Tailor's Bunion: Clinical Evaluation and Correction by Distal Metaphyseal Osteotomy with Cortical Screw Fixation

Fifth metatarsal distal metaphyseal osteotomy represents a very common surgical procedure performed for tailor's bunion deformity. The authors advocate using a cortical bone screw for fixation device offers many advantages over conventional devices (i.e., Kirschner wire). The purpose of this paper is to offer a means to thoroughly evaluate tailor's bunion deformity clinically, biomechanically, and radiographically. This will allow the podiatric surgeon to choose a procedure of choice to correct the deformity. The technique of fifth metatarsal distal metaphyseal osteotomy with cortical bone screw fixation using AO[4] principles is fully described.

Jared P. Frankel, DPM, FACFS[1]
Robert M. Turf, DPM, FACFS[2]
Brian A. King, DPM[3]

Tailor's bunion may represent a combination of factors producing a symptomatic deformity. This may include hypertrophy of soft tissue overlying the fifth metatarsophalangeal joint (MPJ), congenitally enlarged or dumbbell-shaped fifth metatarsal head, or an abnormal lateral angulation of the fifth metatarsal head (1). The fifth ray is a complicated biomechanical complex. A hypermobile fifth ray is associated with a whole host of other biomechanical abnormalities in the foot. There is often associated hallux abducto valgus deformity, and adduction of the first metatarsal. There is also associated metatarsalgia of the lesser metatarsals.

The exact etiology of tailor's bunion is unknown. According to Gray (2), the cause is due to malinsertion or lack of insertion of the transverse adductor hallucis to the fifth MPJ. There may also be an absence of deep transverse metatarsal ligament. This will aid in the fifth metatarsal to splay in abduction. Another cause may include a supernumerary ossicle on the lateral aspect of the fourth metatarsal (3). This will push the fifth metatarsal laterally, exposing the head to trauma. Pressure exerted on the lateral aspect of the fifth metatarsal head similar to that of sitting like a tailor will result in shoe irritation to the fifth MPJ, resulting in hypertrophy and inflammation.

Biomechanics plays a primary role in the development of tailor's bunion deformity. Specific foot types and hypermobile pronating syndromes aid in the deforming forces going through the foot. Abnormal subtalar pronation, forefoot varus and congenital dorsiflexed fifth ray are some examples. Excessive subtalar joint pronation unlocks the midtarsal joint and, in turn, causes unlocking of the fifth ray. The vertical ground reactive forces push the fifth ray into dorsiflexion, abduction, and eversion. A patient with a congenital dorsiflexed fifth ray will subsequently develop as a dorsilateral tailor's bunion.

The fifth ray moves in a direction of supination and pronation. Its axis is of a triplanar nature. The axis itself extends in an inferior lateral to superior medial direction (Fig. 1). The amount of frontal and sagittal plane motion is large in contrast to the small amount of transverse plane motion available as the fifth ray supinates and pronates. All three planes of motion are, however, quite significantly large in a symptomatic deformity.

Splayfoot deformity may be attributed to lack of the transverse pedis muscle insertion into the fifth MPJ or its loss of function (4). The resultant lack of stability of the fifth ray in the transverse plane causes pronation of the fifth ray and resultant tailor's bunion. Excessive subtalar joint pronation at propulsion results in instability of the fifth ray and resultant splaying. Splaying of the foot is also secondary to subluxation occurring at adjacent rays two through four (4). No single etiologic factor is responsible for tailor's bunion. Biomechanics,

From the Department of Podiatric Surgery, Leyden Community Hospital, Northlake, Illinois.
[1] Diplomate, American Board of Podiatric Surgery, Residency Director.
[2] Diplomate, American Board of Podiatric Surgery.
[3] Submitted during first year residency. Address correspondence to: 365 E. North Avenue, Northlake, Illinois 60164.
[4] Association for Osteosynthesis.
0449/2544/89/2803-0237$02.00/0

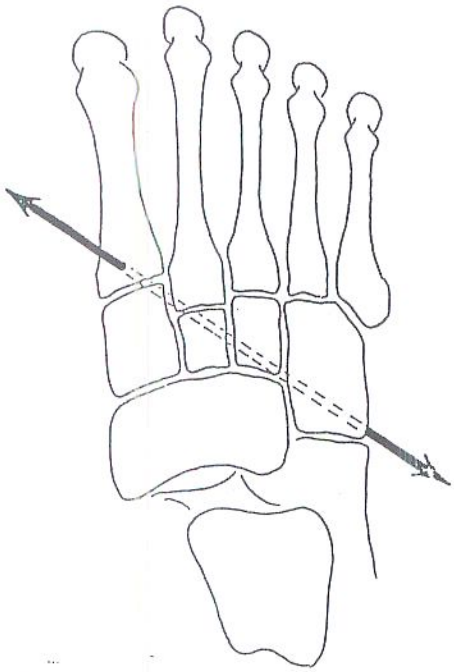

Figure 1. Axis of the fifth ray. Triplanar motion occurs about the axis with pronation and supination of the fifth ray. (Redrawn by permission from Root, M.L., *et al*, *Normal and Abnormal Function of the Foot*, vol. 2, Clinical Biomechanics, Los Angeles, 1977 (4).)

congenital anomaly, and developmental factors all play a role in its cause.

Historic Overview

Hohman (5) advocated transverse osteotomy of the fifth metatarsal neck with medial transposition of the capital fragment. McKeever (6) removed the lateral bony exostosis but recurrence of the deformity developed. An analogy can be made with hallux abducto valgus deformity. Merely staking the first metatarsal head is a poor procedure if structural correction of the ray is required (*i.e.*, high intermetatarsal angle). McKeever also advocated excising the head of the fifth metatarsal for tailor's bunion deformity. The authors do not espouse this procedure. The rate of transfer lesions is high. A painful plantar spur may result from the resected portion of the bone. Postoperatively, the fifth digit may retract dorsally, leaving a cosmetically poor result as well as loss of plantar purchase of the digit. All efforts to maintain a functional fifth ray and joint should be attempted.

DuVries (1) believed a key factor in the development of tailor's bunion was the lateral bowing of the fifth metatarsal. The authors believe that most of the bowing of the fifth ray is actually due to eversion of the fifth metatarsal. The concave plantar surface becomes more apparent laterally with excessive eversion. This is noted radiographically.

Clinical Findings

Patients with tailor's bunion deformity generally complain of discomfort and irritation over the dorsilateral aspect of the fifth metatarsal head. There may be a mild plantar tyloma and rarely an intractable plantar keratosis beneath metatarsal five. Conventional shoegear, with an enclosed toebox, will aggravate the condition. Patients find relief with open-toed shoes or sandals. Irritation to the fifth metatarsal head results in adventitious bursa formation and inflammation. The area is red, tender, and painful. Associated with the tailor's bunion is a fifth digit positioned in varus or adducto varus. A heloma durum is often observed at the proximal interphalangeal joint of the digit or the distolateral aspect. An interdigital soft corn may occasionally be found between toes four and five. This is due to excessive pressure placed on the head of the fifth proximal phalanx abutting the base of the fourth proximal phalanx.

The motion of the fifth ray should be evaluated and compared to the adjacent rays. The fifth ray should be evaluated both weightbearing and nonweightbearing. A differentiation between a splay foot and an isolated tailor's bunion should be noted. This can be addressed on weight-bearing dorsoplantar radiographs. A widening of all metatarsal interspaces will be noted in a splayfoot. An isolated tailor's bunion will only show splaying of the fifth ray.

The lesion pattern is also a clinical indicator for corrective evaluation. The tailor's bunion will present with a dorsolateral bursa and lateral plantar lesion about the fifth MPJ. If a patient presents with a painful fifth metatarsal lesion plantarly, this is not a tailor's bunion, but rather a plantarflexed metatarsal concomitant with a cavus foot. The two types of deformities must be distinguished for proper surgical correction.

Corrective Evaluation

Many parameters must be considered for proper correction in evaluating the bunionette deformity. Such parameters to be discussed are intermetatarsal angle, lateral bowing of the fifth metatarsal, and positional effects on the fifth ray. These factors should be identified and scrutinized so that a surgical procedure of choice may be defined.

Intermetatarsal Angle

The angle formed from the bisection of the fourth and fifth metatarsals produces an intermetatarsal angle. A problem exists because of variation in the structural shape of the fifth metatarsal. A wide base or lateral bowing makes it difficult to define the correct axis of the metatarsal. There is one portion of the fifth metatarsal that exhibits little anatomic variation. This is the proximal medial surface of the metatarsal (Fig. 2). A line drawn parallel to this may represent the bisection of the fifth metatarsal. The angle formed with the bisection of the fourth will create an intermetatarsal angle. According to a study done by Fallat and Bucholz (7), the normal intermetatarsal angle was determined to be 6.47 degrees, with a range of 3 to 11 degrees. Tailor's bunion deformity may range from 3 to 15 degrees with an average of 8.71 degrees.

The position of the whole foot has a significant effect on the intermetatarsal angle. Subtalar joint pronation produces an unlocking effect on the fifth ray. Eversion, abduction, and dorsiflexion of the fifth metatarsal occurs. This increases the angle by 3 degrees.

Lateral Bowing

Lateral bowing of the fifth metatarsal is almost always noted in tailor's bunion deformity. The bowing occurs at the distal one third of the bone, neck, and midshaft. Two lines to form an angle (Fig. 3) are as follows: 1) the bisection of the fifth (*i.e.*, a line parallel to the proximal medial surface of the fifth metatarsal), 2) and a line formed from the bisection of the head and neck of the fifth metatarsal. This second line will capture any lateral bowing occurring in the distal portion of the bone. The angle formed is called the lateral deviation angle. It represents a structural lateral bowing in the fifth metatarsal longitudinal axis. Normal values may range from 0 to 7 degrees (average 2.64 degrees). Those with a tailor's bunion may range from 0 to 16 degrees (average 8.5 degrees) (7).

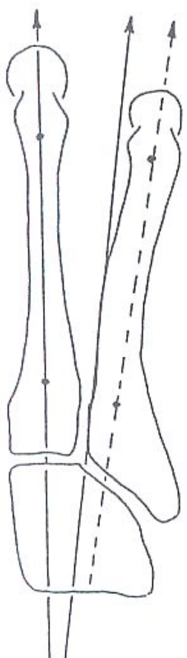

Figure 2. Intermetatarsal angle between metatarsals four and five. The *dashed line* represents the classical means of bisecting the fifth metatarsal, which will be inaccurate due to structural variation. A line parallel to the proximal medial surface is a far more constant parameter to use for measurement (*solid line*).

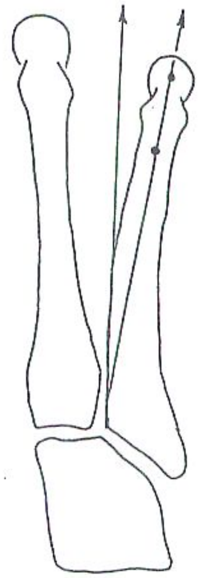

Figure 3. Lateral deviation angle. The two lines that form the angle are the proximal medial surface of the shaft of the fifth metatarsal and the bisection of the head and neck. The angle formed will capture lateral bowing in the distal aspect of the bone.

The position of the foot as a whole will change the lateral deviation angle. As the foot pronates, an increase in eversion in the fifth ray is observed (also an increase in dorsiflexion and abduction). It is interesting to note that an increase in lateral bowing was not observed with increased eversion of the fifth metatarsal as one might expect (7). The bowing is primarily in the distal third of the bone. This will show a relatively small arc of lateral bowing on dorsoplantar x-rays. It is the authors' opinion that an increase in this small arc cannot occur with eversion. If the arc was longer (*i.e.*, the whole shaft of the metatarsal), the arc would increase substantially with fifth metatarsal eversion. The fifth metatarsal head laterally may be quite prominent with a tailor's bunion, and a large flair at the neck will result in a defined lateral arc. Eversion would have minimal effect on this small arc.

The plantar lateral tubercle rotates laterally, with eversion of the fifth ray, and an increased intermetatarsal angle results. These two observations may lead one to think there is increased lateral bowing, but, in fact, these are only positional changes occurring. Lateral bowing of the fifth metatarsal is a structural bony deformity and will not change with position. Excessive eversion of the fifth ray brings the plantar concave surface into view. This creates the appearance of an increased lateral bowing, but it is only a visual artifact on the x-ray.

The hyperostosis noted on the lateral aspect of the fifth metatarsal head is a controversial entity. Many authors believe it is a bony hypertrophy, and continued shoe irritation makes the condition worse. The authors believe that the deformity stems from a dislocation of the fifth metatarsophalangeal joint similarly seen in hallux abducto valgus deformity at the first metatarsophalangeal joint. Hypermobility and lateral deviation of the fifth ray results from eversion/pronation from the subtalar joint and the midtarsal complex. An increase in the intermetatarsal angle is noted. The fifth metatarsal splays laterally and its corresponding digit deviates medially, dislocating the fifth metatarsophalangeal joint. The fifth metatarsal head is further exposed to trauma, irritation, inflammation and bursa formation, producing a symptomatic tailor's bunion.

The values obtained from the measured angles may aid in choosing a corrective surgical procedure. If an excessively high intermetatarsal angle exists, a base procedure may be considered. A high lateral deviation implies excessive structural bowing distal-lateral. A distal osteotomy procedure will be the choice in this case. It is the authors' opinion that mere resection of the lateral hypertrophied head is the least corrective. The deformity will return because the fifth metatarsophalangeal joint is still dislocated. This can be compared to performing solely a medial eminence resection of the first metatarsal head for severe hallux abducto valgus deformity with high intermetatarsal angle. The bunion will probably return. The structural deformity has not been corrected and the joint will continue to dislocate.

Distal Metaphyseal Osteotomy of the Fifth Metatarsal: Fixation Techniques

Means of fixation of fifth metatarsal osteotomies are numerous. Kirschner-wire fixation is probably the most popular. It offers excellent splintage and some compression. The downfall is the Kirschner wire is external to the skin, leading to possible skin irritation or pin tract infection. The pin may be buried subcutaneously, leaving the pin as an internal fixator. The Kirschner wire may be subsequently removed in the office through a small incision. Intramedullary nailing offers the same advantages as Kirschner-wire fixation, but with more compression (Fig. 4).

Monofilament wire, staple, and osteoclasp are also other means of possible fixation. They offer moderate splintage and are internal. Displacement of the osteotomy with weightbearing, however, is very likely. Compression across the osteotomy is minimal with these devices.

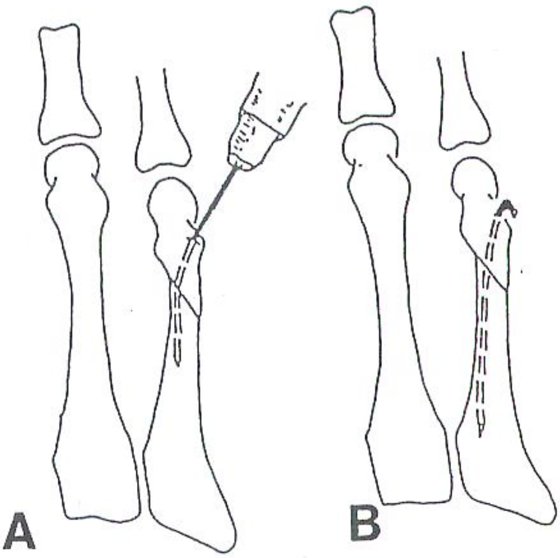

Figure 4. This figure depicts the technique of intramedullary nail fixation. A Kirschner wire is driven down the medullary shaft of the metatarsal. (*A*), the bending movement of the Kirschner allows for compression across the osteotomy site. The Kirschner wire may be left external or buried under the soft tissue. (*B*), redrawn by permission from McGlamry, E. D., *Comprehensive Textbook of Foot Surgery*, Williams & Wilkins, Baltimore, 1987 (8).

The authors believe cortical bone screw, using the lag technique, offers the best means of fixation for the fifth metatarsal distal metaphyseal osteotomies. The screw offers the highest level of compression possible. It is an internal fixator so there is no outside irritation or external opening for infection. Primary bone healing is accomplished along with predictable healing times. It offers the highest protection against weightbearing to prevent displacement of the osteotomy. This method, however, is not without complications. It may be the most difficult technically. The screw could undergo rotation and the osteotomy site could loosen. With excessive torque or shear stresses, the screw could fracture (Fig. 5). The screw could be placed obliquely across the osteotomy, bisecting the axis of the fifth metatarsal and the line of the bone cut (Fig. 6), to avoid this complication. The screw could also retrograde, making the fixation precarious. Shoe pressure could cause irritation over the screw head, requiring removal. By using the guides of AO fixation and careful dissection, these complications may be minimized.

Technique

A dorsolateral incision, approximately 3 to 4 cm., is performed over the head and neck of the fifth metatarsal. The wound is deepened through the subcutaneous elements and all bleeders are clamped and ligated as encountered. Using sharp and blunt dissection, the head

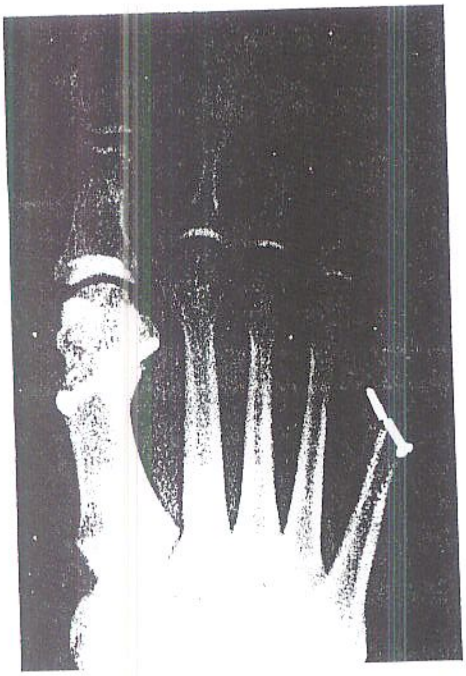

Figure 5. With excessive shear or torque forces placed on the screw, fracture could result.

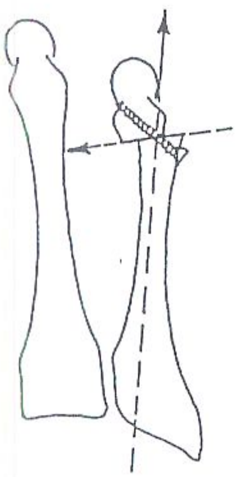

Figure 6. This diagram shows ideal placement of the screw. The screw should be placed obliquely across the osteotomy bisecting the axis of the metatarsal and the bone cut.

and neck of the fifth metatarsal is freed of all soft tissue attachments. The periosteum is then reflected off the neck of the metatarsal. An osteotomy is performed with an oscillating saw. The cut is transverse across the metaphyseal flair of the metatarsal. The cut is made perpendicular to the longitudinal axis of the fourth metatarsal (Fig. 7), or it may be obliqued distal lateral to proximal medial to allow for shortening of the fifth metatarsal. The capital fragment is transposed medially and/or plantarly. Temporary fixation is accomplished with a 0.045-inch Kirschner wire from proximal lateral to distal medial, across the osteotomy site. A 2.0-mm.

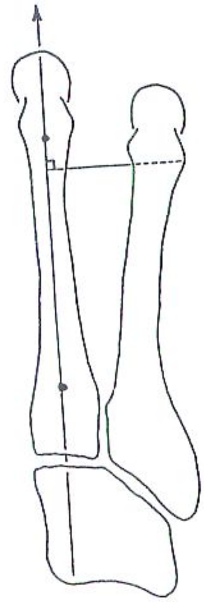

Figure 7. The osteotomy is performed transversely at the metaphyseal flair of the fifth metatarsal. A line perpendicular to the longitudinal axis of the fourth metatarsal is used as a guide for the osteotomy cut.

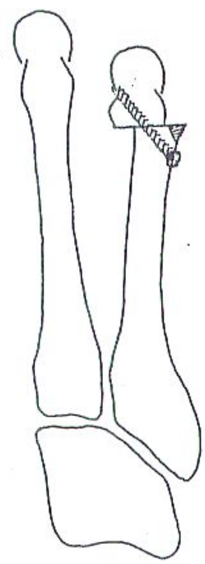

Figure 8. A 2-mm. cortical screw is driven across the osteotomy from proximal lateral to distal medial in a lag fashion to accomplish rigid fixation.

overdrill hole is drilled in the proximal cortex, followed by a 1.5-mm. distal drill hole. The screw entrance site is countersunk and measurement of the screw length is performed. The distal hole threads are cut with a 2.0-mm. tap. The screw is then inserted across the osteotomy site from dorsal proximal lateral to plantar distal medial (Fig. 8). The 0.045-inch Kirschner wire is then removed and a final quarter turn of the screw is performed. The wound is irrigated of all osseous debris.

Deep closure is accomplished with 3-0 Dexon[5] suture. Final skin closure may be facilitated by 5-0 nylon or subcuticular absorbable suture.

The capital fragment may be medially or medially and inferiorly transposed. Never is the fragment dorsally transposed. The inherent shortening from the osteotomy itself reduces weightbearing through the fifth metatarsal. This obviates the need to dorsally transpose the capital fragment.

The choice of which type of movement depends on the deformity. The hypermobile fifth ray generally has no plantar metatarsal five lesion. The fifth ray dorsiflexes and everts with gait. Irritation is on the dorsolateral aspect of the fifth metatarsal head, with lack of weightbearing purchase through the fifth ray. Often one may note an adjacent lesion beneath metatarsal four. Under this scenario, increased weightbearing through the fifth metatarsal is desirable. The capital fragment, therefore, is transposed plantar-medial, and rigidly fixated with a cortical bone screw. The amount of plantar transposition is approximately 2 to 3 mm. This plantar transposition is a key point. It allows for increased weight-bearing force through the fifth ray. Less weight is placed on the fourth metatarsal. The submetatarsal four lesion will then disappear with time. The medial transposition is obviously necessary to correct for lateral splaying of the fifth metatarsal.

The amount of medial transposition of the capital fragment should be approximately one third the width of the metaphyseal flair of the fifth metatarsal. If greater (*i.e.*, 50% to 60%), less bone-to-bone surface contact results. This could lead to osteotomy displacement and subsequent dorsal dislocation. Another sequelae could also form. Excessive medial transposition could allow the capital fragment of the fifth metatarsal and fifth proximal phalanx to abut the adjacent base of the fourth proximal phalanx. A heloma molle may then result (Fig. 9).

If the fifth metatarsal is in a plantarflexed rigid position, a submetatarsal five lesion is likely to be noted. The capital fragment is then transposed medially only, and rigidly fixated. The fragment is not plantarly transposed as in the hypermobile fifth ray. Increased weight through the fifth ray is not desired, so plantar movement of the capital fragment is avoided. Shortening of the fifth metatarsal will occur from the osteotomy cut itself, or from any obliqueness incurred while making the cut. This shortening, alone, will decrease weightbearing through the fifth ray. The plantar metatarsal five lesion disappears with time as weight-bearing force through the fifth ray is decreased.

The authors believe that at no time is dorsal transposition of the capital fragment indicated in distal metaphyseal osteotomies of the fifth metatarsal. The net result of such will likely lead to a submetatarsal four lesion, either symptomatic or asymptomatic (9). This is why performing the procedure without fixation is not advocated. The likelihood of a transfer lesion submetatarsal four is rather high, without fixation. The capital fragment will transpose dorsally to its new level. This will ultimately lead to increased weightbearing under the fourth metatarsal with subsequent lesion.

Figure 9. Postoperative radiograph demonstrating that the distal metaphyseal osteotomy performed on the fifth right metatarsal was transposed medially more than desired (50% to 60%). Hohmann and Akin osteotomy procedures were also performed with cortical screw fixation, bilaterally.

Keating *et al.*, (9) studied transfer lesions occurring beneath metatarsal four, following distal metaphyseal osteotomies of the fifth metatarsal, with no fixation. They reported a transfer lesion rate of 76%. But, if we considered the number of these lesions that were symptomatic, the new rate would be 36%. Regardless, the authors consider the percentage very high, and recommend mandatory fixation. Using rigid fixation with a cortical bone screw, the capital fragment is never transposed dorsally. The movement is medial, plantar, or both.

Discussion

The authors intended to evaluate tailor's bunion thoroughly, in order to select the correct surgical procedure. A number of issues must be settled. Questions to be asked are: is the fifth ray hypermobile or plantarflexes?; is there a sub-fifth metatarsal lesion?; is there a lateral bowing defect or hypertrophic fifth metatarsal

[5] Davis & Geck Co., Pearl River, New York.

head?; and is the intermetatarsal angle between metatarsal rays four and five beyond normal?

The issues of whether the fifth ray is hypermobile and existence of submetatarsal five lesion are important considerations. If there is an absence of submetatarsal five lesion, with associated tailor's bunion deformity, this may indicate that the ray is hypermobile. The ray will dorsiflex and evert excessively during gait. Often, a diffuse submetatarsal four lesion results. Under these conditions, the capital fragment should be transposed medial-plantar. This will allow more weightbearing activity through the fifth ray axis. The foot will operate under improved biomechanical stability. The submetatarsal four lesion should also disappear. If there exists a submetatarsal five lesion, this indicates the fifth ray is in a rigid plantarflexed position. There is primarily a sagittal plane deformity. The fifth ray is not abducting and dorsiflexing as in the hypermobile fifth ray. This foot type may represent an uncompensated rearfoot or forefoot varus, flexible cavus, or rigid anterior cavus. Under these circumstances, the patient has a painful intractable plantar keratosis beneath metatarsal five. The head of the fifth metatarsal may be hypertrophic, and a lateral bowing defect may be present. This may resemble a tailor's bunion deformity, but of a rigid nature. Transposition of the capital fragment would, therefore, occur medially only. The authors would not move the capital fragment dorsally, as one would suspect. Due to shortening of the fifth metatarsal from the osteotomy cut, less weight will bear through the ray secondary to shortening. Transposition of the capital fragment dorsally would be an injustice because of a subsequent transfer lesion beneath metatarsal four.

If the head of the fifth metatarsal is hypertrophic, this usually will correct with medial transposition of the capital fragment. If the head of the metatarsal is excessively osteophytic, resection of the lateral eminence may be indicated. The authors believe this rarely needs to be performed. Similar to bunion surgery, too often the corresponding osteophytic medial eminence is over-emphasized, and resection is of minimal corrective importance. Concomitant with high or moderate intermetatarsal angles, or excessive lateral bowing defects, the authors believe that the deformity will recur with time, if lateral exostectomy is the only means of correction. Structural realignment of the fifth metatarsal by means of distal transposition osteotomy is the key to successful results. Hence, in general, the authors suggest that lateral eminence resection acts only as an ancillary procedure.

Discussion of high intermetatarsal angle between metatarsals four and five is probably more of academic consideration than practical importance. The distal metaphyseal osteotomy with cortical screw fixation will, for all practical purposes, correct the tailor's bunion deformity almost 100% of the time. It is conceivable that an excessively high intermetatarsal angle (*i.e.*, 16% to 17%) may be too large to allow the procedure to correct the deformity, but this is indeed rare. A closing adductory base wedge procedure of the fifth metatarsal is ideal in this instance. This, however, is quite amenable to fixation instability and subsequent fracture of the lateral cortex. There is constant threat of elevatus from a base procedure similarly seen with closing abductory base wedge osteotomy of the first metatarsal.

Summary

It is the intent of this manuscript to present a scientific method to correct tailor's bunion deformity. Extensive radiographic and clinical evaluation are to be performed. Definition of the foot type biomechanically and complete evaluation of forces influencing the fifth ray are important. Such parameters as intermetatarsal angle, lateral bowing defects, presence or absence of a submetatarsal five lesion, and fifth ray mobility are key parameters to define the deformity.

Different types of corrective osteotomies of the fifth metatarsal have been described previously for correcting tailor's bunion deformity. There are also many types of fixation. The authors submit that distal metaphyseal osteotomy of the fifth metatarsal with cortical screw fixation offers the highest level of correction, with minimal morbidity and complications. Distal metaphyseal osteotomies of the fifth metatarsal have a high potential for transfer lesion if no fixation is used. Using the described technique with cortical screw fixation, and correct capital fragment positioning, the rate of transfer lesions should be minimized.

Acknowledgments

The authors wish to thank Carl Ganio, DPM, for his talents as medical illustrator for this manuscript.

References

1. Duvries, H. L. *Surgery of the Foot*, 4th ed., pp 273–277, C. V. Mosby. 1978.
2. Gray, H. *Gray's Anatomy*, 36th ed., p. 616, W. B. Saunders, Philadelphia, 1980.
3. Lelievre, J. L'exostose de la 5 tete metatarsienne. LeConcours Med. 78:4815–4816, 1956.
4. Root, M. L., Orien, W. P., Weed, J. H. *Normal and Abnormal Function of the Foot*, vol. 2, pp. 249–250, 425–442, Clinical Biomechanics Corp., Los Angeles, 1977.
5. Hohman, G. *Fuss and Bein*, pp. 145–192, J. F. Bergman, Muenchen, 1951.
6. McKeever, D. C. Excision of the fifth metatarsal head. Clin. Orthop. 13:321, 1959.
7. Fallat, L., Bucholz, J. An analysis of the tailor's bunion by radiographic and anatomical display. J. A. P. A. 70:597–603, 1980.
8. McGlamry, E. D. *Comprehensive Textbook of Foot Surgery*, 1st ed., vol. 1, pp. 114–131, Williams & Wilkins, Baltimore, 1987.
9. Keating, S. Oblique fifth metatarsal osteotomy: follow-up study. J. Foot Surg. 21:104–107, 1982.