FIFTH METATARSAL SURGERY: TAILOR'S BUNION AND RELATED DEFORMITIES

Dennis E. Martin, D.P.M.

The tailor's bunion and other deformities associated with the distal fifth metatarsal are frequently seen in everyday practice. Classically described, the tailor's bunion is an abnormal prominence of bone or soft tissue about the fifth metatarsophalangeal joint. The deformity is typically located at the lateral or dorsolateral aspect of the joint (Fig. 1). The literature, however, is rather vague in differentiating this condition from other deformities of the fifth ray including those producing plantar and plantar-lateral symptoms. This may explain the controversy which exists regarding the etiology of these different conditions.

We will briefly review the clinical presentation and proposed etiologies for fifth metatarsal deformities. The importance of fully assessing these conditions both clinically and radiographically will be discussed. Surgical considerations will then be addressed based on the principles which are outlined.

Fig. 1. Typical tailor's bunion with irritation at the dorsal- lateral of the fifth metatarsophalangeal joint.

PRESENTATION AND ETIOLOGY

There are a variety of factors that may occur alone or in combination to produce symptoms in association with the distal fifth metatarsal. These may be divided into structural and functional causes of deformity.

Structural deformities may include congenital splaying of the fifth metatarsal secondary to defects of the intermetatarsal ligament or anomalies of the insertion of the transverse head of the adductor hallucis.[1,2] Other more likely structural factors include hypertrophy of the lateral condyle of the fifth metatarsal head, osseous deviation of the metatarsal shaft laterally and/or plantarly, an increased intermetatarsal angle, and a congenitally dorsiflexed or plantarflexed fifth rays. Lelievre described a supernumerary ossicle along the lateral aspect of the fourth metatarsal head that forced the fifth head laterally, subjecting it to trauma.[3] Frankel et. al. accurately identified the contribution that a medially dislocated fifth metatarsophalangeal joint can have on producing pain laterally at the fifth metatarsal head.[4]

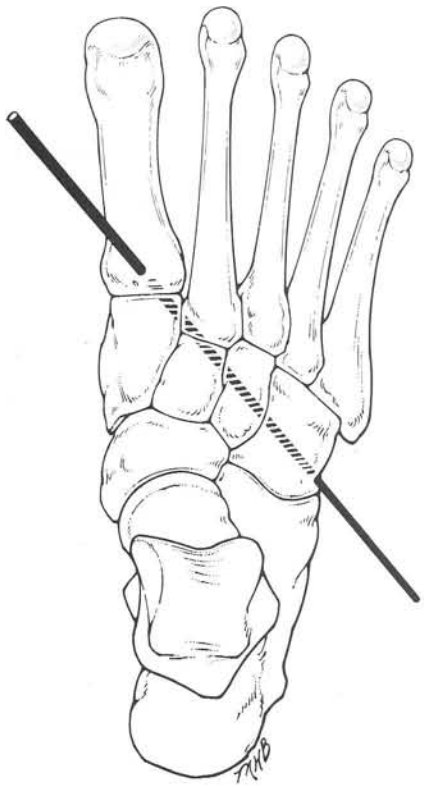


Fig. 2. Tri-plane axis of the fifth ray. Axis runs from inferior-lateral to superior-medial allowing for supinatory and pronatory motion.

Functional etiologies of fifth ray deformity are attributable to abnormal biomechanics. The fifth ray has a separate axis

of motion which permits both supination and pronation (Fig. 2). Excessive subtalar joint pronation will allow the midtarsal joint to unlock and subsequently unlock the fifth ray. As the weight bearing reactive forces push the ray into dorsiflexion, abduction, and eversion, the dorsilateral aspect of the fifth metatarsal head becomes prominent and subject to irritation.

A symptomatic hypermobile fifth ray is often seen in conjunction with other biomechanical abnormalities including hallux valgus, lesser metatarsalgia, and splay foot deformities (Fig. 3). These cases usually require a combination of aggressive orthotic control and surgery to completely alleviate symptoms at the fifth metatarsal head and metatarsophalangeal joint.

Other functional etiologies would include uncompensated rearfoot and forefoot varus conditions where an inordinate amount of pressure is placed along the lateral column. This pressure may result in lateral, dorsilateral, or plantarlateral symptoms.

In most cases, a combination of one or more structural and functional problems lead to the tailor's bunion or other deformity of the fifth metatarsal. Therefore, it is imperative to carefully evaluate each individual case both clinically and radiographically.

EVALUATION

As much care should be taken in evaluating the fifth metatarsophalangeal joint and its pathology as is taken when evaluating the first ray and associated hallux valgus deformities. Clinical examination should begin with a gross inspection of the overall foot. Obvious deformities should be noted, both at the fifth metatarsophalangeal joint and at other areas. A pes cavus or pes valgus deformity should be noted due to the obvious contribution both can have in producing a symptomatic fifth metatarsal problem. As mentioned previously, a tailor's bunion may also be seen as part of an overall splay foot condition. These latter scenarios represent more complicated deformities often requiring more sophisticated surgical techniques.

The lesion pattern of the foot should also be examined, especially those surrounding the fifth digit and metatarsal head. One needs to differentiate between diffuse callus formation and intractable punctate keratoma. This can offer some clue as to whether a structural or functional etiology is implicated (Fig. 4A,B). Other areas of tyloma formation should be noted as well, including a sub-metatarsal formation which may signify a rigid forefoot valgus condition. An associated pinch callus at the interphalangeal joint of the hallux may be secondary to a hallux limitus deformity. This

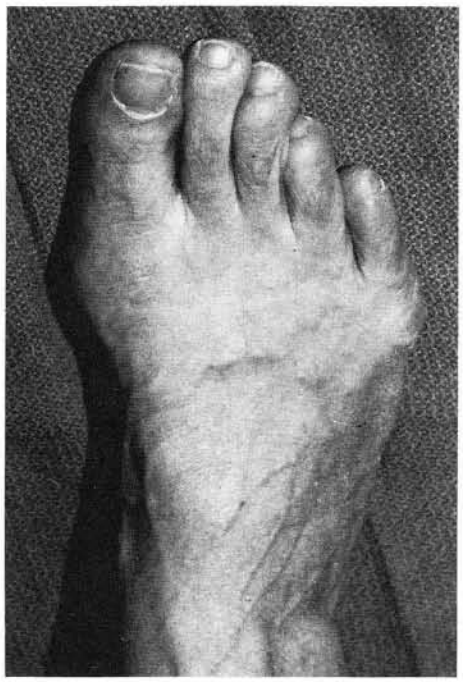


Fig. 3. Splay foot condition with symptomatic bunion as well as tailor's bunion deformity.

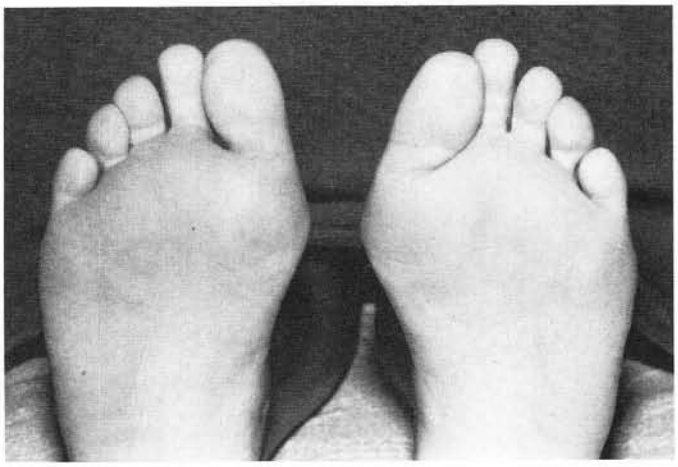
can lead to a compensatory increase in the amount of weight borne along the lateral column.

Examine the fifth metatarsophalangeal joint position and note any articular malalignment that may exist. The effects that a digiti quinti adducto varus deformity has on the fifth metatarsal can be likened to the relationship hallux valgus has on bunion formation.

Biomechanical examination should include evaluation of overall foot type as well as local fifth ray function. Document any compensated or uncompensated rearfoot/forefoot varus conditions that may exist. Note any contribution equinus deformities (rearfoot, forefoot) might have on producing abnormal pronation and fifth ray hypermobility.

It is equally important to correlate the clinical examination with radiographic analysis. The most comprehensive work done in this area was presented by Fallat and Buckholz in 1980.[5] They established a means to accurately assess the intermetatarsal angle between the fourth and fifth metatarsals, taking into account anatomic variations. They also determined the effect that position (pronation and supination) had on the intermetatarsal angle and on lateral bowing of the fifth metatarsal. Catanzariti, et.al., identified the sagittal plane relationship between the head and neck of the fifth metatarsal by using a sagittal plane deviation angle.[6] We will discuss each of these more fully as we address the radiologic work-up of the tailor's bunion.

The majority of the necessary information for accurate assessment of fifth metatarsal conditions is obtained from the dorsoplantar radiograph. When measuring the intermetatarsal angle between the fifth and fourth metatarsals, several peculiar anatomic variations have to be appreciated. Two of the more common variations include an abnormally wide metatarsal base and a structural lateral bowing of the shaft. To account for this, Buckholz and Fallat found the proximal medial portion of the metatarsal shaft to be the most consistent anatomic feature when examining 250 radiographs. Subsequently, they used a line parallel to this area of the shaft as the lateral arm of the intermetatarsal angle and bisected the fourth metatarsal as the medial arm (Fig. 5). In their series of 36 pathologic fifth metatarsals, the average intermetatarsal angle was 8.71 degrees. Personal findings on a series of 20 abnormal fifth metatarsals revealed a slightly larger average intermetatarsal angle approximating 10.3 degrees. These numbers will be affected by foot position as the angle increases when going from supination to pronation.



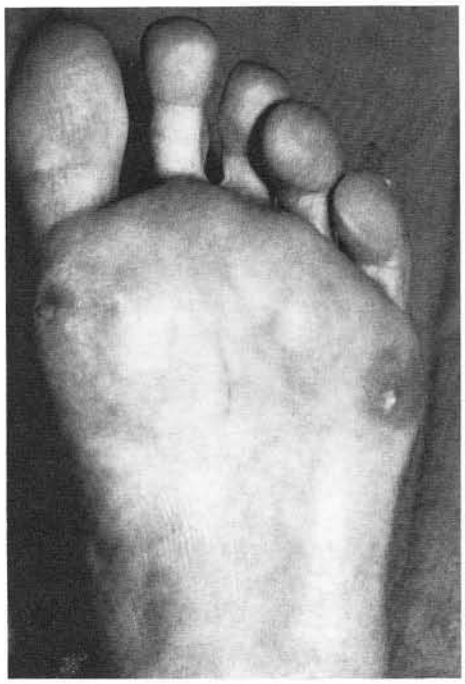


Fig. 4A & 4B. The lesion pattern associated with fifth metatarsal deformities can range from punctate keratoma to diffuse tyloma. This can aid in differentiating between structural and functional etiologies.

Fig. 5. Intermetatarsal angle between the fourth and fifth metatarsals as described by Fallat and Buckholz. They used a line parallel to the proximal medial portion of the fifth metatarsal as the lateral arm and bisected the fourth metatarsal as the medial arm of the angle.

Fig. 6. A structural lateral bowing is commonly seen in the tailor's bunion deformity. This bow is typically seen in the distal third of the metatarsal. The amount of bowing can be calculated by measuring the angle between the bisection of the head and neck of the metatarsal and a line drawn parallel to the proximal medial portion of the fifth metatarsal.

Lateral bowing of the fifth metatarsal is another important concept to keep in mind when reviewing the dorsoplantar radiograph. This bowing is usually seen at the distal third, or neck of the metatarsal, but may start at the mid-shaft region of the bone. There has been some debate as to whether the bowing is due to positional changes in the foot or is a primary structural anomaly of the metatarsal. To examine this, Fallat and Buckholz described an angle formed by a line bisecting the head and neck of the fifth metatarsal and the line previously described to simulate the proximal fifth metatarsal shaft and called it the lateral deviation angle (Fig. 6). They found an average value of 8.05 degrees in the pathologic foot compared to a normal value of 2.64. These numbers were not affected by positional changes of the foot as it was changed from inversion to eversion. When present, this structural deviation of the fifth metatarsal should be considered to be a significant contributing factor in the tailor's bunion deformity.

The last consideration in reviewing preoperative radiographs is the hypertrophy of the lateral aspect of the fifth metatarsal head. As the foot everts, the lateral plantar tubercle rotates and assumes a more lateral position giving the false impression of a hypertrophic condyle. This is not to say that a true lateral prominence cannot be seen. However, it is probably not as common as was once thought.

Before surgically addressing fifth metatarsal pathology, the above clinical and radiographic parameters need to be considered.

SURGICAL CONSIDERATIONS

Many patients with tailor's bunion deformity will respond to some degree of conservative treatment. Shoe modifications, accommodative padding, lesion debridement, and orthotic control can offer effective, temporary relief in many instances. Surgical treatment will more likely address the etiology of the deformity and offer a more permanent correction.

Many surgical procedures have been described for correction of the tailor's bunion, encompassing all levels of the fifth metatarsal. When reviewing the literature it becomes readily apparent that no one technique is adequate in treating all forms of fifth metatarsal pathology. Complications are well documented and include delayed or non-union, floating fifth digit, transfer lesions to adjacent metatarsals, and recurrence of deformity. The study of Fallat and Buckholz suggests that the selection of surgical procedures is most accurate when based on the preoperative radiographic findings. This idea holds considerable merit when combined with a thorough clinical evaluation. As the various approaches to fifth metatarsal surgery used at Northlake Regional Medical Center are discussed, emphasis will be placed on ways to minimize complications and achieve long lasting successful results.

True basal osteotomies have been performed by several authors with reported good results.[7,8,9,10] The more proximal axis point creates a longer radius arm so that greater medial displacement of the fifth metatarsal head can be effected with every degree of wedge resected. However, there are several disadvantages to performing proximal wedge resection. There is a longer lever arm created with this type of osteotomy and the surgical site may become disrupted with smaller degrees of force than osteotomies performed distally. Experience has also taught us that fractures in this area of the fifth metatarsal (ie. classic Jones fractures) are prone to develop a delayed or non-union. Vascular studies of the fifth metatarsal show the greatest confluence of extra-osseous vessels around the proximal and medial aspects of the bone.[11] Disruption of this confluence could serve as a source of delayed healing in proximal fifth metatarsal osteotomies. For both of the above reasons, procedures done at the base region demand excellent reduction with internal fixation as well as strict non-weight bearing postoperatively. However, when the tailor's bunion is due to a significantly increased intermetatarsal angle, this may be the procedure of choice.

Fig. 7. The distally based oblique wedge with intramedullary nailing fixation as described by Yu et al. The apex of the osteotomy is directed proximal-lateral with the base distal-medial.

Fig. 8. Failure of the lateral cortical hinge in the oblique osteotomy. The intramedullary K-wire was not able to withstand the forces of weight bearing resulting in fracture of the hinge.

Fig. 9. Reinforcing the lateral cortical hinge with cerclage wiring techniques led to some improvement in stability under the forces of weight bearing.

When the primary focus of deformity is lateral bowing of the distal metatarsal, the surgical osteotomy should be directed at this level. Though the typical location of the structural bowing is at the distal one third of the metatarsal, it may be seen at a more proximal or distal site. Yancey first described an osteotomy specifically designed to address the pathologic bowing at the junction of the middle and distal thirds of the metatarsal.[12] This procedure was later modified by Yu, et.al.. They described an oblique wedge cut with the base directed distal-medial and the preserved hinge proximal-lateral.[13](Fig. 7) This osteotomy design is quite versatile and offers several distinct advantages over the more proximal techniques. First of all, the relatively distal position of the bone cuts avoids the tenuous blood supply proximally. Secondly, due to a shorter lever arm, the forces of weight bearing are not as likely to disrupt the osteotomy site. Lastly, the oblique nature of the cut, places the lateral cortical hinge more proximally than the traditional distal transverse wedges, creating a longer radius arm. This will allow for a greater amount of medial movement for each degree of wedge removed.

The placement of internal fixation devices is also facilitated by the long oblique nature of the procedure. As mentioned previously, the osteotomy was initially fixated with an intramedullary nailing technique. However, follow-up evaluation revealed a significant number of cases where the stresses of weight bearing overcame the single intramedullary K-wire resulting in fracture of the lateral cortical hinge.[14](Fig. 8) This has led to several modifications in fixation for the osteotomy. Cain reinforced the lateral cortical hinge with a cerclage wire technique.[14](Fig. 9) More recent modifications have applied the fundamental guidelines and techniques of rigid internal fixation developed by the AO/ASIF in fixating fifth metatarsal osteotomies. The most encouraging results have followed the use of two 2.0 cortical screws delivered in a manner similar to that described by Ruch for base osteotomies of the first metatarsal.[15] This technique has been used alone or in combination with cerclage wire techniques (Fig. 10A, B).

Though the oblique osteotomy has proven to be quite successful, the procedure does have several inherent disadvantages. The long oblique nature of the osteotomy makes it an extremely unstable fracture in the case of hinge failure. As the fixation devices are overcome by the forces of weight bearing, the osteotomy can readily shorten or telescope. Continued bending forces may result in angular deformity. Though the disruptive forces of weight bearing are not as great as those proximally, supplementary fixation techniques (i.e., cerclage wire with two 2.0 cortical screws) or postoperative non-weight bearing should be considered for the long oblique cut.

The most popular area for osteotomy of the fifth metatarsal osteotomy is the surgical neck. There have been a variety of surgical procedures performed in this region with acceptable results reported in most instances.[2,4,6,14,16,17,18,19,20,21,22,23](Fig. 11) Both wedge resections and straight slide osteotomies with a variety of fixation techniques have been described. Like most surgical procedures, advantages and disadvantages are associated with each.

Osteotomies of the fifth metatarsal neck will not be adequate for deformities that have significantly high intermetatarsal angles, or where the lateral deviation of the metatarsal occurs proximally. The correction will be limited by the diameter of the metatarsal shaft at this point. In the case of wedge resection, the amount of bone removal that would be required for adequate correction would result in a tremendous amount of shortening to the metatarsal. The use of these

Fig. 10A, B. Recent fixation techniques for the oblique wedge osteotomy have applied the concepts of rigid internal fixation. Two 2.0 cortical screws used alone or in combination with cerclage wiring techniques has proven to be a stable and effective means of fixation

procedures in the more severe cases may lead to a greater incidence of recurrent and transfer lesions.

When the main focus of deformity is at the distal neck of the metatarsal, or where the intermetatarsal angle is only mild to moderate, these osteotomies can be quite satisfactory. Generally speaking, distal procedures are technically easier to perform and are more amenable to the forces of weight bearing. However, it is essential to apply appropriate internal fixation before postoperative weight bearing is allowed.

At Northlake Regional Medical Center a procedure gaining popularity for mild to moderate tailor's bunion deformity is the distal closing wedge osteotomy with horizontal wire loop fixation (Fig. 12). The transverse wedge offers several advantages over the traditional slide osteotomies. First, the transverse nature of the cut offers greater inherent stability than the oblique osteotomy. In case of hinge fracture, the transverse orientation is less susceptible to telescoping or shortening of the fragments upon each other. However, sagittal plane forces do need to be controlled to alleviate any unwanted dorsiflexory or plantarflexory motion with weight bearing. Secondly, a greater amount of correction can be obtained with the wedge resection compared to the slide procedures. Finally, the intra-osseous, horizontal wire loop fixation is relatively easy to perform. In addition, several studies have shown a greater degree of stability offered by intra-osseous wire loop techniques compared to standard Kirschner wire fixation.[24, 25, 26] The patient is typically allowed to bear weight postoperatively with the aid of a padded surgical shoe (Fig. 13).

Complications from this as well as other fifth metatarsal osteotomies can usually be traced to inappropriate fixation or poor control of postoperative weight bearing forces. These include delayed or non-union, floating fifth digits, recurrence of deformity, and transfer lesions.

The importance of adequate internal fixation has already been addressed. However, there are other intraoperative maneuvers we can use to limit some of these other complications. The use of the axis guide for cutting the osteotomy, whether distal or proximal, can be extremely helpful in obtaining the desired surgical result. In cases where bi-plane deformity exists (i.e., plantar-lateral lesion), the guide can be used to accurately achieve the desired amount of correction in each plane (Fig. 14). The axis guide can also aid against the overzealous elevation of the metatarsal. A floating fifth toe may develop if the metatarsal head is dorsiflexed too far.

When the deformity is mild and limited to the hypertrophic lateral condyle of the fifth metatarsal head, simple exostectomy may be the procedure of choice (Fig. 15). However, in the presence of structural deformity, this procedure may not be adequate and recurrence is likely. This can be likened to performing simple exostectomy for a moderate to severe

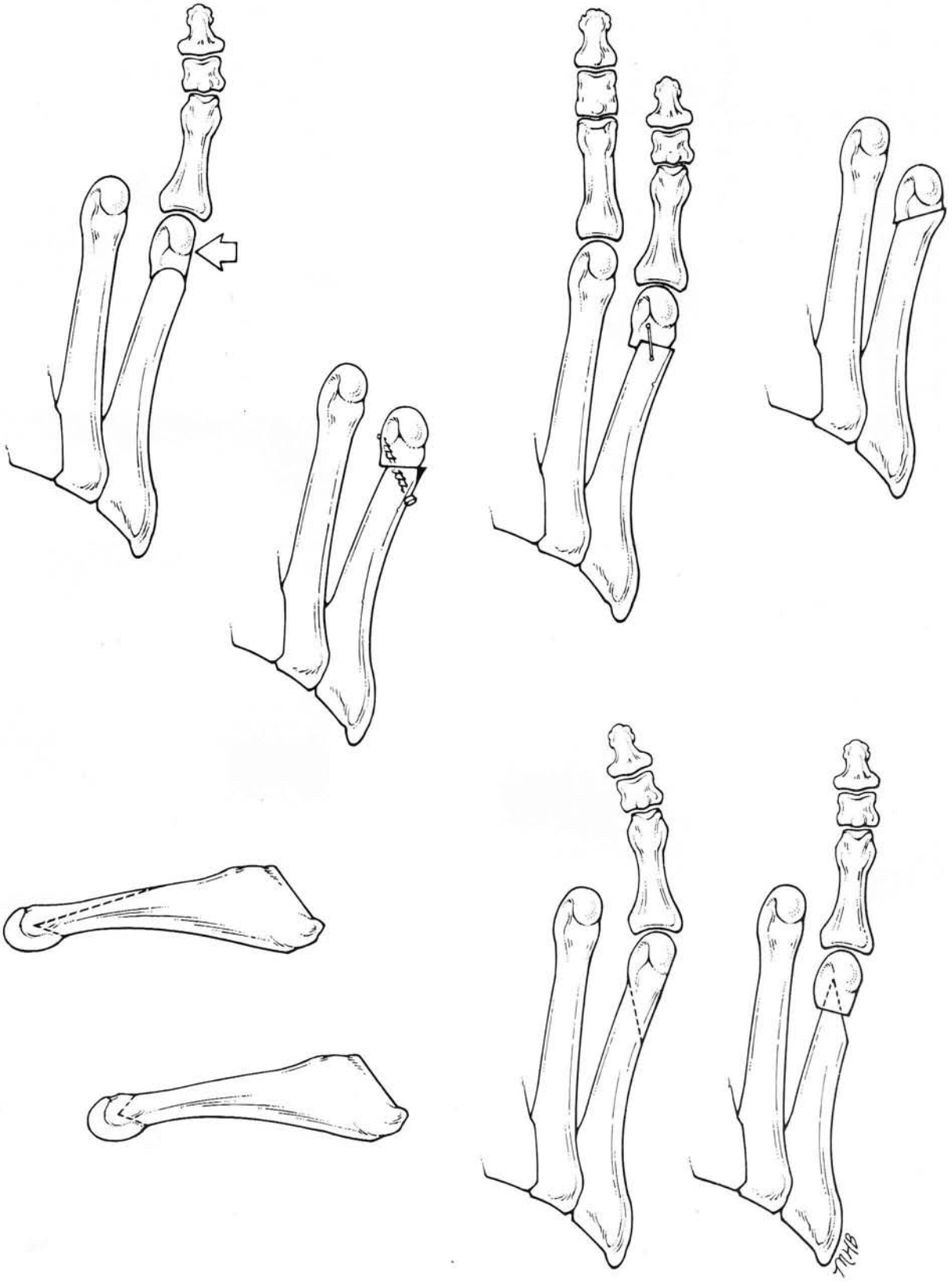


Fig. 11. Osteotomies performed at the surgical neck are probably the most popular site for correction of tailor's bunion deformities. When the primary focus of deformity is at the distal aspect of the metatarsal, these procedures can be quite successful

Fig. 12. The distal, transverse closing wedge osteotomy with horizontal wire loop fixation. This procedure offers versatility and the horizontal loop fixation is an excellent alternative in post-op weight bearing situations

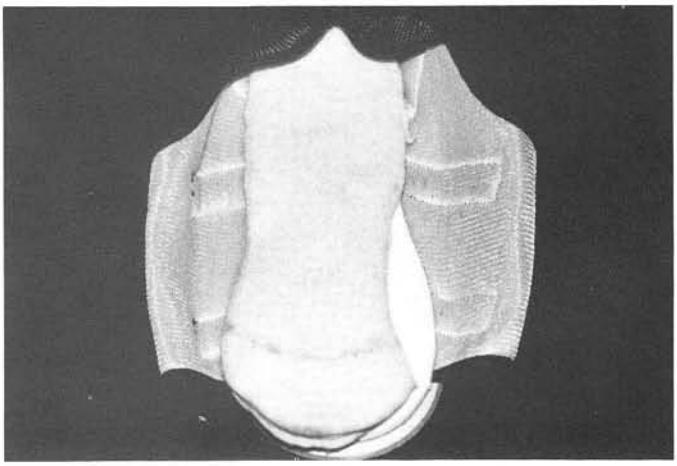


Fig. 13. Appropriately padded post-operative surgical shoe to help neutralize the forces of weight bearing.

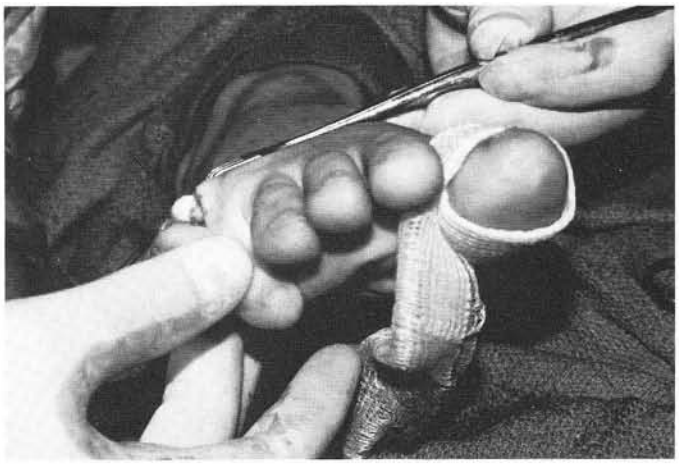


Fig. 14. The use of the axis guide can aid in executing an accurate bi-planar or uni-planar osteotomy. For example, it can aid in preventing overzealous dorsiflexion when performing a dorsiflexory and adductory osteotomy.

Fig. 15. When the deformity is mild and limited to the hypertrophic lateral condyle of the fifth metatarsal head, simple exostectomy may be adequate.

hallux abducto valgus condition with subsequent return of deformity.

Fifth metatarsal head resection has also been described for treatment of deformity at the fifth metatarsophalangeal joint. This is not recommended in the young or middle-aged patient in good health. Biomechanical instability results with transfer lesions likely to develop under the fourth metatarsal. The fifth digit will typically retract to the level of the metatarsal stump producing a non-purchasing toe and a poor cosmetic result. However, in the geriatric patient or the medically unstable patient (i.e. the brittle diabetic with the chronic mal perforans ulceration), this procedure merits consideration. Syndactyly of the fourth and fifth toes will help to prevent later retraction of the fifth digit.

CONCLUSION

There has been no new state of the art procedure presented for the treatment of painful tailor's bunion and associated fifth ray deformities. Rather, a more comprehensive and logical approach to evaluating these conditions has been introduced. Preoperatively the etiological factors need to be fully appreciated. If the primary focus of deformity is more

proximal (i.e., a large intermetatarsal angle or a large proximal lateral deviation angle), then the surgical procedure needs to be addressed at this area. The attitude that "it is just a tailor's bunion" may result in careless preoperative planning, inappropriate selection of procedures, or inadequate postoperative care.

The relative hypermobility associated with the fifth ray and the effects of the ground reactive forces need to be taken into account when planning the osteotomy and postoperative weight bearing status. The more proximal osteotomies will not withstand the forces of weight bearing with standard fixation techniques. Therefore, a period of postoperative immobilization will be required. The use of an axis guide can also help in accurate execution of the osteotomy avoiding overzealous dorsal positioning. Finally, other deformities need to be evaluated to ensure that all factors which may have been involved in the development of the tailors bunion are addressed. Recognition of these principles can alleviate or minimize postoperative complications.

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