CHAPTER 7

TAILOR'S BUNIONS

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INTRODUCTION

Tailor's bunion, sometimes called the bunionette, is an often painful condition affecting the lateral aspect of the fifth metatarsal head. Painful symptoms often occur due to constricting shoe-gear more commonly worn by women. In some instances, an inflammatory bursa can form.

The name Tailor's bunion was derived from the fact that tailors sat in a crossed-legged fashion on the floor when performing their work putting pressure on the lateral side of the forefoot, particularly the fifth metatarsal head, causing symptoms in that area.

ETIOLOGY

The reported etiology of the tailor's bunion has varied greatly over the past 60 years. While it is evident that there is not a specific cause of tailor's bunions, the etiology may be split into two broad categories, structural and biomechanical.

In 1949, Davies believed that the tailor's bunion was due to splaying of the fifth metatarsal in embryonic development. He believed that there was incomplete or imperfect development of the transverse metatarsal ligament. This allowed the fifth metatarsal to abduct and become more prominent.[1] Dickson and Diveley thought the cause of the tailor's bunion was pressure and friction of shoes against a prominent fifth metatarsal head tuberosity. They also noted that bunionettes are seen in splayfoot, flatfoot and outward deviation of the metatarsal.[2]

LeLievre believed that there were three causes of tailor's bunions. One cause was a supernumerary bone lateral to the fourth metatarsal that pushes the fifth metatarsal laterally. Another cause was a wide intermetatarsal angle created by spreading of the fourth and fifth metatarsals. Finally, LeLievre thought that cross-legged sitting put pressure of the lateral side of the fifth metatarsal head.[3]

DuVries also thought that a bunionette was caused by one or a combination of three conditions. He believed that there was hypertrophy of the soft tissue over the fifth metatarsophalangeal joint. Additionally there was a congenitally wide, dumbbell-shaped fifth metatarsal head. Finally there was lateral bending of the fifth metatarsal caused by retrograde pressure from the fifth toe due to restrictive shoe gear, which DuVries believed was most common.[4] Both Brown and Wu also believed that tight shoe-gear caused pressure on the lateral side of the fifth metatarsal head and contributed to the development of tailor's bunions.[5,6] Yancey and Sgarlato published lateral bowing of the fifth metatarsal as a cause of tailor's bunions.[7,8]

Gray believed that a mal-insertion or lack of insertion of the transverse division of the adductor hallucis muscle belly into the fifth metatarsophalangeal joint was responsible for a tailor's bunion deformity. Gray also cited an absence of the deep transverse metatarsal ligament as a potential cause.[9] Leach and Igou proposed in 1974, prominent lateral condyles of the fifth metatarsal head as well as an angular deviation between the fourth and fifth metatarsals as a potential cause of the symptomatic tailor's bunion.[10]

Frascone proposed polymetatarsia as a possible etiology for tailor's bunion deformities. In 1994 he described a case report of a Y-shaped fourth metatarsal head that caused lateral deviation of the fifth metatarsal, leading to the development of a tailor's bunion.[11]

In 1953, Hicks described the biomechanics of the fifth ray and felt that excessive abduction irritates the fifth metatarsal head in shoes.[12] Sgarlato expanded upon this by describing "subluxatory pronation" of the fifth ray with pronation of the subtalar joint and the midtarsal joint.[8]

In 1977, Root listed many of the biomechanical abnormalities that could result in the formation of a tailor's bunion. These included abnormal subtalar joint pronation, uncompensated forefoot and rearfoot varus in a fully pronated foot, a congenitally plantarflexed fifth ray, and idiopathic. He went on to explain that the idiopathic model may be due to the absence of the transverse head of the adductor hallucis muscle belly inserting into the fifth metatarsophalangeal joint.[13]

Buchbinder supported a biomechanical cause in 1982. He went on to state that the lateral or plantar fifth metatarsal head condyle exostosis could be caused by a traction enthesiopathy or by chronic pressure induced irritation. He also further stated that with pronation of the fifth ray, there is rotation of the fifth metatarsal. This rotation causes a plantar grade displacement of the abductor digiti quinti muscle in addition to the apparent lateral bowing of the metatarsal. This displacement causes an altered axis of muscle pull, leading to adductovarus rotation of the fifth toe. This causes an increased in the retrograde force onto the metatarsal, causing further abduction.[14]

In 1989, Frankel also agreed with the biomechanical etiology. He additionally cited vertical ground reaction forces that accentuate fifth ray pronation and lead to the development of a bunionette.[15] Also in 1989, Steinke and Boll believed that neuromuscular disorders that result in a rigid cavus or cavo-varus forefoot posture could lead to bunionette formation.[16]

Diebold reported that trauma at the fifth metatarsophalangeal joint that ruptured the collateral ligaments could lead to tailor's bunion deformity.[17] Both Wu and Diebold believed that the rheumatoid foot with hyperpronation and insufficiency of the intermetatarsal ligament were predisposed to development of the bunionette deformity.[6,17]

Figure 1. Clinical appearance of tailor's bunion.

CLINICAL PRESENTATION

The patient that presents with a symptomatic tailor's bunion deformity will most often have pain dorsolaterally, laterally and/or plantar to the fifth metatarsal head, which is often prominent. The patient will relate worsening symptoms with constrictive shoe-gear, which are the main source of discomfort according to DuVries.[4] There may be an adventitious bursa overlying the bony prominence with associated edema and erythema. If the bursa is inflamed, there may be severe tenderness upon palpation (Figures 1, 2).

Figure 2. Tailor's bunion with inflamed bursa.

There may be a secondary hyperkeratotic lesion over the prominence caused by chronic irritation and/or pressure. This hyperkeratotic lesion, according to Yancey, is most commonly found on the lateral aspect, followed by a plantar lesion, then followed by the combination of plantar and lateral lesions.[7] Fallat reported in 1990 that a heloma molle may be present between the fourth and fifth toes and that the fifth toe may be adducted and rotated in a varus position.[18] There may be a hyper-keratotic lesion overlying the proximal interphalangeal joint dorsolaterally or distally on the digit lateral to the nail border (Lister's corn) (Figure 3).

Figure 3. Hyperkeratotic lesion associated with adductovarus fifth toe.

There have been several reports of age and sex predominance. Buchbinder reported a female to male ratio of 3:1 in a patient population ages 14 to 67. He also reported that 30% of cases were bilateral.[14] Wu reported a female to male ratio of "at least" 10:1 and Nestor reported the ratio to be 3.8:1.[6,19] In 1989 Steinke and Boll reported a series of 27 patients, which included 22 women and 5 men. The patient's average age was 28 with a range of 16 to 57. The authors noted that ten of the patients were younger than 20 years old.[16] Diebold and Bejjani reported a ratio of 1:1 in a study of 12 patients with an average age of 35. They also noted that the peak incidence was in the fourth to fifth decades of life.[17]

In 1985, Thul reported a case in which he discovered a traumatic neuroma intra-operatively while correcting a tailor's bunion. He described the neuroma as being located on the proper digital nerve on the plantar lateral aspect of the fifth metatarsophalangeal joint.[20] Additionally, some patients may present with neuritis due to the pressure caused by the head of the metatarsal impinging on the proper digital nerve of the fifth toe.

RADIOGRAPHIC PRESENTATION

The radiographic evaluation is a vital portion of the examination of a tailor's bunion deformity. Standard dorsoplantar and lateral weightbearing radiographs should be obtained. Medial oblique and lateral oblique views may be obtained to evaluate the plantar lateral and plantar medial condyles, respectively. Nonbiomechanic causes for the lateral prominence, such as fracture, tumor, etc., should be ruled out. In general, a sesamoid axial view is not necessary because it provides little additional information. After other causes for the bunionette deformity have been excluded, evaluation of the position of the fifth metatarsal may proceed.

In 1973, Schoenhaus reviewed 243 nonweightbearing radiographs and determined the intermetatarsal angle between metatarsals four and five (IM4) in normal patients between 20 and 50 years old to be 8°. However, the paper did not mention how they measured this angle.[21]

In 1980, Fallat and Buckholz developed a method to more accurately measure the IM4 angle. In order to do this, they measured the medial proximal portion of the fifth metatarsal shaft in respect to the bisection of the fourth metatarsal. They determined that the average normal angle using this measurement technique was 6.47°, with a range of 3 to 11°. They determined that the average IM4 angle in patients with tailor's bunions was 8.7° (Figure 4).[22] Nestor determined in 1990 that the average IM4 angle was 10.8° in symptomatic bunionettes versus 9.1° in a control group.[19] Coughlin described his average preoperative IM4 angle as 10.6°, which was decreased to 0.8° postoperatively.[23] However, Coughlin measured his IM angle differently than Fallat and Buckholtz described. He simply bisected points in the base and surgical neck of the metatarsals in order to create his axes for measurement.

Fallat and Buckholz also recognized that the lateral bowing angle is a significant cause of tailor's bunions and developed a method with which to measure it. This method involves a bisection of the articular surface of the head and a bisection of the neck of the fifth metatarsal. A line drawn from these bisections will intersect the line drawn parallel to the proximal medial portion of the fifth metatarsal. They determined this angle was normally 2.64°, with a range of 0 to 7°. In the presence of a bunionette deformity, this angle increased to an average of 8.05° (Figure 5).[22] Nestor determined the lateral deviation angle to be 2.4° in both the symptomatic and the control groups.[19]

Nestor also measured the width of the fifth metatarsal head at its widest point and found that it was the same between symptomatic and asymptomatic feet with tailor's bunions, 14.2 mm. However, this was larger than the control group, which was determined to be 13.2 mm. He also measured the fifth metatarsal neck width, which was determined to be 7.5 mm in the symptomatic group versus 7.0 mm in the control group. However, the 5th metatarsal head to neck ratio was not significantly different between the symptomatic and control groups. Nestor did find that the symptomatic group's forefoot width was significantly larger than the control group, 92.5 mm and 86.8 mm, respectively.[19]

Figure 4. The two means of assessing the intermetatarsal angle between the fourth and fifth metatarsals. Angle ABD represents the traditional method, bisecting the shafts of the respective metatarsals. Angle ABC represents the method recommended by Fallat, with the medial shaft of the fifth metatarsal identified.

In 1989, Steinke and Boll proposed a value that they called the fifth metatarsal head prominence. This was measured by drawing a line parallel to the lateral fifth metatarsal shaft and one parallel to the fifth metatarsal head. The distance between these lines is the metatarsal head prominence and was determined to be on average 4 mm (range 2-9 mm) in their preoperative tailor's bunion patients.[16]

Nestor also measured the fifth metatarsophalangeal joint deviation angle by determining the angle formed by the bisection of the fifth metatarsal and the proximal phalanx. They determined this angle was 10.2° varus in normal feet and 16.6° varus in symptomatic feet with tailor's bunions.[19] Coughlin reported that his average metatarsophalangeal joint angle was 16° in his pre-operative tailor's bunion patients. This value was reduced to 0.5° postoperatively.[23]

Crawford described a method to determine where the apex of the deformity is located within the fifth metatarsal. A bisection of the fifth metatarsal base and the fifth metatarsal head are drawn. Next a line is drawn perpendicular to the bisections. The site where the lines meet indicates the point of greatest deformity of the fifth metatarsal.[24]

In their paper in 1980, Fallat and Buckholz proposed six different patho-anatomical types of tailor's bunions.[22] These were 1) Rotation of the lateral plantar tubercle into a lateral position (Figure 6); 2) An increased IM angle (Figure 7); 3) An increased lateral deviation angle (Figure 8); 4) A large round dumbbell shaped 5th metatarsal head; 5)Arthritic changes resulting in exostosis formation at the fifth metatarsophalangeal joint; and 6) Any combination of the above conditions with the first three being the most common.

Coughlin also proposed a classification system in 1991, based on weight-bearing radiographic findings. He described three types defined as: 1) large head, 2) metaphyseal-diaphyseal flare or deviation, and 3) enlarged 4-5 intermetatarsal angle.[23]

SURGICAL TECHNIQUE

The patient is placed supine on the operating table with a bump under the ipsilateral hip. An ankle or calf tourniquet may be used for hemostasis if desired. Alternatively, the surgeon may utilize local anesthetic with epinephrine to achieve hemostasis. The relevant surface anatomy is identified, including the fifth metatarsophalangeal joint, extensor tendon, abductor digiti minimi, lateral dorsal cutaneous nerve and the borders of the fifth metatarsal (Figures 9, 10).

A longitudinal dorsolateral incision is made through the skin. Care must be taken to ensure that adequate exposure to the fifth metatarsophalangeal joint, and the fifth metatarsal to the level that the osteotomy, will be achieved. The incision is carried through the subcutaneous tissue with sharp and blunt dissection (Figure 11). There are many tributaries to the lateral marginal vein overlying the fifth metatarsal and care must be taken to ligate or electro-coagulate any vessels encountered that interfere

Figure 5. Lateral deviation angle as described by Fallat is represented by the angle ABC.

Figure 6. Type 1-Radiograph of rotation of the plantar tubercle into a lateral position.

Figure 7. Type 2-Radiograph of tailor's bunion with an increase in IM4 angle.

Figure 8. Type 3- Radiographic appearance of lateral deviation (bowing) of the fifth metatarsal.

Figure 9. Preoperative appearance of the foot. Notice the lateral prominence and the adducto-varus rotation of the fifth toe.

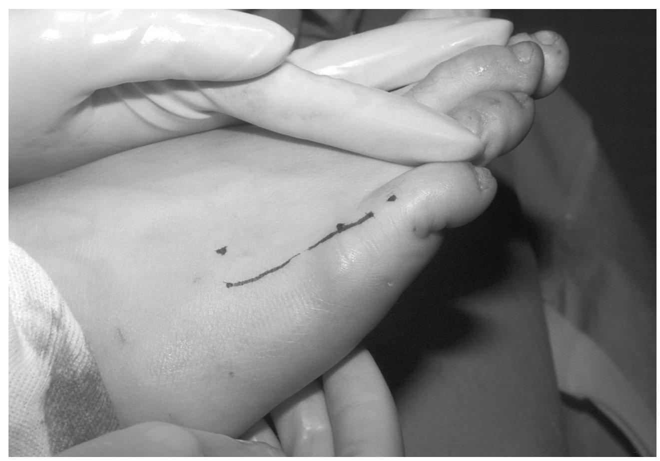

Figure 10. The incision is planned to ensure adequate exposure to all necessary structures.

Figure 11. An incision is made through the skin and the subcutaneous tissue is dissected to the level of the deep fascia. Note the extensor digitorum longus tendon slip traveling to the fifth toe through the incision. Care must be exercised not to damage this tendon.

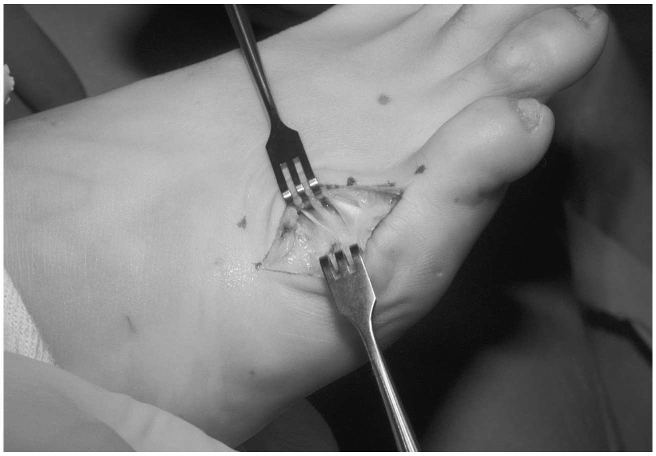

Figure 12. The deep fascia is incised and the extensor tendon is carefully retracted to expose the periosteum.

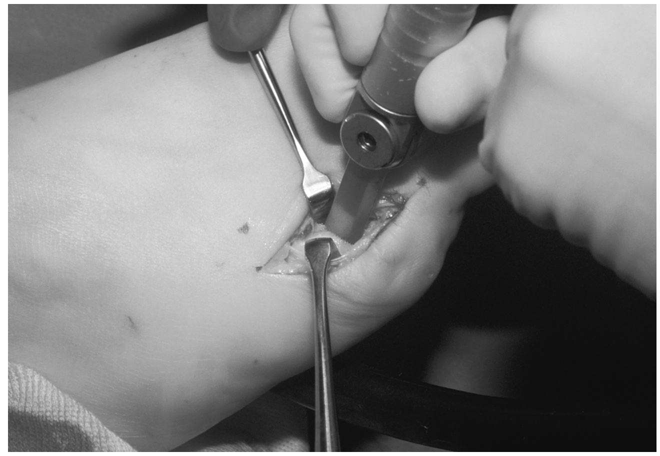

Figure 13. After a longitudinal incision is made through the periosteum, it is dissected away from the bone utilizing a Freer-elevator. Once adequate exposure to the osteotomy site is achieved, a sagittal saw is used to perform the osteotomy (an oblique osteotomy in this case).

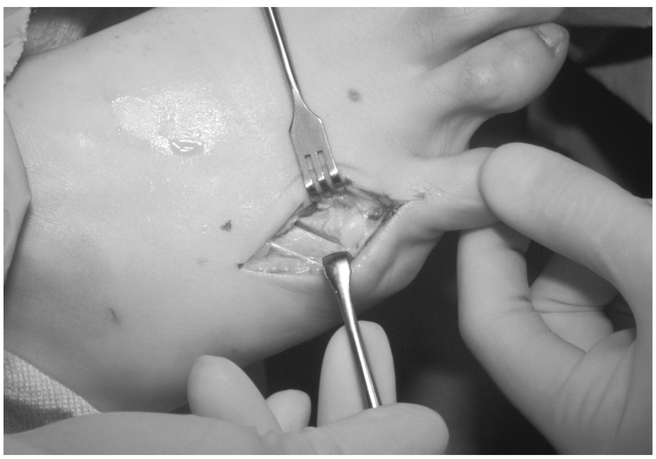

Figure 14. Once the osteotomy is completed, the capital fragment may be shifted medially. Care must be taken not to transpose the fragment too far.

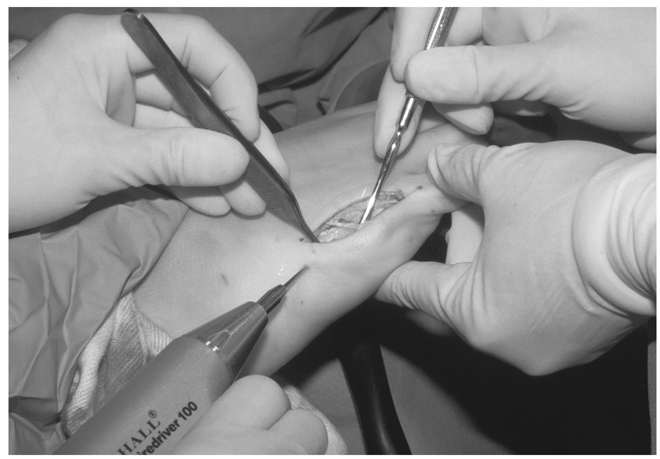

Figure 15. Once the desired correction has been achieved, the fragment may be fixated. In this case, a percutaneous 0.045 K-wire was utilized.

with visualization. One must also be aware that the lateral dorsal cutaneous nerve may be located just plantar to the incision and if encountered, it must be retracted plantarly.

A longitudinal incision is then made directly onto the fifth metatarsal through the deep fascia and periosteum. Dissection may then be continued subperiosteally with a Freer elevator dorsally and plantarly (Figures 12, 13). It is generally easier to begin this subperiosteal dissection proximally, where the periosteum is less adhered to the bone. If an osteotomy is to be performed, care must be taken to only reflect enough periosteal tissue to ensure adequate space to perform the bone cut. If too much periosteum is reflected, delayed healing may result.

In a manner analogous to a bunionectomy, the lateral prominence is then resected parallel to the lateral border of the foot with a sagittal saw, oscillating saw or osteotome and mallet (Figure 13). Care should be exercised not to remove an excessive amount of bone, as fifth metatarsophalangeal joint subluxation may occur postoperatively. The desired osteotomy or ostectomy and fixation are then performed. After copious irrigation, layered closure is performed with absorbable suture and a compressive dressing is applied (Figures 14-19).

CONDYLECTOMY

The condylectomy is perhaps the simplest of procedures for the relief of a symptomatic tailor's bunion deformity. While still commonly performed today as a distinct procedure, it has become a vital component of many of the more proximal procedures.

In 1949, Davies described the resection of the lateral surface of the fifth metatarsal head. In his publication, he noted that when an abduction deformity of the fifth

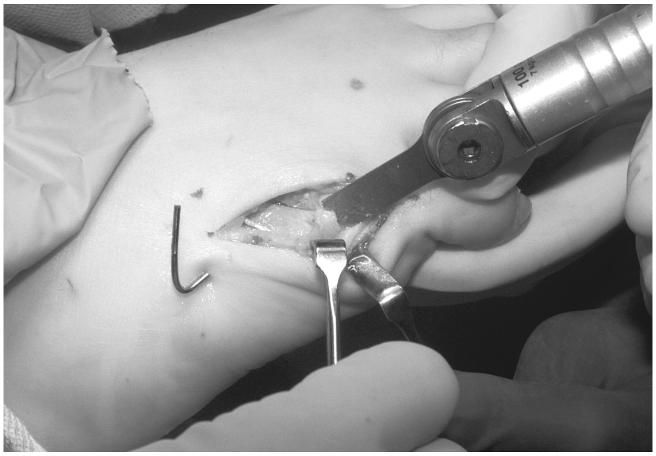

Figure 16. The remaining lateral prominence is resected flush with the lateral surface of the bone.

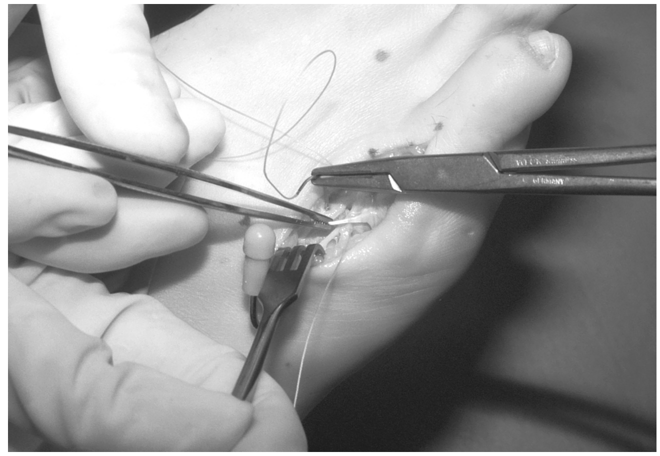

Figure 17. Layered closure is then performed with absorbable suture. The extensor tendon should remain free to glide within its sheath.

Figure 18. Appearance after deep closure is obtained.

Figure 19. Final appearance after subcuticular (intradermal) closure and steri-strips are applied. A compressive dressing is then applied, with care taken to adequately pad the pin site (if present).

metatarsal was present, an osteotomy may be needed.[1] In 1953, Dickson and Diveley reported the resection of the lateral surface of the fifth metatarsal head with a bursectomy performed at the same time.[2] LeLievre, in 1956, described a resection of the lateral aspect of the fifth metatarsal head with resection of the base of the proximal phalanx of the fifth toe.[3] In a similar fashion, DuVries described a lateral condylectomy and if a plantar lesion was present, then a plantar condylectomy was performed as well.[4]

Kitaoka and Holiday stated that lateral condylar resection for bunionette has the advantages of "simplicity, preservation of joint function and metatarsal length, and limited rehabilitation without either fixation or immobilization." They reported the results of 21 condylectomies in 16 patients of varying deformity. In their 15 patients with moderate to severe pain preoperatively, they found that ten had pain postoperatively. However, the degree of pain was reduced in all of these patients. None of their five patients with mild pain preoperatively had prolonged postoperative pain. They reported no cases of postoperative osteonecrosis, degenerative arthritis or transfer metatarsalgia. In patients with poorer results, the authors attributed the result to either an inadequate resection or a postoperative infection.[25]

The condylectomy procedure is accomplished by resecting the lateral one-fourth to one-third of the metatarsal head using a power saw or osteotome. Resection of more than one-third of the metatarsal head may lead to an unstable fifth metatarsophalangeal joint with the tendency to dislocate postoperatively (Figure 20). Postoperative care includes weight-bearing in a surgical shoe until suture removal, then transitioning into a soft shoe with a wide toe-box, to patient tolerance.

Figure 20. A completely dislocated fifth MTPJ following an aggressive condylectomy.

Figure 21. Postoperative radiograph of a McKeever-type distal fifth metatarsal resection. Note the shortening of the fifth toe.

METATARSAL HEAD RESECTIONS

While metatarsal head resections were once performed routinely in the past, the procedure has fallen out of favor. The first report of a fifth metatarsophalangeal joint arthroplasty was published by LeLievre in 1956. In the paper, LeLievre described resection of the metatarsal head exostosis as well as the proximal phalangeal base.[3] In 1959, McKeever reported good results with resection of the distal one half to two thirds of the fifth metatarsal (Figure 21).[26] Kelikian modified McKeever's procedure by syndactylizing the fourth and fifth toes to improve the postoperative cosmetic appearance.[27] Also in 1959, Brown reported resection of the fifth metatarsal in its entirety for the treatment of splayfoot.[5] Resection of the fifth metatarsal head, with or without concomitant phalangeal base resection, was also advocated by Harris, Weisberg and Amberry.[28-30] In 1991, Dorris and Mandel reported 12% of patients had digital contractures and 3% had transfer lesions in a series of 50 fifth metatarsal head resections. The authors reported no cases of "true" recurrence, but did report one incidence of osseous proliferation, which required a subsequent procedure.[31]

In 1977, Addante proposed the resection of the fifth metatarsal head with insertion of a Silastic sphere as a spacer. The size of the sphere was determined based on preoperative radiographs. The resection of the fifth metatarsal head was performed from dorsal-distal-lateral to plantar-proximal-medial, which the authors claimed "helped to position the sphere in a ball and socket fashion."[32] The authors published an eight year follow-up study in 1986. In this study, the authors reviewed 50 procedures in 35 patients for hyperkeratotic lesion formation, radiographic positioning, complications and pain. They found that complications were experienced by eight patients (16%), which included: traumatic dislocation, chronic subluxation of the sphere, inflammatory reaction, abscess formation, transfer lesions and persistence of the original lesion. The authors noted that the sphere had to be removed in only three patients (the traumatic dislocation, inflammatory reaction and abscess formation). Of the four cases in which the implant was incongruent, only one was "free-floating" and none had recurrence of pain. The authors reported a success rate of 84% for the procedure. Reasons for success are attributed to the absence of a fixed axis of motion, smoothness of the implant and an excellent response to compressive forces up to 10,000 pounds.[33]

Generally, the metatarsal head is resected at the junction of the metatarsal head and neck (Figures 22, 23). The postoperative care is identical to the condylectomy.

Figure 22. Radiograph taken following fifth metatarsal head resection and proximal interphalangeal joint arthroplasty. Again, note the significant shortening of the fifth toe.

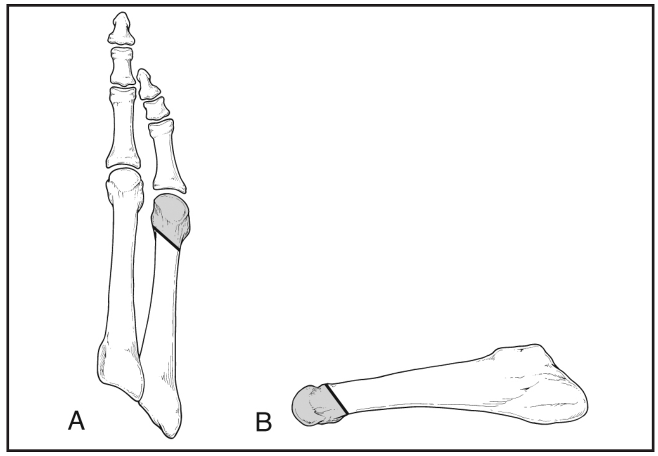

Figure 23.

Figure 24. A Hohmann osteotomy that has been shifted approximately one-half the width of the neck of the metatarsal.

DISTAL OSTEOTOMIES

Distal osteotomies are characterized by beginning the osteotomy within the metaphyseal-diaphyseal junction. This placement is beneficial because of the predominance of cancellous bone in this anatomical location. Due to the bone architecture, these osteotomies are at a decreased risk of delayed and/or non-union owing to the increased blood supply at this location. There have been numerous procedures described in the distal aspect of the fifth metatarsal. Many of these procedures are analogous to the procedures that are performed in the first metatarsal in the correction of a bunion deformity.

In 1951, Hohmann described a transverse osteotomy of the metatarsal neck with medial transposition of the capital fragment (Figure 24).[34] In 1989, Frankel performed a transverse osteotomy utilizing a single 2.0 cortical screw for internal fixation. He recommended transposing the capital fragment one third of the width of the metatarsal. This distance was recommended in order to preserve the stability of the osteotomy.[15] In the same year Steinke and Boll described the "Hohmann-Thomasen" metatarsal osteotomy. This osteotomy consisted of a subcapital displacement osteotomy of the fifth metatarsal with peg-and-hole fixation of the fragment. The authors described an average displacement of the fifth metatarsal head of 5 mm medially. No internal fixation was used, but a 5 week period of cast immobilization was initiated for the patients.[16] The procedure was originally described by Mygind and credited to Thomasen for the correction of hallux valgus.[35] The authors reported good results in 86% of patients.[16]

In 1974, Leach and Igou described a reverse Mitchell procedure at the fifth metatarsal neck. They shifted the distal fragment medially and used chromic catgut for internal fixation.[10] Konradsen described a "tenon and groove" displacement (similar to the reverse Mitchell) osteotomy just proximal to the exostosis to accomplish

Figure 25. An oblique Wilson-type osteotomy that was performed without the use of fixation.

medial displacement and shortening of the fifth metatarsal. The procedure was performed without the use of internal fixation, but a weightbearing below-knee cast was utilized for six weeks postoperatively. The authors reported substantial callous formation on radiographs at six weeks postoperatively; however, no cases of delayed/non-union were noted. The authors also noted that the median shortening of the metatarsal was 4% at six weeks postoperatively.[36]

Helal utilized an oblique osteotomy at the fifth metatarsal neck in the treatment of metatarsalgia in 1975.[37] Since that time, this procedure has been used extensively to correct the tailor's bunion deformity. In 1976, Sponsel performed a distal oblique osteotomy that was oriented from distal lateral to proximal medial without the use of fixation (Figure 25).[38] Keating, in 1982, reported performing distal oblique osteotomies without the use of internal fixation.[39]

In 1988 Catanzariti reported the 5-year follow-up of 22 patients who had received oblique metatarsal neck osteotomies without fixation. He reported that 50% of the patients were "much improved" while 32% were "improved."[40] In 1989, Kitaoka and Leventen described a procedure in which the lateral process was removed with a rongeur, after which an oblique distal osteotomy was performed. The osteotomy that he described extended from proximal lateral to distal medial. The remaining portion of the neck was then removed from the capital fragment. The capital fragment was then shifted medially and impacted onto the metatarsal neck. This was performed without the use of internal fixation or cast immobilization. The authors reported 88% had a good result and 4% had a fair result. They recommended this procedure for the correction of a tailor's bunion that includes metatarsal splaying or out-flaring of the fifth metatarsal.[41]

Hansson described a sliding oblique osteotomy of the fifth metatarsal neck that was oriented from distal lateral to proximal medial in 1989. This osteotomy was fixated with absorbable sutures. Although radiographic union took a "considerable amount of time" all the patients included in the study were reported to be asymptomatic. Hansson recommended this procedure for bunionettes that were caused by a dumbbell-shaped metatarsal head with lateral metatarsal bowing.[42]

Sakoff and Hanft also described an oblique osteotomy from dorsal-distal to proximal-plantar performed just proximal to the dorsal epicondylar ridge. While maintaining an intact plantar cortex, the lateral cortex of the metatarsal was reciprocally planed and the metatarsal head was medially relocated. The alignment was maintained with a 0.045-inch K-wire oriented from proximal, dorsal and lateral to distal, plantar, and medial. No complications were reported on the single patient in the report.[43] In a three year follow-up study, Schabler and Hanft reported a 96% patient satisfaction rate.[44]

In 1991, Coughlin described several variations upon the oblique osteotomy. Following a lateral fifth metatarsophalangeal joint release, an oblique osteotomy is made in the diaphysis of the fifth metatarsal from proximal-dorsal to plantar-distal. Coughlin described the orientation of the saw blade as lateral to medial for a pure lateral keratosis or "upward" (plantar-lateral to dorsal medial) for a combined plantar-lateral keratosis and more obliquely for a pure plantar keratosis. The rationale for the change in obliquity of the saw blade is to create more elevation upon rotation of the distal fragment, thus reducing the pressure that the fifth metatarsal head places upon the plantar aspect of the foot. He emphasized rotation, not translation, of the distal fragment and fixation with a screw, K-wires or combination of the two. Following osseous fixation, the lateral fifth metatarsophalangeal joint capsule is repaired in a fashion to realign the joint. The subjective postoperative results were 80% excellent, 13% good and 7% fair.[23] In 2006, Vienne published a prospective study of 33 "Coughlin" procedures. Using the same scale that Coughlin had used previously, they found that 76% of feet were rated as excellent, 15% of feet were good, 3% fair and one foot had a poor result. In patients that had lateral condylar resection along with the diaphyseal osteotomy, a higher AOFAS score was reported to a statistically significant level.[45]

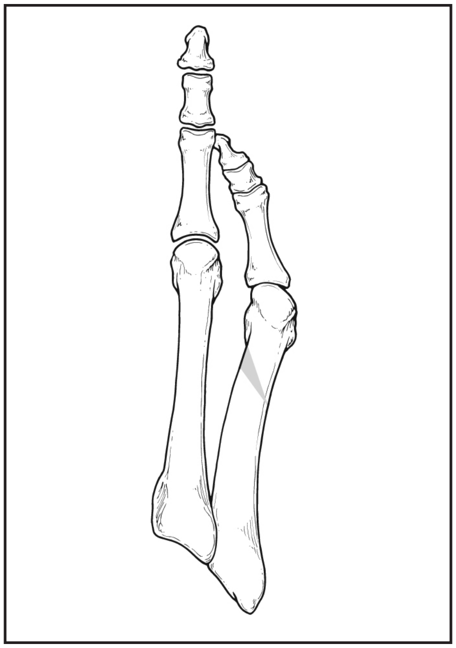

Figure 26.

Figure 27. A distal chevron osteotomy as described by Throckmorton and Bradlee.

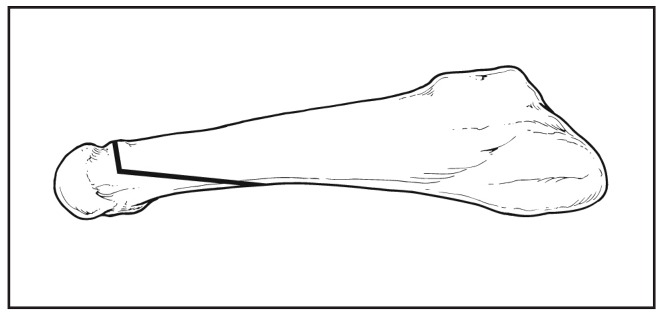

Figure 28.

In 1987 Yu modified the oblique osteotomy to perform a distal base-wedge osteotomy. Yu described a medially based wedge that was angled from medial distal to lateral proximal with the lateral cortex left intact (Figure 26). A 0.062 inch K-wire was used as fixation of the osteotomy. He reported the indication to be for the correction of a tailor's bunion with lateral bowing as the primary pathology.[46] A reverse Reverdin to correct a medially deviated fifth metatarsal head articular surface was described by Mercado in 1979.[47]

Throckmorton and Bradlee, in 1978, advocated a sliding "V" osteotomy of the fifth metatarsal neck with a medial transposition (Figure 27). They recommended transposing the capital fragment 2 mm.[48] In 1991, Kitaoka and Holiday presented a long-term follow-up study of 19 feet in 13 patients who underwent a distal chevron metatarsal osteotomy. The osteotomy was performed with an angle of 60°, no plantar or dorsal displacement and K-wire fixation if the osteotomy was deemed to be unstable after impaction. The average duration of follow-up was 7.1 years. Postoperatively, 3/19 feet had plantar pain, one foot had a persistent lateral callus and one foot had a tender intractable plantar keratosis underneath metatarsal head four.[49] Moran reported his results with the chevron osteotomy in 16 feet in 12 patients. He utilized a similar technique as previously described and noted that postoperative scores on a survey dramatically increased. He noted one case of transfer metatarsalgia to the fourth metatarsal.[50] Boyer and DeOrio reported utilizing an absorbable PDS pin for fixation of a distal chevron osteotomy in 2003.[51]

In 1993, Brim and Boudreau proposed a long arm modification of the chevron osteotomy. The osteotomy is performed in the sagittal plane, perpendicular to the shaft of the fifth metatarsal. The apex of the cut is performed in the surgical neck. The lateral arm is twice the length of the medial arm and should be located at the level of the deformity. The medial arm is made at a 70-80° angle to the lateral arm. The metatarsal head is shifted and rotated medially and then impacted onto the shaft. The authors reported only 1/33 patients experienced a transfer lesion.[52]

Crawford, in 1993, described an L-shaped osteotomy that was fixated with one or two cortical screws (Figure 28). The arms of the osteotomy were described as 60-90° to one another, with the short arm exiting dorsally and the long arm paralleling the weightbearing surface. Crawford reported a complication rate of 4%.[53] Friend, in the same year, reported utilizing an identical L-shaped osteotomy that was oriented with its long arm parallel to the weightbearing surface. The L-osteotomy was performed in the plane perpendicular to the exostectomy. So, for example, if the prominence is dorsolateral, the head of the metatarsal will be moved plantar-medial upon transposition. The authors state that performing the osteotomy and transposition in this manner will reduce the most prominent aspect of the fifth metatarsal. For fixation, the authors utilized an Orthosorb absorbable pin (Johnson & Johnson) in a dorsal to plantar direction. The authors reported one incidence of pin migration that required a return to the operation room for correction. The authors also reported one case of malunion and one case of non-union, both of which were asymptomatic.[54]

In 1980, a crescentic osteotomy at the fifth metatarsal neck was described by Habner and Kraft for the treatment of tailor's bunions with an associated plantar lesion. The osteotomy they described was oriented with the convex surface directed distally. They medially transposed the capital fragment between one-third and one-half the width of the metatarsal.[55]

In 2003, London and Stern described a long oblique distal osteotomy (LODO) of the fifth metatarsal. The osteotomy was performed from dorsal-distal to proximal-plantar and is carried from just proximal to the articular cartilage to a point one-third to one-half the length of the metatarsal. The authors emphasized that the plantar cortex was to remain intact and the distal segment was to be rotated about that intact hinge. To achieve multiplanar correction, the authors advocated using an axis guide (0.045-inch K-wire) at the site of the plantar hinge. The osteotomy was fixated with two 2.0-mm cortical screws. The authors reported 72% excellent and 24% good results. One foot (4%) was rated as poor due to a postoperative nerve entrapment.[56] A similar osteotomy, which was completed plantarly, was reported by Radl in 2005. For fixation, the authors utilized one or two Twistoff screws (DePuy Int.). They reported one case of delayed union in a heavy smoker, two patients required hardware removal and a third reported hardware irritation. The authors concluded that the maximal correction that was obtainable with this osteotomy was 10°, due to lack of bone to bone contact with higher angles of correction.[57]

When performing a distal osteotomy, the distal fragment should generally only be shifted one-fourth to one-third of the width of the metatarsal head to prevent fifth metatarsophalangeal joint dislocation. The postoperative course for distal osteotomies will vary based on the surgeon. Generally, the patient is allowed limited heel weight-bearing in a surgical shoe for approximately four weeks. Depending on radiographic and clinical evidence of healing, the patient may then transition into a soft shoe.

PROXIMAL OSTEOTOMIES

When the deformity of the fifth metatarsal is too severe for a distal osteotomy to correct, then a proximal osteotomy should be performed. An osteotomy in the proximal portion of the first metatarsal was first described in 1901 by Loison and first performed by Balacescu in 1903.[58] However, a proximal osteotomy in the fifth metatarsal was not described until much later.

In 1972, Gerbert described a closing base wedge osteotomy of the fifth metatarsal for the correction of a bunionette deformity (Figure 29). The author's indications included a fifth metatarsal phalangeal joint that was free of arthritic changes as well as a deformity that was within the entire metatarsal. The authors noted that the procedure could also be used with open epiphyseal plates in children. Gerbert also described a biplanar osteotomy that was to be used in the presence of plantar lesions under the fifth metatarsal head. For fixation, the authors used 2-0 stainless steel suture.[59] Rappaport, in 1974, used similar proximal procedures. However, instead of fixating his osteotomies with 2-0 steel suture, he utilized 3-0 braided stainless steel suture for internal fixation. He also maintained his patients in a non-weight bearing cast for six weeks postoperatively.[60] In 1979, Mercado recommended a closing base wedge osteotomy for a laterally deviated metatarsal with a distal deformity.[47]

In 1974, Estersohn described an opening wedge

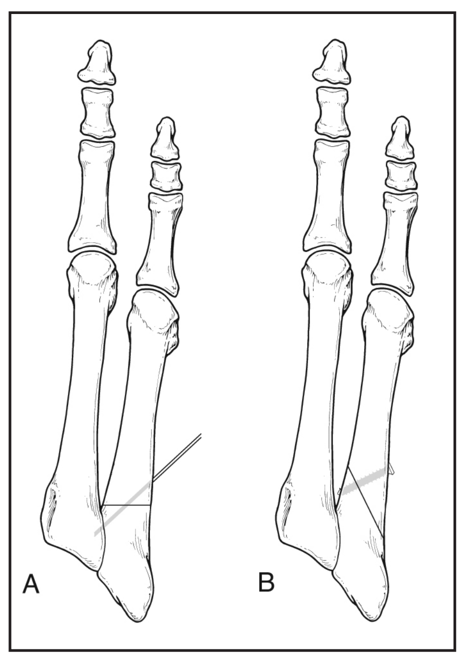

Figure 29.

osteotomy of the fifth metatarsal base. The authors utilized autogenous bone graft that was taken from the medial aspect of the first metatarsal head, the lateral aspect of the fifth metatarsal head or the styloid process of the fifth metatarsal base. After inserting the bone graft, the fourth and fifth metatarsal heads were secured to each other using a 2-0 non-absorbable suture for additional stability of the osteotomy site.[61] In 1980, Bishop also described the opening base wedge osteotomy as a component in his approach for the correction of a splayfoot deformity.[62]

Buchbinder described the derotational, angulational transposition osteotomy (DRATO) for the correction of a bunionette deformity in 1982. This osteotomy was performed two to three centimeters distal to the fifth metatarsal base. The osteotomies performed included a cut in the medial cortex, perpendicular to the declination of the fifth metatarsal and a second cut angled towards the first (with an intact lateral cortical hinge). This second cut resulted in a wedge of bone that had two apices, plantar and lateral. The author stated that the thickness of the wedge at the dorsomedial base is usually between 2.5 and 3.5 mm. Drill holes were then made from lateral to medial on both the distal and proximal aspects of the osteotomy. Buchbinder described the distal hole as being angled 30 degrees plantar-medial and the proximal hole as parallel to the surface. He used two strands of 28-gauge monofilament stainless steel wire passed through the holes to bring the two fragments together. The assistant then pushed the fifth metatarsal head into adduction and dorsiflexion while the lateral hinge was broken and the wires were fastened securely. The patient was placed in a postoperative shoe and allowed to walk. Upon following 38 feet for three years, complications of the procedure included delayed healing, malunion, transfer lesions and recurrence. Despite these complications, the author noted 79% good to excellent results. The authors commented on the necessity for stable fixation of the osteotomy.[14]

In 1987, Diebold utilized a basal chevron osteotomy for the correction of tailor's bunion deformity. The osteotomy was performed with the apex facing proximally. The authors then pivoted the shaft medially and inserted two K-wires from lateral to medial through the shaft of the fifth metatarsal into the shaft of the fourth metatarsal. In the same paper, the authors described how to correct for sagittal plane deformities. They accomplished this by taking a wedge of bone from the chevron cut dorsally and inserting it into the plantar wing of the osteotomy. The authors cited the altered force of the flexor digitorum longus tendon and its role in compressing the osteotomy site in addition to the inherent biomechanical stability of the osteotomy. The authors recommended this procedure for patients who had a large intermetatarsal angle or for those patients undergoing a revisional surgery.[17,63]

In 2002, Okuda performed a proximal "dome-shaped" osteotomy on 10 feet. The author's indication for surgery was a painful callous on the lateral side of the fifth met head and varus fifth toe that failed conservative management. The osteotomy was performed with the concavity oriented distally and the distal fragment was rotated under fluoroscopy until it was parallel to the fourth metatarsal. The author used crossed 1.5 mm K-wires for fixation of the osteotomy and placed the patients in a short leg non-weightbearing cast for 3 weeks. The patients were then placed into a partial weight-bearing short leg plaster shell cast. The patients were then transitioned to full weightbearing with "ready-made" shoes and arch supports 4-5 weeks postoperatively. The authors postoperatively separated the patients into two groups by the ratio of the length of the proximal fragment to the length of the distal fragment (which indicated where on the fifth metatarsal the osteotomy was performed) which they called the mean proximity rates. The authors noted 3/10 feet had delayed union, all of which were from group A, whereas 7/10 from group B experienced no delay in healing. Group A was determined to have a mean proximity rate of 33.4%, while group B had a mean proximity rate of 45.5%. The authors reported that the difference in mean proximity rate between groups A and B was statistically significant. Okuda recommends that an osteotomy of the fifth metatarsal should be placed at the proximal portion of the diaphysis rather than more proximally in order to prevent the occurrence of delayed union.[64]

The postoperative course for a proximal osteotomy generally includes cast immobilization without weightbearing for four to six weeks, followed by a gradual transition from surgical shoe to regular shoe gear, to patient tolerance.

COMPLICATIONS

Many of the complications of tailor's bunion surgery are identical to those of any surgical procedure. These include infection, delayed healing, a painful hypertrophic scar, keloid formation, numbness and recurrence of deformity. As with any bone surgery, delayed union, non-union, pseudarthrosis, transfer lesions (between 12-76%) or lesser metatarsalgia may occur (Figures 30, 31).[1-5,7,10,14-17,23-66] Specifically with tailor's bunion correction, fifth metatarsophalangeal joint subluxation, shortened or retracted fifth toe may occur (Figure 32).

In 1991, Kitaoka and Holiday published a nine year follow-up study of 11 metatarsal head resections in seven patients. The level of resection varied, but was reported to

Figure 30. Transfer lesion located under the fourth metatarsal head following tailor's bunion correction.

Figure 31. Radiographic appearance of a malunion following an oblique osteotomy without fixation.

Figure 32.Clinical photograph of fifth toe shortening following a fifth metatarsal head resection.

Figure 33. Clinical photograph of a non-purchasing "floating" fifth toe following dorsal displacement of the osteotomy.

lie in diaphyseal bone in all cases. They noted a 64% complication rate, with the most common complication being transfer metatarsalgia.[65]

In 1996, Pontious et al compared the outcome of tailor's bunion correction with and without fixation. They found that fixated distal osteotomies dorsally displaced less than non-fixated osteotomies (0.682 versus 2.00 mm). They determined dorsal displacement by drawing a line parallel to the weightbearing surface and tangent to the most dorsal cortex of the proximal and the distal fragments (Figures 33, 34). Also, they noted that non-fixated osteotomies displayed longer time to consolidation, increased delayed/non-union rate and longer time to return to shoe gear.[66]

Figure 34. Radiograph displaying significant dorsal displacement and angulation of the distal fragment.

CONCLUSION

While the tailor's bunion deformity may be a debilitating condition, the podiatric physician has a multitude of options, both conservative and surgical, for treatment. Both the physician and patient must be well-informed of all the possible treatment courses and realistic expectations should be discussed in detail before embarking on any specific treatment modality.

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