CHAPTER **38**

HALLUX VARUS

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INTRODUCTION

Hallux varus can be classified as either an acquired or a congenital deformity. This deformity has a structural and/or soft tissue imbalance consistent with a medially deviated or subluxed first metatarsophalangeal joint. The term hallux varus usually refers to a simple transverse plane adduction deformity (Figure 1), but this term may include a more complex deformity that also involves a flexion contraction at the interphalangeal joint, and extension deformity at the metatarsophalangeal joint (Figure 2).

The acquired hallux varus, although rare, is frequently iatrogenic secondary to hallux abducto valgus surgery. Acquired hallux varus deformities can be classified as either static or dynamic types.[1] The static deformities are those that involve bunionectomies and/or osteotomies without disruption of the muscle and tendon balance around the metatarsophalangeal joint. The dynamic type of deformity results from disturbances of muscle and tendon balance around this joint. Several factors can contribute to the formation of a hallux varus including excessive plantar lateral release, fibular sesamoidectomy, staking of the metatarsal head, overcorrection of the intermetatarsal angle, adductor tendon transfer, excessive tightening of the medial capsule, and aggressive post-operative bandaging. It has been discussed that certain nonsurgical factors may play a role or contribute to a hallux varus. These factors include the natural lack of a sagittal groove, the presence of a rounded metatarsal head, and a relative first metatarsal protrusion, being equal to or longer than the second metatarsal.[2] A lack of soft tissue integrity may also contribute or predispose the digits to medial deviation.

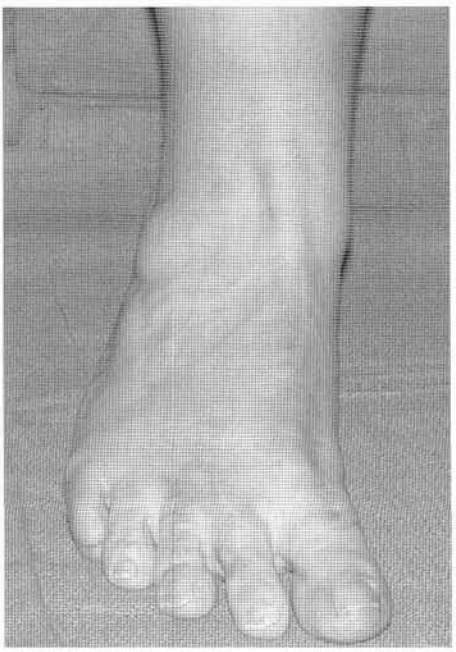

Figure 1. Clinical presentation of hallux varus with transverse plane deformity.

ANATOMY

To understand hallux varus and be able to plan an appropriate surgical approach to its correction, the podiatric physician must have a thorough understanding of the anatomy and its contributing factors. The anatomic relationship of the soft tissue structures around the metatarsophalangeal joint, maintain a balance needed for normal motion and a rectus position of the hallux. When the balance of these forces is disturbed, a multitude of deformities may develop. The metatarsophalangeal joint is crossed by 4 intrinsic muscles (extensor hallucis brevis, flexor hallucis brevis, adductor hallucis, and abductor hallucis) and 2 extrinsic muscles (the extensor hallucis longus and flexor hallucis longus.) The extensor and flexor muscles create motion of the hallux in the sagittal plane. The adductor and abductor muscles act more to stabilize the hallux in the transverse plane. The forces exerted by

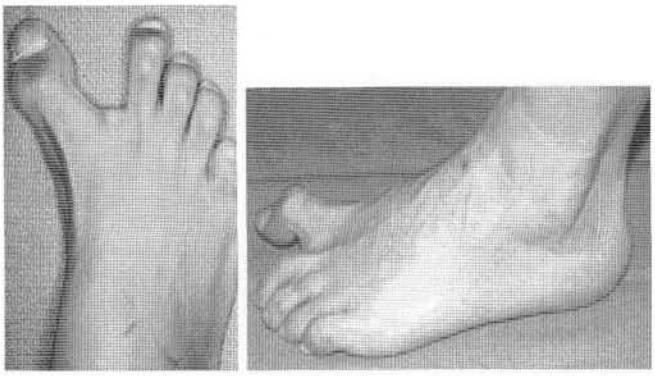

Figure 2. Hallux varus with additional contractures at the interphalangeal and metatarsophalangeal joints.

these muscles are balanced by their anatomic position, preventing the hallux from deviating. The metatarsophalangeal joint is further stabilized by a strong capsule and collateral ligaments. These ligaments form a fan-shaped band that originates from the medial and lateral epicondyles. They run distal and plantar to the base of the proximal phalanx and blend inferior with the ligaments of the medial and lateral sesamoid. The sesamoids are incorporated into the medial and lateral heads of the flexor hallucis brevis tendon and articulate with the plantar surface of the metatarsal. They provide the muscle with increased force and leverage in plantarflexing the hallux.

ETIOLOGY

An approach to hallux varus repair can only be accomplished by following a thorough evaluation and understanding its cause. Although fibular sesamoidectomy has historically been attributed as a primary cause,[3] several factors must be present before the first metatarsophalangeal joint will assume a varus position.[4,5] These factors are discussed individually but it is a combination of these factors that usually lead to this deformity.

Plantar Lateral Release

One approach to the restoration of joint balance in hallux abducto valgus surgery is based on a sequential release of lateral joint contractures. This systematic approach begins with the release of the adductor tendon, transaction of the fibular sesamoidal ligament, transaction of the lateral head of the flexor hallucis brevis, fibular sesamoidectomy, and finally lateral capsulotomy. This is a step-wise process; careful consideration must be taken into account that with each step, the medial structures gain an enhanced muscular advantage.

Medial Exostectomy

Excessive resection of the medial eminence or staking the first metatarsal head acts to destabilize this portion of the joint (Figure 3). The sagittal groove stabilizes the medial rim of the base of the proximal phalanx. The plantar medial condyle serves as a buttress for the tibial sesamoid. Excessive resection of these 2 areas may result in medial displacement of the proximal phalanx and tibial sesamoid. This displacement will further accentuate the medially deforming pull to hold the hallux in varus. The appropriate resection of the medial eminence would be an angle that is oriented dorsal lateral to plantar medial (Figure 4). This would preserve the sagittal and tibial sesamoidal grooves, and allow for medial stability of the metatarsophalangeal joint.

Overcorrection of Intermetatarsal Angle

Following metatarsal osteotomy, an aggressive lateral translocation of the capital fragment may lead to a negative intermetatarsal angle. As the intermetatarsal angle decreases, the medial vector of pull from the soft tissues increases. This is only compounded when accompanied by

Figure 3. Hallux varus resulting from excessive resection of the medial eminence.

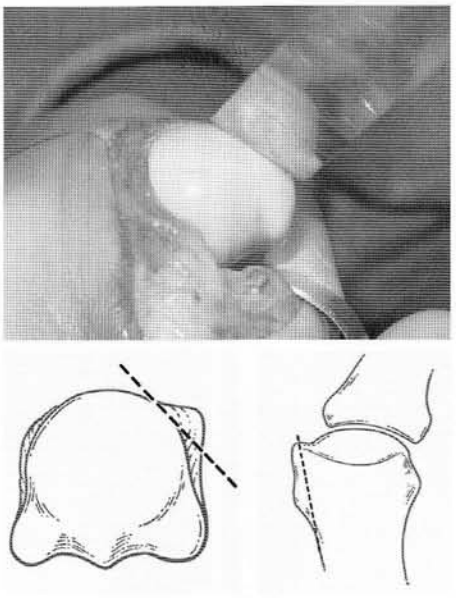

Figure 4. Appropriate angle for resection of the medial eminence. Note the preservation of the sagittal and tibial sesamoidal grooves.

weak lateral soft tissue structures and/or loss of medial osseous stability. An aggressive lateral shift may also be visualized by an increased proximal space between the first and second metatarsal on the dorso-plantar radiograph (Figure 5).

Adductor Tendon Transfer

Lateral deviation of the sesamoid apparatus is commonly encountered in hallux valgus surgery. Restoration of this apparatus beneath the head of the first metatarsal can be accomplished in several ways. The release of lateral soft tissue contractures and lateral translocation of the metatarsal head have already been discussed. The adductor tendon may be transferred beneath the extensor hallucis longus and attached to the medial capsule. When applied with adequate tension, this transfer can help reposition the laterally deviated sesamoids below the metatarsal (Figure 6). An overly aggressive transfer may create medial subluxation of the sesamoid apparatus and subsequent medial joint imbalance.[6]

Excessive Medial Capsulorrhaphy

Joint balance may also be altered if one excises too much capsular tissue or plicates the capsule too tightly in order to obtain greater correction. This alone may not create a hallux varus, but in conjunction with other previously discussed factors, will predispose toward medial subluxation. An aggressive postoperative dressing may have a similar effect, to hold the hallux malpositioned and allow for fibrosis in an adducted position.

CLINICAL FINDINGS

The clinical evaluation attempts to identify all components of the deformity. The patient should be observed in both a nonweightbearing and full-weightbearing attitude. This examination should be compared to the contra lateral extremity. An exaggeration of the deformity with weight bearing suggests an increased role of muscle tendon imbalance. This applies not only to the transverse plane adduction deformity, but also to the sagittal plane contracture and loss of purchase with supporting surface.[7]

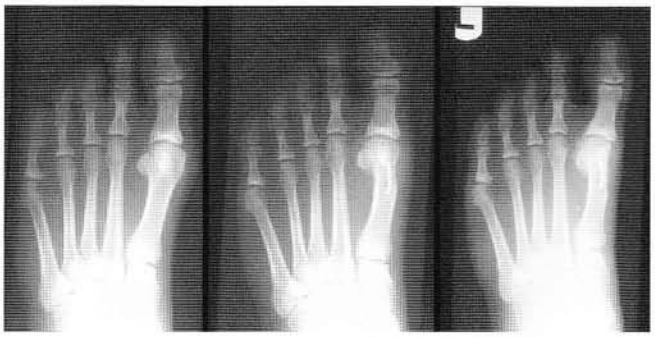

Figure 5. Hallux varus resulting from an aggressive lateral shift. Note the increased space between the proximal first and second metatarsals.

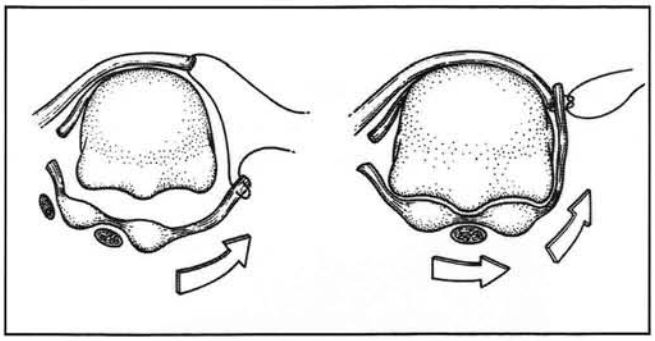

Figure 6. Adductor tendon transfer to reposition the laterally deviated sesamoids below the metatarsal.

Figure 7. Hallux varus following fibular sesamoidectomy.

Figure 8. Intermetatarsal angle reduced to zero degrees.

Figure 9. Hallux varus with associated metatarsus adductus.

A great toe that purchases the supporting surface with weightbearing indicates that the intrinsic musculature integrity has been preserved. A floating to or malleus deformity suggests partial or complete loss of those muscles responsible for stabilization of the proximal phalanx. A thorough examination of flexion and extension at both the interphalangeal and metatarsophalangeal joints will assess integrity and function of the surrounding musculature. Manipulation in the transverse plane will provide an appreciation of the amount of contracture associated with the abductor hallucis muscle and integrity of the lateral capsular structures. The quality and range of motion, as well as the ability to reduce the deformity, are important factors in determining corrective procedures. This assessment will help to determine whether muscle tendon balancing or osseous procedures are needed for adequate reduction of the deformity.

RADIOGRAPHIC FINDINGS

The dorsoplantar radiograph provides information regarding the severity of the deformity in the transverse plane, status and alignment of the joints, and presence or absence of the sesamoid bones (Figure 7). The degree of deformity can be measured by determining the hallux abductus angle. The normal values are between 5 and 15 degrees, but with a varus deformity this angle may be zero or even negative, as the phalanx subluxes medially on the metatarsal head. The intermetatarsal angle may also have an angle close to zero or negative (Figure 8). The metatarsus adductus angle can be increased (Figure 9). Medial transposition of the tibial sesamoid on the metatarsal is often seen following staking of the head. Other finding may include a positive metatarsal protrusion angle and/or a rounded metatarsal head. These findings should confirm clinical observations.

PATIENTS AND METHODS

The authors reviewed the possible cause(s) for hallux varus in 11 patients that presented with this postoperative deformity. The corresponding radiographs of these feet were reviewed: the hallux abductus and intermetatarsal angles, the shape of the first metatarsal head, the presence of metatarsus adductus, the relative lengths of the first and second metatarsals, and tibial/fibular sesamoid positioned were noted on these films. A review of the corresponding operative reports noted possible soft tissue contributions to the varus deformity such as lateral head release of the flexor hallucis brevis, lateral capsular release, adductor tendon transfer, and medial capsulorrhaphy.

OBSERVATIONS

The patient population in this hallux varus review consisted of 11 adult females. The deformity presented postoperatively to hallux abducto valgus surgery. There were 10 distal Austin osteotomies and 1 closing base wedge performed. All procedures included a lateral release of some form. Adductor tendons were released in all 11 cases with transfer of the tendon in 6 cases. The lateral head of the flexor hallucis brevis was resected in 7 cases and the fibular sesamoid was removed in 6 cases. The lateral capsule of the metatarsophalangeal joint remained intact in all cases. Resection of the medial eminence was accomplished with hand instrumentation in an angle oriented dorsal lateral to plantar medial as previously described. The sagittal groove and plantar medial condyle remained intact in all cases.

In an analysis of this data no consistent finding could be attributed to the formation of the postoperative hallux varus. The combinations of multiple factors were examined; fibular sesamoidectomy with or without adductor tendon transfer, and flexor hallucis brevis tendon release without sesamoidectomy and/or tendon transfer. A medial capsulorrhaphy was performed in just over half the cases, in combinations with the other factors. Only one case of hallux varus had a metatarsus adductus component. A varus was also reported with none of the above contributing factors. The presence of a positive metatarsal protrusion angle, rounded metatarsal head, or congenital absence of a sagittal groove, was not reported.

CONCLUSION

Hallux varus as a complication of surgery for hallux valgus is complex and often has a multi factorial cause. A thorough understanding of the possible contributing factors will help the podiatric physician to avoid or minimize its occurrence. Although this complication is unlikely to be caused by any one contribution factor, the exact combination in unknown. Our evaluation of a small varus population failed to conclude a consistent factor in its development. Unique and individual characteristics to each patient may play a role in this complication. To minimize the overall risks, several key areas need to be addressed. The plantar lateral release is a sequential release of deforming forces. Care must be taken to avoid being too aggressive and disturb muscle balance at the joint. The medial sagittal and tibial sesamoidal groove needs to be preserved to maintain the osseous balance between the base of the proximal phalanx, the sesamoids, and the metatarsal head. And finally, avoid the overcorrection of the intermetatarsal angle with an overly aggressive lateral translocation of the capital fragment and adductor tendon transfer. Although surgical correction of this deformity was not discussed, careful evaluation of the potential causes will aid in the decision of available procedures to correct its deformity.

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