriate instruments for different challenging clinical situations, and to discuss recommendations for further required research.

Dr. Michael Solomonov, DMD

Michael Solomonov, DMD, is an Israeli board certified endodontist and the director of the Postgraduate Endodontic program in Endodontics at the Sheba Medical Center, Tel-Hashomer, IDF, Israel.
Dr. Solomonov received his DMD degree at the Tel Aviv University in Israel in 1994, and in 2002 graduated from the 3 years postgraduate program in Endodontology at the Hebrew University – Hadassah in Jerusalem.
From 2003 to 2010 Dr. Solomonov served as a clinical instructor at the Hebrew University, Hadassah School of Dental Medicine, Department of Endodontics, Jerusalem. From 2011 he serves as the director of the postgraduate endodontic program in Endodontic department at the Sheba Medical Center, Tel-Hashomer, IDF, Israel.
From 2008 Dr. Solomonov is an examiner for the Israeli Board of Endodontics at the Scientific Council of the Israeli Dental Association.
He is a member of the American Association of Endodontics (AAE), the European Society of Endodontology (ESE) and the Israeli Endodontic society.
Dr. Solomonov has presented and lectured at national and international congresses in Israel, Russia, Greece, Poland, Japan, Italy, Ukraine, Kazakhstan, Kyrgyzstan, Germany, Moldova, Spain, France, Canada, and Slovenia, and regularly conducts courses on clinical endodontics in Israel and Russia.
He has published over 20 peer-reviewed scientific articles, as well as textbook on clinical endodontics.
Since 1999 he operates a private practice limited to endodontics. He is the founder of the Endodontic Medical Center at the Tel-Aviv metropolis, where he works clinically, alongside board certified endodontists, as well as carries out private courses on contemporary endodontics.

IS-030

Prognosis of Apical Periodontitis: Does size really matters

Ahmed Abdel Rahman Hashem
Ain Shams University, Egypt

There is a general consensus among general practitioners and oral surgeons that the larger the size of apical bone loss, the more we need apical surgery. Is this true? This lecture will try to analyze the basis of this assumption and it's validity. Literature will be discussed and several cases with large apical bone loss, their management and prognosis will be presented.

Prof. Ahmed Abdel Rahman Hashem, BDS, MSc, PhD, FICD

Prof. Hashem was born in Cairo, Egypt 1968. He finished his high school 1985. He was graduated in the Faculty of Oral and Dental medicine, Cairo University 1990, finished his intern 1991 and worked as instructor in the endodontic department in the same university 1992. He got his master degree from the same university in 1997 and moved to Faculty of Dentistry, Ain Shams University to work as assistant lecturer in the department of restorative dentistry. In 2001, he finished his PHD in Endodontics from Faculty of Dentistry, Ain Shams University and promoted to be a lecturer in Endodontic department in the same university. He among others established the Egyptian association of Endodontists in 2001. He was awarded the best research prize in Ain Shams University 2005. In 2007, He became an associate professor in the same faculty.
In 2009, he among others established the Arab MicroDentistry Association and became its president. He was assigned the head of the postgraduate continuous education in the faculty of Dentistry, Ain Shams University in 2010. In 2011, Dr. Hashem moved to the Faculty of Oral and Dental Medicine at Future University. He founded and started one of the finest education centers in the Middle East in the Future university In 2012. This center contains 20 surgical microscopes, digital radiography, soon to have CBCT and all the contemporary devices and instruments in the field of Endodontics. Dr. Hashem conducts a postgraduate Micro-Endodontic course every month in this center since 2012. Also in 2012, he was promoted to full Professor position in department of Endodontics in the same University. He has been since 2012 visiting Metro-Health hospital in Cleveland, USA and conducting a micro-Endodontic course to the residents of the general residency program there.
Dr. Hashem was chosen by the Egyptian Association of Endodontists to be Egypt country representative in the International Federation of Endodontic Associations in 2014. He became a certified speaker to FDI in 2014. He is serving also as the general secretary of the Egyptian Association of Endodontists since 2015. In the beginning of 2016, Dr. hashem joined the board of the Egyptian Dental Syndicate and now acting as the head of the continuous education committee. He was the head of the scientific committee during its last international meeting in September 2016. He was nominated as a Fellow of the International College of Dentists (FICD) in 2016. Dr. Hashem is a member of several national and international associations. He serves as a reviewer in several prestigious international journals. He lectured in numerous national and international conferences.
Prof. Hashem has more than 25 publications in Ain Shams University Dental Journal, the Egyptian Dental Journal, Journal of Endodontics, Journal of Adhesive Dentistry, the International Endodontics Journal, Endodontic practice today, the Asian Journal for Animal Sciences and the Journal for Experimental and Toxologic Pathology.
He has also supervised numerous master and PhD degree theses at Faculty of Dentistry at Ain Shams University. He has also participated in numerous postgraduate endodontic lectures and courses held at Ain Shams University, Cairo University, Suez Canal University, Sharjah University and Metro-Health Cleveland.
Prof. Hashem holds a private practice limited to Micro Endodontics.

[Live endodontic treatment] Practical endodontics in real world

Pyung-sik Kim
Suwon Chois Dental Clinic, Republic of Korea

Endodontic treatment takes up a high proportion for most private dental practitioners. Therefore, I think that the private practitioners are especially interested in endodontics.
It is possible to share a lot of dental treatments by other dentists through the internet and various Social Network Service (SNS). However, most on-line clinical tips seemed to be missing pieces in order to apply in an actual clinical practice. To complement the missing parts, I decided to demonstrate the whole process of the actual endodontic treatment as follows.

1. Access opening
2. Coronal flaring
3. MB2 canal finding
4. Ni-Ti shaping
5. Canal compaction with MTA sealer

It is time to demonstrate the endodontic treatment processes of the first maxillary molar step by step, and I would like to have a discussion session about the treatment processes. There will be some mistakes, and other dentists might have different opinions since the demonstration is in live. Because of this, I think the live performance may be more interesting.

Dr. Pyung-sik Kim, DDS, PhD

Dental college of Chosun University DDS.
Dept. of Conservative Dentistry MSD, Ph.D.
Member of APEX Endodontic Study Group
Suwon Chois Dental Clinic.

Long-term prognostic evaluation of my root canal treatment

Sung Kyo Kim
Kyungpook National University, Republic of Korea

Root canal treatment is to save one's natural teeth with pulpal and/or periapical disease. The long-term prognosis of root canal treatment depends on many different factors. These include the etiology of pathosis, preoperative status of pulp and periapical tissues such as presence or absence of periapical lesion and previously treated canal, diagnostic skill, anatomical complexity of the root canal, possibility of instrumentation to the full working length, any procedural mishaps, level of root canal filling or three-dimensional obturation of the canal, post-endodontic restoration, role of the tooth in the full dentition. In this presentation, the presenter's 10 to 30 year-old cases will be discussed for long-term prognosis of root canal treatment. Additionally, the presenter will discuss on the factors that need to be payed attention for the root canal treatment to have higher long-term success.

Prof. Sung Kyo Kim, DDS, PhD.

He studied Dentistry at Kyungpook National University (KNU) in Daegu, South Korea. He joined the specialty program of Conservative Dentistry at KNU Hospital. He got the PhD degree of Conservative Dentistry at Seoul National University in Korea. He was a Visiting Associate Professor at the University of Pennsylvania, USA. Currently he is Professor of Endodontics and Chairman of Department of Conservative Dentistry, KNU School of Dentistry and Adjunct Assistant Professor, Department of Endodontics, University of Pennsylvania, USA. He also currently is a Honorary Auditor of Korean Academy of Conservative Dentistry (KACD), an Honorary Life Member of Asian Pacific Endodontic Confederation (APEC), and the Present-Elect of International Federation of Endodontic Associations (IFEA). He published more than two hundred articles in national and international peer reviewed journals and gave lectures and presentations more than three hundred times nationally and internationally.

Nonsurgical vs. Surgical retreatment after failure of initial root canal treatment

SeungHo Baek
Seoul National University, Republic of Korea

Treatment options after failure of initial root canal treatment include nonsurgical retreatment, surgical retreatment (periapical surgery, intentional replantation, etc.), extraction and a single tooth implant or a fixed prosthesis. Endodontic failure teeth might be preserved with nonsurgical or surgical retreatment, assuming the tooth is restorable, periodontally sound, and the patient desires to retain the tooth.

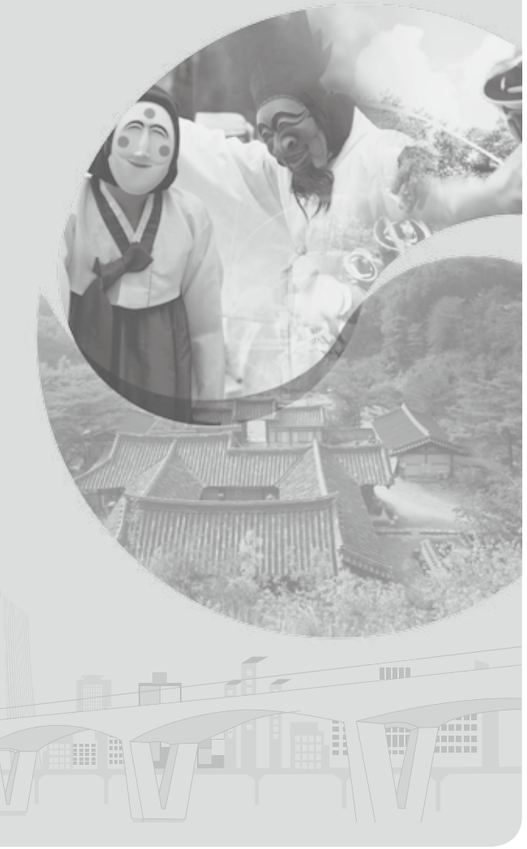
Clinicians are confronted with difficult choices whether a tooth after failure of initial root canal treatment be treated through retreatment or endodontic microsurgery. When a decision is made, the choice of treatment is often based on individual experience and skill rather than on evidence based prognostic factors. Evidence-based dentistry recommends selection of alternate treatment options on the basis of the best available evidence.

The lecture will be included as follows:
1) Clinical outcomes of nonsurgical retreatment and surgical retreatment
2) Prognostic factors relating to the long term outcome
3) Clinical considerations in nonsurgical vs. surgical retreatment
4) Clinical cases

Prof. SeungHo Baek, DDS, MSD, PhD

Professor Baek received his DDS in 1982, MSD and PhD in 1985 and 1991 from Graduate School of Dentistry, Seoul National University. In 1993-1996 he was trained and received the Endodontic specialty certificate from School of Dental Medicine, University of Pennsylvania.
He is a professor at Seoul National University since 1997. He served as the Chairman of Dept. of Conservative Dentistry, the Director of Clinical Services of Seoul National University Dental Hospital and the president of Seoul Dental Hospital for the Disabled. He is the past president of Korean Academy of Conservative Dentistry. He is Adjunct Professor, University of Pennsylvania, School of Dental Medicine, Department of Endodontics.

Country Representative Speakers



CR-001

Prof.
Ghada ElHilaly Eid
Egypt

New Perspective in clinical monitoring of Pulp &/or periapical status and outcomes of therapy "Potential Role of Molecular Markers"

The lecture provides overview over a possible future in which diagnosis via identification of inflammatory molecular markers in inflamed pulp &/or periapical tissue could be more objective by chair-side noninvasive biologic sampling. Thus, may set a lead to biochemically based diagnoses, prognoses, and treatment.

The lecture will cover the following objectives:
First: Emphasis on the challenge that faces clinicians in certain cases, where conventional clinical diagnostic aids are not sufficient to reach definitive diagnosis; such as cases of referred pain, painless pulpitis, periapical scar...etc. Sometimes there is lack of a consistent correlation between clinical and/or radiographic findings with ongoing pathogenesis. Standard histopathologic analysis of a diseased tissue is invasive and only shows changes at the time the tissue is removed. Therefore, it does not represent the complete kinetics of disease development.

Second: Surveys studies to show clinical non-invasive sampling from biological fluids as gingival crevicular fluid GCF, or minimally invasive sampling of dentinal fluid, pulpal blood samples and canal exudates. Interestingly sampling/identification of target marker can be chair side.

Third: Surveys research data to reveal specific mediators from each sampling route that can be diagnostic markers of disease status & monitor treatment outcome. Furthermore, connection between markers & clinically-based diagnosis of signs & symptoms will be presented. Clinically non-invasive sampling of the GCF of specific markers (Substance P, MMP-2,8,9, IL-8) can be used in the diagnosis of pup/periapical diseases, monitoring and in the follow up of treatment. Furthermore minimally invasive sampling of dentinal fluid and of pulpal blood of MMP-8,9, PGE2, PMN elastase can be used in diagnosis of pulp inflammation and used as treatment guide; as whether to go for capping or pulp extirpation. Additionally, canal exudates' markers as MMP-8, PGE2, PMNelastase, IL-1, Ig can be used to monitor treatment outcome.

Finally: Recommendations are set for this biologic modality of specific mediators for diagnosing pulp and periapical diseases, and possible turning off host response and enhancing repair.

CR-002

Dr. Roberto Fornara
Italy

CBCT in endodontics: How and Why

The cone beam computed tomography (CBCT) represents the most important innovation for the study and diagnosis of diseases in the dento-maxillo-facial area through radiograms. From the beginning this technique has shown great advantages compared to the use of traditional computerized tomography systems (TAC) thanks to the short-time acquisition of an entire volume of data without any geometric deformation and with exposure of the patient at relatively low radiation doses. In fact, even if the 3D examination has immediately acquired particular value for the specialists in implant treatment planning, in recent years it has been increasingly adopted by dentists in general.

If initially this technology could seem excessive for the evaluation of endodontically compromised teeth, in fact, also thanks to the use of FOV (fields of view) with reduced dimensions, this modality of investigation is spreading just for the undoubted clinical advantages that derive both for diagnostic evaluations and for endodontic procedures. The CBCT allows the three-dimensional visualization of the endodontic and peri-radicular space allowing the clinician to interpret in the three planes of the endodontic anatomy space and the identification of a possible periapical pathology (especially where for obvious technical reasons the intraoral radiography does not evidence) thus providing more information for a correct endodontic approach. Nevertheless, it is important to underline that the periapical intraoral radiography (REP) performed with reception holder (Paralleling Technique) centerers remains today the diagnostic medium for routine images for a first endodontic evaluation.

The benefits of a rational use of CBCT are numerous, increasing diagnostic capabilities and reducing endodontic overtreatment. For this reason, today it is essential to know the potential of this diagnostic tool that is increasingly indispensable in modern dentistry.

CR-003

Dr. Elena Lipatova
Russia

The use of CBCT and microscope for diagnoses, treatment and follow up of root resorption

Root resorption is one of the most complicated situation for dentist. Diagnostic process, decision making for treatment plan and treatment procedure are very complex and including huge amounts of small details. Outcome is depend on deep knowledge of biological base and clear treatment protocol. Clinical cases of Cervical Invasive, Internal resorption with perforation, External Apical Inflammatory Resorption and others resorption types will be discussed in details on stages of diagnosis, treatment and follow ups up to 14 years.

CR-004

Prof. Bun San Chong
UK

Technological innovations in endodontic practice

The scientific and technological revolution in healthcare has benefitted many medical and dental disciplines, including endodontics. Recent advances such as three-dimensional (3D) imaging and printing have led to these innovations being transferred to endodontics.

Further technological developments are on the horizon and many novel applications are anticipated. Key technologies, for example, smart devices, artificial intelligence (AI), virtual and augmented reality (VR & AR), automation and robotics are predicted to have a major impact on everyday life.

This presentation explores how innovative advances can contribute and facilitate the assessment, management and treatment of challenging endodontic cases in clinical practice.

CR-005

Dr. Mohammad Hossein Nekoofar
Iran (Islamic Republic of)

Current and future challenges of Regenerative Endodontic Procedures (REP)

Various methods and different materials have been suggested to deal with teeth having immature apices and necrotic pulp. Except of the biologically based treatment modalities in other treatment approaches root length and root dentin thickness remain unchanged and consequently such teeth are susceptible to root fracture.

The aim of regenerative endodontics procedures (REPs) as a biologically based treatment is to replace the irreversibly inflamed pulp tissue with newly regenerated tissue in an attempt to stimulate root maturation (Murray et al. 2007).

The principle of REPs is based on the tissue engineering triad:
- Stem cell
- Scaffold
- Signal molecules

The prerequisite of REPs is chemical disinfection of the root canal system that may achieve through profuse irrigation using sodium hypochlorite without mechanical instrumentation to avoid formation of smear layer that may block the release of growth factors from root dentin. In addition, it has been suggested to use the triantibiotic paste as an intracanal medication between the first and the second appointment.

At the second appointment a blood clot is induced inside the canal to act as an scaffold for regeneration and then the coronal access cavity is sealed with a bioactive calcium silicate cement to prevent bacterial penetration and to allow regeneration in a bacteria free environment (Banchs & Trope 2004).

More recently, the use of platelet-rich plasma (Hiremath et al. 2008) and/or platelet-rich fibrin (Bakhtiar et al. 2017) rather than blood clot has been suggested. The material used to provide the bacteria tight seal in this context is important (Bose et al.2009, Torabinejad & Turman 2011) as it should ideally have the ability to up-regulate signaling molecules and provoke regeneration (Huang 2008, Thomson & Kahler 2010). Moreover, since it is not practical to avoid blood contamination the sealing ability and basic physical properties of the material should not be jeopardized by moisture and/or blood exposure.

In this presentation the clinical consideration of REPs by emphasizing on the clinical outcome will be updated and the recent published evidence about REPs will be critically appraised.

CR-006

Dr. Alexander Koval
Ukraine

Concept of IDEPS – New way of eliminating bacterial biofilm

Since the discovery of bacteria in 1676, mankind has successfully learned to combat their planktonic form. However, organized in a biofilm, microorganisms become 100 - 1000 times more resistant. (H. Ceri and all 1999; Kapil Jhajharia and all 2015).

Their striking stability is due to the presence of exopolymer substance (matrix), which constitutes 85% of the entire biofilm weight (J.W.Costerton 1987). Possessing colossal biological and chemical inertness, exopolymer protects bacterial communities.

Modern ways of affecting biofilm are linked with increase of biocide concentration. For instance, previously 0.5% solution NaOCL (Dakin) was sufficient, however 5.25-6% NaOCL is frequently used nowadays. We believe it is a deadlock way which is not effective enough, besides it leads to increase of biocides toxicity. Moreover, NaOCL mainly affects protein and lipid components of the matrix, which make 10% of its structure.

A conceptually alternative solution IDEPS (Intensifier of Disruption of Exopolymer Substances), developed by our group, rests on the fact that chemically biofilm matrix is heterogeneous and varies in different taxa, it commonly consists of polysaccharides, this fraction is most pronounced and amounts to 95%. The mechanism of action of IDEPS is based on primary dissolution of exopolymer matrix of biofilm via transferring microorganisms from their bound state (biofilm) to their planktonic form along with a simultaneous biocidal impact on the microorganisms, which allows effective destruction of biofilm of various microbial origins and ages.

A 6-month-old microbial biofilm was grown in vitro from the samples taken within the apical periodontitis treatment. On this model, the effects of IDEPS and NaOCL 5.25% were compared. IDEPS's acute and chronic toxicity, its impact on the target organs, such as mucous membranes of oral cavity, intestinal tract, SEM of root canal walls, and other extensive clinical studies were performed.

CR-007

Prof. Bouillaguet Serge
Switzerland

Current trends in endodontology

There is evidence showing that the success of endodontic therapy strongly depends on proper shaping and cleaning of the root canal system before three-dimensional filling. Whereas shaping is primarily aimed at cutting infected dentin and enlarging the root canal space, cleaning mainly consists at removing endodontic pathogens and remaining debris. Recently, several simplified shaping procedures based on the use of a single file along with new sophisticated irrigation devices have been launched on the market. Among these are the latest reciprocating files and the machine-assisted irrigation protocols that include sonic, ultrasonic and lasers. Also, there is a trend towards the use thermoplasticized Gutta-Percha techniques, such as warm vertical compaction and core-carrier obturation to improve root canal sealing after shaping. Is there any evidence showing that success rates have increased?? The aim of this presentation is to critically analyse factors influencing success rates in endodontics, to discuss several new concepts in shaping, irrigation and disinfection of the root canal system and to describe new approaches for the restoration of endodontically-treated teeth.

CR-008

Dr. Margaret C. Tiu
Philippines

Challenges of endodontic miscalls

One of the causes of failed endodontic case is misdiagnosis, may it be a case of missed canal, wrong tooth diagnosis or a case of non-odontogenic in nature. This presentation will feature different endodontic cases that were mismanaged because of misdiagnosis and how they were identified and given solutions.

CR-009

Dr. Carla Zogheib
Lebanon

Dynamic activated irrigation: A plus or a must?

The main goal of any endodontic treatment is to eliminate the microorganisms that colonize the root canal system. This disinfection is mainly based on a chemo-mechanical preparation where the limits of the endodontic instruments, which shape the main canal, are palliated by the irrigating solutions. Effective active irrigation is therefore an essential step to the success of endodontic treatment. Studies are currently undergone to validate Sonic/Ultrasonic or Laser activated irrigation (LAI) as innovative and efficient technologies in modern endodontics.

Our presentation will provide an overview of the technologies currently available to improve the effectiveness of endodontic irrigation solutions. Several activation systems will be presented: from manual dynamic with gutta-percha cones, to sonic or ultrasonic systems and finally to laser-activated disinfection. It is therefore clear that the activation of different irrigation solutions would offer several advantages in the clinical endodontic outcome and that the integration of new technologies would contribute to an improvement of the quality of care in daily clinical practice.

CR-010

Dr. Garry L. Myers
USA

Management of the open apex – Challenges and treatment strategies

In the endodontic practice a variety of clinical challenges are frequently encountered that requires the practitioner to evaluate various treatment options to manage each of these scenarios. One such clinical challenge involves teeth requiring endodontic therapy that have an immature and incompletely formed root apex. These types of cases may involve the presence of a normal vital pulp, a diseased vital pulp or a necrotic pulp. Clinical challenges vary from: a) the tooth having thin dentinal walls with an open apical foramen, b) patient management of young patients, c) obtaining a sound apical seal and d) question marks surrounding the long term survivability of these teeth. Treatment guidelines are typically influenced by the pulp vitality of the tooth, thus goals of treatment of teeth with both vital and necrotic pulps will be compared and contrasted. Apexogenesis, apexification and regenerative endodontic procedures will be discussed with indications, advantages, disadvantages and prognoses being identified for each of these treatment options. A review of the various irrigants and materials used in these techniques will be covered. At the conclusion of this presentation the endodontic clinician should have a better understanding of the indications and treatment options available for successful management of teeth with an immature root/apex.

CR-011

Dr. Amir Weissman
Israel

3R – Retrograde Root-canal Retreatment

Modern endodontic microsurgery technique involves apical root resection of 3 mm followed by a 3 mm root-end preparation and filling. The rationale is to reduce lateral canals and apical ramifications, and achieve proper apical sealing to minimize leakage.

In certain clinical situations adherence to the aforementioned technique might not be feasible or practical. In cases of long posts terminating at the apical third, a 3 mm resection might leave insufficient root length for retrograde preparation and filling. Furthermore in cases of relatively short roots a 3 mm resection might impair the crown to root ratio. The 3 mm class 1 root-end preparation is aimed at creating appropriate space for root-end filling, in attempt to prevent leakage, with out attempting cleaning and filling the entire root canal system.

The Retrograde Root canal Retreatment technique (3R) was developed in order to clean and fill the canal system as far coronally as practical whilst preserving as much root structure as possible. The technique has 3 characteristics: 1. A minimal root resection – 1 mm on an average 2. Maximal length retro-preparation 3. Ultrasonic files are used for retro-preparation instead of ultrasonic cast tips. A retrospective outcome study was carried out examining cases in which 3R technique was done.

719 teeth were followed up after 1 year. The overall success rate was 90%. Age, gender, tooth type and size of lesion had no effect on the outcome. The only variable with positive correlation to the outcome was the length of the retrograde preparation (p=0.017). It was found that the longer the retro-preparation the better the outcome (Odds ratio=1.318 C.I.=95%).

CR-012

Dr. Vivek Hegde
Inida

Clinical decision making after instrument separation

The various reasons affecting the long term prognosis of Endodontic treatment include iatrogenic mishaps like under-filling, over-filling, root ledges, perforations and instrument separation. Instrument separation during the shaping procedure hinders the clinician from efficient canal debridement and achieving a fluid tight seal of the entire root canal system. The quest to develop better instruments and techniques to improve oral health care, has led to the introduction of rotary NiTi instruments which not only shape the dentinal wall effectively but also can separate under certain circumstances.

Such separated instruments' removal is performed using operating microscopes, ultrasonics, microtube techniques & various methods. The theoretical knowledge, radiographic /CBCT analysis & enhanced vision (with magnification and illumination), allows clinicians to make decisions to remove, bypass, surgically treat or at times leave the instrument be. Hence, this presentation enlightens the clinician about the various treatment options with consideration for the pulp canal space, the root canal infection, the root canal anatomy, the position and type of fractured instrument and the amount of damage that would be caused to the remaining tooth structure.

CR-013

Dr. Dorothée Louis Olszewski
France

Strategic considerations in treatment planning: Deciding when to treat, or extract a questionable tooth

The advent of implants revived the discussion of one of the great dilemmas of clinical dentistry, which is the identification, based on prognosis, of when a tooth must be extracted or when other treatment options can be considered. Periodontal, endodontic and restorative characteristics must be carefully evaluated to determine prognosis and treatment predictability and consequent development of the treatment plan.

Due to the relevance of this topic, the objective of this lecture is, to assist the dentist in evaluating clinical situations requiring decision making between keeping or extracting a tooth, establishing a correct prognosis.

CR-014

Prof. Saulius Drukteinis
Lithuania

Flowable bioceramic materials in endodontics. Clinical application and 3D reality

Bioceramic materials are now the materials of choice for pulp capping, pulpotomy, perforation repair, root-end filling, and obturation of immature teeth with open apices, as well as the sealer-filler for root canal obturation of mature teeth with closed apices.

These materials are hydrophilic and therefore are not technique sensitive. They are dimensionally stable and expand slightly on the setting, making them one of the best sealing materials in endodontics. When set they are hard and insoluble consequently ensuring a superior long-term seal. When unset the materials possess antibacterial properties. When fully set they are biocompatible and even bioactive.

Over-instrumentation and transportation of root canals increase the risk of perforations, blockages and ledge formation while also risking weakening the root. The risk of procedural errors especially increases in case of endodontic retreatment. Furthermore, root canal filling may be complicated when procedural errors occur, resulting in voids and unsatisfactory three-dimensional seal, and could be very challenging for clinicians.

MTA was used as a material of choice to manage root canal transportations and root perforations for many years. However, for general practitioners, and even for endodontists, there is a big challenge to obturate apical third of curved root canals three-dimensionally when these complications occur. The main difficulties are related to limited visibility and potential problems to deliver and condensate MTA under appropriate control.

Newly developed flowable bioceramics, such as MTA Flow and flowable biosilicate cements are promising regarding better clinical performance. However, there is very limited clinical and scientific information about the quality of root canal obturation and management of endodontic complications using MTA Flow and flowable biosilicate cements. The lecture will focus on the clinical application and performance of new flowable bioceramic materials and comparative 3D micro-CT analysis of these fillings.

CR-015

Dr. Gus (Yoon Ho) Jang
Australia

Cracks in teeth: How to find and manage cracks in teeth with pulp and periapical disease

The main goals of endodontic treatment are to remove bacteria from the root canal system to promote healing and repair of the periapical tissues and to prevent most bacteria from re-entering the canals.
There are many ways for bacteria to penetrate into the root canal system - such as caries, cracks, fractures and breakdown of restorations. In order to have successful endodontic treatment outcomes, it is important to identify the cause(s) of the pulp and periapical diseases - that is, the pathway(s) of bacterial penetration into the root canal system. This is necessary so the cause(s) can be removed as part of the treatment.
Crack is a pathway for bacterial penetration into the root canal system. Cracks in teeth are one of the major causes of pulp and periapical diseases.
Cracks may be detected during the clinical examination under the normal dental operating light by light deflection, change in the tooth colour, shadow, staining or when the crack is large enough to be felt using a sharp explorer. Another commonly used instrument is a selective occlusal force applicator. However, it is often difficult to find cracks when they are small and there is no associated pulp response.
Other methods used for the detection of cracks include radiography, transillumination, magnification, dye staining, ultrasound, optical coherence tomography and quantitative percussion diagnostics.
There are no typical symptoms with cracked teeth. The teeth with cracks have various symptoms depending on the status of the pulp/root canal system, from clinically normal, reversible or irreversible pulpitis to necrotic/pulpless root canal system. Therefore, the treatments for cracked teeth also should have various approaches depending on the status of the pulp/root canal system.
This presentation will discuss advantages and disadvantages of different methods of detecting cracks during endodontic examination and treatments as well as management strategies of cracked tooth.

CR-016

Dr. Miguel Miñana
Spain

Pain: Etiology, prevention and managenet in clinical endodontics

Pain is the most predominantly associated symptom with patients visit to the dental office. Pain related to the endodontic treatment can be a problem to the patient and the endodontist. Both share one common goal before any treatment begins: profound anesthesia and pain control.

Pain control is a major issue in Endodontics. As an endodontists we must try to manage these situations, and try to be experts in acute pain management. Minimizing pain before or during root canal treatment sometimes can be a really a challenge.

LEARNING OBJECTIVES:

- Analyze the factors that may increase or decrease endodontic pain.
- Discuss methods to improve the management of pain clinically and based upon literature and research findings.
- Discuss the potential strategies for preventing postoperative pain.

CR-017

Prof. Hussain F. Al-Huwaizi
Iraq

Healing periapical lesions by non surgical endodontics

Surgical intervention to treat periapical lesions is traumatic, painful postoperatively, frustrating to the patients and has a high possibility of lesion recurrence.
Modern endodontics increased the cleaning and obturation efficiency of the root canals to enhance the chances of healing of the lesion non surgically. Recent bioactive materials may activate the body repair mechanism.
Non surgical endodontics prevents unnecessary removal of the apical region of the root routinely done by the surgical intervention.
The lecture will include clinical cases with follow up upto 3 years and conclusions of MSc studies performed in Iraq to support the use of non surgical endodontic.

CR-018

Prof. Antonio Ginjeira
Portugal

Therapeutic replantation

Usually considered a last resort technique to save teeth, sometimes we need to consider the option to extract, treat and reimplant a tooth from the moment when the necessity to perform an endodontic surgical retreatment is established. The main reasons to choose this way to treat are the inaccessibility of the surgical site or a non accessible location of the lesion from a possible osteotomy. Diagnostic tools like CBCT may reveal crucial in the choice of the best procedure, and microsurgical techniques help identifying and treating the lesions or procedural mishaps that are frequently responsible for the situation.

Diagnosis of teeth that may be extracted, treated and replanted, will be addressed, as well as a rationale to determine if this option is feasible or not, if it is the best option, and how it can be achieved. Risks, outcomes and follow ups will also be discussed.

CR-019

Prof. Kyung-San Min
Republic of Korea

Biological perspectives and clinical applications of calcium silicate-based bioceramics

Mineral trioxide aggregate (MTA), a calcium silicate-based formulation was developed more than 20 years ago and has been considered to have innovative biocompatibility and sealing ability. Therefore, it is widely used adjacent to pulp and periradicular tissues for perforation repair, root-end filling, vital pulp therapy, regenerative endodontic treatment, and even root canal obturation. The augmentation on studies regarding MTA resulted in the development a new generation of endodontic materials, the calcium silicate-based bioceramics. Thus, a brief description of biological perspectives and clinical applications of the bioceramics is presented in this communication.

CR-020

Prof. Chiaki Kitamura
Japan

Translational research for future, advanced, and present endodontic therapies

Translational research is an important step for the development of dentistry. Its goal is the development of the products promising new treatments that can be used with practical applications, and commercialized. In recent Endodontics, famous products, such as dental operating microscope, Nickel-Titanium rotary files, dental corn beam CT, and MTA-based materials, have been developed through translational research, and are clinically being used.
In our lab, three translational researches for Endodontics are now ongoing; encapsulated cell biodelivery for future therapy, anti-inflammatory peptide drugs for advanced therapy, and bioactive glass-based biomaterials for present therapy.
Encapsulated cell biodelivery is a therapeutic option capable of providing in vivo, continuous and de novo synthesized delivery of molecules. In this technology, genetically modified cells are encapsulated in a device and secrete therapeutic molecules via micropores of the device in a targeted tissue. We have indicated that GDNF secreted from the device can prolong odontoblast survival under starvation condition.
Peptide drugs are chemically synthesized peptides that are based on the structure of specific molecules. Peptide drugs are now under clinical trial for diseases such as cardiac infarction. We have demonstrated that anti-inflammatory peptide drugs can restore inflammatory responses of odontoblastic and osteoblastic cells.
Bioactive glass, which belongs to the bioceramics family, is known to show binding ability to bones by the formation of a hydroxyapatite layer on the surface of bioactive glass, and has been already used in orthopedic surgery. Recently, we have developed a newly bioactive glass-based cement (Nishika Canal Sealer BG) through the collaborative research with a dental company, and it is now being commercially marketed as a root canal sealer.
In this presentation, I will show our translational research in Endodontics.

CR-021

Prof. Ahmad Al-Hiyasat
Jordan

Evaluation of the premixed bioceramic in comparison to the other calcium silicate based materials used in vital pulp therapy and root repair

Calcium silicate based materials such MTA become widely spread in endodontic practice due to its superior biocompatibility in comparison to the traditional materials that were used before for vital pulp therapy in particular, in addition to the use of MTA for perforation repair, retrograde filling in endodontic surgery, or as apical plug. Despite its favorable biological features, both Grey and White MTA (GMTA, WMTA) had been reported to cause coronal discolouration when they are used in vital pulp therpy procedures. Indeed, since the trend in the current practice is to keep the pulp vital or to regenerate vital tissue whenever its possible, the need for a materila with no staining effect and good bond strenght to the dentine becom in demand, Therefore new calcium silicate-based materials have been introduced claiming that they have comparable biological and mechanical properties to MTA with a less or non-staining effect, such as Biodentine, TheraCal , and more recently the premixed bioceramic (eg TotalFill).

The purpose of this presentation is to present the outcome of our research that was carried out to evaluate the colour change of coronal tooth structure after placing various calcium silicate-based pulp capping materials including the premixed bioceramic TotalFill in the pulp chamber of human teeth in the presence or absence of blood. Furthermore to evaluate the push out bond strength of some of these materials to the root dentine in the present and absence of smear layer.

Thus the presentation will high light the advantages and disadvantages of the premixed bioceramic in comparison to the other calcium silicate based materials used in endodontic practice based on the results and analysis of scientific research protocol.

CR-022

Dr. Sirawut Hiran-us
Thailand

Management of broken instruments: A review with three case reports with different approaches

Broken instrument is one of the complications that might happen during root canal treatment. Almost twenty years since the first study about the defects in rotary nickel-titanium files have defined the type of fractures of endodontic instruments. Recognition of broken instrument during treatment arose since then. Numerous studies advocated to investigate the factors that may influence the chance of removing these broken instruments and possible complications. Many instruments and techniques have been developed through the decade to manage these situations. The outcome of root canal treatment related to broken instruments also published. Up to present, the best way of management is to prevent it from fracture by understanding the factor that influence the broken mechanism.

This lecture will summarize the literatures involved in this field and present three cases of broken instruments with three different approaches.

CR-023

Dr. Marco Ramírez-Salomón
México

Dental inlays among the preHispanic mayas. Pathologic effects and cement characterization

I. Introduction
The preHispanic maya culture settled in the southeastern Mexico and Central America. There is evidence of high frequency of complex dental procedures among them. They performed dental filings and cemented inlays, most of them kept in good condition for decades, even centuries in their burials.

II. Objective
The objective of this presentation is to show recent research and discoveries concerning the secondary pathological effects of the ancient Maya dental inlays and the dental cement chemical characterization. The largest sample of Maya incrustations ever studied is presented.

III. Results
The results of the frequency of secondary caries, internal root resorption, calcifications and periapical lesions are surprising, as well as the chemical analysis of the dental cement.

CR-024

Dr. Brian Jafine
Canada

Looking through the retrospective scope - How I would have done it differently

This case demonstrates how a clinical situation can cascade out of control for what upon initial presentation appears to be innocuous.
There is a litany of lessons that can be gleaned. Looking back, what would I have done differently? We will discuss the series of events which led to the final outcome and question whether we could have treated this case differently or whether the outcome was inevitable.

CR-025

Prof. Mehmet Baybora Kayahan
Turkey

Saving the hopeless tooth

Root canal treatment is a predictable procedure with high success rate. However, procedural problems such as ledge formation, transportation of the canal, root perforation and extrusion of the irrigants can affect the prognosis. In addition, post–treatment disease can be encountered even in teeth with high quality root canal treatment. Today, patients demand the retention of their teeth more than ever before and this results in increasing necessity for the retreatment. Studies show that previously root canal treated teeth with post-treatment disease can be retreated successfully. There is no doubt that retreatment of teeth are feasible and economical way to preserve function. It also should not be forgotten that recently the criteria used to assess success and failure have been changed. The term “success” can be defined as the retention and function of a symptom-free root canal treated tooth. In this lecture, follow-up of some tricky cases will be presented and discussed from another point of view.

CR-026

Prof. Dr. Roeland De Moor
Belgium

Activation and agitation of endodontic irrigation solutions: Evidence and a critical assessment of the clinical attainments

There is a profound evolution in the application of endodontic irrigation solutions since the beginning of this century. Different devices to activate irrigants have been proposed and marketed. Protocols for agitation (fluid dynamics) and activation (to make more efficient) of endodontic irrigants were launched and investigated. A number of approaches, especially ultrasound and laser activated irrigation have demonstrated their superiority. With more in-depth investigations the working mechanism of both systems became clear. Apparently both approaches differ on the level of acoustic streaming and the type and impact of cavitation. The way in which irrigation solutions are activated also clearly differs. Moreover, within each activation group a realm of activation strategies are found next to differences in the way fluid streaming is produced. So, the question arises as to whether ‘real’ added value disinfection and cleaning is obtained and whether all these extra means do make a difference in the pursuit of higher endodontic success ratios and a better option for tooth preservation.

CR-027

Prof. Liliana Artaza
Argentina

The sinus tract, a symptom or an illness?

The dentoalveolar sinus tract usually develops as a route of drainage from periapical inflammatory lesion and follows a path of least resistance through bone, periosteum and mucosa. It may exit at any point of the oral mucosa or even the skin. Some practitioners are still convinced that the presence of a fistula indicates a more serious lesion that requires apical surgery or even the extraction. However, the treatment has a good prognosis and the indication is the root canal nonsurgical therapy.

The cutaneous or mucosal sinus tract is a symptom of pulp disease. It simply requires identification of the diseased tooth, its root canal system must be cleaned, shaped and filled.

The reason why some authors believe in the need for surgical removal of the sinus tract lies in the mistaken conviction that if lined by an epithelium, it will not heal. Given the current state of knowledge, there is no reason to recommend surgical removal of the sinus tract.

Some studies show that the sinus tracts could facilitate the entry of bacteria from the oral cavity and colonize in the periapice predisposing to extraradicular infection. Although cases of refractory endodontics lesions with persistente sinus tract associated with extraradicular infection of actinomyces or by sporulated forms, have been published. The extrarradicular infection does not occur with high frequency.

The presence of a dentoalveolar sinus tract, in conclusion, is not an indication for extraction, is not an indication for surgery, is not an indication for any specific medication, it is just an indication for a correct root canal treatment.

Clinical cases with dentoalveolar sinus tract will be described, the differential diagnosis with periodontal disease and their treatment and follow up.

2018 IFEA
SEOUL KOREA
The 11th World Endodontic Congress

Hands-on Courses

(HC-101 / HC-201) Hands-on Course by FKG

Anatomically Directed Endodontics

Martin Trope
University of Pennsylvania, USA

The root canal system is highly complex making cleaning during root canal treatment challenging. Many adjunct techniques have been tried to compensate for these shortcomings including; high concentration of NaOCl, EDTA, ultrasonication or by lasers technologies.
In this lecture, it will be explored the knowledge of the root canal internal anatomy and the ability and limitations of the conventional NiTi rotary systems available to predictably clean the root canal system.
Following this part it will be presented and described the recent and novel technologies on NiTi instruments to clean and shape the root canal minimally invasive however efficient and safe. The single shaping file XP-endo® Shaper and the finishing file XP-endo® Finisher will be presented and discussed. Preliminary studies on XPe files have shown remarkable removal of soft tissues, less dentinal chips on isthmus and canal walls after instrumentation, low dentinal stress (less micro cracks) and conservative instrumentation with low amount of dentine removed coronally with efficient cleanness on the apical third area.
Live demonstration on 3D teeth conducted under an OP microscope, and hands-on course.
The topics to present clinically: 1.Scouting complicated root canal anatomy with hands files and scouting NiTi files 2.Instrument the root canal with conventional rotary NiTi files and the new XPe-files 3.Irrigation protocol All participants will follow the same procedure and work on 3D teeth 3D teeth conducted under an OP microscope.

Objectives:

1. Understand the technological challenges and possibilities in endodontic instruments to predictably remove intra canal infection.
2. Present the physical and clinical characteristics of the new NiTi technologies.
3. Demonstrate the clinical use of file lines.

(HC-102) Masterclass by Dentsply Sirona

The importance of technological advancements for the improvement of outcomes in your practice

Sergio Kuttler
International Endodontic Institute in Fort Lauderdale, USA

In 2011, reciprocating instrumentation was reintroduced to Endodontics, and due to its simplicity of use, the lack of procedural errors during cleaning and shaping, it has gained tremendous confidence and acceptance among dental schools, GP's as well as Endodontist worldwide, and with new metallurgy technology to improve the performance of NiTi instruments, these technological advancements in file design, tip design, metallurgy and instrument movements will improve users of this

Objectives:

After this lecture course, the participants will be able to:
- Know the advantages of different alloy treatments in endodontic files
- Know the advantages of one single file NiTi system over the other ones
- Understand the objectives of canal instrumentation and how to achieve these objectives with one single NiTi file system based on research
- Understand the ability of a single file system over multiple files systems in preparing canals without procedural errors

(HC-103) Hands-on Course by Micro-Mega

2Shape: Two files to Shape with a Safe and efficient new innovative file system

Franck Diemer
Toulouse Dental Surgery's University, France

If cleaning and shaping are the paradigm of success of endodontic treatment, innovations are focused on the designs of the files such as cross sections, taper, helical angles and many other specifications that distinguish the identity of a specific instruments. These evolutions reduced significantly file breakage that nevertheless was still haunting NiTi users and pushed forward the researches into new directions. At the same time GP aspire to an efficiency with soft sensations. Thermo-mechanical treatment of endodontic wires prior, during or post machining of endodontic files enhanced the flexibility of these files. These innovative treatment procedures opened the way for a totally new area of NiTi alloy with specific microstructural atomic composition. Combining the cumulative knowledge on file design and new heat treatment procedures, Micro Mega introduces the 2Shape The new file system comprises only two files in continuous rotation that can address most canal configurations.

Before the workshop we will describe the system, and explain the way to use a simple, safe, efficient and short endodontic sequence in rotary motion.

By the end of this Hands On Course attendees will be able to:
- Understand the cleaning and shaping effect of 2Shape following a glide path and/or a Flare
- Do easier and safer endodontic treatment
- Appreciate the soft sensation of low stress for files and operator.

(HC-104 / HC-302) Masterclass by Dentsply Sirona

Featuring Gold Glider & WaveOne Gold

Cliff Ruddle
Advanced Endodontics®, USA

The most recent advances in canal preparation methods have focused on the concept that "less is more."
Dr. Ruddle will describe a state-of-the-art single-file method for glide path management and shaping canals, regardless of their length, diameter, and curvature. Emphasis will be on how the convergence of file design, heat treatment technology, and a unique movement significantly improve safety, efficiency, and simplicity when shaping canals. Well-prepared canals promote 3-D disinfection and filling root canal systems.

Objectives:

At conclusion, participants should be able to:
1) Identify the biological and mechanical objectives for preparing canals.
2) Understand how file design, metallurgy, and movement influence shaping results.
3) Appreciate how performance inspires confidence, fun, and results.

(HC-202) Masterclass by Dentsply Sirona

Featuring ProGlider and ProTaper Gold

Cliff Ruddle
Advanced Endodontics® , USA

Predictably successful endodontics is dependent on fulfilling a series of steps that comprise start-to-finish endodontics. Emphasis will be on negotiating and securing canals to their terminal extents, then expanding these pathways using a dedicated single glide path file. Dr. Ruddle will then describe a state-of-the-art shaping system that utilizes the most proven design features from the past, coupled with the most recent technological advances currently available. Focus will be on creating root-appropriate canal shapes that promote 3-D disinfection and filling root canal systems.

Objectives:

At conclusion, participants should be able to:

1) Appreciate the role root canal system anatomy plays in treatment success.
2) Learn how to manually and mechanically perform glide path procedures.
3) Understand how the final shape influences cleaning & filling root canal systems.

(HC-203 / HC-301) Hands-on Course by Micro-Mega

Experience the simple, fast, and safe way of root canal shaping with 2Shape and One Curve

(HC-203) Sung Geun Cho
Kyung Hee University, Republic of Korea
(HC-301) Jung Hong Ha
Kyungpook National University, Republic of Korea

If cleaning and shaping are the paradigm of success of endodontic treatment, innovations are focused on the designs of the files such as cross sections, taper, helical angles and many other specifications that distinguish the identity of a specific instruments. These evolutions reduced significantly file breakage that nevertheless was still haunting NiTi users and pushed forward the researches into new directions. At the same time GP aspire to an efficiency with soft sensations. Thermo-mechanical treatment of endodontic wires prior, during or post machining of endodontic files enhanced the flexibility of these files. These innovative treatment procedures opened the way for a totally new area of NiTi alloy with specific microstructural atomic composition. Combining the cumulative knowledge on file design and new heat treatment procedures, Micro Mega introduces the 2Shape The new file system comprises only two files in continuous rotation that can address most canal configurations.

Before the workshop we will describe the system, and explain the way to use a simple, safe, efficient and short endodontic sequence in rotary motion. By the end of this Hands-on-course attendees will be able to: - Understand the cleaning and shaping effect of 2Shape following a glide path and/or a Flare

- Do easier and safer endodontic treatment
- Appreciate the soft sensation of low stress for files and operator

(HC-204) Hands-on Course by VDW

VDW endo easy efficient concept: Shape, clean and obturate

Ghassan Yared
Endodontist, Private Practice, Canada

The workshop will provide a hands-on opportunity:

1 - To create a glide path with the reciprocating R-Pilot instrument.
2 - To predictably and safely shape curved and narrow canals with only one Reciproc blue instrument, used in reciprocation, and without any prior instrumentation.
3 - To appreciate the cleaning efficacy of EDDY, a simple and an innovative sonic powered irrigation.
4 - To effectively fill shaped and cleaned canals with a warm gutta-percha or with a simple Reciproc single cone cold obturation technique.

Participants are encouraged to bring 3-4 previously extracted and accessed teeth, and loupes.

(HC-303) Hands-on Course by Coltene

Making the endodontic management of complicated canal systems simple, safe and predictable. A new approach with Hyflex CM and EDM files

Antonis Chaniotis
Private Practice - microEndodontics, Greece

The design and biological objectives of root canal treatment manipulation are well described in the contemporary art of Endodontics. Achieving these objectives in straight canals is considered a simple and straightforward procedure with all instrumentation systems available today. The problems of biomechanical instrumentation and obturation of the root canal systems arise when the internal anatomy of human teeth is rendered severely curved or even bifurcated and anastomotic. In such teeth, the accepted basic endodontic techniques and instrumentation protocols may be challenging to follow.

The aim of this workshop is to describe and practice a new instrumentation technique with Hyflex controlled memory (CM) and electrical discharge machined (EDM) files for the safer and more predictable instrumentation of severely curved and challenging canals systems.

Objectives:

At the end of this workshop the participant will manage to

- Understand the biological objectives of root canal treatment manipulation in relation to each anatomical challenge
- Understand and appreciate the controlled memory thermomechanical processing and electrical discharge machining for the manufacturing of rotary files
- Understand the philosophy behind the new instrumentation technique
- Practice the novel technique in highly curved and doubled curved training blocks
- Achieve a three dimensional obturation of the prepared root canal system by using greater taper gutta-percha points in combination with Gutta-flow bioseal
- Take away tips and hints to use them in the everyday practice

(HC-304 / HC-401) Hands-on Course by Meta Biomed

Objective analysis and application of current trends on root canal cleaning, shaping and filling

Jenner Argueta
Universidad Mariano Galvez De Guatemala, Guatemala

For a proper understanding and clinical application of modern intra-radicular shaping, disinfection and obturation techniques is important to analyze the evolution of the different techniques and materials that have been used successfully along the time; a critical thinking is necessary to learn from the weak points and enhancing the key factors that nowadays are making the endodontic treatment successful. During the workshop and objective review on root canal shaping, cleaning and filling techniques will be made and the participants, at the same time, will have the opportunity to work in vitro root canal treatments using modern endodontic devices, materials and techniques.
3D printed model of Mandibular molar will be used during the workshop for better understanding on the latest endodontic treatment.

Free Lectures

FL-001

Performance of electronic apex locators in 3D-printed tooth models

Sin-Yeon Cho[*1], Juhee Nam[1], So-Yeon Kim[1], Il-Young Jung[2]

[1]Department of Conservative Dentistry, National Health Insurance Ilsan Hospital, Goyang, Republic of Korea
[2]Department of Conservative Dentistry and Oral Science Research Center, College of Dentistry, Yonsei University, Seoul, Republic of Korea

I. Introduction
Electronic apex locators (EALs) can detect apical foramen by measuring impedance and they are affected by the shape of apical canal. Manufacturers and some of the reports claimed that EAL points out apical constriction. On the other hand, some other researchers found that EAL sign represents major foramen. The aims of this lecture are to find the point that EAL sign marks in 3D-printed tooth models and to suggest the reasonable strategy for working length determination.

II. Material and Method
The 5 types of tooth models were made by 3D-printer. All models have identical size of major foramen and apical constriction and show different position of apical constriction. The measuring zig was made for detailed file control and sophisticated measurement. The '0.5' sign and 'Apex' sign were measured with Root ZX mini (J Morita) and Propex Pixi (Dentsply Maillefer).

III. Results
In both EAL, all signs tend to follow major foramen rather than apical constriction. Top and bottom signs are not consistent with one another. In Root Zx mini, the range between top and bottom level of 'Apex' sign is less than that of '0.5' sign. The variance of the apex sign is smaller than that of '0.5' sign.

IV. Conclusion
Electronic apex locator is recommended to find major foramen rather than locate apical constriction. Considering range and variance, 'Apex' sign is more reliable than '0.5' sign.

***Keywords**: Apex locator, Apical foramen, Apical constriction
***Presenting Author**: Sin-Yeon Cho
Conservative Dentistry, National Health Insurance Ilsan Hospital, Goyang, Republic of Korea, sychodds@gmail.com

FL-002

Bone regeneration of endo-perio lesion following combined endodontic and periodontal treatment approach: A case report

Rio Suryantoro*
Endodontic, Rio Suryantoro Private Dental Clinic, Jakarta Selatan, Indonesia

I. Introduction
The periodontal-endodontic lesions have been characterized by the involvement of the pulp and periodontal disease in the same tooth, a single lesion may present signs of both endodontic and periodontal involvement. In this case report, A patient came with clinical condition showed a big periodontal abscess with sinus tract, 10 mm periodontal pocket depth, third degree tooth mobility (lateral and vertical movements), and no caries. from radiographic image showed a big bone loss or radiolucency from apical to periodontal tissue.

II. Material and Method
After a thorough examination, this patient was treated an initial periodontal therapy approach by scaling to improve oral hygiene, followed with splinting on multiple teeth prior to one visit endodontic treatment. The follow up treatment was done up to 12 months, then the final restoration was completed with composite resin.

III. Results
Follow up treatment after 8 and 12 months showed a fully functional tooth, bone regeneration showed by decreased the area of radiolucency from radiographic examination, and tooth mobility grade 1.

IV. Conclusion
A correct treatment plan which consist of endodontic and periodontal approach will give a good long-term result of success in Endo-Perio lesion.

***Keywords**: Periodontal-endodontic lesions, One visit endodontic treatment, Dental abscess
***Presenting Author**: Rio Suryantoro
Endodontic, Rio Suryantoro Private Dental Clinic, Jakarta Selatan, Indonesia, riosuryantoro@gmail.com

FL-003

CBCT for detecting vertical root fracture in endodontically treated teeth: How solid is the evidence?

Amir Azarpazhooh
Faculty of Dentistry, University of Toronto, Toronto, Canada

Cone-beam computed tomography (CBCT) has become an increasingly popular imaging modality in endodontics. The aim of this presentation is to summarize the diagnostic ability of CBCT in detecting Vertical Root Fracture in endodontically treated teeth.

This presentation will discuss the theoretical framework of clinical epidemiology as would be applied to studies of diagnosis. It would further summarize the results of the available in vivo prospective or retrospective clinical diagnostic studies that follow such expected framework. The presentation will carefully review the methodological quality of these studies using the modified Quality Assessment of Diagnostic Accuracy Studies tool.

To date, there are only four studies available that would follow the principals of clinical epidemiology in designing studies of diagnosis. The available studies demonstrate a high risk of bias. There is currently no evidence to suggest that CBCT testing can provide any additional diagnostic benefit to VRF detection in teeth with endodontic treatment.

The current literature must be interpreted with caution because they could possibly mislead practitioners toward a non–evidence-based uptake of CBCT for purposes of VRF detection. Until more evidence is presented to suggest that CBCT is both diagnostically accurate and efficacious, the prudent clinician should carefully consider its potential risks and harms before its prescription.

***Keywords**: Cone beam computed tomography, Endodontics, Vertical Root Fracture, Diagnosis, Clinical Epidemiology
***Presenting Author**: Amir Azarpazhooh
Faculty of Dentistry, University of Toronto, Toronto, Canada, amir.azarpazhooh@utoronto.ca

FL-004

The molecular mechanism of MTA-induced biological activities

Jin Man Kim*
Department of Dentistry, CHA University School of Medicine, Seongnam, Republic of Korea

I. Introduction
Mineral trioxide aggregate (MTA) is a calcium silicate-based bioactive material that has been extensively used in dentistry. MTA has been highlighted in its diverse biological functions and excellent clinical outcomes. However, limited insight into the intracellular signaling pathways has been provided to explain the biological activities of MTA. Here, we firstly elucidate that the extracellular calcium-sensing receptor (CaSR) is a major signaling mediator of MTA-induced biological reactions through versatile live imaging techniques.

II. Material and Method
Human dental pulp stem cells (hDPSCs) were isolated from third molars without caries from 6 patients (18-22 years of age). Cells were used from passages 4 - 9 for all experiments. hDPSCs were transfected with Lipofectamine 2000. Transfected cells were plated on a 96-well glass bottom plate coated with poly-D-lysine hydrobromide for live cell imaging. Live cell imaging was conducted with a laser scanning confocal microscope (LSM 700, Carl Zeiss) with lasers of 405 nm (blue), 488 nm (green), and 595 nm (red) excitation wavelengths for acquisition of multicolor images. To perform intracellular Ca2+ [Ca2+]i measurements under a perfusion system, hDPCs loaded with Fura-2/AM. Fluorescence ratios were monitored through an Olympus IX71 microscope equipped with a rapidly switchable Xenon lamp with dual excitation (340 and 380 nm).

III. Results
We found that MTA activates diverse CaSR downstream pathways of hDPSCs; notably, CaSR activation essentially requires dual modulation of extracellular Ca2+and pH via MTA. Among the CaSR downstream pathways, Ca2+ mobilization from intracellular stores by the phospholipase C pathway plays an important role in osteogenic differentiation of hDPSCs by regulating transcriptional activity. Moreover, we report the role of MTA in enhancing chemotactic and chemokinetic immune cell migration through distinct signaling pathways.

IV. Conclusion
Our findings shed light on the signal transduction mechanism of MTA in diverse biological processes, thus providing a crucial molecular basis for the use of MTA in regenerative dental therapy, speed and low-speed groups.

***Keywords**: Mineral Trioxide Aggregat, Calcium-sensing receptor, Dental pulp, Immune cell, Calcium, pH
***Presenting Author**: Jin Man Kim
Department of Dentistry, CHA University School of Medicine, Seongnam, Republic of Korea, jinmankim@cha.ac.kr

FL-005

Antibacterial action of ultrasonic and laser-activated irrigation in the apical third of root canals

Ibrahim Seghayer[1], **Gary S.P. Cheung**[*2]
[1]Department of Endodontics, Amiri Hospital Dental Center, Kuwait City, Kuwait, [2]Faculty of Dentistry, The University of Hong Kong, Pokfulam, Hong Kong

I. Introduction
This study aimed to compare the effect of passive ultrasonic irrigation (PUI), Photon Induced Photoacoustic Streaming (PIPS) using an Er: YAG laser, and the use of an Er,Cr: YSGG laser (WTL) against Enterococcus faecalis within the apical third of the root canal.

II. Material and Method
Single-rooted human teeth, with root canal prepared and infected with E. faecalis for three weeks, were randomly divided into three experimental groups (n=16 each) and one positive control group (n=10). Some other teeth served as negative (n=10) and sterility control (n=2). The experimental groups were irrigated with PUI (using 3% NaOCl), PIPS (with 3% NaOCl), or Er,Cr: YSGG laser (with sterile saline). The 2 laser machines in PIPS and WTL group were used according to the manufacturers' instructions. All root canals were sampled before the irrigation regime, and then the apical 5mm of the root was resected and pulverized. The amount of bacteria recovered from all samples was counted (CFUs) and compared.

III. Results
The negative and sterility controls indicated no contamination during the study. Significant amounts of bacteria reduction were detected in all experimental groups, compared with the positive control (Kruskal-Wallis Test, $p<0.05$), but there was no significant difference between the three experimental groups in the amount of bacteria reduction at the apical third of the root ($p>0.05$).

IV. Conclusion
Energized irrigation using PUI, PIPS or WTL results in similar amounts of residual bacteria in the apical 5 mm of the root canal system. There seems to be a need for a more effective means of eliminating the intracanal infection.

***Keywords**: Root canal disinfection, Irrigation, Dental laser
***Presenting Author**: Gary S.P. Cheung
Faculty of Dentistry, The University of Hong Kong, Pokfulam, Hong Kong, hku_gc@yahoo.com

FL-006

Rotate or Reciprocate in the era of heat treatment

Walid Nehme[*]
Endodontic, ST Joseph University of Beirut, Beirut, Lebanon

Since Reciprocation was first introduced in 1964 with the Giromatic system by MicroMega various endodontic reciprocating hand pieces have been manufactured that utilize small, equal angles of CW and CCW rotation. Over time, most of these systems were abandoned and replaced by continuous rotation motors or were used only for glidepath. Since 2008, reciprocating motion regained popularity with the combination of NiTi and endodontic torque control motors including unequal CW and CCW motions. Introducing the new reciprocating movement aimed mainly to improve mechanical properties of the endodontic files such as cyclic fatigue, and to obtain more centered preparations with less procedural errors compared to continuous rotation. But with the advent of new manufacturing procedures including heat treatment, manufacturers claim to overcome all mechanical drawbacks of traditional niti files and to an achieve ideal preparations.
During this presentation, we will elaborate on the properties of the new heat-treated files and compare it to reciprocation files through an extensive literature review. The advantages and drawbacks will be carefully examined. Then we will illustrate the implication of these properties on the shaping procedures through clinical cases.
As a result of these investigations, the clinicians will be aware of the improvements of the mechanical properties of new heat treated rotary files compared to the advantages of reciprocating files.
By the end of this talk participants should be able to:
Acknowledge the advantages of heat treatment on rotary files properties
Enumerate the reciprocation advantages
Choose the most appropriate kinematics according to clinical situations

***Keywords**: Heat treatment, Reciprocation, Rotation
***Presenting Author**: Walid Nehme
Endodontic, ST Joseph University of Beirut, Beirut, Lebanon, walidnehmeendo@gmail.com

FL-007

Laser-assisted endodontic micro-surgery: Maximum impact, minimum collateral damage and optimal healing

Nguyen Nguyen[*]
Endodontics, Polaris Dental Specialists, Salem, USA

As dentists and endodontists, our goal should always be to save the natural tooth or "natural implant" while keeping the postoperative symptoms to a minimum. Adequate training, experience through continual practice, and specialized equipment provide the optimal context to address cases that represent an unusual challenge.

This lecture will demonstrate the scientific evidence, indications, clinical step-by-step and tremendous patients benefits of laser-assisted apical microsurgery. Clinical cases and videos will be used to illustrate the principles.

Upon completion of the session, attendees shall be able to

1. Understand the basic foundation of conventional apical surgery
2. Understand the benefits and clinical steps of laser-assisted apical surgery
3. Integrate the Dental Operating Microscope and CBCT with the Er,Cr: YSGG iPlus laser as part of the endodontic triad of surgical armamentarium
4. Understand Return on Investment for the Dental Operating Microscope, CBCT and laser technology

Laser irradiation provides an extremely precise cut through the interaction of laser energy with the tooth surface. hen the iPlus laser is coupled with enhanced magnification, the clinician is capable of delivering an unrivaled level of precision.

The iPlus is also known to be superior to mechanical methods in eradicating bacteria from dentinal tubules. Accelerated post-surgical healing can be attributed to the laser's ability to remove the smear layer in the bony crypt and on the resected root surface but also its excellent bactericidal potential.

Finally, the minimally-invasive effect of the Er,Cr: YSGG iPlus laser is undeniable allowing minimal pain with optimal healing.

In the case of complex anatomy where the root apex cannot be properly cleaned and periapical healing cannot be obtained, the dental professional is faced with the challenges of diagnosing properly, planning adequately and executing effectively without causing unnecessary harm to the patient. In such endeavor, accuracy and effectiveness are essential in attaining success.

***Keywords**: Laser, Microsurgery, Waterlase
***Presenting Author**: Nguyen Nguyen
Endodontics, Polaris Dental Specialists, Salem, USA, drnguyen@polarisdentalspecialists.com

FL-008

Clinical consideration of antiresorptive drugs in endodontics

Minju Song[*]
Department of Conservative Dentistry, Dankook University, College of Dentistry, Cheonan, Republic of Korea

Antiresorptive drugs (ARD) including bisphosphonates and denosumab, are a widely prescribed group of drugs for diverse bone diseases. The patients having ARD have been increased gradually. Dentists also need to pay attention to that medical environment. What is the impact in endodontics and what should we consider for those patients?

In dentistry, ARD has well known to its serious side effect, i.e. osteonecrosis of the jaws (ONJ) after chronic administration, indicating exposed and necrotic bone. However, some patients have no clinical evidence of necrotic bone but present with nonspecific symptoms or radiographic findings such as sclerosis, which could be categorizing into stage 0. Considering that inflammation or infection is considered an important component of ONJ and bone resorption is less likely when taking ARD, endodontists may be able to diagnose stage 0 ONJ and start treatment actively.

Nonsurgical root canal treatment might be suitable alternatives to tooth extraction or other surgical procedures including surgical endodontic procedures in patients taking ADR. Even though tooth extraction is inevitable, proactive root canal treatment should be performed for controlling apical inflammation, in order to reduce the risk of developing ONJ. Considering some reports that ARD could accelerate acute inflammatory response, nonsurgical root canal treatment could be proactive to prevent and treat ONJ.

ARD is known to be closely associated with inflammatory responses, and root canal therapy aims to control inflammation. In order to prevent ONJ related ARD, it is recommended considering proactive nonsurgical root canal treatment actively as well as avoiding surgical treatment like tooth extraction. presented to suggest that CBCT is both diagnostically accurate and efficacious, the prudent clinician should carefully consider its potential risks and harms before its prescription.

***Keywords**: Antiresorptive drugs, Osteonecrosis of the jaws, Inflammations, Root canal treatment
***Presenting Author**: Minju Song
Department of Conservative Dentistry, Dankook University, College of Dentistry, Cheonan, Republic of Korea, minju81s@dankook.ac.kr

FL-009

Outcomes of vital pulp therapy in permanent teeth with different medicaments: Comprehensive review literature

Abbasali Khademi[*1], Najmeh Akhlaghi[2]
[1]Department of Endodontics and Dental Research Center, School of Dentistry School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran (Islamic Republic of)
[2]Department of Pediatrics Dentistry, School of Dentistry School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran (Islamic Republic of)

I. Introduction
Vital pulp therapy (VPT) is a biologic and conservative treatment modality to preserve the vitality and function of the coronal or remaining radicular pulp tissue in vital permanent teeth.

II. Material and Method
A search was conducted via the Cochrane database, PubMed, Scopus and Ovid for any articles with the criteria for "pulp-capping," or "pulp-capping materials" and "VPT outcomes" from 1978-2017. No specific inclusion or exclusion criteria were applied as to what articles would be included in this review. The outcomes of various VPT techniques, including indirect pulp treatment, direct pulp treatment, partial pulpotomy, and complete pulpotomy in vital permanent teeth were extracted.

III. Results
Although various studies have different research approach, most studies noted a favorable treatment outcome. Mineral trioxide aggregate (MTA) appears to be more effective than calcium hydroxide ($Ca(OH)_2$) for maintaining long-term pulp vitality after indirect and direct pulp-capping.

IV. Conclusion
It seems that the success rate for partial pulpotomy and pulpotomy with $Ca(OH)_2$ is similar to MTA.

***Keywords**: Calcium hydroxide, Permanent dentition, Mineral trioxide aggregate, Root canal therapies
***Presenting Author**: Abbasali Khademi
Department of Endodontics and Dental Research Center, School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran (Islamic Republic of), abbaskhademi@hotmail.com

FL-011

Vital pulp therapy, When, Why and How? Long follow-up case series presentation

Jenner Argueta[*]
Endodontics, Universidad Mariano Galvez De Guatemala, Guatemala, Guatemala

As endodontists, we all know that our job is more than doing root canal treatments for giving to patient´s body a good environment to prevent or heal periapical pathosis; Our labor goes beyond de limits of a root canal space that needs to be cleaned, shaped and filled. Endodontist´s advisable goal should be a first step intervention focused in the treatment of pulp disease, providing to the organism a proper environment to allowed tissue recovery when is damaged. The main goal of the lecture is to provide clinical and scientific information related to the moment in which the clinician must decide between on going for a root canal treatment or to give to the pulpo-dentinal complex the opportunity to survive. Always keeping in mind the fact that as long as we don't know what we treat, overtreatment seems to be easier and more predictable than preservation of vital tissues. (Rechemberg, D. Zehnder, M. 2014).

During lecture will be presented different cases of successful vital pulp therapy procedures with almost the same protocol (small variations depending on the case), proper diagnosis and case selection, caries removal, cavity disinfection, placement of pulp capping material, final restoration and follow-up period. Standardization of protocols is important for obtaining successful results.

Final result in the cases to be presented is successful vital pulp therapy procedures.

- At conclusion, participants should be able to list clinical inclusion criteria for a reliable long-term good prognosis on vital pulp therapy.
- At conclusion, participants should be able to discuss the biological mechanisms involved for pulp tissue recovery and reparative/reactive dentine bridge formation.
- At conclusion, participants should be able to describe all factors needed to be considered at the moment of deciding if a case is a good candidate for root canal treatment or vital pulp therapy procedure.

***Keywords**: Vital pulp therapy, Pulp capping, Bioceramics, Dental pulp
***Presenting Author**: Jenner Argueta
Endodontics, Universidad Mariano Galvez De Guatemala, Guatemala, Guatemala, jennerargueta@gmail.com

FL-012

Ultrasonic vibration & thermo-hydrodynamic obturation method for root canal filling: New concept & technical overview

Yongsik Cho[*]
Private Practice, Doctors Dental Clinic, Ilsan, Republic of Korea

Since 1867 when Bowman made claim of the first use of gutta-percha for root canal filling, there have been so many techniques for successful filling of the canal focused mainly on putting gutta-percha to the whole extent of root canal system. But it should be pointed out that gutta-percha does not provide satisfactory seal by itself, in fact. Sealing depends on sealer, not gutta-percha. Moving on from 'compaction of gutta-percha' to 'controlling the hydrodynamic movement of root canal sealer' makes root canal filling procedure very simple, easy, safe and fast. The clinical and radiographic outcome of the root canal obturation with a novel root canal filling technique and the rationale in it will be presented.

Geometrically designed ultrasonic tip is an indirect sealer activator, a heat carrier to soften gutta-percha and also a hand plugger for short-range vertical compaction. It transfers ultrasonic vibration to sealer and soften small portion of coronal gutta-percha simultaneously in 2~3 seconds by contacting gutta-percha point in the root canal in an activated state. During downpacking in a deactivated state, the tip is a cold hand plugger capturing hydraulic pressure generated by the downward movement of the softened gutta-percha. Softened gutta-percha is a gasket, the root canal is a barrel containing root canal sealer, and the tip is a plunger driving down the gasket into the barrel.

Though 'Ultrasonic Vibration & Thermo-Hydrodynamic Obturation (VibraTHO)' technique is very simple and fast, clinical cases with this novel method have shown outcomes no less than other contemporary root canal filling techniques.

This novel technique is a very simple and cost-effective one with favorable clinical outcomes, so it can be a user-friendly root canal filling method for the typical endodontic practice.

***Keywords**: Ultrasonic activation, Thermo-hydrodynamic obturation, Hydraulic pressure, VibraTHO technique, Root canal sealer
***Presenting Author**: Yongsik Cho
Private Practice, Doctors Dental Clinic, Ilsan, Republic of Korea, endocho@naver.com

FL-013

Bibliometric analysis of endodontic journal: A global perspective of 5 years

Lora Mishra[*], Swadheena Patro
Conservative Dentistry and Endodontics, Institute of Dental Sciences, Bhubaneswar, India

I. Introduction
Dental Journals play a significant role in evaluating scientometric out of researcher which greatly affects the status and progress of the academic environment. Bibliometric assessment in endodontic field analyses the quantitative and qualitative aspects of scientific articles and also aid in evaluating scientific output of an individual or countries. The bibliometric analysis plays a vital role in determining the scientific progress of region or a country. The objective of this brief report is to describe and reflect on the scientific research output in form of publication numbers, types and distribution of research published by various countries and regions in Endodontics in span of last 5 years.

II. Material and Method
A retrospective observational study for International Endodontic Journal (IEJ), Journal of Endodontics (JOE), Journal of Conservative Dentistry and Endodontics (JCD). Australian Endodontic Journal (AEJ) and Restorative Dentistry and Endodontic Journal (RDE) from 2013 to 2017 was conducted. Each article was categorized by their first author affiliation / Corresponding author affiliation and the type of article published. SPSS (Version 20, inc, Chicago, IL, USA) statistics software was used to analyze the data.

III. Results
Each Journal Scientific output in last 5 years were tabulated and distribution of articles region wise was done. Europe and USA had maximum contribution in IEJ and JOE whereas Asian countries contribution was seen more in JCD and RDE. Systematic Review and Randomized control trial studies were least published in all the four journals.

IV. Conclusion
There is considerable increase in publication potential, efforts are seen to publish high quality research articles to provide evidence based endodontic care in clinical practice in endodontic journals.

***Keywords**: Bibliometry, Endodontics, Scientometric
***Presenting Author**: Lora Mishra
Conservative Dentistry and Endodontics, Institute of Dental Sciences, Bhubaneswar, India, loramishra@soa.ac.in

FL-014

Laser-assisted endodontics and safety

Eleftherios Terry Farmakis*
Deptartment of Endodontics, National and Kapodistrian University of Athens, Athens, Greece

Nowadays, Laser irradiation has found a place in the modern endodontic armamentarium, mostly aiding the disinfecting procedures - either directly or indirectly.

Critical analysis of the relative literature reveals that the incorporation of this modern technology into everyday endodontic practice requires thorough understanding of the physics behind the application, as the parameters of laser irradiation (wavelength, pulse length, power, fluence) affects the interaction with the target tissue (through absorption, penetration depth, diffusion etc.) and all of the above influence the outcome.

Of the most profound side effects are the temperature development on the external root surface (which mainly affects the patient in many aspects) and the airborne contamination – which is a potential hazard for both patients and medical personnel.

Caution should be exercised when utilizing this innovative technology in Endodontics. Preventive measures should be adopted for maintaining in-office safety during laser-assisted endodontics.

***Keywords**: Laser irradiation, Laser-assisted endodontics, Safety, Temperature development, Airborne contamination
***Presenting Author**: Eleftherios Terry Farmakis
Department of Endodontics, National and Kapodistrian University of Athens, Athens, Greece, elefarm@dent.uoa.gr

FL-015

How it is the outcome of Apical Periodontitis influenced by different factors: The missing link

Elisabetta Cotti*
Conservative Dentistry and Endodontics, University of Cagliari, Cagliari, Italy

A correct endodontic treatment should take care of the infection in the root canal and promote healing of the periapical tissues. Healing of apical periodontitis (AP) is influenced by several factors, mostly related to the pre-existing condition of the tooth and to the technical quality of root canal treatment.

The general health of the patient affected by apical periodontitis, the medications taken, and the host predisposing factors, like genetics, should also be considered when discussing the treatment and prognosis of AP. The patient population requiring endodontic treatment is changing: patients often suffer from a variety of pathologies and/or are under new categories of medications (like biologic drugs).

All these situations may influence the reactions and outcome of the treatment we perform. Some of these conditions and medications should be brought to the attention of the endodontist in order to enable him/her to alter the treatment and expectations consequently and to use new protocols when needed. Throughout the lecture the following points will be discussed: the most important preclinical conditions of the tooth with AP which influence the treatment outcome; the influence of apical periodontitis on systemic disease; the impact of systemic diseases and of the immune system on endodontic infection, the interferences exerted by the immune-modulatory drugs on the development and treatment of endodontic infection, the future hypotheses on the treatment of AP.

***Keywords**: Apical Periodontitis, Treatment Outcome, Biologic Medications, Immune Modulators
***Presenting Author**: Elisabetta Cotti
Conservative Dentistry and Endodontics, University of Cagliari, Cagliari, Italy, cottiend@tin.it

FL-016

Pharmacologic management of mandibular nerve injury after endodontic treatment

Seong Taek Kim*
Orofacial Pain & Oral Medicine, Yonsei University College of Dentistry, Seoul, Republic of Korea

I. Introduction
Reported causes of mandibular nerve injury in relation to neuropathic pain in dentistry include extraction, dental implant surgery, oral and maxillofacial surgery, periodontal treatment, and root-canal therapy. This study analyzed the characteristics of pharmacologic management of neuropathy after root-canal therapy.

II. Material and Method
Fifty patients who complain of abnormal sensation or pain after root-canal therapy and were referred to Department of Orofacial pain & Oral Medicine at Yonsei University Dental Hospital, Seoul, Korea enrolled in this analysis and improvement of symptom was evaluated after pharmacologic management. The patients' pain characteristics, average percentage of pain reduction, and pain relieving factors were investigated.

III. Results
The causes of neuropathy were local anesthesia (46.9%), chemical trauma from the sealant in root-canal (25%), endodontic surgery (15.6%), and unknown causes (12.5%). Medications such as steroids, anticonvulsants, antidepressants, and analgesics were taken for improvement of symptoms and titrated for a variety of period from 1 week to 11 months. It was found that neuropathy of the inferior alveolar nerve and the lingual nerve was in 40 and 10 patients. The improvement of neurosensory disturbance and no improvement after pharmacotherapy was in 21 (66%) and 11 (34%) patients respectively. The hypoesthesia and dysesthesia were improved 67% and 65% respectively.

IV. Conclusion
These results suggest that symptomatic improvement by pharmacologic management can be possible in patients with neuropathy after root-canal therapy. But improvement of symptoms was influenced by the causes and degree of nerve injury, the periods of pharmacotherapy, and the choice of treatment methods. So, further investigation is needed by quantitative measurement of more variables in more individuals.

***Keywords**: Mandibular nerve, Root canal therapy, Nerve injury, Pharmacologic management
***Presenting Author**: Seong Taek Kim
Orofacial Pain & Oral Medicine, Yonsei University College of Dentistry, Seoul, Republic of Korea, k8756050@yuhs.ac

FL-017

Efficacy of ultrasound doppler in assessing pulp vitality in traumatized teeth and long-term prognosis of pulpal status

Soyeun Ahn, Dohyun Kim, **Sungho Park***
Conservative Dentistry, Yonsei University, Seoul, Republic of Korea

I. Introduction
The assessment of pulp vitality is among the most important procedures in treating traumatized teeth.

The first purpose of this study was to compare the ability of electrical pulp test (EPT) and ultrasound Doppler flowmetry (UDF) in determining pulp vitality of traumatized teeth. The second one was to investigate long-term (over 3 years) follow-up results of the teeth which exhibited contradictory results between pulp sensibility test (thermal or electric pulp test) and ultrasound Doppler flowmetry (UDF).

II. Material and Method
A total of 246 teeth in 78 patients with histories of dental trauma between February 2012 and May 2015 were included. Patients were divided into 2 groups. In Group 1, EPT alone was used to assess pulp vitality, whereas in Group 2, both UDF and EPT were used. Kaplan-Meier survival analysis was performed following propensity score matching. Differences between the survival graphs were tested using the log-rank test. Additionally, the teeth that had continuously shown contrasting results on pulp sensibility test and UDF until 1 year after trauma, and more than 3 years follow-up were finally included and a retrospective chart review was performed.

III. Results
The survival rate of Group 1 was 74% and Group 2 was 90% at 1 year. The survival rates of Group 1 and 2 were significantly different (p=0.005). In Group 2, there was a significant difference between the UDF and EPT results at all follow-up periods. In 3 years follow-ups, eight out of the 13 teeth recovered pulp sensibility. Root canal treatment was performed on the 2 teeth. Pulp sensibility test was not feasible for 3 teeth.

IV. Conclusion
UDF seems to be more sensitive in detecting the pulp vitality of traumatized teeth.

Acknowledgement
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***Keywords**: Ultrasound Doppler, Electric pulp test, Cold test, Trauma, Teeth
***Presenting Author**: Sungho Park
Conservative Dentistry, Yonsei University, Seoul, Republic of Korea, sunghopark@yuhs.ac

FL-018

Herpes zoster and endodontics

Jale Tanalp*
Endodontics, Yeditepe University Faculty of Dentistry, Istanbul, Turkey

Endodontic diagnosis presents a significant problem to the clinician especially when confronted with neurological pathologies. Herpes Zoster infections, especially the prodromal stage, are difficult to diagnose and can easily be confused with odontogenic infections such as irreversible pulpitis or acute apical periodontitis. The objective of this presentation was to focus on this significant problem in endodontics and provide an overview of the literature published on this issue so far. The presentation is also supported with a clinical case in which a patient had symptoms of irreversible pulpitis but was later diagnosed with Herpes Zoster infection associated with the trigeminal nerve.

A literature review was conducted by inserting keywords “Herpes Zoster” and “Endodontics” or “Shingles” and “Endodontics”. Articles that were retrieved and evaluated focused on Herpes Zoster as a cause in the development of pulpal and periapical pathologies and root resorption as well as the difficulty of diagnosis in orofacial pain when confronted with cases involving Herpes Zoster. A general description and critical analysis is made on Herpes Zoster infections and endodontic implications. The presentation is further supported by a case in which a 68-year-old woman underwent endodontic treatment due to severe and radiating pain in the face but was later diagnosed with “Herpes Zoster” infection by the formation of characteristic vesicular rashes.

Patients with Herpes Zoster infections may exhibit symptoms resembling pulpitis and a very careful and thorough diagnosis should be made for a definite diagnosis.

Clinicians, specifically endodontists should be cautious about diagnosing cases in which Herpes Zoster is suspected as the causative factor. It is anticipated that this presentation will be helpful to practitioners in acquiring general knowledge on this common infection and clinical manifestations in dentistry.

***Keywords**: Herpes Zoster, Endodontics, Diagnosis
***Presenting Author**: Jale Tanalp
Endodontics, Yeditepe University Faculty of Dentistry, Istanbul, Turkey, jale.tanalp@yeditepe.edu.tr

FL-019

Contemporary endodontics: From access cavity to shaping and cleaning, a minimal invasive concept

Jean Philippe Mallet*
Endodontics, University Paul Sabatier Toulouse, Paris, France

I. Introduction
Cervical preflaring hasve proved to be of extreme importance for the successful root canal therapy as it minimizes the occurrence of per-operative mishaps and allows thorough cleaning and shaping of the apical third of root canals. Nevertheless, with the emergence of new concepts such as minimal invasive as well as the establishment of new manufacturing process such as heat treatments, more conservative preparations are required to preserve dentin in order to protect the integrity of tooth structure and insure its long- time functionality.

II. Material and Method
Using operative microscope all along the access cavity with specific micro tools allow the operator to reduce the removal of dentin and moreover to decrease the constraints applied to the files at the canal entrance. Innovations focusing on the designs of the files such as asymmetrical cross section or thermo-mechanical treatment in prior or post machining process enhanced the mechanical properties, the performance of these files and boosted their cleaning efficiency without increasing the initial canal shape.

III. Results
In this presentation we will describe a new concept and innovative tools to achieve Endodontics while preserving coronal and radicular dentin through a wide range of clinical situations.

IV. Conclusion
By the end of this presentation attendees will be able to:
- Perform a proper access cavity with minimal dentin removal,
- Shape the entire root canal system without compromising tooth integrity,
- Enhance the disinfecting process of the canal space and intricacies with a minimal invasive concept.

***Keywords**: Minimal Invasive Endodontics, Access Cavity, Heat Treatment
***Presenting Author**: Jean Philippe Mallet
Endodontics, University Paul Sabatier Toulouse, Paris, France, drmallet@noos.fr

FL-020

Endodontics retreatment: Decision making and outcomes

Ayman Mandorah*
Consultant Endodontist, Program Director of Saudi Board in Endodontics, King Faisal Hospital, Makkah, Saudi Arabia

The optimal goal of endodontics is to treat apical pathology and prevent recurrence of infection to root canal systems. Periapical lesions may fail to heal after primary root canal treatment due to different mechanical or biological causes, However, the correct decision regarding the retreatment options are difficult and challenging depending on the accessibility to root canal system, presence or absence of periapical lesions, variations in root canal morphology and availability of advanced instruments and devices for predicable outcomes of such cases either with surgical or non-surgical approach.

Learning Objectives

1. Identify causes of post treatment diseases
2. Evaluation of the clinical outcomes of surgical and non-surgical retreatment
3. Understand alternative retreatment options approaches and techniques

***Keywords**: Non-surgical retreatment, Surgical Retreatment, Treatment Outcomes
***Presenting Author**: Ayman Mandorah
Consultant Endodontist, Program Director of Saudi Board in Endodontics, King Faisal Hospital, Makkah, Saudi Arabia, ayman.mandorah@hotmail.com

FL-021

Minimally invasive endodontics: Bye-bye nickel-titanium! Hello stainless-steel!

Ghassan Yared*
Private Practice, Endodontist, Toronto, Canada

Mechanical nickel-titanium instruments have many benefits compared to hand stainless steel instruments; however, their use is limited in many countries due to their higher cost and many dentists are still using hand stainless steel instruments at the risk of compromising the quality of the endodontic treatment. Is there a solution to this problem? Is the use of nickel-titanium indispensable in the context of minimally invasive management of root canals? Is there a role for stainless-steel instruments?
This lecture will discuss the evolution of endodontic instruments, techniques and concepts, and data available from research to show that the switch to rotary nickel-titanium instruments a few decades ago was the result of a gap in our knowledge, and that those instruments are not indispensable and that they can be safely replaced with mechanical stainless-steel instruments. This lecture will introduce the use of mechanical stainless-steel instruments in reciprocation, with small unequal forward and reverse angles, for a conservative canal preparation. The benefits of this novel technique and its increased safety compared to mechanical nickel-titanium instrumentation will be discussed. Clinical applications will be presented, including the conservative management of root canals, the management of abrupt apical curvatures, ledges and instrument fracture.

***Keywords**: Minimally invasive endodontics, Stainless-steel instruments, Reciprocation, Canal preparation
***Presenting Author**: Ghassan Yared
Private Practice, Endodontist, Toronto, Canada, ghassanyared@gmail.com

FL-022

Mechanical properties of glide-path preparation instruments with different pitch length: G-file & new generation G-file

Dana Al Raeesi*[1], Rashid ElAbed*[2]
[1]Dental Department, Ministry of Health and Prevention, Dubai, United Arab Emirates[2], Endodontic, Hamdan Bin Mohammed College of Dental Medicine, Mohammed Bin Rashid University of Medicine and Health, Dubai, United Arab Emirates

I. Introduction
Nickel titanium rotary instruments for endodontic treatment have become more popular due to their higher shaping efficiency and success rate relative to manual instrument. Despite the increased flexibility and strength of NiTi rotary instruments compared to stainless steel files, instrument separation is a primary problem associated with NiTi instruments. Cyclic fatigue and torsional failures are two primary causes of instrument separation. Creating a glide-path during initial root canal preparation is an important step for reducing the fracture risk of NiTi rotary files.

II. Material and Method
G-File (G1 and G2) and new generation G-File (NG1 and NG2) instruments (Micro-Mega, Besançon, France) were compared to evaluate the effects of the shorter pitch of the latter (25% shorter than G-File). For comparing the torsional resistances (n=15), the file tip was fixed with polycarbonate blocks 4 mm from the tip, and the clockwise rotation at a constant rotational speed of 2 rpm was adjusted until the file fractured. The maximum torsional load and distortion angle at fracture were recorded. For comparing the cyclic fatigue resistances (n=15), the files were freely rotated in a simulated curved canal (length, 17 mm; radius, 3 mm; curvature, 90°) at a speed of 300 rpm in a dynamic mode. When the file fractured, the time elapsed was recorded using a chronometer. The number of cycles to failure for each instrument was calculated by multiplying the total time to failure by the rotation rate. Fractured fragments were examined under the scanning electron microscope (SEM).

III. Results
The NG2 instruments had significantly higher cyclic fatigue resistance and torsional strength than the G2 ($P<.05$) and showed approximately the same fatigue resistance as the G1. SEM topographic examination revealed the typical appearances of two failure modes.

IV. Conclusion
In the present study, glide-path instruments with a shorter pitch had increased cyclic fatigue resistance and torsional strength. This presentation will be helpful to practitioners in acquiring general knowledge on this common infection and clinical manifestations in dentistry.

***Keywords**: Torsional resistance, Glide-path, Pitch, Nickel-titanium rotary instrument, Cyclic fatigue
***Presenting Author**: Dana Al Raeesi
Dental Department, Ministry of Health and Prevention, Dubai, United Arab Emirates, alraeesi.d@live.com

FL-023

Outcome of full pulpotomy in symptomatic permanent teeth with carious exposure using a calcium silicate based material

Nessrin Taha*, Hanan Alkhatib
Conservative Dentistry, Jordan University of Science and Technology, Irbid, Jordan

I. Introduction
This study aimed to assess the outcome of full pulpotomy using non staining calcium silicate based material in mature cariously exposed permanent molars.

II. Material and Method
One hundred and seven permanent molar teeth with symptomatic vital pulps in 90 patients aged 10-60 years were included. Preoperative pulpal and periapical diagnosis was established. After informed consent the tooth was anaesthetized, isolated using rubber dam and disinfected with 5% NaOCl before caries excavation; subsequently the pulp was amputated to the level of the canal orifices. Haemostasis was achieved and a 3 mm layer of Neo MTA plus (Avalon Biomed, Houston, USA) was placed as the pulpotomy agent. The tooth was restored with resin composite, and a postoperative periapical radiograph exposed. Clinical and radiographic evaluation was completed at 6 months and 1 year postoperatively. Pain levels were scored preoperatively and 2 days post treatment.

III. Results
Clinical signs and symptoms indicative of irreversible pulpitis were established in 46/109 teeth, and periapical rarefaction was present in 9 teeth. After 2 days 93.4% reported complete relief of pain. 7 teeth had immediate failure, at 6 months 91/100 attended recall with 94.5% clinical and radiographic success. At 1 year 79/97 attended recall, with 97.4% clinical and radiographic success, 7 out of 9 cases with periapical rarefaction had improvement in the periapical index score, 1 failed and 1 did not attend recall. A hard tissue barrier was detected radiographically in 6 cases.

IV. Conclusion
Full pulpotomy using NeoMTA plus was a successful treatment option for carious-exposed pulps in permanent molar teeth up to one year. Clinical signs and symptoms indicative of irreversible pulpitis are not a contraindication.

***Keywords**: Deep caries, Pulpitis, Pulpotomy, Neo MTA plus
***Presenting Author**: Nessrin Taha
Conservative Dentistry, Jordan University of Science and Technology, Irbid, Jordan, n.taha@just.edu.jo

FL-024

Magnification- A holistic approach to predictable endodontics

Viresh Chopra*
Endodontology, Oman Dental College, Muscat, Oman

Magnification in endodontics has changed the way root canal treatment is performed these days. Cases that once seemed impossible have become easy and exciting to operate. Although initial root canal therapy has been shown to be a predictable procedure with a high degree of success, failures can occur after treatment. The introduction of operating microscope has widened the approach for case selection in failed root canal treatment cases. the teeth which were extracted at one point of time can be thought of being saved just because of the operator's ability to see inside the root canals clearly and operate with predictable results. Previously treated teeth with persistent periapical lesion(s) might be preserved with nonsurgical retreatment or endodontic surgery, assuming the tooth is restorable, periodontally sound, and the patient desires to retain the tooth. As fewer teeth are extracted, an increasing number of retreatment cases have been recorded in the past 15 years. Utilization of the enhanced magnification devices in endodontic retreatment has brought significant advantages and has expanded the scope of indications using a non-surgical approach. Procedures such as bypassing a ledge, removing broken instrument or repair a perforation have become considerably more reliable. Minimal invasive approach can be taken for retreatment cases with huge post and perforations. Materials can be applied only to the specific area required just because the operator can see the site large and clear just because of magnification. The operating microscope has change the way we look towards the prognosis giving us a new predictable endodontics.

***Keywords**: Operating microscope, Magnification, Biological approach, Minimally invasive, Predicatatble endodontics
***Presenting Author**: Viresh Chopra
Endodontology, Oman Dental College, Muscat, Oman, chopra.viresh@gmail.com

FL-025

Broken instrument management, Bypass vs. Removal

Talal Alnahlawi*
Endodontics and Operative Dentistry, Syrian Private University, Damascus, Syrian Arab Republic

Endodontic file separation is considered the most annoying accident that can face the dentist during his/her daily endodontic practice. The main problem of having a broken instrument inside the root is the lack of sufficient instrumentation, disinfection, and therefore a proper obturation of the treated root canal which will influence the overall prognosis of endodontic treatment.

The management of such accident needs sufficient understanding of the type and geometry of broken file, location and size of the file, amount of canal disinfection before file separation, and length with amount of engagement with canal walls. After thorough clinical and X ray examination, treatment plan must be based upon three options: bypassing, removal, or leaving the broken file inside the canal with monitoring.

The objective of this presentation is to highlight the factors contributing to file separation and how to avoid it along with a description of a novel technique for bypassing a broken file, and how to remove a broken file when indicated through many clinical cases with illustrations and videos.

***Keywords**: Retreatment, Retrival, Bypass, Microscope, Ultrasonics
***Presenting Author**: Talal Alnahlawi
Endodontics and Operative Dentistry, Syrian Private University, Damascus, Syrian Arab Republic, talal.alnahlawi@gmail.com

FL-026

Computer-aided design and 3D printing: A new era in minimally invasive endodontics

MoatazBellah Ahmed Mohamed Ahmed Soliman Alkhawas*
Department of Endodontics, Faculty of Dental Medicine, Al-Azhar University, Cairo, Egypt

I. Introduction
Management of teeth with calcified canals, broken instruments, perforations apical transportations and/or periapical lesions dictates surgical/non-surgical endodontic retreatment. Using traditional techniques of surgical/non-

surgical retreatment may compromise the remaining tooth structure and the surrounding periodontium. Currently, computer-aided design utilizing cone beam computed tomography (CBCT) data followed by 3D printing of guided templates to the endodontic field aims for augmenting the concept of minimally invasive treatment that directly affects treatment outcome.

II. Material and Method

A CBCT imaging of the affected teeth, rubber base impression making and a study cast construction were carried out. Following CBCT imaging of the study cast, a surgical guide software was used to superimpose the transferred CBCT imaging data with that CBCT data of the study cast. A virtual surgical/non-surgical planning was done for designing the guided template. A 3D printing of the guided template was delivered to aid in the management of canal calcification, broken instrument, perforations apical transportations and/or periapical lesions with a minimally invasive approach.

III. Results

Using guided templates for surgical/non-surgical endodontic retreatment can aide in the conservation of the tooth structure and the surrounding periodontium.

IV. Conclusion

Beside teeth conservation, using the guided templates can reduce the treatment time, accelerate the healing process and improve the treatment outcome.

***Keywords**: Guided access, Broken instrument, Guided trephination, Endodontic microsurgery, 3D printing, Minimally invasive endodontics

***Presenting Author**: MoatazBellah Ahmed Mohamed Ahmed Soliman Alkhawas

Department of Endodontics, Faculty of Dental Medicine, Al-Azhar University, Cairo, Egypt, malkhawas@yahoo.com

Oral Research Presentations

OP-001

Relationship between dentinal defects and endodontic chemo-mechanical instrumentation: A cadaver study using micro-CT

Vui Tan[*1], Varsha Pilbrow[2], Rita Hardiman[1], Peter Parashos[1]

[1]Melbourne Dental School, University of Melbourne, Melbourne, Australia, [2]Department of Anatomy and Neuroscience, University of Melbourne, Melbourne, Australia

I. Introduction

Whilst it is unclear whether microcracks can serve as 'trigger points' for VRF, the current consensus is that they should be prevented in order to improve the longevity of endodontically treated teeth. The aims of this study were to 1)investigate the relationship between the formation of dentinal defects and chemo-mechanical root canal instrumentation in a cadaver model using micro-CT as an imaging modality, and 2)investigate if there is a difference between three particular NiTi instrumentation protocols and the formation of dentinal defects, 3) histologically evaluate any new dentinal defects identified on micro-CT cross-section images.

II. Material and Method

Maxillary and mandibular molars (n=24) were sectioned from cadaver specimens as a tissue block containing the tooth of interest, adjacent teeth, surrounding alveolar bone and attached mucogingival tissues. After a baseline micro-CT scan, the specimens were distributed into 3 groups (n=8 molars): Reciproc, ProTaper Next and Mtwo. A post-operative micro-CT scan of each specimen was performed after access and glide path and after preparation with each instrument. The final post-operative cross-section images of the roots were screened by two blinded examiners to identify any dentinal defects. All experimental procedures and scanning were completed whilst the teeth were in the tissue block. Several specimens were selected for further histological processing to further analyze new and pre-existing dentinal defects.

III. Results

Of the 24 molars, 12 teeth were noted to have pre-existing dentinal defects (50%). Histologically, these defects occurred in the cemental layer. New dentinal defects were observed in the post-operative scans of three canals (3.9%; 3/77). Only one of these microcracks was found to be present histologically, which was associated with the Reciproc protocol.

IV. Conclusion

Within the limitations of the study, chemo-mechanical instrumentation can influence the formation of dentinal defects, but root and root canal anatomy seem to be contributing factors.

***Keywords**: Microcracks, Dentinal defects, Micro-CT, Cadaver

***Presenting Author**: Vui Tan

Melbourne Dental School, University of Melbourne, Melbourne, Australia, vuit@student.unimelb.edu.au

OP-002

Investigation of intracanal moisture conditions on closure property of four root canal sealers

Hantang Sun[*1], Yue Xin[2], Jun Qiu[3], Meiqin Gao[4], Dongmei Xv[1], Yulin Zhang[3]

[1]Department of Operative Dentistry and Endodontics, Nantong Stomatological Hospital, Nantong, China, [2]Department of Stomatology, No. 203 Hospital of People's Liberation Army, Qiqihaer, China, [3]Department of Operative Dentistry and Endodontics, School of Stomatology the Fourth Military Medical University, Xi'an, China, [4]Department of Orthodontics, Nantong Stomatological Hospital, Nantong, China Selatan, Indonesia

I. Introduction

Effective control of liquid infiltration was a challenge for single-visit root canal treatment. Different intracanal moisture conditions would be made by different amount of remaining liquid. It was of great importance to know, to what extent the intracanal moisture conditions would affect the closure property of root canal sealers.

II. Material and Method

One hundred and twelve singles-root canal permanent teeth were included in this study. After crown removal and root canal preparation, 96 teeth were divided into four groups in randomized block design, with 24 in each group. Root canals in group A were filled with AH-plus, those in group M, I and E were filled with MTA, IRoot and Endosequence, respectively. And each group (24 teeth) were further divided into 4 sub-groups with respect to the moisture condition: (1) Dry, (2) Less dry, (3) Moist, (4) Wet. The remaining 16 teeth were used as positive controls and negative controls. The root canals were filled with corresponding sealants by continuous-wave technique (System B) combined with Obtura II system after different drying methods. Microleakage was assessed by ink staining after 7 days.

III. Results

The microleakage of sealants were different under various intracanal moisture conditions. The mean depth of ink dye penetration of AH-plus was minimum under dry condition in contrast to MTA and Endosequence ($p<0.05$). The mean depth of ink dye penetration of IRoot was minimum under wet condition in contrast to AH-plus and MTA ($p<0.05$).

IV. Conclusion

There was different closure property of the four root canal sealants under various intracanal moisture conditions. The closure property of IRoot and Endosequence was better than that of AH-plus and MTA under moist and wet intracanal conditions.

***Keywords**: Intracanal moisture condition, Root canal sealant, Microleakage

***Presenting Author**: Hantang Sun

Department of Operative Dentistry and Endodontics, Nantong Stomatological Hospital, Nantong, China, hantang@fmmu.edu.cn

OP-003

Comparison of apical transportation & centering ability of ProGlider, Path File & G File using CBCT – An in vitro study

Padmini Chandrasekhar*

Conservative Dentistry and Endodontics, Terna Dental College, Mumbai, India

I. Introduction

Root canal negotiation and glide path establishment are the initial phases of biomechanical preparation and are essential steps that influence the predictability and success of root canal treatment. In order to attain the optimal result of maximum cleaning effectiveness and minimum weakening of tooth structure, it is essential that the instruments confirm to and retain the original shape of the canal. Creation of glide path helps to achieve the above motive and also minimizes torsional and bending stresses of subsequent files, thereby reducing procedural errors during root canal preparation. The purpose of this study was to evaluate and compare the apical transportation and centering ability of three guide path preparation systems - ProGlider, Path files and G files by using CBCT.

II. Material and Method

Thirty mesiobuccal roots of mandibular molars with curvatures were randomly divided into three experimental groups (n=10). The three groups were instrumented with ProGliders, Path files and G files respectively. The pre-instrumentation and post-instrumentation CBCT scans were taken and were compared using Galaxis Galileos software. The apical transportation, its direction and centering ability were evaluated. The results were statistically analyzed using ANOVA and paired t test.

III. Results

Although Path files exhibited the least apical transportation and most centering ability, the difference among the tested groups regarding the apical transportation and centering ability was not statistically significant ($p>0.05$). None of the glide path systems showed a perfect centering ability (=1.0). A greater tendency for transportation towards the mesial direction was observed as compared to the distal direction.

IV. Conclusion

Within the limitations of this study it can be concluded that there is no difference in the performance of three glide path systems that were compared.

***Keywords**: Apical transportation, Centering ability, CBCT

***Presenting Author**: Padmini Chandrasekhar

Conservative Dentistry and Endodontics, Terna Dental College, Mumbai, India, dr.psekhar1@gmail.com

OP-004

Cyclic fatigue resistance of Hyflex controlled memory nickel-titanium files after two different types of heat treatment

Mehmet Baybora Kayahan[1], Guher Barut[2], **Vasfiye Isik***[1], Elif Ciftciolu[1]

[1]Endodontics, Okan University Faculty of Dentistry, İstanbul, Turkey, [2]Endodontics, Yeditepe University Faculty of Dentistry, İstanbul, Turkey

I. Introduction

The aim of this study was to evaluate the effect of autoclave sterilization and hot water at a temperature of 100°C on the cyclic fatigue life of small (20/.04) and large (40/.04) size of HyFlex CM files.

II. Material and Method

Twenty-eight size 20, .04 taper HyFlex CM files and 28 size 40, .04 taper HyFlex CM files was included in the present study. All files were used in sequence recommended by manufacturer to shape a total of 56 J-shaped endo-training–blocs to create deformation on the files. Then each group of files were divided into 2 subgroups with 14

files according to the type of heat treatment; autoclave sterilization and hot water at a temperature of 100oC for recovering files. Fourteen files from each different subgroup were tested for cyclic fatigue resistance using stainless-steel artificial canal with 60˚ angle of curvature and a 5 mm radius. Means and standard deviations of number of cycles to failure (NCF) and fragment length of the fractured tip were calculated for each group, and data were statistically analyzed ($p<0.05$).

III. Results

There is no significant difference between hot water and autoclaved sterilization in the fracture resistance of the files with 20/.04 ($p=0.557$) and 40/.04 ($p=0.126$). The fracture resistance of the files with 20/.04 was higher than the files with 40/.04 after both recovering methods ($p=0.000$).

IV. Conclusion

HyFlex Controlled Memory files appear to regain their resistance to fracture both in autoclave sterilization and hot water regardless of the instrument size.

***Keywords**: Cyclic fatigue, Nickel-titanium, Heat treatment
***Presenting Author**: Vasfiye Isik
Endodontics, Okan University Faculty of Dentistry, İstanbul, Turkey, vasfiye86@hotmail.com

OP-005

Evaluation of the smear layer removal and sealer penetration after use of 2 modified sodium hypochlorite solutions

Shalini Aggarwal[*], Poorva Kurtarkar
Dept. of Conservative Dentistry & Endodontics, Dr D.Y.Patil Dental College, Pune, India

I. Introduction

Sodium hypochlorite is the leading irrigant in endodontics as it has superior tissue dissolution and anti-microbial properties. Its merit is marred only by the fact that it needs to be followed by other irrigants, due to its inability to rid the canal of its debris. Combining modifiers like etidronic acid with sodium hypochlorite leads to enhancement of the cleaning abilities of NaOCl without impeding its proteolytic or anti-bacterial properties. It also reduces dentin debris accumulation in the root canal during rotary instrumentation. Whilst, the presence of a surfactant enhanced the ability of sodium hypochlorite to remove the organic material. Evaluation of the smear layer remnants and lateral penetration of endodontic sealers can be done to ascertain the efficacy of the cleaning action.

II. Material and Method

Sixty roots of human teeth, with single canals were divided into 3 groups of 20 each. Each group was further divided into 2 sub-groups.

Group 1: The standard irrigation protocol was followed for the samples in this group using 5.25% hypochlorite. (n=20)
Group 2: The roots in this group were irrigated with NaOCl which had been modified with Surfactants. (n=20)
Group 3: The roots in this group were irrigated using NaOCl, that had been modified with Etidronic Acid. (n=20)

Of the 2 sub-groups in each group, one was left unobturated and processed for viewing under the Scanning Electron Microscope and the other group was obturated and processed for viewing under the Confocal Laser Scanning Microscope. After processing, the samples were assessed under SEM for smear layer removal and under CLSM for sealer penetration.

III. Results

It was found that Group 2 performed the best when sealer penetration was evaluated using the CLSM, followed by Groups 3 and 1.
Group 3 was found to be the best when smear layer removal was evaluated using the SEM, followed by Groups 2 and 1.

IV. Conclusion

The addition of either surfactants or etidronic Acid to Sodium Hypochlorite led to an increase in its cleaning ability. It is thus safe to conclude that these modified solutions could be used in a new irrigation protocol, thereby eliminating the need of additional irrigants to cleanse the canal of debris.

***Keywords**: Sodium hypochlorite, Etidronic acid, Surfactants, Sealer penetration,Smear layer removal
***Presenting Author**: Shalini Aggarwal
Dept. of Conservative Dentistry & Endodontics, Dr D.Y.Patil Dental College, Pune, India, shalini1972minia@gmail.com

OP-006

Comparative study of apically extruded debris by ProTaper Next (PTN) system and K3 endodontic rotary files

Mannu Vikram[*1], Rajkumar Singh[2]
[1]Endodontics, BP Koirala Institute of Health Sciences, Dharan, Nepal, [2]Maxillofacial Prosthetics, BP Koirala Institute of Health Sciences, Dharan, Nepal

I. Introduction

Biomechanical preparation of the root canal is one of the most important aspects of endodontic therapy. Basically preparation techniques produce and push debris out of canals, which is inevitable. This study was designed in a to quantitatively evaluate and compare the amount of apically extruded debris from extracted human teeth using Protaper Next (PTN) rotary file system and K3 endodontic rotary files.

II. Material and Method

Ethical clearance for the study was obtained from Institution Review Committee (IRC) vides letter ref. no. 112/071/072-IRC. This study was conducted in the Department of Conservative Dentistry and Endodontics, College of Dental Surgery, BPKIHS, Dharan. The apical debris extruded by two endodontic instrumentation systems were quantified and compared.

III. Results

The results of the study showed that a significant difference exists between the two instrumentation systems with the ProTaper Next files extruding more apical debris than the K3 system.

IV. Conclusion

Clinicians need to exercise caution in the selection and use of endodontic instruments. Prevention of damage and irritation to surrounding tissues is one of the major challenges facing the clinician.

***Keywords**: ProTaper Next, K3, Apical debris
***Presenting Author**: Mannu Vikram
Endodontics, BP Koirala Institute of Health Sciences, Dharan, Nepal, drmannuvikram@gmail.com

OP-007

Effect of intracanal medicaments on the push out bond strength of two bioceramic root filling materials

Afaf-Al Haddad, **Kranthi Raja**[*]
Conservative Dentistry, MAHSA University, Selangor, Malaysia

I. Introduction

The aim of this study was to evaluate the effect of prior application of Diapex and Odontopaste intracanal medicaments on the bond strength of OrthoMTA and iRoot SP to the root dentin.

II. Material and Method

Thirty single rooted mandibular premolars were decoronated and prepared using ProTaper rotary files. The specimens were randomly and equally divided into a control group (without intracanal medicament) and two experimental groups with Diapex or Odontopaste intracanal medicaments. The intracanal medicaments were removed after one week by rinsing with 10 mL 5.2% sodium hypochlorite followed by 10 mL 17% EDTA. All groups were subdivided into two subgroups according to the root filling materials; iRoot SP or OrthoMTA. Each root was sectioned transversally at the thickness of 1±0.1 mm to obtain 5 sections (n=25/group). The specimens were subjected to push-out test using a Universal Test Machine at a loading speed of 0.5 mm/ min. Failure modes was examined under stereomicroscope. The data were analyzed using Kruskal Wallis and Mann Whitney post hoc test. Mann Whitney tests were performed to detect the difference between two root filling materials for each intracanal medicaments and control separately ($p=0.05$).

III. Results

There was no significant difference between bond strength of iRoot SP and OrthoMTA without medicaments and with prior placement of Diapex ($P>0.05$).
However, iRoot SP showed significant higher bond strength with prior placement of Odontopaste ($P<0.05$). There was no significant difference in bond strength of OrthoMTA with or without intracanal medicament ($P>0.05$). There was no association between failure mode and root filling materials ($P>0.05$). The prominent failure mode for all groups was cohesive.

IV. Conclusion

Prior application of Diapex has no effect on bond strength of iRoot SP and OrthoMTA. However, Odontopaste increases the bond strength of iRoot SP.

***Keywords**: Bioceramics, i Root SP, Ortho MTA, Push out, Bond strength, Intracanal medicament
***Presenting Author**: Kranthi Raja
Conservative Dentistry, MAHSA University, Selangor, Malaysia, kranthi@mahsa.edu.my

OP-008

Comparison of single cone, vertical and lateral condensation obturation methods based on radiographic observation

Noor Hafida Widyastuti[*], Alfatisa Risky Dewantari
Conservative Dentistry, Universitas Muhammadiyah Surakarta, Surakarta, Indonesia

I. Introduction
Root canal obturation is one of root canal treatment procedure by inserting material into a root canal. Some techniques used gutta-percha materials, including lateral condensation techniques, vertical condensation and single cone. The quality of obturation can be evaluated using periapical radiographic. The purpose of this study was to compare three obturation techniques which produces the most compacted filling based on radiographic observation.

II. Material and Method
This research used post-test only control group design. Object of the research is 30 extracted human premolars mandibular. The root canals were prepared by rotary system (ProTaper File; Dentsply Maillefer, Ballaigues, Switzerland) in a crown-down technique. The coronal diameter and apical size of the root canals were standardized in preparation techniques. They were divided into 3 treatment groups of each 10 samples with 3 different obturation techniques. Group 1 vertical condensation technique, group 2 lateral condensation technique, group 3 single cone technique. Obturation results were evaluated using periapical radiography in labio-lingual mesial-distal section, then scoring. The inspection using 2 observers with Cohen's Kappa Value 87%. Data analysis using Kruskall-Wallis test, followed by Post Hoc Mann Whitney test.

III. Results
Nonparametric test of Kruskall Walis got significance value equal to p=0.028 (P<0.05) so root canal obturation technique has an effect on the hermetical obturation of root canal system. The Post Hoc Mann Whitney test showed no significant difference between lateral condensation technique group with single cone group.

IV. Conclusion
The vertical condensation was better on the root canal obturation results than single cone and lateral condensation technique based on radiographic observation.

***Keywords**: Root canal treatment, Obturation, Vertical condensation, Lateral condensation, Single cone technique, Radiography
***Presenting Author**: Noor Hafida Widyastuti
Conservative Dentistry, Universitas Muhammadiyah Surakarta, Surakarta, Indonesia, noor.hafida@ums.ac.id

OP-009

Assessment of the XP - endo Finisher efficacy on cleaning residual fillings from the walls of previously treated canals

Ahmed Elhakim*, Mohamed Ibrahim, Amany Badr
Endodontic Department, Faculty of Dentistry, Mansoura University., Mansoura, Egypt

I. Introduction
This study was designed to compare the efficacy of XP-endo Finisher (XPF) to three irrigation protocols (Conventional needle irrigation (CNI), Passive Ultrasonic Irrigation (PUI), and EndoVac (EV)) on the cleanliness of root canal surfaces after the removal of root canal filling material using scanning electron microscope (SEM).

II. Material and Method
Seventy-two distal roots of lower molars were used in this study. After being cleaned and shaped to size 35/4, the samples were obturated with single cone gutta-percha &TotalFill BC Sealer (TF). Retreatment was performed using D-Race retreatment rotary files in a crown down manner and irrigation using conventional needle irrigation. All canals were further enlarged to size 40/.04. divided into four groups for XPF and the three irrigation methods (CNI, PUI and EV). An alternating protocol of NaOCl and EDTA with standard volume was used as a final irrigation. Roots were split and scanned using SEM. A four-grade debris scoring system was adopted and each root third (coronal, middle, apical) was given a score.

III. Results
Evaluation of the debris showed that XPF had the highest efficacy of cleaning the root canal after removal of the obturating materials. Conventional needle irrigation showed significantly lower efficacy in cleaning the canals compared to the other three systems used. No significant difference was found between EV and PUI. Regarding The canal level, the apical third had the highest debris with the CNI and PUI, on the contrary the apical third showed lower levels of debris with EV and XPF.

IV. Conclusion
The use of XPF and the irrigation activation methods has a beneficial impact on reducing residual filling materials compared to CNI. The XPF with its characteristic metallurgy and shape alternating design was superior to the other methods for canal cleanness following retreatment. Although EV and PUI performed similarly, EV had higher cleaning efficacy at the apical third.

***Keywords**: Retreatment, Irrigation, Activation, Xp - endo Finsiher, EndoVac
***Presenting Author**: Ahmed Elhakim
Endodontic Department, Faculty of Dentistry, Mansoura University, Mansoura, Egypt, elhakeem_ahmad@mans.edu.eg

IV. Conclusion
Based on all these 3 parameters evaluated, though TS files removed less dentin and extruded less debris it may not be effective in long oval canals as 38.59% of dentin surface was unprepared. In such cases SAF was found to be more effective.

***Keywords**: Dentin removal, Debris extrusion, TRUShape files, Dentin contact, SAF files, WaveOne files
***Presenting Author**: Rajkumar Kothandaraman
Conservative Dentistry and Endodontics, SRM Dental College, Chennai, India, endoraj@gmail.com

OP-010

Comparing the contact percentage, dentin removal and apical debris extrusion of various rotary and reciprocating files

Rajkumar Kothandaraman*, Athul Babu Kuriyan, Karthikeyan Kittappa, Mahalaxmi Sekar
Conservative Dentistry and Endodontics, SRM Dental College, Chennai, India

I. Introduction
The enlarging and shaping of the root canals using instruments allow adequate chemical debridement while preserving the original root canal morphology. Nevertheless, the cross-sectional design and the instrument taper leads to certain disadvantages, such as non-uniform dentin contact, unnecessary removal of dentin, microcrack formation and debris extrusion into periapical tissue. Development of micro computed tomography (MCT) has gained significant importance in dental research due to its non-invasive three-dimensional assessment of the root canal system. Hence the aim of this study was to determine the percentage of contact, amount of dentin removed and debris extruded apically after instrumentation with ProTaper Universal (PTU), Self-Adjusting (SAF), WaveOne (WO) and TRUShape (TS) Files.

II. Material and Method
Sixty mandibular first molars with single oval canals were divided into four groups each (n=15) based on the instrument used for root canal preparation: group 1- PTU, group 2 - SAF, group 3 - TS, group 4 - WO. Distal roots were standardised to a length of 10 mm. All the samples were mounted in 2.2" x 1.3" rectangular elastomeric mold and subjected to pre-instrumentation MCT analysis. Debris extrusion was analyzed mounting the samples in Eppendorf tubes followed by corresponding instrumentation of the root canal. The samples were then dried and weighed using microbalance. Finally, post-instrumentation MCT analysis was performed placing the samples in the previously fabricated mold.

III. Results
Instrumentation with TRUShape file system in oval canals resulted in less amount of dentin removal and debris extrusion.

OP-011

Quantitative analysis of dentin resin interface of luted fibre post after active and passive irrigation: A confocal study

Pratima Shenoi*, Swati Demble, Chetana Makade
Conservative Dentistry & Endodontics, VSPM's Dental College & Research Centre, Nagpur, India

I. Introduction
Fiber posts have been recommended to rebuild endodontically treated teeth because of their dentin-matched characteristics. Effective bonding between post, dentin, and adhesive resin cement and its durability are essential for the longevity of the restorations. Previous research has suggested that the efficacy of the dentin adhesives mostly depends on the smear layer removal and the resin dentin inter-diffusion zone formation. The use of self-etch adhesive systems for fiber post cementation has increased because of the easily manageable clinical procedures associated with them. However, their efficacy to permeate the smear layer and to impregnate the dentin remains a major concern. The hybridized smear layer produced by self-etching adhesives is a weak area in the bonding interface. Therefore, dentin surface of the root canal needs to be effectively cleaned before fiber post cementation, allowing the infiltration of a self-etching adhesive. Thus, the study aimed to evaluate the effect of active and passive post space irrigation on resin dentin interface of self etch adhesives.

II. Material and Method
Decoronated maxillary anteriors with a standardized length were taken as samples. After post space preparation, the samples were randomly divided into two groups according to the post space irrigation protocol:
Group A: Active Irrigation
Group B: Passive Irrigation
The fiber posts were luted with self-etch adhesives.

The samples were sectioned at 1, 4, 7 mm from CEJ. These sectioned samples were subjected to confocal laser scanning microscopy for evaluation of thickness of hybrid layer and resin tags.

III. Results

The results obtained indicated that there was a highly significant difference in thickness of hybrid layer and resin tags in groups actively irrigated when compared with those passively irrigated ($p<0.001$).

IV. Conclusion

The results showed that active irrigation could be advantageous for post space irrigation when fiber posts are bonded with a self etch adhesive systems.

***Keywords**: Inter-diffusion zone, Self-etch, Smear layer
***Presenting Author**: Pratima Shenoi
Conservative Dentistry & Endodontics, VSPM's Dental College & Research Centre,Nagpur, India, prshenoi@gmail.com

OP-012

Effectiveness of irrigation techniques on sealer penetration in curved roots

Ayca Yilmaz[1], Turgut Yagmur Yalcin[1],
Dilek Helvacioglu-Yigit[*2]
[1]Endodontics, Istanbul University, Istanbul, Turkey, [2]Endodontics, Kocaeli University, Kocaeli, TurkeySurakarta, Indonesia

I. Introduction

The objective of this study was to compare the effectiveness of different techniques used for final irrigation on sealer penetration of curved root canals at 2 and 4 mm from root apex.

II. Material and Method

Sixty-five freshly extracted maxillary first molar teeth with mesiobuccal roots having more than 20° of root curvature were used. The root canals were instrumented and were randomly divided into 4 experimental groups and 1 control group according to the final irrigation protocols: group 1 Manual dynamic activation (MDA) with a master gutta-percha cone; group 2 Sonic irrigation by using the EndoActivator system (SI); group 3 Passive ultrasonic irrigation with EndoUltra (PUI); group 4 Conventional needle irrigation (CI). Control group was composed of 5 specimens without final irrigation after instrumentation. All teeth were obturated with gutta-percha and AH Plus sealer labeled with fluorescent dye. Transverse sections at 2-mm and 4-mm from root apex were examined with the aid of confocal laser scanning microscopy. Total percentage (%) and maximum depth (mm) of sealer penetration were measured.

III. Results

All of the experimental groups exhibited significantly higher penetration rates than the control group at both sections ($p<0.05$). However, no significant differences were found in the penetration depth and percentage among the four experimental groups evaluated at both sections ($p>0.05$). PUI, SI and CI groups showed significantly less percentage of penetration in 2-mm section than 4-mm section ($p<0.05$) whereas there was no significant difference between two sections in MDA group ($p>0.05$).

IV. Conclusion

The use of activation techniques in the final irrigation procedure did not significantly achieve greater sealer penetration when compared with conventional needle irrigation.

***Keywords**:Confocal laser scanning microscopy, Irrigation techniques, Sealer penetration
***Presenting Author**: Dilek Helvacioglu-Yigit
Endodontics, Kocaeli University, Kocaeli, Turkey, dhelvacioglu@gmail.com

OP-013

Confocal laser scanning microscopic evaluation of the depth of penetration of five root canal sealers

Gaurav Kulkarni[*]
Conservative Dentistry and Endodontics, Terna Dental College, Navi Mumbai, India

I. Introduction

The aim of this study was to evaluate and compare the depth of penetration of five root canal sealers into radicular dentinal tubules using confocal laser scanning microscopy.

II. Material and Method

Fifty freshly extracted single-rooted maxillary anterior teeth were decoronated at cementoenamel junction. Instrumentation was performed with ProTaper rotary nickel-titanium instruments (Dentsply Maillefer). The canals were prepared up to size F3. Final irrigation protocol included flushing the canal with 5 mL Smear Clear, 5 mL 5% sodium hypochlorite and 5 mL distilled water. The samples were then randomly divided into

5 groups (N=10) and obturated by lateral compaction technique using the respective sealers labeled by fluorescent rhodamine B dye (Mayor Diagnostics, Mumbai, India). AH Plus (Dentsply Maillefer), EndoRez (Ultradent), Zinc Oxide Eugenol (Prime Dental Products), Sealapex (SybronEndo) and MTA-Fillapex (Angelus) formed the test groups. Teeth were then positioned in blocks of orthodontic resin and left undisturbed until the resin set. Three horizontal sections of 1-mm representing coronal middle and apical thirds were made. All samples were examined with Zeiss (LSM 780) confocal laser scanning microscope. Images were analysed by using ZEN 2.1 software. Data was recorded and subjected to statistical analysis using one-way ANOVA test.

III. Results

Significantly higher depth of penetration was demonstrated by the tested sealers in coronal thirds when compared to apical thirds ($p<0.05$). Maximum penetration depth was demonstrated by AH Plus in the coronal and apical thirds and by MTA-Fillapex in the middle thirds. The lowest recorded penetration depths were by Zinc Oxide Eugenol in the coronal and middle thirds and Sealapex in the apical thirds.

IV. Conclusion

None of the root canal sealers were able to penetrate the complete depth of radicular dentinal tubules. While AH Plus and MTA Fillapex showed highest penetration into radicular dentinal tubules; Zinc Oxide Eugenol and Sealapex demonstrated least penetration.

***Keywords**: Root canal sealers, MTA Fillapex, CLSM
***Presenting Author**: Gaurav Kulkarni
Conservative Dentistry and Endodontics, Terna Dental College, Navi Mumbai, India, drgauravkulkarni@gmail.com

OP-014

Accuracy of endoscopes to detect middle mesial root canals branching from coronal third of mesial root canals of mandibular molar teeth

Ali Keleş[*1], Cangül Keskin[1], Rawan Alqawasmi[1],
Kaan Gündüz[2], Hikmet Aydemir[1]
[1]Faculty of Dentistry Department of Endodontics, Ondokuz Mayıs University, Samsun, Turkey, [2]Faculty of Dentistry Department of Dentomaxillofacial Radiology, Ondokuz Mayıs University, Samsun, Turkey

I. Introduction

The aim of this study was to compare the effectiveness of endoscopic visualization and cone beam computed tomography (CBCT) to detect middle mesial root canals (MMCs) branchings from coronal third of mesial root canals of mandibular molars with no canal orifice using micro-computed tomography (micro-CT) images as reference.

II. Material and Method

Twenty-five mesial roots of mandibular first molars presenting single MMC branching from one of the mesiobuccal (MB) or mesiolingual (ML) root canals within coronal third, were selected based on their micro-CT scans. The specimens were scanned using CBCT. The divergence of MMCs from MB or ML canals were inspected using endoscopic unit, which probe was inserted from the main MB or ML canals. Ability of endoscopes to visualize the divergence point of MMCs was compared with micro-CT images of the specimens. Data was analyzed using Fisher's exact tests and inter-examiner reliabilities for each assessment technique were verified by Kappa test with 5% significance threshold.

III. Results

Seven MMCs branchings were detected using endoscopic visualization (28%) whereas only one MMC branching was detected in CBCT images (4%). Kappa tests showed high inter-examiner reliability. Fisher's exact test showed that endoscopic visualization detected significantly higher ramification than CBCT imaging ($P<0.05$).
Discussion: Endoscopic visualization and CBCT imaging have potential for enhanced visualization of the fine structures of internal root canal anatomy. Endoscopes have the advantage of not harming the patient.

***Keywords**: Endoscope, Micro-computed tomography, Accessory canals, Root canal anatomy
***Presenting Author**: Ali Keleş
Faculty of Dentistry Department of Endodontics, Ondokuz Mayıs University, Samsun, Turkey, alikeles29@yahoo.com

OP-015

A 3D finite element analysis on relationship between Mineral Trioxide Aggregate thickness and pulp perforation width

Zeynep Ozkurt Kayahan[*1], Buket Turgut[2], Hakan Akin[3], Mehmet Baybora Kayahan[4], Ender Kazazoglu[1]

[1]Prosthodontics, Yeditepe University Faculty of Dentistry, Istanbul, Turkey, [2]Mechanical Engineering, Gaziosmanpasa University Faculty of Natural Sciences and Engineering, Tokat, Turkey, [3]Prosthodontics, Cumhuriyet University Faculty of Dentistry, Sivas, Turkey, [4]Endodontics, Okan University Faculty of Dentistry, Istanbul, Turkey

I. Introduction

The aim of this study was to evaluate the stress distribution in different thicknesses of mineral trioxide aggregate (MTA) placed on various widths of pulp perforations during the condensation of resin material.

II. Material and Method

The mandibular molar tooth was modeled by Cosmoworks program (SolidWorks, Waltham, MA). Three finite elemental analysis models representing 3 different dimensions of pulp perforations; 1, 2 and 3 mm in diameter were created. The perforation area was assumed as filled with MTA with different thicknesses; 1, 2 and 3 mm for each pulp perforation width, creating a total of 9 different models. Materials used were assumed to be homogenous and isotropic. A 66.7 N load was applied, which is advocated as the hand condensation force of restorative materials, from the occlusal surface of the crown and parallel to the long axis of the tooth. An engineering simulation program (ANSYS, Canonsburg, US) was used for the analysis. Results were presented considering von Mises stress criteria.

III. Results

As MTA thickness increased, the stress values recorded within the area between pulp and MTA decreased. Deformation was decreased when the thickness of MTA increased.

IV. Conclusion

Stresses at the MTA-pulp interface and deformation on MTA decrease with the increase in MTA thickness.

***Keywords**: MTA, Finite element analysis, Stress, Thickness, Pulp perforation

***Presenting Author**: Zeynep Ozkurt Kayahan

Prosthodontics, Yeditepe University Faculty of Dentistry, Istanbul, Turkey, zeynepozkurt@hotmail.com

OP-016

Effect of 35% sodium ascorbate on the calcium and phosphorus loss in dentin bleached with 35% hydrogen peroxide

Tunjung Nugraheni[*1], Nuryono Nuryono[2], Siti Sunarintyas[3], Ema Mulyawati[1]

[1]Conservative Dentistry, Faculty of Dentistry, [2]Chemistry, Faculty of Chemistry, [3]Biomaterial, Faculty of Dentistry, Universitas Gadjah Mada, Yogyakarta, Indonesia

I. Introduction

Post bleaching procedure often results free radical trapped in dentin tubules and inter-prismatic enamel that lead to demineralization and denaturation. Sodium ascorbate acts as antioxidizing agent that binds free radical so that the demineralization and denaturation can be stopped. This study assessed the calcium and phosphorus loss from the dentin surface following bleaching with 35% hydrogen peroxide and reversal with 35% sodium ascorbate.

II. Material and Method

Six sound premolar's crowns were cut into four equal parts to obtain 24 specimens. The level of calcium and phosphorus, and the surface structure of dentin were assessed using SEM-EDX. All specimens were randomly divided into four groups (n=6). Group A (control): specimens were bleached with 35% hydrogen peroxide, immersed in an artificial saliva then stored in incubator at 37°C for seven days. Group B: specimens were bleached with 35% hydrogen peroxide followed with 1 time application of 35% sodium ascorbate for 5 minutes. Group C: specimens were bleached with 35% hydrogen peroxide followed with 2 times application of 35% sodium ascorbate. Group D: specimens were bleached with 35% hydrogen peroxide followed with three times application of 35% sodium ascorbate. Level of calcium, phosphorus and the surface structure of dentin were re-assessed using SEM-EDX at the same location as before.

III. Results

The one-way ANOVA analysis showed that there was statistically significant loss of calcium between four groups ($p<0.05$), however the loss of phosphorus showed no statistical difference. LSD test showed the difference loss of calcium between control group and group C and D or between group B, C and D. The dentin tubules in control group showed wider than group B, C and D.

IV. Conclusion

Frequency of 35% sodium ascorbate application affected the loss of calcium and dentin surface structure in bleached dentin with 35% hydrogen peroxide.

***Keywords**: 35% Sodium ascorbate, Bleached dentin, 35% Hydrogen peroxide, Calcium and phosphorus loss

***Presenting Author**: Tunjung Nugraheni

Conservative Dentistry, Faculty of Dentistry, Universitas Gadjah Mada, Yogyakarta, Indonesia, tunjungnugraheni22@gmail.com

OP-017

Lateral thinking in endodontic diagnosis

Rupal Vaidya*

Conservative, Endodontics and Aesthetic Dentistry, Vaidik Dental College and Research Center, Daman, India

Endodontics is a multifaceted specialty with much emphasis on how cases are clinically treated. Clinicians have increased their ability to more accruable perform endodontic procedures by way of increased visualization using DOM, precise apical constriction detection using EAL, enhanced imaging techniques using digital radiography and more. Practices have incorporated more refined canal cleaning and shaping techniques by using ultrasonic and rotary driven Ni-Ti files facilitated with computer assisted electronic handpieces. Much other recent advancement has also been introduced with the objective of achieving an optimal result during endodontic treatment. However, these advancements are useless if an incorrect diagnosis is made. Testing, questioning & reasoning are combined in order to achieve an accurate diagnosis and to ultimately form an appropriate treatment plan. The art and science of making these diagnoses are the initial steps that must be taken before initiating any treatment. Pain is common. It causes human suffering and has significant socio-economic effects. Pain motivates individuals to seek care. Although toothache is most common pain entity occurring in facial region it's clear that many other types of pain can occur in the same general area. It's paramount to realize that not all pain entities presenting as toothache are of endodontic origin. Endodontists must be familiar with non-odontogenic pain as well as radiolucent non-odontogenic periapical lesions. Glandular odontogenic cysts, langerhan's cell, histiocytosis, etc. mimic periapical pathology. There are several indicators that a toothache may be non-odontogenic in origin. Red flags for non-odontogenic pain includes toothaches that have no apparent etiology for pulpal or periradicular pathosis, pain that's spontaneous, poorly localised or migratory and pain that is constant and non-variable. It is mandatory for all endodontists to diagnose unusual conditions in day-to-day practice.

***Keywords**: Glandular odontogenic cyst, Langerhan's histiocytosis, Non-odontogenic pain

***Presenting Author**: Rupal Vaidya

Conservative, Endodontics and Aesthetic Dentistry, Vaidik Dental College and Research Center, Daman, India, drrupalvaidya@yahoo.com

OP-018

The limitations of indications for nonsurgical endodontic retreatment

Burcu Serefoglu*, M.Kemal Caliskan

Department of Endodontology, Ege University, Faculty of Dentistry, Izmir, Turkey

To evaluate the limitations of the nonsurgical endodontic retreatment and explain by the cases when and why apical surgery is preferable to nonsurgical retreatment or vice versa.

Conventionally, nonsurgical endodontic retreatment should be preferred over apical surgery in teeth with failed root canal therapy. However, in some cases the prognosis will be poorer or it can be impossible to perform nonsurgical endodontic retreatment. Therefore, clinical and radiographic findings must be considered carefully for case selection in nonsurgical retreatment or apical surgery to perform a correct diagnosis and treatment planning. The feasibility of orthograde access to the root canals is the main factor to decide the accurate indication. When it is impossible to remove the extruded gutta-percha and sealer or broken instruments beyond the apical foramen, the prognosis will be affected by the foreign material and the insufficient bacteria elimination. Another factor that will make retreatment difficult or unbearable is apical strip perforations especially in curved canals. Also, in cases where former nonsurgical retreatments failed and the teeth had radiographically sufficient root canal filling and had esthetic crown restoration, apical surgery should be preferred to nonsurgical endodontic retreatment due to the expected better prognosis. On the other hand, in cases where apical surgery was previously performed without retrograde filling material, root length was quite short and the teeth had open apex, nonsurgical retreatment should be chosen.

Nonsurgical endodontic retreatment should be considered as the first treatment option in teeth with insufficient previous root canal treatment if there is a chance to improve the filling by retreatment. However, depending on the limitations of retreatment procedure, apical surgery sometimes can be the correct treatment planning to achieve the clinical success. Nonsurgical endodontic retreatment still should be the first treatment option to maintain the teeth in function despite its limitations.

***Keywords**: Nonsurgical endodontic retreatment, Apical surgery, Endodontic failure

***Presenting Author**: Burcu Serefoglu

Department of Endodontology, Ege University, Faculty of Dentistry, Izmir, Turkey, burcuseref@yahoo.com

OP-020

Smear layer removal in the apical third using four different irrigation systems. FESEM evaluation in an *ex vivo* study

Pietro Palopoli[*1], Manuele Mancini[2], Loredana Cerroni[2], Giovanni Olivi[3], Matteo Olivi[4], Cristiano Buoni[1], Luigi Cianconi[1]

[1]Restorative Dentistry and Endodontics, Tor Vergata University, Rome, Italy, [2]Dental Materials, Tor Vergata University, Rome, Italy, [3]Catholic University of the Sacred Heart, Rome, Italy, [4]Private Practice, Rome, Italy

I. Introduction

To remove the smear layer, a post-shaping alternating irrigation with EDTA and NaOCl is recommended. To enhance the irrigants' distribution and effectiveness in areas difficult to access, such as the apical area, several activation techniques have been developed. Moreover, while keeping the apical preparation as wide as possible was once suggested to increase the cleanliness of the canal's apical third, today great importance is given to dentin preservation. Therefore, the aim of this study was to compare the smear layer removal in the apical third after final irrigants activation with Sonic (EndoActivator, EA), Passive Ultrasonic Irrigation (EndoUltra, PUI), PIPS and SWEEPS in minimally shaped canals. Photon-induced photo acoustic streaming (PIPS) is a laser agitation technique, which emits a pulsed laser light into the fluids. Shock Wave Enhanced Emission Photoacoustic Streaming (SWEEPS) is a novel laser technique that delivers a pair of individual pulses. This is the first study ever testing SWEEPS in relation with smear layer removal.

II. Material and Method

Eighty-five single-rooted human teeth were selected for the study. Specimens were shaped to TruShape 25/.06 and irrigated with 5.25% NaOCl, and then divided into 5 groups: (1 control [n=5] and 4 tests groups [n=20]) according to the final activation technique (EA, PUI, PIPS and SWEEPS). Specimens were then split longitudinally and observed by Field Emission Scanning Electron Microscopy. The presence of smear layer at 1, 3, 5 and 8 mm from the apex was evaluated.

III. Results

Scores were analyzed by Kruskal-Wallis and Mann-Whitney U tests. P values were computed and compared with statistical significance at the P=.05 level. EndoActivator was as effective as EndoUltra in removing the smear layer at 1, 3, 5 and 8 mm from the apex. PIPS and SWEEPS removed significantly more smear layer than PUI and EA at 1 mm from the apex. No differences were found between PIPS and SWEEPS' effectiveness. Every technique performed better than the control group.

IV. Conclusion

The challenge for future Endodontics is to provide enhanced cleanliness while saving as much restorable tooth as possible. In our study none of the activation systems completely removed the smear layer from the endodontic space. Nevertheless, PIPS and SWEEPS showed the best results.

***Keywords**: Smear-Layer removal, Post shaping irrigation, PUI, Sonic activation, PIPS, SWEEPS*

***Presenting Author**: Pietro Palopoli

Restorative Dentistry and Endodontics, Tor Vergata University, Rome, Italy, pietropalopoli@hotmail.it

OP-021

Clinico - Histopathological comparison of pulpal changes following direct pulp capping procedures using Endosequence Root Repair Material, Mineral Trioxide Aggregate and calcium hydroxide – A pilot study

Saravanan Poorni[*1], Manali R Srinivasan[1], Jayanandan Muruganandhan[2], Govindarajan Sujatha[2]

[1]Conservative Dentistry and Endodontics, Sri Venkateswara Dental College and Hospital, Chennai, India, [2]Oral and Maxillofacial Pathologist, Sri Venkateswara Dental College and Hospital, Chennai, India

I. Introduction

The present study was designed to obtain a clinical and histopathological comparison of pulpal changes following direct pulp capping procedures using Endosequence Root Repair Material (ERRM), Mineral Trioxide Aggregate (MTA), Biodentine and calcium hydroxide.

II. Material and Method

Study was designed as a split mouth trial. Patients with four premolars to be extracted for orthodontic purpose were selected for the study after due process. Each participant received all four pulp capping agents (Endosequence Root Repair Material, Mineral Trioxide Aggregate, Biodentine and calcium hydroxide) and the interventions randomly allocated to one of the four premolars. All interventions were performed with a two-day period between interventions. Extractions were performed 8 weeks after pulp capping. In the intervening period, patients were reviewed. Subjective and objective findings were recorded. All the specimens were then subjected to histopathological evaluation of dentinal bridge quality and pulpal changes.

III. Results

Among the 5 participants who completed the trial, the teeth restored with ERRM presented with improved clinical responses compared to the other pulp capping agents. There was no significant difference with respect to inflammatory cell response among the four groups. New dentin formation was observed for all the groups at the end of 8 weeks. There was no significant difference in the morphology of the dentine formed among the four groups.

IV. Conclusion

This Pilot study concluded that all four agents were effective pulp capping materials; although there is clinical evidence to postulate that ERRM present clinical advantages over other pulp capping agents.

***Keywords**: Endosequence Root Repair Material, Mineral Trioxide Aggregate, Biodentine, Direct pulp capping*

***Presenting Author**: Saravanan Poorni

Conservative Dentistry and Endodontics, Sri Venkateswara Dental College and Hospital, Chennai, India, poorniis@yahoo.com

OP-022

SEM & TEM analysis of MTA monoblock canal obturation and long- term outcomes

Jun Sang Yoo[*]

Oral & Maxillofacial Surgery, BioMTA, Seoul, Republic of Korea

The main characteristics of MTA are hydraulic setting, sealing ability, antibacterial effect and bioactivity.

Firstly, sealability as a canal obturation material can be achieved by the apical 5mm monoblock. For the sealability for a repair treatment, short setting MTA should be applied because the long setting MTA does not set in the tissue fluid and cause an interfacial microleakage. Through SED and EDS analysis, we could confirm that interfacial surface between dentin and MTA was a hybrid layer of Ca, P, and Si. This result indicates a chemical bonding.

Secondly, antibacterial effect can be achieved by a biomineralization process in the dentinal tubules and in the smear layers. Bacterial entombment by intratubular biomineralization can be induced after MTA canal obturation. Short tag-like structures obliterated the entrance of the dentinal tubules and long tag of CDHA precipitates filling the lumens of dentinal tubules. This bacterial entombing mechanism is a novel aspect of MTA canal obturation

Last one is a bioactivity. In animal studies, MTA showed a cementum formation at the apical foramen and a biological closure. This finding indicates that MTA can play an active role in promoting of hard tissue formation.

We performed the 3 studies. In vitro study, In vivo one and statistical analysis of 5976 clinal cases.

In vitro study*, E.faecalis species was inoculated into the root canal space and MTA Monoblock obturation was performed. According to the time tables, thin sectioned roots were examined by SEM, EDS and TEM.

In vivo study, the interfacial layer and dentinal tubules of MTA filled patient's teeth were examined by SEM and EDS. In the lumen of dentinal tubules, carbonated apatite long tags were formed.

Chemical bonding between MTA and dentin was confirmed in the interfacial surface.

About the statistical analysis, survival rate, success rate, re-endo rate & vertical root fracture rate were examined. The total number of cases was 5976 and especially, 600 apical lesion cases were analyzed for the success rate. Survival rate 98.1%, success rate in re-endo case 90.3%, retreatment rate 0.08% and VRF rate 0.8% were achieved.

According to these studies, we could conclude that

1. Biomineralization in dentinal tubules and interfacial layer explain the sealability and antibacterial effect of MTA monoblock obturation.
2. MTA monoblock obturation can be included in the evidence-based dentistry.

***Acknowledgments**: This research was partially supported by an Engineering-Dentistry Interdisciplinary Research Grant (860-20150009) that was jointly funded by the College of Engineering and School of Dentistry, Seoul National University, Republic of Korea.*

***Keywords**: MTA, Obturation, Monoblock, Sealability, Antibacterial, Biomineralization*

***Presenting Author**: Jun Sang Yoo

Department Oral & Maxillofacial Surgery in Seoul national University Dental Hospital, Seoul, Republic of Korea, dryjskr@daum.net

OP-024

The effect of chitosan nanoparticle as a final irrigation solution on the micro-hardness of root canal dentin

Diatri Nari Ratih[*], Arafita Putri Fardani

Conservative Dentistry, Faculty of Dentistry, Yogyakarta, Indonesia

I. Introduction

Root canal irrigation is one of the most important stages during root canal treatment. One of the requirements of root canal irrigation material is it can eradicate the smear layer but does not alter the physical properties of the root canal dentin. The purpose of this study was to investigate

the effect of 0.2% chitosan nanoparticles as the final irrigation solution on the micro-hardness of root canal dentin.

II. Material and Method

Twenty-four premolars were used in this study and were assigned randomly into 3 groups of 8 teeth. Group 1, was irrigated with 17% EDTA; group 2, was irrigated with 0.2% chitosan nanoparticles; group 3, was irrigated with 2.5% NaOCl (control). The micro-hardness test was performed using the Vickers Hardness Tester. Data were analyzed using one-way ANOVA and Tukey test with 95% level of significance.

III. Results

The results showed that the mean and standard deviation of micro-hardness of final irrigation using 0.2% chitosan nanoparticles, 17% EDTA, and 2.5% NaOCl were 49.88±2.34, 45.04±4.02, 50.72±2.08 respectively. Statistical analysis revealed that 0.2% chitosan nanoparticles produced the significant greater micro-hardness compared to 17% EDTA ($p<0.05$), whereas was less than 2.5% NaOCl ($p>0.05$).

IV. Conclusion

It can be concluded that final irrigation with 0.2% chitosan nanoparticles had an effect on the micro-hardness of the root canal dentin. Final irrigation using 0.2% chitosan nanoparticles was greater in micro-hardness than that of with 17% EDTA although was similar with 2.5% NaOCl.

***Keywords**: Chitosan nanoparticle, Final irrigation, Micro-hardness
***Presenting Author**: Diatri Nari Ratih
Conservative Dentistry, Faculty of Dentistry, Yogyakarta, Indonesia, trinaugm@yahoo.com

OP-025

Analysis of interleukin-1β expression in inflamed rat dental pulp after capped with Trigona sp. Propolis from Indonesia

Ardo Sabir[*], Juni Jekti Nugroho, Afniati Rachmuddin, Aidasriwaty Gasma, Andi Wisda Martianti Mayasari
Department of Conservative Dentistry, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia

I. Introduction

Propolis is a natural product of plant resins collected by bees from various plant sources. It was always mentioned as an anti-inflammatory agent. Cytokines are proteins that play a critical role in inflammation process. When dental pulp has inflammation, interleukin-1β (IL-1β) was released by innate immune cells. The aim of the present study was to analysis IL-1β expression in inflamed rat dental pulp after application of propolis.

II. Material and Method

Flavonoid and non-flavonoid substances were purified from Trigona sp. propolis collected from South Sulawesi, Indonesia using thin layer chromatography. Eighty male Sprague Dawley rats were randomly divided into five groups equally. As negative control (group I), rats were not conducted any treatment. At group II, III, IV and V, a Class I cavity was prepared on the occlusal surface of right maxillary first molar. Dental pulp was exposed and allowed in oral environment for 60 minutes, then ethanol extract of propolis (group II), extract flavonoid-propolis (group III), extract non-flavonoid propolis (group IV), or calcium hydroxide as positive control (group V) were applied on dental pulp. All cavities were filled with glass ionomer cement. Rats were sacrificed at 6 hours, 2, 4 or 7 days. Sample biopsy were obtained, processed for immunostaining of IL-1β using biotin-streptoavidin method and viewed under light microscope. Data was analysis using Friedman and Kruskal-Wallis tests with significance level of $p<0.05$.

III. Results

All materials test showed IL-1β expression in inflamed rat dental pulp, and this expression was decreased with the longer of observation time periods. Ethanol extract of propolis was stronger to decreased IL-1β expression than other materials test. There was significant difference ($p<0.05$) of IL-1β expression between group I and other groups in 6 hours and 2 days but not in 4 and 7 days of time periods.

IV. Conclusion

Propolis from South Sulawesi, Indonesia suppressed IL-1β expression in inflamed rat dental pulp.

***Keywords**: Interleukin 1-β, Propolis, Dental pulp, Inflammation, Rat
***Presenting Author**: Ardo Sabir
Department of Conservative Dentistry, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia, ardo.sabir@yahoo.com

OP-026

The effect of sodium ascorbate on odontoblast layer of dental pulp after in office bleaching using hydrogen peroxide

Yulita Kristanti[*1], Juni Handajani[2]
[1]Conservative Dentistry, Faculty of Dentistry Universitas Gadjah Mada, Yogyakarta, Indonesia, [2]Oral Biology, Faculty of Dentistry Universitas Gadjah Mada, Yogyakarta, Indonesia

I. Introduction

In one side, in office bleaching has a better aesthetic result compared to another tooth bleaching technique, but on the other side it also has side effect such as enamel surface roughness as a result of demineralization. So far, distillated water has been used to rinse the hydrogen peroxide after treatment, but previous research showed, that some of them still exist. Sodium ascorbate is an antioxidant that capable of prevent further damage caused by the remaining oxidant, such as hydrogen peroxide. The aim of this research was to study the effect of different concentration of sodium ascorbate on odontoblast layer after in office bleaching.

II. Material and Method

Forty eight teeth from eighteen male rats (250-300 g) were bleached using 40% hydrogen peroxide gels, and then were randomly divided into 3 groups. Group I was rinsed with warm distilled water only, Group II using warm water and 10% sodium ascorbate, Group III using warm distillated water followed by 25% sodium ascorbate. The rats were sacrificed on the first day after treatment, and then fixed into 10% buffered formalin. Histological preparation was stained using hematoxillin eosin. The odontoblast layer was observed on the occlusal area of the tooth with 400x light magnification microscope in 10-field view. The data were analyzed using Kruskall Wallis Test followed by Mann Whitney Test.

III. Results

Kruskal Wallis test showed significant difference among Group I, II and III ($p<0.05$). Mann Whitney test result showed significant difference between Group I and II, I and III, II and III. It can be concluded that rinsing with 25% sodium ascorbate after in office bleaching showed the highest odontoblast layer score, followed by 10% sodium ascorbate.

IV. Conclusion

It can be concluded that rinsing using higher concentration of sodium ascorbate (25%) showed better result in protecting odontoblast layer after in office bleaching compare with 10% sodium ascorbate.

***Keywords**: Sodium ascorbate, Odontoblast, In-office bleaching
***Presenting Author**: Yulita Kristanti
Conservative Dentistry, Faculty of Dentistry Universitas Gadjah Mada, Yogyakarta, Indonesia, litaugm11@gmail.com

OP-027

Accuracy of different electronic apex locators in determination of minimum root perforation diameter

Simay Koc[*], Alper Kustarci, Kursat Er
Endodontics Clinic, Akdeniz University, Antalya, Turkey

I. Introduction

The aim of this study was to demonstrate the detection of minimum root canal perforation diameter with Apex ID (SybronEndo, Orange, CA, USA), Dr's Finder NEO (Good Doctors, Incheon, Korea), Propex Pixi (Dentsply Maillefer, Ballaigues, Switzerland), Raypex 6 (VDW, Munich, Germany) electronic apex locators (EALs).

II. Material and Method

One hundred extracted, single-rooted human teeth were artificially perforated using burs with 5 different diameters (1.25 mm, 1.0 mm, 0.75 mm, 0.5 mm, 0.25 mm) in 5 mm above the apex. Each group consisted of 20 teeth. The actual canal lengths (AL) up to the perforation site were measured, and then the teeth were embedded in an alginate mold. Perforations were electronically measured using a size 40 K-file by each EAL. For each tooth, AL was subtracted from the electronic canal length (EL) of the perforation. Statistical analyses were performed using One-way ANOVA, Wilcoxon and Friedman tests at a significance level of 0.05.

III. Results

There was no significant difference between the measurements of each EAL for diameters of 1.25 mm and 1 mm ($p>0.05$), although significant differences were found between the Apex ID and Propex Pixi and the Apex ID and Raypex 6 for 0.75 mm diameter ($p<0.05$). However, none of EAL could detect the perforations for diameters of 0.5 mm and 0.25 mm.

IV. Conclusion

Although all EALs tested could not detect the perforations for diameters of 0.5 mm and 0.25 mm, they were highly successful in determination of simulated root perforations for diameters of 1.25 mm, 1 mm, 0.75 mm.

***Keywords**: Apex locator, Root perforation, Apex ID, Propex Pixi, Raypex 6, Dr's Finder NEO
***Presenting Author**: Simay Koc
Endodontics Clinic, Akdeniz University, Antalya, Turkey, simaykoc04@gmail.com

OP-028

Antimicrobial activity of herbal extracts and oils against common endodontic pathogens using MBC/MIC ratio

Chetana Makade*, Pratima Shenoi

Conservative Dentistry & Endodontics, VSPMs Dental College & Research Center, Nagpur, India

I. Introduction

Essential oils & plant extracts have evoked interest owing to small number of trephenoids & phenolic compounds. It's challenging to completely eradicate the microbes from dentinal tubules and biofilm using irrigation and intracanal medication in root canal therapy. This study was undertaken to determine an antimicrobial action of lemon grass oil, basil oil, green tea extract and mint oil against common endodontic pathogens like E.faecalis, S.aureus, C.albicans, Fusobacterium nucleatum, Actinomycis, Lactobacilli, P.intermedia and P.streptococci. by evaluating MBC/MIC ratio using minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC)/ minimum fungicidal concentration (MFC).

II. Material and Method

MIC, MBC and MFC determination was evaluated against eight endodontic pathogens by broth dilution method. MBC was detected by subculturing onto blood agar from the tube showing no turbidity (MIC) and the next tube to it. All the test organisms and medicaments were analyzed using Descriptive statistics.

III. Results

The MBC/MIC ratio as a measure of medicament's activity against each organism was compared statistically using Kruskal-Wallis test & p-value was obtained using one-sample Wilcoxon test. Basal oil had MBC: MIC<4 for all the organisms ($p<0.05$), mint oil showed bacteriostatic activity on E feacalis and P. streptococci ($p>0.05$). For tea extract, except Actinomycis, Lactobacilli, S.aureus and F.nucleatum, other organisms had bacteriostatic effect (MBC: MIC>4); ($p>0.05$); whereas lemon grass oil, had bactericidal effect against all the organisms except P.streptococci ($p>0.05$).

IV. Conclusion

Basal oil and lemongrass oil showed bactericidal effect on all the tested organisms. The concentration of medicaments differed for organisms, but the effect was bactericidal, excepting P. Streptococci.

***Keywords**: Lemongrass, Basil, MBC/MIC ratio, Antimicrobial activity, Endodontic pathogens

***Presenting Author**: Chetana Makade

Conservative Dentistry & Endodontics, VSPMs Dental College & Research Center, Nagpur, India, makade.chetana@gmail.com

OP-030

Bioactive glass in endodontics

Tugce Yuca Ozturk*

Endodontics, Bezmialem Vakıf University, Istanbul, Turkey

This lecture aimed to emphasizes the importance and the usage of bioactive glass in endodontics. Bioactive glass is a biomaterial in which chemical bonding occurs between tissue and implanted materials through the replacement of the silica groups of the structure with calcium and phosphorus ions in the body. It is a group of biomaterials used in dentistry and orthopedics. Bioactive glass has been modified from a bioinert situation to a bioactive state that can stimulate a strong response after implantation to human body. Bioactive glass is a silica-based material as well as it has the ability to bond quickly to tissues with chemical reactions that result in contact with tissue fluids. In addition, due to its surface-active properties, it is possible to bind to live tissues such as bone by providing a hydroxyl carbonate apatite layer on the surface in physiological fluids. It is possible to say that bioactive glass dissolves equally well and participates in the newly formed tissue thanks to its excellent osteoconductive ability and allows the mesenchymal stem cells to migrate in the biocompatible frame. Therefore, the use of bioactive glass as a remineralization agent in dentistry has been investigated in recent years. The stimulating effect of bioactive glass on the formation of hard tissue and its support for increased remineralization and antibacterial properties have led to the idea of improving the properties of these materials by participating in the construction of existing materials in dentistry. Due to the chemical composition and unique properties of bioactive glass, its popularity continues to increase in endodontics field.

***Keywords**: Bioactive Glass, Endodontics, Biomaterial

***Presenting Author**: Tugce Yuca Ozturk

Endodontics, Bezmialem Vakıf University, Istanbul, Turkey, tugceyuca@hotmail.com

OP-031

Antibacterial effect of arginine on Enterococcus faecalis

Margareta Rinastiti*[1], Deniar F. Widhawati[2], Yulisa W.R. Astanti[2], Heribertus D.K. Yulianto[3], Aryan Morita[3]

[1]Department of Conservative Dentistry, Faculty of Dentistry, Universitas Gadjah Mada, Yogyakarta, Indonesia, [2]Student, Faculty of Dentistry, Universitas Gadjah Mada, Yogyakarta, Indonesia, [3]Department of Biomedical Sciences, Faculty of Dentistry, Universitas Gadjah Mada, Yogyakarta, Indonesia

I. Introduction

Antimicrobial activity of interappointment intracanal-medications is an important consideration in endodontics. Arginine is one of the amino acid that is potentially used as an antibacterial agent in dentistry due to its positive charge that can be bonded with negative surface of bacterial cell. The objective of this study was to determine antibacterial efficacy of arginine against Enterococcus faecalis and compare its efficacy with calcium hydroxide ($Ca(OH)_2$).

II. Material and Method

The antibacterial effect of four different concentration of arginine, i.e.: 5%, 8%, 10% and 12%, glycerin and $Ca(OH)_2$ were evaluated in this study by using agar-diffusion and spectrophotometric methods. The inhibition effects were measured by dropped 50 µl of each material into agar-wells and recorded after 24- hours incubation. The antibacterial effect also evaluated by measuring the optical density before and after incubation at 600 nm length of wave. One ml of the bacterial-suspension was inoculated into 1 ml suspension of each materials tested, withdrawn immediately and the absorbance was read. After 24 hours incubation, the absorbance of suspensions was re-measured. The data was statistically analyzed using one-way ANOVA followed by LSD post hoc test.

III. Results

One way ANOVA test showed that there was a significant difference of antibacterial activity between 5%, 8%, 10% and 12% solutions of arginine, glycerine and $Ca(OH)_2$ against E. faecalis growth ($p<0.05$). The highest antibacterial effect either based on agar well-diffusion and spectrophotometric methods was revealed by $Ca(OH)_2$ followed by 12%, 10% and 8% arginine solution. Those three arginine solution showed a higher antibacterial effect compare to glycerin as negative control.

IV. Conclusion

The arginine has potential effect as an endodontic dressing material due to its antibacterial property. A further research is needed to evaluate the most effective concentration and appropriate vehicle.

***Keywords**: Antibacterial effect, Intracanal medication, Enterococcus faecalis, Arginine

***Presenting Author**: Margareta Rinastiti

Department of Conservative Dentistry, Faculty of Dentistry, Universitas Gadjah Mada, Yogyakarta, Indonesia, rinastiti@ugm.ac.id

OP-032

Biocompatability of three perforation repair materials

Mohamed Salem*, Ihab Hassanein, Abeer ElGendy

Endodontics, Faculty of Dentistry, Ainshams University, Cairo, Egypt

I. Introduction

The aim of this study was to compare the biocompatibility of three bioceramic materials when used to repair furcation perforation in dogs' teeth. The materials tested were Biodentine (Septodont, Saint Maur des Fosses, France), Endosequence root repair material putty (ERRM) (Brasseler USA, Savannah, GA) and Micro Mega MTA (Besançon Cedex, France, also known as MM-MTA).

II. Material and Method

A total of eight adult clinically free mongrel doges were the animal model selected for this study. Four dogs were sacrificed after one month while the other 4 were sacrificed after 3 months. In each dog 8 perforations were made in 8 premolars. Two perforations were repaired with Biodentine, two with Endosequence, 2 with MM-MTA and two were left unsealed to be used as control groups. The inflammatory cell count was calculated using special analysis software.

III. Results

After one month, the highest cell count was recorded with Biodentine followed by control group, Endosequence and the least inflammatory cell count was recorded with MM-MTA. There was no statistically significant difference between Endosequence and control groups, both showed statistically significant lower mean values than Biodentine. The difference between MM-MTA and other groups was statistically significant. After three months Biodentine showed the highest mean inflammatory cell count followed by the control group, MM-MTA while the lowest mean of inflammatory cell count was recorded with Endosequence. The difference between the four groups was statistically significant.

IV. Conclusion

Endosequence root repair material (ERRM) putty was the

most biocompatible root repair material on the long term. It showed good results after one month and was the most biocompatible material after three months.

***Keywords**: Bioceramics, Biocompatability, Perforation repair, Cell count
***Presenting Author**: Mohamed Salem
Endodontics, Faculty of Dentistry, Ainshams University, Cairo, Egypt, mohamedsalem1110@gmail.com

OP-033

Comparative bioactivity of two bio ceramic indirect pulp capping materials - An ex-vivo study

Aakriti Saini[*1], Vidya Saraswathi M.[2], Ajay Logani[1]
[1]Conservative Dentistry and Endodontics, All India Institute of Medical Sciences,CDER, New Delhi, India, [2]Conservative Dentistry and Endodontics, Manipal College of Dental Sciences, Manipal University, Manipal, Karnataka, India

I. Introduction
The intent of indirect pulp capping (IPC) material is to induce a reparative dentinogenic response. Their bioactivity is directly proportional to its potential to release calcium and hydroxyl ions. The aim of the study was to evaluate the calcium ion release and pH of MTA-Angelus® and EndoSequence® BC RRM-Fast Set Putty™ on an ex-vivo tooth model.

II. Material and Method
Forty-five human premolar teeth were decoronated at the level of the cement-enamel junction. Standardized 4 x 3 mm class I cavity were prepared in the anatomic crown to obtain 1±0.2 mm remaining dentine thickness. Experimental group (n=30) was divided viz. Group I (n=15), IPC with MTA-Angelus® and Group II (n=15), IPC with BC RRM-Fast Set Putty™. In group III, no IPC material was applied. All cavities were restored with a glass ionomer cement base and composite resin. The remaining tooth structure was coated with nail varnish. The samples were immersed in 10 ml of deionized water that was changed at 3, 24 hours, 7, 21 and 42 days. At each time interval, the deionized water was tested to determine the calcium ion release and pH change using an atomic absorption spectrophotometer and a digital pH meter respectively. Data was statistically analyzed using ANOVA with post-hoc Games Howell and post-hoc Bonferroni test (Level of significance set at $p<0.001$).

III. Results
At 3, 24 hours and 7 days time interval, calcium ion release was higher for Group I (peak at 7 days- 4.29 mg/l) in comparison to group II ($p<0.001$). However, a reverse trend was observed at 21 and 42 days ($p>0.001$). The pH values were higher for group I ($p<0.001$ at 3,24-hour time interval)

IV. Conclusion
Both materials exhibited bioactivity, however MTA-Angelus® displayed an early and higher surge in diffusibility and release of ions.

***Keywords**: Bioactivity, Pulp capping, Mineral trioxide aggregate
***Presenting Author**: Aakriti Saini
Conservative Dentistry and Endodontics, All India Institute of Medical Sciences, CDER, New Delhi, India, aakriti.saini@gmail.com

OP-034

Effect of resin solvents on the dislodgement resistance of root canal fillings

Tayfun Alacam, Ozgur Ilke Atasoy Ulusoy, **Gamze Nalci**[*], Arzu Manti Sahin
Endodontics, Gazi University Faculty of Dentistry, Ankara, Turkey

I. Introduction
The aim of this investigation was to compare the effects of two resin solvents (ethyl acetate, methyl ethyl ketone) with chloroform, applied either with conventional syringe irrigation or ultrasonic activation, on the push-out bond strength of epoxy resin-based root canal sealer (AH Plus).

II. Material and Method
The root canals of eighty-four single-rooted human premolar teeth were chemomechanically instrumented to a master apical size of F3. The root canals were then divided into 6 experimental (n=12), and 1 control (n=12) group according to the applied solvent solutions: Group1, ethyl acetate (EA) [conventional syringe irrigation (CSI)]; Group2, EA [Passive ultrasonic irrigation (PUI)]; Group3, methyl ethyl ketone (MEK) (CSI); Group4, MEK (PUI); Group5, Chloroform (CSI); Group6, Chloroform (PUI); Group7, Distilled water (control). The root canals in the experimental groups were finally irrigated with distilled water. All the samples were obturated using gutta-percha cones and AH Plus sealer. Each root was sectioned horizontally at the coronal and middle thirds to obtain slices with 1.5±0.2 mm thickness. Compressive loading at a speed of 1mm/min was applied to the fillings using a universal testing machine until bond failure occured. The maximum force in Newton to dislodge the obturation material was recorded. The push-out bond strength in megapascal (MPa) was calculated for each specimen. The data were statistically analyzed using two-way ANOVA.

III. Results
The lowest push-out bond strength values were obtained from the samples treated with ultrasonically activated chloroform ($p<0.05$). When used with conventional syringe irrigation, there was no significant difference between the ethyl acetate and MEK groups regarding bond strength ($p>0.05$).

IV. Conclusion
Type of the solvent solution and its activation method has an influence on the adhesion of root canal fillings.

***Keywords**: Bond strength, Chloroform, Ethyl acetate, Methyl ethyl ketone
***Presenting Author**: Gamze Nalci
Endodontics, Gazi University Faculty of Dentistry, Ankara, Turkey, nalcigamze@gmail.com

OP-035

Determination of pulp vitality in oropharyngeal cancer patients undergoing radiotherapy: A clinical study

Sonali Kapoor[*]
Conservative Dentistry and Endodontics, Manubhai Patel Dental College and Hospital, vadodara, India

I. Introduction
The pulpal vitality of a tooth plays an important role in decision making for an accurate endodontic diagnosis and treatment planning. Dental pulp is a connective tissue with vascularization and innervation. Radiation therapy is one of the modes of treatment in head and cancer patients. Radiation affects dental pulp by reducing cellularity, vascularity leading to pulp degeneration. Pulse oximetry is a precised diagnostic tool in determining oxygenated blood flow. The aim of the present study was to estimate the impact of irradiation on pulpal blood flow in head and neck cancer patients using pulse oximetry.

II. Material and Method
Total 25 head and neck cancer patients were considered for the study. Informed consent was taken. In each patient, two maxillary and mandibular posteriors were assessed using pulse oximetry to evaluate oxygenation level of pulp (SpO2) at eight different time intervals: PO1 before radiotherapy PO2 at 10Gy, PO3 at 20Gy, PO4 at 30 Gy, PO5 at 40 Gy, PO6 at 50Gy, PO7 between 60-70Gy, PO8-6 months after the completion of the treatment.

III. Results
Significant difference was noted in oxygenated levels of pulpal blood flow before, during and after radiotherapy using pulse oximetry.

IV. Conclusion
Based on results, pulse oximetry helps in assessing the pulpal blood flow. Thereby it also helps in decision making for further dental treatment therapy in such cancer cases.

***Keywords**: Pulp vitality, Pulse oximetry, Ionizing radiation, Oropharyngeal cancer
***Presenting Author**: Sonali Kapoor
Conservative Dentistry and Endodontics, Manubhai Patel Dental College and Hospital, Vadodara, India, docsonali@gmail.com

OP-036

Regenerative Endodontic Protocol in Immature teeth should be performed with complete biomechanical preparation

Alicia Caro[*]
Endodontic, Universidad De Valparaíso, Chile, Viña Del Mar, Chile

I. Introduction
The pulp necrosis in an immature tooth causes the stop growth of the root development, the aim of the regenerative endodontic, in these teeth, is to eradicate signs and symptoms, complete the root development and achieve the recovery of the pulp tissue.

To achieve these objectives all necrotic tissue must be removed, because the gangrene by decomposition will release a series of chemical mediators that perpetuate the inflammation of the apical tissue, disfavoring the action of the mother cells.

The aim of this study is to show that the revascularization protocols that contemplate complete instrumentation of the root canals have a cup of success higher than those that make minimal instrumentation.

II. Material and Method
An in vivo experimental analytical study was conducted in patients who attended the Specialty Clinic in Endodontics of the Faculty of Dentistry of the University of Valparaíso, during the years 2012-2017. 12 cases were treated with controls up to 5 years. The clinical and radiographic follow-up of the cases was carried out. For this study we used the protocol proposed by the University of Valparaíso, based on the protocol recommended by the American Association of Endodontics, but with complete biomechanical preparation and several sessions of medication according to the clinical diagnosis.

III. Results

In all cases there was remission of signs and symptoms, there was thickening of the walls and in some cases complete apical closure was achieved and there was a positive response to pulp sensitivity tests.

IV. Conclusion

In view of the positive results of the follow-up of patients treated with the pulp regeneration protocol, in immature teeth, with pulpal necrosis, proposed by the Endodontics Chair of the University of Valparaíso, the maximum elimination of pulpal tissues is suggested through a complete instrumentation of the root canals.

***Keywords**: Regenerative endodontics (REP), Stem cells, Guided tissue engineering, Growth factors, Fibrin Rich Plasma (PRF)

***Presenting Author**: Alicia Caro

Endodontic, Universidad De Valparaiso, Chile, Viña Del Mar, Chile, draaliciacaro@gmail.com

OP-037

Lithium containing S-PRG fillers enhanced tertiary dentin formation via Wnt/β-catenin pathway activation

Manahil Ali[*], Motoki Okamoto, Shungo Komichi, Masakatsu Watanabe, Yusuke Takahashi, Mikako Hayashi

Restorative Dentistry and Endodontology, Osaka University Graduate School of Dentistry, Suita City, Japan

I. Introduction

Surface pre-reacted glass (S-PRG) fillers have been reported to have various bioactive effects because of their properties of releasing multiple ions. We demonstrated S-PRG fillers containing cement induced reparative dentinogenesis using rat pulp capping model. A combination of lithium ions and S-PRG fillers promoted formation of tertiary dentin with tubules in vivo. The eluate from Li-containing S-PRG cement enhanced differentiation and mineralization of human dental pulp stem cells (hDPSCs) in vitro. In this study, we investigated the mechanism of these phenomena from the view of involvement of Wnt/β-Catenin canonical pathway using immunohistochemistry.

II. Material and Method

This study was conducted under the approval of the Institutional Animal Care and Use Committee of Osaka University Graduate School of Dentistry (No. 28-013-0). Direct pulp capping was established on maxillary first molars of male Wistar rats. Capping materials were S-PRG containing LiCl-100 mM, MTA and S-PRG cement. Samples were collected at 5,7 or 14 days after the operation. Hematoxylin/Eosin staining and immunofluorescence staining against β-Catenin and Axin-2 were performed.

III. Results

H/E stained showed sound pulp tissue beneath the injury site and incomplete dentin bridges were observed in 2-week samples from all groups. The results of immunofluorescence staining results revealed that only 100 mM Li-contained S-PRG cement expressed both of β-Catenin and Axin-2 along the dentinal wall of the pulp space that was the differentiated odontoblastic cell layer. This result indicated Li-containing S-PRG cement might activate Wnt/β-Catenin signaling pathway during the wound healing process of the pulp tissue.

IV. Conclusion

The novel combination of Lithium and S-PRG fillers facilitated tertiary dentin formation via activating Wnt/β-Catenin signaling pathway. This result suggested that Li-containing S-PRG cement can be clinically applied as a new capping agent alternative to MTA.

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***Keywords**: Lithium ions, Tertiary dentin, Surface pre-reacted glass fillers, MTA, Wnt/β-catenin pathway

***Presenting Author**: Manahil Ali

Restorative Dentistry and Endodontology, Osaka University Graduate School of Dentistry, Suita City, Japan, manahilnory91@hotmail.com

OP-038

Stem cells isolated from dental tissues

Fatma Kaplan[*]

Endodonti, Bezmialem Vakıf University, İstanbul, Turkey

Necrosis may develop in the pulp of teeth which immature due to decay, trauma and developmental disorders. Conventional root canal treatment may be difficult in these teeth because of thin, fracture-prone dentinal walls and short roots. The classic apexification procedure require long term calcium hydroxide application to the root canal due to create apical barrier. However, it has been reported that the application of long-term calcium hydroxide to the root canal may cause increase to incidence of root fracture. Therefore, it has been recommended to create apical plug with MTA before root canal filling called single visit apexification in recent years. Regenerative endodontic therapy is recommended in case of immature teeth with necrotic pulp. The main purpose of tissue engineering applications is providing to regeneration in the structure that has developmental disorder, disease and damaged tissue. The stem cells, which have the potential to heal in damaged areas by transforming into various tissue and cell types, are y such as bone marrow, periosteum, muscle, retina, cornea, pancreas, nervous system, brain, peripheral blood and oral tissues. Obtaining stem cells from oral tissues provides convenience in terms of applthe basis of these applications. Stem cells can be obtained from many sources in the human bodications. In this review, we aimed to give information about stem cells isolated from dental tissues, general characteristics of these cells. The future development of regenerative endodontic procedures will require a comprehensive research program directed at each of these components and their application to our patients. The unleashed potential of regenerative endodontics may benefit patients each year.

***Keywords**: Stem cell, Regenerative endodontics, Tissue engineering

***Presenting Author**: Fatma Kaplan

Endodonti, Bezmialem Vakıf University, İstanbul, Turkey, fatmakpln.91@gmail.com

OP-039

Impact of minimal root canal taper on the fracture resistance of endodontically treated bicuspids

Germain Sfeir[*], Carla Zogheib

Department of Endodontics, Saint Joseph University, Beirut, Lebanon

I. Introduction

Minimal invasive endodontics should enhance the fracture resistance of teeth. The aim of this study was to assess the influence of final preparation taper on the fracture resistance of maxillary premolars.

II. Material and Method

60 maxillary premolars were selected and divided into 2 groups: 30 were shaped with a final 4% taper and an apical diameter of 0.3 mm and 30 with 6% taper and an apical diameter of 0.3 mm using iRaCe® instrument (FKG dentaire, Switzerland). All root canals were cleaned with sodium hypochlorite and a final rinse of EDTA. All canals were filled with gutta-percha single-cone filling technique and AHPlus® sealer (Dentsply- Maillefer, Baillagues, Switzerland). Access cavity was restored with resin composite. Roots were wax coated, placed in an acrylic mold and loaded to compressive strength fracture in a mechanical material testing machine recording the maximum load at fracture and fracture pattern (favorable/restorable or unfavorable/unrestorable). Fracture loads were compared statistically and data examined with Student t-test with a level of significance set at p-value≤0.05.

III. Results

No statistically significant difference was registered between the 4% taper of preparation (270.47±90.9N) and 6% taper of preparation (244.73±120.3N) regarding the fracture resistance of the endodontically treated premolars (p-value=0.541), while more favorable restorable fractures were registered in the 4% taper group.

IV. Conclusion

Continuous 4% preparation taper did not enhance the fracture resistance of endodontically treated maxillary premolars when compared to a 6% taper root canal preparation. Minimal tapered preparations did not increase the fracture resistance.

***Keywords**: Taper preparation, Fracture resistance, Compressive strength, Minimally invasive endodontics, Maxillary premolars

***Presenting Author**: Germain Sfeir

Department of Endodontics, Saint Joseph University, Beirut, Lebanon, germainsfeir@gmail.com

OP-040

Nurturing the nature: A novel approach with PRF in management of deep carious lesions

Vaishali Parekh[*]

Department of Conservative Dentistry & Endodontics, Karnavati School of Dentistry, Gujarat University, Ahmedabad, India

I. Introduction

Highly variable anatomy & complexities of dental pulp makes predictability of endodontic treatment questionable. Dentin-pulp complex, being a specialized organ, is essential to maintain vitality and function of the tooth for long term. Platelet Rich Fibrin - PRF, a second-generation platelet rich concentration, is enriched with growth factor & it has ability to provide scaffold for regenerative procedure. So, our aim is to clinically evaluate the effect of PRF as direct pulp capping agents.

II. Material and Method

A study was conducted on 10 healthy adults with age range between 16 to 25 years, teeth having class I deep carious lesion & history of patient suggesting reversible pulpitis were included in the study. Vitality tests and radiographic

evaluation were performed prior to the treatment. After isolation, caries excavation was done with medium to large round burs and spoon excavators. At exposed pulp site, bleeding was controlled & clean exposed site were shielded with autologous PRF. Final sealing of class I restoration was done with Biodentine. Patient was kept under observation for clinical signs & symptoms, vitality and radiographic evaluation periodically starting from 24 hours, 21 days, 1 month, 3 months & 6 months. After 3 months of asymptomatic condition permanent restoration was placed.

III. Results

6 months of our follow up revealed relatively asymptomatic patient with responsive to vitality measures and no periapical changes seen on radiographs.

IV. Conclusion

The vitality of the dentine-pulp complex is fundamental to the health of tooth and is a priority for targeting clinical management strategies. The overall response of the tooth to injury, such as dental caries, represents the complex interplay between injury, defense and regenerative processes. PRF, is highly biocompatible and can maintain vitality of the pulp. Based on the short-term results of this study, direct pulp capping with PRF could be an alternative treatment in permanent teeth with carious pulp exposure.

***Keywords**: PRF, Direct pulp capping, Deep carious lesion, Biodentine
***Presenting Author**: Vaishali Parekh
Department of Conservative Dentistry & Endodontics, Karnavati School of Dentistry, Gujarat University, Ahmedabad, India, vaishaliparekh66@gmail.com

OP-041

Adhesion of pulp stem cells on biomaterials and dentin: Effect of human-derived concentrated growth factor

Beyza Borazan[1], **Tugba Turk**[*1], Serhan Ozverel[2], Ayse Nalbantsoy[2]
[1]Endodontology, Ege University, Faculty of Dentistry, Izmir, Turkey, [2]Bioengineering, Ege University, Faculty of Engineering, Izmir, Turkey

I. Introduction

Aims of present study were to describe the in vitro isolation of dental pulp stem cells (DPSC) from human molar teeth and evaluation of the effect of human-derived concentrate growth factor (CGF) on adhesion and proliferation of stem cells on biomaterials and dentin by immunohistochemistry, colorimetric assay, and SEM.

II. Material and Method

Dental pulps were obtained from sound human molars. Carefully extracted pulp tissue was minced into small pieces. The tissue blocks were cultured in alpha-modification of Eagle medium, supplemented with 20% fetal bovine serum and a complex of 100 U/mL penicillin G and 100 mg/mL streptomycin. DPSC were characterized by flow cytometric analysis. Additionally, to control stem cell nature, cultured cells differentiated into osteocytes and adipocytes. To obtain root canal fragments, single root teeth were collected. After separation of the crowns at cemento-enamel junction, roots were instrumented and vertically divided into two pieces. Samples divided into 12 groups and were set up as follows; in group 1: only dentin, group 2: only cells, group 3: dentin and MTA, group 4: dentin and Biodentin, group 5: only MTA, group 6: only Biodentin. Biomaterials were placed into half-length of canals. DPSC were seeded onto samples and cultured in the medium. Group 7-12, were formed symmetrically like first 6 groups, diversely DPSC were seeded onto samples and cultured in CGF mediated medium. CGF was obtained from volunteers. After 14 and 21 days, MTT and ALP Activity tests were performed. The samples were stained with Alizarin Red S to evaluate calcium ions. Finally, samples were examined by SEM.

III. Results

The groups with Biodentin demonstrated the significantly higher number of cells compared to MTA groups. The ALP activity was higher in the presence of dentin that was also demonstrated on alizarin red s staining. Treatment of CGF significantly enhanced proliferation and differentiation of dental pulp stem cells on dentin.

IV. Conclusion

Presence of dentine increased odontoblastic differentiation of DPSC. CGF, a new generation of platelet concentrate product, appears to have promising applications in regenerative endodontic therapies.

***Keywords**: Pulp stem cell, Concentrated growth factor, Biomaterial, MTA, Biodentin
***Presenting Author**: Tugba Turk
Endodontology, Ege University, Faculty of Dentistry, Izmir, Turkey, tugbaturk@gmail.com

OP-042

Evaluation of surface integrity of root end cavities prepared using conventional and piezoelectric device – An SEM Study

Sreenath Narayanan*, Mithra Hegde, Manjiri Honap
Conservative Dentistry & Endodontics, A B Shetty Memorial Institute of Dental Sciences, Mangaluru, India

I. Introduction

The aim of the study was to evaluate the surface integrity of root end cavities prepared using conventional and piezoelectric devices using scanning electron microscopy analysis.

II. Material and Method

Twelve single-rooted mandibular premolar teeth were selected and root end cavities were prepared and divided into two groups. In the first group, 3 mm root-end cavities were prepared using conventional retro preparation burs and in the second group, 3 mm root-end cavities were prepared using piezo electric retrotips. The specimens were analyzed under scanning electron microscope and coded for blind evaluation. Specimens were examined at 100x, 500x and 1000x magnification for smear layer and debris. Gutmann's scoring criteria was followed to score the specimens. Statistical analysis was carried out using Shapiro-Wilk test and the independent sample t-test was used to check mean differences between variables.

III. Results

It was found that statistical significant differences existed in mean debris and smear layer scores ($p<0.001$) between the two groups. In the piezoelectric group, significantly lower debris layer and smear layer were found, compared to the conventional bur group.

IV. Conclusion

Root-end cavities prepared using piezo retrotips produced cleaner, well-centered and more conservative surface with minimal debris and smear layer, compared to root-end cavities prepared using conventional burs.

***Keywords**: Piezosurgery, Root end cavities, Scanning electron microscopy, Resection
***Presenting Author**: Sreenath Narayanan
Conservative Dentistry & Endodontics, A B Shetty Memorial Institute of Dental Sciences, Mangaluru, India, dr.sreenathn@gmail.com

OP-043

Non surgical management of rare anomaly: Dens invaginatus

Sweta Bhandari*
Endodontics, Smile Dental Clinic, Muscat, Oman

I. Introduction

Dens invaginatus refers to a developmental anomaly resulting from an abnormal infolding of inner enamel epithelium into the dental papilla. This gives rise to a communication between the pulp and oral environment; increasing the susceptibility of the tooth to caries and pulpitis. Root canal treatment of such tooth with complex root canal anatomy can be difficult because infected pulp tissue may remain in inaccessible area of the canal. Hence it is important to identify this anomaly and manage it as early as possible. This article presents a case of dens invaginatus in a 40-year-old female patient with an open apex and a large periradicular lesion along with a sinus opening and management of the same by nonsurgical root canal treatment using MTA as an apical barrier.

II. Material and Method

Rubber dam, stainless steel k files, EDTA, sodium hypochlorite 5.25%, cacium hydroxide paste, metapex, Mta, Fibre post, dual cure resin based cement.

Access opening was done, it showed 3 canals. The attachments between all canals were removed with the help of diamond burs and was followed by cleaning and shaping with ss k files. Metapex was placed for 6 months, recalled and once the patient was symptom free it was obturated with mta as apical filling and finished with a Fibre post using dual cure resin cement.

III. Results

After the treatment patient was free of pain, sinus healed, showed reduction in periapical translucency in X-ray.

IV. Conclusion

Dens invaginatus having a complex root canal anatomy poses a challenge for a root canal treatment so it should be detected and treated as early as possible.

***Keywords**: Dens Invaginatus, Management
***Presenting Author**: Sweta Bhandari
Endodontics, Smile Dental Clinic, Muscat, Oman, drswetasurana@gmail.com

OP-044

Depletion rate of hydrogen peroxide and intracoronal bleaching efficacy of sodium perborate mixed with water

Mohamed Amer[*1], James Holden[2], Neil OBrien- Simpson[2], Peter Parashos[1]
[1]Endodontics, The University of Melbourne, Melbourne, Australia, [2]Molecular Science and Biotechnology, The University of Melbourne, Melbourne, Australia

I. Introduction
Anecdotally, the intra-coronal bleaching agent replacement interval range in the literature is 3-12 days. The objective of this study was to correlate the depletion rate of hydrogen peroxide with the intra-coronal bleaching efficacy of sodium perborate mixed with water.

II. Material and Method
After cleaning and shaping the root canals of unrestored premolar teeth (n=49), the access cavities were stained with blood. The teeth were sectioned 3 mm below the cervical margin and sealed apically with white Cavit. The root stumps were covered with a double layer of varnish and sodium perborate mixed with water in a 2 gm : 1 ml ratio was packed into the access cavities and sealed with white Cavit. The change in colour of the teeth was measured daily for 28 days using standardized photographs and correlated with the depletion rate of hydrogen peroxide release measured using the Amplex red assay kit.

III. Results
Hydrogen peroxide release peaked at 24 hours and then quickly decreased reaching a plateau at 72 hours. There was a steady increase in the mean colour change of all teeth, which only slightly decreased over time. Statistical analysis showed no correlation between the hydrogen peroxide depletion rate and the mean colour change in teeth bleached with sodium perborate and water.

IV. Conclusion
Regular replacement of the bleaching mixture during intra-coronal bleaching based on hydrogen peroxide depletion rate seems not to be scientifically supported. A single application of sodium perborate mixed with water continued to induce colour change in teeth stained with blood for up to 28 days.

***Keywords**: Depletion rate, Hydrogen peroxide, Intracoronal bleaching
***Presenting Author**: Mohamed Amer
Endodontics, The University of Melbourne, Melbourne, Australia, m.amer@student.unimelb.edu.au

OP-045

Evaluation of PUFA (Pulpal involvement, Ulcer, Fistula, Abscess) index in screening for endodontic disease: Reliability and accuracy

Dalia Abdullah[1], Amy Kia Cheen Liew[2], **Lay Ann Teh**[*1], Eason Soo[1]
[1]Endodontics, Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia, [2]Dental Public Health, Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia

I. Introduction
The aim of this study is to evaluate the reliability and accuracy of PUFA Index and Periapical Index (PAI) score using Dental PanTomography (DPT) in screening endodontic disease.

II. Material and Method
A total of 165 Malaysian adults who attended the Primary Care Unit at the Faculty of Dentistry, Universiti Kebangsaan Malaysia, Kuala Lumpur were screened for the clinical consequences of untreated dental caries using PUFA Index i.e presence of pulpal involvement (P), ulceration (U), fistula (F) and abscess (A). Periapical status of all teeth in DPT from these patients was scored based on the PAI. The gold standard clinical diagnosis of all teeth was done based on the American Association of Endodontists' endodontic diagnosis classification.

III. Results
Prevalence of PUFA>0 was 98.2% (n=162) with mean number of teeth with caries of 10.90. Mean number of teeth affected (PUFA) was 2.72. Out of 4115 teeth assessed, 16.2% (n=666) were diagnosed with pulpal infection, 16.2% (n=325) with periapical infection. The intra and inter-examiner reliability of PUFA in screening endodontic disease is high at 0.83 and 0.87 respectively. Intra and inter-examiner reliability of PAI in screening for endodontic disease is also high at 0.83 and 0.80 respectively. The sensitivity of PUFA Index was moderate (0.68, 0.88) but the specificity was high (0.99, 0.95) when compared to gold standard pulpal and periapical diagnosis, respectively. Using the ROC Contrast Estimation Test, PUFA is more accurate than PAI in screening endodontic disease ($p<0.0001$, $p=0.0007$).

IV. Conclusion
Results suggest that there is moderate prevalence of endodontic disease (PUFA) among the Malaysian subpopulation. PUFA is reliable and accurate in screening for endodontic disease. Index can be used to complement DMFT Index in assessing the consequences of untreated dental caries.

***Keywords**: PUFA, PAI, Reliability, Accuracy, Screening, Index
***Presenting Author**: Lay Ann Teh
Endodontics, Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia, dr.annteh@gmail.com

OP-046

Effect of the retrograde filling on bacterial penetration and proliferation in the apical part of the root - CLSM study

Shlomo Elbahary[*]
Endodontics, Tel Aviv University, Tel Aviv, Israel

I. Introduction
A recent study reported that confocal laser scanning microscopy (CLSM) can be used as a novel experimental model to histologically demonstrate bacterial root-end colonization following root-end filling. It was found that bacteria may colonize at the filling-dentine interfaces and deeper into the dentinal tubules. However, the penetration of the filling materials into the dentinal tubules was not evaluated and a recent study found that CLSM may also be used to evaluate sealer penetration into dentinal tubules. Thus, the aim of this study was to evaluate the effect of the retrograde filling penetration into dentinal tubules on bacterial penetration and proliferation in the apical part of extracted human teeth, using a novel experimental model that is based on CLSM and scanning electron microscopy evaluations.

II. Material and Method
The apical 3-mm root-ends of 55 extracted single rooted human teeth were resected, and 3-mm retrograde cavities were prepared and filled using fluorescence stained filling, either mineral trioxide aggregate (MTA), intermediate restorative material (IRM), or Biodentine (n=10 each); 25 teeth served as controls. The roots were placed in an experimental model, sterilized, and coronally filled with E. faecalis bacterial suspension for 21 days. Then, the apical 3-mm segments were cut to get two slabs (coronal and apical). The slabs were stained using LIVE/DEAD BacLight Bacterial Viability Kit and evaluated using CLSM.

III. Results
No fluorescence was observed in the negative control group, and fluorescence was found in all the specimens of the positive control group. When comparing the different retrograde filling materials there were no significant difference in the size of fluorescent staining within the evaluated areas (dead and live bacteria combined), ($p>0.05$). However, there were significantly more dead bacteria than live bacteria in the MTA, IRM and Biodentine groups ($p<0.05$). There were significant ($p<0.05$) negative correlations between the size of filling material staining area and the size of bacteria stained area (significantly less stained bacteria, dead and alive together, were associated with more stained filling materials). Significant negative correlation was also found regarding the size of filling material staining area and live bacteria staining areas ($p<0.05$). The minimal and maximal colonization depths into the dentinal tubules were 1 and 1480 µm, respectively, with a mean of 167 µm. The minimal and maximal filling penetration depths into the dentinal tubules were 0 and 957 µm, respectively, with a mean of 130 µm, without significant differences between the evaluated materials (MTA, IRM, Biodentine) ($p>0.05$).

IV. Conclusion
CLSM can be used to histologically demonstrate bacterial root-end colonization and penetration of bacteria and materials following root-end filling. This colonization at the filling-dentine interfaces and deeper into the dentinal tubules may be inhomogeneous, favoring the bucco-lingual aspects of the root. Clinical relevance following root-end resection and filling bacterial colonization may lead to inflammatory reactions at the periapical tissues; the viability of the colonized bacteria may be affected by the type of root-end filling material.

***Keywords**: Endodontic surgery, Root-end filling, Bacterial colonization, Enterococcus faecalis, Confocal laser scanning microscopy
***Presenting Author**: Shlomo Elbahary
Endodontics, Tel Aviv University, Tel Aviv, Israel, shlomodent@gmail.com

OP-047

Evaluation of flow patterns of various irrigants in the canal isthmus using modified Endovac technique: A CFD analysis

Dhanasekaran Sihivahanan[*], Anchu Rachel Thomas, Ranjith Kumar Sivarajan
Conservative Dentistry and Endodontics, SRM Institute of Science and Technology, Chennai, India

I. Introduction
Irrigation plays an essential part in root canal debridement because it allows for cleaning beyond what might be achieved by root canal instrumentation alone. Effective irrigation depends on irrigant exchange along the full length of the canal, including the main canals, lateral canals and isthmuses of the roots. Aim of the study is to compare the flow pattern of different irrigating solution and to evaluate exchange of irrigants in the root canal isthmus region.

II. Material and Method
Preoperative micro-CT scan was performed in six extracted

mandibular premolar teeth, one mandibular premolar with an isthmus connecting the two canals was chosen for the study. Sequent micro-CT imaging was done after cleaning & shaping with ProTaper rotary system (up to F3). The postoperative micro-CT images obtained were exported in a STL format to the Materialise Mimics Software to generate a CFD model. The model was transformed to study the flow pattern of the various final irrigating solutions. They were divided into the following groups Group I: Irrigation with 2.5% NaOCl, Group II: Irrigation with 2% CHX, Group III: Irrigation with 17% EDTA solution, Group IV: Normal Saline. The flow pattern associated with each irrigants was analyzed.

III. Results

The CFD model analysis shows that, Group I and Group IV have similar and greater flow patterns in the canal isthmus region, the least flow patterns was seen for the Group II.

IV. Conclusion

Within the limitations of the study it can be concluded that, the modified EndoVac irrigation system along with the 2.5% NaOCl irrigation solution is an effective irrigation protocol for the penetration of irigants into the canal isthmus region.

***Keywords**: Canal Isthmus, Flow Patterns, Modified Endovac, Computational Fluid Dynamics, Micro CT, Final Irrigation

***Presenting Author**: Dhanasekaran Sihivahanan

Conservative Dentistry and Endodontics, SRM Institute of Science and Technology, Chennai, India, endosihi@gmail.com

OP-048

Diagnosis and treatment of cracked tooth - A clinical case series

Medha Jain*

Private Practice, Dental Clinic Dr. Medha Jain, Vadodara, India

The diagnosis of cracked tooth is often challenging, largely because the associated symptoms tend to be very variable and at times bizarre. Higher levels of magnification with an operating microscope allow a visual confirmation of the crack for a definitive and an early diagnosis. The precise location and the extent of the crack as it appears under magnification can guide towards a predictable restorative treatment plan. This oral presentation reviews the diagnosis and treatment of cracked teeth through a series of clinical cases of cracked teeth, such as longitudinal crack, cusp fractures, and vertical root fractures. The possibility of cracked tooth must always be considered when a patient complains of pain or discomfort on chewing or biting. Knowledge and awareness of cracked tooth should enable an early diagnosis, thereby preventing further crack propagation and a predictable prognosis.

***Keywords**: Cracked tooth, Crack propagation, Magnification, Longitudinal crack, Cusp fracture, Vertical Root Fracture

***Presenting Author**: Medha Jain

Private Practice, Dental Clinic Dr. Medha Jain, Vadodara, India, docmedha@gmail.com

OP-049

Impact of different activation techniques in reducing intracanal Enterococcus faecalis populations: An in vitro study

Wajih Al Hajj*[1], Germain Sfeir[1], Desiree El Hajj[2], Dolla Sarkis[1], Issam Khalil[1], Carla Zougheib[1]

[1]Endodontics, Saint Joseph University - Beirut Lebanon, Beirut, Lebanon, [2]Bacteriology, Saint Joseph University - Beirut Lebanon, Beirut, Lebanon

I. Introduction

The purpose of this study was to assess the effectiveness of three activation devices laser-activated irrigation by photon-induced photoacoustic streaming (PIPS), the Sonic Powered Irrigation by EDDY, and the ultrasonic irrigation by Endoultra in the reduction of Enterococcus faecalis in root canal disinfection, compared to conventional irrigation.

II. Material and Method

Forty four extracted single-rooted mandibular premolars were mechanically prepared, sterilized, and inoculated with E. faecalis for 2 weeks. Bacterial count after inoculation was evaluated in 4 randomly chosen teeth, the remaining forty infected root canals were divided equally into 4 groups according to the final activation technique used.

Group A: laser-activated irrigation by photon-induced photoacoustic streaming (PIPS); Group B: 5 the Sonic Powered Irrigation by EDDY; Group C: ultrasonic irrigation by Endoultra; Group D: conventional irrigation.

Colony forming unit (CFU) counts of the breeding colonies of microorganisms was evaluated immediately by inoculation on blood agar, and the logs of the CFU counts were calculated. The data was evaluated statistically using Kruskal-Wallis tests followed by Mann-Whitney tests. and the least significant difference post hoc tests at 95% confidence level (P=0.05).

III. Results

A decrease of CFU after irrigation in the four groups was found. But a significant difference was found between conventional irrigation and the other three irrigation techniques. The average CFU after irrigation with syringe ($p<0.001$), PIPS ($p=0.018$), EDDY and Endoultra ($p=0.042$) were significantly greater than the value 0; which mean that no irrigation technique can completely eliminate bacterial colonies of E. Faecalis from canal. PIPS gave the least average CFU after irrigation, with no significant difference between PIPS, EDDY, and Endoultra ($p=0.141$).

IV. Conclusion

The use of the PIPS laser technique, EDDY and Endoultra with a novel irrigation protocol in an in vitro setting showed statistical significance in achieving higher Elimination of E. faecalis compared to the conventional irrigation technique.

***Keywords**: Irrigation, PIPS, Ultrasonic activation, Sonic activation, *E. faecalis*

***Presenting Author**: Wajih Al Hajj

Endodontics, Saint Joseph University - Beirut Lebanon, Beirut, Lebanon, wajihhage@gmail.com

OP-050

The effect of osmotic stress on *Enterococcus faecalis* and *Streptococcus sanguinis* viability and sodium hypochlorite (NaOCl) biocidal activity

Deon Naicker, Peter S Zilm, **Giampiero Rossi-Fedele***

Adelaide Dental School, University of Adelaide, Adelaide, Australia

I. Introduction

To investigate the effect of osmotic stress on cell viability of Enterococcus faecalis and Streptococcus sanguinis and, whether osmotic stress modifies the biocidal efficacy of sodium hypochlorite (NaOCl) against these microbes in the stationary phase.

II. Material and Method

E. faecalis and S. sanguinis were grown overnight and then suspended in solutions consisting of 0.9% NaCl (iso-osmotic group), Milli-Q ultrapure water (hypo-osmotic group) or 9% NaCl (hyperosmotic group) for five days. Thereafter, bacterial cells were subjected to 0.0001% NaOCl for 10 minutes. Cell survival was monitored by viable count plating (CFU/mL). A linear mixed-effects model was used to determine the association between CFU/mL mean (logarithmic transformation) and the interaction of solution.

III. Results

After incubation in the different solutions, for S. sanguinis, the hyperosmotic group presented with the highest CFU/mL mean, with statistically significant differences when compared to the iso-osmotic group ($p<0.001$) only. For E. Faecalis, there were no statistically significant differences in CFU/mL mean between the various groups.

Following exposure to NaOCl, pre-treatment exposure to hypo-osmotic stress was associated with a lower CFU/mL for S. sanguinis ($p<0.001$), when compared to both hyperosmotic and iso-osmotic conditions. No significant differences were found when comparing hyperosmotic and iso-osmotic conditions. For E. faecalis, statistically significant differences ($p<0.001$) were found when comparing the hypo-osmotic and hyperosmotic groups, with hypo-osmotic stress having lower CFU/mL values. A statistically significant difference was found between the iso-osmotic and hyperosmotic groups ($p<0.001$), with the iso-osmotic group presenting a greater mean CFU/mL reduction.

IV. Conclusion

Hyperosmotic conditions appear suitable to maintain viability for E. faecalis and S. sanguinis in the stationary phase. Exposure to hypo-osmotic stress prior to NaOCl is associated with greater biocidal efficacy compared to hyperosmotic conditions for both microbes.

***Keywords**: Osmoss, Sodium hypochlorite, Bacterial stress, Enterococcus faecalis, Streptococcus sanguinis, Stationary phase

***Presenting Author**: Giampiero Rossi-Fedele

Adelaide Dental School, University of Adelaide, Adelaide, Australia, giampiero.rossi-fedele@adelaide.edu.au

OP-051

Enhanced antimicrobial infiltration into radicular dentin via electrokinetic flow

Anna Hwayoung Yi*, Chenhui Peng, Frederico Souza, Sang Jin Lee, Jongyoon Han

Department of Prosthodontics, Harvard School of Dental Medicine, Boston, USA

I. Introduction

The failure of conventional endodontic treatment poses a serious health and economic burden both on national and individual scale. Conventional endodontic treatment modalities are limited to transport processes by passive diffusion that delivers therapeutics unevenly at unpredicted rates, and their actions are mostly confined only to the surface layer. The dentinal micro-channels, typically

ranging 3-67 nm in size for intertubular dentin and ~1 µm for dentinal tubules, would be greatly benefitted from definitive and controlled transport of therapeutic molecules into its depths. The present study demonstrates the enhanced and definitive transport of applied antibiotics into the dentin through micro and nanochannel structures by inducing the electrokinetic flow, which was previously shown to carry both positively and negatively charged molecules deep (~1 mm) into smallest nanopores of enamel.

II. Material and Method

Aim 1: The infiltration of antimicrobial into the dentin slabs was demonstrated by two different methods: (1) the electrokinetic flow assisted infiltration of antimicrobial solution into the dentin slab was monitored using fluorescent microscopy and the change in current level (A). (2) cultured bacteria (B. visidae) was used for qualitative analysis via light microscopy after antimicrobial solution was infiltrated through the dentin slab.

Aim 2: The infiltration of antimicrobial into the dentin of extracted whole tooth after the root canal treatment was evaluated. This involved (1) ex vivo infiltration of antimicrobial into the dentin of root canal without conventional root canal treatment; (2) ex vivo infiltration of antimicrobial into the dentin of root canal after conventional root canal treatment.

III. Results

The infiltrated dentin chips and whole tooth samples showed more fluorescence when compared to the non-infiltrated controls. Examination using light microscopy confirmed the bacteriostatic activity of the antimicrobials. Dead cultures of Escherichia coli were observed in the infiltrated group.

IV. Conclusion

The results of present study showed evidence of significant improvement in antimicrobial infiltration via electrokinetic flow.

***Keywords**: Electrokinetic Flow, Disinfection, Root canal treatment

***Presenting Author**: Anna Hwayoung Yi
Department of Prosthodontics, Harvard School of Dental Medicine, Boston, USA, anna_yi@hsdm.harvard.edu

OP-052

Effect of laser photodynamic therapy towards phenotype character at *cps 1, 2* and 5 genotype of persistent intra radicular infection *Enterococcus faecalis* isolates

Dewa Ayu N.P.A.[*1], Siti M. Soerono Akbar[1], Boy M. Bachtiar[2], Andi Arus Victor[3]
[1]Department of Conservative Dentistry, Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia, [2]Departemen and Laboratory of Oral Biology, Faculty of Dentistry, Universitas Indonesia, Jakarta, Indonesia, [3]Departemen of Ophthalmology, Faculty of Medicine, Universitas Indonesia, Jakarta, Indonesia

I. Introduction

Irregular shape of root canal especially at one third of apical area still leaves the problem in root canal sterilization. Using laser photodynamic therapy with photosensitizer is one of several ways to solve this problem. Knowing the variation of the genotypes and the phenotypes character of bacteria are useful to know its behavior against environmental changes. It thus expected to find the best technique for root canal sterilization. The aim of the research was to analyze the genotype types and character change of *E. faecalis* phenotype in cases of persistent intra radicular infection after treatment with laser photodynamic therapy.

II. Material and Method

Colonies confirmed as *E. faecalis* isolated from the root canal were then determined the type of polysaccharide capsule (cps) such as *cps 1,2 and 5* that will be the sample of choice in the next study. After the determination of genotype cps, experimental laboratory experiments will be conducted to the change of phenotype character by analyzing the sensitivity of *E. faecalis* to the laser photodynamic therapy that are LED 639 nm and diode 810 nm with some exposure time. The result of the research was seen by bacteria viability test that is calculate colony that grow in medium agar after given treatment.

III. Results

In this study, antibacterial effect was greater in the group using laser diode 810 nm than LED 630 nm. The treatment groups using photosensitizer on both types of lasers produced a better sensitivity effect than those not using them in all types of cps. Duration of 60 second irradiation more effective than 30 second specially on LED 630 nm group especially to genotype *cps 2*. However, these differences did not differ significantly.

IV. Conclusion

Laser photodynamic therapy can increase the sensitivity of *cps 1, 2 and 5* genotype *E. faecalis* in persistent intra radicular infection.

***Keywords**: *E. faecalis*, Laser photodynamic therapy, *cps 1, 2 and 5 genotype*, Sensitivity

***Presenting Author**: Dewa Ayu N.P.A.
Department of Conservative Dentistry, Faculty of Dentistry, Universitas Indonesia, Indonesia, dewaayunpa@yahoo.co.id

OP-053

Current trends in irrigant agitation methods among endodontists in India - A KAP based survey

Velmurugan Natanasabapathy[*1], Archana Duruvasulu[1], Ambalavanan Namachivayam[1], Kandaswamy Deivanayagam[2], Srinivasan M.R[3]
[1]Conservative Dentistry & Endodontics, Meenakshi Ammal Dental College, Chennai, India, [2]Conservative Dentistry & Endodontics, Ramachandra Dental College, Chennai, India, [3]Conservative Dentistry & Endodontics, Venkateshwara Dental College, Chennai, India

I. Introduction

Chemomechanical preparation is an essential step for the success of root canal treatment. More than 30-45% area of the root canal is untouched by the instruments that we use to prepare the root canal system. Root canal irrigants play a very critical part in disinfection of these parts of the system. But for irrigants to disinfect these areas, it has to penetrate the entire root canal system. Currently options are divided among endodontists with regards to use of irrigant activation system. Aim of this survey was is to ascertain the practice/use of irrigant agitation systems amongst endodontists in India.

II. Material and Method

An invitation to participate in a web-based survey was e-mailed to 265 members of the Indian Association of Endodontists. Survey participants were asked 36 questions based on knowledge, attitude & practice, about the choice of irrigants & irrigant activation methods they use. The questionnaire was validated by four experts in the field of Endodontics.

III. Results

139 participants replied to the survey, with an overall response rate of 55.5%. Our data indicate that 77.5% of respondents primarily use sodium hypochlorite, with 86.2% of them using irrigant agitation methods. 80% of respondents aim to disinfect the isthmus. Most of them 76% strongly feel that ultrasonic assisted agitation is the superior method for disinfection isthmus.

IV. Conclusion

Most of the respondents are using sodium hypochlorite as the primary irrigant of choice. Majority of the participants aim to disinfect the isthmus for better outcome of endodontic treatment. Ultrasonic irrigation is the most commonly used method for irrigant activation amongst endodontist in India.

***Keywords**: Irrigant survey, Irrigant agitation, Isthumus disinfection, KAP survey

***Presenting Author**: Velmurugan Natanasabapathy
Conservative Dentistry & Endodontics, Meenakshi Ammal Dental College, Chennai, India, vel9911@yahoo.com

OP-054

Comparison of success rate of different anesthesia protocols in mandibular first molars with symptomatic irreversible pulpitis

Shahriar Shahi[*1], Mehrnush Mohamadi[1], Parya Ebrahimi[2]
[1]Endodontics, Dental and Periodontal Research Center, Tabriz University of Medical Sciences, Tabriz, Iran (Islamic Republic of), [2]Endodontics, Dentistry Student, Tabriz University of Medical Sciences, Tabriz, Iran (Islamic Republic of)

I. Introduction

It is very difficult to achieve proper anesthesia in mandibular molars with irreversible pulpitis. The aim of the present study was to compare different techniques used for anesthesia in mandibular first molars with symptomatic irreversible pulpitis using prilocaine.

II. Material and Method

Of 175 patients referring to be included in the study, 23 patients excluded. A total of 152 patients with symptomatic irreversible pulpitis in mandibular first molar were randomly assigned to 4 groups (n=38); group 1: Inferior alveolar nerve block standard anesthetic technique (IANB); group 2: IANB technique plus intraligamental injection (PDL); group 3: IANB technique plus buccal infiltration technique; and group 4: use of two standard IANB techniques. The patients recorded their pain severity at entry into the dentin, at entry into the pulp chamber and during instrumentation with the use of visual analog scale. No pain or mild pain was considered success. Data were statistically analyzed using the chi-square and Mann-Whitney U tests.

III. Results

The overall success rate for the IANB, IANB with PDL, IANB with buccal infiltration, and two standard IANB group were 30%, 65%, 35%, and 60%, respectively.

IV. Conclusion

Based on the results of the present study, use of

complementary techniques such as the intraligamental technique and two standard IANB techniques before initiating treatment increase the success rate of IANB technique in mandibular first molars with symptomatic irreversible pulpitis.

***Keywords**: Prilocaine, Inferior alveolar nerve block, Irreversible pulpitis
***Presenting Author**: Shahriar Shahi
Endodontics, Dental and Periodontal Research Center, Tabriz University of Medical Sciences, Tabriz, Iran (Islamic Republic of), sshahriar32@gmail.com

OP-055

How do we deal with the geriatric patients?

Fatima Basturk[*], Dilek Turkaydin
Endodontics, Marmara University, Faculty of Dentistry, Istanbul, Turkey

I. Introduction
Elderly refers to the people aged 65 years and older, unless otherwise specified. Turkey's population aged 65 years or older grew by 17% in the last five years. That represents 8% of the total population of Turkey. This number is far beyond South Korea whose elderly population (13.6%) outnumbered children 14 and under for the first time ever in 2017. However, there is a lack of information amongst clinicians regarding the attitudes towards and treatment of older patients. This presentation aims to describe how we, clinicians, should examine and care for our geriatric patients.

II. Material and Method
The number of admitting elderly patients to our university hospital at a period of one year was verified and classified according to the following categories; young olds (age 65 to 74), old olds (age 75 to 84) and oldest olds (aged 85 and over). The distribution of elderly admissions was calculated and possible reasons for the rate of these admissions were discussed. These numbers represent the functionally independent elderly who were able to get to dentist and frail elderly who has chronic conditions with impaired mobility. Homebound or institutionalized elderly were unable to be listed. A clinical example of how to take care and accurately diagnose a frail elderly in the oldest olds category in endodontics clinic will be explained thoroughly.

III. Results
Of all admissions to the university hospital, 6% were geriatric patients. This percentage is lower than the total geriatric population of Turkey. There is a lack of admission of oldest olds.

IV. Conclusion
Receding pulp tissue, high prevalence of periodontal disease, dry mouth and cognitive impairment can be observed with old age. However, as with any age group, older patients must be considered as individuals. Clinicians should be informed about the diagnosis and treatment of geriatric patients, considering the fact that it is a rapidly growing population.

***Keywords**: Geriatric, Geriodontology, Elderly patient
***Presenting Author**: Fatima Basturk
Endodontics, Marmara University, Faculty of Dentistry, Istanbul, Turkey, fatimabasturk@gmail.com

OP-056

Difference of fracture toughness of nanohybrid resin composite with fiber reinforced composite (FRC)

Chandra Sari Kurniawati[*1], Dini Rachmawati[2], Dihan Masadah[3]
[1]Conservative Dentistry, Dentistry of Brawijaya University, Malang, Indonesia, [2]Pediatric Dentistry, Dentistry of Brawijaya University, Malang, Indonesia, [3]Student, Dentistry of Brawijaya University, Malang, Indonesia

I. Introduction
Restorative materials of dentistry should have aesthetic and good strength so it can be used as restorations on anterior and posterior teeth. Nanohybrid resin composite is a composite resin with nano filler particles that have aesthetic and good durability against fracture. The newest composite resin, fiber reinforced composite consist of combination of resin matrix, E-glass fiber, and an inorganic particulate filler. Composite resins with the addition of E-glass fibers are expected to have higher fracture toughness values than composite resins without E-glass fiber.

II. Material and Method
This study used 20 samples then divided into 2 groups, specifically group I nanohybrid resin composite and group II fiber reinforced composite. Each sample was applied by incremental on glass mold then exposed with light cure stiffening for 20 seconds on each. Before polymerization of the second layer, the central part of the specimen is given a sharp crack. Then the sample is kept at temperature 37°C for 48 hours and tested for fracture toughness by Universal Testing Machine specification Tamogrocki Wilhem Herm Holm.

III. Results
Statistical test results with the independent T-Test showed significant differences in fracture toughness values between group I and group II ($p<0.001$).

IV. Conclusion
The conclusion of this research is the difference of fracture toughness of nanohybrid resin composite with fiber-reinforced composite. Greater fracture toughness owned by fiber reinforced composite restoration materials.

***Keywords**: Nano hybrid resin composite, Fiber reinforced composite, Fracture toughness
***Presenting Author**: Chandra Sari Kurniawati
Conservative Dentistry, Dentistry of Brawijaya University, Malang, Indonesia, lgivasalma@yahoo.com

OP-057

In-vitro assessment of free active chlorine in sodium hypochlorite solution mixed with lidocaine hydrochloride with adrenaline

Charanya Chandrasekaran[*], Mahalaxmi Sekar, Balasubramaniam Saravana Karthikeyan, Ishwarya Gurucharan
Conservative Dentistry & Endodontics, SRM Institute of Science & Technology, SRM Dental College, Ramapuram, Chennai, India

I. Introduction
The most commonly employed anesthetic agent in endodontics is 2% Lidocaine HCl with adrenaline (LA). Intrapulpal injection technique (IPI) is one of the commonly employed supplemental anesthesia adjuvant to conventional maxillary infiltrations or mandibular inferior alveolar block in situations, especially in acutely inflamed molars. Vidhya et al. in a study evaluated the chemical interaction between lidocaine hydrochloride (with and without adrenaline) and NaOCl using nuclear magnetic resonance spectroscopy and reported the formation of a precipitate, 2,6-xylidine, which is a known carcinogen. Such potential interactions might arise when NaOCl is subsequently employed for pulp tissue dissolution following immediate IPI administration. The therapeutic effects of sodium hypochlorite (NaOCl) solutions are dependent on the levels of free available chlorine (FAC). Till date, there are no reports on the effect of LA on FAC of NaOCl. Hence the aim of this study was to assess the effect of LA on the FAC content of 3% NaOCl solutions when mixed at varying proportions.

II. Material and Method
3% NaOCl and LA were mixed in 3 different ratios ie., 9:1, 7:3 and 1:1 v/v respectively in a test tube. Plain 3% NaOCl (unmixed) served as a positive control.
Group I: 3% NaOCl (control)
Group II: 3% NaOCl + 2% LA (9:1)
Group III: 3% NaOCl + 2% LA (7:3)
Group IV: 3% NaOCl + 2% LA (1:1)
Iodometric titration method was employed to determine FAC in the test solutions of NaOCl.

III. Results
Reduction in FAC was observed in the test groups of 3% NaOCl admixed with 2% LA. Greater the proportion of LA admixed with NaOCl, lower was the FAC. Thus, Group IV exhibited the least FAC release.

IV. Conclusion
Within the limitations of this in vitro study, it could be concluded that 2% LA when admixed with 3% NaOCl significantly reduces its FAC content. Hence, adequate caution should be exercised to prevent such potential interactions in a clinical scenario.

***Keywords**: LA, Sodium hypochlorite, Interaction, 2,6-xylidine, Free available chlorine
***Presenting Author**: Charanya Chandrasekaran
Dept. of Conservative Dentistry & Endodontics, SRM Dental College, Ramapuram, Chennai, India, charanya1711@gmail.com

OP-058

The use of micro-computed tomography in assessing root canal filling quality in endodontic research

Asiye Dincer[*]
Endodontics, Bezmialem Vakif University, Istanbul, Turkey

In the past years, micro-computed tomography (micro-CT) has gained increasing significance in endodontic research because of its high accuracy and resolution. It is possible to create 2 and 3-dimensional images. In addition, the results are reproducible and the sections can be reconstructed on any level. Images can be evaluated in terms of quality as well as quantity. Beside the advantages of micro-CT, it is not suitable for clinical use and the method is high costly and time consuming. In endodontic researches, micro-CT imaging has been used to evaluate root canal morphology, the effect of instrumentation and irrigation techniques, the accumulation of hard tissue debris, calcium silicate-based materials porosity and quality of obturation. For a successful endodontic treatment, it is important to perform a hermetic obturation of root canal system to

achieve an ideal and high quality obturation. An ideal root canal filling must seal entire root canal system including root canal irregularities. It is possible to determine voids in the interface between filling material and dentine and the porosity within the filling material. In addition micro-CT can distinguish gutta-percha and sealer based on different colors because of their different densities. While the current micro-CT technology still has limitations, it has shown to be a promising tool in endodontic research. The use of micro-CT in endodontic research may advance the development of new techniques of obturation.

***Keywords**: Micro-computed tomography, Root canal filling, Obturation
***Presenting Author**: Asiye Dincer
Endodontics, Bezmialem Vakif University, Istanbul, Turkey, asiyedincer@yahoo.com

OP-059

Apicoectomy using ER,CR: YSGG laser versus conventional methods for microsurgical retrograde endodontic treatment: A comparative retrospective investigation

Thanh An Hong[*1], Tuong Nguyen Nguyen[2]
[1]5th year student of Odontostomatology Faculty, University of Medicine and Pharmacy of Ho Chi Minh City, Vietnam, [2]Endodontics, Polaris Dental Specialists, Salem, USA

I. Introduction
Laser has become a well-known and well-accepted tool in medicine. In dentistry, even though its applications are permeating various fields such as orthodontics, periodontics, endodontics and restorative dentistry, laser-assisted dentistry is still few and far between. In endodontics especially, attempts to include laser as part of the armamentarium has encountered fierce resistance from those who are timid in letting go of the old ways. This retrospective study aims at evaluating the use of Er,Cr: YSGG laser versus conventional methods for microsurgical retrograde endodontic treatment, in terms of clinical outcome and therapeutic success.

II. Material and Method
Clinical records and radiographs were gathered from 106 patients (187 teeth) who underwent endodontic microsurgery from April 2012 to April 2018, with a minimum 3 months of post-operative follow-up. All the surgical procedures were performed by a single endodontist. All patients were treated with either the Er,Cr: YSGG laser or scalpel/burs. Outcome was divided into complete healing, incomplete healing, uncertain healing and non-healing depending on clinical and radiographic findings. The two first groups were considered as success while the latter 2 were considered as failure.

III. Results
One hundred and six patients with 187 teeth met the inclusion criteria and were included in the study.
Seventy of 73 teeth that underwent laser treatment healed while 90 of 114 teeth were considered successful when conventional methods were applied. The success rate was therefore 95.89% and 78.95%, respectively. Under the conditions of this study, it appears that the use of laser has a significant effect on the outcome between two groups ($p<0.005$).

IV. Conclusion
The present study shows that using the Er,Cr: YSGG laser gives a better success for retrograde endodontic treatment along with a tremendous decrease in the amount but also duration of the post-operative symptoms caused by inflammation. This study suggests that using Er,Cr: YSGG laser should no longer be a complement to contemporary techniques for endodontic surgery. Instead, it should be taught and recommended as a better alternative to the scalpel and bur.

***Keywords**: Laser, Endodontic, Retrograde, Retrospective, Apicoectomy
***Presenting Author**: Thanh An Hong
5th year student of Odontostomatology Faculty, University of Medicine and Pharmacy of Ho Chi Minh City, Vietnam, thanhanhong@gmail.com

OP-060

Comparison of Mechanical Properties of Reciproc, Reciproc Blue and T-endo MUST Nickel-Titanium Reciprocating Instruments

Taha Özyürek [*1], Mustafa Gündoğar [2]
[1]Department of Endodontics, Faculty of Dentistry, Istanbul Medeniyet University, Istanbul, Turkey, [2]Department of Endodontics, Faculty of Dentistry, Istanbul Medipol University, Istanbul, Turkey

I. Introduction
The aim of the present study was to evaluate and compare the cyclic fatigue resistance, torsional resistance and bending properties of Reciproc (RPC), Reciproc Blue (RPC Blue), and T-endo MUST (TEM) nickel-titanium (NiTi) reciprocating instruments.

II. Material and Method

Sixty RPC, 60 RPC Blue and 60 TEM instruments were included to the present study and divided into 3 subgroups (cyclic, torsion, and bending groups). Twenty instruments in each group were reciprocated in an artificial canal until fracture occurred and the time to fracture was recorded. The torsional strength of 20 instruments in each group was measured using a torsiometer after fixing firmly the apical 3 mm of the instrument. Also, 20 instruments in each group were tested for bending resistance using cantilever bending test. A scanning electron microscope was used to characterize the topographic features of the fracture surfaces of the broken instruments. The data was statistically analyzed using Kruskal-Wallis test with SPSS 21.0 software at 5% significance level.

III. Results
RPC Blue and TEM instruments showed significantly higher cyclic fatigue resistance than RPC instruments ($p<0.05$). The fractured cross-sectional surfaces revealed typical features of cyclic fractures, including crack origins, fatigue zones and overload fast fracture zones. RPC instruments showed significantly higher torsional and bending resistance than RPC Blue and TEM instruments ($p<0.05$). After torsional tests, the fractured cross-sectional surfaces revealed skewed dimples near the center of the fracture surfaces and circular abrasion streaks.

IV. Conclusion
Within the limitation of the present study, the RPC Blue and TEM instruments had improved resistance to cyclic fatigue and flexibility compared with RPC.

***Keywords**: Bending resistance, Cyclic fatigue, Nickel-titanium, Torsional strength, Static test
***Presenting Author**: Taha Özyürek
Department of Endodontics, Faculty of Dentistry, Istanbul Medeniyet University, Istanbul, Turkey, tahaozyurek@hotmail.com

OP-061

Healing of periapical lesions in children and adult patients following endodontic treatment

Iris Slutzky Goldberg[*], Marina Raginsky- Harari
Endodontics, HUHSDM, Jerusalem, Israel

I. Introduction
Several case reports demonstrated fast healing of periapical lesions in children. The age of the patient may have an influence on the remodeling rate of healthy bone or following fracture. As of yet, the difference between the healing rates of periapical lesions in children versus adults has not been published. The accepted endodontic literature recommends a follow up period of 6 month or 1 year following root canal treatment. The aim of this work was to compare the healing rate of periapical lesions following endodontic treatment in children and in adults, to revise the recommended follow up period for children and to set new guidelines for pediatric endodontics.

II. Material and Method
Twenty-five children aged 8-12 and 25 adults aged 40-60 were included in the study. Root canal treatment was performed in teeth with a periapical lesion, including Ca(OH)2 dressing and a follow-up period of 3-4 months. Data including the patient's age, gender, tooth type, degree of root development, periapical diagnosis, size of periapical lesion pre-op, post-op and at follow up, follow up period, dressing period and assessment of the root canal filling was collected.

III. Results
There was no significant difference between groups in pre-op and post-op average lesion size, however, a significant difference was found when the lesion size at follow up in the two groups was compared. Among 4 of the children, and neither of the adults, complete healing was observed at the final session, after the dressing period.

IV. Conclusion
The healing rate of periapical lesions in children is significantly faster than in adults and can sometimes be observed at the final treatment session. A short-term follow up protocol should be considered when treating children.

***Keywords**: Healing, Apical radiolucency, Children, Adults, Outcome
***Presenting Author**: Iris Slutzky Goldberg
Endodontics, HUHSDM, Jerusalem, Israel, dr.iris1@gmail.com

OP-062

Comparison of the shaping abilities of XP-endo Shaper and ProTaper Universal in oval-shaped canals: A micro-CT analysis

Handan Ersev[*1], Tuba Ayhan[2], Sebahat Ozler[2], Erdogan Fisekcioglu[3], Yunus Emre Halis[4], Goker Kuluslu[4], Jale Tanalp[2]

[1]Department of Endodontics, Faculty of Dentistry, Istanbul University, Istanbul, Turkey, [2]Department of Endodontics, Faculty of Dentistry, Yeditepe University, Istanbul, Turkey, [3]Department of Oral Diagnosis and Radiology, Faculty of Dentistry, Yeditepe University, Istanbul, Turkey, [4]3D Medical and Industrial Design Laboratory, Faculty of Medicine, Istanbul University, Istanbul, Turkey

I. Introduction

The aim of this study was to compare the shaping abilities of the XP-endo Shaper and ProTaper Universal systems in oval-shaped canals using micro-computed tomographic imaging.

II. Material and Method

The canal diameters of mandibular incisors were measured 4 mm from the apex radiographically and if the buccolingual diameter was 2.5 times larger than that of the mesiodistal diameter, the canals were verified as oval-shaped. The selected twenty two teeth were assigned to root canal preparation (n=11) with the ProTaper Universal or XP-endo Shaper. Teeth were scanned before and after root canal preparation using micro-computed tomography. Two-dimensional (area, perimeter, roundness, major diameter, and minor diameter) and 3-dimensional (volume, surface area, and structure model index) evaluation of the root canal was performed. Data were statistically compared between groups using the independent samples t-test and Mann Whitney-U test and within groups using the paired sample t-test.

III. Results

When the full canal length was evaluated, within groups, preparation significantly increased all tested parameters ($p<0.05$). The ProTaper Universal preparation resulted in a significantly larger canal volume ($p<0.012$) and removal of more dentin ($p<0.006$) compared with the XP-endo Shaper. Although the mean difference in surface area was significantly higher for the ProTaper Universal ($p<0.007$), no statistical difference was observed in regard to the untouched surface areas between the two systems ($p>0.05$). However, in regard to the apical third, the postoperative major diameter and surface area values were significantly higher in the ProTaper Universal group ($p<0.05$).

IV. Conclusion

The ProTaper Universal removed more tooth structure. No difference was detected in regard to the untouched walls of the oval canals prepared with the ProTaper Universal and the XP-endo Shaper. Neither technique could completely prepare the outline of oval-shaped root canals.

***Keywords**: Micro-computed tomography, ProTaper Universal, Root canal preparation, Single-file system, XP-endo Shaper

***Presenting Author**: Handan Ersev

Department of Endodontics, Faculty of Dentistry, Istanbul University, Istanbul, Turkey, ersev@istanbul.edu.tr

OP-063

Role of needle gauge and topical anaesthesia on pain perception during intra-pulpal injection - Double blinded randomized

Nandini Suresh[*], VishnuPriya K, Kinnari S, Dinesh Kowsky, Velmurugan N

Conservative Dentistry & Endodontics, Dr. Chennai, India

I. Introduction

Intrapulpal anaesthesia (IP) is considered as a last resort when other supplemental anaesthetic techniques fail to achieve profound anaesthesia in patients with symptomatic irreversible pulpitis. The pain perceived by the patient during IP administration is severe. In medical field, thinner gauge needles have proven to reduce the pain during injection. In endodontic literature, the use of 31 gauge needles (GN) for reduction of pain during IP has not been analyzed. Primary objective was to assess the pain during IP injection administered using 31GN and 27GN with/without topical anaesthesia as an adjunct. Secondary objective was to assess the success of anaesthesia with these techniques.

II. Material and Method

One hundred patients, on whom the Inferior alveolar nerve block (with 2% lidocaine) and supplemental anaesthetic techniques failed (during access opening), were recruited for the trial. Block randomization was computer generated and allocation concealment was done using opaque sealed envelopes. In group 1, IP was administered (2% lidocaine) with 31G insulin needles for 25 patients. To blind the patient short 27GN were used for IP administration in group 2. In group 3 and 4, Prilox gel was used as topical anaesthetic agent for 1 minute prior to IP administration with either 27GN or 31GN respectively. The VAS scoring was assessed immediately after IP (pain during IP) and after cleaning and shaping (anaesthetic success) by a blinded observer.

III. Results

Statistics was performed using OpenEpi version-3. Pain during IP with 31gauge needle with and without prilox gel was mild in 85% and 64% of cases respectively. Whereas, all patients had severe or very severe pain when IP was administered with 27GN (with and without Prilox). The success of IP anaesthesia was 100% (VAS scoring<3) in all the groups.

IV. Conclusion

Within the limitations of the study it was proved that the pain during IP anaesthesia was reduced significantly when administered with 31GN and Prilox.

***Keywords**: Intrapulpal anesthesia, Randomized control Trial, CONSORT, Prilox, Insulin needle

***Presenting Author**: Nandini Suresh

Conservative Dentistry & Endodontics, Dr. Chennai, India, nandini_80@hotmail.com

OP-064

Dentinal microcrack formation during root canal preparations by different rotary instruments

Ezekiel Barretto[*], Shishir Shetty

Conservative Dentistry and Endodontics, A.B.Shetty Memorial Institute of Dental Sciences, Mangalore, India

I. Introduction

The primary aim of chemo mechanical preparation is to completely remove the microorganisms, pulp tissue and debris and enlarging the canal diameter to receive an obturating material. At times, we inevitably end up damaging the root dentin, which becomes a gateway to dentinal cracks or even vertical root fractures, thereby failure of treatment.

In the last decade, the emergence of NiTi rotary instrumentation has transfigured the root canal treatment by reducing the operator fatigue, time required to complete the preparation and minimized the procedural errors as compared with hand instrumentation. However, rotary files with large tapers may cause significantly more complete and incomplete dentinal cracks.

Silk file introduced by Mani is a relatively new file system. The manufacturer claims that Silk's cross-sectional teardrop design eliminates the "screwing-in" effect.

The purpose of this study was to compare the incidence of dentinal micro cracks after instrumentation with 3 different types of NiTi files ie Silk (Mani), Twisted Files (Sybron endo) and ProTaper Universal (Dentsply).

II. Material and Method

One hundred extracted mandibular premolar teeth were collected. In the instrumentation sequence of ProTaper Universal, S1, S2, F1, F2 and F3 instruments will be used. Size 25 and 30 will be used incase of Twisted Files. Size 25 and 30 will be used in case of Silk Files. All roots will be sectioned perpendicular to the long axis at 3, 6, 9 mm from the apex .In the hand files instrumentation was done up to size 30. 20 teeth were left uninstrumented. Each specimen will be checked for the presence of dentinal defects under 25x magnification using a stereomicroscope.

III. Results

The Silk File Group presented with the highest incidence of dentinal micro cracks followed by the Twisted file group and the ProTaper Universal Group.

IV. Conclusion

All three Rotary file systems showed the occurrence of dentinal microcracks.

***Keywords**: Deninal microcracks, Rotary file, Nickel titanium, Stereomicroscope

***Presenting Author**: Ezekiel Barretto

Conservative Dentistry and Endodontics, A.B.Shetty Memorial Institute of Dental Sciences, Mangalore, India, barrettoezekiel@hotmail.com

OP-065

Comparison of fracture resistance of endodontically treated teeth restored with various post-core applications

Taha Ozyurek[1], Gulsah Uslu[2], **Can Topkara**[*3], Koray Yilmaz[4], Mustafa Gundogar[5], Imran Kocak[6]

[1]Endodontics, İstanbul Medeniyet University, İstanbul, Turkey, [2]Endodontics, Onsekiz Mart University, Canakkale, Turkey, [3]Endodontics, Ondokuz Mayıs University, Samsun, Turkey, [4]Endodontics, Mustafa Kemal University, Hatay, Turkey, [5]Endodontics, İstanbul Medipol University, İstanbul, Turkey, [6]Prosthodontics, Samsun Oral Health Care Hospital, Samsun, Turkey

I. Introduction

The aim of present study was to compare the fracture resistance of endodontically treated teeth restored with various post-core applications.

II. Material and Method

A hundred forty mandibular premolar teeth were used in the present study. The teeth were decoronated, treated endodontically, and restored with two post core systems FiberSite (n=40) and RelyX Fiber Post (n=80). The FiberSite Post System contained its own core structure. Two types of core material were used in RelyX Fiber Post groups: Clearfil DC Core Plus (n=40) and Filtek Bulk Fill Posterior (n=40). Half of each group of samples was crowned with CAD/CAM system CEREC Blocks. As a result, 7 different groups, each consisting of 20 specimens, one group served as a control group (n=20).

All posts and crowns cemented with Clearfil DC Core Plus. The fracture strength test was performed using a universal testing machine at constant crosshead speed of 1 mm/min. The force was applied in bucco-lingual direction with 30° using 6 mm round tip. The data were recorded and compared using the one-way ANOVA and post hoc Tukey tests at 5% significant level.

III. Results

The Group 4 (RelyX Fiber Post + Filtek Bulk Fill Posterior) showed the significantly highest fracture resistance followed by Group 3 (RelyX Fiber Post + Clearfil DC Core Plus), Group 5 (FiberSite + Crown). The difference between Group 3 and Group 5 was not significant ($p>0.05$). The fracture resistance of Group 2 (FiberSite + Clearfil DC Core Plus) increased 13% after the crown placement ($p<0.05$). However, in Group 3 (RelyX Fiber Post + Clearfil DC Core Plus) and Group 4 (RelyX Fiber Post + Filtek Bulk Fill Posterior) the fracture resistance decreased after crown placement 22%.

IV. Conclusion

In the fracture endurance tests of post-core systems, the presence of the crown structure can affect the results in different directions. Supporting the crown structure with a monoblock structure as far as possible increases the fracture resistance of the teeth.

***Keywords**: Post core , Fracture strength, Fiber post, CAD/CAM, Bulk fill, Monoblock
***Presenting Author**: Can Topkara

Endodontics, Ondokuz Mayıs University, Samsun, Turkey, can.tkara@hotmail.com

OP-066

Characteristic features and pulp-tooth volume ratio of C-shaped canals evaluated by CBCT

Igor Tsesis[1], **Abdulkadir Ozsahin**[*2], Eyal Rosen[1], Gul Sonmez[3], Meltem Dartar Oztan[2], KIvanc Kamburoglu[3]

[1]Endodontic, Department of Endodontology Goldschlager School of Dental Medicine Tel Aviv University, Tel Aviv, Israel, [2]Endodontic, Ankara University Faculty of Dentistry, Ankara, Turkey, [3]Dentomaxillofacial Radiology, Ankara University Faculty of Dentistry, Ankara, Turkey

I. Introduction

A thorough knowledge of the root canal anatomy and its variations is required for achieving successful outcome in root canal therapy. One of the anatomical variations of the root canal system is the C-shaped configuration. It is named so because of the C-shaped cross-sectional shape of the root and root canal. The aim of this study was to evaluate the prevalence of C-shaped root canals in mandibular second molars, and to assess the pulp-to-tooth volume ratios of the teeth with C-shaped canals, and the correlation of various factors such as; prevalence of root-canal treatment in C-shaped teeth, the incidence of contra-lateral C-shaped tooth (bi-lateral occurrence).

II. Material and Method

The study was approved by the institutional ethical committee. CBCT scans from 448 patients were acquired using a CBCT device (Planmeca Promax 3D Max, Helsinki, Finland). The CBCT scans were evaluated by two calibrated observers. Prevalence of the C-shaped canals was evaluated and the type was allocated using Dummer et al. 2017 classification. Patient gender, and age was recorded for each case. In addition, length, size, diameter and angle of the C-shaped canals were evaluated. For evaluation of the Pulp-to-tooth volume ratios reconstructed CBCT images were transferred as DICOM files to the software program 3D DOCTOR (Able Software Corp, Lexington, MA, USA) for volumetric measurements.

III. Results

C-shaped canal system was present in 15% (n=68) of the teeth. In the majority of C-shaped canals (74%) were symmetrical and were found in bilateral molars. Pulp-to-tooth volume ratios were found different for symmetrical and asymmetrical c shaped teeth.

IV. Conclusion

C-shaped canal systems varied considerably in regards to anatomical configuration, with a higher prevalence of three and two canals. CBCT can be a useful clinical tool for performing endodontic diagnosis and treatment for patients when C-shaped canal configuration suspected.

***Keywords**: C-shaped root canal, Volume ratio measurement, Mandibular second molar
***Presenting Author**: Abdulkadir Ozsahin

Endodontic, Ankara University Faculty of Dentistry, Ankara, Turkey, dentabdulkadir@icloud.com

OP-067

Root canal anatomy of South Asian Indian teeth

Shishir Singh[*]

Conservative Dentistry and Endodontics, Terna Dental College, Navi Mumbai, India

I. Introduction

A clear and proper understanding of the root canal anatomy and morphology of teeth is important for carrying out good root canal treatment. It is important to be familiar with a proper knowledge of canal numbers and divisions, which in turn helps to locate and negotiate them and aid in their successful management. The root canal anatomy of human teeth have always intrigued the dentist not knowing what to expect once access preparation is done and canal locating begins. The number of root canals and their varied morphology always poses a challenge in endodontic treatment sometimes resulting in a missed canal or an unfilled canal. These dead spaces are home to the microorganisms, which proliferate and spread causing an infection, resulting in a periapical infection.

The aim of this research was to study the following: (i) number of roots and their morphology; (ii) number of root canals per tooth; (iii) root canal configuration in each root using Vertuccis classification, with additional modifications; (iv) presence and location of lateral canals and intercanal communications.

II. Material and Method

The samples size comprised of 475 indigenous Indian teeth using the India ink dye penetration and decalcification technique followed by rendering the specimens transparent by immersion in methyl salicylate. The specimens were studied under magnification and photographs were taken using special lighting. The data was then recorded individually and processed using the SPSS statistical software.

III. Results

The results will be presented as tables and graphs as per the statistical analysis. The individual teeth with their root canal anatomy as per Vertucci is seen in the various samples and shown.

IV. Conclusion

The Indian teeth showed a varying anatomical pattern. The incidence of lateral canals as well as isthmuses is well documented.

***Keywords**: Clearing, India ink, Incisors, Premolars, Molars, Morphology
***Presenting Author**: Shishir Singh

Conservative Dentistry and Endodontics, Terna Dental College, Navi Mumbai, India, drshishirs@hotmail.com

OP-068

Clinical application of 3D technology in Endodontics

Cemre Koc[*1], Kivanc Kamburoglu[2], Gul Sonmez[2], Abdullah Capci[3]

[1]Endodontics, Başkent University, Faculty of Dentistry, Ankara, Turkey, [2]Dentomaxillofacial Radiology, Ankara University, Faculty of Dentistry, Ankara, Turkey, [3]Oral and Maxillofacial Surgery, Başkent University, Faculty of Dentistry, Ankara, Turkey

I. Introduction

Computer aided design software merged impression files with CBCT DICOM data to form a STL file-containing region of interest for teeth in pulp canal obliteration, surgical endodontics (apical resection, autotransplantation). For obliterated canals, 3D printed guides can provide preserving tooth integrity and avoiding root perforations. For surgical endodontics, this technology enables the clinician to evaluate the anatomy of surgical site and ensure atraumatic procedure for apical resection and autotransplantation.

II. Material and Method

For all treatments (root canal, apical resection and autotransplantation) CBCT images were taken with small FOV and 0.08 mm voxel size and intraoral impressions were obtained by using alginate. For the case of obliterated root canal, angle and length of the drill was virtually planned using software in order to eliminate the calcified section of root canal the pathway. Thereafter, the drill was inserted in the root canal by using the template and the root canal treatment was performed. For the case apical resection, intraoral and CBCT data were combined to design a guide due to the determination of access point for osteotomy. For the case of autotransplantation, similar to apical resection, intraoral and CBCT data were combined and then, phantom tooth was printed and used for preparation of the recipient site. Transplanted tooth was extracted and inserted the prepared socket.

III. Results

3D printed guides for clinical application were found to be applicable and timesaving during treatment procedure.

IV. Conclusion

The described method for these specific clinical situations revealed promising results. Further research and clinical trials should be carrying out for improve this technique and assess treatment outcomes.

***Keywords**: 3D technology, Root canal obliteration, Apical resection, Autotransplantation, CBCT
***Presenting Author**: Cemre Koc

Endodontics, Başkent University, Faculty of Dentistry, Ankara, Turkey, cemrekoc@gmail.com

OP-069

Evaluation of filling ability of two different root canal sealers used with two different root canal filling techniques

Etienne Medioni*, Sandra Balbi, Elodie Suso, Catherine Ricci

Restorative Dentistry and Endodontics, Dental Faculty of Nice, France

***Keywords**: Endodontic sealer, Bioceramic sealer, Epoxy resin based sealer, Single cone technique, SystemB, Confocal laser microscope

***Presenting Author**: Etienne Medioni

Restorative Dentistry and Endodontics, Dental Faculty of Nice, France, medioni@unice.fr

I. Introduction

The aim of the study was to investigate the ability of the Smart past bio® (bioceramic sealer) and AH Plus® used with a single cone technique C-Point® and the System B® to fill effectively the root canals and to determine the adaptation and distribution of sealers inside dentinal tubules.

II. Material and Method

The root canals of forty-four freshly extracted single-rooted teeth were prepared using a rotary single instrument F360® (35/100, 4 taper- Komet, France). Four groups of ten teeth each were formed: Smartpast bio/CPoint, Smartpast bio/SystemB, AH+/CPoint and AH+/SystemB. The two sealers were labelled with 0.1% Rhodamine B fluorescent dye. Four teeth were used as control (sealers without rhodamine B). The teeth were horizontally sectioned at 2, 5 and 9 mm from the apex. The sections were observed under a confocal laser microscope. The maximal penetration length of sealers inside the dentinal tubules was measured at each level. The percentage of gap-containing region to canal circumference was calculated using the CLSM 2 mm from the apex. Non-parametric statistical tests were achieved to compare both lengths and voids observed in the four groups.

III. Results

CPoint/SmartPaste Bio had the best penetration length at 5 mm (1528 µm, $p=0.0014$), and the groups CPoint/SmartPaste Bio and System B/SmartPaste Bio at 9 mm ($p<0.0001$). There was no significant difference at 2 mm. For the four groups and both sealers, the penetration length was significantly better at 9 mm than at 2 mm. At 2 mm from the apex, the groups System B/SmartPaste Bio and System B/AH Plus had significantly fewer voids than other groups (2.0% vs 8.8%, $p=0.0239$).

IV. Conclusion

The use of a bioceramic sealer with System B seems to be the best combination for sealing ability of the root canal. Further studies have to be achieved in order to verify the stability of physical, chemical and biologic properties of the sealer with warm compaction techniques.

Poster Research Presentations

P1-001

Effectiveness of rotary instruments and hand files in removing gutta percha from root canals during retreatment

Abeir Mansour*, Amany Badr
Endodontics, Mansoura University, Faculty of Dentistry, Mansoura, Egypt

I. Introduction
Cases in which the root canal therapy has failed can often be successfully retreated. A variety of different techniques have been used for removing filling materials. The aim of the present study was to investigate the efficacy of three rotary NiTi systems (D-Race, R-Endo, and Mtwo) and one hand instrumentation sequence to remove gutta-percha root fillings.

II. Material and Method

Forty recently extracted human single rooted teeth were used in this study. Access cavities into each pulp chamber were prepared using high speed diamond burs and Endo-Z with copious water spray. Each canal was prepared and obturated. The teeth were randomly divided into four groups (n=10) according to the instruments used for removal of the root canal filling materials. Group A: root canal retreatment with D-Race retreatment files. Group B: root canal retreatment with R-Endo system. Group C: root canal retreatment with Mtwo files. Group D: root canal retreatment with Hedström hand files. For all samples the working time of the procedure was measured with a digital stop watch. The following parameters were evaluated: Time for canal filling removal, canal wall cleanliness. Statistical analysis of data was done.

III. Results
The results showed that, rotary NiTi retreatment systems had no better cleansing ability than the conventional methods in the orthograde retreatment of failed root canal cases. Less time is required for the removal of gutta-percha from the retreated root canals by the use of rotary NiTi systems than hand instrumentation technique.

IV. Conclusion
It was concluded that rotary NiTi retreatment systems used for retreatment may be considered as a safe and effective method for gutta-percha removal during orthograde retreatment.

***Keywords**: Root canal retreatment, Rotary NiTi, Cleanliness, Time
***Presenting Author**: Abeir Mansour
Endodontics, Mansoura University, Faculty of Dentistry, Mansoura, Egypt, abeersalah1976@hotmail.com

P1-002

The effect of technique and time in sonic activation on the extrusion of sodium hypochlorite - An *in vitro* study

Natalia Iskandar Setiawan*, Bernard O Iskandar, Aryadi Subrata
Conservative Dentistry, Trisakti University, Jakarta, Indonesia

I. Introduction
Root canal preparation is an important step in endodontic treatment, and it plays a key role in treatment success. During chemo-mechanical preparation of root canal and activate final irrigant with sonic or ultrasonic or manual activator, necrotic debris, pulp remnants, microorganisms, dentin chips and irrigants can be extruded into the apical region. The aim of this study was to discover the effect of technique and time in sonic activation on the extrusion of sodium hypochlorite.

II. Material and Method
Thirty-two extracted single-rooted mandibular premolar teeth were selected and divided randomly into four groups and instrumented with rotary files until 35/.04 (M-Two, VDW). During final irrigation, group 1 filled with 5.25% sodium hypochlorite (NaOCl) solution and Endoactivator was activated for 30 seconds; group 2 filled with 5.25% NaOCl solution and Endoactivator was activated for 60 seconds; group 3 filled with 5.25% NaOCl solution and EDDY was activated for 30 seconds; group 4 filled with 5.25% NaOCl solution and EDDY was activated for 60 seconds. This sequence was repeated three times. The volume of extruded irrigant was measured by micropippet. The data were statistically analyzed with ANOVA two-ways test.

III. Results
The mean volume of apical extruded irrigant in technique group between Endoactivator and Eddy were 20,095 µL and 9,245 µL, while for duration group between 30 seconds and 60 seconds were 19,016 µL and 10,324 µL. Endoactivator extruded significantly greater amounts of irrigant than EDDY ($p<0.001$), whereas 30 seconds extruded significantly greater than amounts of irrigant than 60 seconds.

IV. Conclusion
The activation with EDDY for final irrigation had smaller extruded irrigant compared with Endoactivator. Considering the activation time, 60 seconds appeared to be advantageous due to their working time for activator.

***Keywords**: Apical Extrusion, Sonic activator, Duration, Sodium hypochlorite
***Presenting Author**: Natalia Iskandar Setiawan
Conservative Dentistry, Trisakti University, Jakarta, Indonesia, natalia.iskandar@gmail.com

P1-003

Effect of autoclave cycles on surface characteristics of S-file using Scanning Electron Microscopy

Pedram Iranmanesh*[1], Hamid Razavian[1], Hamid Mojtahedi[2], Rahman Nazeri[3]
[1]Department of Endodontics and Dental Research Center, School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran (Islamic Republic of), [2]Department of Oral and Maxillofacial Surgery, School of Dentistry, Tehran University of Medical Sciences, Tehran, Iran (Islamic Republic of), [3]Department of Endodontics, School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran (Islamic Republic of)

I. Introduction
Using autoclave is a common technique for sterilization of all files. Surface defects in endodontic instruments can lead to unwanted complications such as instrument fracture. The aim of this study was to evaluate the effect of autoclave cycles on surface characteristics of S-File using scanning electron microscopy (SEM).

II. Material and Method
The surface characteristics of seventeen #30 new S-Files were assessed by four steps including without autoclave, 1 autoclave cycle, 5 autoclave cycles and 10 autoclave cycles. Surface changes were examined by SEM under two magnifications of 200× and 1000×. Data were analyzed by SPSS 20 using repeated measures ANOVA and independent sample t-test.

III. Results
SEM measurements showed new files had debris and irregularities on their surfaces. When the autoclave cycles were increased, the mean of surface roughness also increased at both magnifications ($P<0.05$, repeated measures ANOVA). The mean of surface irregularities of the files was significantly higher at 1000× compared to 200× in all stages ($p<0.05$, independent t-test).

IV. Conclusion
Sterilization by autoclave increased the surface irregularities of the S-files and these were associated with the number of autoclave cycles.

***Keywords**: Endodontic instruments, Root canal therapy, Scanning Electron Microscopy, Sterilization, Surface characteristic
***Presenting Author**: Pedram Iranmanesh
Department of Endodontics and Dental Research Center, School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran (Islamic Republic of), pedram.iranmanesh@yahoo.com

P1-004

Effect of up-and-down speeds on canal centering ability and stress generation of NiTi rotary instruments

Keiichiro Maki*, Daisuke Tokita, Shunsuke Kimura, Miki Nishijo, Arata Ebihara, Takashi Okiji
Department of Pulp Biology and Endodontics, Division of Oral Health Sciences, Graduate School of Med, Tokyo Medical and Dental University, Tokyo, Japan

I. Introduction
The aim of this study was to evaluate the effect of different speeds of up-and-down motion on canal centering ability and torque/force generation of nickel-titanium (NiTi) rotary instruments.

II. Material and Method
Twenty-one simulated resin canal blocks with a J-shaped canal (Endo Training bloc, 0.02 taper, 17 mm in length; Dentsply Sirona, Ballaigues, Switzerland) were prepared with ProTaper NEXT (PTN; Dentsply Sirona) X1, X2, and X3 instruments using an original automated root canal instrumentation and torque/force analyzing device with different up-and-down speeds of 10, 50 and 100 mm/min (low-speed, medium-speed and high-speed group, respectively). Pre- and post-instrumentation images were superimposed and centering ratios were calculated at 0, 0.5, 1, 2 and 3 mm from the apex. Maximum vertical force and torque values were recorded. Results were statistically analyzed using one-way analysis of variance and Tukey's test.

III. Results
At 0, 0.5, 1 and 2 mm from the apex, the high-speed group showed the lowest centering ratio (i.e., least deviation), followed by the medium-speed and low-speed groups ($p<0.05$). Vertical forces (downward and upward) tended to increase with increasing the up-and-down speed, and, in X2 and X3 instruments, the high-speed and/or medium speed groups generated significantly larger values compared with the low-speed group ($p<0.05$). The high-speed and/or medium-speed groups also generated significantly larger clockwise torque compared with the

low-speed group ($p<0.05$) in all instruments. Two and one X2 instruments fractured in the high-speed and low-speed group, respectively.

IV. Conclusion

The up-and-down speed influenced on the canal centering ability and stress generation of PTN; the high-speed group showed the best centering ability whereas tended to generate larger vertical force and torque compared with the medium-speed and low-speed groups.

***Keywords**: Nickel-titanium rotary file, Speed of up-and-down motion, Centering ability, Vertical force, Torque, ProTaper NEXT
***Presenting Author**: Keiichiro Maki

Department of Pulp Biology and Endodontics, Division of Oral Health Sciences, Graduate School of Med, Tokyo Medical and Dental University, Tokyo, Japan, k.maki.endo@tmd.ac.jp

P1-005

Effect of light activated disinfection on the adhesion of endodontic sealers to dentin

Kathryn Diane Joy Ilagan-Manzano*, Grace Ellen Dey, Illuminada Viloria, Katrina De Luna, Phides Nunez

Graduate School, University of The East, Manila, Philippines

I. Introduction

Light activated disinfection (LAD) is a technique in disinfection that combines the action of light and a photosensitizer to chemically react to one another to produce free radicals and Reactive Oxygen Species (ROS). This substance will cause cellular damage to the microorganism. LAD has shown great potential in the treatment of localized bacterial mediated infections. The aim of this study was to perform an in vitro experiment that will observe the effect of LAD on the adhesion of resin-based sealer and ZOE-based sealer to dentin when used as an adjunct to root canal disinfection.

II. Material and Method

Twenty extracted single-rooted teeth were selected and prepared using a rotary system. The samples were divided into four Groups; Group A- AH plus without LAD exposure, Group B- AH plus with LAD, Group C – ZOB seal without LAD exposure while Group D – ZOB seal with LAD exposure. Each root was sectioned into 2 slices (1mm thick), nearest to the CEJ resulting in 40 tooth slabs as specimens (10 per group). The samples were then subjected to push-out test. Data were analyzed using unpaired t-tests, with significance set at $p<0.05$.

III. Results

The results revealed that there was no statistical significance occurred between the control group and the experimental group. Group A, (10.64 +/- 2.20 MPa) in comparison to Group B (10.77 +/-2.88 MPa) while in Group C (1.47 +/-0.41MPa) in comparison with Group D (1.49 +/-0.57MPa).

IV. Conclusion

In conclusion, the adhesion of both resin-based sealer and ZOE-based sealer on the radicular dentin were not affected by the ROS produced by LAD when used as an adjunct in disinfecting the root canal system. This is due to the minimum exposure of the dentin surface to the residual oxidant substance and the selectivity of the photosensitizer to bind to radicular dentin.

***Keywords**: Light activated disinfection, Endodontic sealer, Adhesion, Push-out test
***Presenting Author**: Kathryn Diane Joy Ilagan-Manzano

Graduate School, University of The East, Manila, Philippines, dianeilagan.dmd@gmail.com

P1-006

Comparison of smear layer removal using 40% citric acid with or without surfactant: A SEM study

Pawel Andersz[1], Alicja Nowicka[2], **Mariusz Lipski***[3]

[1]Dental Practice, Szczecin, Poland [2]Department of Conservative Dentistry and Endodontics, Pomeranian Medical University of Szczecin, Szczecin, Poland [3]Department of Preclinical Conservative Dentistry and Preclinical Endodontics, Pomeranian Medical University of Szczecin, Szczecin, Poland

I. Introduction

Citric acid is used to chemically soften the root canal dentin, to dissolve the smear layer, and to increase dentin permeability. Surfactant is added to the citric acid solution to increase the cleaning efficacy and the ability of the chelator to penetrate the dentin. The aim of this in vitro study was to examine the smear layer removal using 40% citric acid with or without surfactant by scanning electron microscopy (SEM).

II. Material and Method

Sixteen extracted single-rooted human teeth were used in the study. The crowns were removed at the cementoenamel junction. The root canals were cleaned and shaped using E3 Endostar nickel-titanium rotary files powered by the endodontic micromotor to a size 30.04. Irrigation was performed with 1 ml of 2.5% of NaOCl solution after each instrument change. The final irrigation (2 ml) was as follows: group I - 40% citric acid with surfactant (8 teeth) and group II - 40% citric acid without surfactant. The root canals were finally irrigated with 5 ml of distilled water to remove any precipitate. The roots were then gently split into two halves using a chisel and examined under environmental scanning electron microscopy at x1000 magnification. The amount smear layer at the coronal, middle, and apical regions of roots were scored according to Hülsmann et al. Data were statistically analyzed by Shapiro-Wilk, Kruskal-Wallis and median tests ($p\leq0.05$).

III. Results

There were no statistical significant differences among groups. Scores 1 and 2 were recorded in 75% in group I and 83.3% in group II. A statistically significant difference was found between the apical third and the middle and coronal thirds for both groups. In the apical third canal walls were often contaminated by smear layer.

IV. Conclusion

Surfactant addition to 40% citric acid does not improve its cleaning effectiveness.due to their working time for activator.

***Keywords**: Smear layer, Chelator, Surfactant, SEM
***Presenting Author**: Mariusz Lipski

Department of Preclinical Conservative Dentistry and Preclinical Endodontics, Pomeranian Medical University of Szczecin, Szczecin, Poland, mariuszlipski66@tlen.pl

P1-007

Effect of autoclave sterilization on torsional fracture resistance of NiTi instrument

Woo Young Kim*[1], Duck-Su Kim[2], Seok Woo Chang[2], Kyoung-Kyu Choi[2], Ji-Hyun Jang[2]

[1]Department of Conservative Dentistry, Kyung Hee University Dental Hospital, Seoul, Republic of Korea, [2]Department of Conservative Dentistry, School Of Dentistry, Kyung Hee University, Seoul, Republic of Korea

I. Introduction

The purpose of this study is to compare the torsional fracture resistance of four different NiTi rotary file systems and to evaluate the effect of autoclave sterilization on the torsional fracture resistance.

II. Material and Method

Four different NiTi instruments with similar apical sizes and different manufacturing methods and movements were used; PTU (ProTaper Universal, Dentsply), K3X (K3XF, SybronEndo), EDM (Hyflex EDM, Coltene), TFA (TF adaptive, SybronEndo). For group 1 (Gr 1), files (n=10) in each group were tested without autoclave sterilization. For group 2 (Gr 2) and 3 (Gr 3), files (n=10) in each group were autoclaved 3 cycles and 7 cycles before test, respectively. Torsional fracture test was accomplished according to ISO 3630-1 standards. The maximum torque (Ncm) and angular deflection (°) until torsional fracture were measured. All measured values were statistically analyzed by one-way ANOVA with Bonferroni post-hoc comparison test ($p<0.05$). Two-way ANOVA was performed to determine the interaction between type of NiTi files and autoclave sterilization condition ($p<0.05$). The fractured surfaces of the instruments were observed under FE-SEM.

III. Results

TFA had significantly lower maximum torque than PTU, K3X and EDM files within the same autoclave condition. Within the same NiTi file system, maximum torque was not significantly different according to the autoclave condition, except EDM. Within the same type of files, only 7 cycles autoclaved PTU had significantly higher angular deflection than PTU without autoclave.

IV. Conclusion

Within the limitations of the present study, in most cases, autoclave sterilization did not significantly affect the torsional fracture resistance of NiTi instruments. TF adaptive file had a lower maximum torque than other NiTi files in torsional fracture. The fracture angles tended to be in the order of TFA> EDM> K3X> PTU.

***Keywords**: NiTi file, Torsional fracture, Autoclave sterilization, SEM
***Presenting Author**: Woo Young Kim

Department of Conservative Dentistry, Kyung Hee University Dental Hospital, Seoul, Republic of Korea, kyy0317@naver.com

P1-008

The effect of different application time of sonic irrigation and passive ultrasonic irrigation techniques on intracanal

Hernika Harperiana*, Juanita A Gunawan, Anastasia E Prahasti

Conservative and Endodontic Department, Trisakti University, Jakarta, Indonesia

I. Introduction

The purpose of this study was to assess the effect of different application time of sonic irrigation and passive ultrasonic irrigation techniques on intracanals smear layer removal in the apical third portion of the straight root canal.

II. Material and Method
Straight root canals of 56 extracted mandibular premolars were used. The teeth were randomly divided into four equal groups (n=14). Root canals of the teeth were prepared to size 25/.06 and at the end of preparation, were irrigated with 5.25% sodium hypochlorite, followed by 17% EDTA and activated with passive ultrasonic irrigation (PUI) (Irrisafe; Satelec, France) in 30 sec (group 1), activated with sonic EDDY (EDDY; VDW, Munich, Germany) in 30 sec (group 2), activated with PUI in 60 sec (group 3), and activated with EDDY in 60 sec (group 4). Roots were split longitudinally, and the canal walls were subjected to scanning electron microscopy. The presence of smear layer at apical levels was evaluated using a 5 point scoring system and statistically analyzed using Kruskal-Wallis and Mann-Whitney tests.

III. Results
Smear layer removal with EDDY in 30 sec and PUI in 30 sec was not significantly different ($p>0.05$), also EDDY in 60 sec and PUI in 60 sec, but EDDY in 60 sec was superior to EDDY in 30 sec ($p<0.005$). PUI in 60 sec and PUI in 30 sec was not significantly different ($p>0.005$).

IV. Conclusion
In this limited laboratory study, canal irrigation with 5.25% NaOCl and 17% EDTA with different application time and activation techniques were equally effective in removing the smear layer from the canal walls of the straight roots.

***Keywords**: Root canal irrigation, Passive ultrasonic irrigation, Sonic activation, Smear layer
***Presenting Author**: Hernika Harperiana
Conservative and Endodontic Department, Trisakti University, Jakarta, Indonesia, hernikaharperiana@gmail.com

P1-009

Evaluation of XP-endo Finisher efficiency in removing smear layer

Alexandr Mitronin*, Dina Galieva, Maria Korchagina, Diana Ostanina, Vladislav Mitronin, Maria Ilina
Department of Cariesology and Endodontics, Moscow State University of Medicine and Dentistry Named After A.I. Evdokomov, Moscow, Russian Federation

I. Introduction
Smear layer inevitably formed during instrumentation, plugs dentinal tubules and prevents thorough disinfection of root canal system and sealer penetration, thus impairing the treatment outcome. The Objective of the present study is to evaluate 'in vitro' efficiency of smear layer removal by conventional chemo-mechanical preparation alone and with a new instrument XP-endo Finisher.

II. Material and Method
40 single-rooted premolars were divided into two equal groups "A" and "B", 20 molars constituted group "C". Samples of all groups were prepared with ProFile NiTi instruments, 3% NaOCl and 17% EDTA. In groups "B" and "C" XP-endo Finisher was added to remove smear layer. Quality of smear layer removal was assessed with SEM in coronal, middle and apical parts of the canal according to Hülsmann criteria.

III. Results
There were no statistically significant differences ($p<0.05$) in amount of smear layer in coronal part of the canals in groups "A" and "B" in the first part of the study. In the middle part there was less smear layer in group "B" (1.25) than in group "A" (1.95). There was almost no smear layer in the apical part of group "B" samples (1.35), whereas amount of smear layer in group "A" samples was significant (2.25). The second part of the study showed that after smear layer treatment there were no statistically significant differences ($p<0.05$) between group 'B' and 'C' samples in amount of residual smear layer in coronal and middle parts of canals. Group 'C' samples showed almost no smear layer in the apical third, but scores according to Hülsmann criteria were somewhat higher (1.55) than in group 'B' (1.35).

IV. Conclusion
Introduction of XP-endo Finisher into the chemo-mechanical instrumentation protocole increases the efficient of smear layer removal throughout the root canal. XP-endo Finisher proved to be highly efficient in removing smear layer from apical third of root canals with complex anatomy.

***Keywords**: Smear layer, XP-endo Finisher, Chemo-mechanical root canal treatment
***Presenting Author**: Alexandr Mitronin
Department of Cariesology and Endodontics, Moscow State University of Medicine and Dentistry Named after A.I. Evdokomov, Moscow, Russian Federation, mitroninav@list.ru

P1-010

Effect of vibration frequency in ultrasonic cleaning on removal of the root canal smear layer

Miyako Ono*, Nagahiro Miyamoto, Yasuharu Tai, Jun Yamamoto, Shun Ono, Takumasa Yoshida, Noriyasu Hosoya
Department of Endodontology, Tsurumi University School of Dental Medicine, Kanagawa, Japan

I. Introduction
The purpose of this study was to observe the effect of ultrasonic vibration frequency on removal of the smear layer and investigate efficient smear layer removal methods.

II. Material and Method
Twenty single root extracted teeth were used. The roots were cut 15 mm from the apex, and a canal was prepared up to #40 with NiTi files. Five of the test-teeth were randomly classified into each of the following groups. Group 1: cleaning with 6% NaOCl as a control, Group 2: cleaning with EDTA solution (4.0 ml/min), Group 3: filling the root canal with EDTA solution and cleaning with ultrasonic vibration of 30 kHz, and Group 4: filling the root canal with EDTA solution and cleaning with ultrasonic vibration of 40 kHz. In each group, the cleaning time was 15 s or 30 s. After cleaning, the root canal wall was observed with scanning electron microscope (SEM). The status of the smear layer was classified coronally, centrally, and apically, and assessed by three endodontists using the system proposed by Torabinejad et al. One-way ANOVA and multiple comparison tests were used to test for statistically significant differences.

III. Results
The smear layer was not removed by cleaning with NaOCl. In Groups 2, 3, and 4, the smear layer removal effect was better with cleaning for 30 s than for 15 s. Compared with the apex side, the removal effect improved with movement to the center and coronal side. In all locations, the removal effect was better with ultrasonic vibration, and apically and centrally the removal effect was better in Group 4 than in Group 3.

IV. Conclusion
In root canal cleaning using EDTA solution, the smear layer could be more efficiently removed with the addition of ultrasonic vibration. The results also suggest that ultrasonic vibration of 40 kHz is suitable for efficient removal of the smear layer.

***Keywords**: Smear layer, Ultrasonic vibration, EDTA, Root canal preparation
***Presenting Author**: Miyako Ono
Department of Endodontology, Tsurumi University School of Dental Medicine, Kanagawa, Japan, ono-m@tsurumi-u.ac.jp

P1-011

Factors affecting cyclic fatigue resistance between tapering and metallurgic improvement of NiTi rotary files

Panupong Jiradechochai*[1], Chantida Pawaputanon Na Mahasarakham[1], Kunwara Thariya[1], Kamonporn Wangkuenklang[2], Soranan Jaroonsakchai[2], Pichayanan Chantarayotha[3]
[1]Department of Restorative Dentistry, Khon Kaen University, Khon Kaen, Thailand, [2]Dental Department, Nondang Hospital, Amphur Nondang, Nakhon Ratchasima, Thailand [3]Dental Department, Khao Suankwang Hospital, Amphur Khao Suankwang, Khon Kaen, Thailand

I. Introduction
The purpose of this study was to evaluate factors affecting cycling fatigue resistance compared between different tapers and metallurgic improvement of NiTi rotary files.

II. Material and Method
A total of 90 files; no.25, 30, 35 of K3 files (0.02, 0.04 fixed taper), and no.25, 30, 35 of K3XF files (0.04 fixed taper), were divided into 9 groups of 10 files each. The samples were rotated until fracture, and the number of cycles to failure was recorded. The surfaces of fractured instruments were analyzed by scanning electron microscope (x200) to determine characteristics.

III. Results
The results showed that K3 files, which were less taper, had more numbers of cycle to failure than K3XF files at the same size ($P<0.01$). SEM analysis revealed that the fractured surfaces of all instruments were due to cyclic fatigue.

IV. Conclusion
Base on this study, the taper has more effects on cyclic fatigue resistance than metallurgic improvement by R-phase heat treatment of NiTi rotary files with identical geometric characteristics.

***Keywords**: Cyclic fatigue resistance, Taper, Metallurgic improvement, NiTi rotary file, K3, K3XF
***Presenting Author**: Panupong Jiradechochai
Department of Restorative Dentistry, Khon Kaen University, Khon Kaen, Thailand, goldie_dome@hotmail.com

P1-012

Cyclic fatigue resistance of XP-Endo Shaper, K3XF and Protaper Gold nickel-titanium instruments

Cangul Keskin, Ugur Inan, Duygu Hazal Guler,
Elif Kalyoncuoglu*
Department of Endodontics, Ondokuz Mayis University, Faculty of Dentistry Department of Endodontics, Samsun, Turkey

I. Introduction
The aim of this study was to compare the cyclic fatigue resistance of ProTaper Gold (PTG; Dentsply Maillefer, Ballaigues, Switzerland), K3XF (SybronEndo; Orange, CA, USA) and XP-endo Shaper (FKG Dentaire; La Chaux-de-Fond, Switzerland) nickel-titanium rotary instruments at intracanal temperatures.

II. Material and Method
Eighteen XP-endo Shaper (30.01), 18 K3XF (30.04) and 18 ProTaper Gold F3 (30.09v) instruments were used to test cyclic fatigue resistance at intracanal temperature (35±2°C). The instruments were tested in a metal block that simulated a canal curvature angle of 60° and curvature or radius of 5 mm. All instruments were operated until fracture occurred, then numbers of cycles to failure (NCF) was calculated. The lengths of fractured fragments were measured with a digital caliper. The data were analyzed statistically using the one-way analysis of variance (ANOVA) and Tukey post hoc tests with significance set at $p<0.05$.

III. Results
The XP-endo Shaper instruments showed a significantly higher number of cycles to fracture than the K3XF and ProTaper Gold instruments ($P<0.05$). There was no difference between the ProTaper Gold and K3XF instruments ($p>0.05$).

IV. Conclusion
XP-endo Shaper instruments exhibited greater cyclic fatigue resistance compared with the other instruments at intracanal temperature.

***Keywords**: Cyclic fatique, Nickel titanium, K3XF, Intracanal temperature
***Presenting Author**: Elif Kalyoncuoglu
Department of Endodontics, Ondokuz Mayis University, Faculty of Dentistry Department of Endodontics, Samsun, Turkey, elif_kalyoncu@hotmail.com

P1-013

Centering ability of two rotary instruments - WaveOne and ProTaper Universal - in simulated canal shaping

Anh Hong Le*
Odonto-Stomatology, Hong Bang International University, Ho Chi Minh, Vietnam

I. Introduction
Root canal preparation is essential for success in endodontic herapy. The aim of the process is to clean the canal and establish a continuous tapered shape while maintaining the original path of the canal, this means centering ability. Recently, there are many instruments which have been introduced many advantages, WaveOne is one of them. The new file is a single-file reciprocating shaping technique to achieve the final shape. Furthermore, the files are manufactured using M-Wire technology, improving strength and resistance to cyclic fatigue by up to nearly four times in comparison with other brands of rotary NiTi files. This study was designed to compare two rotary instruments: WaveOne and ProTaper Universal in regard to centering ability when shaping simulated canals.

II. Material and Method
This in vitro study used 20 curved L-shaped simulated canals in plastic blocks (EndoTraining Bloc-L, Dentsply-Maillerfer, Ballaigues, Switzerland) that were standardized for length, taper and curvature. Two groups of 10 specimens each (group 1-WaveOne, group 2-Protaper Universal) were prepared by the same experienced operator according to the manufacturer's instruction. Pre- and post- instrumentation digital images were superimposed to analyze centering ability. Total amount of resin removal, direction of transportation, and centering ratio were measured at 11 levels, corresponding with each of 1mm from foramen to 11mm. Data was statistically analyzed using the Independent-samples T test and Mann-Whitney test.

III. Results
Both ProTaper and WaveOne instruments removed more resin on the inner side (concave) of the curvature in comparison with the outer side (convex) of the curvature. WaveOne instrument led to more preparation than ProTaper instruments. Both instruments had the same centering ability when shaping simulated canals ($p>0.05$) Both instruments tended to create more transportation at curve portions of the canals.

IV. Conclusion
Both rotary-file systems showed relatively good shaping ability and can be suitable for shaping of curved canal.

***Keywords**: Cleaning and shaping root canal, Endodontic therapy, WaveOne and rotary ProTaper Universal rotary instruments, Centering ability, Transportation
***Presenting Author**: Anh Hong Le
Odonto-Stomatology, Hong Bang International University, Ho Chi Minh, Vietnam, leanhhong2476@yahoo.com

P1-014

Evaluation of the efficacy of XP-endoFinsher file to reduce bacterial count in canals prepared to different apical sizes and tapers (in vitro study)

Mohamed A. Hamed*[1], Wael H. Kamel[2], Ashraf S. Refaei[3], Mohamed E. Rokaya[1]
[1]Department of Endodontics, Faculty of dentistry, Al-Azhar University, Assuit, Egypt, [2]Department of Endodontics, Faculty of Dentistry for Girls, Al-Azhar University, Cairo, Egypt, [3]Department of Endodontics, Faculty of Dentistry fo Boys, Al-Azhar University, Cairo, Egypt

I. Introduction
The goal of endodontic treatment is to control apical periodontitis. One feature of bacteria in biofilm is increased resistance to antimicrobial agents. Failure to completely eradicate intraradicular microorganisms may contribute to secondary endodontic infection. Complexity of root canal anatomy is also a deciding factor in successful endodontic therapy, as it resists penetration of irrigant solutions into narrow, curved canals, also vapor lock phenomena are the factors that contribute to failed endodontic therapy and persistent microbial species. so, mechanical debridement in these limited spaces is ideal for reduction of this bacterial load by itself and by allowing irrigant penetration deeper into the canal, finally by irrigant agitation that improving its antibacterial properties. Many tools and a lot of materials were developed to enhance bacterial reduction in root canals but which of them is ideal. this is the question?

II. Material and Method
Seventy-five extracted human mandibular first molars, teeth were radiographically examined to exclude any abnormalities the teeth should had a root curvature ranging from 15°-35°, then underwent for sterilization using gamma radiation. Furthermore, inoculation of root canals with E. faecalis was done using a disposable sterile plastic syringe. The bacterial sampling was done three times for each root throughout the study: A-After incubation of root canals. B-After instrumentation of root canal. C-After using the XP endofinisher file .The Root canals in each group were instrumented using Race rotary files, moreover cleaning was accomplished using a combination of saline solution and XP endofinisher file.

III. Results
A statistically significant difference in bacterial count wa s found between (Before Instrumentation) on one hand a nd each of (after instrumentation) and (after XPF) on the other hand where ($p\leq0.001$). Also, a statistically significant difference was found between (after instrumentation) and (After XPF) where ($p\leq0.001$).

IV. Conclusion
The Xp endofinisher file is an effective tool in reducing th e intracanal bacteria.

***Keywords**: XP-endo Finisher file, Endodontic biology, Race files, Bacterial count
***Presenting Author**: Mohamed Ahmed Mahmoud Hamed
Department of Endodontics, Faculty of Dentistry Al Azhar University, Assuit, Egypt, hdc.obourcity@gmail.com

P1-015

Comparison of antimicrobial efficacy of lasers, chlorine dioxide, sodium hypochlorite against enterococcus faecalis

Sunil Rao*, Aditi Amin
Endodontics and Conservative Dentistry, Yogitaa Dental College and Hospital, Khed Maharastra India, Khed, India

I. Introduction
There are facultative anaerobic gram +ve bacteria present in the biofilm and they infiltrate the dentinal tubules. The use of mechanical instrumentation alone cannot clean these tubules. Hence irrigants have to be used along with them. Sodium hypochlorite which is widely used in present day endodontics has several issues with its safety concerns. So, the need is to look for newer irrigants and equipment have become essential. Hence, the need was felt to use safer alternatives like chlorine dioxide and lasers to disinfect the root canal.

II. Material and Method
Forty healthy permanent teeth were decoronated at cemntoenamel junction.The root length is standardized to 14 mm and canal is prepared to size F3. A suspension of E. faecalis is adjusted to 0.5 turbidity and injected into the teeth. The inoculated specimen was placed in vials of brain heart infusion and procedures are performed after incubation anaerobically at 37°C.

Group A- Diode laser
Group B- 5 ml of chlorine dioxide
Group C- 5 ml of sodium hypochlorite
Group D- Normal saline

III. Results
The results of the present study showed that sodium hypochlorite (99%) & chlorine dioxide (92%) were both effective in eliminating E.faecalis when compared to diode lasers.

IV. Conclusion
From the above results it can concluded that the use of chlorine dioxide as aroot canal irrigant might prove to be advantageous considering the several undesirable charaterstics of sodium hypochlorite.

***Keywords**: Antimicrobial efficacy, Enterococcus faecalis, Chlorine dioxide, Diode lasers
***Presenting Author**: Sunil Rao
Endodontics and Conservative Dentistry, Yogitaa Dental College and Hospital, Khed Maharastra India, Khed, India, sunnyrao774@gmail.com

P1-016

Screening of a representative gene related to thalamic neuronal activation following dental pulp inflammation in rats

Hiroki Murano[*], Tomoatsu Kaneko, Su Yee Myo Zaw, Phyo Pyai Sone, Mitsuhiro Sunakawa, Takashi Okiji
Pulp Biology and Endodontics, Tokyo Medical and Dental University, Tokyo, Japan

I. Introduction
We have reported that pulp inflammation induces neuronal activation in the contralateral thalamus in rats (Kaneko et al., J Endod, 2013). This study aimed to screen representative gene(s) associated with the neuronal activation with a microarray analysis.

II. Material and Method
All experiments were conducted under the approval of the Animal Care Committee, TMDU (A2018-189A).The left maxillary first molar of 5-week-old male Wistar rats was treated as follows (n=3 each);

Group 1: Pulp exposure followed by application of mustard oil (an inflammatory irritant; 0.5 µl) and temporally sealing.

Group 2: Injectionof a local anesthetic (2% lidocaine with epinephrine, 1:80 000), followed by the same treatment as in Group 1.

Group 3: Untreated.

Sixty min after the mustard oil application, thethalamus was retrieved. Total RNA from contralateral thalamus (n=1, each Group) and ipsilateral thalamus (n=1, Group 3) was analyzed using a microarray system (Geneatlas™, Affymetrix).To confirm the microarray results, RT-PCR was performed for contralateral thalamus (n=3, each group) and ipsilateral thalamus (n=3, Group 3). Finally, mRNA expression in both sides of the thalamus (n=3, each group) was analyzed with real-time PCR.

III. Results
The microarray analysis identified KCNA1 (potassium voltage-gated channel subfamily A member 1) as a most significantly decreased gene in Group 1. KCNA2 and KCNA3 were not different in each group. RT-PCR confirmed the decrease of KCNA1 mRNA in the contralateral thalamus of Group 1.Real-time PCR showed that the KCNA1 mRNA level in the contralateral thalamus of Group 1 was decreased significantly as compared with that in the other groups, and that the level was not significantly different between Groups 2 and 3.

IV. Conclusion
KCNA1 was detected as a representative gene related to the pulp inflammation-induced neuronal activation in rat thalamus.

***Keywords**: Thalamic, Pulp inflammation, KCNA1, Rats, Microarray, RT-PCR
***Presenting Author**: Hiroki Murano
Pulp Biology and Endodontics, Tokyo Medical and Dental University, Tokyo, Japan, muraendo@tmd.ac.jp

P1-017

Comparison of antimicrobial efficacy of silver nanoparticles and chlorhexidine when used alone and in combination – A pilot study

Duraivel Dasarathan[*], Charanya Seetharaman, Srinivasan Manali Ramakrishnan
Department of Conservative Dentistry and Endodontics, Sri Venkateswara Dental College and Hospital, Chennai, India

I. Introduction
The objective of the study was to compare the antimicrobial efficacy of silver nanoparticles and 2% chlorhexidine gluconate when used alone and in combination under ex vivo conditions.

II. Material and Method
Eighteen freshly extracted single rooted tooth were selected. Radiographs were taken to check for any calcification, supplementary canals or root decay. Crowns were sectioned and root canals were prepared. The canals were irrigated using 5.25% sodium hypochlorite and 17% EDTA. The samples were then sterilized using autoclave and apex was sealed with Cavit G. The microorganisms were standardized to 0.5 McFarland scale. The teeth were then contaminated with the test microorganisms Enterococcus faecalis, Candida albicans and Klebsiella pnuemoniae. The teeth were sealed coronally and incubated at 37°C for 2 weeks. Samples were divided into 3 test groups of 6 samples each. Test drugs were placed

into the canals based on the group they belonged to. Group A received silver nanoparticles, group B received combination of chlorhexidine and silver nanoparticles, group C received chlorhexidine and samples were incubated. The antimicrobial efficacy was checked after 48 hours and 10 days. Samples were collected using sterile paper points and placed in a test tube containing 1 ml of saline and incubated at 37°C for 30 minutes. Colony forming units (CFU) were counted using a counting chamber. The data were tabulated and analyzed using SPSS version 22.

III. Results
A statistically significant reduction in the CFU was obtained in the samples that belonged to the group that received a combination of CHX and AgNP when compared to the other two groups. The combination showed highest efficacy against C.albicans among the three organisms tested.

IV. Conclusion
The present study demonstrates the antimicrobial efficacy of a novel mixture of CHX-AgNP solution and it may be developed as a promising antimicrobial agent against endodontic flora.

***Keywords**: Nanoparticle, 2% chlorhexidine, Intracanal medicament, E. faecalis
***Presenting Author**: Duraivel Dasarathan
Department of Conservative Dentistry and Endodontics, Sri Venkateswara Dental College and Hospital, Chennai, India, durai_bds@yahoo.com

P1-018

The potency of arrowleaf sida (Sida rhombifolia L.) root extract as an alternative agent in endodontic treatment

Maria Tanumihardja[*1], Nurhayati Natsir[1], Indrya Kirana Mattulada[1], Lukman Muslimin[2]
[1]Conservative Dentistry, Hasanuddin University, Makassar, Indonesia, [2]Pharmacy, Hasanuddin University, Makassar, Indonesia

I. Introduction
Arrowleaf sida (Sida rhombifolia L.), an herbal-based therapeutic plant, have long been used in Indonesia for treating gingivitis, periodontitis, and other oral infections. However, only few studies have reported scientific evidence on their effects. This study aimed to assess the in vitro and in vivo effectiveness of the root of S. rhombifolia to reduce inflammation and periapical lesion induced by lipopolysaccharide isolated from Porphyromonas gingivalis.

II. Material and Method
In vitro antimicrobial activity was tested using agar well diffusion test. The inoculums of Enterococcus faecalis (E. faecalis) and Actinomyces spp were streaked on the agar plate and S. rhombifolia extracts were loaded onto an agar plate. The plates were incubated at 37°C for 24 h. The inhibition zones indicating the antimicrobial potential were measured using a millimeter scale. The in vivo effectiveness was investigated using rat periapical lesion model. The incisia teeth were drilled to expose the dental pulp to the oral cavity and periapical lesions were induced with LPS. Pour plate method was used to determine the bacterial CFU from the gingival crevicular fluid (GCF) and C-reactive protein (CRP) serum was examined by enzyme-linked immunosorbent assay (ELISA).

III. Results
The result shows that S. rhombifolia root extract can inhibit E. faecalis, however no inhibition zone was found on the plate of Actinomyces spp. In vivo observation shows that S. rhombifolia extract could not reduce the total bacteria on GCF; however, it could reduce the level of CRP compared to negative control ($p<0.05$) at optimum doses 2.4 g/kgBW.

IV. Conclusion
In conclusion, S.rhombifolia root extract has the potential to be developed as an alternative agent in endodontic treatment.

***Keywords**: Sida rhombifolia, Arrowleaf sida, Alternative agent, Endodontic
***Presenting Author**: Maria Tanumihardja
Conservative Dentistry, Hasanuddin University, Makassar, Indonesia, maria_tanumiharja@yahoo.com

P1-019

Fish collagen stimulates the proliferation and differentiation of pre-osteoblast cells

MarkLuigi F Capati[*], Ayako Nakazono, Kohei Yamamoto, Kouji Tsugimoto, Kajiro Yanagiguchi, Shizuka Yamada, Yoshihiko Hayashi
Cariology Department, Graduate School of Biomedical Sciences, Nagasaki University, Nagasaki City, Japan

I. Introduction
Fish that are genetically distant relatives from mammals have recently drawn attention as an alternative source of collagen. Fish collagen (FC) derived from the scales, skin, and bone has gained interest in many laboratories for its bioactive properties such as an excellent biocompatibility, low antigenicity, high biodegradability

and cell proliferation potential. Biological safety of Tilapia type I atelocollagen (TAC) was also confirmed using various test methods recommended with ISO standards, so it can be a good candidate as a biological scaffold. The recent calorimetry also suggests that the denaturation temperature (Td) of TAC was 35-360°C that is almost similar to human temperature and TAC can be stored for over 1 year under frozen condition.

II. Material and Method

The proliferation and differentiation of typical pre-osteoblasts derived from the mouse calvaria, MC3T3-E1 cells were used in this study and the following test were carried out, microarray analysis, alkaline phosphatase (ALP) staining assay for mineralization, and RT-PCR analysis for the expression of calcification-related genes.

III. Results

Microarray revealed that there are 72 up-regulated genes and out of 72, 10 genes are related to differentiation and proliferation of osteoblastic cells, RT-PCR also revealed that the mRNA expression of these genes increased after 3-day culture on FC gel. A change in morphology (spindle-shaped cells) and an increasing staining was observed in MC3T3- E1 cells after 2 weeks of culture in FC was observed. Four bone calcification related genes were also tested and the result shows that there were increased expressions.

IV. Conclusion

The result of this research suggests that TAC may represent not only a promising alternative to mammalian and avian collagen products but also a novel biomaterial with cell differentiation ability.

***Keywords**: Fish collagen, Cell proliferation, Cell differentiation

***Presenting Author**: MarkLuigi F Capati

Cariology Department, Graduate School of Biomedical Sciences, Nagasaki University, Nagasaki City, Japan, markluigi1002@gmail.com

P1-020

Comparison of antimicrobial activity of traditional and new developed root sealers against pathogens related root canal

Joo-Hee Shin*

Endodontics, Korea University Medical Center Dental Hospital, Seoul, Republic of Korea

I. Introduction

Bacterial infection is closely associated with the failure of endodontic treatment, and use of endodontic sealer with antimicrobial activity and biological compatibility is necessary for the success of root canal treatment. The purpose of this study was to investigate and to compare the antibacterial effect of two calcium silicate-based root canal sealers (Endoseal and EndoSequence BC sealer) as recent development sealers and with three conventional root canal sealers (AH Plus, Sealapex, and Tubli-Seal), before or after setting, on *Porphyromonas endodontalis (P. endodontalis), Porphyromonas gingivalis (P. gingivalis),* and *Enterococcus faecalis (E. faecalis).*

II. Material and Method

The sealers were soaked in phosphate buffered saline to elute its compositions after and before setting. Then, the elutes were used for the antimicrobial assay. X-ray fluorescence analysis was also carried out to compare compositions of two calcium silicate-based sealers.

III. Results

The conventional root canal sealers have strong antibacterial activity against the Gram-negative bacteria, *P. endodontalis* and *P. gingivalis*. Endoseal sealer showed antibacterial activity against not only the Gram-negative bacteria, but also against the Gram-positive bacteria, E. faecalis. However, Endosequence BC sealer exhibited a weak antibacterial effect on all bacteria in this study. X-ray fluorescence analysis exhibited that Endoseal contained more types and more amount of the oxide compound known to have strong antimicrobial activity such as Al2O3, Fe2O3, MgO, Na2O, NiO, and SO2 than Endoseqeunce BC.

IV. Conclusion

Endoseal, which contains various types of oxide compounds, seems to be a suitable sealer for preventing bacterial infection in both treated and untreated root canals.

***Keywords**: Root canal sealer, Antimicrobial activity, Oxide compound, *E. faecalis*

***Presenting Author**: Joo-Hee Shin

Endodontics, Korea University Medical Center Dental Hospital, Seoul, Republic of Korea, endoshin11@gmail.com

P1-021

Bacterial leakage and marginal adaptation of various bioceramics as apical plug in open apex model

Patcharachol Lertmalapong*[1], Jeeraphat Jantarat[2], Ratchapin Srisatjaluk[3], Chulaluk Komoltri[4]

[1]Sirindhorn College of Public Health Suphanburi, Suphanburi, Thailand [2]Operative Dentistry and Endodontics, Faculty of Dentistry, Mahidol University, Bangkok, Thailand, [3]Oral Microbiology, Faculty of Dentistry, Mahidol University, Bangkok, Thailand, [4]Faculty of Medicine Siriraj Hospital, Bangkok, Thailand

I. Introduction

Bioceramic materials have been introduced as apical plug for apexification. The essential property that affects treatment outcomes is sealing ability. Recently, innovative bioceramics have been developed from MTA to improve its restricted properties. Therefore, aim of this study was to evaluate sealing ability of five bioceramics (ProRootMTA, Biodentine, RetroMTA, and TotalFill Bioceramic Root Repair Material paste and putty) as apical plugs using bacterial leakage test. In addition, marginal adaptation was observed in qualitative analysis using SEM to correlate sealing ability and marginal adaptation of various bioceramics.

II. Material and Method

One hundred and seventy extracted human mandibular premolars were prepared to simulate open apex using peeso reamer no.4. One hundred and fifty specimens were obturated with five bioceramics in two different thicknesses (3 and 4 mm) and divided into 10 experimental groups (Group 1, 2 (3 and 4 mm) ProRootMTA, Group 3, 4 (3 and 4 mm) Biodentine, Group 5, 6 (3 and 4 mm) TotalFill BC RRM paste, Group 7, 8 (3 and 4 mm) TotalFill BC RRM putty, Group 9, 10 (3 and 4 mm) RetroMTA). Ten samples of each experimental group and 2 control groups were evaluated bacterial leakage using E. faecalis for 75 days. While, 5 samples of each experimental group were sectioned, investigated gap area at material-dentin interface using SEM and compared mean percentage of gap area per cross-section area of root canal.

III. Results

Result of bacterial leakage, Group 2, 3, 4, 7 and 8 exhibited significantly lesser leakage compared with other groups. Result of marginal adaptation, Group 2, 3, 4, 7 and 8 had lesser mean percentage of gap area compared with other groups.

IV. Conclusion

Biodentine and TotalFill BC RRM putty at 3 and 4 mm as well as ProRootMTA at 4 mm exhibit the best sealing ability and marginal adaptation.

***Keywords**: Apexification, Apical plug, Bacterial leakage, Bioceramic, Marginal adaptation, Sealing ability

***Presenting Author**: Patcharachol Lertmalapong

Sirindhorn College of Public Health Suphanburi, Suphanburi, Thailand, patholemee@gmail.com

P1-022

The effect of chelating agents on the push-out bond strength of ProRoot MTA and Endosequence Root Repair Material

Burak Buldur, Fatih Oznurhan, Arife Kaptan, **Mevlut Kayabasi***

Department of Pediatric Dentistry, Cumhuriyet Uiversity, Sivas, Turkey

I. Introduction

This study aimed to evaluate the effects of 17% ethylenediaminetetraacetic acid (EDTA), 7% maleic acid (MA), and 10% citric acid (CA) on the push-out bond strength of ProRoot MTA and Endosequence Root Repair Material (ERRM) putty.

II. Material and Method

Eighty single-rooted extracted human teeth were instrumented to obtain a standardized immature teeth model. Based on the chelating agents tested, the specimens were randomly divided into three experimental groups: Group 1 (17% EDTA), Group 2 (7% MA), Group 3 (10% CA), and Group 4 (Positive Control) (n=20 for each group). Each group was further classified into two subgroups: Group A (ProRoot MTA) and Group B (Endosequence Root Repair Material (ERRM) putty) (n=10 for each subgroup). After irrigation and placement of cements, teeth were stored at 37°C and 100% humidity for a week. A total of 240 dentine discs (three discs per teeth) were obtained and subjected to push-out assay. Data were analyzed using two-way analysis of variance and Tukey's post hoc t-test.

III. Results

Both types of chelating agent and calcium silicate-based cement were significantly associated with the push-out bond strength values. The push-out bond strength was significantly less for CA as compared to EDTA or MA. ERRM had higher bond strength values than ProRoot MTA ($p<0.05$).

IV. Conclusion

The use of chelating agents increased the push-out bond strength of CSC. Regardless of tested chelating agents, ERRM had higher bond strength values than ProRoot MTA.

***Keywords**: Calcium silicate cement, Chelating agent, Endosequence Root Repair Material, Mineral trioxide aggregate, Push-out bond strength

***Presenting Author**: Mevlut Kayabasi

Department of Pediatric Dentistry, Cumhuriyet Uiversity, Sivas, Turkey, mevlutkybs@gmail.com

P1-023

Working width and shape of the apical third in the maxillary lateral incisors in the population of Chennai, T.N., India

Nyklesh Vijayakumar[*1], **K. Senthil Kumar**[*2]

[1]Conservative Dentistry and Endodontics, Consultant Endodontist, Chennai, India, [2]Conservative Dentistry and Endodontics, Hod Chettinad Dental College, Chennai, India

I. Introduction

Shaping of the root canal plays a key role, both for cleansing of the canal and also for 3D obturation of the root canal system. However, Apical third shaping still remains controversial. Guidelines or standards for apical preparation were espoused by Weine. He advocated enlarging the apical part of the root canal to three sizes larger than where the first file bound. Buchanan has advocated minimal apical preparation (e.g. #20 or #25) based on his clinical opinions.

However, it is apparent from the literature that the apical constriction is not uniformly round, but is generally either oval or irregular. Clinically, this means that the greatest diameter of the canal shape must be taken into consideration if this area is to be thoroughly debrided with root canal instruments.

Concept of working width, was first introduced by Dr. Yi-Tai Jou at the University of Pennsylvania *(Jou YT, Karabucak B, Levin J, et al. Endodontic working width: current concepts and techniques. Dent Clin North Am. 2004;48:323-335.).*

STATE-OF-THE-ART Electronic Gadgets easily establish the working length, however, determination of the *WORKING WIDTH* still remains a challenge.

II. Material and Method

Total of 100 teeth were fixed in 10% formalin. Periodontal tissue remnants were mechanically removed. The root segments were obtained by removing the crown 1 mm beneath the cementum-enamel junction (CEJ) using a rotary diamond disk. The distance at the apical third was determined. A 0.012 mm Ni-Ti wire was inserted in the cut section of the roots.

The roots were carefully sectioned at 1 mm from the apex by a slow-speed water-cooled diamond saw. All cross sections were examined under the microscope at 40x magnification and photographed and readings were noted. Shape of Apical foramen and the working width was determined.

III. Results

Working width and shape of the apical third in the maxillary lateral incisors in the population of Chennai, was identified as 0.40 mm.

IV. Conclusion

As endodontists we should be adopting best available evidence for supporting clinical treatment methods to measure the working width.

***Keywords**: Actual cross-sectional area of the wire (ACSW), Image cross sectional area of the wire (ICSW), Image cross sectional area of root canal (ICSRC), Actual cross sectional area of root canal (ACSRC)

***Presenting Author**: Nyklesh Vijayakumar

Conservative Dentistry and Endodontics, Consultant Endodontist, Chennai, India, nyklesh@gmail.com

P1-024

Evaluation of smear layer removal and lubrication effect by prototype EDTA gel conditioner

Ryuji Fujimaki[*]

Department of Pulp Biology and Endodontics, Kanagawa Dental University, Yokosuka, Japan

I. Introduction

The purpose of the present study is to evaluate the removal of smear layer and lubricating effect for the prototype EDTA gel conditioner, which is a clear colored material in visibility of the root canal orifice during treatment.

II. Material and Method

The removal effect of the smear layer was observed by SEM. After removing the dental crown of single-root human normal teeth, it was split in the perpendicular direction, embedded with the cross-section surface turned upwards, and the dentin surface was polished. The test materials EDTA 17% gel conditioners, was applied, onto the dentin surface for 1 minute, and then a SEM observation was made to examine the smear layer removal effect.

Torsional stress was measure by Data Logger system. 40 plastic curved root canal models were prepared by Ni-Ti file (ProTaper Next (Dentsply Sirona) or Endo Wave (J. MORITA)) with prototype EDTA gel conditioner Each group was divided into 4 groups as follows: prototype EDTA, 17% EDTA gel, Glyde (Dentsply Sirona), RC-Prep (Premier Dental). The current value of the electric motor was measured by Data Logger at the apex position, as well as positions -5, -3, and -1 mm from the apex.

III. Results

Smear layer at the root canal orifice, middle, and apical areas of canal were almost removed and dentinal tubules were open. Regardless of which gel conditioners were used, the motor current value at the apex position and position -1 mm from the apex was increased, which means torsional stress tended to be raised.

IV. Conclusion

The prototype 17% EDTA gel conditioner was confirmed to be removal of smear layer at each measuring area until 1min working, and the visual field of canal orifice was obtained during root canal preparation used by this prototype EDTA.

***Keywords**: EDTA, Smear layer , Clear colored

***Presenting Author**: Ryuji Fujimaki

Department of Pulp Biology and Endodontics, Kanagawa Dental University, Yokosuka, Japan, fujimaki@kdu.ac.jp

P1-025

Anatomicalconsideration of C-shaped canal in mandibular second molars: A micro-CT study in Thai subpopulation

Chuta Kooanantkul[*], Lalida Ongchavalit

Operative and Endodontics, Mahidol University, Bangkok, Thailand

I. Introduction

The purpose of this study was to test the agreement of the clinical photograph of pulpal floor and the accuracy of the radiographic images compare with micro-computed tomography (μCT).

II. Material and Method

74 extracted C-shaped mandibular second molars were scanned with μCT and 3D reconstructed. Tooth was attached to a cadaver's mandible and pre-operative radiograph was taken. Tooth was section 2 mm above CEJ, the access was opened, and the image of the pulpal floor was taken. Files were inserted to 0.5 mm above apical foramens. Working length radiographs (LT) were taken with straight on and 20 degree mesially and distally shift. All pulpal floor images from photograph and 3D reconstruction were classified by Min's classification. All radiographs and 3D reconstruction were classified by Fan's classification. The inter-observer reliability, agreement, and accuracy between clinical and 3D reconstruction image were analyzed.

III. Results

Inter-observer reliability of the photograph and 3D reconstruction image were 0.96 in both groups. The agreement between photograph and 3D reconstruction image was 0.86. Inter-observer reliability of the preoperative radiographs, LT, and 3D reconstruction images were 0.77, 1.00 in all angles, and 1.00 respectively. The accuracy of preoperative radiographs and LT were 62.50% and 83.33% in all angles, respectively.

IV. Conclusion

Clinical floor appearance and 3D reconstruction image can be used to classify the pulpal floor type indifferently. LT should be used to classify the radiographic type rather than the preoperative radiograph.

***Keywords**: C-shaped canal, Tooth anatomy, Radiographic type, Pulpal floor classification

***Presenting Author**: Chuta Kooanantkul

Operative and Endodontics, Mahidol University, Bangkok, Thailand, re_drumme@hotmail.com

P1-026

Assessment of cuspal deflection in root canal treated mandibular molar teeth using conservative access cavity

Mohammad Hossein Malekipour[*], Farzaneh Shirani, Saber Asadi

Operative Dentistry, Isfahan University of Medical Science, Isfahan, Iran (Islamic Republic of)

I. Introduction

The aim of this study was to evaluate the amount of cuspal deflections in mandibular molar teeth with conservative access cavity.

II. Material and Method

100 mandibular molar teeth were divided into 10 groups. In group number 1 no intervention was done on teeth and it was selected as control group. In groups number 2, 3 and 4 the ordinary access cavity was producted with preserving 1 and 2 and without marginal ridge. In groups number 5, 6 and 7, conservative access cavity was producted with dentin and enamel above pulp chamber and 2 marginal ridges, 1 marginal ridge and without marginal ridge. In groups number 8, 9 and 10 conservative access cavity was producted with dentinal roof without 2 marginal ridges, 1 marginal ridge and 2 marginal ridges. Following that, root canal therapy was done on teeth primarily, compressive axial loading of 150 N was then applied on all the teeth and after 24 hours 250N compressive axial loading was applied. Cuspal deflections were measured with micrometer. Then achieved data were analyzed by DUNNETT test (α=0.05).

III. Results

The ordinary cavity group without 2 marginal ridges

had the most cuspal deflection in comparison with the control group (P=<0.001). Furthermore, the least cuspal deflection difference is related to conservative cavity group with 2 marginal ridges preservated by dentin and enamel above pulp chamber (p=0.999).

IV. Conclusion

The amount of cuspal deflection in teeth that were root canal therapied with conservative access cavity was less than teeth that were treated by ordinary access cavity preparation.

***Keywords**: Dental Access Preparation, Molar Tooth, Root Canal Preparation, Cuspal Deflection
***Presenting Author**: Mohammad Hossein Malekipour
Operative Dentistry, Isfahan University of Medical Science, Isfahan, Iran (Islamic Republic of), malekipour00@gmail.com

P2-001

Stress analysis according to retrograde preparation designs in the mandibular molar: Finite element analysis

So-Young Park[*1], Sunil Kim[1], Yoon Lee[2], Chan-Joo Lee[3], Hyeon-Cheol Kim[4], Euiseong Kim[1]
[1]Microscope Center, Department of Conservative Dentistry and Oral Science Research Center, Yonsei University College of Dentistry, Seoul, Republic of Korea, [2]Department of Conservative Dentistry, Wonju Severance Christian Hospital, Yonsei University, Wonju, Republic of Korea, [3]Dongnam Regional Division, Korea Institute of Industrial Technology, Jinju, Republic of Korea, [4]Department of Conservative Dentistry, School of Dentistry, Dental Research Institute, Pusan National University, Yangsan, Republic of Korea

I. Introduction

The aim of this study was to investigate the influence of various apical preparation designs for surgical endodontics on stress concentrations in the mesial root of the mandibular molar under different experimental conditions using a finite element analysis.

II. Material and Method

The study was designed two apical preparation groups according to whether an isthmus was present or not. Each group contained four subgroups according to the size of the apical preparation. We constrained the displacement of all nodes at the base of the supporting bone and applied a force of 150 N to the vertical axis. We analyzed stress generation and concentrations numerically for the groups and subgroups.

Group I, II: the tooth had no isthmus. 2 separated MB and ML canals were prepared circularly and in bucco-ligual direction, respectively.

Group III, IV: the tooth had isthmus. The preparation included MB, ML canals and isthmus increasing circular and bucco-lingual direction, respectively.

III. Results

In the subgroups, the von Mises and maximum principal stresses reduced gradually according to the enlargement of the prepared cavity. However, when the preparation extended excessively in the isthmus preparation groups, the situation reversed; that is, both von Mises and maximum principal stresses increased.

IV. Conclusion

Within the limitations of this study, the stress level was less influenced by the amount of apical preparation except when the amount of remaining dentin was extremely thin.

***Keywords**: Finite element analysis, Stress distribution, Apical preparation design, Surgical endodontics
***Presenting Author**: So-Young Park
Microscope Center, Department of Conservative Dentistry and Oral Science Research Center, Yonsei University College of Dentistry, Seoul, Republic of Korea, happypsy80@naver.com

P2-002

Viability of fibroblast cells with antiseptic solution (Chlohexidine, Alkalize Water, Acid Water, and Sodium Hipochloride)

Jos Erry HW[*], Cita T, Andika N.
Conservative Dentistry, University of Indonesia, DKI Jakarta, Indonesia

I. Introduction

In Endodontic treatment, we often used antiseptic solution as irrigation solution to clean the cavity and the root canal. The solution often used to kill the bacteria. But what happen in the fibroblast cells? Fibroblast cells in Endodontic treatment have a big role to repaire the injury tissue. The aim of this research is knowing the viability of the fibroblast cells that contact with the antiseptic solution (Chlohexidine, Alkalize Water, Acid Water, and Sodium Hipochloride).

II. Material and Method

The fibroblast cells were cultured in tissue culture plates 6 well 2 ml. And the cells were incubated in CO2 incubator with consentrate 5% in temperature 37°C in a week. After that, the cells were centrifuged with each solutions in 10 minutes. The cells were counting use haemocytometer.

III. Results

The viability of fibroblast is not significantly different of each solution. But result show that the highest viability is alkalize water group and acid water group.

IV. Conclusion

The fibroblast cells viability in each group of antiseptic solutions (Chlohexidine, Alkalize Water, Acid Water, and Sodium Hipochloride) has variety but not significantly different.

***Keywords**: Fibroblast, Viability, Chlorhexidine, Alkalize water, Acid Water, Sodium hipochloride
***Presenting Author**: Hesti Witasri Jos Erry
Conservative Dentistry, University of Indonesia, DKI Jakarta, Indonesia, hesti.witasari@gmail.com

P2-003

Evaluation of reducing torsional stress by prototype EDTA: An in vitro measurement

Jiro Suzuki[*]
Department of Pulp Biology and Endodontics, Kanagawa Dental University, Yokosuka, Japan

I. Introduction

The purpose of the present study is to evaluate the use of the prototype EDTA root canal conditioner for root canal preparation, and what sort of effect can be applied to the torsional stress.

II. Material and Method

Thirty-five plastic curved root canal models were prepared by ProTaper Next (Dentsply Sirona) or EndWave (J. MORITA) with each EDTA gel conditioner. Each group was divided into 7 groups as follows: prototype EDTA gel conditioners (4 different viscosity) A, B, C, D, Glyde (Dentsply Sirona), RC-Prep (Premier Dental) and DW (negative control). All plastic canal models were prepared by the ProTaper Next (X1 and X2) or Endo Wave (#20 and #25) by the Dentaport system (J. MORITA). Measurement of the current value corresponding to torsional stress during the root canal preparation was determined the working length with #10 K-file, made a glide path, cleaned and dried the canal, and then performed canal preparation with each EDTA gel conditioner. The current value of the electric motor was measured by Data Logger at the apex position, as well as positions -5, -3, and -1 mm from the apex. Statistical analysis was carried out using the multiple comparisons: the way of non-repeated measures ANOVA and Bonferroni's method.

III. Results

Regardless of which gel conditioners were used, the motor current value at the apex and -1 mm from the apex was increased, which means torsional stress tended to be raised. The results of this study showed that there was increased cutting stress with ProTaper X1 and EndoWave #25 at -1 mm from the Apex, and with ProTaper X2 and EndoWave #25 at the Apex. Hence, the study showed that applying medium viscosity EDTA (prototype B and C) at -1 mm from the Apex, and high viscosity EDTA (prototype D) at the Apex was effective for reducing cutting stress and maintaining the original canal shape.

IV. Conclusion

All EDTA gel conditioners tested reduced the torsional stress during root canal formation, and no significant difference was found between the all gel conditioners.

***Keywords**: EDTA, Root canal treatment, Cutting stress
***Presenting Author**: Jiro Suzuki
Department of Pulp Biology and Endodontics, Kanagawa Dental University, Yokosuka, Japan, j.suzuki@kdu.ac.jp

P2-004

Investigation of apical foramen changes after endodontic treatment using micro-computed tomography

Jongki Lee*
General Practitioner, Seoul Well Dental Clinic, Changwon, Republic of Korea

I. Introduction
The purpose of this investigation was to inspect changes in apical foramen after root canal treatment.

II. Material and Method
Teeth extracted after endodontic treatment were inspected using micro-computed tomography. The treatments were done by a single private practitioner. The period from root canal treatment to extraction varied from less than one year to over ten years. The reasons for extraction included root fractures, severe periodontitis, and root resection due to treatment failures. The extracted teeth were stored in 95% alcohol and then underwent MCT with a voxel size of 19μm3. The apical status of each of the MCT images was then inspected using OnDemand3D (CyberMed Inc.) software.

III. Results
The apical foramen (n=51) statuses of extracted roots inspected by MCT images were categorized into four types including 1) precipitation of opaque material around the wall of the apical foramen, 2) open foramen, 3) apical foramen filled with root canal sealer, and 4) gutta-percha impingement with root resorption, with the proportion of 53.0%, 37%, 5.9% and 4.0% respectively. The precipitation of opaque material mainly occurred in vital root canal treatment cases. The precipitation ranged from a slight narrowing of the foramen to a full blocking of the foramen. The open foramen cases were highly related to the presence of necrotic pulp. The canals shaped and obturated exactly to the apical terminus in post-treatment x-rays tended to show impingement of gutta-percha in the extracted root.

IV. Conclusion
Within the limitations of this study, such as small sample size and all treatments done by a single dentist, the results show that the apical foramen after root canal treatment changed in different ways depending on the precondition of treated teeth and the quality of treatment. This might suggest clues to ideal treatment strategies for the precondition of teeth that could be confirmed with similar research done with large samples.

***Keywords**: Micro-computed tomography, Apical foramen, Endodontic treatment
***Presenting Author**: Jongki Lee
General Practitioner, Seoul Well Dental Clinic, Changwon, Republic of Korea, jongki@nate.com

P2-005

Long term survival and decision making for the retention of endodontically treated cracked teeth (A 10-15 years study)

Pei Yuan Chan*, Nah Nah Chen
Endodontics, National Dental Centre Singapore, Singapore, Singapore

I. Introduction
Teeth with incomplete tooth fracture or cracked tooth syndrome have always presented diagnostic and restorative challenges to dentists. The decision to retain such teeth is a clinical dilemma, often fraught with unpredictability. There is no known study that has looked into the prognosis and long term survival of endodontically treated cracked tooth. The aim was to investigate the 10-year and 15-year survival rates of endodontically treated cracked teeth with incomplete tooth fracture.

II. Material and Method
Patients who had undergone root canal treatment for cracked teeth at National Dental Centre Singapore, during the period from January 2001 to December 2005, were invited for a clinical and radiographic examination.

III. Results
Two hundred and twenty patients responded and the recall rate was 40% (220/550 patients). A total of 206 teeth (197 patients) was included in the analysis. The mean age of the patients was 48.6 years (range, 22-74). The 10-year and 15-year survival was 71.2% (95% confidence interval [CI], 0.65-0.77) and 53.4% (95% confidence interval [CI], 0.45-0.61) respectively. Tooth type and presence of pre-treatment pocketing were predictors for tooth survival. Molars had a lower odds of tooth loss as compared to anteriors or premolars (hazard ratio 0.48; 95% CI, 0.24-0.98; p=0.044). The presence of pre-treatment pocketing of 4 to 5 mm increased the odds of tooth loss by 2.3-fold (hazard ratio 2.29; 95% CI, 1.33-3.96; p=0.003) and pre-

treatment pocketing of ≥6 mm increased the odds of tooth loss by 2.9 fold (hazard ratio 2.86; 95% CI, 1.47-5.54; p=0.002), but there was no difference between the 4 to 5 mm group and the ≥6 mm pre-treatment pocketing groups.

IV. Conclusion
The 10-year and 15-year survival was 71.2% and 53.4% respectively, for endodontically treated cracked tooth. Anterior and premolar teeth are at greater odds of being lost over time as compared to molars and pre-treatment pocketing of more than 4 mm had higher odds of being extracted.

***Keywords**: Cracked tooth, Endodontic, Failure rate, Long term survival
***Presenting Author**: Pei Yuan Chan
Endodontics, National Dental Centre Singapore, Singapore, Singapore, chan.pei.yuan@ndcs.com.sg

P2-006

Middle mesial canals in mandibular first molars - An illustrated systematic review

Joao Meirinhos*, Mariana Pires, Joana Cordeiro Martins, Mario Rito Pereira, Isabel Vasconcelos, Antonio Ginjeira
Endodontics, Faculdade de Medicina Dentária da Universidade de Lisboa, Lisboa, Portugal

I. Introduction
Success of endodontic treatment depends on the thorough disinfection of the root canal system. The knowledge of the most common root canal configurations, as well as their variations, is essential to achieve this goal, since missed canals can lead to failure of endodontic treatment. Through the years, numerous studies have reported on the most common root canal configuration of each tooth, and particularly of the permanent mandibular molars, the tooth most prone to be subjected to root canal treatment at an early age. The methodologies employed have also varied, ranging from radiographs, diaphanization and, more recently, three-dimensional techniques such as cone-beam computed tomography (CBCT) or micro computed tomography (micro-CT). We aimed to describe and review the morphological aspects of the middle mesial canals in permanent mandibular first molars.

II. Material and Method
On March 2018, a search was conducted on Pubmed using the key words (molar) AND (middle mesial canal) for all types of publications, from 1974 onward. The references of the resulting studies were also reviewed. The data extracted included author and year of publication, population, methodology, number of teeth per study, incidence of middle mesial canal in the mesial root of mandibular first molars and configuration of the anatomy.

III. Results
28 studies were identified including a total of 5693 mandibular first molars. The overall incidence of middle mesial canals was 9.7%. According to Vertucci's classification, the most common canal system configuration of the mesial root was Type VIII (33.3%).

IV. Conclusion
Root canal morphology and configuration might present the clinician with a complex anatomy requiring more diagnostic approaches, access modifications, and clinical skills to successfully localize, negotiate, disinfect, and seal the root canal system. More studies about root canal anatomy are necessary to provide important information to the clinicians.

***Keywords**: Molar, Middle mesial canal, Vertucci
***Presenting Author**: Joao Meirinhos
Endodontics, Faculdade de Medicina Dentária da Universidade de Lisboa, Lisboa, Portugal, jmeirinhos17@gmail.com

P2-007

Study of novel dental endoscopic system with intraoral camera and image probe for the observation of root canal

Masataka Fujimoto*[1], Masahiro Okuda[2], Shinji Yoshii[1], Satoshi Ikezawa[3], Toshitsugu Ueda[4], Chiaki Kitamura[1]
[1]Div. of Endodontics and Restorative Dentistry, Kyushu Dental University, Kitakyushu, Japan, [2]Faculty of Environmental Engineering, University of Kitakyushu, Kitakyushu, Japan , [3]Research and Development Center for Taste and Odor Sensing, Kyushu University, Fukuoka, Japan, [4]Graduate School of Information, Production and Systems, Kyushu Dental University, Kitakyushu, Japan

I. Introduction
At present, dentists prepare a root canal without direct visual confirmation of its structure and post-treated shape. There are several commercially available dental endoscopic systems. However, they do not provide required diagnosis resolution. In addition, they are not sterilizable devices. To solve these issues, we have developed a novel endoscopic system to acquire clear observation of the inside of the root canal (Yoshii et al., Int. J. Smart Sensing Intell. Syst., 2013, Fujimoto et al., IEEE Sensors J., 2016). In the present study, we fabricated a new endoscopic system based on the intraoral camera for easy use of dental endoscopic system.

II. Material and Method
An intraoral camera (SOPRO LIFE, ACTEON) and an endoscope probe were connected via objective lens. The endoscope probe was consisted of image fiber, gradient-index lens and optical fibers, covered with stainless-steel tube. To evaluate the ability of the system, resolution charts in which line and space pattern were drawn with several spaces (10-100 μm) were used. In the image processing of captured images, Robust Principal Component Analysis (RPCA) was applied to remove the noise, followed by the enhancement of the image contrast.

III. Results
In raw captured images, our endoscopic system captured all resolution charts. These images applied to the image processing, and the visibility, which showed the resolution, was analyzed. The image captured with the fabricated system and treated by the processing of RPCA and the enhancement showed higher visibility than those of raw images.

IV. Conclusion
The present study showed that the endoscopic system with intraoral camera and endoscopic probe may have the potential to direct and clear observation of the root canal wall during the Endodontic treatment. This work was partially supported by the Ministry of Internal Affairs and Communications of Japan under the Strategic Information and Communications R&D Promotion Programme of 2017-2019, No. 3620.

***Keywords**: Endoscope, Endodontic, Image fiber, Gradient-index lens
***Presenting Author**: Masataka Fujimoto
Div. of Endodontics and Restorative Dentistry, Kyushu Dental University, Kitakyushu, Japan, r12fujimoto@fa.kyu-dent.ac.jp

P2-008

Obturation via hydraulic condensation of bioceramic sealer; A five-year survival rate study

Sara Hoge*, Allen Ali Nasseh
Dept of Endodontics, Harvard School of Dental Medicine, Boston, USA

I. Introduction
Current obturation methods are technique sensitive and time consuming, since they rely on a dense compaction of gutta percha to establish an adequate seal. We propose a more time-efficient technique: hydraulic condensation. Hydraulic condensation is performed by delivering a calcium silicate sealer as the main obturation filler via gutta percha. As it is delivered, hydraulic pressure delivers the sealer 3-dimensionally. Hydrophilic properties allow it to follow moisture into dentinal tubules and its setting reaction forms hydroxyapatite, bonding to dentin. These properties have been confirmed via in vitro studies, but long-term clinical survival has not been evaluated. This study assesses the 5-year survival rates of root canal therapy using hydraulic condensation of bioceramic sealer.

II. Material and Method
This retrospective study examines the five-year survival rate of 207 teeth obturated using hydraulic condensation. Teeth were selected by randomizing patients treated by a single endodontic specialist using the same methodology: single visit, crown-down with Endosequence rotary filing system, irrigation using activated 6% sodium hypochlorite and 17% EDTA, and obturating with hydraulic condensation of Endosequence BC Sealer with gutta percha. Vital and nonvital teeth, as well as teeth presenting with periapical lesions were all included. Retention of theses teeth was assessed 5 years following treatment.

III. Results
The five-year survival for 207 primary root canal-treated teeth was 97.6% (95% confidence interval of 94.5%-99.2%). Survival by tooth type was 96.4%, 94.3%, and 98.6% for anterior teeth, bicuspids, and molars, respectively. Survival by vitality of tooth prior to treatment was 97.9% for vital pulps and 97.0% for necrotic. Teeth presenting with periapical radiolucency survived at a rate of 96.8%.

IV. Conclusion
This study suggests favorable survival rates may be obtained using hydraulic condensation of bioceramic sealer. This allows for use of an obturation technique that saves time for the patient and practitioner without compromising long-term survival of the tooth.

***Keywords**: Bioceramic sealer, Calcium silicate, Hydraulic condensation, Clinical efficiency, Endodontic survival rates, Obturation techniques
***Presenting Author**: Sara Hoge
Dept of Endodontics, Harvard School of Dental Medicine, Boston, USA, sara_hoge@hsdm.harvard.edu

P2-009

Assessment of postoperative pain following one-visit root canal treatment: Comparison of different obturation materials

Neslihan Simsek, **Melis Sila Cetin***, Levent Akinci
Endodontics, Inonu University Faculty of Dentistry, Malatya, Turkey

I. Introduction
This study compared the postoperative pain of orthograde fillings with orthoMTA (BioMTA, Seoul, Republic of Korea) and cold lateral compaction technique in one-visit root canal treatment of asymptomatic, single rooted teeth with vital pulps.

II. Material and Method
The study included 28 teeth which required root canal treatment for prosthetic reasons or asymptomatic irreversible pulpitis. Patients with no contributory medical history or pregnancy and who agreed to participate in the study were included. Immunocompromised patients who were on antibiotics, analgesics or corticosteroids preoperatively or during treatment were excluded. Patients who received dental treatment within the last month and who had other symptomatic teeth or periodontal disease were also excluded. Twenty-eight patients (20 women, 8 men) aged 18 to 69 years were randomly assigned into two treatment groups: obturation with mineral trioxide aggregate using orthograde method (MTA); and cold lateral compaction of gutta-percha (GP). Root canal fillings and composite restorations were performed during one visit by a single operator. Preoperative and postoperative pain after 1, 2, 3 and 7 days were recorded on a visual analogue scale (VAS) by patients. Data were statistically analyzed using unpaired t test and Wilcoxon test ($p<0.05$).

III. Results
Pain was reported in both groups at 1st day (MTA: $p=0.024$; LC: $p=0.042$) but there was no difference between groups ($p=0.958$). On 7th day no significant pain score was reported in either group compared to preoperative pain. Whereas significant postoperative pain was reported 1st and 2nd days in the females, postoperative pain wasn't significantly different from preoperative pain during 7 days in males. Patients under 45 years reported significant pain on 1st and 2nd day after treatment while those over 45 reported no significant postoperative pain throughout the control period.

IV. Conclusion
No significant difference in postoperative pain was found between MTA and LC technique on 7th day. MTA is a suitable material for root canal obturation when non-cytotoxic and biocompatible properties are also considered.

***Keywords**: Postoperative pain, MTA, Root canal obturation, Cold lateral compaction
***Presenting Author**: Melis Sila Cetin
Endodontics, Inonu University Faculty of Dentistry, Malatya, Turkey, sila.cet@gmail.com

P2-010

Antibacterial activity of silver nanoparticles activated by photodynamic therapy in infected root canals

Hakan Aydin[1], **Kursat Er***[1], Alper Kustarci[1], Murat Akarsu[2], Gul Merve Gencer[2], Hakan Er[3], Rasih Felek[4]
[1]Department of Endodontics, Akdeniz University Faculty of Dentistry, Antalya, Turkey, [2]Department of Chemistry, Akdeniz University Faculty of Arts and Science, Antalya, Turkey , [3]Electron Microscopy Image Analyzing Unit and Department of Biophysics, Akdeniz University Faculty of Medicine, Antalya, Turkey, [4]Department of Microbiology, Akdeniz University Faculty of Dentistry, Antalya, Turkey

I. Introduction
The aim of this study was to evaluate the effect of antibacterial activity of light application [photodynamic therapy (PDT)] on the combination of a photosensitizer agent, Toluidine Blue O (TBO) and a nano agent, silver nanoparticles (AgNPs) on a 3-week old mature Enterococcus faecalis (E. faecalis) biofilm formed experimentally on extracted human teeth. To evaluate the effect of antibacterial activity of light application [photodynamic therapy (PDT)] on the combination of a photosensitizer agent, Toluidine Blue O (TBO) and a nano agent, silver nanoparticles (AgNPs) on a 3-week old mature E. faecalis biofilm formed experimentally on extracted human teeth.

II. Material and Method
In this study, concentrations at 20 ppm TBO and 10 ppm AgNP that the provided highest antibacterial effect against E. faecalis on TBO/AgNP combination was used according to preliminary study. After instrumentation, 130 human single-rooted, straight-canal mandibular premolars teeth that a standard length had adjusted to 13 mm contaminated with bacteria and experimental procedures were conducted against 21-day old mature biofilm. Teeth were randomly divided into 5 main experimental groups (n=20) and sodium hypochlorite (NaOCl) (n=10) and saline solution (n=10). Then, these main groups were divided into 2 subgroups (30 and 60 sec) (n=10). Experimental procedures consist of the following groups: G1; PDT (TBO + light), G2; AgNPs, G3; TBO/AgNP, G4; AgNP/light, G5; TBO/AgNP/light. Irrigation with

2 mL of 2.5% NaOCl for 1 min and irrigation with 2 mL of 0.9% saline solution for 1 min serve positive and negative control, respectively. Kolmogorov Smirnov, Oneway ANOVA and Tukey HSD tests were used to carry out statistical analysis of the study's data. After Bonferroni correction, $p<0.004$ was taken as the statistical significance.

III. Results

NaOCl group provided a bacterial reduction, which was higher than all other groups in a statistically significant manner, and was the group that displayed the highest antibacterial activity. Light application on the TBO/AgNPs combination was the group that provided the highest bacterial reduction after NaOCl.

IV. Conclusion

Photoactivation on TBO/AgNP combination led to increase in effect of PDT and this group was the most successful group after NaOCl.

***Keywords**: Photodynamic therapy, Silver nanoparticles, Root canal disinfection

***Presenting Author**: Kursat Er

Department of Endodontics, Akdeniz University Faculty of Dentistry, Antalya, Turkey, kursater@akdeniz.edu.tr

P2-011

Antibacterial effect of calcium hydroxide nanoparticles on Enterococcus faecalis

Pitchanun Lungkapinth*, Phumisak Louwakul

Department of Restorative Dentistry and Periodontology, Chiang Mai University, Chiang Mai, Thailand

I. Introduction

The study was aimed to compare the antibacterial property of calcium hydroxide nanoparticles (CHNP) and calcium hydroxide (CH) against *Enterococcus faecalis (E. faecalis)*.

II. Material and Method

E. faecalis strain ATCC 29212 was used in this study. The antibacterial property of CHNP and CH was evaluated by direct contact and agar diffusion tests. The following concentrations were tested: (1) 5% CH (g/L), (2) 25% CH (g/L), (3) 5% CHNP (g/L) and (4) 25% CHNP (g/L). The direct contact test was done at 30 seconds, and one, and five minutes. The agar diffusion test was conducted at 24 hours. *E. faecalis* suspension (0.5 McFarland) and sterile water were used as positive and negative controls, respectively. Data were analyzed with a level of significance set at $p<0.05$.

III. Results

In the direct contact test, 5% and 25% CHNP completely killed *E. faecalis* at every contact time point. CHNP groups were more effective than CH groups ($p<0.05$). The antimicrobial activity of CH was related to its concentration. CH could not eliminate all planktonic bacteria, but CH was more effective than the negative control ($p<0.05$), but CH groups didn't completely eliminate *E. faecalis.* In the agar diffusion test, the CHNP groups yielded greater inhibition zones did than the CH groups ($p<0.05$).

IV. Conclusion

CHNP was more effective than CH in the elimination of *E. faecalis*. Short-term application of the CHNP eliminated *E. faecalis* completely and, thus, may be beneficial to use as a disinfectant in one-visit root canal treatment.

***Keywords**: Calcium hydroxide, Nanoparticles, Enterococcus faecalis, Bacteria, Root Canal

***Presenting Author**: Pitchanun Lungkapinth

Department of Restorative Dentistry and Periodontology, Chiang Mai University, Chiang Mai, Thailand, amamtown@gmail.com

P2-012

Effect of S-PRG root canal dressing on the healing of periapical lesions in rat

Bin Xiong*[*1], Kaname Shirai[1], Kousei Matsumoto[1], Hiroyuki Watanabe[1], Shintaro Shimizu[1], Yoshihiro Abiko[2], Yasushi Furuichi[1]

[1]Department of Periodontology and Endodontology, Division of Oral Rehabilitation, School of Dentistry, Hokkaido, Japan, [2]Department of Human Biology and Pathophysiology, Division of Oral Medicine and Pathology, School of Dentistry, Hokkaido, Japan

I. Introduction

Recently, a prototype endodontic root canal dressing was developed by modification of S-PRG filler, which have considerably biological effectiveness due to its ability to release multiple ions, including B, F, Si, and Sr, etc. The aim of this study was to compare the periapical repair of rat teeth with periapical lesion following root canal treatments by using S-PRG intracanal dressing or $Ca(OH)_2$ paste.

II. Material and Method

The mesial root of maxillary first molars in 18 male Wistar rats were left exposed after chamber open for 28 days. After #8 to #15 K-files preparation to the length of the tooth, canals were irrigated with 2.5% NaOCl solution followed by canal drying and filling either with S-PRG or $Ca(OH)_2$ in experimental groups, while in the negative control group were irrigated only. The access openings were restored with a composite resin. Periapical radiographs, Hematoxylin and Eosin staining and immunochemistry were performed after 3 days of the treatments. Data were evaluated using analysis of variance (ANOVA) with Turkey's HSD tests.

III. Results

S-PRG and $Ca(OH)_2$ have resulted in a significantly larger reduction in mean size of the periapical lesions from radiographic in comparison to the irrigation group ($p<0.05$). A significant decrease in the number of macrophages was observed in the S-PRG group ($p<0.05$), but not in the $Ca(OH)_2$ group, compared with the irrigation group.

IV. Conclusion

S-PRG dressing revealed the comparable effects to $Ca(OH)_2$ on healing in experimentally induced periapical lesion models of rat.

***Keywords**: S-PRG, Calcium hydroxide, Periapical lesions, Intracanal dressing treatment, Periapical radiography, Histology

***Presenting Author**: Bin Xiong

Department of Periodontology and Endodontology, Division of Oral Rehabilitation, School of Dentistry, Hokkaido, Japan, 1143271986@qq.com

P2-013

Comparative analysis of irrigation activation techniques in root canals during endodontic treatment

Maria Sukhikh*, Dina Galieva, Alexander Mitronin*

Cariesology and Endodontic, Moscow State University of Medicine and Dentistry Named After A.i. Evdokimov, Moscow, Russian Federation

I. Introduction

Results of pulp treatment aren't always positive. Microorganisms are the main cause of endodontic pathology. Reduction of microbial load is principal tasks of endodontic treatment. There is a necessity to develop new techniques to improve efficiency of endodontic treatment.

II. Material and Method

The study analysed 16 upper central incisors extracted due to periodontal reasons in patients aged 40-55. Chemomechanical instrumentation, 4% taper (S1-Protaper), apex enlargement to #40 (ISO) were performed. Teeth were divided into 4 groups according to system of irrigant activation applied. Group 1: conventional preparation using gutta percha cone. Group 2: endoactivator application. Group 3: XP-endo Finisher. Group 4: Gentlefile-Brush. Then each group was subdivided into 2 subgroups (a, b). In the first part of the study (subgroups "a") intracanal dye was applied, then central incisors were cut and root canal surfaces were studied using dental microscope (Groups 1a, 2a, 3a, 4a). In the second part of study (subgroups "b") canals were filled with zinc-phosphate cement and comparative evaluation of filling area was performed using X-ray and CBCT, coronal and sagital views (Groups 1b, 2b, 3b, 4b), with ArhiCAD software.

III. Results

The first part of the study proved that canal preparation, especially in the apical third, was more efficient in groups 4a and 3a. In the second part of the study it was shown that in subgroup 1b filling area of the coronal cross-section was 5.6 mm^2 and that of the saggital - 5.2 mm^2. The results were better in subgroup 2b: 6.8 mm^2 and 6.4 mm^2 respectively. The scores in subgroup 3b were 7.2 mm^2 and 7.0 mm^2. Filling area in subgroup 4b (Gentlefile) constituted 7.6 mm^2 and 7.8 mm^2 respectivley.

IV. Conclusion

High efficiency of root canal system cleaning was proved in groups 3 and 4 (XP-endo Finisher, Gentlefile). In comparison with other systems Gentlefile system showed stronger performance in root canal filling area.

***Keywords**: Endodontic, Irrigation system, Root canal, Cleaning efficiency

***Presenting Author**: Maria Sukhikh

Cariesology and Endodontic, Moscow State University of Medicine and Dentistry Named After A.i. Evdokimov, Moscow, Russian Federation, itmashenka@gmail.com

P2-014

Effect of the new root canal sealer containing low concentration of eugenol on the polymerization of resin composite

Munehiro Maeda*[*1], Taro Nsihida[1], Shuichi Hashimoto[2], Masaru Igarashi[1]

Department of Endodontics, Nippon Dental University School of Life Dentistry, Tokyo, Japan, [2]School of Life Dentistry, Nippon Dental University, Tokyo, Japan

I. Introduction

Eugenol, an antibacterial and sedative substance is used as a root canal sealer. However, the polymerization of resins was inhibited by sealers containing eugenol. Recently, we have invented a new sealer (NS) containing low

concentration (15%) eugenol and zinc oxide to reduce the tissue damage of high concentration eugenol. The purpose of this study was to evaluate the influence of the NS on the polymerization of 2 resin composite materials (UniFil Core EMTM; UC and ResiCemTM; RC).

II. Material and Method

Powder constituents of NS were 0.4 g of zinc oxide, 0.4 g of rosin and 0.2 g of others. Liquid constituents of NS were 0.75 ml of oleic acid, 0.15 ml of eugenol and 0.1 ml of others. The ZOE sealer (ZE) containing 80% eugenol, zinc oxide, rosin was used as a control. The each sealer was filled into a metal ring on a glass plate and was kept for 24 h at 37°C. The resins were placed on the surface of each sealer kept in the ring. Each resin was hardened using a LED light curing unit. Afterward, the resins were removed from the sealers. Brinell hardness (n=6) of the resins was measured.

III. Results

Hardness values (the ZE-contacted UC; 54.4±2.3 and the ZE-contacted RC; 54.1±4.3) of the UC and RC in contact with ZE as a control sealer were significantly less than those (the UC; 60.9±3.2 and the RC; 61.0±2.5) ($p<0.05$) of the resins without ZE, respectively. The hardness values (the NS-contacted UC; 60.1±2.9 and the NS-contacted RC; 59.3±2.5) of the resins in contact with the NS were not different significantly compared to those of the non-treated resins, respectively.

IV. Conclusion

These results showed that the new sealer have a good compatibility to the resin composite materials.

***Keywords**: New root canal sealer, Low concentration of eugenol, Polymerization of resin composite

***Presenting Author**: Munehiro Maeda

Department of Endodontics, Nippon Dental University School of Life Dentistry, Tokyo, Japan, maeda-mu@tky.ndu.ac.jp

P2-015

Evaluating electromagnetic interference of communication devices with Root ZX Mini apex locator

Foad Iranmanesh[*1], Marzieh Shafieibavani[1], Pedram Iranmanesh[2]

[1]Department of Endodontics, Dental School, Rafsanjan University of Medical Sciences, Rafsanjan, Iran (Islamic Republic of), [2]Department of Endodontics and Dental Research Center, School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran (Islamic Republic of)

I. Introduction

The correct determination of working length is a critical factor in the success of endodontic treatment. Nowadays, the electronic apex locators (EALs) are more used because of their ease of use, high accuracy, and the uncertainty of other methods. Because EALs use the electronic method, it is likely that electromagnetic waves (EMWs) affect their performance. This study was aimed to investigate the possibility of this interference.

II. Material and Method

The visual canal length (CL) of 12 maxillary incisors (Vertucci's type I) was measured with a K file and magnifying glass. Root ZX mini apex locator is used to measure CL in the absence/presence of EMWs in both the second (2G) and third generations (3G) of mobile communication network at the mode of ringing and conversation at direct contact and the distances of 25 and 50 cm.

III. Results

The mean CL at presence of EMWs in all conditions and distances (by removing the conversation with 2G at direct contact group) were not significantly difference with CL and EAL and absence of investigated EMWs group (Repeated-Measures Analysis of Variance (ANOVA), $p=0.083$). The indicator of EAL were unstable on apex sign at least 5 seconds for 5 teeth (41.7% of samples) in conversation with 2G at the direct contact group.

IV. Conclusion

EMWs of 2G and 3G not cause malfunctions of the Root ZX mini apex locator except conversation with 2G at the direct contact.

***Keywords**: Electronic apex locator, Electronic communication, Working length

***Presenting Author**: Foad Iranmanesh

Department of Endodontics, Dental School, Rafsanjan University of Medical Sciences, Rafsanjan, Iran (Islamic Republic of), foad.iranmanesh@iran.ir

P2-016

The TRPV4 mechanosensor contributes to mineralization in the KN-3 odontoblast-like cell line

Junko Hatakeyama[*1], Hisashi Anan[1], Yuji Hatakeyama[2], Ayako Washio[3], Takahiko Morotomi[3], Chiaki Kitamura[3]

[1]Section of Operative Dentistry and Endodontology, Fukuoka Dental College, Fukuoka, Japan, [2]Section of Molecular Cell Biology and Oral Anatomy, Fukuoka Dental College, Fukuoka, Japan, [3]Department of Science of Oral Functions, Kyushu Dental University, Fukuoka, Japan

I. Introduction

When mechanostress is applied to teeth, mineralization of dentin occurs. The TRPV channel, which is a mechanosensor, is present in odontoblasts and a possible role for it in the mineralization process has been reported. Odontoblasts are expected to excrete calcium in dentin, and reactive dentin formation occurs due to activation of the TRPV channel by mechanostress receptors. However, a detailed mechanism is not yet clear. Therefore, we examined the degree of mineralization when the TRPV4 channel was stimulated in odontoblast cells.

II. Material and Method

In this study, the rat dental pulp-derived KN-3 odontoblast-like cell line (provided by Professor Chiaki Kitamura, Kyushu Dental University) was used. Quantitative PCR and fluorescent immunostaining were performed to confirm the expression of TRPV4 in KN-3 cells. RN1734, an inhibitor of TRPV4, or 4a-phorbol 12, 13-didecanoate (4a-PDD), a promoter of TRPV4, was added to the cell culture medium; cell proliferation assay measurement was performed at 1, 2, 3, and 4 days of culture. After cells reached confluence, RN1734 or 4a-PDD was added to calcification induction medium (ascorbic acid and b-glycerophosphate) and alkaline phosphatase activity was measured at 3 or 7 days of culture; alizarin red staining was also performed to evaluate the influence of TRPV4 on odontoblast mineralization ability.

III. Results

In KN-3 cells, TRPV4 gene expression and protein expression were confirmed. With the addition of 4a-PDD or RN1734, no differences in KN-3 cell proliferation were observed. In alizarin red staining, the addition of 4a-PDD to KN-3 cells promoted significant calcification and increased alkaline phosphatase activity. However, the addition of RN1734 did not promote calcification by alizarin red staining; in contrast, suppression of alkaline phosphatase activity was observed.

IV. Conclusion

Our results suggest that the mechano-sensor TRPV4 might be involved in hard tissue formation by odontoblast-like cells.

***Keywords**: TRP channel, TRPV4, Odontoblast-like cells, Mechanostress, Mechanosensor, Mineralization

***Presenting Author**: Junko Hatakeyama

Section of Operative Dentistry and Endodontology, Fukuoka Dental College, Fukuoka, Japan, hatajun@college.fdcnet.ac.jp

P2-017

Root reinforcement from root canal obturation with bioceramic cone and sealer

Sittichoke Osiri[*], Kallaya Yanpiset, Danuchit Banomyong, Vanthana Sattabanasuk

Department of Operative Dentistry and Endodontics, Faculty of Dentistry, Mahidol University, Bangkok, Thailand

I. Introduction

Bioceramic sealer (BCS) and bioceramic cone (BCC) have been introduced. The manufacturer recommends to obturate root canals with a matched single conetechnique. BCS might create bond to dentin. Moreover, adhesion between bioceramic particles in BCS and BCC is expected. Root canal obturationwith bioceramics might improve fracture resistance of root. The objective of this study was to evaluate root reinforcement of BCC/BCSby investigating fracture resistance, push-out bond strength, sealer penetration, and modulus of elasticity (MOE), in comparison to gutta-percha/AH Plus (GP/AH).

II. Material and Method

Eighty-four roots from bilateral mandibular premolars were prepared using rotary Ni-Ti files. For fracture resistance test, forty roots were randomly divided into 4 groups (n=10 each): intact roots (negative control), prepared roots (positive control), and the roots obturated with either BCC/BCS or GP/AH. Root canals were obturated with matched single cone technique, and loaded with a spreader-like tip until fracture. For push-out bond test (n=10 each), coronal, middle and apical root slices of BCC/BCS and GP/AH were loaded with a cylindrical plunger, and failure modes were determined. Sealer penetration of BCC/BCS and GP/AH (n=12 each) were evaluated for maximum depth, circumferential and total area of penetration at coronal, middle, and apical levels using confocal laser scanning microscopy. MOE was investigated according to ISO 4049:2000.

III. Results

Fracture loads of BCC/BCS, GP/AH and intact roots were not significantly different, but significantly higher than prepared, non-obturated roots. BCC/BCS provided higher bond strength, maximum depth and circumferential penetration at apical root level, and greater sealer penetration area at all levels than GP/AH. MOE of BC sealer was 30% of dentin value, but those of all other materials were much lower.

IV. Conclusion

BCC/BCS bonded and reinforced the prepared roots, which fracture resistances were similar to intact roots.

***Keywords**: Bioceramic, Bond strength, Fracture resistance, Modulus of elasticity, Root canal obturation, Sealer
***Presenting Author**: Sittichoke Osiri
Department of Operative Dentistry and Endodontics, Faculty of Dentistry, Mahidol University, Bangkok, Thailand, sittichoke_osiri_9@hotmail.com

P2-018

Long-term survival of avulsed anterior teeth up to 10 years

Dohyun Kim[*], Euiseong Kim
Department of Conservative Dentistry, Yonsei University College of Dentistry, Seoul, Republic of Korea

I. Introduction
The purpose of this retrospective study was to evaluate the prognosis of avulsed anterior teeth, and determine prognostic factors affecting the survival of avulsed teeth.

II. Material and Method
A clinical database was searched for patients with histories of avulsion on anterior teeth (incisors and canines), between 2008 and 2017. The survival of each tooth was determined according to clinical and radiographic evaluations performed at least 1 year after trauma. Kaplan-Meier survival analysis was performed to calculate survival probability of the avulsed teeth over time. Cox proportional hazard regression analysis was performed to identify prognostic factors and estimate their effects.

III. Results
A total of 216 avulsed teeth were included. Mean survival period was 9.0 years. The estimated 1-year and 5-year survival probabilities were 96.3% and 92.6%, respectively. Age of patient (HR: 1.03) and accompanying alveolar bone fracture (HR: 3.11) were found to be the contributing factors for the survival of avulsed teeth ($p<0.05$).

IV. Conclusion
Within the limitations, the findings of this study suggest that the prognosis of avulsed teeth is favorable after proper management. Older patients and teeth accompanied with alveolar bone fracture are more susceptible to failures.

***Keywords**: Avulsion, Survival, Prognosis
***Presenting Author**: Dohyun Kim
Department of Conservative Dentistry, Yonsei University College of Dentistry, Seoul, Republic of Korea, dohyun0kim@yuhs.ac

P2-019

Impact of final restoration on the coronal seal of root treated teeth: A preliminary report

Norazlina Mohammad[*1], Aws Hashim Ali Al-Kadhim[1], Faizah Abd Fatah[1], Aimi Amalina Ahmad[1], Abdul Azim Asy Abdul Aziz[1], Azlan Jaafar[2]
[1]Conservative Dentistry & Prosthodontic, Faculty of Dentistry Universiti Sains Islam Malaysia, Kuala Lumpur, Malaysia
[2]Periodontology and Community Dentistry, Faculty of Dentistry Universiti Sains Islam Malaysia, Kuala Lumpur, Malaysia

I. Introduction
Breach of coronal seal in root treated teeth will allow the access and growth of oral microflora into the root canal system and periapical area, which may lead to treatment failure. Placement of cuspal coverage through extracoronal restoration has been the recommended final restoration especially for posterior RCT teeth. However, due to the current advancement in adhesive dental materials and current concept of minimally invasive dentistry (MID), many dental operators and dental schools have shifted towards the use of intracoronal restorations for root treated teeth. The clinical performances of the intracoronal and extracoronal restorations need to be regularly monitored to ensure the attainement of sustainable and reliable coronal seal of the root treated teeth. Therefore, it was the aimed of this study to evaluate the quality of coronal restorations in endodontically treated teeth performed by Universiti Sains Islam Malaysia undergraduate dental students.

II. Material and Method
Patients previously undergone RCT with the minimum one year of obturation were recalled for review to evaluate the quality of coronal restorations. 3 independent calibrated examiners examined the technical quality of 50 endodontically treated teeth using the Modified USPHS criteria 1971. The data were descriptively analyzed using SPSS version 21.

III. Results
10 anterior, 22 premolar and 18 molar root treated teeth in 49 patients were evaluated in this study. 24 teeth were restored with extracoronal and 26 teeth intracoronal restorations. The intracoronal restorations were composite (n=12), amalgam (n=7) and glass ionomer cement (n=7). All of the extracoronal restorations were present during examination with good marginal integrity, anatomical contour and no marginal discolouration compared to intracoronal restorations at 88.4%, 84.6% and 76.9% respectively. 15.4% of the intracoronal restorations have marginal discolouration and 15.4% developed secondary caries.

IV. Conclusion
Extracoronal restorations of endodontically treated teeth evaluated in this study provide good coronal seal compared to the intracoronal restorations.

***Keywords**: Quality, Coronal restorations, Root canal treatment, Undergraduate students
***Presenting Author**: Norazlina Mohammad
Conservative Dentistry & Prosthodontic, Faculty of Dentistry Universiti Sains Islam Malaysia, Kuala Lumpur, Malaysia, norazlina79@usim.edu.my

P2-020

Periapical status of non- root- filled teeth with coronal restorations, among a sample of Jordanian population

Aladdin Al-qudah[*], Diana Abdul Jawad
Conservative Dentistry, Jordan University of Science & Technology, Irbid, Jordan

I. Introduction
Studies evaluating the changes in periapical status (PAS) in non-root filled teeth restored with either resin composite, amalgam or crown restorations are still scarce. The aim of this study was to measure and compare the prevalence of apical periodontitis (AP) in teeth restored with composite, amalgam or crowns in an adult Jordanian population.

II. Material and Method
This study was performed at Jordan University of Science and Technology (JUST), Irbid, Jordan. Restored teeth, which were non-root-filled and with closed apices were included. A final sample of 491 subjects was examined. Clinical examination and digital periapical radiographs were used to record type, material, and quality of restorations. PAS was evaluated on digital periapical radiographs. Chi-square test and logistic regression analysis were used to analyze the association between PAS and gender, age, restorations' material/type and quality.

III. Results
The examined sample had more inadequate restorations than adequate ones (61.3% vs. 38.7% respectively). High prevalence of AP was found in restored non-root-filled (RNRF) teeth of the examined sample; 26.3% of subjects were diagnosed with AP on 1 or more RNRF teeth, and 9.7% of all RNRF teeth had a lesion. AP occurred slightly more frequently in teeth restored with crowns (12.5%) than those restored with amalgam (9.8%) or composite restorations (8.7%). However, these differences were not statistically significant (p=0.386). Regression analysis showed no association between AP and gender, age, and type/material of the restoration, but a significant association with the restoration's quality ($p<0$ .001).

IV. Conclusion
High prevalence of AP was found in restored non-root-filled (RNRF) teeth of the examined sample. No statistically significant difference in the prevalence of AP was found among teeth restored with amalgam, composite or crown restorations.

***Keywords**: Periapical status, Non-root filled, Amalgam, Composite, Crown
***Presenting Author**: Aladdin Al-qudah
Conservative Dentistry, Jordan University of Science & Technology, Irbid, Jordan, aqudah@just.edu.jo

P2-021

Effect of the microscope blue light on the visual function

Noriko Muto[*], Nobuyuki Tani-Ishii
Oral Interdisciplinary Medicine, Kanagawa Dental University, Yokosuka Shi, Japan

I. Introduction
The light source used for a dental microscope (referred to microscope) includes a blue light wavelength (blue light). Since dental treatment using microscope continues precision work within a limited visual field for a long time, influence on the visual function to clinical practice is reasoned through a sense of eye fatigue and disorder. In this research, in order to analyze the influence on the microscope and the visual function in detail, a questionnaire survey was conducted on the influence that the operator considers, and based on the result, the vision test was conducted and analyzed.

II. Material and Method
Kanagawa Dental University Division of Pulp biology and volunteers were enrolled in subjects in their 20s and 30s. Corrected visual acuity of the subject was 1.0 or more, refraction±4 D or less and it was assumed that there was no ophthalmologic disease other than refraction abnormality. The treatment contents were supposed to be endodontic treatment with a model. Analysis of the vision analyzed the questionnaire and BUT, pupil diameter and miosis rate before and after the root canal treatment of natural extracted teeth. This research was carried

out under the approval of Kanagawa Dental University Research Ethics Review Committee (number; 383).

III. Results

In this study, effects were found to be particularly significant after 30's. All Subjects in 30's and beyond have continued medical examination using a microscope for 3 to 5 years. In the halogen light source and the LED light source, a tendency different from fatigue level and subjective symptoms when using for the same time were observed, but there is a possibility that a difference in visual function that affects depending on the content of blue light.

IV. Conclusion

It is necessary to collaborate with ophthalmologists to analyze the influence on visual function and consider improvement measures.

***Keywords**: Microscope, Blue light, Visual function, Endodontics treatment
***Presenting Author**: Noriko Muto

Oral Interdisciplinary Medicine, Kanagawa Dental University, Yokosuka Shi, Japan, mutoh@kdu.ac.jp

P2-022

Assessment of novel ex vivo biofilm models using oral sample

Kittipit Klanliang[*1], Hazuki Maezono[1], Mikiyo Yamaguchi[1], Maki Sotozono[1], Saori Matsui[1], Naomichi Yoneda[1], Yuichiro Noiri[2], Mikako Hayashi[1]

[1]Department of Restorative Dentistry and Endodontology, Graduate School of Dentistry, Osaka University, Osaka, Japan [2]Division of Cariology, Operative Dentistry and Endodontics, Graduate School of Dentistry, Niigata University, Niigata, Japan

I. Introduction

Biofilm-grown bacteria harbored in oral cavity contribute to chronic oral infections. In endodontic treatment, to remove or inactivate those biofilms formed in root canal system is crucial. To evaluate the efficacy of medicines or methods for controlling such biofilms, experimental biofilm models are needed. Our group developed two types of ex vivo polymicrobial biofilm models which were obtained from human dental plaque to reproduce human oral environment. The goal of this study was to assess the biofilm characteristics obtained from the novel ex vivo biofilm models.

II. Material and Method

Based on supragingival plaque samples collected from the human oral cavity, hydroxyapatite (HA) discs were used as a substratum for growing biofilm. 24-well tissue culture plate and modified Robbins device (MRD) were used for static and flow cell ex vivo models, respectively. The multispecies biofilms were cultured using Brain Heart Infusion (BHI) medium at 37°C, under anaerobic condition for 3 weeks. Biofilms formed on the HA discs were collected at 1, 2 and 3 weeks, viable cell count was obtained and DNA was extracted for pyrosequencing analysis. In addition, micromorphological analysis was performed using a scanning electron microscope (SEM).

III. Results

In any of static and flow cell models, the number of viable bacteria in the biofilms increased gradually during the observation period. At 3-week incubation, the number of bacteria on the HA discs did not show significant difference between the models. However, biofilm bacteria increased more rapidly in the flow cell model than the static model. In addition, micromorphological observation revealed the increase in the thickness of biofilm with time and the structures became complicated.

IV. Conclusion

In this study, we developed novel ex vivo models for forming biofilm on HA discs from oral sample and successfully produced standardized mature biofilms.

***Keywords**: Biofilm, Endodontic microbiology, Ex vivo model
***Presenting Author**: Kittipit Klanliang

Department of Restorative Dentistry and Endodontology, Graduate School of Dentistry, Osaka University, Osaka, Japan, kittipitdent006@gmail.com

P2-023

Effect of massage on the pain and success of anesthesia in maxillary central incisors: Double-blind, crossover trial

Saber Khazaei[*1], Roohollah Sharifi[2], Pedram Iranmanesh[1]

[1]Department of Endodontics and Dental Research Center, School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran (Islamic Republic of), [2]Department of Endodontics, School of Dentistry, Kermanshah University of Medical Sciences, Kermanshah, Iran (Islamic Republic of)

I. Introduction

Anterior maxilla is considering as one of the most painful infiltration injection sites. The aim of present study was to investigate the efficacy of local massage on infiltration injection in maxillary central incisors on the success of anesthesia and pain injection.

II. Material and Method

In this double-blind randomized crossover clinical trial 30 participants were selected. Infiltration injection with and without "massage before the injection" were conducted over two sessions with an interval of 2 weeks. The massage was done intraoral at the vestibule depth by rotational movements with a finger for 1 minute. Then, a cartridge of Mepivacaine 3% was immediately injected into the vestibular depth of maxillary central incisor. The success rate of anesthesia was determined at three intervals 5, 15, and 30 minutes after injection by electrical pulp tester. The injection pain in both methods was measured after injection immediately by Visual Analogue Scale (VAS) at three times, needle insertion, 5 seconds after injection, and needle withdrawal. Data were analyzed by SPSS 16 software.

III. Results

The success of anesthesia with and without the massage at three intervals (5, 15, and 30 minutes after injection) was not significant (McNamara, $p>0.05$). However, the mean score of VAS in injection time with the massage were lower; the mean scores of VAS with and without the massage at three times (needle insertion, 5 seconds after injection, and needle withdrawal) were not significant (Wilcoxon, $p>0.05$).

IV. Conclusion

Massage before infiltration injection in the maxillary central incisors had no impact on the pain of needle insertion and the success of anesthesia.

***Keywords**: Anesthesia, Injections, Massage, Pain
***Presenting Author**: Saber Khazaei

Department of Endodontics and Dental Research Center, School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran (Islamic Republic of), saber.khazaei@yahoo.com

P2-024

Comparative evaluation of microlakage at enamel and dentin margins of two different class ii basis restoration

Priska Lasari[*], Tien Suwartini, Wiena Widyastuti

Conservative Dentistry, Trisakti University, Jakarta, Indonesia

I. Introduction

Volumetric shrinkage still remains a major drawback of the composite restoration that include gap formation at the tooth restoration interface causing microleakage, there by permitting the passage of micro-organisms and oral fluids resulting in post-operative sensitivity, pulpal inflammation, and secondary caries. Various material and techniques have been proposed and implemented to minimize the polymerization shrinkage in dental composites. The purpose of this in vitro study was to evaluate the microleakage in Class II basis composite restorations of bulk fill flowable composite and resin modified glass ionomer bioactive ionic resin-based composite with gingival cavosurface margin at enamel (above CEJ) and dentin (below CEJ).

II. Material and Method

Thirty premolar maxilla freshly extracted teeth, free from caries and fracture were selected. They were prepared class II on mesial above the CEJ and distal below the CEJ, and through proper mounting and matrix application, were restored using SDR and RMGI bioactive ACTIVA in 4 mm bulk increment as a basis restoration and then restored with resin composite Filtex z350 (3M, ESPE). The teeth were subjected to thermocycling for 1000 cycle and were tested for microleakage through immersion in 2% methylene blue dye and incubated at 37°C for 24 hours the specimens then subsequently sectioned mesiodistally and observed under 40x Stereomicroscope and the scores were obtained for each group.

III. Results

The statistical analysis showed that there is no significant difference in microleakage between each group.

IV. Conclusion

Within the limitations of this study, none of the two materials were free from microleakage. RMGI bioactive ACTIVA materials showed more microleakage at gingival margins compared to SDR with no significant difference base on statistical analysis.

***Keywords**: Microleakage, Class II restoration, Basis restoration, SDR
***Presenting Author**: Priska Lasari

Conservative Dentistry, Trisakti University, Jakarta, Indonesia, priska.lasari@gmail.com

P2-025

Assessment of radicular morphology of mandibular molars in Indian population- A retrospective CBCT analysis

Radhika Manel, **Amandeep Kaur**[*], Ajay Logani

Conservative Dentistry and Endodontics, All India Institute of Medical Sciences, CDER, New Delhi, India

I. Introduction

To assess the radicular morphology of permanent mandibular first, second and third molar in a representative Indian population using retrospective cone beam

computed tomographic data.

II. Material and Method

Ethical clearance was obtained. One thousand CBCT scans were obtained from the data bank of an imaging center over a period of one year. These scans were of patients with permanent dentition who had undergone the radiological investigation as prescribed by their treating dentist for a dental/maxillofacial related cause. All scans were taken under standard operating conditions with a limited field of view. These scans were coded to protect the identity of the patients. 10,306 mandibular molars (first molars n=1186, second molars n=1264 and third molars n=779) were analyzed using i-CAT vision software in axial, sagittal and coronal planes. The parameters evaluated were number of roots classified as single, two and multiple, type of canal configuration according to Vertucci's classification and length of roots.

III. Results

The longest roots were observed in mandibular first molar (mesial root-14.36±1.65 mm, distal root-13.39±1.65 mm). Mandibular third molar exhibited the shortest roots (10.88±1.68 mm). Majority of the mandibular molars had two roots. The observed incidence of radix entomolaris was 2.61%, 1.10% and 2.05% in mandibular first, second and third molars respectively. The most common canal configuration for all molars was Vertucci's Type II for mesial root and Vertucci's Type I for distal root.

IV. Conclusion

Variation in root canal morphology is a norm rather than exception. "The eyes only see what the mind knows" and hence the knowledge of variation of root canal morphology in a population is imperative. CBCT can be a viable tool for evaluating population based root canal anatomy. This would enable the clinician to deliver predictable outcomes and prevent iatrogenic errors.

***Keywords**: CBCT, Mandibular molars, Root canal anatomy

***Presenting Author**: Amandeep Kaur

Conservative Dentistry and Endodontics, All India Institute of Medical Sciences, CDER, New Delhi, India, amandoc24@gmail.com

P2-026

The importance in determining the working length (WL) in endodontics: Attitudes and practices of Ivorians dental surgeon

Aline Krah-Sinan[*1], Marie Adou-Assoumou[1], Florent Kouakou[1], Stephane Xavier Djole[1], Reine Natacha Tra-Laga[1], Babacar Faye[2]

[1]Endodontic and Restorative, Félix Houphouet Boigny University of Abidjan, Abidjan, Côte d'Ivoire, [2]Endodontic and Restorative, Endodontic and Restorative Department, Cheikh Anta Diop University of Dakar, Sénégal, Dakar, Senegal

I. Introduction

The determination of the working length is an essential step in the endodontic treatment that follows chronologically the realization of the access cavity and the initial catheterization. Well conducted, it ensures therapeutic success by avoiding over-instrumentation and under-instrumentation causing failure and post-operative complications. The objective of this study was to assess methods and techniques in determining the working length used in general practice in Ivory Coast.

II. Material and Method

This was a three-month cross-sectional descriptive survey, which focused on the knowledge, attitudes and practices of 130 general practitioners in Abidjan, relating to the topic.

III. Results

Results show that screen film radiography is the most commonly used method (72%), but 18% of practitioners do not have it in their practices. Among those who have this device, only 44.61% determine the working length, about 12% never do it and the remaining (43%) does it a few times. Only 5% of the surveyed populations have the apex locator. For most dentists (70%), the apical limit is below the radiographic apex, that is at 1mm for 31% or 2mm for 39%. 12% goes up to the radiographic apex, therefore at the foramen level and 18% have no opinion about it. Regarding techniques, 52% of practitioners use empirical techniques (tactile sense) and 46% using radiographic techniques. Combining apex locator and radiography is virtually non-existent (1.5%).

IV. Conclusion

Within this work limits, it can be concluded that not all Ivorians practitioners consistently determine the working length. Radiography is the commonly used method and empirical and conventional techniques are the most used techniques.

***Keywords**: Endodontics, Working length, Determination, Dental surgeons, Survey

***Presenting Author**: Aline Krah-Sinan

Endodontic and Restorative, Félix Houphouet Boigny University of Abidjan, Abidjan, Côte d'Ivoire, aline_sinan@yahoo.fr

P3-002

Do smart phones interfere with working length determination using electronic apex locators?

Nishanthine Cruz Irudhayaraj[*], Jayashree Amirthalingam, Srinivasan Manali R

Department of Conservative Dentistry and Endodontics, Sri Venkateswara Dental College and Hospital, Chennai, India

I. Introduction

The objective of this clinical study was to evaluate the electromagnetic interference of two different smart phones during working length determination using electronic apex locator.

II. Rationale

The success of the root canal treatment depends on the accurate determination of the working length. Electronic apex locater provides more accurate estimation of the working length, reduces treatment time and radiation dose to the patient. Possibility of inaccurate reading as a result of electromagnetic interference by different electronic devices including smart phones is a major concern regarding electronic apex locators. During electronic working length determination possibility of electromagnetic interference might explain some clinical difficulties due to lack of stability of electronic apex locators. This clinical study is to demonstrated that reliability and stability of electronic apex locator were not influenced when placed in direct contact with smart phones.

II. Material and Method

Thirty patients indicated for root canal treatment was selected for this study. Patients with dental caries and chronic pulpitis were included in this study. Teeth presenting with periapical pathologies, root resorption, root fractures, open apex were excluded from the study. Written informed consent was obtained for the same. Working length was determined using Ingle's radiographic method and the effect of smart phone on electronic apex locators (EAL) was determined under three different experimental settings: (1) EAL without smart phone in operator room, (2) EAL with iphone 6s placed in close contact, (3) EAL with Samsung S7 placed in close contact. The data were tabulated and subjected to statistical analysis.

III. Results

No significant difference was found for electronic working length measurements in the presence or absence of smart phones.

IV. Conclusion

The smart phones used in this clinical study did not affect the accuracy of electronic working length measurements. Smart phones do not interfere with working length determination using electronic apex locators.

***Keywords**: Electronic apex locator, Smart phones, Working length determination

***Presenting Author**: Nishanthine Cruz Irudhayaraj

Department of Conservative Dentistry and Endodontics, Sri Venkateswara Dental College and Hospital, Chennai, India, drnish11@gmail.com

P3-003

Effect of erbium, chromium-doped yttrium, scandium, gallium and garnet laser on human apical papilla cell proliferation

Apichaya Srisathian[*], Tanida Srisuwan

Department of Restorative Dentistry and Periodontology, Chiang Mai University, Chiang Mai, Thailand

I. Introduction

The application of laser in regenerative endodontics is promising since it has biostimulation effect. This study investigated the direct effect of erbium, chromium-doped yttrium, scandium, gallium and garnet (Er,Cr: YSGG) laser on human apical papilla cell (APC) proliferation when used at either low or high power output. The appropriate working distance of the laser tip was also examined.

II. Material and Method

The Er,Cr: YSGG laser (Waterlase C100, Biolase, San Clemente, CA) connected to an endodontic fiber tip (Z4, Endolase Tip, Biolase) was used at different power outputs (0.1 W, 0.5 W and 1 W) to irradiate the cultured human APC for 20 seconds using the continuous mode. In the same power setting group, the laser tip was assigned to place at two, five and eight millimeters from the bottom of each culture well. The groups without laser treatment served as controls. Then, the number of laser-irradiated APC was assessed periodically using alamarBlue® assay up to 72 hours.

III. Results

The number of APC, at 48 and 72 hours after irradiation, was significant greater in all groups using power output at 0.1 W than in groups using 0.5 and 1 W ($p<0.05$). The cell numbers were significantly decreased when the laser was set at 1 W ($p<0.05$). Considering the level of laser tip placement, the groups using 0.5 W and 1 W power levels showed higher cell numbers when tip was placed at 8 mm

than groups placing at 2 mm and 5 mm respectively. The significant differences were observed at the initial time points, one to six hours, after irradiation.

IV. Conclusion

The use of Er,Cr: YSGG laser at 0.1 W promoted APC proliferation. Placement of the laser tip at 8 mm did not exert negative effects on APC survival.

***Keywords**: Apical papilla cells, Erbium lasers, Regenerative endodontics
***Presenting Author**: Apichaya Srisathian

Department of Restorative Dentistry and Periodontology, Chiang Mai University, Chiang Mai, Thailand, meaw_pinkcat@hotmail.com

P3-004

Irisin induces angiogenesis and odontoblastic differentiation in human dental pulp cells

Ji-Won Son, Yun-Chan Hwang, Won-Mann Oh, **Bin-Na Lee***

Department of Conservative Dentistry, Chonnam National University, School of Dentistry, Gwangju, Republic of Korea

I. Introduction

This study investigated whether irisin promotes odontogenic differentiation and angiogenesis in human dental pulp cells (hDPCs).

II. Material and Method

Gene expressions of angiogenesis and odontoblastic differentiation were analyzed by qRT-PCR. We used western blot assay to measure the odontogenic, angiogenic protein expression and MARK pathway involvement. ALP staining and ARS staining were performed. We used One-way ANOVA and student's t-test with SPSS 23.0 software. The significance difference was determined at $p<0.05$.

III. Results

Irisin at 20 ng concentration significantly increased the mRNA level of DSPP, DMP-1, FGF and VEGF in hDPCs. Irisin at 20 ng concentration significantly enhanced the ALP expression and calcified nodule formation ($p<0.05$). Irisin enhanced ERK, p38 phosphorylation within 5 min of treatment. Irisin-induced DSPP and VEGF protein expression and mineralization were appreciably blocked with the presence of MAPK inhibitors in hDPCs.

IV. Conclusion

Irisin stimulated odontogenic differentiation and angiogenesis in hDPCs through activating MARKs (ERK and p38) activity in vitro.

***Keywords**: Angiogenesis, Human dental pulp cell, Irisin, Odontoblastic differentiation
***Presenting Author**: Bin-Na Lee

Department of Conservative Dentistry, Chonnam National University, School of Dentistry, Gwangju, Republic of Korea, bnlee13@jnu.ac.kr

P3-005

Enzyme activity of human dental pulp as a diagnostic marker of pulp inflammation

Alexandr Mitronin[1], Irina Ostrovskaya[2], **Diana Ostanina***[1]

[1]Department of Cariesology and Endodontics, Moscow State University of Medicine and Dentistry Named After A.I. Yevdokimov, Moscow, Russian Federation, [2]Department of Biochemistry, Moscow State University of Medicine and Dentistry Named After A.I. Yevdokimov, Moscow, Russian Federation

I. Introduction

Dentists can face difficulties in evaluating pulp status, since pulp abnormalities may develop without clinical signs. Proteins participating in many biological processes may be used as diagnostic markers of pulp inflammation. Thus, the aim of the research was to estimate the activity of certain enzymes in healthy and inflamed pulps in order to determine pulp vitality potential.

II. Material and Method

Pulp specimens obtained from 125 teeth demonstrating signs of initial hyperemia (n=34), acute (n=25) or chronic (n=66) inflammation were examined. The control group consisted of the pulp specimens obtained from 23 permanent teeth that had been removed for orthodontic or prosthodontic reasons. Pulp was extracted with barbed broach. Pulp tissues were rinsed in 0.9%NaCl and placed into pre-cooled porcelain mortar containing 5 µg of aluminosilicate powder and 0.5M Tris-HCl Buffer (pH=7.3) (tissue weight 1 mg/10 µL). Mixture was homogenized and centrifuged at 3000 rpm for 15 min. Spectrophotometry was applied to determine activity of aspartate aminotransferase (AST), alanine aminotransferase (ALT), lactate dehydrogenase (LDH), alkaline phosphatase (ALP), malate dehydrogenase (MDH), superoxide dismutase (SOD) in IU/min*g of tissue in obtained homogenate.

III. Results

Permanent teeth with signs of initial pulpitis demonstrated increased activity of SOD and ALP ($p<0.001$), significantly decreased activity of ALT ($p<0.05$), while activity of MDH, AST, LDH was found to be similar to the results in control group. Teeth with the diagnosis of acute pulpitis showed significant ($p<0.05$; $p<0.001$) increase in LDH, ALP activity and decreased activity of MDH, AST, ALT.

Teeth with chronic pulpitis demonstrated significant decrease ($p<0.05$) in AST, ALT, ALP, LDH activity indicating decreased intensity of all metabolic processes.

IV. Conclusion

It was revealed that pulp cells being in acute or chronic inflammation do not have regeneration potential. The activities of investigated enzymes in pulp with initial pulpitis are very similar to those in normal tissues that can be considered as a background for vital pulp therapy.

***Keywords**: Reversible pulpitis, Pulp inflammation, Pulp proteome, Enzyme activity, Vital pulp therapy
***Presenting Author**: Diana Ostanina

Department of Cariesology and Endodontics, Moscow State University of Medicine and Dentistry Named After A.I. Yevdokimov, Moscow, Russian Federation, dianaostanina@mail.ru

P3-006

A chitosan as a potential for tissue engineering in endodontics

Dian Agustin Wahjuningrum*[1], Fikarini H Puteri[2], Fauzan Hasby[1], Rifatul Jannah[1], Senny Kandarini[1]

[1]Department of Conservative Dentistry, Universitas Airlangga, Surabaya, Indonesia, [2]Faculty of Bioscience& Medical Engineering, Universiti Teknologi Malaysia, Johor Bahru, Malaysia

I. Introduction

Bone defects in endoperio disease requiring grafts to promote healing are frequently occurring and costly problems in Endodontics. A bioactive material, recent progresses as well as future trends and challenges is one of the key factors for successful tissue engineering. Chitosan, a biodegradable, naturally occurring polymer, has drawn considerable attention in recent years as scaffolding material in tissue engineering and regenerative medicine.

Chitosan is especially attractive as a bone scaffold material because it supports the attachment of stem cells and proliferation of osteogenic induction. The aim of this research is to know the difference of osteogenic induction using Chitosan and hADMSC.

II. Material and Method

The research design used laboratory experimental. The samples used were 12 mandibular socket post molar extraction of Rat according to the predefined sample criteria. Commercially available chitosan results from alkaline deacetylation of chitin, utilized method for chitosan scaffolds is the phase separation and lyophilization technique with pores. The experimental groups included (1) negative control, (2) Chitosan scaffolds and Chitosan scaffolds containing (3) undifferentiated hADMSC with 1, 4, and 8 weeks application. Osteogenic induction was tested using OSX and BMP marker.

III. Results

The result of statistical analysis using independent t-test showed that $p<0.05$. Chitosan scaffold with stem cells seeding will increasing osteogenic induction.

IV. Conclusion

Osteoprogenitor cells combined with supportive biomaterials represent a promising approach to advance the standard of care for bone grafting procedures.

***Keywords**: Chitosan, Tissue engineering, Endodontic
***Presenting Author**: Dian Agustin Wahjuningrum

Department of Conservative Dentistry, Universitas Airlangga, Surabaya, Indonesia, dianagustin_fkg@yahoo.co.id

P3-007

Basket File (BF): A new hollow concept

Ajinkya Pawar*

Conservative Dentistry and Endodontics, Nair Hospital Dental College, Mumbai, India

I. Introduction

The objective of the current poster will be to put forward a new conceptual design of an endodontic file named as a Basket File and to exhibit one of the pilot study on cyclic fatigue using this file in comparison with other commonly used rotary files.

II. Material and Method

Twenty-five new files (n=5 for each file) ProTaper Universal #25/0.08; ProTaper NEXT #25/0.06, NeoEndo #25/0.06; CricEndo #24/0.06; and Basket File #25/0.06, were submitted to cyclic fatigue tests. The cyclic fatigue-testing device used in the present study has been used for studies on cyclic fatigue resistance previously. The artificial canal was manufactured to provide the instrument with a very challenging trajectory 60° curvature, with a 5 mm radius. All instruments were rotated or reciprocated until fracture occurred. The time to fracture was recorded. All data were subjected to statistical evaluation with analysis of variance test. The separated fragments were scanned using scanning electron microscopy to see the stress areas.

III. Results

The results exhibited that the new conceptual file BF did

not separate when used in the cyclic fatigue apparatus. These files were used in the apparatus for 10 minutes. The results exhibited a statistically significant difference between the groups.

IV. Conclusion

The results exhibited that the new conceptual file BF did not separate when used in the cyclic fatigue apparatus. These files were used in the apparatus for 10 minutes. The results exhibited a statistical significant difference between the groups.

***Keywords**: Basket File, Cyclic fatigue, Hollow file, New concept

***Presenting Author**: Ajinkya Pawar

Conservative Dentistry and Endodontics, Nair Hospital Dental College, Mumbai, India, ajinkya@drpawars.com

P3-008

The ability of Lysate- PRF induces proliferation of fibroblast cells in endodontic regenerative therapy

Endang Suprastiwi*

Conservative Dentistry, Universitas Indonesia, Jakarta, Indonesia

I. Introduction

Lysate- PRF is a scaffold that contains growth factor. The study to analyze the ability of two types of Lysate- PRF in inducing the proliferation of fibroblast cells.

II. Material and Method

Microplate with 24 wells each filled 200 µl suspension DMEM + 10% FBS and 10 x 104 fibroblasts. Then FBS is replaced with a concentration of 1%, for serum starvation process. Each 3 wells were exposed with 50%, 25%, 12.5% Lysate-PRF and 50%, 25%, 12.5% Lysate A -PRF respectively. Three other wells are exposed to 10% FBS. Microplate was incubated for 24 Hour at 37°C with 5% CO2. The growth of fibroblast was calculated by automatic cell counter.

III. Results

The highest mean value of the Lysate-PRF group at 12.5% (312.833) while the Lysate A -PRF group at 25% (303.500). If all the groups compared did not show any significant differences. Lysate-PRF and Lysate A-PRF have the same ability to induce fibroblast proliferation.

IV. Conclusion

Lysate-PRF and Lysate A -PRF have the same ability as 10% FBS in inducing fibroblast cell proliferation or the same as physiological condition.

***Keywords**: Lysate-PRF, Fibroblast, Proliferation, Regenerative, Endodontic

***Presenting Author**: Endang Suprastiwi

Conservative Dentistry, Universitas Indonesia, Jakarta, Indonesia, esuprastiwi@yahoo.co.id

P3-009

Long-term effect of acidic pH on the surface microhardness of ProRoot MTA, Biodentine and TotalFill Root Repair Material

Koral Bayraktar, Fatima Betul Basturk, **Dilek Turkaydin***, Mahir Gunday

Endodontics, Marmara University, Istanbul, Turkey

I. Introduction

We aimed at comparing the microhardness values of ProRoot MTA, Biodentine and TotalFill Root Repair Material (TF-RRM) Putty at varying pH and times.

II. Material and Method

Materials were mixed and placed in cylinder blocks with internal dimensions of 6x4 mm. Ten samples of each material were soaked in buffered solutions of butyric acid with 4.4, 5.4, 6.4 and 7.4 pH values and stored at 37°C in 100% humidity. The samples were submitted to microhardness test at the end of 1 week and then 1 month. MANOVA and Tukey HSD tests were carried out to compare the mean values at a significance level of $p<0.05$.

III. Results

Low pH caused a significant decrease in the microhardness values of all samples. Surface microhardness increased with time ($p<0.0001$). The microhardness values of Biodentine were significantly greater than those of ProRoot MTA and TF-RRM Putty ($p<0.0001$). The lowest microhardness values were recorded for TF-RRM Putty groups regardless of the pH of the environment and the evaluation time.

IV. Conclusion

An acidic environment impaired the surface microhardness of all root repair materials tested. Overall, the mean surface microhardness of TF-RRM Putty was lower than those of ProRoot MTA and Biodentine. Biodentine showed the greatest microhardness values at all pH values, regardless of the evaluation time.

***Keywords**: Biodentine, Endosequence Root Repair Material, iRoot BP Plus Root Repair Material, ProRoot MTA, TotalFill Root Repair Material, pH

***Presenting Author**: Dilek Turkaydin

Endodontics, Marmara University, Istanbul, Turkey, erbaydilek@yahoo.com

P3-010

Rheological and physical properties of phyllosilicate clay added tricalcium silicate

Donghoon Kang*[1], Takahiro Wada[2], Motohiro Uo[2], Takashi Okiji[1]

[1]Department of Pulp Biology & Endodontics, Tokyo Medical and Dental University, Tokyo, Japan, [2]Department of Advanced Biomaterials, Tokyo Medical and Dental University, Tokyo, Japan

I. Introduction

Tricalcium silicate (TCS) is a main component of MTA and synthetic TCS is expected as a new endodontic biomaterial for its high purity. However, TCS has difficulties of handling in clinical use due to its poor rheological property. To solve this problem, rheology modifiers can be applied and especially, phyllosilicate clays are expected as compatible rheology modifiers for TCS. The aim of this study is to investigate the influence of phyllosilicate clays to TCS on rheological and physical properties.

II. Material and Method

TCS (Nippon Shika Yakuhin), phyllosilicate clays (bentonite (Bt, Kaneatsu) & Laponite (La, BYK)) were used and 3 groups of powder were prepared: TCS (Cont.), 30wt% of Bt added TCS (30Bt), 25wt% of La added TCS (25La). Each powder was mixed at mixable minimum liquid-powder ratio (Cont. and 30Bt at 0.5, 25La at 0.6). To evaluate rheological properties (injectaiblity & yield point), each paste was placed in long narrow syringe and universal testing machine (EZ LX, Shimadzu), with a test speed of 15 mm/min, was used to evaluate the rheological properties of the paste at 24°C. Injectability was expressed as a percentage of extruded paste. Yield point was defined as the load needed for extrusion. Compressive strength was measured according to ISO 9971-1. Each sample was cured at 37ºC for 24 hours.

III. Results

30Bt showed larger injectability than 25La (30Bt: 63.66%, 25La: 31.43%). Yield point of 25La was larger than 30Bt (30Bt: 20.56N, 24La: 44.38N) and 25La paste showed more viscous than 30Bt paste. In compressive strength, there was no significant difference in Cont. and 30Bt. However, 25La showed significant decrease of compressive strength comparing with Cont. and 30Bt.

IV. Conclusion

By adding proper amount of Bt and La, rheological properties of the paste were improved. However, La addition showed significant decrease in compressive strength of the hardened cement.

***Keywords**: MTA, TCS, Handling property, Rheology property, Phyllosilicate clay, Rheology modifier

***Presenting Author**: Donghoon Kang

Department of Pulp Biology & Endodontics, Tokyo Medical and Dental University, Tokyo, Japan, d.kang.endo@tmd.ac.jp

P3-011

Effectiveness of irrigations with two sonic activation equipments in cleaning the $Ca(OH)_2$ residual in the apical third

Adelia Mutia Indah*, Juanita A G, Selviana Wulansari

Conservative Dentistry, Trisakti University, Jakarta, Indonesia

I. Introduction

The aim of this study was to determine the effectiveness difference of sonic activation techniques with two different tools in cleansing $Ca(OH)_2$ in the apical third of root canals based on activation time.

II. Material and Method

Twenty extracted single-rooted teeth were divided randomly into 2 groups. Canal instrumentation was done, and the teeth were filled with $Ca(OH)_2$ paste. One week later, sonic techniques with two difference tools were used for $Ca(OH)_2$ removal. All the groups were irrigated with NaOCl 5.52% with flow rate 5 ml/ minute. In the first group, the irrigants were activated using EDDY (polyamide tip, VDW) for 30 seconds. The second groups, irrigants were activated using the EndoActivator (Dentsply Tulsa Dental Specialties, Tulsa, OK) for 30 seconds. The canal walls were viewed, and the remaining amount of $Ca(OH)_2$ was evaluated using a scanning electron microscope. A scoring system was used to assess the amount of residue $Ca(OH)_2$ in the apical third of root canals. The obtained data were statistically analyzed using the Mann-Whitney U test.

III. Results

(a) Remnants of medicament were found in all teeth, (b) No statistically significant difference in the elimination of both $Ca(OH)_2$ from the entire canal ($p=0.64$). However activated the irrigants using EDDY was better eliminated

from the Endoactivator.

IV. Conclusion

None of the investigated techniques removed the $Ca(OH)_2$ dressing completely. However, the EDDY System showed better results in removing $Ca(OH)_2$ in the apical third of root canals in comparison with EndoActivator.

***Keywords**: Calcium hydroxide, EDDY, Endoactivator, Irrigation

***Presenting Author**: Adelia Mutia Indah

Conservative Dentistry, Trisakti University, Jakarta, Indonesia, adelia.sadat@yahoo.com

P3-012

Micro-CT evaluation of dentinal microcrack formation after using rotary, hybrid and reciprocating NiTi instruments

Saulius Drukteinis[*], Ieva Buzyte, Vytaute Peciuliene

Conservative Dentistry and Endodontology, Institute of Dentistry Faculty of Medicine Vilnius University, Vilnius, Lithuania

I. Introduction

Several studies have reported a causal relationship between preparation of the root canal with nickel-titanium (NiTi) instruments and the formation of dentinal micro-cracks. However, some studies have not revealed a causal relationship between instrumentation with rotary or reciprocating instruments and the formation of new dentinal defects. The aim of this study was to evaluate and compare ex vivo the incidence of micro-cracks in root dentine after canal preparation with rotary, hybrid and reciprocating NiTi endodontic instruments in extracted mandibular first molars using micro-computed tomography (MCT).

II. Material and Method

Forty mandibular first molars were selected and assigned to 4 experimental groups (n=10), according to the instrument system used for preparation: ProTaper NEXT (PTN), BioRace (BR), Genius (GN) or WaveOne (WO) systems. Canals were accessed in a conventional manner and instrumented using crown-down technique according to the manufacturer's protocol. MCT at an isotropic resolution of 22.8 µm was used to scan the specimens before and after instrumentation. Dentinal micro-cracks were assessed on a comparison of the pre- and post-instrumentation MCT scans at the coronal, middle and apical thirds. One-way analysis of variance was performed to determine any significant differences between groups; significance was set at $p<0.05$.

III. Results

No new micro-cracks were observed after root canal instrumentation with the hybrid GN instrument system. Rotary (PTN, BR) and reciprocating (WO) instrument systems caused dentinal micro-cracks, predominantly in the middle third of the root canals; however, no significant difference was found between them in the incidence of crack formation ($p>0.05$).

IV. Conclusion

Within the limitations of this study, root canal preparation with the hybrid Genius system did not induce the formation of dentinal micro-cracks, while root canal shaping with rotary and reciprocating file systems produces micro-cracks on the root canals of mandibular first molars.

***Keywords**: Dentin micro-cracks, Hybrid movement, Microcomputed Tomography, Reciprocation, Rotary

***Presenting Author**: Saulius Drukteinis

Conservative Dentistry and Endodontology, Institute of Dentistry Faculty of Medicine Vilnius University, Vilnius, Lithuania, saulius.drukteinis@gmail.com

P3-013

Evaluation of different irrigation techniques in pig's infected root canal: In vivo study

Toshinori Tanaka[*1], Keisuke Handa[1], Suresh V. Venkataiah[1], Masafumi Kanehira[1], Tatsuya Hasegawa[1], Yuichiro Noiri[2], Masahiro Saito[1]

[1]Operative Dentistry, Tohoku University Graduate School of Dentistry, Sendai, Japan, [2]Cariology, Operative Dentistry and Endodontics, Niigata University Graduate School of Medical and Dental Sciences, Niigata, Japan

I. Introduction

Biofilm formation in the root canal is the important causative factor in the formation of endodontic lesion, thus the elimination of the biofilm play significant role in the treatment of periapical lesion. Numerous studies on root canal disinfection have been performed in in vitro models. However, it is difficult to estimate elimination of the biofilm in the root canal in vivo. Therefore, we aimed to develop an in vivo intraradicular biofilm model in cattle pigs to evaluate the onset of periapical lesion, and to compare an effect on biofilm removal by different irrigant agitation techniques.

II. Material and Method

The research was approved by university ethics committee before beginning the experiments. Mandibular second premolars of cattle pigs were used in this study. Access cavity was prepared and root canals were exposed to the oral environment and filled after 2 weeks. Development of endodontic lesions was evaluated by micro CT analysis and C-Reactive Protein assay after 4 weeks. The presence of microorganisms in root canals was investigated by scanning electron microscope (SEM). Root canal irrigation for each group was performed as follows; no irrigation, sodium hypochlorite (NaOCl) syringe irrigation (NSI), NSI + ultrasonic activation, NSI + Endoactivator, and NSI irrigation + laser activation. The tooth roots were extracted after irrigation, and real-time polymerase chain reaction (PCR) performed to determine bacterial count.

III. Results

Periapical lesions were induced by exposing root canals to the oral environment in the cattle pigs. CRP levels were significantly increased at 2 weeks and decreased at 6 weeks. SEM images showed biofilm formation in root canals. Real-time PCR analysis showed highest debridement of biofilm by syringe irrigation + laser activation group compared with other groups.

IV. Conclusion

Our result showed intraradicular biofilm model in cattle pig was developed, and laser-activated irrigation showed highest chemical debridement of biofilm.

***Keywords**: Intracanal biofilm, Irrigation, Activation

***Presenting Author**: Toshinori Tanaka

Operative Dentistry, Tohoku University Graduate School of Dentistry, Sendai, Japan, tt2306@caa.columbia.edu

P3-014

Pulpal responses after direct pulp capping with two calcium-silicate cements in rat model

Panruethai Trongkij[*1], Supachai Sutimuntanakul[2], Puangwan Lapthanasupkul[3], Chitpol Chaimanakarn[2], Rebecca Wong[4], Danuchit Banomyong[2]

[1]Department of Operative Dentistry and Endodontics, Private practice, Bangkok, Thailand, [2]Department of Operative Dentistry and Endodontics, Department of Operative Dentistry and Endodontics, Faculty of Dentistry, Mahidol University, Bangkok, Thailand, [3]Department of Oral and Maxillofacial Pathology, Department of Oral and Maxillofacial Pathology, Faculty of Dentistry, Mahidol University, Bangkok, Thailand, [4]Restorative Section, Restorative Section, Melbourne Dental School, University of Melbourne, Melbourne, Australia

I. Introduction

This study aimed to investigate the effects of Bio-MA (M-Dent/SCG, Bangkok, Thailand), a new calcium chloride containing, calcium-silicate based cement, as a pulp capping material on mechanically exposed rat molar pulp.

II. Material and Method

Sixty maxillary first molars of Wistar rats were mechanically exposed and randomly assigned according to the two capping materials, Bio-MA or white mineral trioxide aggregate (WMTA, ProRoot MTA, Tulsa Dental Products, Tulsa, OK, USA), at three follow-up periods-1, 7, or 30 days (n=10 teeth of each). Nine intact molars were served as negative controls. Other nine molars were pulpal exposed and covered with polytetrafluoroethylene (PTFE) tape (n=3 per period) to serve as positive controls. The rats were sacrificed, and the maxillary segments were prepared and stained with hematoxylin and eosin (H&E) for histological analyses. Inflammatory cell infiltration and reparative dentin formation were blindly evaluated, using grading scores.

III. Results

At 1 day, a localized mild inflammation was mostly detected in all experimental groups. At 7 days, dentin bridge formation was observed at exposure sites with few inflammatory cells. At 30 days, pulp capped with Bio-MA or WMTA appeared normal without inflammation; dentin bridge was completely formed with tubular structure and minimal defects, covering the exposure sites in most specimens. The uncapped pulp in the positive control groups showed persistent moderate chronic inflammation and incomplete calcification at 7 and 30 days. No significant difference in pulpal responses between the two capping materials was observed at any observation period ($P>0.05$). Formation of hard tissue barriers at 7 and 30 days in Bio-MA and WMTA groups was significantly higher than that at 1 day ($P<0.01$).

IV. Conclusion

Bio-MA exhibited a similar biocompatibility, in pulpal response and reparative dentin formation, to WMTA. Bio-MA could be used as an alternative pulp-capping material to WMTA.

***Keywords**: Biocompatibility, Calcium silicate, Dental pulp capping, Mineral trioxide aggregate, Pulpal inflammation, Reparative dentin

***Presenting Author**: Panruethai Trongkij

Department of Operative Dentistry and Endodontics, Private practice, Bangkok, Thailand, pan.trongkij@hotmail.com

P3-015

The effect of endodotic treatement on the outcomes of cyst enucleation

Daesoon Kim*, Jungsoo Lee, Nan Sim Pang
Advanced General Dentistry, Yonsei University, Seoul, Republic of Korea

I. Introduction
The treatment options for large periapical lesions range from conventional nonsurgical root canal treatment to various surgical interventions. The current endodontic philosophy for the treatment of large periapical lesions involves initial nonsurgical root canal treatment of involved teeth. The problem is that the origin of the cyst is difficult to distinguish from radiologic findings or clinical findings not the post-operative biopsy, especially in previously endodontic treated teeth. This retrospective study aimed to investigate whether or not the preoperative endodontic treatment of the cyst-involved teeth before knowing the origin of the cyst affects the postoperative outcomes after cyst enucleation.

II. Material and Method
Two hundred cases of cyst enucleation which were accompanied with endodontic evaluation or further endodontic treatment of involved teeth from March 2008 to December 2014 were retrospectively investigated by medical records and radiographs. We investigated whether the preoperative endodontic treatment affected the recurrence of cyst according to the origin of cyst and the related prognostic factors including preoperative clinical finding and operative procedures were assessed.

III. Results
As the results of the biopsy after cyst enucleation, 138 cases were originated from inflammatory reason and 62 cyst cases were from developmental origin. According to survival analysis, inflammatory cyst had 10.9% recurrence rate at 5 years and developmental cyst had 9.7% at the same time. In inflammatory originate cysts, even if involved teeth had already been endodontically treated, whether or not re-endodontic treatment significantly affected recurrence rate. When the associated tooth was molar or cystic lesion was larger, including more teeth, these cases were significantly associated with recurrence of cyst. Apicoectomy and retrofilling significantly affected the outcome of cyst enucleation.

IV. Conclusion
In cystic lesion of inflammatory origin, endodontic evaluation and preoperative root canal therapy for Intraradicular disinfection is a prerequisite for satisfactory outcome after cyst enucleation.

***Keywords**: Cyst enucleation, Endodontic treatment, Cyst recurrence
***Presenting Author**: Daesoon Kim
Advanced General Dentistry, Yonsei University, Seoul, Republic of Korea, KDS9801@yuhs.ac

P3-016

Impact of excessive use of oral antiseptics on the incidence of cardiovascular events

Bader AlOtaibi*[1], Ali AlSofyani[1], Hesham Elsharkawy[2]
[1]Faculty of Dentistry, Taif University, Taif, Saudi Arabia, [2]Oral Medicine, Faculty of Dentistry, Taif University, Taif, Saudi Arabia

I. Introduction
Most nitrates which are circulating in the plasma become concentrated in salivary glands and released into saliva. Oral facultative anaerobic nitrate-reducing bacteria inhabiting the oral cavity reduce the nitrate molecules to nitrites. After swallowing, some nitrites are absorbed into the blood stream and in conjunction with nitrites formed from nitric oxide (NO) metabolism, become a source of vasodilatory NO. It has been recently found that the use of antibacterial mouthwash by healthy individuals for more than one week elevates the blood pressure to some extent and reduces nitrate reduction. In the present review, our main objective is to explore the interruption of the nitrate–nitrite–NO pathway through the use of antibacterial mouthwash.

II. Material and Method
MEDLINE/PubMed and EMBASE were searched for all studies related to our key words.

III. Results
It was revealed that the use of antibacterial mouthwash by healthy individuals for more than one week elevated the blood pressure to some extent. As reduction of commensal bacteria by oral antiseptics prevents endogenously produced nitrates from being recycled to systemic nitrite which could have a direct blood pressure lowering effect.

IV. Conclusion
We concluded that excessive use of oral antiseptic mouthrinses could lead to cardiovascular events particularly in patients with high risk to cardiovascular accidents.

***Keywords**: Nitrates, Nitrites, NO, Cardiovascular diseases, Antiseptic mouthwashes
***Presenting Author**: Bader AlOtaibi
Faculty of Dentistry, Taif University, Taif, Saudi Arabia, b.alotebi@tudent.edu.sa

P3-017

A plasma jet system for disinfection of *Enterococcus faecalis*

Kanruethai Saleewong*[1], Phumisak Louwakul[1], Saengusa Khemaleelakul[1], Dheerawan Boonyawan[2]
[1]Department of Resorative and Periodontal Dentistry, Chiang Mai University, Chiang Mai, Thailand, [2]Department of Physics and Materials Sciences, Chiang Mai University, Chiang Mai, Thailand

I. Introduction
Root canal failure is mainly caused by intraradicular infection, especially in the apical part of root canal that always has complex anatomy i.e. ramifications, apical deltas. Some bacteria may also survive from chemomechanical preparation by various mechanisms including biofilm formation. Non-thermal plasma has been developed and applied in biomedical field due to its microbiocide, safety, and penetration properties. The purpose of this study was to investigate the effect of the newly developed jet plasma against the *Enterococcus faecalis (E. faecalis)* biofilm.

II. Material and Method
Three prepared dentin slices were infected with *E.faecalis* in Tryptic Soy Broth and incubated at 37°C for 7 days. A cold atmospheric He/O2 plasma jet (Flow rate of He=1,000 ml/m and O2=3 ml/m) was used to treat *E. faecalis* biofilm for 5 and 10 minutes. Inactivation efficacies of the biofilms were evaluated by LIVE/DEAD staining and XTT assay. Morphology of the biofilms was evaluated by Scanning Electron Microscopy (SEM).

III. Results
Both 5- and 10-min treated samples in LIVE/DEAD staining revealed bacterial death more than control. The longer treatment time, the more ruptured cells. The XTT assay resulted in a significant reduction of *E. faecalis* ($p<0.05$), but the plasma jet could not sterilize the dentin slices. The SEM showed rupture of the bacterial cell membrane caused by cell lysis and destruction of the biofilm.

IV. Conclusion
The newly developed jet plasma can partially inactivate *E. faecalis* biofilm and may be beneficial for root canal disinfection.

***Keywords**: Cold plasma, Plasma jet, Enterococcus faecalis, Biofilm, Debridement, Root canal
***Presenting Author**: Kanruethai Saleewong
Department of Restorative and Periodontal Dentistry, Chiang Mai University, Chiang Mai, Thailand, irishie2033@hotmail.com

P3-018

Cyclic fatigue resistance of WaveOne Gold Glider, One G and ProGlider nickel-titanium glide path files in artificial canals with double (S-shaped) curvature

Damla Kırıcı*, Alper Kuştarcı
Department of Endodontics, Faculty of Dentistry, Antalya, Turkey

I. Introduction
This study aimed to compare the cyclic fatigue resistances of WaveOne Gold Glider, One G File and ProGlider NiTi glide path files in S-shaped artificial canals.

II. Material and Method
Fifteen WaveOne Gold Glider (15/.02), 15 One G (14/.03) and 15 ProGlider (16/.02) single-file glide path files were included. Forty five (n: 15/each) were subjected to static cyclic fatigue testing using double-curved canals until fracture occurred (TF). The number of cycles to fracture (NCF) was calculated by multiplying the rpm value by the TF. The length of the fractured fragment (FL) was determined by a digital microcaliper. Six samples of fractured files (n: 2/each) were examined by SEM to determine the fracture mode. The NCF was analysed statistically with the Kruskal-Wallis test. The fragment length was analysed using one-way analysis of variance and Tukey's post hoc tests.

III. Results
All the files fractured first in the apical curvature and then in the coronal curvature. The NCF values revealed that the WaveOne Gold Glider had the greatest cyclic fatigue resistance, followed by the One G and ProGlider in both the apical and coronal curvatures ($P<0.05$).

IV. Conclusion
WaveOne Gold Glider NiTi glide path files, used in a reciprocating motion, had the greatest cyclic fatigue resistance amongst the tested NiTi glide path files in an artificial S-shaped canal.

***Keywords**: WaveOne Gold Glider, Cyclic fatique, Glide path
***Presenting Author**: Damla Kırıcı
Department of Endodontics, Faculty of Dentistry, Antalya, Turkey, d_ozsu@hotmail.com

P3-019

Customised framework for three-dimensional reconstruction and measurement in endodontic research

Young Bin Bok[*1], Diogo G. Guerreiro[1], Mario R. Pereira[2], Neville J. McDonald[1]

[1]Endodontics, University of Michigan, Ann Arbor, MI, USA [2]Endodontics, University of Lisbon, Lisbon, Portugal

I. Introduction

The purpose of this proof-of-principle study was to customize an application framework by using the MeVisLab and Cinema 4D image processing and visualization platforms for three-dimensional reconstruction and assessment of tooth and root canal morphology.

II. Material and Method

Several teeth were scanned using micro-computed tomography. A customized application framework based on MeVisLab was built and internal and external anatomy was reconstructed for visualization and analysis. Example morphometric analysis was performed. The segmented enamel, dentin and root canal system were transferred into Cinema 4D. Textures were applied to the different segmented parts in order to build a computer-generated image from the micro CT (mCGI).

III. Results

A 3D model of teeth showing internal anatomy was constructed by manipulating high-resolution tomographic images. The combination of both platforms allowed a manipulation environment that was able to perform morphometric analysis but also generates high-quality mCGI for educational and research purposes.

IV. Conclusion

The combination of an application framework in MeVisLab provided an economical platform and met current requirements of endodontic research. Furthermore, Cinema 4D allows improved visualization and mesh corrections in order to improve output quality. The use of these softwares and the resulting exchange of researchers experience might help to improve the quality of endodontic research with micro–CT.

***Keywords**: Micro CT, Application framework, MeVisLab, Cinema-4D, Morphology

***Presenting Author**: Young Bin Bok

Endodontics, University of Michigan, Ann Arbor, MI, USA, ybbdenix@umich.edu

P3-020

Assessment of the quality of endodontic treatment performed on a postgraduate teaching clinic in Dubai, UAE

Hessa Fezai[*1], Samira Alsalehi[2]

[1]Endodontic, Dubai Health Authority, Dubai, United Arab Emirates, [2]Endodontic, Hamdan Bin Mohammed College of Dental Medicine, Mohammed Bin Rashid University of Medicine and Health, Dubai, United Arab Emirates

I. Introduction

The primary goal of endodontic therapy is to prevent or heal apical periodontitis. There is substantial evidence that the technical quality of root canal treatment has a significant influence on endodontic outcomes.

The aim of this study was to evaluate the technical quality of root canal fillings carried out on a Postgraduate Endodontic Teaching Clinic.

II. Material and Method

Three hundred and forty nine radiographs of patients who had received endodontic treatment during the period (2012-2015) on a Postgraduate Endodontic Clinic were initially selected. A number of these radiographs were discarded due to poor quality images/technical errors. A residue of 298 root canal fillings was included in the study.

The sample was divided into groups of anterior, premolar and molars. The technical quality of the root canal filling was assessed using two main parameters; density of the root filling and the distance between the end of the root filling and radiographic apex.

III. Results

The sample evaluated consisted of 48% molars, 34% premolars and 18% anterior teeth. The percentage of satisfactory root fillings was highest in anterior/premolar teeth (89.7%) followed by second molars (82.3%) followed by first molars (72.2%) and were statistically significant (p=0.03).

Adequate homogeneity of root canal fillings were found in 93% of the cases. This compared with 90% of cases with adequate length of root fillings. Thus 84% (0.93x0.90=0.84) of the cases were considered to have good quality endodontic work. A typical such case treated by the author is included here as an illustration.

IV. Conclusion

Eighty four percent of the root fillings were acceptable on both counts of homogeneity and root filling length. At the other extreme where both homogeneity and length were unacceptable, the corresponding figure was only 1%. The above figures underscore the high quality of work carried out on the Postgraduate Endodontic Clinic.

***Keywords**: Quality of Endodontic treatment, Obturation, Radiographic evaluation

***Presenting Author**: Hessa Fezai

Endodontic, Dubai Health Authority, Dubai, United Arab Emirates, dr_hessa1985@hotmail.com

P3-021

Effectiveness of irrigation techniques for the removal of calcium hydroxide from simulated internal resorption cavity

Alper Kustarci[*1], Begum Haseki Guldas[2], Kursat Er[1]

[1]Endodontics, Akdeniz University, Faculty of Dentistry, Antalya, Turkey, [2]Endodontics, Special Dental Clinic, Antalya, Turkey

I. Introduction

Calcium hydroxide (CH) has to be completely removed before the canal filling because any CH residue on dentin walls can affect the dentinal bond strength and the penetration of sealers into the dentin tubules and cause to apical leakage. This study aimed to assess the effectiveness of XP-endo Finisher (XP), EndoActivator (EA), Er, Cr: YSGG laser (LAI), passive ultrasonic irrigation (PUI) techniques in removing CH from simulated internal resorption cavities.

II. Material and Method

Seventy-five single-rooted mandibular premolar teeth were instrumented with WaveOne Gold reciprocal moving file system. The teeth were fixed in modified Eppendorf vials with silicone impression material and subsequently, teeth were split into two halves with a separator disc and internal resorption cavities were formed in the apical 1/3 region of the teeth. The teeth were reassembled, and CH was delivered into the root canals with a lentulo file. The access cavities were sealed with a temporary filling material and teeth were stored at 37ºC and 100% humidity for 1 week. Then the specimens were irrigated with 5 mL 2.5% NaOCl and 5 mL 17% EDTA. Then, the activation was performed to the teeth with EA, PUI, LAI and XP agitation techniques. After the process has run out, the teeth were separated again and the presence of CH in the internal root resorption cavities were assessed by stereomicroscope. Data were analyzed by using one-way ANOVA and post-hoc Tukey tests.

III. Results

Remnants of CH in simulated internal root resorption cavities were found in all experimental groups. EA, PUI, LAI and XP removed significantly more CH than conventional needle irrigation (CNI) ($p<0.05$), showing no significant difference between them ($p>0.05$).

IV. Conclusion

In all groups, CH residues remained in internal resorption cavities. Activation methods tested were found to be superior to CNI.

***Keywords**: XP-endo Finisher, EndoActivator, PUI, Er,Cr: YSGG laser, Internal root resorption, Calcium hydroxide

***Presenting Author**: Alper Kustarci

Endodontics, Akdeniz University, Faculty of Dentistry, Antalya, Turkey, akustarci@hotmail.com

P3-022

An in vitro comparison of bond strength of different sealers/obturation systems to root dentin using push out test

Zeti Adura Che Ab Aziz[*], Noor Hayaty Azami, Yap Wai Ying

Restorative Dentistry, University Malaya, Kuala Lumpur, Malaysia

I. Introduction

Three-dimensional obturation is important for successful endodontic treatment. There are various sealers available in the market and the newer products promote ‘monobloc’ obturation system.

The objective of this study was to evaluate the bond strength of different sealers/obturation systems; TotalFill BC obturation system (FKG), TotalFill sealer with gutta-percha, EndoREZ obturation system (Ultradent) and EndoRez sealer with GP to intraradicular dentine at 2 weeks and 3 months post obturation compared to GP/AH Plus.

II. Material and Method

Sixty single-canal anterior teeth were prepared and assigned to experimental groups, designated as Group 1: Gutta-percha/AH Plus, Group 2: TotalFill BC point/BC sealer, Group 3: gutta-percha/TotalFill BC sealer, Group 4: EndoREZ point/EndoREZ sealer and Group 5: gutta-percha/EndoREZ sealer. After obturation, 6 teeth in each group was sectioned to 2-3 root slices of 2mm thickness and prepared for push-out assessment using universal testing machine at 2 weeks post obturation and another 6 teeth was assessed after 3 months post obturation.

III. Results

Analysis using repeated measures ANOVA showed difference of mean between groups for 2 weeks post obturation regardless of location was significant ($p<0.05$).

The mean push-out bond strength of group 4 was significantly lower than group 1, 2 and 3. The mean push out bond strength of group 5 was significantly lower than group 1, 2 and 3. An independent t-test showed Group 2 and 3 had higher mean push out bond strength at 3 months compare to 2 weeks post obturation. For group 4 and 5, the mean push out bond strength 3 months was significantly lower than 2 weeks post obturation. Stereomicroscopic examination revealed that most of the samples showed mixed failure.

IV. Conclusion

TotalFill BC obturation system/TotalFill BC sealer showed comparable bond strength to AH Plus which had increased with time whereas EndoRez obturation system/EndoRez sealer had a poor push-out bond strength which decreased with time.

***Keywords**: Bioceramic sealers, Bond strength, Push out
***Presenting Author**: Zeti Adura Che Ab Aziz
Restorative Dentistry, University Malaya, Kuala Lumpur, Malaysia, zetiaziz@um.edu.my

P3-023

Consideration of access cavity to root canal by using the preparation guides

Taro Nishida[*1], Yoshiki Sekiya[2], Miki Sekiya[1], Munehiro Maeda[1], Masaru Igarashi[1]
Department of Endodontics, The Nippon Dental University, School of Life Dentistry at Tokyo, Tokyo, Japan, [2]Department of Dental Materials Science, The Nippon Dental University, School of Life Dentistry at Tokyo, Tokyo, Japan

I. Introduction

On mandibular incisor, access cavity preparation is recommended on lingual surface conventionally. However, it was difficult to access the root canal due to lingual shoulder. The lingual shoulder may make a cause of a ledge at apical portion. The aim of this study was to fabricate preparation guides (PG) for access cavity on mandibular incisor, and to compare changes of root canal form by using PGs.

II. Material and Method

Ten mandibular incisors extracted from Japanese subjects were used and divided in two groups: using PGs or control (preparation from lingual surface conventionally). They were scanned by micro-CT (ScanXmate-D100SS270, Comscan) and reconstructed by 3D image processing software (TRI/3D-BON, Ratoc). At first, root canal curvature were measured for coronal half on labio-lingual images and mesio-distal images. Then, two horizontal cross-sectional images which were divided into three equal parts longitudinally were made from root canal images.

Straight lines which were passing through the center were determined as root canal axis. Guided holes were designed on the root canal axis on PGs. PGs were fabricated by using 3D printer (Nobel 1.0, XYZ Printing). Access cavity preparation were done for two groups by using a long shank bar (Surgical bar #1557, MANI). After preparation, they were scanned by micro-CT. Root canal curvature included access cavity were measured for coronal images.

III. Results

Root canal curvature were not observed before preparation. After preparation, root canal curvature were not observed in PGs. Although, all control specimens showed curvature on labio-lingual images. It was not observed on mesio-distal images. The change of root canal curvature was 17.7 degree.

IV. Conclusion

These results suggest that change root canal form could be reduced by using PG. To attain more comprehensive understanding on this problem, further investigations would be necessary in future study.

***Keywords**: Access Cavity, Micro CT, Preparation Guide, 3D printer, Guided Endodontics
***Presenting Author**: Taro Nishida
Department of Endodontics, The Nippon Dental University, School of Life Dentistry at Tokyo, Tokyo, Japan, t-nishida@umin.ac.jp

P3-024

The difference effect of caseinphospopeptide-amorphous calcium phosphate and soy milk on bleached enamel roughness

Hanny Aryani[*], Bernard O. Iskandar, Dina Ratnasari
Conservative Dentistry, Trisakti University, Jakarta, Indonesia

I. Introduction

Bleaching is one of minimal invasive procedure to improve esthetic appearance. Bleaching products gave negative impact on enamel surface such as increasing of enamel roughness, deep pores, decreasing of enamel microhardness. Remineralizing agents used to decrease enamel roughness after bleaching procedure. The aim of this study is to compare the difference effect of caseinphosphopeptide – amorphous calcium phosphate and high calcium soy milk with different duration of application on email roughness after in-office bleaching procedure.

II. Material and Method

Thirty two enamel samples of third molar were chosen and randomly divided to 4 groups. After initial measurement of enamel roughness with profilometer, the samples were bleached with hydrogen peroxide 37.5% 3 times for 8 minutes each times then the samples were measured again. Two groups (A and B) were treated with CPP-ACP for 5 minutes and immersed in high calcium soy milk for 5 minutes for 5 days, one time a day. Another two groups (C and D) were treated with CPP-ACP for 5 minutes and immersed in high calcium soy milk for 5 minutes, one time a day for 14 consecutive days. On the last day (the 5th day and 14th day), enamel surface were measured with profilometer and statistically analyzed.

III. Results

The surface roughness significantly increased after bleaching in all groups and decrease after application of CPP-ACP and high calcium soy milk compare to surface roughness after bleaching procedure ($p<0.005$). The email roughness after application CPP-ACP and high calcium soy milk for 5 days showed statistically similar on enamel roughness, application for 14 days showed CPP-ACP was the highest decrease of email roughness.

IV. Conclusion

There was difference effect of caseinphosphopeptide – amorphous calcium phosphate and high calcium soy milk with different duration of application on email roughness after in-office bleaching procedure.

***Keywords**: Extracoronal bleaching, Enamel roughness, CPP-ACP, High calcium soy milk
***Presenting Author**: Hanny Aryani
Conservative Dentistry, Trisakti University, Jakarta, Indonesia, hanny.aryani@gmail.com

P3-025

The expressions of NF-Kb and TNF-A on BHK-21 culture cell exposed Lta lactobacillus acidophilus induced by curcumin

Juniarti Devi Eka[*]
Department of Conservative Dentistry, Faculty of Medicine, Airlangga University, Surabaya-Indonesia

I. Introduction

The microbial populations involved in dental caries are known to be highly complex and variable. Lactobacillus acidophilus is one of the bacteria that plays an important role in the progression of caries, especially in dentin or deep caries. Caries will reach the pulp and causes inflammation, so it needs a treatment called pulpcapping to protect the pulp. Curcumin was known to be containing anti-inflammatory agent. We try to observe the inflammatory effect of curcumin to BHK21 cell culture by measurement expression of NF-κb and TNF-α through the the signaling process.

The aim of this research is to investigate expressions of NF-κb and TNF-α on BHK-21 fibroblast cells exposed inactivated Lactobacillus acidophilus induced by curcumin.

II. Material and Method

This research was done in BHK-21 fibroblast culture cell exposed LTA (Lipoteichoic acid) Lactobacillus acidophilus 10 µg/ml, and induced by curcumin 10 µg/ml measurement of NF-κb and TNF-α expressions by using immunochytocemistry technique from immunostaining kit.

III. Results

Data analysis was performed on SPSS, using one-way ANOVA showed that $p<0.05$. This suggests that there is a difference in the degree of Expressions of NF-κB and TNF-α on BHK-21 culture cell exposed LTA (Lipoteichoic acid) Lactobacillus acidophilus induced by Curcumin.

IV. Conclusion

Decreased expressions of NF-κB and TNF-α on BHK-21 culture cell exposed LTA (Lipoteichoic acid) Lactobacillus acidophilus induced by Curcumin.

***Keywords**: Curcumin, LTA Lactobacillus acidophilus, BHK-21 cells, NF-κB and TNF-α.
***Presenting Author**: Juniarti Devi Eka
Department of Conservative Dentistry, Faculty of Medicine, Airlangga University, Surabaya, Indonesia, yuniartidevieka@yahoo.com

P3-026

A comprehensive analysis of the effects of BMP-1 on glyco-alteration in human dental pulp cells

Koichiro Muromachi[*], Nobuyuki Tani-Ishii
Division of Pulp Biology and Endodontics, Department of Oral Interdisciplinary Medicine, Kanagawa Dental University, Kanagawa, Japan

I. Introduction

We previously reported that the expression of bone morphogenetic protein (BMP)-1 is promoted in odontoblast-like cells and reparative dentin subjacent to dental caries. BMP-1 has been well investigated as a catalytic enzyme of procollagen I-III and dentin-specific

non-collagenous proteins; however, how BMP-1 affects cell surface molecules remains unclear. The degrees of cellular differentiation are known to induce changes in the glycan structures in membrane glycoprotein. In this study, we performed a comprehensive analysis of the BMP-1-altered cellular glycosylation profiles by a glycomic approach.

II. Material and Method

This study was approved by the ethics committee of Kanagawa Dental University (No. 277). Human dental pulp (fibroblast-like) cells (HDPCs) were obtained from intact third molars under aseptic conditions. The protein glycosylation profiles of insoluble fractions from HDPCs were studied by lectin microarray and lectin blotting. Enrichment of glycoprotein was performed by lectin affinity columns. CBB-stained bands of the enriched samples excised from an SDS-PAGE gel were analyzed by liquid chromatography with tandem mass spectrometry (LC-MS/MS).

III. Results

A lectin microarray analysis and subsequent lectin blotting evaluation indicated that BMP-1 down-regulated the sialylation of insoluble fractions from HDPCs. LC-MS/MS of the enriched samples identified six proteins.

IV. Conclusion

These results suggested that BMP-1 plays a novel role in the regulation of the sialylation of glycoproteins and likely contributes to cellular differentiation.

***Keywords**: Dental pulp, Glycomics, Lectin, BMP-1
***Presenting Author**: Koichiro Muromachi
Division of Pulp Biology and Endodontics, Department of Oral Interdisciplinary Medicine, Kanagawa Dental University, Kanagawa, Japan, muromachi@kdu.ac.jp

P4-001

Integrin subunit expression by human cementoblast

Taiki Koba[*1], Kiyoko Watanabe[2], Seiji Goda[2], Nobushiro Hamada[2], Nobuyuki Tani-Ishii[1]
[1]Oral Interdisciplinary Medicine, Kanagawa Dental University, Yokosuka, Japan, [2]Oral Science, Kanagawa Dental University, Yokosuka, Japan

I. Introduction

The extracellular matrix is considered as an insoluble local mediator which plays an important role in regulating cell function. Communication between the cell and its matrix occurs via the integrins, a family of transmembrane proteins. Cementum is a mineralized tissue produced by cementoblasts covering the roots of teeth that provides for the attachment of periodontal ligament to tooth root. Cementoblasts share many molecular properties with osteoblasts, however, the expression of integrin subunit by cementoblasts is not clear. The purpose of this study was to investigate which integrins are present on immortalized human cementoblast cells.

II. Material and Method

An immortalized cell line of human cementoblast (HCEM) and osteoblast-like MG63 cell were used in this study. The HCEM cells were provided by Prof. T. Takata (Hiroshima University). Integrin subunit expression was identified by flow cytometer (FACSCalibur: Becton Dickinson). Cells were EDTA released into single cell suspension and directly stained with FITC- or Alexa- labeled antibodies against surface markers: CD49a, CD49b, CD49c, CD11a, CD51, CD29, CD18 and CD61 (integrin subunits: α1, α2, α3, αV, β1, β2 and β3, respectively). For each antibody, 106 cells were re-suspended in PBS containing 1% FBS, and incubated for 30 min on ice in 200 µl of antibody solution. 1 × 104 cells were analyzed and a mean intensities were determined using Becton Dickinson software.

III. Results

Cementoblasts primarily expressed α2, α3, αV, β1 subunits, especially α3, β1 subunits were highly expressed. Fluorescence intensity detecting α1 and β3 was lower and subunit β2 was not detected on HECM cell surface. The staining patterns were almost similar to those on osteoclast-like MG63 cells.

IV. Conclusion

We investigated integrin subunits expression by cementoblast. The results suggested that integrins expressed on HCEM may play important roles for its adhesion to extracelluar matrix and periodontal tissue cells, similar to osteoblasts cells.

***Keywords**: Cementoblast, Integrin subunits, FACS
***Presenting Author**: Taiki Koba
Oral Interdisciplinary Medicine, Kanagawa Dental University, Yokosuka, Japan, koba@kdu.ac.jp

P4-002

The effect of acidic level condition as pain transmission inhibition

Jenny Sunariani[*1],Latief Mooduto[2], Dian Agustin Wahjuningrum[2], Wisnu Setyari Juliastuti[1], Gadis Meinarsari[3]
[1]Department of Oral Biology, Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia, [2]Department of Conservative Dentistry, Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia, [3]Departement of Physiology, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia

I. Introduction

Perception of pain is a relief sufferer so come to be treated. Pain is also a function of self-protection against tissue damage. The occurrence of pain due to changes in homeostasis in the form of a disruption of the body's liquid balance of acidosis. One of the causes of acidosis is the excessive influx of alcohol into the body in alcohol drinkers. The acidity because alcohol input, make dopamine D2 receptor (DRD2) gene have independently been proposed as biological/genetic markers for alcoholism.

The aim of this research is to find the effects of alcohol consumption in preventing the impulse pain transmission.

II. Material and Method

White mice spreading in 3 group (7 animal model each group) of white mice given alcohol and another group of mice not given alcohol. After 30minits post treatment, samples will be check with 1 voltage of electric stimulation.

III. Results

The data were analyzed with Wilcoxon Rank Sum Test, which showed significant difference between the two groups ($p<0.05$). Alcohol could prevent the working ability of local anesthetic.

IV. Conclusion

Pain still spreads after given 1 voltage of electric stimulation, even after injection of local anesthetic is given after alcohol consumption.

***Keywords**: Pain, Alcohol, Acidosis
***Presenting Author**: Jenny Sunariani
Department of Oral Biology, Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia, jenny-s@fkg.unair.ac.id

P4-003

Endodontic management of autotransplanted teeth

Zedgenidze Alena[*], Badalyan Kristina
CNIIS, Moscow, Russian Federation

I. Introduction

The aim of our research was to observe the periodontal ligament formation and resorption causes due to the endodontic treatment after autotransplantation of third molars with closed tip in adults. In this study, we want to determine the quality of reattachment appeared and the type of resorption in a sequence of endodontic treatment.

II. Material and Method

In the study we have observed 50 patients who did undergo autotransplantation of third molars with a closed root tip. All clinical cases are divided into three groups.
The first group is presented by autotransplantation in a socket with chronic inflammatory process. Due to the curettage the periodontal ligament of bone was strongly reduced. The second group includes cases without signs of inflammation and the ligament of bone stayed untouched. The third group the socket was prepared in native bone in an absence of periodontal fibres. All teeth were transplanted respectively to the current protocol. The endodontic treatment was performed in 48 cases: before the surgery (9); during the surgery extra-orally (16); in 14-21 days after the surgery (18); in 21-35 days (5).
All patients were observed on 7, 14, 30, 60, 90 days and 6, 12, 24 months after transplantation. The sutures were removed in 7 days. After removing a splint (the average time of splinting is 30 days) the special measurements were done.
The protocol of measurements:
1. Tooth hygiene.
2. Control of mobility with Periotest-M.
3. Probing of gingival attachment at six points.
4. Cool-testing (for non-treated teeth).
5. X-ray examination.
6. Foto protocol.
Autotransplanted teeth were put in the occlusion by covering with crowns or modelling with resin if needed.

III. Results

The first results were evaluated after 3 and 6 months. According to the Periotest rates, values from -8 to -3 were considered as ankylosis (AN), from -3 to +10 were defined as normal mobility, from +10 to +20 mobility of first(I) degree, from +20 to +30 - second(II) and more + 30 - the third(III) degree. After 3 months, the number of

teeth in normal mobility was 36 (72%), I - 9 (18%), II - 4 (8%) and III - 1 (2%), AN - 0. After 6 months, 41 teeth had normal mobility (82%), I - 4 (8%), II - 1 (2%), III - 1 (2%), AN - 3 (6%).

The depth of periodontal attachment did not exceed 3 mm, but in 8 cases (16%) there were recessions according to I Miller class. These parameters were stable from 3 till 6 months.

During the X-ray examination, the equability of the periodontal ligament space was determined, especially the presence of bone lysis, the phenomena of inflammatory and replacement resorption. It was found after 3 months that in 26 (52%) cases, PDL did not differ significantly from the PDL of adjacent teeth. In 15 (30%) cases PDL had an uneven narrow structure, less than 1 mm thick. In 3 cases (6%), signs of replacement resorption were found and in 6 (12%) PDL expansion was observed. After 6 months in 41 (82%) cases there were no signs of PDL abnormality, excepting that it was thinner than 1 mm.

IV. Conclusion

Since the study is still ongoing, we can evaluate the first results of autotransplantation after 3 and 6 months and draw preliminary conclusions. Using the Periotest control, periodontal probing, and regular x-ray examination, we are able estimate the PDL state sufficiently. It was found that the replacement resorption cannot be evaluated earlier than 6 months after the transplantation. We also determined that the gingival attachment that had firstly formed does not tend to change. It has also been shown that despite the thinness of PDL on the radiograph, it does not differ functionally from other teeth.

***Keywords**: Autotransplantation, Replacement resorption, Reattachment, PDL formation, Inflammation
***Presenting Author**: Zedgenidze Alena

CNIIS, Moscow, Russian Federation, endotreat@gmail.com

P4-004

Prevalence of apical periodontitis in endodontically treated teeth and associated prognostic factors in Thai

Panupong Thampibul[*1], Jeeraphat Jantarat[1], Raweewan Arayasantiparb[2]

[1]Department of Operative Dentistry and Endodontics, Faculty of Dentistry, Mahidol University, Bangkok, Thailand, [2]Department of Oral and Maxillofacial Radiology, Faculty of Dentistry, Mahidol University, Bangkok, Thailand

I. Introduction

Post-treatment disease is the term suggested by Friedman describing the periapical disease in endodontically treated teeth (ETT). This pathology was reported widespread disease among the populations of various countries. The majority of endodontic epidemiological studies were conducted in Europe and Americas. However, no study has yet evaluated in the Southeast Asian country

as well as Thailand. Consequently, the aim of this study was to investigate the prevalence of apical periodontitis in ETT from Thais and determine the association among technical quality of root filling, restoration and other factors with the periapical status of ETT.

II. Material and Method

Full-mouth periapical radiographs from Thais attending the Faculty of Dentistry, Mahidol University, Thailand were examined. For the ETT, the periapical status, quality of root filling and restorations, existence of post and its relationship to the rootfilling were evaluated. Logistic regression was used to identify the significant outcome predictors affecting the periapical status of ETT.

III. Results

The total number of ETT was 1511, and 35% presented apical periodontitis. A significantly higher prevalence of apical periodontitis was observed in teeth with inadequate root filling (56%) than adequate root filling (15.3%). For combined data of root filling and restoration qualities, a significantly higher prevalence of apical periodontitis was observed in teeth with both inadequate qualities (73.6%) than both adequate qualities (9.9%). Apical periodontitis in ETT were significantly associated with molar (OR=1.54), short (OR=2.85) and long (3.86) root filling, unsatisfactory root filling (OR=3.90), remaining root filling <4 mm (OR=1.66) and inadequate restoration (OR=4.15).

IV. Conclusion

The prevalence of apical periodontitis among ETT in Thais was at 35% and inadequate root filling were observed in 48.1%. Type of teeth, remaining root filling, quality of root filling and restorations were significantly associated with the periapical disease in ETT.

***Keywords**: Apical periodontitis, Coronal restoration, Endodontic treatment, Epidemiology, Root canal filling
***Presenting Author**: Panupong Thampibul

Department of Operative Dentistry and Endodontics, Faculty of Dentistry, Mahidol University, Bangkok, Thailand, pnp6563@hotmail.com

P4-005

Effects on smear layer removal with 0.5% phytic acid after sonic agitation: A SEM study

Ismail Omer Yeniyurt[*], Ali Cemal Tinaz

Endodontics, Gazi University, Ankara, Turkey

I. Introduction

The purpose of this study was to evaluate the effects of 0.5% phytic acid at the different time intervals with sonic agitation on smear layer removal.

II. Material and Method

52 freshly extracted, single-rooted, human mandibular premolar teeth with relatively similar dimensions and lengths were selected for study. All of the teeth were instrumented with Protaper Universal files, using the crown-down technique up to size # 30, .06 taper (F3). Root canals were irrigated between each file with 2 mL, 5% NaOCl. Groups are as follows; Group 1 : 5 mL 0.5% phytic acid with sonic agitation (1 min), Group 2: 5 mL 0.5% phytic acid with sonic agitation (30 sec), Group 3: 5 mL 0.5% phytic acid (1 min), Group 4: 5 mL 0.5% phytic acid (30 sec). Photomicrographs were taken at x2000 magnification from scanning electron microscope (SEM), from the coronal, middle and apical third of each specimen for evaluation.

III. Results

Concerning smear removal, in apical region no significant differences among groups were detected. In the coronal and middle region sonic agitation systems removed significantly more smear layer than conventional irrigation. Best result was obtained to remove smear layer with sonic agitation in 1 minute (Group 1).

IV. Conclusion

0.5% phytic acid with sonic agitation showed better results than conventional irrigation.

***Keywords**: Phytic acid, Sonic agitation, Smear layer
***Presenting Author**: Ismail Omer Yeniyurt

Endodontics, Gazi University, Ankara, Turkey, oyeniyurt@gmail.com

P4-006

Emergency Pulpotomy vs. Pulpectomy: Pain relief for symptomatic irreversible pulpitis

Hayoung Kim[*], Jong Ryul Kim

Endodontology, Temple University Kornberg School of Dentistry, Philadelphia, USA

I. Introduction

Irreversible inflammation of the pulp is a common etiology for dental pain which requires endodontic emergency treatment. There are two treatment options that are commonly considered for pain relief from teeth with irreversible pulpitis: pulpotomy and pulpectomy. Currently, a standard protocol to determine the appropriate treatment for pain relief from irreversible pulpitis has not yet been established. Therefore, this study aimed to compare the level of postoperative pain relief from symptomatic irreversible pulpitis after pulpotomy or pulpectomy.

II. Material and Method

Forty patients with symptomatic irreversible pulpitis on molars or premolars were included for the study. The patients were randomly divided into two groups to receive either pulpotomy or pulpectomy. After anesthesia and access opening to pulp chamber, group A were treated with pulpotomy (n=20) and group B were treated with pulpectomy (n=20) by the same operator. Severity of pain level was evaluated at 24 hours, 48 hours, and 72 hours postoperatively with a standard numeric pain scale. The number of ibuprofen tablets taken by the patient was recorded at the same time intervals. The data was statistically analyzed using two-way ANOVA with repeated measures and Tukey post-hoc test, using $p<0.05$.

III. Results

There was no significant difference on preoperative pain level between the two groups. For each group, postoperative pain significantly decreased from the preoperative pain starting from 24 hours after the treatment ($p<0.05$). The pain level at 24 hours, 48 hours, and 72 hours post-treatment was not significantly different. The number of ibuprofen taken was significantly higher in the pulpectomy group compared to the pulpotomy group after 24 hours and 48 hours of treatment ($p<0.05$), but not after 72 hours.

IV. Conclusion

The emergency pulpotomy and pulpectomy were both effective in reducing pain in teeth with symptomatic irreversible pulpitis. However, pulpectomy group took more ibuprofens at 24 and 48 hours after the treatment compared to pulpotomy group.

***Keywords**: Pulpotomy, Pulpectomy, Pulpitis, Pain Relief, Emergency
***Presenting Author**: Hayoung Kim

Endodontology, Temple University Kornberg School of Dentistry, Philadelphia, USA, hkim408@gmail.com

P4-007

Effect of Aloevera Gel on the Expression of TNF-αTGF-β, osteoblast and osteoclast in alveolar bone post avulsion

Yuli Nugraeni*

Conservative and Endodontics, Brawijaya Dental Faculty, Malang, Indonesia

I. Introduction

Dento-alveolar trauma resulted from accidents involving the oral regions mostly affect the upper central incisors. The successful treatment of a traumatically avulsed tooth is to restore adhesion and tissue regeneration in the periodontal ligament (PDL). Therefore, an appropriate management should be done to avoid the development of ankylosis. Ankylosis of the periodontal ligament (PDL) becomes a problem. In addition, ankylosed teeth are also more susceptible to root resorption. Unfortunately, the rate of bone formation is unpredictable. Aloe vera (*A. vera*) gel has been used to improve various stages in wound-healing processes. Traditionally, *A. vera* gel is used to treat minor wounds and inflammatory skin disorders.

II. Material and Method

The research design used was a post-test randomized controlled group design. The incisors in the upper jaw of rats were extracted. There were two groups, a control, and an *A. vera* administration group. After post-extraction, each group was divided into three treatment groups based on time of exposure; at days 3, 7, and 14. After the rats were sacrificed, alveolar bones were preserved and the expression of TNF-α and TGF-β were assessed via immunohistochemistry. Therefore, the osteoblast and osteoclast were examined by Hematoxylin eosin. Group and time mean differences in expression were analyzed using statistical approach one-way ANOVA, Tukey HSD, Pearson Correlation and Regression Testing.

III. Results

The results of this study showed that the expression of TGF-β and osteoblast were increasing significantly ($p<0.05$) and the expression of TNF-α and osteoclast were decreasing significantly after administrated by *A. vera* gel.

IV. Conclusion

A. vera gel has the potential to increase the osteoblast of replanted teeth.

***Keywords**: Aloe vera gel, TNF-α, TGF-β, Osteoblast, Osteoclast

***Presenting Author**: Yuli Nugraeni

Conservative and Endodontics, Brawijaya Dental Faculty, Malang, Indonesia, yulinugraeni@yahoo.com

P4-008

Effects of dopamine on odontoblastic differentiation

Shoko Fujino*[1], Sayuri Hamano[1], Atsushi Tomokiyo[1], Daigaku Hasegawa[2], Shinichiro Yoshida[2], Hideki Sugii[2], Ayako Washio[3], Naohisa Wada[4], Chiaki Kitamura[3], Hidefumi Maeda[1]

[1]Department of Endodontology and Operative Dentistry, Kyushu University, Fukuoka, Japan, [2]Department of Endodontology, Kyushu University Hospital, Fukuoka, Japan, [3]Division of Endodontics and Restorative Density, Department of Science, of Oral Functions, Kyushu Dental University, Fukuoka, Japan [4]Division of General Dentistry, Kyushu University Hospital, Fukuoka, Japan

I. Introduction

Tyrosine Hydroxylase (TH) is one of the catecholamine synthetases and transforms tyrosine to dopamine (DA). DA promoted mineralization of osteoblasts in mice (Dong *et al.*2015). However, the functions of DA in odontoblasts have not been examined. In this study, we investigated the expression of TH and DA in odontoblasts and the effects of DA on odontoblastic differentiation.

II. Material and Method

(1) The pulp tissues of the lower first molar and upper incisor in normal rat, and of rat direct capping model were used for immunostaining with anti-TH antibody. (2) Immunostaining of KN-3 cells (pre-odontoblasts) was performed using anti-TH antibody and anti-DA antibody. (3) Expression of DA receptors (*D1R, D2R, D3R, D4R, D5R*) was analyzed using semi-quantitative RT-PCR analysis. (4) KN-3 cells were cultured in control medium (CM) containing 2 mM $CaCl_2$ (DM, differentiation medium) and DM including DA. After 7 days, Alizarin Red staining was performed.

III. Results

(1) TH was specifically expressed in the odontoblastic layer of rat pulp tissue. In incisor, TH was observed in pre-odontoblasts through mature odontoblasts, particularly predominant in the latter cells. In rat direct capping model, TH-positive cells were not detectable beneath the exposed region at day 3 of operation, while marked beneath dentin bridge at day 14. (2)(3) KN-3 cells showed positive reactions for anti-TH antibody and anti-DA antibody and expressed *D1R, D3R*, and *D5R*. (4) DA-treated KN-3 cells induced Alizarin Red positive reaction, compared to untreated cells.

IV. Conclusion

These results suggested that the expression of TH in odontoblasts was upregulated dependently on their differentiation stages in the physiological and pathological conditions. DA transformed by TH might be involved in odontoblastic differentiation.

***Keywords**: Dopamine, Odontoblast, Tyrosine Hydroxylase

***Presenting Author**: Shoko Fujino

Department of Endodontology and Operative Dentistry, Kyushu University, Fukuoka, Japan, shoko.115@dent.kyushu-u.ac.jp

P4-009

Wound healing potential of Pueraria mirifica extracts on human dental pulp cells

Uthaiwan Arayatrakoollikit*[1], Siriwannapa Kawsamer[2], Ponlatham Chaiyarit[3]

[1]Department of Restorative Dentistry, Faculty of Dentistry, Khon Kaen University, Khon Kaen, Thailand, [2]Dental Department, Srisaket Hospital, Srisaket, Thailand, [3]Department of Oral Diagnosis, Research Group of Chronic Inflammatory Oral Disease and Systematic Disease in Association with Oral, Khon Kaen, Thailand

I. Introduction

Pueraria mirifica is a medicinal plant endemic to Thailand. It has been used in Thai traditional medicine for its rejuvenating qualities in the elderly for a century. Since the in vitro and in vivo anti-osteoporotic effects of *Pueraria mirifica* (PM) in rodents have been verified. The aims of this study were to determine the biological effects of *Pueraria mirifica* extracts on wound healing and mineralization in human dental pulp cells, in vitro.

II. Material and Method

Primary-cultured human dental pulp cells were treated with various concentrations (0.1, 0.5, 1, 5, 10, 50, and 100 ng/ml) of *Pueraria mirifica* extracts. Wound healing efficiency and mineralization in human dental pulp cells were performed by in vitro scratch assay after 6, 12, 18 and 24 hour of exposure and Arizalin red staining after 7 and 14 days of exposure, respectively. The data were statistically analyzed by One-Way ANOVA.

III. Results

Pueraria mirifica extracts at concentrations of 1 and 5 ng/ml significantly reduced the scratched area ($p=0.004$, $p<0.001$ and $p=0.001$ at 6, 12 and 18 hour, respectively). Moreover, *Pueraria mirifica* extracts at concentrations of 5 ng/ml were significantly reduced the scratched area ($p=0.025$) after 24 hours of exposure. However, *Pueraria mirifica* extracts had no effect on the mineral deposition of human dental pulp cells after 7 and 14 days of exposure ($p>0.05$).

IV. Conclusion

This study demonstrated that *Pueraria mirifica* extracts stimulated wound healing of human dental pulp cells. This event suggests that Pueraria mirifica extracts may play an important role in early stage of wound healing of dental pulp.

***Keywords**: Pueraria mirifica, Human dental pulp cells, Wound healing assay, Arizalin red

***Presenting Author**: Uthaiwan Arayatrakoollikit

Department of Restorative Dentistry, Faculty of Dentistry, Khon Kaen University, Khon Kaen, Thailand, uthaiara@hotmail.com

P4-010

Influence of endodontic treatment on Alveolar Bone in Treatment of Periodontitis

Dina Galieva*, Alexander Mitronin, Larisa Elizova, Maria Sukhikh, Jazgul Asirbekova

Endodontics, Moscow State University of Medicine and Dentistry, Moscow, Russian Federation

I. Introduction

Endodontic treatment of teeth with deep bony lesions often leads to complications after treatment and relapse of the primary condition that causes more bone loss. Thus, it is indispensible to develop common treatment strategy, including endodontic and periodontal treatment stages. Thus, the aim of the study was to increase efficacy of treatment of endo-perio lesions with primary periodontal disease and secondary pulp involvement.

II. Material and Method

Seventy-eight teeth were studied [GI, periodontal pocket depth, area size of bone lesion on CBCT, electric pulp test (EPT), cold test]. Group 1 was composed of patients with pulpitis due to progression of periodontal disease (severe CGP), aged between 25 to 50 years, 30 male and 28 female patients. Group 2 (Control) consisted of 20 patients with chronic pulpitis without signs of periodontal inflammation, aged between 20 & 50 years, 8 male and 12 female patients. There were three subgroups (1a;1в;1c) in group 1. In 1a (n=20) a root canal and periodontal pocket were prepared chemomechanically, 2% and 0.05% chlorhexidine solutions were applied. In 1b (n=19) photoactivated desinfection was applied after conventional therapy of root canal and periodontal pocket. In 1c (n=19) laser was used after standard preparation of root canal and periodontal pocket. Comparative evaluation of changes in bone lesions (mm^2) on CBCT with ArchiCAD software was performed one year after endodontic treatment.

III. Results
No relapse was observed in group 1a and bone healing after treatment constituted 68% ($p<0.5$); in group 1b relapse was in 10% of all cases and bone healing after treatment amounted to 45% ($p<0.5$); no relapse was marked in group 1c and bone healing after treatment was 42% ($p<0.5$).

IV. Conclusion
Endodontic treatment with chemomechanical preparation showed the best result during 24 months after treatment. 1a subgroup, chemomechanical preparation of root canal and periodontal pocket with 2% and 0.05% chlorhexidine solutions respectively is the most efficient.

***Keywords**: Endo-perio lesions, Periodontal treatment, Periodontal pocket, Endodontic treatment, Root canal, Bone healing
***Presenting Author**: Dina Galieva
Endodontics, Moscow State University of Medicine and Dentistry, Moscow, Russian Federation, dtg70@mail.ru

P4-011

The effects of ethylenediaminetetraacetic acid on blood clot in regenerative endodontic procedures

Peerapohn Taweewattanapaisan*
Department of Operative Dentistry and Endodontics, Faculty of Dentistry, Mahidol University, Bangkok, Thailand

I. Introduction
Regenerative Endodontic Procedures (REPs) base on tissue engineering concept. Blood clot acts as natural scaffold due to it rich of fibrin, stem cells and essential growth factors. The growth factors could be release from dentin matrix into the root canal space using Ethylenediaminetetraacetic acid (EDTA). However, EDTA has been used as an anticoagulating agent in medicine since 1950s. In periodontal studies, EDTA inhibits blood clotting process. In regenerative endodontics, clinicians have to confront prolonged clotting time or blood clots have broken down after a calcium silicate based material was placed over it. However, effects of EDTA irrigation on blood clot formation in REPs have not been demonstrated.

II. Material and Method
Thirty-five human premolars were selected. Roots were prepared to stimulate open apices. Samples were irrigated with various protocols as followed; (1) Normal Saline Solution [NSS], (2) EDTA (1 min)+NSS [E1N], (3) EDTA (5 min)+NSS [E5N], (4) EDTA (1 min) [E1], (5) EDTA (5 min) [E5]. Roots were split and few drops of human blood were placed. Characteristics and fibrin density of clot were observed using SEM analysis. Fibrin density at coronal, middle and apical level was performed using Kruskal-Wallis test and Bonferroni adjustment.

III. Results
In NSS, E1N and E5N revealed denser fibers with biconcave of erythrocytes than E1 and E5. Fiber density in NSS showed the greatest values of 11.60, 12.38 and 13.33 fibers per 10 µm at coronal, middle and apical, respectively. No significance difference at all levels were observed between NSS, E1N and E5N ($p>0.05$). However, the fiber density in NSS were more than those in E1 and E5 ($p<0.05$).

IV. Conclusion
Clot formation was affected by EDTA irrigation for 1 and 5 minutes. Flushing with 20 mL of NSS for 5 minutes could enhance fiber formation.

***Keywords**: Ethylenediaminetetraacetic acid, Regenerative Endodontic Procedures, Blood clot, Fibrin formation, Scanning electron microscope
***Presenting Author**: Peerapohn Taweewattanapaisan
Department of Operative Dentistry and Endodontics, Faculty of Dentistry, Mahidol University, Bangkok, Thailand, yui.twps@gmail.com

P4-012

Effect of light curing unit and thickness of RMGICs bioactive and conventional GICs: A compressive strength assessment

Daryono*, Bernard O Iskandar, Wiena Widyastuti
Conservative and Endodontic Dentistry, Trisakti University, Jakarta Barat, Indonesia

I. Introduction
The aim of this study was to evaluate compressive strength of resin modified glass ionomer cements (RMGICs) Bioactive (Activa,Pulpdent) and Conventional (Fuji II LC,GC Corp) polymerized using halogen light (Optilux 501,Demetron, Kerr) and LED (LED B,Woodpecker Medical) for different curing times and thickness material.

II. Material and Method
Samples were placed in disc shaped plastic molds with uniform size of 5 mm diameter and 4 mm in thickness for compressive strength test. For 8 groups 7 samples for compressive strength (n=56). In group 1-4, samples were polymerized using halogen light source for 40 seconds. In group 5-8, samples were polymerized using LED light source for 20 seconds. In group 1,3,5,7, samples of 2 mm in thickness and group 2,4,6,8 samples of 4 mm in thickness. All data were analyzed by three ways analysis of ANOVA and Tukey's post-hoc tests.

III. Results
The ANOVA test results show a significant difference in the variable group of RMGICs bioactive is significantly higher ($p<0.001$) than conventional. Group of material thickness variable showed significant difference that is with thickness 2 mm is significantly higher ($p<0.001$) than 4 mm. There are no significant differences ($p=0.633$) in compressive strength on the effects of light curing unit. While the interaction between material RMGIC, material thickness and light curing unit no significant difference ($p=0.976$).

IV. Conclusion
RMGICs bioactive can be a material of choice for restoration of posterior cavities with thickness 2 mm and use appropriate light curing devices to polymerize material in deep cavities to maximize the compressive strength of restorative materials.

***Keywords**: RMGICs, LED, Halogen light, Thickness, Compressive strength
***Presenting Author**: Daryono
Conservative and Endodontic Dentistry, Trisakti University, Jakarta Barat, Indonesia, drgmdz_mail@yahoo.com

P4-013

Alternative treatment methods of chronic apical periodontitis: Practical dentistry trends

Maria Ilina*, Alexander Mitronin, Eugenia Yurtseva, Diana Ostanina
Department of Cariesology and Endodonics, Moscow State University of Medicine and Dentistry, Moscow, Russian Federation

I. Introduction
Nowadays chronic apical periodontitis (CAP) is a world spread dental disease. There are many treatment techniques.
What is the most used by dentists?

II. Material and Method
578 cases of CAP were registered after analyzing 4767 case histories of patients, treated in a network of clinics in 2002-2017.

Clinical cases were divided into groups:

I. CAP as a complication of caries with subsequent primary endodontic treatment.
II. CAP as pulpitis treatment complication followed by endodontic retreatment.
III. Cases of apical surgery for CAP treatment.

Exclusion group: CAP treatment during pregnancy, tooth extractions(including third molars) due to complications of CAP.

III. Results
1. 260 CAP cases (44.9% of all cases in 2002-2017) were registered for period 1 (2002-2009).
   318 CAP cases (55.1%) were registered for period 2 (2010-2017).
2. 524, 27, 27 CAP cases were registered in groups I, II, and III respectively for 15 year period.
3. Period 1: 228 cases (87.7% of all cases of period 1) were in group I,
   14 (5.4%) - group II,
   18 cases (6.9%) - group III.
   Period 2: 296 cases (93.1% of all cases of period 2) were recorded in group I,
   13 (4.1%) - group II,
   9 (2.8%) - group III.

Tooth hemisection, crown-radicular separation, root amputation and tooth replantation were never performed in these clinics during 15 years.

IV. Conclusion
1. CAP was 10.2% less frequent in 2002-2009, than in 2010-2017.
2. In 2002-2017 primary endodontic treatment was applied more frequent (90.7%), than retreatment (4.65%) or apical surgery (4.65%).
3. Period 2 compared to period 1:
   -group I increased by 5.4%,
   -group II decreased by 1.3%,
   -group III decreased by 4.1%.

We observe these changes due to rapid development not only in manufacturing of endodontic instruments, but also in prosthodontics and implantology.

***Keywords**: Chronic apical periodontitis, Endodontic treatment, Endodontic retreatment, Apical surgery, Treatment complications
***Presenting Author**: Maria Ilina
Department of Cariesology and Endodonics, Moscow State University of Medicine and Dentistry, Moscow, Russian Federation, il.maria0123@gmail.com

P4-014

Flexural strength comparison of nanohybrid and nanoceramic composite resin with fiber reinforced composite resin base

Hendro Malimas*, Tien Suwartini, Anastasia Prahasti
Conservative Dentistry, Trisakti University, Jakarta, Indonesia

I. Introduction
The fiber reinforcer material has been used widely for deep cavity. Nowadays we used regular resin composite to maintain long life tooth but usually it failed because of the materials itself. No study has been reported the comparison of the combination of resin composite nanohybrid and nanoceramic with base resin composite fiber reinforced yet.

II. Material and Method
Forty-four specimens were prepared in a split mold (25x2x2 mm). The specimen were divided into four groups according to the type and the thickness of resin (N=11); 1 mm nanohybrid composite + 1 mm Fiber reinforced composite (Group 1); 2 mm nanohybrid composite + 2 mm fiber reinforced composite (Group 2); 1 mm nanoceramic + 1 mm fiber reinforced composite (Group 3); 2 mm nanoceramic + 2 mm fiber reinforced composite (Group 4). The flexural strength (MPa) mean values were determined in a 3-point bending test at a crosshead speed 1 mm/min by universal testing machine (Unipulse, Japan).

III. Results
The results were statistically analyzed, using two-way ANOVA and Tukey post-hoc test ($p<0.05$).

IV. Conclusion
Nanohybrid composite resin restorations with fiber reinforced composite resin base show higher flexural strength than nanoceramic composite resin restoration with fiber reinforced composite resin base.

***Keywords**: Restoration, Fiber reinforced composite base, Nanohybrid Composite, Nanoceramic composite
***Presenting Author**: Hendro Malimas
Conservative Dentistry, Trisakti University, Jakarta, Indonesia, yusaku.ichiro@gmail.com

P4-015

Mineralization potential of human apical papilla cells after exposure to either ProRoot® MTA or Biodentine™

Kunlada Wattanapakkavong*, Tanida Srisuwan
Department of Restorative Dentistry and Periodontology, Chiang Mai University, Chiang Mai, Thailand

I. Introduction
ProRoot® MTA and Biodentine™ have been used as a coronal barrier in regenerative endodontics. However, several case reports have revealed different radiographic findings after these materials were used. In the cases using Biodentine™, the formation of a hard tissue bridge at the middle of the root canal has frequently been observed. Thus, the purpose of this study was to investigate the mineralization potential of human apical papilla cells (APCs) after exposure to either Biodentine™ or ProRoot® MTA.

II. Material and Method
Human apical papilla cells harvested from immature third molar teeth were cultured in the presence of either Biodentine™ or ProRoot® MTA. APCs without either material, cultured in regular complete medium, served as a negative control. Cell proliferation was assessed on Days 1, 2 and 3, using the Alamar blue™ test. Cell mineralization was evaluated using alizarin red S staining, and quantitatively analyzed on Days 7 and 21. Results were analyzed using the Kruskal-Wallis and Mann-Whitney U tests ($p<0.05$).

III. Results
Overall, the proliferative capacity of APCs in every group was similar for the first three days. When comparing proliferative capacity within the same material group, only ProRoot® MTA significantly promoted cell proliferation at all time periods ($p<0.05$). The mineralization potential of APCs was significantly higher in the Biodentine™ group on Days 7 and 21 than in the control group ($p<0.05$). ProRoot® MTA also promoted mineralization, but at later time points than did Biodentine™.

IV. Conclusion
ProRoot® MTA and Biodentine™ enhanced APCs proliferation and differentiation. ProRoot® MTA appeared to promote greater cell proliferation, whereas Biodentine™ promoted faster cell differentiation.

***Keywords**: Regenerative endodontics, Coronal barrier, ProRoot® MTA, BiodentineTM
***Presenting Author**: Kunlada Wattanapakkavong
Department of Restorative Dentistry and Periodontology, Chiang Mai University, Chiang Mai, Thailand, kwangkunlada@gmail.com

P4-016

Level of root filling density filling using $Ca(OH)_2$ sealer plus nano chitosan

Dewa Made Wedagama*
Department of Conservative Dentistry, Universitas Mahasaraswati, Bali, Indonesia

I. Introduction
Endodontic treatment aims to clean the pulp or microorganism tissue contained in the root canal system so

that it can fill the root canal properly and repair periapical tissue. The purpose of root canal filling is to create the perfect density along the root canal system from the orifices to the apex ends. Many techniques are used for root canal filling. One of them is by lateral condensation technique (lateral condensation). Another technique is the technique of gutta-percha which is made plastic by heating (thermoplasticized gutta-percha technique). $Ca(OH)_2$ can adapt well to dentin and gutta-percha point surfaces in order to reduce leakage of apical foramen and can stimulate the formation of hard tissue. Nano chitosan can react with any material (Smart material). It is bioactive, biocompatible, and adaptable to the environment. Further, its stability is good.

The aim of this research is to know the difference of root filling density level using Nano Chitosan added to $Ca(OH)_2$ sealer with thermoplastic condensation technique.

II. Material and Method
The research design used laboratory experimental. The samples used were 16 maxillary incisors according to the predefined sample criteria. The sample test is done by using Scanning Electron Microscopy (SEM).

III. Results
By statistical analysis using independent t-test showed that $p<0.05$. This suggests that there is a difference in the degree of density between the lateral and thermoplastic condensation techniques (Lateral Condensation Technique 9.3788 µm and thermoplastic condensation techniques 3.8863 µm).

IV. Conclusion
Root canal filling with thermoplastic technique has much better density than lateral condensation techniques, especially in apical thirds.

***Keywords**: Calcium hydroxide, Nano chitosan, Sealer, Biomaterial
***Presenting Author**: Dewa Made Wedagama
Department of Conservative Dentistry, Universitas Mahasaraswati, Bali, Indonesia, wedagama@doctor.com

P4-017

Flavonoid extract of propolis 26% potential against Streptococcus mutans glucan attachment

Setyabudi Goenharto*[1], Theresia Indah Budhy[2], Ira Widjiastuti[1]
[1]Department of Conservative Dentistry, Universitas Airlangga, Surabaya, Indonesia, [2]Department of Oral Pathology, Universitas Airlangga, Surabaya, Indonesia

I. Introduction
Caries is one of the diseases included in the top ten diseases in Indonesia, which amounted to 45.68%. National Health Survey 2001 show Dental and Mouth Disease was ranked first with 59.9%. Data issued by the MOH of Riskesda 2007 showed that 72.1% of the Indonesian population has experience tooth decay and as much as 46.5%, of which active caries that has not been treated. Problems encountered in the field of dentistry today is almost all materials used in dental care is a chemical import and have side effects including toxicity and resistance properties of materials. One effort to reduce the negative impact of the use of chemicals is to use natural ingredients. The benefits of propolis in oral health is as an anti-bacterial for flavonoid content and tt-farnesol Apigenin is a flavonoid that is important in propolis. Antibacterial activity of a material is indicated by a decrease in the growth of bacterial colonies, reducing the ability of bacteria adhesion and decreased activity of the enzyme glucosyl transferase (GTF) produced by the bacteria. The purpose of the study was to know how the effects of extracts of propolis on the attachment of Streptococcus mutans (S. mutans) glucan on the surface of the tooth enamel.

II. Material and Method
Different propolis flavonoid concentration was used to inhibit bacterial attachment S. mutans glucan.

III. Results
There is significant difference between propolis flavonoid concentrations.

IV. Conclusion
Based on the research that has been done can be concluded that propolis flavonoid concentration of 0.0489% is the lowest concentration that can inhibit bacterial attachment S. mutans glucan.

***Keywords**: Propolis, Flavonoid, Glucan, S. mutan
***Presenting Author**: Setyabudi Goenharto
Department of Conservative Dentistry, Universitas Airlangga, Surabaya, Indonesia, setyabudigoenharto@yahoo.com

P4-018

The pure bioceramic seal part 1: Efficacy of 3 different sealer application techniques

Christian Holscher*[1], Gerrit Gelberg[2], Stefan Ruettermann[2]
[1]Integra Medical Research, Integra, Luxembourg, Luxembourg, [2]University Institute of Dentistry of the Carolinum Foundation, Goethe University Frankfurt, Frankfurt, Germany

I. Introduction
The attempt to replace gutta-percha with other materials or adhesive techniques has been more or less successful in the past. Calcium silicate-based cements showed decisive advantages in terms of biocompatibility, adhesion and volume stability. Calcium-silicate may have the potential to replace gutta-percha in the future. Unfortunately, there is a major gap of knowledge in the application of bioceramic sealers. In this respect, the efficacy of 3 methods for application with 3 sealers was compared.

II. Material and Method
135 single-rooted human teeth were randomly divided into 3 groups (n=45), shortened to a standardized length of 20 mm and prepared to size 40/04 using BioRace-NiTi-files. They were embedded into a silicon mount and split longitudinally. Standardized grooves were prepared at 3 mm coronal of the root tips. Each group was divided into 3 sealer subgroups of n=15 (AH-Plus, MTA-Fillapex, Totalfill). The sealer was placed in the reassembled teeth with 3 different techniques: injection with a canula, injection + push-pull activation with size 40/04 gutta-percha, injection + push-pull + ultrasonic activation. After incubation for 3 weeks at 100% humidity and 37°C, digital images were taken at 20x and 40x magnification. Two calibrated observers independently examined each image twice using a 4-stage score for the root canal wall and groove.

III. Results
Inter- and intraobserver agreement were 76% and 85%, respectively. Sealer activation resulted in significantly superior distribution within all methods. Push-pull activation performed significantly better than injection or additional ultrasonic activation regarding the root canal wall. Nevertheless, ultrasonic activation could significantly improve the sealer distribution in the grooves. Regardless of the material used, sealer injection failed completely in sufficient sealer placement.

IV. Conclusion
Contrary to the manufacturer's specifications, sealer distribution using just a canula is an insufficient technique. The push-pull technique or additional ultrasonic activation performed significantly better in both, bioceramic and epoxy based sealers.

***Keywords**: Bioceramic sealer, Cold hydraulic obturation, Sealer placement, Sealer distribution, MTA Fillapex, Totalfill
***Presenting Author**: Christian Holscher
Integra Medical Research, Integra, Luxembourg, Luxembourg, c.holscher@gmx.de

P4-019

Effect of root canal irrigation regimen on APC attachment and transforming growth factor (TGF-ß) release from dentin

Tanida Srisuwan*, Sanupong Prompreecha, Kunlada Wattanapakkavong
Department of Restorative and Periodontology, Faculty of Dentistry, Chiangmai University, Chiang Mai, Thailand

I. Introduction
A dentin conditioning step has become an essential procedure in regenerative endodontics, since it improves cell migration and cell attachment to the dentin. This study investigated the effect of different irrigation regimens on apical papilla cell (APC) attachment when supplemented either with Endoactivator (EA) or Passive ultrasonic irrigation (PUI). Moreover, the amount of TGF-ß release from the root dentin after pre-conditioning was also evaluated.

II. Material and Method
Four irrigation regimens, normal saline solution (NSS), ethylenediaminetetraacetic acid (EDTA), chlorhexidine digluconate (CHX) with EDTA, or CHX alone, were used to irrigate the immature root canal models into which dentin slices were inserted. These irrigation regimens were supplemented with either EA or PUI. Then, isolated APCs were cultured on the dentin and counted for attachment using fibronectin staining. To evaluate the amount of TGF-ß release from the root canals after pre-conditioning, the models were placed in PBS for 7 days. An enzyme-linked immunosorbent assay (ELISA) was used to measure the amount of TGF-ß.

III. Results
Greater APC numbers were observed in the groups in which NSS was used than in other groups, when using the same techniques ($p<0.001$). However, TGF-ß was not detected in the groups using NSS as the irrigant. In the group using EDTA, the amount of TGF-ß release was significantly higher than in those using CHX alone or NSS ($p<0.05$). EA or PUI supplementation neither improved APC attachment nor TGF-ß release from the root dentin.

IV. Conclusion
When NSS was used as a final irrigant, the number of attached cells was significantly increased. The amount of TGF-ß release was detected only when EDTA was associated in the final irrigation.

***Keywords**: Regenerative endodontics, TGF-ß, Apical papilla cell, Dentin conditioning, EA, PUI
***Presenting Author**: Tanida Srisuwan
Department of Restorative and Periodontology, Faculty of Dentistry, Chiangmai University, Chiang Mai, Thailand, tanida_srisuwan@yahoo.com

P4-020

Damp response in pulp complex induction by resin bonding agent

Widya Saraswati*
Department of Conservative Dentistry, Universitas Airlangga, Surabaya, Indonesia

I. Introduction
We studied the molecular mechanisms involved NLRP3 which induced by resin monomer such 2-hydroxyethyldimethacrylate (HEMA). In odontoblast pulp cells of teeth rat, HEMA induced severe damages that induced innate immunity response. NLRP3, a cytosolic intracellular pattern recognize receptor (PRR) regulates a highly pro inflammatory cytokines IL-1β and could lead into a cell death. We found an increase of reactive oxygen species (ROS) activation after HEMA exposure. However, it is still unclear how HEMA could drive innate immune response in dentin pulp complex. The aim of this study to check the expression of NLRP3 inflammasome that could be activated by resin bonding agent HEMA as danger associated molecular pattern (DAMP) response.

II. Material and Method
The study design was randomized post test only control groups. The sample of the research was Sprague Dawley (SPD) rats which divided into 4 groups; 1 control group and 3 experimental groups. Molar tooth cavity was applied with HEMA pure liquid (Sigma Aldrich) with concentration 0,016µg/ml, then filled with glass ionomer cements Teeth were extracted after 24, 48 and 72 hours and decalcificated using EDTA for 8 weeks. Immunohistochemistry staining antibody anti NLRP3 were applied to investigate the expression in odontoblast pulp cells.

III. Results
The study showed HEMA upregulated activation of NLRP3 inflammasome in 24, 48 and 72 hours significantly in odontoblast pulp cells ($p<0.05$).

IV. Conclusion
Increased expression of NLRP3 showed a key role to activate danger signal through inflammasome pathway and leads to innate immunity response of odontoblast pulp cells.

***Keywords**: NLRP3, Odontoblast pulp cells, HEMA, DAMP, Resin, Inflamasomme
***Presenting Author**: Widya Saraswati
Department of Conservative Dentistry, Universitas Airlangga, Surabaya, Indonesia, widya.saraswati@yahoo.com

P4-021

CBCT and micro-CT in detection of radiographically undetected canals

Chayaporn Sirinimitpol*[1], Kallaya Yanpiset[1], Jira Kitisubkanchana[2]
[1]Operative Dentistry and Endodontics, Faculty of Dentistry, Mahidol University, Bangkok, Thailand, [2]Department of Oral and Maxillofacial Radiology, Faculty of Dentistry, Mahidol University, Bangkok, Thailand

I. Introduction
The purpose of this study was to compare cone-beam computed tomography (CBCT) and micro-CT for determine action of the existence and size of the root canals that undetected in the digital periapical radiography.

II. Material and Method
Forty-eight human roots with indiscernible root canals were selected by assessment with digital periapical radiography. The roots were scanned using CBCT and micro-CT for detection of the canals from the axial images before multiple cross-sectioning of the roots was made. In the canals that could not be detected on CBCT images, the presence or absence of root canals was confirmed in micro-CT image and tooth sectioning (gold standard). In the detected canals, the diameter of root canal sizes was measured. The sensitivity and specificity in identification of the root canal of CBCT, micro-CT and tooth sectioning were calculated into percentage. The measured root canal sizes were compared between the two methods.

III. Results
Sensitivities in identification of the canals were 33.2% and 81.9% for CBCT and micro-CT, respectively. Specificity in the identification was 100% and 85.7% for CBCT and micro-CT, respectively. There was no significant difference in the root canal sizes measured from micro-CT and tooth sectioning ($p>0.05$). An average root canal size that could not be detected in CBCT was 0.071 +/- 0.041 mm, and in micro-CT was 0.03 +/- 0.022 mm.

IV. Conclusion
CBCT could determine the existence of root canals with an average diameter was above 0.07 mm. While micro-CT could detect root canals when the diameter was above 0.03 mm. Micro-CT was more sensitive in detecting the root

canals, compared with CBCT. There was no statistically significant discrepancy in the measured root canal size between micro-CT and tooth sectioning.

***Keywords**: CBCT, Micro-CT, Calcified canal, Root canal size, Sensitivity
***Presenting Author**: Chayaporn Sirinimitpol
Operative Dentistry and Endodontics, Faculty of Dentistry, Mahidol University, Bangkok, Thailand, namemyway@hotmail.com

P4-022

Prevalence of a second canal and root canal morphology of mesiobuccal root of Thai maxillary molars: A CBCT study

Saranya Srisuma[*1], Chitpol Chaimanakarn[1], Jira Kitisubkanchana[2]
[1]Department of Operative Dentistry and Endodontics, Faculty of Dentistry, Mahidol University, Bangkok, Thailand , [2]Department of Oral and Maxillofacial Radiology, Faculty of Dentistry, Mahidol University, Bangkok, Thailand

I. Introduction
The complex root canal system of maxillary molars has caused a high percentage of treatment failure due to the inability to locate a second mesiobuccal canal (MB_2). The purposes of this study were to investigate the prevalence of MB_2, root canal morphology of mesiobuccal root, and location of MB_2 orifice of maxillary first and second molars in Thai sub-population.

II. Material and Method
CBCT images taken at the maxillary molar region were collected in 2014-2015 from the department of Oral and Maxillofacial Radiology, Faculty of Dentistry, Mahidol University. The maxillary first and second molars were analyzed to determine the prevalence of MB_2 canal, root canal morphology of mesiobuccal root according to Vertucci's classification. The geometric location and vertical position of MB_2 orifices were measured.

III. Results
From 438 CBCT data collected, 348 maxillary first molars and 321 maxillary second molars were included in this study. MB_2 was detected in 65.23% of the maxillary first molars and in 32.40% of the maxillary second molars with the average of 49.48%. There was no statistically difference among gender (p-value=0.783) or age interval (p-value=0.539). The most common canal morphology of mesiobuccal root was Vertucci's type I (55.76%), followed by Vertucci's type II (15.6%), and Vertucci's type IV (15.1%), respectively. MB_2 orifice was located at 1.03±0.22 mm. mesially and 2.53±0.55 mm. palatally from MB_1 orifice. When located deeper in apical direction, MB_2 was located at 3.14±1.55 mm. from the highest point of pulpal floor.

IV. Conclusion
CBCT was an effective method to study root canal anatomy. This retrospective study showed that mesiobuccal root had highly variable canal morphology and high prevalence of MB_2, especially in maxillary first molars. About half of them had MB_2, which was located mesially and palatally to MB_1 on pulpal floor level or separated apically from pulpal floor.

***Keywords**: Second mesiobuccal canal, MB2, Cone-beam computed tomography, Maxillary molars
***Presenting Author**: Saranya Srisuma
Department of Operative Dentistry and Endodontics, Faculty of Dentistry, Mahidol University, Bangkok, Thailand, ngekzein@gmail.com

P4-023

Treatment outcomes of C-shaped canal in mandibular second molars: A retrospective study

Chuta Kooanantkul, Chatpakorn Ueaworatham, Roongrawee Kamolroongwarakul, Kallaya Yanpiset, **Jeeraphat Jantarat***
Department of Operative Dentistry and Endodontics, Faculty of Dentistry, Mahidol University, Bangkok, Thailand

I. Introduction
Complexity of C-shaped canal makes root canal treatment more difficult to clean, shape and obturate effectively. Presently, only one clinical outcome of C-shaped root canal treatment is reported. The aims of this study were to evaluate treatment outcomes of C-shaped canal in mandibular second molars and investigate their prognostic factors.

II. Material and Method
Clinical and radiographic data of patients who had undergone root canal treatment on C-shaped mandibular second molars in Endodontics Clinic, Faculty of Dentistry, Mahidol University between 2004 and 2016 were collected. Percentage of healed rate was analyzed and prognostic factors were investigated using binary logistic regression.

III. Results
From 145 teeth, 111 teeth met the criteria. Recall rate was 77.9% with average of 33.9 months recall period. Healed rate and survival rate of C-shaped canal treatment was 78.4% and 92.8% respectively. Binary logistic regression identified significant ($p<0.05$) prognostic factors, which were pre-operative radiolucent lesion and quality of restoration. Teeth with pre-operative radiolucent lesion size≤5 mm and size>5 mm were significantly associated with 3 and 10 times higher odds ratio for disease than teeth without lesions respectively. Teeth with poor restoration showed 13 times higher odds ratio for disease than teeth with good restoration.

IV. Conclusion
This study revealed 78.4% completely healed rate of root canal treatment of C-shaped mandibular second molars with 92.8% survival rate. Presence of pre-operative radiolucency and poor restoration were significant negative prognostic factors affecting treatment outcomes of C-shaped canal.

***Keywords**: Treatment outcome, C-shaped canal, Retrospective study, Root canal treatment
***Presenting Author**: Jeeraphat Jantarat
Department of Operative Dentistry and Endodontics, Faculty of Dentistry, Mahidol University, Bangkok, Thailand, jeeraphat.jan@mahidol.ac.th

P4-024

Effect of sodium thiosulfate on bond strength of an epoxy resin–based sealer to NaOCl- and citric acid-treated dentin

Ezgi Doganay Yildiz[*1], Hakan Arslan[2], Mine Ozdemir[3], Ismail Uzun[4], Ertugrul Karatas[2], Alper Ozdogan[5], Merve Iscan Yapar[6]
[1]Department of Endodontics, Kırıkkale University, Kırıkkale, Turkey, [2]Department of Endodontics, Ataturk University, Erzurum, Turkey, [3]Department of Endodontics, Erzincan University, Erzincan, Turkey, [4]Department of Endodontics, Ondokuz Mayıs University, Samsun, Turkey, [5]Department of Prosthodontics, Ataturk University, Erzurum, Turkey [6]Department of Restorative Dentistry, Ataturk University, Erzurum, Turkey

I. Introduction
The aim of this study was to evaluate the effect of sodium thiosulfate on the bond strength of an epoxy resin-based sealer to sodium hypochlorite (NaOCl)- and citric acid-treated dentin.

II. Material and Method
Fifteen maxillary central incisors with straight roots were selected. Three discs (1.0±0.1 mm thick) were cut from the middle third of the roots under continuous water irrigation using a low-speed saw. A 1-mm round tungsten carbide bur was used to drill two holes in the root dentin under water-cooling, perpendicular to the root slice. All of the specimens were immersed in 5.25% NaOCl for 30 minutes, then immersed in 10% citric acid for 1 minute and 5.25% NaOCl for 1 minute. The specimens were randomly distributed into 3 groups, as follows: group 1: control group (no irrigation was performed); group 2: distilled water group (immersed in distilled water for 10 minutes; and group 3: sodium thiosulfate group (immersed in 5% sodium thiosulfate for 10 minutes). The holes were dried and filled with an epoxy resin-based sealer. A push-out test was performed on each hole and bond strength values were recorded. The one-way analysis of variance (ANOVA) and LSD tests were performed for the bond strength data. The data for failure type were analyzed using a chi-square test ($p=0.05$).

III. Results
The bond strength of the specimens irrigated with sodium thiosulfate was higher than that of the control group ($p<0.05$). However, there were no significant differences between the control and the distilled water groups ($P>0.05$). There were no significant differences in the failure type within the groups ($p>0.05$).

IV. Conclusion
Within the limitations of the present study, it can be concluded that 5% sodium thiosulfate for 10 min increased the bond strength of the sealer to NaOCl- and citric acid-treated dentin.

***Keywords**: Sodium thiosulfate, Bond strength, Resin sealer
***Presenting Author**: Ezgi Doganay Yildiz
Department of Endodontics, Kırıkkale University, Kırıkkale, Turkey, dtezgidoganay@gmail.com

P4-025

S1P signaling is a positive regulator of bone formation and is required for osteoblast differentiation

Etsuko Matsuzaki*, Kazuma Matsumoto, Hisashi Anan
Section of Operative Dentistry and Endodontology, Department of Odontology, Fukuoka Dental College, Fukuoka, Japan

I. Introduction
Sphingosine-1-phosphate (S1P) is known as a signaling sphingolipid that regulates many cellular responses, including cellular differentiation. Signaling through the specific cell surface G-protein-coupled receptors (subtypes S1PR1 to S1PR5) mediates most of the biological action of S1P. In this study, we investigated the roles of S1P for the osteoblast differentiation with a special reference to the molecular basis.

II. Material and Method

MC3T3-E1 cells, a mouse osteoblast-like cell line, are used for this study. For in vivo experiments, mice were injected intraperitoneally with S1PR1/R2 agonist 1mg/kg pf body weight every day for 28 days. Mice sacrificed and the right tibias were excised, and then subjected to micro-computed tomography analysis. The handling mice and all procedures were approved by the Animal Committee of Fukuoka Dental College (No. 15022).

III. Results

We found that S1P activated the type 1 receptor (S1PR1), which triggered the nuclear localization of b-catenin, resulting in the upregulation of osteoprotegerin and osteoblast differentiation-related genes including alkaline phosphatase in MC3T3-E1 cells. Furthermore, S1PR2 activation by S1P induced the activation of RhoA/ROCK signaling pathway, which led to the phosphorylation of Smad1/5/8, resulting in the increase of Runx2 gene expression.

Furthermore, we performed animal experiments to assess the involvement of S1P signaling pathways in osteoblast differentiation in vivo. Injection of S1PR1/R3 agonist (FTY720) promoted bone properties such as bone volume density, the trabecular thickness, and trabecular number, which were inhibited by the specific inhibitor of S1PR1. We also found that bone volume increased by S1PR2 agonist was attenuated by either S1PR2 inhibitor or ROCK inhibitor injection, consistent with the in vitro observation.

IV. Conclusion

We conclude that both S1PR1 and R2 signalings accelerate bone formation and induce osteoblast differentiation.

***Keywords**: S1P, Bone formation, Osteoblast differentiation
***Presenting Author**: Etsuko Matsuzaki
Section of Operative Dentistry and Endodontology, Department of Odontology, Fukuoka Dental College, Fukuoka, Japan, matsuzaki@college.fdcnet.ac.jp

Clinical Case Presentations

C1-001

Six month follow up of one visit endodontic treatment

Arisandi Husni[*1], Wahyuni Suci Dwiandhany[2], Farida Rahim[1], Asrianti Fattah[1], Yonathan Pasino[1]

[1]Resident of Conservative Dentistry Specialist Program Study, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia, [2]Department of Conservative Dentistry, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia

I. Objective

Endodontic treatment is one of indicated treatment for dental pulp infections. The success of a cleaning and shaping of endodontic treatment are complete removal of a pulp and bacterial toxin from the root canal. The main purpose of cleaning the root canal is to remove damaged dentine tissue, eliminate microorganisms found in root canals and dentinal tubules and to prevent recontamination after treatment. Multiple visits of endodontic treatment require considerable time to complete treatment. Current techniques and tools for endodontic treatment such as the use of rubber dam, loupe, apex lacator, and Ni-Ti rotary files, will not only improve the success rate of endodontic treatment but also shorten the time required for treatment. With adequated equipment and operator skills, endodontic treatment can be completed in one visit.

II. Case Presentations

A 19-year-old female patient came to the Department of Dental Conservation, Dental and Oral Hospital to relieve pain in her lower right mandibular tooth, an intraoral examination showing cavities and being diagnosed with irreversible pulpitis. Local anesthesia and endodontic treatment were performed, after determining the working length, and creating glide paths using K-file # 10, # 15 and ProGlider (densply). Root canal preparation using proTaper next X1 - X2. Each instrument was lubricated with EDTA gel during mechanical preparation, and was irrigated with 5.25% sodium hypochlorite and finally obturated with the final restoration is onlay porcelain.

III. Conclusion

One-visit endodontic treatment can be performed to reduce patient visit time in view condition such us operator skills and adequate equipment availability.

***Keywords**: One visit endodontic, Glide path, ProTaper Next

***Presenting Author**: Arisandi Husni

Resident of Conservative Dentistry Specialist Program Study, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia, arisandi.pkmlau@gmail.com

C1-002

Endodontic therapy of maxillary second molar and mandibular second molar fused with paramolar tubercles

Joo Hyun Hong*, Bin Na Lee, Hoon Sang Chang, In Nam Hwang, Won Mann Oh, Yun Chan Hwang

Department of Conservative Dentistry, Chonnam National University Dental Hospital, Gwangju, Republic of Korea

I. Objective

Supernumerary teeth in the molar are classified as paramolars or distomolars based on location. These teeth are frequently fused with adjacent teeth and pulp cavities may also be connected each other. Molar fused with paramolar tubercles may have complications such as deep caries or pulpitis which require endodontic therapy and restoration. Proper understanding of these variations is important in order to ensure success in endodontic treatment. Cone beam compute tomography(CBCT) can be helpful to understand anatomy of complicated cases. These case reports describe endodontic therapy and follow-up of maxillary second molar and mandibular second molar fused with paramolar tubercles.

II. Case Presentations

<Case 1>
Chief complaint: I cannot sleep well for 3 days because of pain on lower left molar
Sex/age: M/18
Past Medical/Dental History: Cu on #37 (because of pain and gingival swelling 6 years ago)
Present Illness: #36 Per(+), Mo(-), Cold(+), EPT(+)
#37 Per(++), Mo(-), Cold(-), EPT(-), Probing depth(MB 843,ML 433) Pus d/c on #37 buccal area
Impression: Periapical abscess without sinus on #37
Tx Plan: RCT on #37

<Case 2>
Chief complaint: Upper right molar and head hurts even when I am still 3 days ago.
Sex/age: F/28
Past Medical/Dental History: Non specific
Present Illness: #17 Per(+), Mo(-), Cold(-), EPT(-)
Impression: Necrosis of pulp on #17
Tx Plan: RCT and Cr on #17

III. Conclusion

Occurrence of supernumerary teeth are rare and tooth fusion is the result of the union of two distinct dental entities that occurs at any stage of dental organ development. Molar fused with paramolar tubercles which have complications can be managed either by removal or endodontic therapy or by maintain them with frequent management. After judicious evaluation of case history and clinical and radiographic examination, endodontic treatment will perform with use of Cone beam computed tomography.

***Keywords**: Supernumerary teeth, Paramolar, endodontic therapy, Cone beam compute tomography.

***Presenting Author**: Joo Hyun Hong

Department of Conservative Dentistry, Chonnam National University Dental Hospital, Gwangju, Republic of Korea, juile88@naver.com

C1-003

Management of tooth with horizontal root fracture due to traumatic injury

Joo-Yeong Lee*, Sang-Won Kwak, Hyeon-cheol Kim

Department of Conservative Dentistry, Pusan National University Dental Hospital, Yangsan, Republic of Korea

I. Objective

Root fracture infrequently occurs by traumatic accidents and involves fracture of dentin, cementum and pulp. In case of horizontal root fracture, coronal segment could be displaced, while apical segment is usually immobile. If apical pulpal circulation is not disrupted, tooth vitality of apical segment could be sustained. However, conventional endodontic treatment could be needed when the pulpal necrosis occurs on coronal segment. This case report describes a management of tooth with horizontal root fracture due to traumatic injury.

II. Case Presentations

<Case 1>
1. Chief Complaint: Teeth injuries due to slip down.
2. Sex/age: M/44
3. Past medical history: No contributory
4. Dental history: No contributory
5. Present illness: percussion (+), mobility (+) on #11, 21
6. Dx.Impression: Horizontal root fracture on #11, 21
7. Tx. Plan: 1) Teeth splint on #13-23
2) Root canal treatment of #11

<Case 2>
1. Chief Complaint:
Nasal bone fracture and Tooth injury due to fall down.
2. Sex/age: M/40
3. Past medical history: No contributory
4. Dental history: No contributory
5. Present illness: percussion(-) mobility(++) on #11
6. Dx.Impression: Horizontal root fracture on #11
8. Tx. Plan: 1) Teeth splint on #12-22
2) Root canal treatment of #11

III. Conclusion

For diagnosis of root fractures, radiographic examination is extremely important. Because root fractures are usually oblique, multiple radiographs should be taken from different angle to figure out the numbers and locations of fracture line. Proximity between segments affects prognosis of treatment. Repositioning of coronal segment into close proximity as much as possible is decisive. Teeth should be splinted with flexible wire for 2 to 4 weeks. The prognosis of treatment improves with close reduction of the root segments, and semirigid splint for the appropriate period.

***Keywords**: Horizontal root fracture, Dental trauma, Tooth injury

***Presenting Author**: Joo-Yeong Lee

Department of Conservative Dentistry, Pusan National University Dental Hospital, Yangsan, Republic of Korea, ljy8829@nate.com

C1-004

Endodontic surgery: Is it an archaic clinical procedure?

Srinivasan Manali Ramakrishnan[*1], Meenakshisundaram Rajasekaran[2]

[1]Department of Conservative Dentistry and Endodontics, Sri Venkateswara Dental College and Hospital, Chennai, India, [2]Ragas Dental College and Hospitals, Chennai, India

I. Objective

Non surgical endodontic treatment is highly predictable treatment option in most cases of persistent periapical pathosis. It is the first treatment of choice in an attempt to correct obvious deficiencies in patients with failed root canal treatment. Periradicular surgery should be considered as an extension of non surgical treatment, as the objectives of treatment are the same: prevention or elimination of apical periodontitis. Endodontic surgery has developed the perception as a redundant procedure, with the emergence of implants. This opinion has been based on endodontic surgery being performed using obsolete concepts and techniques that compromised the potential for clinical success, frequently resulting in the persistence of patient symptoms, periapical pathology, and, ultimately, extraction of the treated tooth.

II. Case Presentations

This paper presents a series of cases successfully managed using combined endodontic therapy and surgical

intervention. A case of external Resorption that was successfully managed by endodontic surgery has been described. This presentation also includes a case of where hemisection was the treatment of choice. A case of failed conventional root canal treatment is also presented where retreatment was attempted and was not successful. This was successfully managed by surgical endodontics.

III. Conclusion

With the emerging concepts of magnification, advanced principles of soft and hard tissue management, surgical endodontics has emerged as a highly predictable and comparatively painless procedure. Periapical surgery should be regarded as the method of choice when orthograde endodontic therapy is futile.

***Keywords**: Surgical endodontics, Endodontic mishap management, Hemisection, External resorption
***Presenting Author**: Srinivasan Manali Ramakrishnan

Department of Conservative Dentistry and Endodontics, Sri Venkateswara Dental College and Hospital, Chennai, Indiadrmrsrini@yahoo.com

C1-005

Anesthetic efficacy of supplemental intraligamentary injection with 4% articaine versus 2% lidocaine

Nazanin Zargar*, Hengameh Ashraf , Elnaz Shooshtari

Department of Endodontics, Dental School of Shahid Beheshti University of Medical Science, Tehran, Iran

I. Objective

Profound pulpal anesthesia in posterior mandibular teeth with irreversible pulpitis usually requires administering an inferior alveolar nerve block (IANB) and supplemental injections. This prospective randomized double blind trial aimed to evaluate the anesthetic efficacy of the supplemental Intraligamentary injection with Lidocaine or Articaine in mandibular molar teeth with irreversible pulpitis after an ineffective inferior alveolar nerve block with the same anesthetic.

II. Case Presentations

64 healthy patients diagnosed with irreversible pulpitis of a mandibular molar were included in this randomized double-blind clinical study. The patients divided into 2 subgroups and randomly received lidocaine or articaine. All the patients received 1.5 ml inferior alveolar nerve block injection (2% lidocaine or 4% articaine) and 0.3 ml long buccal injection. After 15 minutes patients without lip numbness have been excluded from the study. Then in patients who reported lip numbness, teeth have been examined by the cold test and electrical pulp test. The patients indicated their pain on Heft-Parker VAS. If the electrical pulp tester number was been under 80, supplemental intraligamental injection (PDL) was performed for the patients (by the same anesthetic).

The success rate of the inferior alveolar nerve block with lidocaine in mandibular first molars was 30% and in mandibular second molars was 10%. The success rate of inferior alveolar nerve block with articaine in mandibular first molars was 30% and in mandibular second molars was 30% and there was no significant difference between lidocaine and articaine. The supplemental PDL injection success rate with articaine was 78.1% and with lidocaine was 71.9%. There was no significant difference between lidocaine and articaine in supplemental injections (p=0.564).The success rate of PDL injection with lidocaine in teeth 6 and 7 was 62.5% and 81.3%, respectively without significant difference (p=0.433). The success rate of PDL supplemental injection with articaine in the teeth 6 and 7 was 56.3 and 100%, respectively with a significant difference (p=0.007). The intraligamentary injection was more effective in mandibular second molars (P value=0.011).

III. Conclusion

No statistically difference in anesthetic efficacy was recorded between articaine and lidocaine in supplemental intraligamentary injection but intraligamental injection was more effective in the second mandibular molars especially with articaine.

***Keywords**: Inferior alveolar nerve block, Lidocaine, articaine, Irreversible pulpitis, PDL injection
***Presenting Author**: Nazanin Zargar

Department of Endodontics, Dental School of Shahid Beheshti University of Medic, Tehran, Iran, nzargar48@yahoo.com

C1-006

Treatment of open apex using revascularization versus MTA apexification

Sangmi Ahn*, Sang Won Kwak, Hyeon Cheol Kim

Department of Conservative Dentistry, Pusan National University Hospital, Yangsan, Republic of Korea

I. Objective

In clinical practice we could encounter situations in which conventional canal filling with gutta-percha is impossible. For example, in immature permanent teeth the apex could be not closed yet. Also, apical stop can be lost due to the apical root resorption. These days with the development of dental materials, the management of open apex became easier with the MTA. In addition, the concept of regenerative endodontics is on the rise. This case report describes the cases which manage open apex with revascularization and MTA apexification.

II. Case Presentations

<Case 1>

1. Chief Complaint:
   I have pain and swelling on upper left incisors.
2. Sex/age: M/17
3. Past medical/dental history:
   Resin filling on #11,21 (7 years ago, due to crown fracture)
4. Present illness:
   Percussion(+), palpation(+) on #21,22, apical root resorption on #21
5. Dx. Impression:
   Pulp necrosis with chronic apical abscess on #21,22
6. Tx. Plan:
   Root canal treatment and MTA apexification of #21,22

<Case 2>

1. Chief Complaint:
   Referred from LDC for the treatment of teeth with open apex
2. Sex/age: M/12
3. Past medical/dental history:
   Access cavity preparation on #25 (4 days ago, due to the fracture of dens evaginatus)
4. Present illness: Percussion(+) on #25
5. Dx. Impression:
   Prior access with symptomatic apical periodontitis on #25
6. Tx. Plan: Revascularization of #25

III. Conclusion

Sometimes we met teeth with open apex accompanying periapical disease. In case of immature permanent teeth, pulp revascularization or apexification can be considered. Especially, thorough the pulp revascularization, additional root development can be achieved. However, in mature permanent teeth with apical resorption, regenerative approach could be inappropriate. If the apex is too large to fill in with gutta-percha, MTA plug formation in apical area could be good strategy. Clinicians could consider management of open apex with methods using MTA according to status of individual teeth.

***Keywords**: Revascularization, Apexification, MTA, Open apex
***Presenting Author**: Sangmi Ahn

Department of Conservative Dentistry, Pusan National University Hospital, Yangsan, Republic of Korea, smahn4009@gmail.com

C1-007

Regenerative Endodontic Procedure (REP) of immature necrotic tooth using Platelet-Rich Fibrin (PRF)

Sung Hyeon Choi*, Bin Na Lee, Hoon Sang Chang, Yun-Chan Hwang, In Nam Hwang, Won Mann Oh

Department of Conservative Dentistry, Chonnam National University Dental Hospital, Gwangju, Republic of Korea

I. Objective

Caries or trauma inducing loss of pulp vitality in an immature permanent tooth results in divergent apices and short root with thin radicular walls. Such cases can be managed by REP that lengthens as well as thickens the thin root walls. In REP, various biomaterials such as collagen or platelet rich plasma (PRP) can be used as a scaffold in addition to blood clot. However, PRP exhibits sudden release of growth factors in 7-14 hours. After that, the release of growth factors from PRP dramatically diminishes. PRF is an autologous fibrin mesh that releases slowly of growth factors up to 28 days.

The purpose of this case report is to discuss the clinical and radiological outcome of REP of immature tooth with a necrotic pulp using PRF.

II. Case Presentations

1. Chief Complaint: Sometimes, I have a toothache.
2. Sex/age: F/11
3. Past Medical/Dental history:
   Not Significant / RMGI filling on #16
4. Cold(-), EPT(-), Mob(-), Per(+), Probing depth (WNL), decayed state, gingival swelling on #16
5. Impression: Periapical abscess without sinus on #16
6. Tx plan: REP on #16

III. Conclusion

PRF releases various growth factors slowly such as platelet-derived growth factor (PDGF), transforming growth factor-β1 (TGF-β1) and vascular endothelial growth factor (VEGF) extending up to 28 days. Moreover, the natural fibrin of PRF also protects the growth factors from proteolysis. PRF clot traps all important circulating immune cells and cytokines that act against infection. In this case, MTA was packed directly over PRF and blood clot so as to obtain a tight seal. Moisture from PRF was helpful in the setting of MTA. At 10 months recall check, radiographic findings showed dentin growth and thickness apically. Also, the patient's complaint got improved, and there was no significant clinical finding. However, long-term studies are needed to establish PRF supplements in REP as a routine protocol.

***Keywords**: Regenerative endodontic procedure, Platelet-rich fibrin (PRF), Growth factors
***Presenting Author**: Sung Hyeon Choi

Department of Conservative Dentistry, Chonnam National Universitiy Dental Hospital, Gwangju, Republic of Korea, goldmagen@hanmail.net

C1-008

Surgical management of extruded gutta percha through a root perforation using Mineral Trioxide Aggregate: A case report

Abhishek Anil*, Mithra Hegde, Aditya Shetty

Department of Conservative Dentistry and Endodontics, A B Shetty Memorial Institute of Dental Sciences, Mangalore, India

I. Objective

Iatrogenic root perforation leads to an artificial communication between the root canal system and the periodontium and may have serious implications. A conservative non-surgical approach must be opted when access to seal the perforation is adequate. However, in cases of inadequate access to the defect, especially in complex iatrogenic treatment errors, surgical management may be required to seal the perforation, and save the tooth.

II. Case Presentations

A 62-year-old male patient complained of pain in the upper front tooth region since 3 days. Patient stated that he had undergone root canal treatment a week ago. Upon clinical evaluation, a gingival abscess was present in relation to the upper right lateral incisor. IOPA and CBCT radiographic images revealed a radicular perforation apical to the crestal bone level and a fragment of the gutta percha cone extruding and curving into the periodontal space. Under magnification using operating microscope, an orthograde approach was opted for removal of the coronal fragment of gutta percha; however, the extruded fragment of gutta percha was inaccessible. Thus, a conservative Ochsenbein-Luebke flap was raised under magnification using dental loupes and the gutta percha fragment was removed. The perforation site was cleaned and then sealed with Mineral trioxide aggregate (MTA Angelus; Angelus Soluções Odontológicas, Londrina, Brazil). The flap was repositioned and sutured. The true canal was located, instrumented and obturated using a bioactive sealer (MTA Fillapex; Angelus, Londrina, Brazil). CBCT images revealed complete fill of the perforation site with MTA.

III. Conclusion

Radicular perforations need to be diagnosed and managed with utmost precision and care as they critically hamper the prognosis of the tooth. Surgical management may be opted in complicated scenarios of perforations which enables the clinician to access remote areas, seal the perforation site and possibly improve the prognosis of the tooth.

***Keywords**: Root perforation, Radicular perforation, Surgical endodontics, Extruded gutta percha, CBCT, MTA
***Presenting Author**: Abhishek Anil

Department of Conservative Dentistry and Endodontics, A B Shetty Memorial Institute of Dental Sciences, Mangalore, India, docabhi93@gmail.com

C1-009

Survive for VRF tooth by using intracanal adhesive with intentional replantation

Masaru Igarashi*, Taro Nishida, Miki Sekiya, Munehiro Maeda

Endodontics, The Nippon Dental University School of Life Dentistry at Tokyo, Tokyo, Japan

I. Objective

One of the major reasons of extraction on teeth treated with root canal therapy is root fracture. Especially vertical root fracture (VRF) is most serious disease of save the tooth and the survive of the tooth with VRF is difficult. Vertical fracture causes endodontic-periodontal disease of the tooth, and its prognosis is poor. In recent years, improvement of the adhesive dental material has progressed, and a system which strongly adheres to dentin is used. In this report, the concept and procedure of a new treatment for the vertical tooth root fracture tooth reconstructed by intracanal adhesion method by intentional replantation will presence.

II. Case Presentations

After extracting the vertical fracture tooth, the root canal contents of the broken pieces were removed to the root apex, and root canal dentin was cut along the fracture line from inside the root canal toward the root surface. The interior of the tooth root was cut and removed as much as possible, suction dried inside the enlarged root canal, filled with dual cure adhesive core resin, and reinforcing wire was used to prevent refracture. After performing the apicoectomy as necessary, replanting was carried out and temporarily fixed for one week. The fractured tooth was set full-covered metal crown after a few months later and a good prognosis was shown.

III. Conclusion

Reconstruction with intracanal adhesion with intentional replantation is effective for save the VRF.

***Keywords**: Vertical root fracture, Intracanal adhesion, Intentional replantation, Reconstruction, Dual cure composite resin
***Presenting Author**: Masaru Igarashi

Endodontics, The Nippon Dental University School of Life Dentistry at Tokyo, Tokyo, Japan, m-igarashi@tky.ndu.ac.jp

C1-010

Simplified management of severely dilacerated root with separated instrument and perforation: A case report

Suman Gautam*[1], Asha Thapa[2]

[1]Conservative Dentistry and Endodontics, Nepal Medical College Pvt. Ltd., Kathmandu, Nepal, [2]Conservative Dentistry and Endodontics, National Academy of Medical Science, Bir Hospital, Kathmandu, Nepal

I. Objective

Canal curvature always possess a problem for carrying out endodontic treatment, if not given due attention to during planning of the case, preoperatively. Mishaps like instrument separation and perforation being the most common forms which ultimately leads to failure of the treatment.

II. Case Presentations

A 35 years of age female patient was referred for completion of initiated endodontic re treatment. Periapical radiographs were inconclusive so CBCT scan was done for correct evaluation of root anatomy followed by surgical management of the case. Also, one year follow up shows that the patient is asymptomatic and clinically satisfactory healing is taking place.

III. Conclusion

Tooth anatomy should be assessed prior to treatment of any case, radiographs might not suffice in all the cases and CBCT scan has to be taken for proper evaluation of the case. This will help to develop a sound treatment plan and get predict CBCTable result helping the patient to retain the natural tooth in function.

***Keywords**: CBCT, Dilaceration, Mishaps, Surgical management
***Presenting Author**: Suman Gautam

Conservative Dentistry and Endodontics, Nepal Medical College Pvt. Ltd., Kathmandu, Nepal, drsumanendo@gmail.com

C1-011

Cemental tear treated with intentional replantation

Il Hwa Lee*, Jeong Bum Min, Ho Keel Hwang, Hyoung Hoon Jo

Department of Conservative Dentistry, Chosun University Dental Hospital, Gwangju, Republic of Korea

I. Objective

Cemental tear is a special type of root surface fracture. It often accompanys with periapical lesions or gingival swelling. This leads difficulty to early diagnosis. The predisposing factors of cemental tear are age, sex, tooth type, and attrition. Cemental tear mainly occurs in male patients over 60 years and shows periradicular abscess of upper or lower anterior teeth. This case reports describes management of cemental tear with intentional replantation.

II. Case Presentations

< Case 1>

1. Sex / age: M / 63
2. CC: I have dull pain on lower anterior teeth.
3. Past Dental History (PDH): Root canal treatment (CUDH, 1 year ago)
4. PI: #31 Canal filled & resin core state
   Periradicular radiolucency
   Swelling on lingual gingiva
   per(+, mild), mob(-), PD=3 mm
5. Impression: Chronic apical abscess
6. Tx. Plan: Intentional replantation

< Case 2>

1. Sex / age: M / 64
2. CC: I felt pain on upper anterior teeth.
3. Past Dental History (PDH): None
4. PI: #21 severe attrition
   Periradicular radiolucency
   Longitudinal radiolucent fracture line on middle/apical portion of root surface (in CBCT)
   Swelling on palatal gingiva
   Sinus tract formation on labial gingiva
   (GP cone tracing → #21 root apex)
   air(-), per(+), mob(+), EPT(-/-), bite test(+), PD=3 mm
5. Impression: Cemental tear, Chronic apical abscess
6. Tx. Plan:
   Root canal treatment + Intentional replantation

III. Conclusion

Endodontists should be careful to avoid misdiagnosis and unnecessary root canal treatment in cemental tear. The objective of treatment is to remove the source of abscess. In this case, total debridement of fractured

cemental fragment as intentional replantation after root canal treatment. Clinicians should know this disease, make accurate diagnosis and treat properly.

***Keywords**: Cemental tear, Intentional replantation, Root surface fracture, Chronic apical abscess
***Presenting Author**: Il Hwa Lee
Department of Conservative Dentistry, Chosun University Dental Hospital, Gwangju, Republic of Korea, dentepisode@daum.net

C1-012

Periapical surgery of fused palatal and distobuccal roots of maxillary first molar aided by CBCT and 3D printed model

Chia-Lun Tsai[*], Yi-Ching Ho, Shue-Fen Yang
Endodontics, Taipei Veterans Hospital, Taipei, Taiwan

I. Objective

The incidence of root fusion in the maxillary first molar is 0.73~6.2%. A fused root morphology can pose challenge to periapical surgery due to the presence of an isthmus. A 3D printed presurgical model was used to simulate the management of this anatomically difficult case.

II. Case Presentations

A 46-year-old male presented for evaluation of a gingival nodule. Clinical examination showed no symptoms on the right maxillary first premolar (tooth 14) and first molar (tooth 16). Periodontal probing depths were within 2mm. Crown margins of tooth 14 and 16 were sound and showed no caries. A sinus tract was traced radiographically to the mesiobuccal root of tooth 16. The periapical radiograph showed a periapical radiolucency on tooth 14 and 16. Both teeth had a thick and long cast post. CBCT images further revealed a low-density area (7x4x11 mm) encompassing the mesiobuccal and the fused distobuccal-palatal root of tooth 16. Tooth 14 diagnosis was previously treated and asymptomatic apical periodontitis; tooth 16 diagnosis was previously treated and chronic apical abscess. The patient elected to have periapical surgery.

A 3D printed model based on the fused deposition modeling technique was fabricated for clinical simulation and model surgery. Periapical surgery was performed on tooth 14 and 16. To manage the fused root, a 28 mm long bur was required for root resection. The isthmus was carefully prepared to a depth of 2 mm due to its narrow width. All canals and isthmuses were root-end filled with MTA. Pathology report showed a periapical granuloma. A 3-unit bridge was placed 3 months after the surgery. The 1-year follow-up showed clinical normally and radiographic healing of tooth 14 and 16.

III. Conclusion

Variations of root fusion in maxillary first molar should be recognized. CBCT aid preoperative assessment. The application of an accurate 3D printed model may increase surgical efficiency in an anatomically complicated case.

***Keywords**: Periapical microsurgery, Maxillary first molar, Root fusion, Cone-beam CT, 3D printing
***Presenting Author**: Chia-Lun Tsai
Endodontics, Taipei Veterans Hospital, Taipei, Taiwan, manganese927@hotmail.com

C1-013

Palatally approached micro-surgery on the palatal root of maxillary first molar with persistent sinus tract: Case report

Chang Gi Cho[*], Myoung Uk Jin, Young Kyung Kim, Sung Kyo Kim, Jung-Hong Ha
Conservative Department, Kyungpook National University, Daegu, Republic of Korea

I. Objective

Periradicular micro-surgery has shown high success rate for teeth with persistent periradicular pathosis. Although the palatal root of maxillary molar could be surgically accessed either buccal or palatal approach, it is very challenging owing to its anatomical structures, such as maxillary sinus and anterior palatine artery and limited visibility. This case report presents two cases of periradicular micro-surgery of palatal root of maxillary first molar using palatal approach.

II. Case Presentations

<Case I>
1. Sex/age: M/69
2. Chief Complaint (C.C): persistent sinus tract after recurrent nonsurgical root canal treatment (NRCT)
3. Past Dental History (PDH) : recurrent NRCT on #26 was performed because of sinus tract
4. Present Illness(PI): #26 Per (-), Pal (+), Mob (0), PD (333/323), Sinus tract (+)
5. Impression: Periapical abscess with sinus to oral cavity on #26
6. Treatment plan: Apicoectomy on palatal root of #26 with palatal approach

<Case II>
1. Sex/age: F/51
2. C.C: persistent sinus tract on #16

3. PDH: recurrent NRCT was completed although sinus tract was persistent, because there was no specific finding on CBCT and microscopic observation.
4. PI: #16 Per (-), Pal (-), Mob (0), PD (323/323) Sinus tract (+)
5. Impression: Periapical abscess with sinus to oral cavity on #16
6. Treatment plan: Apicoectomy on mesiobuccal, mesiodistal and palatal root of #26 with palatal and buccal approach simultaneously.

III. Conclusion

In this report, we presented two cases of periradicular micro-surgery on palatal root of maxillary molar using palatal approach. By using palatal approach, we could get direct access to palatal root without obstruction of the maxillary sinus and buccal roots although there were limited visibility and difficulties of manipulating. Although periradicular micro-surgery on palatal root of maxillary molar is very challenging, precise case selection combined with planning and proper manipulation could make the palatal approach a useful option in maxillary molar surgery.

***Keywords**: Periradicular micro-surgery, Palatal approach, Palatal root of maxillary molar
***Presenting Author**: Chang Gi Cho
Conservative Department, Kyungpook National University, Daegu, Republic of Korea, changgi.cho@gmail.com

C1-014

Unusual complication following replantation of an avulsed immature permanent incisor

Seunghye Kim[*], Sooji Choi, Gyu-lim Kim
Department of Pediatric Dentistry, Ajou University Dental Hospital, Suwon, Republic of Korea

I. Objective

Avulsion of teeth most frequently occurs in maxillary cental incisor area, in children from 7 to 9 years of age, who have relatively loosely structured periodontal ligament and low mineralized bone surrounding. Pulp necrosis and various types of root resorption may occur as complication of avulsion. In dealing with avulsed immature teeth, clinicians should be try to promote pulpal healing and continued root formation. Here, we report a case of an 8-year-old boy whose replanted central incisor was supraerupted by about 3mm after removal of splint without further traumatic incidence.

II. Case Presentations

A 8-year-old-boy visited our clinic, with chief complaint of prolonged inflammation of the avulsed central right permanent incisor. He had received replantation, temporary splint, and endodontic treatment on the incisor in a local clinic. Fistula tract with sensitivity to percussion, mobility of one degree, and supraeruption were observed. After multivisit canal irrigation and dressing with calcium hydroxide, the endodontic treatment with completed by MTA apexification. The supraerupted crown was reshaped with diamond bur and slight resin build-up for esthetic appearance. In 11-month follow-up, continued root formation was observed with favorable esthetic satisfaction.

III. Conclusion

In this case, unusual supraeruption of a replanted avulsed incisor is presented. Interestingly, the apex of the newly formed root of the replanted incisor was about the same level with that of the contralateral incisor. The mechanism of supraeruption of the once replanted avulsion is unknown, but it can be clinically dealt with proper endodontic procedure and reshaping of crown portion.

***Keywords**: Avulsion, Replantation, Supraeruption, Root formation
***Presenting Author**: Seunghye Kim
Department of Pediatric Dentistry, Ajou University Dental Hospital, Suwon, Republic of Korea, greatpleasure@daum.net

C1-015

Management of a tooth which has internal / cervical / apical resorptions together: A case report

Nilay Ayaz[*1], Ertugrul Karatas[1], Mustafa Simsekyilmaz[2], K. Meltem Colak[1]
[1]*Endodontics, Ataturk University, Erzurum, Turkey*
[2]*Periodontology, Ataturk University, Erzurum, Turkey*

I. Objective

Dental resorption is loss of hard tissues and a pathologic event that must be treated to avoid loss of the affected teeth. The aim of this case report is to present surgical endodontic treatment of a maxillary central incisor which has internal/cervical/apical resorptions together.

II. Case Presentations

Crown fracture and resorptions were observed in examination of a 15-year-old male patient with a dento-alveolar trauma history on an upper left central incisor. To assess resorption areas CBCT images were taken.

Initially, the pulp polib was removed and an access cavity was preperad. Following rubber dam placement, root canal lenght was observed with a radiograph because perforation side block the apex locator to give true response. After root canal was shaped, and irrigated with NaOCl under sonic activation, calcium hydroxide paste was applied. 1 week later, perforation areas at middle third and apex of the tooth covered with MTA from inside root canal, wet pelet and temporary filling material were kept with a day's break. At another appoinment firstly, the root canal obturated with thermoplasticised obturation technique. Subsequently, palatal flap was reflected to reach cervical resorption where the disto-palatal side of the tooth. The resorption area was cleaned, etched, rinsed, filled with composite resin, flap was reposionated and sutured. After waiting the soft tissue healing coronal restoration was completed with composite resin by using strip crown.

III. Conclusion

In radiographic evaluation filling was provided adequately. The patient had no semptoms after 1 year follow up but a few discolorations occurred at cervical third of crown. The clinical follow-up will be continued and a veneer crown restoration may be advised a few years later.

***Keywords**: Trauma, Resorption, Thermoplasticised obturation, Surgical endodontic treatment
***Presenting Author**: Nilay Ayaz

Endodontics, Ataturk University, Erzurum, Turkey, nilaybilgic@yahoo.com

C1-016

Root canal treatment of a maxillary first premolar with three root canals

Ye-Rim Lee*, Jin-Woo Kim, Se-Hee Park, Kyung-Mo Cho

Conservative Dentistry, Gangneung-Wonju University Dental Hospital, Gangneung, Republic of Korea

I. Objective

For successful root canal treatment, location of all existing canals in the tooth plays an important part in the initial treatment procedures.

The majority of maxillary first premolars have two conical roots, that is one buccal and one palatal root. The buccal root may be further divided into two, an incidence of 1% to 5%, which causes the tooth to have three canals, a mesiobuccal, a distobuccal and a palatal canal. This case report presents the root canal treatment of maxillary first premolar with three root canals.

II. Case Presentations

A 58-year-old female was referred for the treatment of her maxillary right first premolar. The patient's chief complaint was spontaneous pain on right side of her upper jaw. Patient's medical history was non-contributory. Clinical and radiographic examination revealed a deep carious lesion in right maxillary first premolar. The tooth was sensitive to cold or electronic pulp testing, with responses indicating irreversible pulp damage.

After the injection of local anesthesia and rubber dam isolation, endodontic access cavity was prepared. With the aid of a dental operating microscope, the presence of three separate root canal orifices was detected. All three-root canals were instrumented with Ni-Ti rotary instruments and obturated by continuous wave compaction with gutta percha.

III. Conclusion

Endodontic success in teeth with the number of canals above that normally found requires a correct diagnosis and careful radiographic inspection. Morphological variations in pulpal anatomy must be always considered before beginning treatment. A second buccal canal and root is a rare anatomical variation that can be seen in maxillary first premolars. Endodontists should always consider the possibility of unusual number of roots and canals to overcome infections and related symptoms.

***Keywords**: Maxillary first premolar, Three root canal, Root canal treatment, Anatomy
***Presenting Author**: Ye-Rim Lee

Conservative Dentistry, Gangneung-Wonju University Dental Hospital, Gangneung, Republic of Korea, 01072115622@naver.com

C1-017

Treatment of C-shaped canal in mandibular first premolars with the aid of cone-beam computed tomography

Seong-Ju Lee*, Se-Hee Park, Kyung-Mo Cho, Jin-Woo Kim

Conservative Dentistry, Gangneung-Wonju University Dental Hospital, Gangneung, Republic of Korea

I. Objective

Successful root canal treatment depends on detailed knowledge of the morphology of the root canal system. The C-shaped root canal configurations can be difficult to recognize, prepare and obturate. Cone-beam computed tomography (CBCT) are useful in clinically to determine

the root canal morphology. C-shaped canal in mandibular first premolars often have a longitudinal radicular groove or depression on surface of the lingual area of root. This case report describes the rare occurrence of C-shaped root canal anatomy in mandibular first premolar diagnosed with the aid of CBCT.

II. Case Presentations

A-41-year-old male patient was referred for secondary caries treatment of the left mandibular first premolar (#34). While examining the periapical radiographs of #34, blurred image at one third of the root were observed. To ascertain the three-dimensional morphology of #34, dental imaging with the help of CBCT was planned. It showed C-shaped root canal anatomy with vertucci type V configurations. In this case, a radicular groove was present in the mesiolingual surface of the root. The endodontic therapy was accomplished and it was restored with post and crown. At the 1 year follow ups, there was no sign and symptom in clinical examination and radiograph.

III. Conclusion

The C-shaped canal is unusual and can lead to difficulties during treatment. So, the proper diagnosis of this situation is mandatory before treatment. CBCT was used as a diagnostic tool to identify the unusual and complex root canal configuration in mandibular first premolars. When performing root canal therapy, clinicians must be aware of the existence of C-shaped morphologies in mandibular premolars.

***Keywords**: C-shaped, Mandibular first molar, Root canal treatment, Cone-beam computed tomography (CBCT)
***Presenting Author**: Seong-Ju Lee

Conservative Dentistry, Gangneung-Wonju University Dental Hospital, Gangneung, Republic of Korea, isl5522@nate.com

C1-018

Aesthetic improvement of teeth with calcific metamorphosis

Ilda Budiwati*[1], Wahyuni S. Dwiandhany[2], Farida Rahim[1], Afniati Rachmuddin[1], A. Wisda Martianti[1]

[1]Resident of Conservative Dentistry Specialist Program Study, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia, [2]Departement of Conservative Dentistry, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia

I. Objective

Pulp canal obliteration (PCO), also called calcific metamorphosis (CM), is defined as the deposition of hard tissue into the root canal space, yellowish color change in the clinical crown as well as decreased pulp response to the thermal test compared to other teeth. Radiographic examination shows partial or complete calcification of the root canal chambers. Clinically the tooth will have discoloured crown. Factors that cause pulp canal obliteration is still unknown, but mostly associated with trauma, age, systemic diseases and chronic irritation of deep caries and restorations. Teeth suffering from trauma usually have pulp canal obliteration. Calcification occurred in part or all of the root canal will close and obscure access to the root canal system and will complicate the preparation, disinfection and obstruction of the root canal.

II. Case Presentations

A 37-year-old male patient came to Dental Hospital Hasanuddin University complained about his discoloured teeth since suffering from trauma about 2 years ago. Root canal treatment was planned for incisor central and lateral. No canal was located upon access opening. Further access was made by small round bur & K-files for locating the canal. Then finally access was gained to the canal. The working length was determined. Chemomechanical preparation was done with K-Files & file hand use system. Tooth was obturated by using single cone technique with AH plus sealer.

III. Conclusion

Thorough knowledge of tooth morphology, certain amount of patience, use of appropriate instruments and materials are essential to successfully manage such cases.

***Keywords**: Calcified canal, Calcific Metamorphosis, Dental trauma, Discoloration, Internal bleaching, Obliteration of the pulp
***Presenting Author**: Ilda Budiwati

Resident of Conservative Dentistry Specialist Program Study, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia, ildailda81@yahoo.com

C1-019

A favorable healing case of idiopathic external root resorption

Soojung Kim*, Hyunjung Ko, Miri Kim

Department of Conservative Dentistry, Asan Medical Center, Seoul, Republic of Korea

I. Objective

Idiopathic external root resorption of permanent dentition is defined as external root resorption without an etiologic

factor. It is accidentally detected from periodic dental examination due to its asymptomatic condition. As the disease progresses, the signs may occur. This clinical case presents idiopathic external root resorption and its management.

II. Case Presentations

1. Chief complaint: Pus discharge from upper front gum boil
2. Sex/age: 30/F
3. Past medical history: N/S
   Past dental history:
   Crown restoration on maxillary left lateral incisor (#22)
4. Present illness:
   Sinus tract on buccal gingiva of #22 Mobility(-), percussion(-), tenderness to palpation(+)
   Probing pocket depth=5 mm(mesial)
5. Assessment: External root resorption of #22
6. Treatment done: Suppression of all resorbing tissues and reconstruction of resorptive defect by placement of MTA with flap surgery after conventional root canal treatment
7. Results: The sinus tract disappeared after root canal treatment and not recurred during follow-up period. At 2 months follow-up, patient's alveolar bone showed increased density, but failed to completely recover its previous level of bone. Therefore, gingival recession following the flap surgery was inevitable.

III. Conclusion

Treatment method for idiopathic external root resorption has not been established yet. As this treatment technique achieves an acceptable result, it can be considered as a treatment option in cases where a natural tooth preservation is necessary.

***Keywords**: Idiopathic, External root resorption, Mineral trioxide aggregate, Flap surgery
***Presenting Author**: Soojung Kim
Department of Conservative Dentistry, Asan Medical Center, Seoul, Republic of Korea, bqsoonga@naver.com

C1-020

Separated surgical needle in the root canal: An uncommon case report

Mehtap Salman*, Ozgur Uzun
Endodontics, Gazi University, Ankara, Turkey

I. Objective

In some cases, we can see unexpected separated objects in root canals. We must try to fix those cases also. The aim of this case report is to describe the removal procedure of separated needle (21 gauge) from root canal of tooth #21.

II. Case Presentations

A 13-year-old female patient presented to a dentist with the pain of a restorated tooth #21. Dentist prepared a small access cavity, cleaned the root canal and then closed the cavity with cotton pellets. He gave syringe and needles to patient and recommended her to put the needle into root canal and aspirate if she has pain again.

She had pain and placed the needle into the root canal to aspirate. But the needle was broken in the canal. Patient placed another needle and it was broken also. She consulted to another dentist and she removed the needle at the coronal part and referred to our clinic for the other. We took the radiographs and saw that a part of the needle was pass out from the foramen and stuck into the bone.

The access cavity was enlarged under rubber dam isolation. We decided to use Masserann Kit but broken part of the needle was thicker than the extractor tube. So, we used the large trepan drills of kit as extractor tube and removed the broken needle from the root canal. Root canal was reprepared and calcium hydroxide paste was applied. All the symptoms were disappeared in 10 days.

III. Conclusion

As a dentist we must be carefully what we want from our patients. As an endodontist we can see uncommon objects in the root canals and may use techniques and instruments in variations. But success is always possible by using the right contemporary endodontic procedures.

***Keywords**: Separated instrument, Iatrogenic, Endodontic procedure, Endodontics
***Presenting Author**: Mehtap Salman
Endodontics, Gazi University, Ankara, Turkey, mehtapgoktas90@gmail.com

C1-021

Treatment of dens invaginatus by removal of invaginated hard tissue

Bo Ra Song*, Jung-Hong Ha, Young Kyung Kim, Sung Kyo Kim, Myoung Uk Jin
Department of Conservative Dentistry, School of Dentistry, Kyungpook National University, Daegu, Republic of Korea

I. Objective

Dens invaginatus is a developmental anomaly resulting in a deepening or invagination of the enamel organ into the dental papilla prior to calcification of the dental tissues. Endodontic treatment for teeth with dens invaginatus can be difficult due to the unusual anatomy and relative inaccessibility of the diseased pulp tissue. For successful endodontic treatment, the invaginated hard tissue have to be removed carefully. This case report presents the treatment of dens invaginatus by removal of invaginated hard tissue with the use of the dental operating microscope and the ultrasonic instrument.

II. Case Presentations

<Case 1>
-Chief complaint: Sinus tract formation under the chin
-Sex/age: F/43
-Past Medical/Dental History: N/S
-Present Illness:
Sinus tract on chin area
Per (+), Pal (+), Mob (0), Cold (-), EPT (inf./64), PD (323/323) on #31
Per (+), Pal (+), Mob (1), Cold (-), EPT (inf./64), PD (333/333), Dens invaginatus on #41
-Impression:
Pulp necrosis, Chronic apical abscess with extraoral sinus tract on #31, 41 Dens invaginatus on #41
-Tx Plan: Nonsurgical endodontic treatment on #31,41

<Case 2>
-Chief complaint: Dull pain on #22
-Sex/age: F/17
-Past Medical/Dental History: N/S
-Present Illness:
Sinus tract on Lt. labial gingiva
Per (+), Pal (+), Mob (0), Cold (-), EPT (inf./64), PD (323/323), Dens invaginatus on #22
-Impression:
Pulp necrosis, Chronic apical abscess with intraoral sinus tract, Dens invaginatus on #22
-Tx Plan: Nonsurgical endodontic treatment on #22

III. Conclusion

The present case demonstrates that root canal treatment of dens invaginatus by removal of invaginated hard tissue and orthograde apical obturation with mineral trioxide aggregate (MTA). Complete removal of invaginated hard tissue can be achieved with the help of the dental operating microscope and the ultrasonic instrument. It provides better access to facilitate debridement, disinfection, and obturation.

***Keywords**: Dens invaginatus, Invaginated hard tissue, Dental operating microscope, Ultrasonic instrument
***Presenting Author**: Bo Ra Song
Department of Conservative Dentistry, School of Dentistry, Kyungpook National University, Daegu, Republic of Korea, roseluv65@hanmail.net

C1-022

Root canal treatment of two rooted mandibular canine

Yi san Kim*, Bin Na Lee, Hoon Sang Chang, Yun Chang Hwang, In Nam Hwang, Won Mann Oh
Department of Conservative Dentistry, Chonnam national university dental hospital, Gwnagju, Republic of Korea

I. Objective

The root canal treatment is a complicated procedure, since many morphological variations can occur at the root canal treatment. Mandibular canine is often known to have a one root and very rarely was reported the presence of two roots. One of the reasons failure to root canal treatment is missing the one of canal treatment that remained undetected. Thus, it is essential for the clinician should consider the dental anatomy and its possible variations.
The objective of this case report is to describe the unusual root canal anatomy and endodontic treatment procedure of madibular canines with two roots.

II. Case Presentations

<Case 1>
1. Chief complaint:
   #43 Throbbing pain (referred from dept. of Pros)
2. Sex/age: F/79
3. Past Medical/Dental History:
   Hypertsnsion, Diabetes mellitus
   Extraction #31, 4(1month ago)
4. Present Illness:
   #43 Air (-), Per(+), Mob(+), EPT(+. 8/10), Cold(+), sinus tract(-), Periapical radiolucency
5. Impression:
   #43 Peri-apical abscess without sinus 6. Tx Plan: #43 RCT

<Case 2> (After 1year, the same person)
1. Chief complaint: #33 Throbbing pain
2. Present Illness:
   #33 Air (+), Per(+), Mob(-), EPT(+,4/10), Cold(+, hypersensitivity)
3. Impression: #33 Irreversible pulpitis
4. Tx Plan: #33 RCT

III. Conclusion

Knowledge of anatomical variation is key factor for successful root canal treatment. Radiographic examination and the use of dental operating microscope are also necessary for proper root canal treatment of teeth which has anatomical variation.

***Keywords**: Root canal treatment, Mandibular canine, Two roots
***Presenting Author**: Yi san Kim

Department of Conservative Dentistry, Chonnam national university dental hospital, Gwnagju, Republic of Korea, angelboys85@naver.com

C1-023

Internal bleaching on the discolored lower incisive: A case report

Aidasriwaty Gasma*, Nurhayaty Natsir, Uci Ernawati, Sulistiya Hastuti, Nurtiara Oktaviana

Conservative Dentistry, Hasanuddin University, Makassar, Indonesia

I. Objective

Anterior tooth discoloration may cause a significant aesthetic problem which affecting an aesthetic appearance. Bleeding in a traumatized tooth often leads to intrinsic discoloration. One of the treatment options for this condition is internal bleaching with walking bleach technique using 35% hydrogen perioxide.

II. Case Presentations

A 31-year-old woma patient presented to RSGM UNHAS with discolored and mobile lower anterior tooth 41 due to an accident 4 years ago. The radiograph showed a periapical lesion which extended from the central incisive into the periapical region left and right lateral incisives. In this case report, walking bleach technique was done post-endodontically using 35% hydrogen peroxide, followed with a direct composite restoration.

III. Conclusion

Internal bleaching with walking bleach technique provide an aesthetic result.

***Keywords**: Tooth discoloration, Internal bleaching, Walking bleach
***Presenting Author**: Aidasriwaty Gasma

Conservative Dentistry, Hasanuddin University, Makassar, Indonesia, aidasriwatygasma@yahoo.com

C1-024

Non surgical management of complex root canal anatomies using unconventional treatment modalities

Shalu Mahajan*

Reader at Dept of Conservative Dentistry & Endodontics, Teerthanker Mahaveer University, Moradabad, India

I. Objective

One of the biggest challenge in non surgical management of teeth is to comprehensively understand the variations of tooth root canal anatomy. A thorough knowledge of the basic root canal anatomy and its variations is necessary for successful endodontic management. CBCT plays a major role in the diagnosis and treatment planning for various clinical situations which are otherwise difficult to successfully treat with traditional diagnostic aids. With the evolution of new heat treated endodontic instrumentation, conservative approach towards root canal shaping is possible even in severely curved roots. Newer agitation devices and thermoplasticized obturation techniques helps in three-dimensional cleaning and obturation of a well-prepared root canal system.

II. Case Presentations

My case reports will demonstrate a systematic approach towards unusual anatomies of Root Canal System using CBCT for three-dimensional diagnosis, dental operating microscope (DOM) for magnification and latest heat-treated file systems to shape root canals in conservative and efficient ways. Latest irrigation agitation devices and solutions will also be used for three-dimensional cleaning of complex root canal system. And use of thermoplsticized techniques for three dimensional obturation of well-shaped and cleaned canals followed by good coronal seal.

III. Conclusion

Modern diagnostic aids, instruments and instrumentation techniques help us to treat complex root canal system in much effective and efficient ways.

***Keywords**: CBCT, Thermoplasticized technique, Dental operating microscope
***Presenting Author**: Shalu Mahajan

Reader at Dept of Conservative Dentistry & Endodontics, Teerthanker Mahaveer University, Moradabad, India, mahajan.shalu@gmail.com

C2-001

Broken instrument caused by inadequate canal enlargement

Andi Wisda Martianti Mayasari*[1], Wahyuni Suci Dwiandhany[2], Ardo Sabir[3], Uci Ernawati[1], Sulistya Hastuti[1]

[1]Resident of Conservative Dentistry Specialist Program Study, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia, [2]Department of Conservative Dentistry, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia, [3]Resident of Conservative Dentistry Specialist Program Study/ Department of Conservative Dentistry, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia

I. Objective

Clinicians often deal with endodontic procedural mishaps such as broken instrument during endodontic treatment. The use of reciprocating file systems has become popular for shaping the root canal. Files might undergo separation due to torsional failure, that occurs when the instrument locked in the canal while it's shank continues to rotate. Subsequently, separation of file occurs when the elastic limit of the alloy is exceeded. Management of a broken instrument in root canal is difficult and time consuming. Several devices and techniques have been developed to retrieve broken instrument.

II. Case Presentations

A 53-year-old patient came to Department of Conservative Dentistry, Hasanuddin Dental Hospital complaining pain on her right mandibular teeth, intraoral examination showing abfraction on her cervical surface of second premolar, the tooth was diagnosed with pulpitis irreversible. Endodontic treatment was performed, after working length determination, root canal initially prepared with path File No.2 (white) has an ISO 16 tip size. The WaveOne Gold primary (25/07) used to initiate the shaping procedure with inward and outward circumferential brushing motion. Each instrument was lubricated with EDTA gel during mechanical preparation and irrigated with 5.25% sodium hypochlorite. When WaveOne Gold primary achieves 2/3 coronal root canal, upper segment of file was broken and embedded on root canal. Clinically 1 mm of broken segment was visible below orifice, and hard to retrieved. Preparation was suspended and rescheduled for management of broken file. This case report describes a broken file due to inadequate canal enlargement. Ultrasonic technique proven to be effective to remove a broken file in root canal.

III. Conclusion

Root canal instrumentation following the manufacturer's instructions can be impede the incidence of broken instrument.

***Keywords**: Broken instrument, Inadequate canal enlargement, Ultrasonic, WaveOne Gold
***Presenting Author**: Andi Wisda Martianti Mayasari

Resident of Conservative Dentistry Specialist Program Study, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia, andiwisdamartianti@gmail.com

C2-002

Platelet-Rich Fibrin (PRF) as an utologous biomaterial in apical surgery: Case reports

Priyanka Sawant*, Nilker Vimala, Leena Padhye

Conservative Dentistry and Endodontics, Dr D Y Patil University, Nerul., Mumbai, India

I. Objective

The successful treatment of periapical inflammatory lesion depends on the reduction and elimination of the offending organism. Periapical surgery, one of the treatment alternatives, includes the curettage of all periapical soft tissues and sometimes application of different biomaterials to enhance the new bone formation in the defect site. Platelet rich fibrin (PRF) is a wonderful tissue engineering product and has gained much popularity due its promising results in wound healing bone induction.

II. Case Presentations

PRF acts as rich source of growth factor necessary for healing. The cases presented here shows success achieved in using PRF in surgical management of chronic periapical inflammatory lesions. Case one was radicular cyst with persistent discharge from the canal. Case two was failed primary endodontic treatment with a persistent apical lesion. Case three was combined Endo Perio lesion. PRF was used to stabilize and fill the bony cavity. It was used as biomimetic material for regeneration of bone.

III. Conclusion

The application of PRF biomaterial in apical surgery showed promising result in stimulating bone formation after 3 months, 6 months and one year recall around periapical surgical defects.

***Keywords**: Platelet rich fibrin, Biomimetic, Healing, Periapical lesions
***Presenting Author**: Priyanka Sawant

Conservative Dentistry and Endodontics, Dr D Y Patil University, Nerul., Mumbai, India, priyanka.sawant1989@yahoo.com

C2-003

Nonsurgical endodontic treatment of the maxillary second molar with an unusual positioning of mesio-palatal canal: A case report

Seung Jae Do*, Min-Seok Seo, Young-Mi Moon

Conservative Dentistry, Wonkwang University Daejeon Dental Hospital, Daejeon, Republic of Korea

I. Objective

Adequate knowledge about the morphology of root canal system is elementary for successful endodontic treatment. Maxillary second molar have various shapes, resulting in diagnostic and treatment challenges. Cone-beam computed tomography (CBCT) cab ne very helpful in diagnosis and treatment of these complex anatomic variations. The present case report describes the nonsurgical endodontic management of a left maxillary second molar with an unusual positioning of P-MB and with resorption of distobuccal root by third molar.

II. Case Presentations

1. Chief complaint: Spontaneous pain on #27
2. Sex/age: F/ 32
3. Past medical / Dental history:
   Composite resin restoration on #27
4. Present illness:
   Per(+) mob(0) bite test(+) EPT(+) cold(++, lingering pain)
5. Impression:
   Irreversible pulpitis with symptomatic apical periodontitis
6. Tx. plan: Nonsurgical root canal treatment on #27

III. Conclusion

The MB2canal is commonly located palatally and mesially to the MB1. In various in vitro and in vivo studies, the location of the MB2canal has been reported closer to the MB1 canal in the buccolingual direction, slightly mesial to a line joining the MB1 and palatal canals, at 1-4 mm from the mesiobuccal orifice and at sometimes even 4 mm from palatal canal.

However, in the present case the MB2 canal was located much closed to the palatal root canal orifice. This unusual morphology was diagnosed clinically with magnification and confirmed with the help of CBCT. Therefore, CBCT can provide greater insight into their complex radicular configurations.

***Keywords**: Maxillary second molar, CBCT, Unusaul anatomy of canal

***Presenting Author**: Seung-Jae Do

Conservative Dentistry, Wonkwang University Daejeon Dental Hospital, Daejeon, Republic of Korea, ehtjdwo823@nate.com

C2-004

Endodontic management of middle canal in mandibular molars using ultrasonic and Ni-Ti rotary instruments

Go-Eun Lim*, Sung-Ae Son, Jeong-Kil Park

Conservative Dentistry, Pusan National University Dental Hospital, Yangsan, Republic of Korea

I. Objective

Missed canals of endodontically treated teeth may contribute to post-operative pain or failure of therapy. If the presence of missed canals is suspicious and all three or four root canals were treated during the endodontic treatment in mandibular molars, one of the possible additional canals is middle mesial canal located between mesiobuccal and mesiolingual canals. This case presentation reports the management of middle mesial canals with dental microscope, ultrasonic and Ni-Ti rotary instruments.

II. Case Presentations

Case 1: A 27-year-old female patient referred from department of dental prosthodontics to department of conservative dentistry because of biting pain on left lower second molar after tooth preparation. The tooth was tender to biting, percussion and cold. Radiographic examination showed no specific findings. Diagnostic impression was irreversible pulpitis. Treatment plan was root canal treatment on left lower second molar. The tooth had distal C-shaped canal and middle mesial canals between mesiobuccal canal and mesiolingual canal.

Case 2: A 32-year-old female patient referred from local dental clinic because of canal calcification and persisted pain on right lower first molar. Clinical and radiographic examination showed canal calcification, prior access, and biting pain, percussion on right lower first molar. Diagnostic impression was irreversible pulpitis. Treatment plan was root canal treatment on right lower first molar. The tooth also had a middle mesial canal.

III. Conclusion

First patient complained post-operative pain for a few days after pulpectomy of C-shaped canal. Canals were clean and the working length was fine. Thus missed canal was suspicious and was detected with dental microscope, ultrasonic and Ni-Ti rotary instruments. Consequently endodontic treatments were successfully done by securing the middle mesial canal.

***Keywords**: Mandibular molar, Middle mesial canal, Post-operative pain, Dental microscope, Ultrasonic instrument, Ni-Ti rotary instrument

***Presenting Author**: Go-Eun Lim

Conservative Dentistry, Pusan National University Dental Hospital, Yangsan, Republic of Korea, gelim87@gmail.com

C2-005

Management of an inflammatory internal root resorption in a radix entomolaris with 5 canals: A case report

Yuksel Eren*, Mugem Ekici

Endodontics, Gazi University Faculty of Dentistry, Ankara, Turkey

I. Objective

Internal inflammatory root resorption is a rare condition in permanent teeth, which requires the presence of necrotic and infected pulp tissue within the coronal portion of the root canal system as well as inflamed pulp tissue apical to the resorptive defect. The aetiology of internal root resorption is not completely understandable, trauma and chronic pulpitis are considered the main risk factors. It is usually asymptomatic and detected during routine radiographic examinations. Cone-beam computed tomography (CBCT) displays the location and extension of resorptive defects. Early diagnosis and management of such defects is essential to maintain the integrity of the tooth.

II. Case Presentations

A 32-year-old male patient was referred to endodontic clinic. In clinic examination, right mandibular first molar was asymptomatic. Both electric and thermal pulp tests were negative. Radiographic examination revealed indications of internal root resorptions both coronal part of the mesial and distal roots. Afterwards, CBCT images ensured the accurate location and extent of resorption. Also, three mesial and two distal canals were detected in CBCT images. During the management, the root canals were prepared, irrigated, and calcium hydroxide paste was placed for a week. In the second session, root canals were obturated with warm vertical compaction of gutta percha (System B and Obtura). Then the tooth was restored with light-cured composite resin.

III. Conclusion

Our results show that, although management of internal root resorption is a challenge for practioners, early diagnosis and proper treatment approaches lead to satisfactory results. In addition, follow up is essential to evaluate the long term prognosis.

***Keywords**: Cone-beam computed tomography, Internal root resorption, Root canal treatment, Warm vertical compaction

***Presenting Author**: Yuksel Eren

Endodontics, Gazi University Faculty of Dentistry, Ankara, Turkey, yuko.eren07@gmail.com

C2-006

Mandibular first molar with six separate canals

Se Ra Jung*, Ji Young Moon, Hyoung Hoon Jo, Ho Keel Hwang

Department of Conservative Dentistry, Chosun University Dental Hospital, Gwangju, Republic of Korea

I. Objective

The process of identifying and determining the root canal morphology is particularly challenging in endodontic treatment of a tooth with atypical canal configuration. The number of roots in the mandibular first molar is directly related to ethnicity of the population studied. In the Mongoloid, Native American, Eskimo, and Chinese population, the presence of a third root should be considered a normal anatomical variation. The mesial root usually presents with 2 canals, the most common root canal configuration is Type II and III. The presence of a third canal, known as middle mesial, was found to have an incidence of 2.6%. The most common root canal configuration in the distal root is type I with 62.7%, followed by type II with 14.5% and type III with 12.4%.

This case reports present the diagnosis and clinical management of mandibular first molar with 3 separate mesial and 3 separate distal canals. All the 6 canals had an independent apical foramen.

II. Case Presentations

1. Sex / age: M / 40
2. CC: I'd like to get my teeth treated.
3. Past Dental History (PDH): CI am. F.
4. PI: #46 Severe caries
   Periapical radiolucency
   air(-) per(-), mob(-), EPT(-), pain(-)
5. Impression: Pulp necrosis / Apical periodontitis
6. Tx. Plan: RCT

III. Conclusion

This case report describes the endodontic treatment of a mandibular first molar with 6 separate root canals. Endodontic success in tooth with multiple root canals requires careful exploration of pulpal chamber. Many cases of endodontic failure are due to missed canals. Clinicians should be aware of the incidence of these extra canals in the mandibular first molar. Microscope and radiographs are important tools in diagnosing and managing such teeth with anatomical variation.

***Keywords**: Mandibular first molar, Six canals, Root canal anatomy
***Presenting Author**: Se Ra Jung

Department of Conservative Dentistry, Chosun University Dental Hospital, Gwangju, Republic of Korea, sera05@naver.com

C2-007

MTA (Mineral Trioxide Aggregate) - The biological healer

Sanhita Goswami*, Debaprasad Das, Sourav Bhattacharyya

Department of Conservative Dentistry and Endodontics, Haldia Institute of Dental Sciences and Research, Kolkata, India

I. Objective

The success of endodontic treatment is not only confined to achieving a three dimensional hermetic obturation of the root canal space but also upon the uneventful healing of the periapical tissues. The maintenance of harmony in the biological environment surrounding the tooth root is crucial to the ultimate success of any endodontic procedure. The success of the treatment has lent itself to the advent of newer technologies in instrumentation as well as to the influx of biomimetic materials. These materials have fulfilled the biological objectives of endodontic treatment with their unique biosimulating properties, the most popular and effective among them being MTA. It's use encompasses a variety of situations like apexification, root end filling, root repair material and regenerative endodontics.

II. Case Presentations

This presentation includes four different clinical cases. The first two cases described periapical lesions associated with immature permanent tooth (central incisor and mandibular premolars) where single step apexification was performed with MTA. The healing of the lesion was observed over a 6 month and 1 year follow up. The third case presented with middle third root fracture in root treated central incisor where retreatment was performed and intraradicular fixation with fiber post was done. Mucoperiosteal flap was elevated and the fracture site exposed a cemental tear which was repaired with MTA. The last case revealed a retreatment in maxillary second premolar where apical stop could not be achieved and so intentional bleeding was induced and the canals were filled with MTA. Both the cases showed satisfactory clinical outcome.

III. Conclusion

The setting reaction of MTA involves hydroxyapatite formation which ensures a close adaptation with the dentin/ cementum of root and is a biomimetic barrier/ seal. It's high ph on setting also ensures a healthy environment for healing of the biological tissues. Thus MTA stands the test of time as a magic material.

***Keywords**: MTA, Endodontics, Biomaterials
***Presenting Author**: Sanhita Goswami

Department of Conservative Dentistry and Endodontics, Haldia Institute of Dental Sciences and Research, Kolkata, India, sanhita.goswami18@gmail.com

C2-008

Mineral trioxide aggregate as apical plug in non-surgical approach of trauma-induced apical root resorption

Aqilla Tiara Kartikaning Tyas*, Ema Mulyawati

Conservative Dentistry, Faculty of Dentistry, Universitas Gadjah Mada, Yogyakarta, Indonesia

I. Objective

Apical root resorption is a pathologic condition of destructive loss of apical tooth structure, resulted as a sequela of inflammation, mechanical stimulation, neoplastic process, systemic condition, or traumatic injury. Non-surgical approach is considered as the first choice for the treatment using material that promotes apical sealing. Mineral Trioxide Aggregate (MTA) is widely used as apical plug, which aims to physically seal the apex and biologically regenerate tissue.

II. Case Presentations

A 23-year-old male patient was referred to the Clinic of Conservative Dentistry Dental Hospital of Universitas Gadjah Mada, complained about his darkened front left upper tooth. Patient had history of falling from riding motorbike 7 years ago, but the tooth was left untreated. Thermal test and electric pulp testing of tooth 21 showed non-vital. Periapical radiograph showed irregularity in the apex, marking the resorption in the apical third. Diagnosis of tooth 21 was pulp necrosis and apical resorption. Biomechanical preparation was performed under rubber dam isolation and calcium hydroxide was left for 2 weeks as intracanal medicament. MTA was used as an apical plug and followed with backfilled gutta-percha and bio-ceramic sealer. Internal bleaching was performed to lighten the discolored tooth followed with composite resin restoration. Patient had been recalled regularly and after 6 months, no signs and symptoms were noted. Radiograph of tooth 21 showed no progression of the defect.

III. Conclusion

MTA is one of the materials to plug the apices, and known to have good sealing ability, biocompatibility, antibacterial effect, and ability to help promote bone, dentin, and cementum regeneration. Orthograde filling with MTA followed with gutta-percha was performed as non-invasive approach in apical root resorption and showed no progression of defect.

***Keywords**: Apical root resorption, Apical plug, Mineral trioxide aggregate
***Presenting Author**: Aqilla Tiara Kartikaning Tyas

Conservative Dentistry, Faculty of Dentistry, Universitas Gadjah Mada, Yogyakarta, Indonesia, aqilla.tiara@gmail.com

C2-009

The orthograde application of mineral trioxide aggregate for treatment of internal root resorption

Hyunjin Jo*[1], Sungok Hong[2], Seokryun Lee[1]

[1]Department of Conservative Dentistry, Wonkwang University Dental Hospital, Iksan, Republic of Korea, [2]Department of Conservative Dentistry, Wonkwang University Sanbon Dental Hospital, Gunpo, Republic of Korea

I. Objective

Internal root resorption(IRR) is the rarely occurring pathologic condition of the root canal frequently associated with chronic pulpal inflammation and pulpal necrosis. It is characterized by the radiographic appearance of an oval-shaped enlargement within root canal and usually asymptomatic, so it is often discovered by chance during routine radiographic examinations. Because of the complex irregularities of IRR, it may be difficult to obturate the root canals appropriately. Mineral trioxide aggregate(MTA) has satisfactory properties including biocompatibility, favorable sealing ability, antibacterial effect, and a capacity to promote periradicular tissue healing. The following two cases describe the treatment of IRR using orthograde application of MTA.

II. Case Presentations

1. Sex/Age: F/57
2. Chief Complaint (C.C):
   Referred from Dept. of Perio. for evaluation of #21
3. Present Illness (P.I):
   #21: internal root resorption at apical 1/3 of root canal, Per(-), Mob(-), EPT(-)
4. Impression:
   Pulp necrosis and internal root resorption on #21
5. Tx. Plan: Root canal treatment & MTA filling on #21

1. Sex/Age: F/68
2. Chief Complaint (C.C):
   Referred from Dept. of Perio. for evaluation of #23
3. Present Illness (P.I):
   #23: internal root resorption at apical 1/3 of root canal & internal apical root resorption, Per(-), Mob(-), EPT(-)
4. Impression:
   Pulp necrosis and internal root resorption on #23
5. Tx. Plan: Root canal treatment & MTA filling on #2

III. Conclusion

In both cases, no perforation of root canal wall observed by cone-beam computed tomography(CBCT). But in the second case, anatomical shape of the apex was "open-apex" due to internal apical root resorption. To obturate such canal with IRR and "open-apex", orthograde MTA application was performed under microscope using modified matrix concept to form an apical collagen barrier to prevent of extrusion of MTA, and indirect ultrasonic activation to enhance the density and adaptation of MTA.

***Keywords**: Internal root resorption, MTA, Orthograde filling
***Presenting Author**: Hyunjin Jo

Department of Conservative Dentistry, Wonkwang University Dental Hospital, Iksan, Republic of Korea, diozz@nate.com

C2-010

Repair of iatrogenic furcal perforation with fast-setting calcium silicate cement

Jae-Heon Jung*, Jeong-Won Park, Kyeol Koh, Su-Jung Shin

Operative Dentistry, Gangnam Severance Hospital, Seoul, Republic of Kore

I. Objective

Furcal perforation is an undesirable complication that can occur during endodontic treatment. During locating

root canal orifices wrong direction with burs and/or excessive removal of tooth structure can result in furcal perforation. A communication between pulpal floor and periodontal ligament space can cause a chronic inflammatory reaction of the periodontium that can lead to irreversible loss of attachment or loss of the tooth. Mineral trioxide aggregate (MTA) has been widely used to repair perforation and this can be attributed to its biocompatibility, low induction of inflammation, capacity for creating a seal between the pulpal chamber and periodontal tissues. Recently, various calcium silicate cements were introduced and proved to be similarly and reliably applicable as a perforation repair material. This clinical case presents the repair of iatrogenic furcal perforation with fast-setting calcium silicate cement during non-surgical root canal treatment.

II. Case Presentations

A 74-year-old female patient was referred to our institution for the treatment on mandibular right first molar (#46). She had a continuous dull pain on right mandibular region, which had started after initiation of root canal treatment on the first molar by her general dentist about two weeks ago. Clinical and radiographic examinations revealed that the dentist was unable to locate the root canals and a perforation occurred during pulp chamber access. First, a furcal perforation site was sterilized using 2.5% sodium hypoclorite solution and sealed with calcium silicate cement (RetroMTA®, bioMTA, Seoul, Korea). After confirming the initial setting of RetroMTA, root canal treatment was completed and gold crown was placed. Radiographically a slight extrusion of RetroMTA to PDL space was observed. At recall check-ups, patient was asymptomatic and there was no sign of radiolucency around RetroMTA.

III. Conclusion

It was concluded that fast-setting calcium silicate cement was beneficial to repair a furcal perforation due to easy handling and fast setting.

***Keywords**: Furcation perforation, Calcium silicate cement, Fast-setting

***Presenting Author**: Jae-Heon Jung

Operative Dentistry, Gangnam Severance Hospital, Seoul, Republic of Korea, jjh9021@yuhs.ac

C2-011

Tooth discoloration induced by White Mineral Trioxide Aggregate

Rupam Tripathi*

Department of Conservative Dentistry and Endodontics, UCMS College of Dental Surgery, Bhairahawa, Nepal

I. Objective

Mineral trioxide aggregate (MTA) has been widely used in different clinical situations due to numerous favourable properties. Despite it, MTA has shown some drawbacks such as long setting time, difficult handling, and tooth color change. Although white MTA (WMTA) has been developed to overcome the tooth discoloration caused by the application of grey MTA. Several studies have reported tooth discoloration after using WMTA, too. So, this case report describes the tooth discoloration caused by WMTA and its management.

II. Case Presentations

A 17-years-old male patient was referred to the Department of conservative dentistry and endodontics with non-contributory medical and dental history with pain in upper front region of jaw since last 1 month. There was history of trauma 8 years back. On clinical examination, yellowish discoloration was found i.r.t #11 and #21. On the basis of clinical and radiographic findings the diagnosis of Necrotic pulp with symptomatic apical periodontitis was made. Regenerative procedures with MTA was done i.r.t 21 and root canal treatment was performed i.r.t 11. After 8 months, Patient came with the dark discoloration in the dental crown of left upper central incisor. Internal bleaching was performed producing satisfactory esthetic results.

III. Conclusion

Although, MTA appears to be promising successor to calcium hydroxide for pulpal and periodontal healing. Despite the fact that several studies have shown its discoloration, chemical interaction with dental structures is still not clear and requires further investigation. The recommendation to use WMTA in the esthetic zone should be reconsidered.

***Keywords**: Discoloration, Internal bleaching, Regenerative procedure, WMTA (White Mineral Trioxide Aggregate)

***Presenting Author**: Rupam Tripathi

Department of Conservative Dentistry and Endodontics, UCMS College of Dental Surgery, Bhairahawa, Nepal, rupam.tripathi121@yahoo.com

C2-012

Blunderbuss root canal therapy with collagen membrane and MTA: A case report

Sulistiya Hastuti*, Juni Jekti Nugroho, Nurtiara Oktaviana, Yonathan Pasino, Andi Wisda Martianti

Conservative Dentistry, Hasanuddin University, Makassar, Indonesia

I. Objective

Open apices of root canal give different challenges to endodontist to gain the complete apical sealing during root canal treatment. The greater diameter of the root canal may complicate the MTA condensation and apical seal. Collagen barrier is an allogeneic and or xenogeneic forms of collagen membrane use to improve the MTA adaptation. Objective: Tooth 21 with an open apex and blunderbuss canal was successfully treated with collagen membrane and MTA apical plug.

II. Case Presentations

A 23-year-old female patient came to Department of Conservative Dentistry, Hasanuddin Dental Hospital with her chief complaints of unaesthetic restoration and history of traumatic fracture on tooth 21 when she was 8 years old. The radiograph examination showing a wider canal diameter with an open apex. Case management: Shaping and cleaning of root canal tooth 21 with circumferential technique and dressing with calcium hydroxide medicaments. The collagen barrier was applied and apical plug with MTA.

III. Conclusion

The combination of collagen barrier and MTA apical plug is a proper alternative in the open apex and blunderbuss case management.

***Keywords**: Apical plug, Blunderbuss canal, Collagen membrane, MTA

***Presenting Author**: Sulistiya Hastuti

Conservative Dentistry, Hasanuddin University, Makassar, Indonesia, sulistiyahastuti@gmail.com

C2-013

Management of radicular cyst with endodontic surgery

Gita Tarigan[*1], Rusdy Hendry[2]

Endodontics, Prima Indonesia, Kota Medan - Medan Kota, Indonesia, [2]Lecture of Oral Surgery University North Sumatera, Indonesia

I. Objective

When root canal therapy is done according to accepted clinical principles and under aseptic conditions, the success rate is generally high. However, it has also been reported that 16% to 64.5% of endodontically treated teeth are associated with periapical radiolucent lesions. There are great variations among clinicians when suggesting treatment of these failed endodontic cases. Preliminary radicular cyst treatment can be performed by conventional methods or surgical endodontic. Endodontic surgical methods are required when conventional treatment was no successful. One of endodontic surgical treatment which is the apex resection was used to treat inflammation, infection or other abnormality in the area of apical root.

II. Case Presentations

A male patient (aged 26) was diagnosed with swelling in buccal at the apex 41 after 3 years he always consumes antibiotic, in radiograph find well defined at tooth 32, 31, 41, 42 about 2mm. first diagnoses we called ameloblastoma. Endodontic treatment on 32, 31, 41, 42, followed by the apexresection and first diagnose is ameloblastoma.

III. Conclusion

Treatment using endodontic surgical method with apex resection has a high success rate in cases that cannot be treated with conventional treatment.

***Keywords**: Odontogenic cyst, Radicular cyst, RCT, Enucleation

***Presenting Author**: Gita Tarigan

Endodontics, Prima Indonesia, Kota Medan - Medan Kota, Indonesia, gitatarigandrg@gmail.com

C2-014

Restoring hemisected mandibular first molar with mini dental implant

Azizah Arifati*

Conservative and Endodontics, Bengkulu City Public Hospital, Bengkulu, Indonesia

I. Objective

Mandibular first molar are the major standpoint forocclusion. Under specific conditions, like bifurcation perforations, hemisection of the tooth is indicated after an endodontic treatment. To prevent jeopardizing the adjacent tooth structure, a procedure providing prosthetic rehabilitation of tooth structure left is needs.

II. Case Presentations

A 36-year-old female patient was presented to Conservative Dentistry Department with pain on mastications. Percussion test was positive, thermal and palpation test were negative. Periapical radiograph examinations revealed radiolucency lesions in bifurcation

and periapical lesion in mesial root. Hemisection procedure was done after endodontic treatment. Mini dental implant has to be placed 4 months after hemisection procedure and cone bean computed tomography (CBCT) examination. Molar tooth then restored using porcelain to metal crown resembles two bicuspids. Radiographs of treatment after 6 months showed less periapical lesions and no clinical symptoms present.

III. Conclusion

Replacement of the mesial root with single mini dental implant after hemisection and single unit porcelain fused to metal crown can providing strength and support the weakened tooth structure.

***Keywords**: Hemisection, Mandibular first molar, Mini dental implant, Perforation bifurcation
***Presenting Author**: Azizah Arifati

Conservative and Endodontics, Bengkulu City Public Hospital, Bengkulu, Indonesia, aarifati@yahoo.com

C2-015

Diagnostic dilemma in endodontic imaging – A case report

Pavithra Ravindra*, Vijetha V, H Murali

Department of Conservative Dentistry & Endodontics, R V Dental College & Hospital, Bangalore, India

I. Objective

Diagnostic Imaging in form of Radiographs & CBCT are an integral part of Endodontics. But there are limitations when these both techniques cannot provide a clear diagnostic picture in some conditions. We, hereby present a similar case where endodontic treatment had to be completed by surgical intervention, an account of an Impacted tooth which made interpretation from routine imaging a challenge.

II. Case Presentations

A middle aged male patient reported for endodontic management of maxillary left 1st Premolar. During the course of treatment, it was not possible to ascertain clear information regarding the concern tooth either by radiographs or CBCT an account of an impacted canine. This situation mandated a planned surgical intervention for completion of the endodontic treatment for a predictable treatment outcome. The surgical intervention was carried out and the canine tooth was removed, following which the endodontic treatment for the concerned premolar was completed. The Patient is been followed up for assessment of treatment outcome by periodic recalls.

III. Conclusion

The imaging and the interpretations are influenced by many factors, one of which is the anatomical variations in hard tissue / teeth. In such conditions, surgical interventions may be needed to achieve the satisfactory treatment outcomes. But, it should also be remembered that these surgical interventions, should be attempted with utmost discretion and not as routine procedure.

***Keywords**: Imaging techniques, Ambiguous situations, Surgical interventions
***Presenting Author**: Pavithra Ravindra

Department of Conservative Dentistry & Endodontics, R V Dental College & Hospital, Bangalore, India, pavithraravindra193@gmail.com

C2-016

Management of a foreign body material in the periradiular area

Chang-Ho Yun*, Min-Seock Seo, Young-Mi Moon

Department of Conservative Dentistry, Wonkwang Univ. Daejeon Dental Hospital, Daejeon, Republic of Korea

I. Objective

When root canal treatment is required, all procedures including canal preparation and canal obturation must be limited within a root canal space. If there is an overextended root canal filling materials, unfavorable outcome can occur. This case report describes a management of the cystic lesion with an overextended filling materials.

II. Case Presentations

< Case 1>

1. Sex / Age: M / 50
2. Chief complaint:
   Referred from public hospital for management of periapical lesion.
3. Present illness:
   #12-22 Bridge state, #12: unfilled canal with metal post #12 per(-) bite(-) palpation(+), Periapical lesion (+,radiopaque materials)
4. Dx.: #12 periapical granuloma
5. Tx. Plan: #12 periapical surgery

III. Conclusion

Endodontic outcome assessments show that extrusion of filling materials induces a low incidence of healing. This case shows the consequence of overfilled materials, which finally require surgical management.

In this case report, a mass of overfilled materials and granulomatous tissue were detected. This report describes the surgical treatment of a symptomatic upper lateral incisor with an overextended canal filled material.

***Keywords**: Periapical surgery, Extruded filling material, Periapical granuloma
***Presenting Author**: Chang-Ho Yun

Department of Conservative Dentistry, Wonkwang Univ. Daejeon Dental Hospital, Daejeon, Republic of Korea, younch777@gmail.com

C2-017

Root resection of mandibular first molar: Two case reports

Jiwon Jeong*, Yoorina Choi, Seokryun Lee, Sujung Park

Department of Conservative Dentistry, Wonkwang Univ. Dental Hospital, Iksan, Republic of Korea

I. Objective

Root resection is the process by which one or more of the roots of a tooth are removed at the level of the furcation while leaving the crown. Thus, this procedure is useful for the preservation of a tooth rather than extraction. This case reports show the root resection to preserve a tooth of severe bone loss involved in one root.

II. Case Presentations

<I>

1. Sex/Age: M/58
2. Chief Complaint (C.C):
   "I have a pain on left lower molar when I bite."
3. Past Dental History (PDH):
   Root canal treatment, Gold Crown restoration on #36 (5 years ago)
4. Present Illness (P.I):
   #36 per(+), bite(+), mesio-buccal PD: full depth, mob(-)
5. Impression:
   Symptomatic apical periodontitis, mesial vertical root fracture on #36
6. Tx plan: #36 Mesial root resection and bond graft

<II>

1. Sex/Age: F/35
2. Chief Complaint (C.C):
   Referred from the department of the orthodontics and the periodontics for the evaluation and treatment of the exposed root and hypersensitivity on #36
3. Past Dental History (PDH):
   Orthodontic treatment (2014.06~2017.07)
4. Present Illness (P.I):
   #36 per(-), bite(-), Ice(+++), gingival swelling on disto-lingual root
   Disto-lingual root is totally located lingual side of the alveolar bone.
5. Impression:
   Gingival recession and hypersensitivity on #36
6. Tx plan: #36 Mesial root resection and bond graft

<III>

1. Sex/Age: F/35
2. Chief Complaint (C.C):
   Referred from the department of the orthodontics and the periodontics for the evaluation and treatment of the exposed root and hypersensitivity on #36
3. Past Dental History (PDH):
   Orthodontic treatment (2014.06~2017.07)
4. Present Illness (P.I):
   #36 per(-), bite(-), Ice(+++), gingival swelling on disto-lingual root
   Disto-lingual root is totally located lingual side of the alveolar bone.
5. Impression:
   Gingival recession and hypersensitivity on #36
6. Tx plan:
   ① Root canal treatment of #36
   ② Distolingual root resection
   ③ Prosthetic treatment of #36

III. Conclusion

Root resection has been considered as a traditional and reliable dental treatment. In multi-rooted teeth, to conserve tooth root resection could be considered as an alternative treatment if one root is severely involved. In such these cases, root resection was suitable treatment for extending the function of the remaining tooth structure therefore patients were satisfied. If dentists select the case carefully, it could be an adequate treatment for patients who want to conserve their own tooth.

***Keywords**: Root resection, Vertical root fracture, Bone graft
***Presenting Author**: Jiwon Jeong

Department of Conservative Dentistry, Wonkwang Univ. Dental Hospital, Iksan, Republic of Korea, miharu_@naver.com

C2-018

Autogenous transplantation of third molar to replace hopeless tooth

Il-Seok Song*

Private Clinic, Sejong Top Dental Clinic, Sejong, Republic of Korea

C2-019

Autogenous tooth transplantation of third molar to replace an endodontically unfavorable molar

Yongmin Kim*, Sinyoung Kim, Sungeun Yang

Conservative Dentistry, Seoul Saint Mary's Hospital, Seoul, Republic of Korea

I. Objective

Autotransplantation is the surgical repositioning of an autogenous erupted or unerupted tooth from one site to another in the same individual. This treatment is indicated in traumatic tooth loss, teeth with severe caries, congenitally missing teeth, teeth with bad prognosis and in case of developmental anomalies of teeth. The following 2 cases describe the potential to utilize autotransplantation to replace hopeless teeth with sound wisdom teeth.

II. Case Presentations

<Case 1>

A 31-year-old man was visited to my private clinic with the complaint of pain on left first and second mandibular molar. Chronic apical periodontitis and a retained root were detected on left mandibular molars. After extraction of the teeth, opposite-positioned upper and lower third molars were atraumatically extracted, placed in the recipient sites. After 2 months, autotransplanted teeth were restored with crowns and post-treatment panoramic radiograph showed no external root resorption.

<Case 2>

A 18-year-old man was visited to my private clinic with the complaint of severe caries on left second mandibular molar. Periapical and panoramic radiographs showed distal external root resorption and the tooth extraction was inevitable. The tooth was extracted and the recipient site was prepared to receive the donor tooth. Subsequently, the third molar adjacent to the extracted tooth was atraumatically extracted, placed in the recipient site, and splinted with a stainless steel wire. After 2 months, conventional endodontic treatment was performed and the tooth was restored with a crown. The result was satisfactory at 8-month follow-up.

III. Conclusion

From these cases, it is recommended that autotransplantation should be considered as a treatment option when indicated. Critical factors in autotransplantation include suitable donor teeth, appropriate recipient sites, and good periodontal conditions. Successful autotransplantation results in good functional adaptation, biocompatibility in the oral cavity and preservation of the alveolar ridge, hence should be considered as a first choice if possible.

***Keywords**: Autotransplantation, Hopeless tooth, Third molar

***Presenting Author**: Il-Seok Song

Private Clinic, Sejong Top Clinic, Sejong, Republic of Korea, sis-einstein@hanmail.net

I. Objective

Autogenous tooth transplantation of a third molar is an alternative treatment for replacing non-restorable molar or tooth extraction site. Most frequently, a third molar is transferred to the site of a hopeless molar. This procedure can be a good alternative compared to dental implant or conventional prosthetics in that the esthetic results are good by preserving periodontal ligament, the cost is low, one-stage surgery can be used, and orthodontic tooth movement is possible.

II. Case Presentations

A 57-year male patient who had a chief complaint of pain on #27 came to our clinic. Severe root caries accompanying periapical lesion was observed on #27 and #27 was decided to be pulled out. This patient wanted the treatment option of using his own tooth instead of implant insertion and autogenous tooth transplantation using #28 was planned as an alternative. Root canal treatment on #28 was performed before operation. After then, #27 was extracted and #28 was transplanted into the fresh extraction socket of #27. #28 was retrofilled using White Mineral Trioxide Aggregate. In this case, additional stabilization procedure using resin-wire splint wasn't applied due to sufficient stability of transplant. The patient has been observed for 6 months and any complication wasn't detected.

III. Conclusion

In this case, any clinical sign or symptom of failure were absent and proper bony healing was observed on radiographs. But further long-term follow up would be necessary because complications such as ankylosis or root resorption might happen.

In case of specially single tooth implant, a higher incidence of postoperative complication has been reported. Therefore, clinicians should consider autogenous tooth transplantation as a viable fist treatment option in replacing endodontically unfavorable tooth if there is proper donor tooth and recipient site.

***Keywords**: Third molar, Autotransplantation, Autogenous tooth transplantation

***Presenting Author**: Yongmin Kim

Conservative Dentistry, Seoul Saint Mary's Hospital, Seoul, Republic of Korea, yongmin32@nate.com

C2-020

Management of compromised periapical lesion with regenerative techniques endodontic surgery: Report of two case

Dini Asrianti Bagio*[1], Emmanuella Gayatri[1], Teuku Ahmad Arbi[2], Indah Yulianto[3], Anggraini Margono[1], Endang Suprastiwi[1]

[1]Department of Conservative Dentistry, Universitas Indonesia, Jakarta, Indonesia, [2]Department of Oral Maxillofacial Surgery, Universitas Syiah Kuala, Aceh, Indonesia, [3]Department of Dermatology, Universitas Negeri Sebelas Maret, Solo, Indonesia

I. Objective

The outcome of apical surgery procedure may be compromised due to the large size and extent periapical lesion. There are two types of compromised periapical lesions, which are through-and-through peripical lesion and large periapical (cystic) lesion. The prognosis of both types of lesion can be unpredictable because of the fast proliferation of soft tissue from the facial and lingual aspects that may interfere with bone ingrowth from approximal bone surfaces, resulting in a fibrous connective tissue core. To overcome this situation, clinicians have advocated the use of Regenerative Techniques (RT) in Endodontic Surgery (ES).

II. Case Presentations

This case report will discuss about management of two compromised periapical lesions with different RT in ES procedures and followed with evaluation of the outcome of each case. The through-and-through periapical lesion was managed with combination of biomaterial for retrograde filling (Biodentine®, Septodont) and Denaturalized collagen Carbonat Apatit bonegraft ($Ca_{10}(PO_4)_6(OH)_2$) (Gamacha®, Swayasa Prakarsa). The large periapical (cyctic) lesion was managed with combination of biomaterial for retrograde filling (Biodentine®, Septodont), Platelet Rich Fibrin (PRF) concentrate media and Denaturalized collagen Carbonat Apatit bonegraft ($Ca_{10}(PO_4)_6(OH)_2$) (Gamacha®, Swayasa Prakarsa).

III. Conclusion

The management of the large periapical (cyctic) lesion case shows more rapid healing than the other case. Even though the large periapical (cyctic) lesion has more rapid healing but both cases are excellent in achieving bone healing after 3-month, 6-month and 1-year follow-ups.

***Keywords**: Compromised periapical lesion, Regenerative Techniques (RT), Endodontics Surgery (ES), Platelet Rich Fibrin (PRF), Carbonat Apatit, Denaturalized collagen

***Presenting Author**: Dini Asrianti Bagio

Department of Conservative Dentistry, Universitas Indonesia, Jakarta, Indonesia, dini.rz@gmail.com

C2-021

Management of open apices with periapical lesions in central maxillary insisor using MTA as an apical plug

Shalina Ricardo*, Kamizar Nazar, Aditya Wisnu Putranto

Conservative Dentistry, Universitas Indonesia, Jakarta, Indonesia

I. Objective

Trauma could lead permanent young tooth into necrotic that cease the apical growth. The permanent teeth with open apices need special management in their treatment because usually they have thin wall, widened canal and open apical foramen that makes cleaning and shaping endanger for perforation. Orthograde approach still become a preferable treatment in open apices instead of surgical closure, but the procedure could be quiet challenging. Biomaterial like MTA (Mineral Trioxide Aggregate) has been develop as an apical plug material for treating open apices because it could interact with both hard and soft tissues and marginal sealing that prevent marginal leakage and provide protection at the open apices.

II. Case Presentations

This case report represents couple successful management of open apices of granuloma and absess in maxillary left central insisor using MTA as an apical plug. Both cases represent a young male that had trauma while they were teenager couple years earlier and lead to ceased apical growth. The clinical examination revealed an enamel-dentin crown fracture and the pulp of the tooth was open. Radiographic examination revealed an immature permanent tooth with an open apex and radiolucent lesion at the periapical area. Biomaterial MTA were used as an apical plug in apexification for 3-4 mm and proved has good sealing ability in the apices. The outcome of large periapical lesion shows good result within short period of time.

III. Conclusion

MTA in the Apexification procedures has various advantages of being used at open apices and could reduce the number of clinical appointments and increasing

patient compliance. 3 and 4 mm thickness of apical plugs revealed a good sealing ability. Healing time and process of wide open apices shorter than the moderate open apices.

***Keywords**: MTA, Apexification, Open apices, Apical plug
***Presenting Author**: Shalina Ricardo
Conservative Dentistry, Universitas Indonesia, Jakarta, Indonesia, shalinaricardo@gmail.com

C2-022

Regenerative endodontic treatment of immature permanent tooth with pulpal necrosis: 1-year follow up

Jinjoo Han*, Dohyun Kim, Il-Young Jung, Sung-Ho Park
Department of Conservative Dentistry, Yonsei University College of Dentistry, Seoul, Republic of Korea

I. Objective
Treatment of immature permanent teeth with necrotic pulp status and open apex has several clinical challenges to the dentist. Because of the thin dentinal root walls, these teeth may be susceptible to root fracture during or after treatment. Regenerative endodontics is a promising alternative treatment for immature permanent teeth with necrotic dental pulp. In this case, a necrotic immature permanent premolar with dens evaginatus was treated by a regenerative endodontic treatment, which result in a resolution of clinical symptoms and in radiographic changes in root dimensions.

II. Case Presentations
1. Chief complaint:
   Referred from local clinic for root canal treatment on #45 due to apical lesion. No pain.
2. Sex/age: M/12
3. Past Medical/Dental History:
   Adenoidectomy, 2011-12, SEVERANCE ENT Hospital
4. Present Illness:
   Mob(-) Per(-) Ice(-) EPT(-) with sinus tract on buccal, with full probing depth on midbuccal on #45
5. Impression:
   Pulp necrosis and Chronic apical abscess on #45
6. Tx Plan: Regenerative endodontic treatment on #45

III. Conclusion
The goal of regenerative endodontics is the use of biologic-based procedures to solve the clinical symptoms and repair or replace the damaged structures of the pulp-dentin complex. In this case, apical part of the pulp had survived despite the development of periapical abscess because of the rich blood supply through the open apex. More long term clinical and histological studies are required to investigate the outcome of regenerative endodontic treatments.

***Keywords**: Regenerative endodontics, Apexogenesis, MTA
***Presenting Author**: Jinjoo Han
Department of Conservative Dentistry, Yonsei University College of Dentistry, Seoul, Republic of Korea, hanjj@yuhs.ac

C2-023

Management of external perforating cervical resorption using biodentine and a regenerative surgical approach

Jassada Panyasorn*[1], Jarunee Wattanakla[1], Tanida Srisuwan[2]
[1]Private Practice, Private Practice, Chiang Mai, Thailand, [2]Endodontic Division, Department of Restorative Dentistry and Periodontology, Faculty of Dentistry, Chiang Mai University, Chiang Mai, Thailand

I. Objective
Perforating external root resorption is a serious situation requiring complex treatment planning and clinical approaches. Currently, a variety of techniques, including different types of materials, have been proposed. This case report presents the management of a maxillary central incisor with external cervical resorption, perforating to the inner root canal space, with surgical approaches using Biodentine, followed by the use of a guided tissue regeneration technique.

II. Case Presentations
A 49-year-old male patient presented with a fistula tract on the palate located near the maxillary left central incisor with slight tenderness. Tooth 21 had root canal treatment completed three years ago, followed by composite veneer restoration. A 10-12 mm periodontal pocket was found on the palatal side without tooth mobility. A periapical radiograph showed satisfactorily root-canal-treated tooth with a 7 x 7 mm periapical lesion on tooth 21. Moreover, a 5 x 5 mm, round, radiolucent lesion was observed at the coronal third of the root.

Under a dental operating microscope, the perforation was observed inside the root canal without bleeding. The decision was made to manage the perforation site using a surgical approach. Therefore, a palatal flap was opened. The resorptive cavity was cleaned using an ultrasonic instrument and repaired with Biodentine. An absorbable collagen membrane was placed covering the exposed root surface and the flap was repositioned. Root canal retreatment was commenced after one week. At one-year follow-up, satisfactory healing of the periapical lesion with arrest of the resorptive defect was observed.

III. Conclusion
Treatment of a perforating external resorption is a critical step requiring careful judgment and multidisciplinary clinical skills. Proper management allows clinicians to achieve successful treatment outcomes.

***Keywords**: External root resorption, Biodentine, Perforation repair, Surgical approaches
***Presenting Author**: Jassada Panyasorn
Private Practice, Private Practice, Chiang Mai, Thailand, Jassadadent@gmail.com

C2-024

Partial pulpotomy on mandibular 1st molar with cariously exposed pulp

Wonhuy Choi*, Euiseong Kim, Yooseok Shin, Byoung-Duck Roh
Conservative Dentistry, Yonsei University Dental Hospital, Seoul, Republic of Korea

I. Objective
Mineral trioxide aggregate (MTA) is recommended as the material of choice in partial pulpotomy cases due to several advantages, but long setting time of MTA makes it difficult to finish the treatment in one visit. Recently, MTA products with relatively short setting time are developed to overcome this shortcoming. In this case, fast setting MTA (RetroMTA, BioMTA, Seoul, Korea) was used during partial pulpotomy procedure.

II. Case Presentations
A 22-year-old female came to our clinic with a chief complaint of overall dental examination and treatment. Mandibular right first molar was diagnosed as advanced dental caries with normal pulp and apex. Mesial pulpal horn seemed to be involved in caries.
During caries removal procedure, mesiobuccal pulpal horn was exposed. Pulp tissue was removed about 2.0 mm depth from the exposure site. 2.5% sodium hypochlorite was applied for 5 minutes, and hemostasis was confirmed. Then, RetroMTA was applied with 2.5 mm thickness. Although the advertised setting time according to the manufacturer's guide for RetroMTA is 150 seconds, the MTA was not completely set after 15 minutes. Wet cotton was applied and resin filling was done as a temporary restoration.
A week later, the tooth was asymptomatic and responded normal to vitality tests. Upon the removal of composite resin, complete setting of the MTA was confirmed. Final restoration with composite resin was done thereafter.
At 3-months check-up, the tooth was asymptomatic and maintained normal vitality. Due to thin unsupported enamel on mesial surface, gold crown restoration was done. At 5-months check-up, the tooth had no specific abnormalities.

III. Conclusion
Despite the manufacturer's guide, complete setting of RetroMTA was not achieved within 15 minutes. Therefore, more than 15 minutes for complete setting of RetroMTA should be allowed to provide adequate sealing, which is important in partial pulpotomy. Resin can be considered as a temporary filling material during setting of MTA.

***Keywords**: Partial pulpotomy, RetroMTA, Setting time, Temporary restoration
***Presenting Author**: Wonhuy Choi
Conservative Dentistry, Yonsei University Dental Hospital, Seoul, Republic of Korea, wonhuy@yuhs.ac

C3-001

Non-surgical management using MTA of tooth with open apex and external resorption in relation to impacted canine

Cyntia Dewi Maharani*, Diatri Nari Ratih, Margareta Rinastiti
Conservative Dentistry, Gadjah Mada University, Yogyakarta, Indonesia

I. Objective
External resorption on the apical surface as a result of an impacted tooth pressure, can lead to open apex. Mineral Trioxide Aggregate (MTA) is a potential material of apexification treatment to induce apical closure. This report presents non-surgical management using MTA of tooth with open apex and external resorption in relation to impacted canine.

II. Case Presentations
A 55-year-old female patient presented to the Clinic of Conservative Dentistry Dental Hospital of Universitas Gadjah Mada, due to pain particularly during biting or chewing of maxillary right central incisor. The patient complained that the pain occurred since 1 year ago. According to patient, unfinished root canal treatment had been performed previously, and approximately ten years before unfinished root canal treatment had been performed, the impacted maxillary right canine had been extracted. No facial injury was noted. Clinical examination revealed the discoloration of tooth 11 with large opening access on palatal aspect of root canal, and composite resin restoration on mesio-incisal surface. Maxillary right posterior teeth were missing. Radiographic examination revealed open apex of tooth 11 and thickening of periodontal ligament space. Shortening root length and slightly irregular apical margin suggested due to external resorption involving teeth 11 and 12. Diagnosis of tooth 11 was non-vital with open apex, external resorption and symptomatic apical periodontitis. Under rubber dam isolation, root canal of tooth 11 was prepared by conventional technique and intracanal medicament of calcium hydroxide was placed for two weeks. Apexification treatment was performed using white MTA as a 3.5 mm apical plug followed by restoration using prefabricated fiber post and lithium disilicate crown. Two weeks follow up showed asymptomatic and no abnormalities occurred on tooth 11.

III. Conclusion
Non-invasive management using MTA can lead to healing, thus the function of the tooth could be restored immediately.

***Keywords**: External resorption, Open apex, Impacted canine, MTA, Apexification
***Presenting Author**: Cyntia Dewi Maharani
Conservative Dentistry, Gadjah Mada University, Yogyakarta, Indonesia, cyntiadeem@gmail.com

C3-002

Comparison between two bio-active materials in furcation perforation management: Case reports

Silviana Swastiningtyas, **Anggraini Margono***
Conservative Dentistry, Universitas Indonesia, Jakarta, Indonesia

I. Objective
Furcation perforation is iatrogenic or pathologic communications between the root canal space and the periradicular tissues. The trauma of a perforation at the furcation region can induce an inflammatory response, causing destruction of the periodontal ligament and resorption of bone and dental tissues. In order to overcome this situation, various materials with bioactive properties has been successfully used to seal perforation.

II. Case Presentations
This case report will discuss about management of furcation perforation with different bioactive materials in mandibulary molars. Direct perforation in furcation site was managed with mineral trioxide aggregate/ MTA (ProRoot, Denstply) and followed by root canal treatment. Stripping perforation in furcation site was managed with Biodentine® (Septodont) after root canal treatment accomplised.

III. Conclusion
Furcation perforation management with MTA and Biodentine provided favorable healing due to their seamless sealing ability and bioactive properties.

***Keywords**: Furcation perforation, Bioactive materials, MTA, Biodentine
***Presenting Author**: Anggraini Margono
Conservative Dentistry, Universitas Indonesia, Jakarta, Indonesia, margonodewi@yahoo.com

C3-003

One-step apexification with MTA: A non-surgical approach for traumatised immature permanent tooth

Raras Ajeng Enggardipta*, Ema Mulyawati, Tri Endra Untara
Conservative Dentistry, Faculty of Dentistry, Universitas Gadjah Mada, Yogyakarta, Indonesia

I. Objective
Apexification is a method to induce calcific barrier in root with open apex or continued apical development of teeth with incomplete roots and necrotic pulp. Mineral trioxide aggregate (MTA) has been proposed as material suitable for one-step apexification because it neither induce resorption nor weakening of the root canal dentin. MTA can be used as apical barrier in teeth with necrotic pulp and open apex as it has good biocompatibility, bioactivity, bacteriostatic activity, and favourable sealing ability.

II. Case Presentations
A 26-year-old female patient reported with a chief complaint of discoloured left maxillary central incisor with history of trauma 16 years ago. The tooth did not respond to vitality test. The periapical radiograph revealed a large periapical lesion, open apex and apical root resorption of 21 tooth. Ellis class IV fracture was evident. Apexification with MTA was planned. Access opening was prepared under rubber dam isolation and working length was determined. Biomechanical preparation was done using K-file #80 with circumferential filing motion. Root canal irrigation was done using 2.5% NaOCl and saline. Calcium hydroxide was placed in the root canal and patient recalled after 7 days. At subsequent appointment, canal was irrigated and dried with paper points. MTA was placed using plugger in apical 4 mm. A wet cotton pellet was placed in the canal and access cavity was sealed. At next appointment, root canal was obturated with gutta-percha point. Glass ionomer cement as intra-orifice barrier was placed before intra-coronal bleaching procedure was performed. The coronal restoration was finished with fiber post and composite resin. After six months the radiographic examination showed decrease of periapical lesion.

III. Conclusion
The traumatised immature permanent tooth with open apex and large periapical lesion can be treated with non-surgical approach using MTA as an apical plug. One-step apexification with MTA is effective management, predictable procedure and less time consuming.

***Keywords**: One-step apexification, Mineral trioxide aggregate, Immature permanent tooth, Apical plug
***Presenting Author**: Raras Ajeng Enggardipta
Conservative Dentistry, Faculty of Dentistry, Universitas Gadjah Mada, Yogyakarta, Indonesia, rarasajeng65@gmail.com

C3-004

Sealing furcal perforations using Biodentine (Two case report)

Ratna Indriutami*
Dentistry, Ciptomangunkusumo Hospital/faculty of Medicine Universitas Indonesia, Jakarta, Indonesia

I. Objective
Perforation is a communication between root canal system with periodontal tissue. Iatrogenic Perforation frequency in endodontic procedure are 3-10%. Perforation can be repair with non surgical treatment using biocompatible material on the affected area, which can prevent bacteria infection, induced healing tissue, good sealing ability, and easy to use. Biodentine is one of ideal material for perforation repairs and good barrier for these kind of communications. On the basis of recent physical and biologic property studies, one of the relatively new introduced is biodentine.

II. Case Presentations
Two case report presented using biodentine as biomaterial to seal furcal perforations. Both case cause by previous iatrogenic procedure.

III. Conclusion
Perforation repair using biodentine was shown to be successful in this case series, the teeth were preserved and extraction was avoided.

***Keywords**: Sealing furcal perforations, Biodentine, Repair perforations
***Presenting Author**: Ratna Indriutami
Dentistry, Ciptomangunkusumo Hospital/faculty of Medicine Universitas Indonesia, Jakarta, Indonesia, icy_indri@Yahoo.com

C3-005

Large-sized furcation perforation repair with collagen membrane & MTA

Taeuk Sun*, Chanui Hong, Yongbum Cho, Minju Song
Conservative Dentistry, Dankook University Dental Hospital, Cheonan, Republic of Korea

I. Objective
Perforation is classified according to various criteria. If the perforation has old, large and crestal charicteristics, the prognosis may be questionable. The old perforations can cause intracanal contamination. Large perforations can cause the problem of an incomplete seal of the defect, thus allowing continuous bacterial irritation of the

perforation area. When treating a perforated furcation, intracanal dryness may be difficult to achieve, as there may be fluid flow into the canal, due to the large surface of granulation tissue outside the perforation.

After complete disinfection, furcation perforation repair with collagen membrane and MTA could improve prognosis. Small pieces of absorbable collagen are used to push the granulation tissue out of the perforation and keep it in place outside the root. This matrix reconstructs the outer shape of the root and facilitates the adaptation of repair materials. MTA has sealability, biocompatibility and radiopacity, the requirements for ideal filling material.

II. Case Presentations

A 15 year-old male patient came to our hospital because of a toothache on his #36 tooth. Nonsurgical retreatment had been initiated in a local clinic, and there was a furcation perforation. Because he felt pain on bite exam, it was diagnosed as previously treated with symptomatic apical periodontitis. At his first day, gutta percha was removed and MTA (ENDOCEM Zr; Maruchi) was applied after irrigation and hemorrhage. At the second visit, MTA was washed out. So, the small pieces of collagen membrane (Colladerm; Bioland) and MTA were applied in the perforation site after cleaning and shaping of canals. At his next visit, canals were filled with gutta percha after confirming the hardening of the MTA.

The pain was removed and the bone was healed completely 6 months later.

III. Conclusion

Large-sized furcation perforation repair with collagen membrane and MTA could improve the prognosis of the tooth.

***Keywords**: Furcation perforation repair, Collagen membrane, MTA, Large-sized perforation
***Presenting Author**: Taeuk Sun

Conservative Dentistry, Dankook University Dental Hospital, Cheonan, Republic of Korea, sun31028@naver.com

C3-006

Resolution of bifurcation involvement after non-surgical root canal treatment: Application of CBCT

Masahiko Minakami*, Etsuko Matsuzaki, Hisashi Anan

Section of Operative Dentistry and Endodontology, Department of Odontology, Fukuoka Dental College, Fukuoka, Japan

I. Objective

Endodontic-periodontal problems with bifurcation involvement are often observed in clinical situations. Cone-beam computed tomography (CBCT) is useful for not only correct diagnosis but also treatment procedure. Here, we report a case of endodontic-periodontal disease with a bifurcation involvement in which successful results were obtained using the infected root canal treatment with CBCT.

II. Case Presentations

A 32-year-old male visited with the chief complaint of gingival swelling of mandibular first molar. He visited general practitioner and received a diagnosis of severe furcation involvement and tooth extraction. He was referred to our hospital for specialized care, manifesting spontaneous pain (-), percussion pain (+), buccal gingival swelling (+), sinus tract (-), and apical pressure pain (+) in 36. A probing periodontal pocket depth (PPD) of 7 mm with bleeding on probing, and Class I bifurcation involvement was found at the buccal of 36. A radiographic examination revealed the wide radiolucency in the bifurcation and periapical region of 36. The infected root canal treatment was implemented based on a clinical diagnosis of Class I endodontic-periodontal disease. However, neither disappearance of abscess nor clinical healing tendency was seen at 3 months after starting the root canal treatment. Therefore, CBCT photography was done. CBCT examination revealed fenestration in the vicinity of the distal root may be involved in the expansion of the periapical inflammation. In addition, the root canal debridement seemed to be incomplete. Then, we performed infected root canal treatment of distal root of 36 using 3D-images of CBCT. At 4 months after starting the treatment, the patient was clinically asymptomatic, and bone regeneration was observed at the furcation region of 36 with the reduction of PPD.

III. Conclusion

We conclude that CBCT is useful for not only correct diagnosis but also non-surgical root canal treatment of a confusing endodontic-periodontal disease.

***Keywords**: Bifurcation involvement, CBCT, Endodontic-periodontal disease, Infected root canal treatment
***Presenting Author**: Masahiko Minakami

Section of Operative Dentistry and Endodontology, Department of Odontology, Fukuoka Dental College, Fukuoka, Japan, mina1225@college.fdcnet.ac.jp

C3-007

Endodontic treatment of a mandibular first molar with radix entomolaris

Ara Cho*, Hokeel Hwang, Hyounghoon Jo

Department of Conservative Dentistry, Chosun University Dental Hospital, Gwangju, Republic of Korea

I. Objective

For a successful endodontic treatment, thorough cleaning and shaping of the root canals and providing an appropriate three-dimensional obturation is essential. However, often root canal treatment is complicated by the presence of variations in the root canal anatomy.

Mandibular first molar is prone for malformations and anomalies in its development. The major variant is the occurrence of a third root, which is often reported in the literature. If this additional root is located distolingually, it is called radix entomolaris. Variations in the root configuration can impose problems during endodontic treatment. Radix endomolaris is often not diagnosable because of overlapping by the distal root with orthograde radiographs. A thorough examination of the preoperative radiographs and the presence of any questionable differences in the radiographs may suggest radix endomolaris. Cone beam computed tomography may be an ideal diagnostic aid in the management of radix endomolaris as it provides a three-dimensional view of the extra root, length, and location.

II. Case Presentations

1. Sex / age: M / 35
2. CC: A month ago, my tooth was broken.
3. PI: #46 restoration loss and secondary caries
   per(-), mob(-), EPT(+) pain(-)
4. Impression: Dental caries
5. Tx. Plan: caries control, RCT, Crown restoration

1. Sex / age: F / 20
2. CC: I have tooth decay.
3. PI: #36 Gold inlay (3 years ago, LDC)
   Secondary caries
   per(-), mob(-), EPT(+) pain(-)
4. Impression: Dental caries
5. Tx. Plan: caries control, RCT, Crown restoration

III. Conclusion

The presence of this extra root may lead to missed canal, instrument separation due to severe curvature, aberrations in cleaning and shaping while doing endodontic therapy, and so on. Thus, a very accurate clinical and radiographic diagnostic procedures and meticulous canal preparation are necessary.

***Keywords**: Radix entomolaris, Mandibular first molar, Root canal anatomy
***Presenting Author**: Ara Cho

Department of Conservative Dentistry, Chosun University Dental Hospital, Gwangju, Republic of Korea, hroha@naver.com

C3-008

Latex fragment as an etiological factor in resistant chronic periapical inflammation

Heejin Kim*[1], Kyung-San Min[2]

[1]Conservative Dentistry, College of Medicine, Kosin University, Busan, Republic of Korea, [2]Conservative Dentistry, School of Dentistry, Chonbuk National University, Jeonju, Republic of Korea

I. Objective

Small and large cystic lesions frequently heal simply with endodontic therapy. However, refractory larger lesions after non-surgical endodontic treatment may need additional diagnosis and treatment. If surgical enucleation is elected on the preferential basis, other teeth or structures may be unnecessarily damaged. Therefore, a case can be made for first attempting decompression which is more conservative treatment and a following workable protocol for this is presented.

II. Case Presentations

Treatment of a maxillary second premolar with an associated cystic lesion by conventional endodontic therapy combined with decompression and cyst enucleation is reported. In this case, 1 week with penrose rubber tubing in place and daily irrigation with 0.12% chlorhexidine led to uncomplete healing with need for further diagnosis and surgery. Followed by cyst enucleation with biopsy of the lesion and apical surgery on the tooth, the cause of refractory lesion was found to be foreign latex material in periapical tissue which is assumed to be originated from a dental glove. At the 6-month recall, the lesion has been resolving, and the adjacent teeth remain vital and normal.

III. Conclusion

A latex foreign object remained around the apical tissue was discovered on apical surgery of a patient with a persisting endodontic infection. Attempts to decompress the lesion resulted in simple retrieval of the object in the periapical cyst. Eventually, the cyst was retrieved by a simple technique, followed by successful apical surgery. When treating non-surgical endodontic refractory lesion of a patient with past dental history of incision and drainage, the possibility of allergic reaction from foreign body should always be kept in mind by the practitioner.

***Keywords**: Large apical lesion, Foreign body, Resistant inflammation
***Presenting Author**: Heejin Kim
Conservative Dentistry, College of Medicine, Kosin University, Busan, Republic of Korea, island719@naver.com

C3-009

Treatment of horizontally root fractured maxillary incisors

Ji Hye Yoon*, Bin Na Lee, Hoon Sang Chang, In Nam Hwang, Won Mann Oh, Yun Chan Hwang
Department of Conservative Dentistry, Chonnam National University Dental Hospital, Gwangju, Republic of Korea

I. Objective
Horizontal root fractures commonly occur at the anterior maxilla and generally teeth with complete root formation are affected. The diagnosis of root fracture is established by the radiographic examination and clinically the fractured tooth is slightly extruded and displaced palatally. The healing process of horizontal fractures depends on variable factors such as age, fracture type, location of fracture, severity of dislocation, treatment delay, splinting type and period. These case reports describe the treatment and follow-up of 2 maxillary central incisors with horizontal root fracture.

II. Case Presentations
1. Chief complaint:
   I fell down from the bicycle one month ago.
   My Rt Mx incisor was fractured and Lt Mx incisor was avulsed (referred from dept. of OMS).
2. Sex/age: M/14
3. Past Medical/Dental History:
   Resin wire splint(RWS) on #13-23 and arch bar on Mx (1 month ago)
4. Present Illness:
   #12 Per(-), Mo(+), Cold(-), EPT(-), #11 Per(+), Mo(+++), Cold(-), EPT(-), middle root fracture
   #21 Per(+), Mo(++), Cold(-), EPT(-), #22 Per(+), Mo(+), Cold(-), EPT(-)
5. Impression:
   Fracture of root of tooth on #11, Avulsion of tooth on #21
   Extrusive luxation on #12, 22
6. Tx Plan:
   Resin wire splint on #13-23, Root canal treatment on #21, follow up for evaluation of RCT on #11, 12, 22

1. Chief complaint:
   I got punched last night and my Lt Mx incisor was fractured.
2. Sex/age: F/17
3. Past Medical/Dental History: Non specific
4. Present Illness:
   #21 Per(+), Mo(+++), Cold(-), EPT(-), Air(-), cervical root fracture
5. Impression: Fracture of root of tooth on #21
6. Tx Plan:
   Resin wire splint on #13-23 and follow up for valuation of RCT on #21

III. Conclusion
A root-fractured tooth requires proper initial management and periodic evaluation. If the tooth shows non-vital symptoms, or if the patient complains pain, RCT can be performed, usually to the coronal segment only.

***Keywords**: Horizontal root fracture, Prognosis, Healing pattern
***Presenting Author**: Ji Hye Yoon
Department of Conservative Dentistry, Chonnam National University Dental Hospital, Gwangju, Republic of Korea, borabila@naver.com

C3-010

Diagnosis and multidisplinary treatment planning for traumatized central incisors: A clinical case

Victoria Sansalvador*, Sergio Irazusta, Jose Antonio Gonzalez
Endodontics, Uic, Barcelona, Spain

I. Objective
Dental trauma injuries occur in a low percentage of the population, and less frequently two injuries occur in the same patient.

We are presenting a clinical case of a 60-year-old woman, who came to the university clinic having suffered two traumas 50 and 40 years ago, in both right and left upper central incisors. A CBCT scan was performed for the better diagnosis and treatment plan.

II. Case Presentations
The first trauma occurred when the patient was 9 years old, affecting the left central incisor. She might have received vital pulp therapy treatment for the 2.1, which remained intact for the next 50 years. We observe in the radiographic examination that the 2.1 was shorter and had a wide root canal, with thin dentinal walls. An apexification was done, using intracanal medication between visits.

Moreover, the second trauma she suffered 10 years later, caused a horizontal root fracture in the apical third of the root in the right central incisor. The 1.1 was left without intervention. Treatment planning in horizontal root fractures, are challenging

and there are several options to be considered. At the radiographic examination, we observe radiolucency image between coronal and apical fragments. Endodontic treatment was performed in 1.1, using intracanal medication. After 12 months control, an apical surgery was done to remove the apical fragment in 1.1.

Both central incisors became darker over the years. The patient wanted to improve aesthetics and performing a bleaching treatment and composite veneers were the optimal option for her.

We will explain in detail the diagnosis, forecast and treatment planning in both teeth.

III. Conclusion
Different considerations are taken into account in cases of immature or mature traumatized permanent teeth. Correct diagnosis and multidisciplinary intervention in these cases is the key to achieve the good prognosis and aesthetics results.

***Keywords**: Treatment planning, Prognosis, Apexification, Horizontal root fracture
***Presenting Author**: Victoria Sansalvador
Endodontics, Uic, Barcelona, Spain, vickysansa@uic.es

C3-011

Surgical treatment of the severe radicular grooves by intentional replantation with 2-segments restoration method

Hanguo Wang*
Department of Operative Dentistry and Endodontics, The Third Affiliated Hospital, Air Force Medical University, Xi'an, China

I. Objective
The radicular groove is a developmental anomaly that usually stars near the cingulum of maxillary incisors and extends along the root to varying lengths. The severe radicular groove extending to the root apex often leads to complex combined endodontic-periodontal lesions. There are various therapeutic options for such case, however, the prognosis is unfavorable. Here we report successful surgical treatment of the maxillary lateral incisors with severe radicular grooves by intentional replantation with 2-segments restoration method.

II. Case Presentations
Immediate after the root canal obturation, 3 cases of maxillary lateral incisors with severe radicular groove were extracted gently with minimal damage to the PDL. Under a dental microscope, radicular groove from the cingulum extending to the root apex was clearly visible. The root end was resected 3mm in length. Subsequently, the radicular groove was removed and a class II cavity (including the root end preparation) was prepared with a small fissure bur. Then the cavity was filled by 2-segments restoration method, i.e., coronal part to the cemento-enamel junction was filled with flowable composite, while the apical part to the CEJ (including the root apex) was filled with bioceramics iRoot BP plus. The complete extraoral procedure lasted less than 10 minutes. The tooth was then replanted into its alveolar bone and splinted with a flexible splint for 7 days. Postsurgical healing was excellent and the sinus tract was closed at the 1-week postoperative visit. At a 3-month recall, the teeth were asymptomatic with no periodontal pocket. At a 6-month or 1-year recalls, the teeth showed almost complete periapical and periodontal healing.

III. Conclusion
Intentional replantation with 2-segments restoration method is a viable treatment modality for the management of severe radicular grooves. In the apical part to the CEJ, the bioceramics has excellent sealing ability, biocompatibility and bioactivity, which may induce the regeneration of periodontal and periapical tissue. In the coronal part to the CEJ, the groove is restored with flowable composite, which has much shorter setting time, good sealing ability and may induce the junctional epithelium to reattach to form good dento-gingival junction.

***Keywords**: Radicular groove, Intentional replantation, Bioceramics, Endodontic microsurgery
***Presenting Author**: Hanguo Wang
Department of Operative Dentistry & Endodontics, The Third Affiliated Hospital Air Force Medical University, Xi'an, China, wanghg@fmmu.edu.cn

C3-012

Multi-disciplinary treatment of young-permanent traumatized upper incisor. A clinical case presentation

Jorge Moreno*
Dentistry, Adjunct Professor, Division of Endodontics. Western University, London, Ontario, Canada

I. Objective
The prevalence of dental trauma among young patients remains significant with undesirable consequences,

including tooth loss, which negatively affect the development, quality of life, esthetics, function and self steem of the young patients. Different dental specialties can join efforts to re-establish esthetics and function of traumatized teeth that, otherwise, could result in tooth loss at early ages.

II. Case Presentations
A healthy 13-years-old male patient was referred for a second opinion after suffering a sport-related trauma that led to a complicated coronal/root fracture of tooth # 21. Clinically, total loss of the crown was confirmed along with a vertical root fracture extending sub-gingivally in the palatal root side apical to the cemento-enamel junction. A decision was made to attempt orthodontic extrusion to expose the fracture line and facilitate the placement of a full-coverage crown. An apical plug with MTA was provided by the endodontist to seal the over-enlarged apical constriction providing enough space for an intra-canal appliance which anchored the root to the horizontal wire supported by braces placed by the orthodontist on the neighbouring upper incisors. Exposure of the full fracture line was obtained in 8 months and the patient underwent periodontal surgery by the periodontist to recover the esthetic contour of the gingival margins, affected during the extrusion. The prosthodontist completed the treatment with a fiber post and a full ceramic crown. A 3 year follow up is presented confirming complete functionality and accurate esthetic results highlighting the benefit of interdisciplinary treatment on maintaining the natural dentition during the patients developmental age.

III. Conclusion
Combined efforts and expertise from different dental specialties are fundamental to improve the expected outcome of the treatment required to accurately manage dental trauma and constitute an invaluable resource that best practices should consider to overcome the prevalence of early tooth loss among young patients population affected by dental trauma.

***Keywords**: Complicated coronal/root fracture, Multi-disciplinary specialists treatment, Trauma Management
***Presenting Author**: Jorge Moreno
Division of Endodontics. Western University, London, Ontario, Canada, endogeorge@yahoo.com

C3-013

Internal bleaching on traumatized discolored upper right central incisor: A case report

Uci Ernawati*, Christine Rovani, Asrianti Fattah, Aidasriwaty Gasma, Ardo Sabir
Conservative Dentistry, Hasanuddin University, Makassar, Indonesia

I. Objective
Discoloration may occur in traumatized tooth. This is caused by bleeding in the pulp chamber and product of hemorrhage in the form of ferric sulphate compound diffusion into the dentinal tubules resulting in discoloration of the tooth.

II. Case Presentations
A 48-year-old male visited RSGM UNHAS with discolored of upper anterior tooth. Patient had experienced trauma 15 years ago. Clinical examination revealed negative results the vitality test, percussion and palpation, hence the tooth was diagnosed as pulp necrosis. Root canal treatment was performed and followed with internal bleaching treatment; the walking bleach method using 35% hydrogen peroxide.

III. Conclusion
Traumatized tooth discoloration was predictably managed with internal bleaching technique to restore the esthetically.

***Keywords**: Internal bleaching, Discoloration, Trauma, Walking bleach
***Presenting Author**: Uci Ernawati
Conservative Dentistry, Hasanuddin University, Makassar, Indonesia, uciernawatippdgskons@gmail.com

C3-014

Retreatment of untreated canal: Case report

Farida Rahim*, Nurhayaty Natsir, Ilda Budiwati, Arisandi Husni, Ardo Sabir
Conservative Dentistry, Hasanuddin University, Makassar, Indonesia

I. Objective
The causes of the endodontic failures are multifactorial. One of them is the presence of persistent infection results from untreated canal which can implicate pathological conditions in periapical tissue. Root canal retreatment aims to eliminate the bacteria and prevent further infection. Treatments includes complete removal of root filling material, cleaning, shaping and obturating.

II. Case Presentations
A 32-year-old woman came to the RSGM Unhas and complaint more sensistive when chewing on right molar mandibular. The tooth had been treated 10 years ago. Restoration of 46 seem discoloured and sensitive to percussion. Radiographically, a lesion of endodontic origin was noted at the mesial root. Retreatment began with removing guttap percha using Pro Taper Retreatment Files (Pro Taper R Files), root canal preparation with Protaper Next then obturation.

III. Conclusion
Size of lesion decreased at eight months postoperative radiography. Appropriate retreatment effective to eliminate persistent infections at untreated canal.

***Keywords**: Retreatment, Untreated canal, Periapical lesion
***Presenting Author**: Farida Rahim
Conservative Dentistry, Hasanuddin University, Makassar, Indonesia, faridarahim.56@gmail.com

C3-015

Effect of length LED and plasma arc in extra coronal bleaching hydrogen peroxide 35% on enamel microhardness

Rozyta Karunia Hakim*
Conservative Dentistry, Trisakti University, West Jakarta, Indonesia

I. Objective
One of the major side effects of bleaching procedur is the reduction of enamel microhardness. Bleaching using hydrogen peoxide 35% enhanced by a light source to accelerate process but association with enamel demineralisation. Irradiation by light sources (LED and plasma arc) inevitably generates heat and can alter the surface composition of enamel. **Aim**: The purpose of this in vitro study was to evaluate and compare effect of length light emitting diode (LED) and plasma arc on microhardness enamel.

II. Case Presentations

III. Conclusion
Within the limitation of this study, there were significantly effect of length LED and Plasma Arc in extra coronal bleaching with hydrogen peroxide 35% on microhardness enamel based on statistical analysis.

***Keywords**: Light emitting diode, Plasma arc, Bleaching hydrogen peroxide, Microhardness
***Presenting Author**: Rozyta Karunia Hakim
Conservative Dentistry, Trisakti University, West Jakarta, Indonesia, rozytakh@gmail.com

C3-016

A perfect seal for a better heal

Aseng Tangu*
Deparment of Conservative and Endodontics, Shree Bankey Bihari Dental College and Research Center, Delhi, India

I. Objective
Teeth with incomplete root development caused by trauma, caries and other pulpal pathosis, the absence of natural constriction at the end of the root canal presents a challenge and makes control of filling materials difficult. The most commonly advocated medicament is calcium hydroxide although recently considerable interest has been expressed in the use of mineral trioxide aggregate. MTA remains subject to some concerns, such as its long setting time, poor handling characteristics, low resistance to compression, low flow capacity, limited resistance to washout before setting, possibity of staining of tooth structure, presence and release of arsenic, and high cost. Recently, biodentin has been introduced compared with MTA, biodentin also offers advantages of accelerated setting, improved overall physical and mechanical properties and easier handling.

II. Case Presentations
Three cases of traumatic injuries with immature root apex reported in department of conservative dentistry and endodontics, SBB dental college and research center, India. Clinical examination showed no response to pulp vitality test. Single visit apexification with biodentin was planned. a common treatment protocol was followed for all cases. Access opening was done under rubber dam isolation, irrigation done under standard irrigation regime using sodium hypochlorite, chlorhexidine, EDTA and saline. Working length determination done radiographically, circumferential filing done, calcium hydroxide dressing placed. during follow up visit, the canals are dried with paper points. biodentin application done using MAP system and hand plugger, obturation done with custom made GP, finally restored with composite.

III. Conclusion
Single visit apexification with novel biocompatible material like biodentin is a new boon in effective management of teeth with open apex. The positive clinical outcome is seen after 6 months.

***Keywords**: Apexification, Biodentin, Single visit apexification
***Presenting Author**: Aseng Tangu
Department of Conservative and Endodontics, Shree Bankey Bihari Dental College and Research Center, Delhi, India, bubblebum117@gmail.com

C3-017

Retreatment using reciprocal technique on endodontic treatment of the posterior tooth

Yonathan Pasino[*1], Christine Rovani[*2],
Afniati Rachmuddin[1], Arisandi Husni[1], Sulistiya Hastuti[1]
[1]Resident of Conservative Dentistry Specialist Program Study, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia, [2]Department of Conservative Dentistry, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia

I. Objective
In endodontic treatment there are many factors causing failure of therapy, including incomplete cleaning and shaping of root canal and inadequate obturation that cause persistent of microorganisms in root canal. Other factors causing the endodontical failure are the restoration dislodgement which lead to dissolution of the luting cement and the microleakage to the periapical area which lead to periapical disorder. Consequently, the root canal retreatment would need to cope with the endodontical failure. One of the key to a successful retreatment is the selection of the appropriate root canal preparation techniques. Reciprocal technique is a gyromatric preparation technique which uses back and forth revolution movement with the advantage of minimal but effective tissue removal of the root canal wall and short working time. This case report shows an example of the successful root canal retreatment of an endodontically failed restoration using the reciprocal technique.

II. Case Presentations
A 30-year-old man visited the RSGM-UNHAS with chief complaining pain on the maxillary left second molar and restoration failure a month before. Clinical examination shows gutta percha in the orifice and a wide cavity. Radiographical examination shows an obturation underfilling and a periapical radiolucency. The treatment plan to endodontic retreatment the tooth using reciprocal technique, single cone obturation and final restoration with a porcelain crown.

III. Conclusion
Reciprocal technique is effective in cleaning and shaping, preventing the debris extrusion to apical and preventing the instrumental fracture in the root canal, and also shortening the root canal treatment working time.

***Keywords**: Retreatment, Reciprocal, Endodontic failure
***Presenting Author**: Yonathan Pasino
Resident of Conservative Dentistry Specialist Program Study, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia, yonathan.pasino.109@gmail.com

C3-018

Traumatic occlusion (Deep bite) as possible reason of endodontic abscess: A case report

Bursa Serce[*], Guven Kayaoglu
Department of Endodontics, Gazi University, Ankara, Turkey

I. Objective
Swellings due to endodontic origin are seen most commonly in the intraoral region and in rare cases they manifest extraorally, depending on the causative tooth, root location, bone thickness and muscle inserts. This report involves a case of traumatic occlusion of the lower anterior teeth, causing pulpal necrosis with periradicular periodontitis, resulting in the occurrence of a submental abscess.

II. Case Presentations
A 21-year-old female patient was referred to our clinic with extraoral swelling and complaints of spontaneous pain associated with the mandibular anterior teeth. There was no history of acute trauma. Clinical examination revealed mandibular anterior crowding and deep bite. There was no caries and periodontal disease. Mandibular central and lateral incisors were sensitive to percussion and these incisors failed to respond to electrical and thermal pulp tests. Radiologic examination revealed a diffuse radiolucent area in relation with the mandibular lateral and central incisors. In CBCT examination, it was determined that these incisors had two canals. The diagnosis was established as chronic periapical abscess resulting from pulp necrosis due to occlusal trauma. The abscess was drained from the root canals. Root canals were prepared using the Protaper Universal NiTi files and irrigated with 5.25% NaOCl solutions. After that, a calcium hydroxide paste was applied for three weeks. Antibiotic and analgesic were prescribed. After acute symptoms disappeared, the root canals were filled with gutta-percha and AH 26 sealer using the lateral condensation method. At the 6-month follow-up, the periapical lesions had resolved significantly.

III. Conclusion
In this case, elimination of the infection by non-surgical endodontic treatment achieved resolution of the submental abscess and resulted in periapical healing.

***Keywords**: Endodontic treatment, Submental abscess, Traumatic occlusion
***Presenting Author**: Bursa Serce
Department of Endodontics, Gazi University, Ankara, Turkey, busrasercee@gmail.com

C3-019

Gingival fenestration defect healing on mandibular second premolar treated with orthograde MTA filling and surgical treatment

Gilsu Kang[*], Yooseok Shin, Euiseong Kim, Byoung-Duck Roh
Department of Conservative Dentistry, Yonsei University College of Dentistry, Seoul, Korea

I. Objective
Gingival fenestrations are infrequently encountered in clinical practice, but when present can create great difficulties for the clinician. Combined loss of bone and soft tissue results in denuded and clinically exposed root surfaces. Their treatment might be further complicated by communication, with the oral environment making the susceptible to the deposition of plaque and calculus, a secondary factor in preventing reformation of mucosal covering. Their existence should be considered before the several common dental procedures like endodontic treatment, periodontal or apical surgeries.

II. Case Presentations
1.Chiep complaint:
Referred from Local clinic for #35 Root canal treatment.
I heard that my left lower tooth has an inflammation on the root.
2. Sex / Age: F /29
3. Past medical / dental history:
N-S / Root canal treatment (6-7 times, Local clinic)
4. Present illness:
#35 Mob(-), Per(-)
with periapical radiolucency
with gingival fenestration
with previously initiated state
with external root resorption
with normal PD
5. Impression:
#35 Chronic apical abscess
with previously treated therapy
with external root resorption
6. Tx. plan:
#35 Root canal treatment
(Follow up & CBCT imaging)

III. Conclusion
True combined endodontic-periodontal pathology mostly necessitates endodontic and periodontal therapies in combination to achieve the best treatment outcomes. In this case, gingival fenestration developed in the mandibular second premolar due to chronic periapical inflammation which was successfully treated with Endodontic treatment, orthograde MTA filling and root resection without bone grafting and free mucosal graft. Attachment of periodontal ligament with repair of gingival fenestration and periapical healing could be appreciated both clinically and radiographically.

***Keywords**: MTA, Fenestration, Orthograde filling, Surgery
***Presenting Author**: Gilsu Kang
Department of Conservative Dentistry, Yonsei University College of Dentistry, Seoul, Korea, GUKGUK777@yuhs.ac

C3-020

Surgical endodontic treatment of persistent apical periodontitis with an extraradicular infection

Ji Hye Sim[*], Jung-Hong Ha, Myoung Uk Jin, Sung Kyo Kim, Young Kyung Kim
Department of Conservative Dentistry, School of Dentistry, Kyungpook National University, Daegu, Republic of Korea

I. Objective
Endodontic infections are usually restricted to the root canal system. However, in some cases, bacterial infections extend to the periradicular tissues and cause extraradicular infections, which are associated with persistent apical periodontitis. Extraradicular infections may not respond favorably to a conventional root canal treatment and therefore surgical approaches should be indicated. This report presents two cases of chronic periapical abscess with an extraradicular infection. A periradicular surgery was performed because a nonsurgical root canal treatment failed to resolve the symptoms including a persistent sinus tract.

II. Case Presentations
<Case 1>
-Chief Complaint: sinus tract on #25
-Sex/Age: M/54

-Past Medical/Dental History:
nonsurgical endodontic retreatment on #25 one month ago
-Present Illness:
Per (-), Pal (+), Mob (1), probing depth (447/445)
-Impression:
chronic periapical abscess and a previous endodontic treatment on #25 -Treatment Plan: a nonsurgical endodontic retreatment on #25 (with a periradicular surgery, if needed)

<Case 2>
-Chief Complaint: sinus tract on #46
-Sex/Age: F/68
-Past Medical/Dental History:
root canal treatment on #46 twenty years ago
-Present Illness:
Per (-), Pal (-), Mob (0), probing depth (3510/3310)
-Impression:
chronic periapical abscess and a previous endodontic treatment on #46
-Treatment Plan:
a nonsurgical endodontic retreatment on #46 (with a periradicular surgery, if needed)

III. Conclusion

When considering the follow up results after the periapical surgery in these clinical cases, surgical intervention seems to be necessary for persistent apical periodontitis with an extraradicular infection. Bacterial cells invade the periradicular tissues by direct spread of an infection from an inadequately treated root canal space, contaminated periodontal pockets that communicate with apical areas, or sinus tract openings. Moreover, some microorganisms can resist the immune defenses and survive in the periradicular tissues interfering with healing after a conventional root canal treatment. Mineralized extraradicular biofilms on the apical root surface need to be removed by a root-end resection and root planning.

***Keywords**: Extraradicular infection, Persistent apical periodontitis, Periradicular surgery
***Presenting Author**: Ji Hye Sim
Department of Conservative Dentistry, School of Dentistry, Kyungpook National University, Daegu, Republic of Korea, sbjihye@naver.com

C3-021

Intentional replantation to repair an iatrogenic root perforation caused by orthodontic procedure

Sujitha Ramaraj[*], Kyung-San Min
Conservative Dentistry, School of Dentistry, Chonbuk National University, Jeonju, Republic of Korea

I. Objective

Intentional replantation is a reliable and predictable treatment for cases in which nonsurgical endodontic retreatment failed and endodontic surgery is hampered because of anatomic limitations. This case presents the management of a tooth with symptomatic apical periodontitis due to an accidental iatrogenic root perforation in root canal treated molar caused by orthodontic screw placement.

II. Case Presentations

A 21-year-old male patient was presented with periapical swelling and pus discharge through sinus tract in relation to root canal treated right lower second molar. In the first visit, it was suspected to be an endo failure and nonsurgical endodontic retreatment was initiated. Access was modified with coronal disassembly and gutta-percha was removed from all the canals using a nickel-titanium file (Reciproc R25) and intracanal medication with a calcium hydroxide paste (cleaniCal) was given. Though the sinus disappeared initially, it was reappearing in spite of periodic change of intracanal medicament. A further investigation with CBCT confirmed the presence of an iatrogenic root damage caused by orthodontic screw placed during previous treatment. Hence a diagnosis of iatrogenic lateral root perforation was arrived in relation to the mesial root. Intentional replantation was planned. After the root canal treatment was completed, the tooth was atraumatically extracted followed by root-end resection, retrograde preparation with ultrasonic tips, and root-end filling with a calcium silicate-based cement (EndocemMTA). The perforation site was also repaired with EndocemMTA and tooth was replanted. The sinus tract resolved after one week. Six-month and one-year follow-ups revealed complete healing and a fully functional asymptomatic tooth. The radiographs show a normal periodontal ligament space with no evidence of external resorption.

III. Conclusion

Intentional replantation with careful case selection may be considered as a last option for preserving hopeless teeth. In addition, orthodontic screws should be placed carefully not to damage adjacent roots.

***Keywords**: Intentional replantation, Cone beam computed tomography, Orthodontic, Orthodontic screw, Iatrogenic perforation
***Presenting Author**: Sujitha Ramaraj
Conservative Dentistry, School of Dentistry, Chonbuk National University, Jeonju, Republic of Korea, sujitharamaraj@yahoo.in

C3-022

Apicoectomy as upper central incisivus with large periapical lesion treatment

Nia Wijayanti[*]
Conservative Dentistry, School of Dentistry of Universitas Muhammadiyah Yogyakarta, Yogyakarta, Indonesia

I. Objective

In some case of large periapical lesion of necrose teeth, it cannot be treated only with conventional endodontic therapy, but must requiring endosurgery intervention, such as apicoectomy. Apicoectomy performed to treat the periapical lesion, and will be followed with retrograde filling using mineral trioxide aggregate (MTA) to completed the treatment.In some case of large periapical lesion of necrose teeth, it cannot be treated only with conventional endodontic therapy, but must requiring endosurgery intervention, such as apicoectomy. Apicoectomy performed to treat the periapical lesion and will be followed with retrograde filling using mineral trioxide aggregate (MTA) to completed the treatment.

II. Case Presentations

A 26-year-old female patient reported to conservative departement with chief complained of pain and reccurent abses of centralis incisivus for years. Clinically, the tooth was hypersensitive to percussion and palpation but failed to respond to pulp sensitivity testing. Radiograph examination showed a large diffused radiolusence in apical insicivus centralis. The conventional endodontic treatment was performed on tooth #11, followed by apicoectomy with retrograde filling using MTA.

III. Conclusion

The clinical and radiograph followed up for 4 months showed succesful result due to absence of abses and painful symptom and due to periapical bone repair. It was showed the effectiveness of apicoectomy and retrograde filling using MTA for the treatment of large periapical lesion of necrose teeth.

***Keywords**: Periapical lesion, Apicoectomy, Retrograde filling
***Presenting Author**: Nia Wijayanti
Conservative Dentistry, School of Dentistry of Universitas Muhammadiyah Yogyakarta, Yogyakarta, Indonesia, niawijayanti_drg@yahoo.com

C3-023

Management of lateral root canal perforation of the upper central incisivus

Erma Sofiani[*]
Conservative Dentistry, School of Dentistry of Universitas Muhammadiyah Yogyakarta, Yogyakarta, Indonesia

I. Objective

The failure in root canal treatment is frequently caused by root canal perforation. There are several factors that can be responsible for the occurance of root canal perforation. Basically, the occurrence of root canal perforation is also closely related to the anatomy of tooth surface. The higher rate of perforation may lead to complication.The alternative treatment for the perforation is utilizing MTA in a combination with the flap operation method.

II. Case Presentations

A 24-years-old woman complained about her upper right central incisor which was painful and swelling in the mucolabial fold. The root canal treatment history of tooth was treated two times, the first was 13 years ago and second times was 3 years ago. After the last treatment, she reported painful and recurrent fistula. Due to her condition, consuming antibiotics and analgesics were the option for her to overcoming those issues. The clinical examination showed a positive result on both percussion and palpation. There was also a radiolucent image on the apical area, lateral perforation on the distal side of the third apical region. Moreover, the overview of the radiopacity around the root canal filling indicated the non-hermetic filling on the previous RCT. Therefore, the tooth #11 was diagnosed as a non-vital tooth with lateral root perforation. Re-treatment was performed with stepback method. The flap operation method was performed to show lateral perforation then it was filled with MTA and obturation was conducted with lateral condensation method. Final restoration was conducted by all porcelain crown.

III. Conclusion

All porcelain crown was given as permanent filling, then after six months and one year evaluation, the condition of the retreated-tooth keeps showing a good condition

without any complain, pain and clinical abnormalities which suggested that it could function properly.

***Keywords**: Lateral perforation, Re-treatment, Non vital tooth
***Presenting Author**: Erma Sofiani
Conservative Dentistry, School of Dentistry of Universitas Muhammadiyah Yogyakarta, Yogyakarta, Indonesia, e_sofiani@yahoo.com

C3-024

Treatment of root perforation with gingival fenestration

Yoojin Ha*, Sujung Park, Seokryun Lee
Conservative Dentistry, Wonkwang University Dental Hospital, Iksan, Republic of Korea

I. Objective

Access opening is the first and the most important phase of root canal treatment. Lack of attention to the degree of axial inclination of a tooth in relation to adjacent teeth and to alveolar bone may result in either gouging or perforation of the crown or the root at various levels. This case report presents the management of perforated (at coronal 1/3 of the root) maxillary lateral incisor with restoration on perforation site, re-RCT.

II. Case Presentations

1. Sex/Age: M/20
2. Chief Complaint (C.C): There is a hole on my upper gum.
3. Present Illness (P.I):
   #12 per(-), mob(-), gingival fenestration with 5mm probing depth
4. Past Dental History:
   Root canal treatment (10 years ago) due to pain - Root canal re-treatment initiated (1 month ago) -Root canal filling (2 weeks ago)
5. Impression:
   #12 - Previously treated tooth with symptomatic periapical periodontitis, perforation on labial side
6. Tx. Plan
   1) Perforation repair, re-RCT
   2) Nonvital tooth bleaching
   3) Periodontal management, If an esthetic result of gingival repair can't be achieved.

III. Conclusion

In this case, the patient visited our department with gingival fenestration as the chief complaint. During flap procedure, root perforation was found at the gingival fenestration site. It is assumed that root perforation occurred due to iatrogenic injury by dental history taking. The tooth was treated with composite restoration on perforation site and re-RCT at the first visit. Additionally, to achieve aesthetic outcome, non-vital tooth bleaching and periodontal management was done. These reports demonstrate favorable clinical outcomes at the end of treatment, further follow-up will be required.

***Keywords**: Access opening, Root perforation, Gingival fenestration
***Presenting Author**: Yoojin Ha
Conservative Dentisry, Wonkwang University Dental Hospital, Iksan, Republic of Korea, dbwls7569@daum.net

C4-001

Anterior aesthetic rehabilitation caused by dental trauma – A case report

Revina Ester Iriani Marpaung*
Department of Conservative Dentistry, Faculty of Dental Medicine, Airlangga University, Surabaya, Indonesia

I. Objective

The needs of dental patient have gradually changed. Today's focus of society has shifted towards the importance of beauty and attractiveness. Esthetic restoration and treatment applied to create and enhance beauty of an individual within functional and physiological limits.

II. Case Presentations

A 27-year-old male patient reported to the Department of Conservative & Endodontics with chief complaint to fix the problem of his teeth. From the anamnesis was known that the patient had an accident occurred 3 months ago. On intraoral examination, mobility and fractured anterior teeth were involved. Stabilization with fiber splint was performed by previous periodontist few days after the accident. On clinical and radiographic examination, root resorption on tooth #11 and agenition on tooth 22 were found.

Root canal treatment was planned on tooth #11, #12, #13, #21 and #23 using reciprocal system and dressed with calcium hydroxide. Apexification on tooth #11 using MTA. Crown lengthening on #21 was performed to achieve an ideal esthetic. Fiber post and all ceramic crown on tooth #11, #12, #13, #21 and #23 were chosen for the final restoration. 2 months follow up showed satisfying results.

III. Conclusion

Apexification on root resorption using MTA have a pleasant result to create an apical plug. All ceramic crown would be the ideal choice for esthetic restoration because of its translucency and natural appearance. Crown lengthening can be done to obtain an ideal and natural esthetic.

***Keywords**: Fractured tooth, Dental trauma, Apexification, Root resorption, Esthetic dentistry, Root canal treatment
***Presenting Author**: Revina Ester Iriani Marpaung
Department of Conservative Dentistry, Faculty of Dental Medicine, Airlangga University, Surabaya, Indonesia, revinaesteri@gmail.com

C4-002

Inferior alveolar nerve paresthesia caused by periapical lesion on mandibular second molar

Hyeon Wook Jang*, Dohyun Kim, Sunil Kim, Il-Young Jung
Conservative Dentistry, Yonsei University College of Dentistry, Seoul, Republic of Korea

I. Objective

Paresthesia of inferior alveolar nerve can be caused by a variety of factors such as systemic disorders, traumatic injuries, expanding compressive lesions, local infections and so on. Periapical lesion on mandibular molar area can interfere with nerve conduction of inferior alveolar nerve due to mechanical pressure or microbial products, which can lead to paresthesia.

II. Case Presentations

1. Sex/Age: Male/57
2. Chief Complaint (C.C): My left lower lip is numb
3. Past Dental History: Caries treatment of #37 (1 year ago)
4. Present Illness:
   Mob(-), Per(-), Cold(-), EPT(-), 6 mm probing depth on distal, Periapical radiolucency on #37
   Hypoesthesia on left lip & chin area (Pin prick: Rt./Lt.=10/4, Touch sense: Rt./Lt.=10/10) 5.
   Impression: R/O) Radicular cyst on #37
6. Treatment Plan: Non- surgical root canal treatment on #37

III. Conclusion

Paresthesia may be caused by mechanical pressure associated with the periapical lesions. As the mechanical pressure decreases, the symptom can be reversibly resolved. When the periapical lesion is adjacent to inferior alveolar nerve, minimally invasive treatments such as non-surgical root canal treatment should be considered first. As in this case, especially in the case of cystic lesion, a good result can be obtained by reducing the pressure.

***Keywords**: Paresthesia, Hypoesthesia, Inferior alveolar nerve
***Presenting Author**: Hyeon Wook Jang
Conservative Dentistry, Yonsei University College of Dentistry, Seoul, Republic of Korea, pontiacdream@gmail.com

C4-003

The management of complicated-crown-fractured teeth using different pulp treatment

Sangsu Lee[*1], Sungok Hong[2], Seokryun Lee[1]

[1]Conservative Dentistry, Wonkwang University Dental Hospital, Iksan, Republic of Korea, [2]Conservative Dentistry, Wonkwang University Sanbon Dental Hospital, Sanbon, Republic of Korea

I. Objective

Crown fracture of the anterior teeth is a common type of dental trauma. Especially, Complicated crown fracture is involved in enamel, dentin, and pulp. Clinicians may be in a challenge if the fracture margin is located on subgingival level and it is not easy to grasp the pulp status and decide appropriate pulp treatment. This case report describes 2 teeth with complicated crown fracture. Each tooth was treated using different pulp treatment and the fragment was reattached with palatal flap elevation.

II. Case Presentations

1.Sex/Age: M/14
2.Chief Complaint (C.C):
I fell down and my teeth were broken.
3.Present Illness (P.I):
#11 complicated crown fracture (subgingival margin), per(+), mob(+), EPT(+) / #21 complicated crown fracture (pulp horn exposure), per(+), mob(-), EPT(+)
4.Impression:
Complicated crown fracture, subluxation on #11 / Complicated crown fracture, concussion on #21
5.Tx. Plan:
#11 RCT, FRC post cementation, fragment reattachment with flap elevation / #21 Vital pulp therapy (partial pulpotomy), fragment reattachment

III. Conclusion

To decide the root canal treatment on the tooth with complicated crown fracture, not only the period between trauma and treatment, pulp exposure extent, and maturity of the root, but also the location of fracture line and necessity of post should be considered. In this case, despite normal pulp status, root canal treatment was done on #11 because post was needed to obtain enough retention of fragment. Whereas, partial pulpotomy was done on #21 using calcium silicate-based material and upper cavity was filled with composite resin for a tight seal. So far, there is no clinical symptom on #11, 21 and the vitality of #21 is well maintained. Clinicians should consider things mentioned above to manage such complex dental trauma cases.

***Keywords**: Complicated crown fracture, Treatment decision, Vital pulp therapy, FRC post
***Presenting Author**: Sangsu Lee
Conservative Dentistry, Wonkwang University Dental Hospital, Iksan, Republic of Korea, isoawalker@naver.com

C4-004

Dentigerous cyst mimicking a lesion of endodontic origin: A case report

Jeen Nee Lui[*1], Danny Ben Poon Tan[2]

[1]Restorative Dentistry, National Dental Centre Singapore, Singapore, Singapore, [2]Oral and Maxillofacial Surgery, National Dental Centre Singapore, Singapore, Singapore

I. Objective

Dentigerous cyst is one of the most common odontogenic jaw cysts, however, dentigerous cysts associated with supernumerary teeth are reported to be rare. This presentation describes an unusual case of dentigerous cyst associated with a supernumerary tooth mimicking a lesion of endodontic origin.

II. Case Presentations

A 42-year-old Chinese male presented with discomfort from his maxillary left lateral incisor (#22) for several months. He did not recall any previous trauma to the tooth. Intra-oral findings revealed an intact tooth which was non-responsive to pulp sensibility tests and tender to percussion. Panaromic and periapical radiographs showed a circumscribed periapical lesion of about 1cm in diameter around the apex of #22. Diagnosis of #22 was pulp necrosis and symptomatic apical periodontitis. Root canal treatment was carried out in 2 visits with calcium hydroxide as an intra-canal medicament. Two months post treatment, the patient continued to complain of persistent discomfort. Enucleation of the lesion and root end surgery of #22 was planned. After enucleation of the soft tissue lesion under local anaesthesia, a buried supernumerary was noted and excised. Root end surgery of #22 was not carried out. Histology of the excised lesion reported a diagnosis of dentigerous cyst. A 10-month review revealed a decrease in size of the periapical radiolucency and establishment of intact periodontal ligaments around #22.

III. Conclusion

This case highlights the need for the clinician to be cognizant of differential diagnosis for periapical lesions, such as odontogenic and non-odontogenic cysts, for non-vital teeth where the cause for pulp necrosis cannot be ascertained. It also shows the limitations of 2D radiographs as the presence of the supernumerary tooth in dental paranomic and periapical radiographs was not obvious.

***Keywords**: Periapical diagnosis, Dentigerous cyst, Supernumerary
***Presenting Author**: Jeen Nee Lui
Restorative Dentistry, National Dental Centre Singapore, Singapore, Singapore, lui.jeen.nee@singhealth.com.sg

C4-005

Treatment of necrotic premolars with the anomaly of a gemination and concrescence

Sergio Irazusta[*], Victoria Sansalvador, Xavier Ruiz, Jose Antonio Gonzalez

European Master of Endodontics, Universitat Internacional de Catalunya, Barcelona, Spain

I. Objective

During teeth development, each tooth germ consists on an enamel organ and a dental papilla surrounded by a dental follicle or sac. During this procedure, variations and anomalies are not frequent but can occur. They can be divided according to position, volume or dental union. Germination is a rare anomaly where a germ is divided in two but this division is incomplete. Moreover, a concrescence represents an uncommon developmental anomaly in which juxtaposed teeth are united in the cementum but not in the dentin. The prevalence of both anomalies is really low.

II. Case Presentations

A 12-year-old female patient came to the clinic with the chief complaint of a sinus tract. In the clinical examination the patient presents a supernumerary premolar with gemination. Sensibility test were negative in the premolar and the supernumerary. The diagnosis was pulp necrosis with symptomatic apical periodontitis. In the CBCT a concrescence of the 2.4 with the supernumerary premolar was revealed, showing us the difficulties to achieve a good apical seal. We perform the root canal treatment of both teeth in 3 visits with calcium hydroxide and we finally seal the apex with Biodentine.

III. Conclusion

The presence of concrescent teeth and a supernumerary with a gemination, may influence endodontic procedures as well as periodontal, surgical and even orthodontic diagnoses and treatment. Therefore, consideration should be given to the possible occurrence, recognition, and implications of this anomaly in diagnosis and treatment planning. In this clinical case we explain how we diagnose and treat both necrotic teeth.

***Keywords**: Root canal treatment, Concrescence, Gemination, Dental anomalies
***Presenting Author**: Sergio Irazusta
European Master of Endodontics, Universitat Internacional de Catalunya, Barcelona, Spain, irazus13@uic.es

C4-006

One visit endodontic treatment of the mandibular first molar with four canals and periapical lesion

Desi Wadianawati[*], Diatri Nari Ratih, Ema Mulyawati

Conservative Dentistry, Faculty of Dentistry, Universitas Gajah Mada, Yogyakarta, Indonesia

I. Objective

The successful root canal treatment depends on adequate cleaning, shaping, and filling of the root canal system. Generally, mandibular first molars have three of root canals. This paper presented one visit endodontic treatment of pulp necrosis mandibular first molar with four canals and periapical lesion.

II. Case Presentations

A 34-years-old female patient came to the Department of Conservative Dentistry with discolored restoration. Clinical examination revealed the presence of composite restoration with secondary caries in the buccal region of the left mandibular first molar. The mobility of the tooth was within physiologic limit and the vitality test indicated that the tooth was non-vital. Radiography examination showed the presence of radiolucency in the periapical area. It was diagnosed as pulpal necrosis with asymptomatic apical periodontitis. The treatment planning was explained to the patient and endodontic treatment was initiated under rubber-dam isolation. Access opening was prepared using an endo access bur and Endo Z. Four canals were located, two canals were in the mesial and two others were in the distal side. The root canals were explored with a size #15 k-file and the working length was determined with electronic apex locator, then confirmed by periapical radiography. The root canals were shaped with ProTaper rotary instrument. During preparation, the root canals were irrigated with 2.5% NaOCl, EDTA, Chlorhexidine solutions respectively. The canals were dried, and a gutta-percha master cone was confirmed radiographically. Then, the canals were obturated using single cone method with gutta-percha point (X2) and

epoxy sealer. The access opening was sealed with glass ionomer cement. Afterwards, restoration was performed using short fiber reinforced composite and packable composite resin.

III. Conclusion
In conclusion, the successful of root canal treatment are based on knowledge of dental anatomy, treatment procedure, and accurate diagnosis.

***Keywords**: Four canals, Periapical lesion, Mandibular first molar, One visit endodontic treatment
***Presenting Author**: Desi Wadianawati
Conservative Dentistry, Faculty of Dentistry, Universitas Gajah Mada, Yogyakarta, Indonesia, desiwadianawati@yahoo.com

C4-007

Assessment of healing of large cyst-like lesion after non-surgical root canal treatment

Huibae Yang*, Dohyun Kim, Sunil Kim, Sung-ho Park
Conservative Dentistry, Yonsei University College of Dentistry, Seoul, Republic of Korea Hospital, Sanbon, Republic of Korea

I. Objective
It is often confusing to make a treatment plan of a large cyst-like lesion. Generally, to avoid unnecessary invasive treatment, conventional non-surgical root canal treatment is recommended first. In addition, we can consider decompression, marsupicalization, or surgical enucleation of cyst as well. This case presents a large cyst-like lesion, which was successfully healed after non-surgical root canal treatment.

II. Case Presentations
1. Chief complaint:
   Referred from local dental clinic for treatment of periapical lesion of #46 and sensory abnormality on right mandibular molar area.
2. sex/age: F/23
3. Past Medical/Dental History:
   root canal treatment & crown on #46, 2012 local clinic, due to dental caries
4. Present lllness:
   #46
   mob(-), per(+), bite(+)
   with periapical radiolucency
   with tenderness to palpation on buccal gingiva (fluctuation consistency)
   with normal probing depth
5. Impression:
   Symptomatic apical periodontitis(R/O) Radicular cyst(R/O) on #46
6. Tx Plan: non-surgical root canal retreatment

III. Conclusion
Whether large cyst-like lesions can be healed only by non-surgical root canal treatment is still controversial. In this case, endodontic treatment was the first attempt, and the lesion healed well. Usually, a surgical approach can be used for fast and definitive treatment for large cyst-like lesions. However, if the patient shows good compliance, non-surgical root canal treatment should be initially attempted.

***Keywords**: Large cyst-like lesion, Non-surgical root canal treatment, Radicular cyst
***Presenting Author**: Huibae Yang
Conservative Dentistry, Yonsei University College of Dentistry, Seoul, Republic of Korea, yhb8904@yuhs.ac

C4-008

Aesthetic enhancement with external bleaching on the first degree of tetracycline discoloration: A case report

Asrianti Fattah*[1], Christine Anastasia Rovani[2], Ilda Budiwati[1], Uci Ernawati[1], Farida Rahim[1]
[1]Resident of Conservative Dentistry Specialist Program Study, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia, [2]Department of Conservative Dentistry, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia

I. Objective
Tooth discoloration is commonly due to extrinsic or intrinsic factors. Tetracyclines are a group of drugs which can cause intrinsic discoloration of teeth. This can be treated with bleaching, veneers or crowns. The most noninvasive and conservative treatment for these discoloration is external bleaching, including first and second degree of tetracycline discoloration. This case report aims to discuss the treatment of discolored tooth due to tetracycline stain.

II. Case Presentations
A twenty-eight-year-old male patient came to Dental Hospital UNHAS, complaining discoloration of his teeth. The teeth color is yellow to grey, which is uniformly spread through the tooth. External bleaching treatment was performed using 40% hydrogen peroxide gel.

III. Conclusion
External bleaching on the first degree of tetracycline discoloration effectively makes the tooth look brighter.

***Keywords**: External bleaching, Tetracycline, Tooth discoloration
***Presenting Author**: Asrianti Fattah
Resident of Conservative Dentistry Specialist Program Study, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia, asriantidrg@yahoo.co.id

C4-009

Determination and multidiciplinary management of endo-perio lesion

Afniati Rachmuddin*, Nurhayaty Natsir, Nurtiara Oktaviana, Asrianti Fattah, Ilda Budiwati
Conservative Dentistry, Hasanuddin University, Makassar, Indonesia

I. Objective
As the pulp infection reaches the apical foramen, it may reach the periodontal ligament which will cause widespread inflammation of the periodontal tissue that will eventually lead to bone destruction, and vice versa. Diagnosis and treatment of such cases become a challenge in overcoming the inflammatory conditions. Endodontic treatment is considered less effective to resolve these deficiencies. This causes a poor prognosis so that regenerative periodontal tissue therapy is also required.

II. Case Presentations
A 25-year-old male came to RSGM UNHAS Department of Conservative Dentistry with his chief complaints of lower right tooth were mobile and less comfortable. Objective examination showed the accumulation of calculus in the lingual region of mandibular teeth, tooth 45 were mobile two degree with fistula in the buccal areas of tooth 44 and 45, no caries detected, thermal tests was negative(-), percussion and palpation tests were positive(+), radiographic examination showed a lesion in the lateral root extends to apical, the tooth was diagnosed with necrosis of the pulp. Multivisit root canal treatment were performed on tooth 45 afterwards was referred to the Department of Periodontology for periodontal treatment using bone graft and Platelet Rich Fibrin.

III. Conclusion
The treatment results of endo-perio lesions with extensive periapical damage showed an excellent healing. Thus, the success of the treatment was determined by appropriate diagnosis and interdisciplinary endodontic and periodontic treatment.

***Keywords**: Endo-perio, Root canal treatment, Periodontal therapy
***Presenting Author**: Afniati Rachmuddin
Conservative Dentistry, Hasanuddin University, Makassar, Indonesia, afni_poet@yahoo.com

C4-010

Regenerative endodontic treatment of immature necrotic mandibular premolar using MTA

Ja Yeon Lee*, Jung-Hong Ha, Myoung Uk Jin, Young Kyung Kim, Sung Kyo Kim
Department of Conservative Dentistry, KNUDH, Daegu, Republic of Korea

I. Objective
Endodontic management of immature permanent teeth with necrotic pulps and open apices is a significant challenge, owing to the presence of thin dentin walls and the lack of a natural apical constriction that an obturation material can be placed against.

In this case report, we treated an immature necrotic mandibular premolar with apical abscess. Instead of the standard root canal treatment and apexification, the root canal was not mechanically cleaned to the apex but copious irrigation and MTA (Mineral Trioxide Aggregate) filling material were used in the canal. Thus necrotic and infected pulp was removed coronally, leaving residual pulp tissue apically in the canal to promote revascularization.

II. Case Presentations
< Case 1 >
1. Chief complaint:
   Pain of #45 (referred from local dental clinic)
2. Sex/age: F/16
3. Past Dental History:
   Previously Initiated Endodontic Therapy on #45 (Local Dental Clinic)
4. Present Illness: #45 per(+), pal(-), mob(0), PAR(+)
5. Impression: Previously Initiated Therapy, Apical Abscess
6. Treatment plan: Revascularization on #45

< Case 2 >
1. Chief complaint:
   Toothache and gingival swelling on #35 (referred from Dept. of PEDD)
2. Sex/age: M/10
3. Past Dental History:
   Incision & Drainage on #35 (Department of Oral

Maxillofacial Surgery) Revascularization on #35 (Department of Pediatric Dentistry)
4. Present Illness:
#35 per(+), pal(+), mob(0), PAR(+), swelling on the buccal gingiva with fluctuation
5. Impression: Previously Initiated Therapy, Apical Abscess
6. Treatment plan: Revascularization on #35

III. Conclusion

This case report describes two cases of regenerative endodontic treatment of necrotic immature permanent teeth using MTA which resulted in continued root development, increased thickness in the dentinal walls and apical closure. These developments in regeneration of a functional pulp-dentin complex have a promising impact on efforts to retain the natural dentition, the ultimate goal of endodontic treatment.

***Keywords**: Regenerative endodontic treatment, Immature teeth, MTA
***Presenting Author**: Ja Yeon Lee
Department of Conservative Dentistry, KNUDH, Daegu, Republic of Korea, nature10201@gmail.com

C4-011

Management of necrotic immature teeth by revascularization

Junwoo Baek*, Minju Song, Chan-Ui Hong, Yong-Bum Cho
Department of Conservative Dentistry, Dankook University, Cheon-an, Republic of Korea

I. Objective

Treatment of necrotic immature teeth with open apex has been a challenge in endodontics. Apexification, the traditional treatment, is an effective but does not promote further root development. Revascularization of immature tooth is based on the concept that vital stem cells in apical papilla can recover the tooth vitality. This case report describes two cases about pulp necrosis of immature permanent teeth that treated by Revascularization using calcium hydroxide intracanal medicaments.

II. Case Presentations

1. Chief complaint:
Referred from PED, It was bothering me since yesterday.
2. Sex/age: F/12
3. Past Medical/Dental History: N/S
4. Present Illness:
#45 Per(+), Resting pain(+), PA lesion(+), Cold(-)
5. Impression:
#45 Pulp necrosis with apical periodontitis, Dens evaginatus
6. Tx Plan: #45 Revascularization

1. Chief complaint:
Something small on my teeth got broken a week ago. And it hurting me since 3 days ago.
2. Sex/age: F/14
3. Past Medical/Dental History: N/S
4. Present Illness:
#45 Per(+), Pal(+), Mob X, PA lesion(+), Cold(-)
5. Impression:
#45 Pulp necrosis with symptomatic apical peridontitis, Dens evaginatus
6. Tx Plan: #45 Revascularization

III. Conclusion

Regenerative endodontic therapy, Revascularization, induces thickness and length of immature teeth. But the outcome of revascularization procedure remains still unpredictable and challenging. Long term clinical and histological studies are required to investigate the outcome of Revascularization according to intracanal medicaments.

***Keywords**: Revascularization, Regeneration, Calcium hydroxide
***Presenting Author**: Junwoo Baek
Department of Conservative Dentistry, Dankook University, Cheon-an, Republic of Korea, silent0001@naver.com

C4-012

Bicuspidization: A surgical approach to furcation involvement in mandibular first molar with true combined lesion

Aldila Ceasy Prameswari*, Wignyo Hadriyanto, Tunjung Nugraheni
Conservative Dentistry, Universitas Gadjah Mada, Yogyakarta, Indonesia

I. Objective

Untreated true combined lesion may create defects that lead to total loss of the tooth, unless the defects are eliminated. Defect in furcation area resulting from the combined lesion has always been a concern regarding the choice of treatment. Bicuspidization is a process to separate distal and mesial roots in mandibular molars along with their coronal portions into two segments that retain individually. Bicuspidization can preserve as much structure as posibble and eliminate the furcation defect on mandibular molar rather than extracting it. This procedure will eliminate the existence of furcation and facilitate adequate cleansing for hygiene maintenance.

II. Case Presentations

A 18-year-old female patient complained of pain in left mandibular posterior region since 2 weeks and increased during mastication. She also reported that swelling occurred in the first 3 days. Clinical examination showed large caries on occlusal area, sensitive to percussion, Grade 1 mobility, and probing depth was 7 mm in mid buccal aspect of 36 tooth. Vitality test yielded no response. Periapical radiograph confirmed Class II furcation involvement with vertical bone loss and radiolucent area in mesial periapical. Bone support for both roots remain intact. Based on clinical examination, bicuspidization procedure followed with bone graft placement would be performed. Two months follow up showed good healing response on furcation and mesial periapical area.

III. Conclusion

Bicuspidization can be considered as suitable alternative treatment to extraction for multi rooted teeth with Class II furcation involvement. Through this procedure, unfavorable anatomic and furcation defects were removed, tooth structure can be preserved and good healing response is achievable. Patient will also able to clean the furcation region adequately, thus oral hygiene can be maintained properly.

***Keywords**: True combined lesion, Furcation involvement, Bicuspidization
***Presenting Author**: Aldila Ceasy Prameswari
Conservative Dentistry, Universitas Gadjah Mada, Yogyakarta, Indonesia, aldilaprameswari@gmail.com

C4-013

Hemisection – A surgical approach to iatrogenic complication of endodontics therapy: Case report

Selvia Martinova*, Wignyo Hardianto
Conservative Dentistry, Faculty of Dentistry Gadjah Mada University, Yogyakarta, Indonesia

I. Objective

A broken instrument in a root canal and perforation of bifurcation can lead to the emergence of infection. Iatrogenic complication of endodontic treatment need surgical procedure as an alternative way to retain a tooth from total loss of the tooth structure. Hemisection is the surgical separation of a multi-rooted tooth through the furcation in such a way that a root and the associated portion of the crown may be removed.

II. Case Presentations

A 26-year-old female patient was referred by a general dentist after initiation of a root canal treatment. The chief complain is pain and localized swelling on the bucal side of the mandibulary right first molar. Patient refused to tooth extraction. A diagnostic radiograph revealed that access opening was done in 46 and a broken file in mesially root canal. There is a radiolucent area in the bifurcatio and periapical regions, especially the mesial part of the root but not yet a large area. Root canal treatment is performed on the retained segment. Hemisection was carried out under local anesthesia with the vertical cut method. The mesially root was removed with extraction forceps. The retained root was trimmed. The socket was irrigated with sterile saline. Bone graft (GamaCHA) is inserted into the socket and then covered with periodontal membrane. Suturing the flap was performed with interrupted technique. The patient returned after 1-month and radiograph figured a good of post surgical healing. Final restoration was completed with fiber post and fixed porcelain fused to metal crown.

III. Conclusion

Hemisection can be a successful endodontic therapy after iatrogenic complication of endodontic treatment if the surgical procedure is adequate and performed earlier as the support bone has not yet a large bone defect.

***Keywords**: Iatrogenic complication, Broken instrument, Bifurcation involvement, Hemisection
***Presenting Author**: Selvia Martinova
Conservative Dentistry, Faculty of Dentistry Gadjah Mada University, Yogyakarta, Indonesia, selvia_martinova@outlook.com

C4-014

Management of invasive cervical resorption with combination technique using RMGI-MTA: A case report

Nurtiara Oktaviana*[1], Juni Jekti Nugroho[2], Yonathan Pasino[1], Aidasriwaty Gasma[1], Arisandi Husni[1]
[1]Resident of Conservative Dentistry Specialist Program Study, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia, [2]Departement of Conservative Dentistry, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia

I. Objective

Invasive cervical resorption (ICR) is a clinical term used to describe a relatively uncommon but occurs aggressively, no external sign and the etiology is not very clear. The resorption condition is often detected by radiographic

examination. The radiographic of this lesion is irregularly radiolucencies. Multidiscipline treatment is advocated in cases involving invasive defect, by removal of the granuloma tissue and filling with various restorative materials.

II. Case Presentations

A 28-year-old patient came to Hospital Dental Education (RSGMP), Hasanuddin University. The chief complaint was gingival swelling in the palatal cervical area of the maxillary right central incisor. The patient had a history of trauma to his upper teeth 10 years ago, no history of orthodontic treatment or bleaching. The resorptive lesion advanced into the periodontal ligament region, and the adjacent papilla showed an erythematous swelling. No caries or restorations were detected. Endodontic treatment was performed, after working length determination. Preparation was done with crown down technique and dressing with calcium hydroxid. ICR management has been done conventionally using MTA, but unsuccessful so it was decided for surgical treatment by removal the granuloma tissue and filling the resoption defect with RMGI and MTA. After the materials had been placed, the flap was repositioned and sutured.

III. Conclusion

Management of invasive cervical resorption can be effective when remove the etiological factor and interrupts the progressive resorption mechanism.

***Keywords**: External root resorption, Invasive cervical resorption, RMGI, MTA, Root canal treatment
***Presenting Author**: Nurtiara Oktaviana

Resident of Conservative Dentistry Specialist Program Study, Faculty of Dentistry, Hasanuddin University, Makassar, Indonesia, oktaviananurtiara@gmail.com

C4-015

Root canal treatment of type IV Vertucci configuration on left mandibular first premolar

Paulus Alexander*, Eko Fibryanto, Taufiq Ariwibowo

Department of Conservative Dentistry Trisakti University, Jakarta-Indonesia

I. Objective

Teeth have highly complex internal and external anatomical variation. A thorough knowledge of root canal anatomy and its variations are necessary for successful endodontic treatment. Mandibular premolar, often called as "endodontist's enigma", are the most difficult teeth to undergo endodontic treatment. The major portion of the population present with the single root and single canal in the mandibular premolar, but the literature holds the information of multiple canal existence in these teeth. The occurrence of the variations in the root canal system of mandibular premolars is relatively very high when compared to other teeth, due to which they are considered difficult to be treated endodontically. The aim of this case report is to present a successful treatment outcome of type IV Vertucci configuration on left mandibular first premolar.

II. Case Presentations

A 81-year-old man was referred for root canal treatment on left mandibular first premolar. Clinical assement showed large caries lession on distal region. Radiographic examination showed bifurcation at the level of middle third of root suggesting two roots with two canals having type IV configuration according to Vertucci configuration. Root canal treatment was performed under dental operating microscope with Protaper Next system and calcium hydroxide as medicament. One week later the tooth was obturated with gutta-percha and followed by composite resin for final restoration.

III. Conclusion

Root canal treatment of type IV Vertucci configuration on left mandibular first premolar showed a successful treatment outcome.

***Keywords**: Type IV Vertucci, Protaper Next
***Presenting Author**: Paulus Alexander

Department of Conservative Dentistry Trisakti University, Jakarta-Indonesia, paulusaiskandar@gmail.com

C4-016

Management of failed root canal treated incisor by orthograde filling with MTA prior to the surgical treatment

Praman Kundacha*, Phumisak Louwakul

Department of Restorative Dentistry and Periodontology., Chiang Mai University, Chiang Mai, Thailand

I. Objective

Persistent intraradicular infection is the most common cause of treatment failure. Periradicular surgery is indicated in case of impossible or failed non-surgical retreatment. Endodontic microsurgery yields very high success rate, but its procedure needs specialized skills and instruments. An alternative surgical technique is, therefore, proposed in this case report.

II. Case Presentations

A 23-year-old Thai female patient was referred with a chief complaint of moderate pain and swelling in maxillary left central incisor. The patient gave a history of non-surgical root canal treatment on this tooth one year ago. On clinical examination, there was a swelling, with firm consistency, at labial vestibule. The tooth was tender to percussion. Radiographic examination showed a large radiolucent area at root apex of the tooth 21, size 10x8 mm^2. A diagnosis was previously treated tooth with symptomatic apical periodontitis. Nonsurgical retreatment was planned. After the coronal restoration and root canal filling were completely removed, pus exudate drained through the canal. The root canal was debrided and medicated. After 5 visits of re-irrigation and intracanal medication, the swelling was not improved. CBCT was then taken and apical perforation was found. Therefore, the treatment plan was changed to surgical retreatment. We decided to perform an orthograde filling with mineral trioxide aggregate (MTA) at one week prior to the surgery. The 3-mm apicoectomy was done without retropreparation. Under a microscopic evaluation, the resected MTA was set completely and adapted well to the canal wall. The patient has been symptom-free after the surgery. The periapical lesion was completely healed at 14-month follow-up.

III. Conclusion

The orthograde filling with MTA prior to the apicoectomy is an alternative option to the endodontic microsurgery. This technique is easy to manipulation, reduces time of surgery and, more importantly, provides the satisfactory outcome.

***Keywords**: Orthograde filling, Mineral trioxide aggregate, Apicoectomy, CBCT
***Presenting Author**: Praman Kundacha

Department of Restorative Dentistry and Periodontology., Chiang Mai University, Chiang Mai, Thailand, tum.pq62@gmail.com

C4-017

Hemisection: A modern endodontic approach as an alternative treatment for the extraction of molar teeth: Case series

Oguz Tavsan*, Nelihan Simsek

Department of Endodontics, İnönü Universty, Malatya, Turkey

I. Objective

Hemisection is an appropriate treatment choice when resorption, perforation, fractured instruments, or periodontal damage is restricted to one root and the other is healthy. This case series presents the hemisection of molar roots when complications prevent root-canal treatment.

II. Case Presentations

Case 1: A 50-year-old male presented to our clinic with pain in tooth #46. Radiographic and clinical examination of the tooth revealed acute apical periodontitis. When endodontic access was provided, glass ionomer cement was discovered on the mesial root canals and a large perforation site underneath. Root canal treatment and a metal post were applied to the distal root canals. After the tooth was restored with direct composite resin, the roots were separated, and the mesial root was extracted. Prosthetic restorations were applied to the tooth.

Case 2: A 43-year-old male presented to our clinic with an abscess of tooth #26. Radiographic and clinical examination revealed swelling in the tooth's vestibular mucosa, a fractured instrument at the mesial root canal, and a large periapical lesion. The tooth was diagnosed with a phoenix abscess. The fractured instrument in the mesial root canal could not be removed using a Masseran kit and ultrasonic instruments. The mesial root was separated from the other roots and extracted. Root canal treatment was applied to the remaining distal and palatinal root canals. The fiber post was applied in the palatal root canal and restored with direct composite resin. Prosthetic restorations were applied to the tooth.

III. Conclusion

In endodontic treatment of molar teeth, extraction is the only effective treatment for a large perforation, a vertical fracture, or some instrument fractures. However, when these complications are confined to a single root, hemisection may be an alternative for extraction of the tooth. In 12–18 months follow up, the teeth were clinically asymptomatic and functional, and the extraction socket was fully healed.

***Keywords**: Hemisection, Perforation, Instrument fracture
***Presenting Author**: Oguz Tavsan

Department of Endodontics, İnönü Universty, Malatya, Turkey, tavsan.oguz@gmail.com

C4-018

On time clinical management of an anterior dens evaginatus, talon cusp

Nandy Acevedo*
Endodontics Department, San Carlos University, Guatemala, Guatemala

I. Objective
Talon Cusp is a variation of Dens Evaginatus, a developmental dental anomaly. It is a tubercle that regularly contains enamel, dentin and pulp. It is usually necessary to eliminate it, and pulpal exposure may occur. Literature has proven, vital pulp therapy efficiently works on healthy pulp. Finding these anomalies, on time, makes it possible work in a conservative way.

II. Case Presentations
An 11-year female presented to the Endodontic Clinic, referred from the Orthodontics department, she had a tubercle on the lingual face of the central superior incisor. There was no evidence of carious lesions. They needed it to be removed because the tubercle avoided the incisor to reach the correct position in the arcade, making her smile look misaligned. After evaluated clinical and by CBCT, it was known that pulp exposure was happening. It was planned to make a modified Cvek protocol for partial pulpotomy, using biodentine as capping. After absolutely isolated, every instrument used during the procedure was totally sterilized. Kakehashi (1965) clarified it is of remarkable importance to be sure that we are treating the pulp with a bacterial free procedure. After the tubercle was eliminated and the pulp exposure was clear, biodentine was placed over the pulp and evaluated after 1, 3, 6 and 12 moths, to assure the success of the treatment as keeping vitality and the correct maturing of the root which was with an open apex.

III. Conclusion
If we are able to observe a dental development anomaly like the talon cusp on time we can treat them in a conservative way, like pulp capping and avoid all the problems as occlusion, or necrosis pulps by getting cavities before it is eliminated. Besides the correct treatment needs knowledge and have the adequate material to use for the pulp capping as in this case.

***Keywords**: Dens Evaginatus, Pulp capping, Pulp Therapy, Biodentine
***Presenting Author**: Nandy Acevedo
Endodontics Department, San Carlos University, Guatemala, Nandy.aq@gmail.com

C4-019

Nonsurgical endodontic treatment of maxillary premolar with three canals

Se Yeong Han*, Jung-Hong Ha, Young Kyung Kim, Sung Kyo Kim, Myoung Uk Jin
Conservative Dentistry, KNUDH, Daegu, Republic of Korea

I. Objective
Most maxillary first premolars have two root canals and maxillary second premolars may have one or two canals. Although not a common clinical finding, three canals can occur in maxillary premolars. Some studies show that the incidence of three-canalled maxillary premolars has been observed as 5 to 6% for first premolars and 1% for second premolars. These case reports represent clinical cases of nonsurgical endodontic treatment of maxillary premolar with three canals.

II. Case Presentations
<Case 1>
1.Chief complaint: Swelling on #14
2.Sex/age: M/24
3.Past Medical/Dental History:
Root canal treatment &prosthetic treatment, 3 years ago / Swelling on #14, 4 days ago
4.Present Illness: Per(-), Pal(+), Mob(0), Probing depth (323/323), sinus tract & swelling on #14
5.Impression: Periapical abscess with sinus tract & previously treated on #14
6.Tx Plan: Nonsurgical retreatment on #14

<Case 2>
1.Chief complaint: Crown fracture during eating on #24
2.Sex/age: M/31
3.Past Medical/Dental History:
Crown fracture during eating due to caries on #24, two weeks ago
4.Present Illness:
Per(-), Pal(-), Mob(0), Cold test(+), EPT (12/64), Probing depth(333/333)
5.Impression: Caries of dentin on #24
6.Tx Plan: Nonsurgical root canal treatment on #24

III. Conclusion
The knowledge of root canal morphology and its frequent variations is a basic requirement for successful root canal procedures. Clinically, visualization of three-canalled maxillary premolars on preoperative radiographs can often be difficult. In straight-on radiographs of maxillary premolars, whenever the mesio-distal width of the mid-root image was equal to or greater than the mesio-distal width of the crown, the tooth most likely had three roots. When three canals are present, the external outline form becomes triangular, with the base on the buccal aspect. The mesiobuccal and distobuccal corners of the triangle should be positioned directly over the corresponding canal orifices. Therefore, clinicians should pay attention to the possibility of the presence of three-canalled maxillary premolars during diagnosis and evaluation.

***Keywords**: Three-canalled maxillary premolar, Maxillary premolar with three canals, Three-canalled premolar
***Presenting Author**: Se Yeong Han
Conservative Dentistry, KNUDH, Daegu, Republic of Korea, hsy5599@nate.com

C4-020

Treatment of complicated crown fracture by reattachment using fiber post: A case report

Esra Ulukoylu*, Ertugrul Karatas, Hakan Arslan
Endodontics, Ataturk University Department of Endodontics, Erzurum, Turkey

I. Objective
Trauma of anterior teeth is quite a common form of traumatic dental injuries that mainly affect the maxillary incisors in both children and adults. Complicated crown-root fractures are particularly challenging for esthetic and functional rehabilitation. Reattachment of fractured tooth fragments provides a feasible restorative alternative. The purpose of this case report was to present the management of a crown-root fracture by reattachment.

II. Case Presentations
A 17-year-old male patient was referred to dental clinic with a complicated crown fracture of the right permanent maxillary central incisor. Clinical and radiographic examinations showed that the fracture line extends subgingivally. The fractured fragment was temporarily removed and left in salin solutions. Following access cavity preparation, the root canal was shaped using a Reciproc (40) file (RPC; VDW, Munich, Germany) and irrigation was performed with 1% NaOCl during instrumentation. Calcium hydroxide paste was placed into the root canal and the patient was recalled after 1 week for obturation. After one week, the tooth was asymptomatic Final obturation was carried with gutta-percha points and AH plus paste (Dentsply, Maillefer, Switzerland). After root canal obturation, and fractured fragment was fixed by fiber-reinforced composite posts.

III. Conclusion
The advantages of reattachment procedure are, less time-consuming; aesthetic properties of the tooth, contour, color and translucency remain the same; the emotional and social response from the patient is highly positive.

***Keywords**: Crown-root fracture, Reattachment, Trauma
***Presenting Author**: Esra Ulukoylu
Endodontics, Ataturk University Department of Endodontics, Erzurum, Turkey, ulukoyluesra@gmail.com

C4-021

Endodontic management of traumatic teeth with open apex and wronged treatment by illegal dental technician using MTA

Fresynandia Karyneisa Putri*, Dian Agustin Wahjuningrum
Conservative Dentistry, Airlangga University, Surabaya, Indonesia

I. Objective
Open apex is usually caused by traumatic incident and it happening in patient at young age. Endodontic treatment of mature teeth with necrotic pulps and open apex involves induction on apical closure by apexification procedure, to create optimal results for conventional endodontics. Calcium Hydroxide is a golden treatment for apexification in Indonesia, but there are many disadvantages. MTA is known as a material that provide good biocompabilty and formation of hydoxyapatite.

II. Case Presentations
A 25-year-old female patient came to Clinic of Conservative Dentistry of Airlangga University with the complain of discoloritation on first incisive, and pain on percussion. The radiographic examination showed there was a large filling using self-cured acrylic performed by illegal dental technician, large root canal, open apex and radiolucency at the periapical area. The apexification procedure is isolation using rubber dam, Acces Opening, working length determinatation using apex locator, Debridement using Circumferential filing motion using K-file Ni-Ti no 70, irrigation using saline, dressing using $Ca(OH)_2$, on second visit operator performed apexification using MTA, the procedure are irrigation using saline, dried with paper point, placing the MTA using MAP one around 3-4 mm in apical, obturation with thermoplasticized techniques, used fabricated metal post and all porcelain crown for final restoration. After six months follow up radiographically there was reduction in size of periapical lession. The patient had no complaints.

III. Conclusion
MTA is become the material that demonstrated good biocompability, ability to seal, and its high pH may impart some antimicrobial properties compared than Calcium Hydroxide in Apexification Treatment.

***Keywords**: Traumatic teeth, Open apex, MTA
***Presenting Author**: Fresynandia Karyneisa Putri
Conservative Dentistry, Airlangga University, Surabaya, Indonesia, fresyputri@gmail.com

C4-022

The aesthetic complex treatment for multiple caries with occlusion restoration

Latief Mooduto[*], Fredline C, Dian Agustin Wahjuningrum
Department of Conservative Dentistry, Universitas Airlangga, Surabaya, Indonesia

I. Objective
The teeth damaged by caries usually cased by microorganism (streptococcus mutan). This impact of the damaged front teeth very take effect on someone's appearance, especially with x bite occlusion with patient's complaint caries with pain. The purpose of this case report is present the complex treatment of the multiple in front caries with malocclusion are aesthetic complex treatment.

II. Case Presentations
This paper reported a 18-year-old girl. Diagnosed for these teeth were 11; 22 necrosis; 11; 21 pulpitis. Dental radiographic of 22 is periapical abscess.

Case management: The aesthetic complex treatments are: root canal treatment for all four teeth, and the preparation technique are crown down pressure less, with single cone obturation. The restoration is porcelain crown with fabricated pin. The result of treatment is very significant and the patient was satisfied and no more complaints.

III. Conclusion
This treatment for multiple visit and the restoration with inclination restore for upper front teeth are aesthetic complex treatment. This will help to improve aesthetic outcomes for the patient.

***Keywords**: Caries, Root canal treatment, Aesthetic complex, Porcelain restoration
***Presenting Author**: Latief Mooduto
Department of Conservative Dentistry, Universitas Airlangga, Surabaya, Indonesia, latief-m@fkg.unair.ac.id

Management of third molar teeth from an endodontic perspective

Shekhar Bhatia[*1], Michelle Anne Leong[2]
[1]Clinical Dentistry, International Medical University, Kuala Lumpur, Malaysia, [2]Dentistry, Klinik Pergigian Bandar Mas, Johor, Malaysia

I. Objective
Third molar teeth are subjected to many dental difficulties because of their location, unusual occlusal anatomy and unusual eruption patterns. Due to these limitations, their extraction remains the treatment of choice for many dentists. Regardless of being a common dental practise, minimum intervention and retaining every functional component of the dental arch are of main importance in modern dental practice. As such, this case report aims to discuss the application of this conservative approach on third molar teeth from an endodontic perspective.

II. Case Presentations
This paper reports two cases, one of which is left mandibular third molar with difficult access and severe curved roots and the other one right mandibular third molar with dilacerated mesial root. In both cases the teeth were important from functional point of view as opposing teeth were present. Managing difficult access, severe curvature with proper glide path management and use of NiTi instruments, disinfection protocol, followed by obturation and final restoration will be discussed.

III. Conclusion
Performing root canal therapy on a third molar is always challenging. A thorough knowledge of root canal anatomy and its variations, careful interpretation of the radiograph, close clinical inspection of the floor of the chamber, proper modification of access opening, patient compliance and patience on the part of the operator are essential for a successful treatment outcome to avoid the occurrence of serious complications due to anatomical challenges.

***Keywords**: Endodontics, Mandibular third molar, Root canal morphology
***Presenting Author**: Shekhar Bhatia
Clinical Dentistry, International Medical University, Kuala Lumpur, Malaysia, drshekharbhatia@gmail.com

C4-023

C4-024

Endodontic treatment and esthetic rehabilitation of anterior maxillary teeth with periapical lesions

Ervita Kholestyana[*]
Medical Staff in Kanujoso Djatiwibowo Hospital, Balikpapan, Indonesia

I. Objective
The restoration of endodonticaly treated teeth is one of the most challenging situation in the clinical practice, because it involves procedures related several areas, such as endodontic, operative dentistry, and prosthetic. The prognosis depends not only on the success of the endodontic treatment, but also on the definitive restoration that will be placed onto the tooth.

II. Case Presentations
A 26-year-old male presented for treatment of the anterior maxillary teeth that had been restored in the past with inadequate acrylic crowns. The radiograph shown that periapical lessions appear. The periodontal treatment plan included mechanical debridement and the gingival management to improve gingival contouring. Root canal treatment was indicated for four maxillary incisors. The size of periapical radiolucencies decreased and lession remission occured after root canal obturation. The endodontically treated teeth received a fiber post in the prepared canal space and the crown buildup was done with composite resin.Prosthetic rehabilitation was done with single-unit-ceramic-crowns. Clinical and radiographic evaluation after 6 months showed succesful result.

III. Conclusion
This case showed that chronic periapical lessions can respond favorably to nonsurgical endodontic treatment and that, with proper indication, fiber post can provide an effective conservative and esthetic option for reinforcing endodontically treated teeth undergoing crown prosthetic rehabilitation.

***Keywords**: Periapical lesions, Endodontic treatment, Fiber post, Ceramic crown
***Presenting Author**: Ervita Kholestyana
Medical Staff in Kanujoso Djatiwibowo Hospital, Balikpapan, Indonesia, kholestyana@yahoo.com

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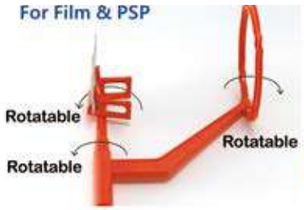

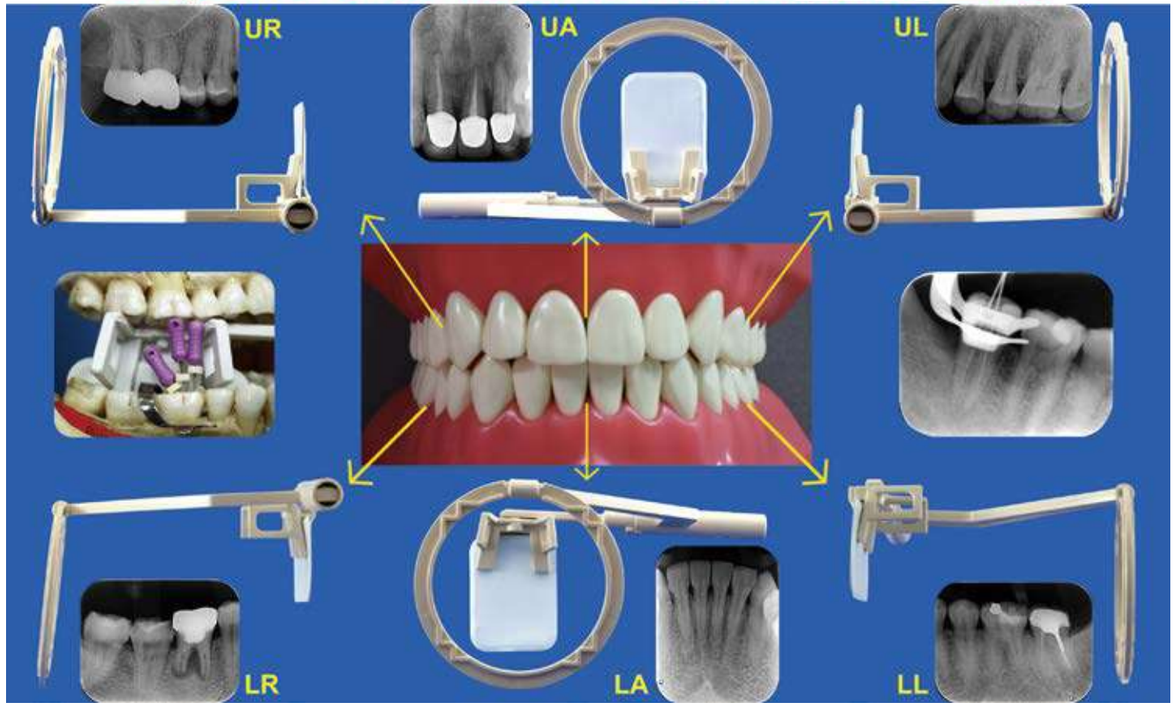

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