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Soft Tissue Procedures for Hallux Abducto Valgus

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More than 100 procedures for the removal of a bunion (medial eminence) and correction of hallux abducto valgus deformity have been described.[1] In a rather simplistic classification, these procedures are either soft tissue corrections principally around the first metatarsophalangeal joint or those procedures that employ an osteotomy to correct a structural component of the deformity.

Although soft tissue procedures have been described as the sole means for the removal of a bunion or correction of hallux abducto valgus, in most instances they are now used when very strict preoperative criteria have been met.[2-8] However, it is imperative to remember that whenever an osseous procedure is performed, the deforming forces and pathology around the first metatarsophalangeal joint have been addressed and corrected using a "soft tissue procedure," usually in some modification from the original authors' descriptions.

HISTORICAL PERSPECTIVE

The three most important procedures and those that serve as a foundation for any modifications are the Silver, Hiss, and McBride bunionectomies.

In 1923 Silver described his procedure, which consisted of removal of the medial eminence coplanar with the medial cortex, a lateral capsulotomy, adductor release, and reinforcement of the medial capsule via a V to Y capsulotomy.[9] He astutely realized this procedure should never be attempted when degenerative joint disease is present. In 49 surgeries on 31 patients, there were only 2 recurrences and 2 hallux varuses during a 2-year follow-up. The methodology by which these numbers were obtained was not reported.

Hiss in 1931 described hallux abducto valgus as a "buckle joint" whereby a tendon imbalance was caused by the altered and diminished pull of the abductor hallucis and the increased advantage of the adductor hallucis. His observation of the pathology- elucidated the fact that the medial capsule was stretched while the lateral capsule was contracted. His insight brought about the concept of capsule tendon balance as a surgical goal. This could be accomplished by resection of the medical eminence, an adductor hallucis tenotomy, a medial elliptical capsulotomy, and the repositioning of the abductor hallucis more dorsally via sutures into the medial periosteum and capsule of the first metatarsal.[10] The latter would create fibrosis, periarticularly in hopes of preventing elongation and relaxation of the medial structures. Fibular sesamoidectomy was performed as needed.

The evolution of surgical procedures for bunion correction next addressed the fibular sesamoid and its significance in the formation of a bunion deformity. This concept was popularized by McBride.[11-13] In his original work of 1928, the medial eminence was removed coplanar with the first metatarsal, the adductor hallucis was released and transplanted into the lateral head of the first metatarsal, and the fibular sesamoid was removed if eroded, abnormal in shape, or displaced. The amount of displacement never was addressed. Two incisions were utilized: one dorsomedially and another through the first interspace. The

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final position after closure was 10° of varus, but no mention was made of the long-term consequences of this overcorrection.[11]

In 1954, McBride further elucidated his surgical approach by staging the development of a bunion deformity.[12] In stage 1, the bunion is just beginning to form. No articular changes would be evident, and correction could be achieved by a closed tenotomy of the adductor hallucis. Stage 2 represents a moderate deformity; a rather large medial eminence with an adventitious bursa is found. In this instance the eminence is removed, the adductor hallucis is cut and a ⊦ to j-in. wedge-shaped part of the medial capsule is removed. Stage 3 is a severe deformity characterized by a moderate amount of cartilage degeneration of the first metatarsophalangeal joint. For these cases, the fibular sesamoid is removed, the tenotomized adductor hallucis is resutured into the lateral aspect of the first metatarsal neck, and the first and second metatarsals are reapproximated using sutures through the capsules of each. Severe degenerative joint disease exists in stage 4. Both sesamoids may have to be removed if diseased. Again, no objective studies are contained in the paper to substantiate the claims proposed.

Finally, in 1967 McBride called the conjoined adductor hallucis the culprit of the bunion deformity.[13] A simple test determined if the adductor and lateral capsule were to blame and whether the fibular sesamoid should be excised. If the hallux corrected while the adductor was at rest but not weight-bearing, then just the adductor was contracted. Such a finding did not warrant the removal of the fibular sesamoid. Conversely, if the hallux was unable to correct while weight-bearing then the capsule was contracted and the sesamoid should then be excised.

Table 7-1 lists some of the lesser known authors of soft tissue procedures or those who for various reasons have not been given the proper credit for their work over the course of time. From the Silver, Hiss, and McBride papers, foot surgeons performed varied parts of these procedures. Their importance is paramount to adequate and long-term success of any hallucal procedure.

OBJECTIVES OF SOFT TISSUE PROCEDURES

Pathology around the first metatarsophalangeal joint may present as a bunion (medial eminence) with or without adventitious bursa formation or as a hallux abducto valgus deformity whereby the hallux is abducted with or without valgus rotation. In the latter case, the intermetatarsal and hallux abductus angles can be significantly increased.

Such deformities alter the anatomy and thereby the mechanics of the structures of the first metatarsophalangeal joint. The medial structures are stretched while the lateral are contracted (Fig. 7-1). Mechanical advantage of the adductor hallucis over the abductor hallucis perpetuates the deformity. The abductor hallucis then becomes merely a plantar-flexor. In longstanding cases, cartilaginous changes occur at the articular surfaces as the hallux drifts laterally, thus depriving the medial cartilage of proper articulation by the proximal phalangeal base. In protracted cases, the hallux rotates in a valgus direction.

The main objectives of any procedure in hallux abducto valgus surgery are to correct the deformity, prevent recurrence, and maintain as nearly normal motion as possible.[14,15] Used as the entire procedure in rather mild cases and combined with procedures that realign deformed osseous structures im more severe cases, the Silver, Hiss, and McBride techniques can accomplish these stated objectives. Soft tissue procedures are never performed on congruent joints; the objective is to create one. If a soft tissue procedure is done alone on a congruent joint, the joint will ulti-

Table 7-1. Lesser Known Authors and Their Procedures

Author	Date	Procedure
Lothrop	1873	Adductor tenotomy and lateral capsulotomy
Fowler	1887	Remove head through interdigital incision
Syms	1897	Remove as much of medial eminence as needed to flatten
Schede	1904	"Simple exostectomy — remove bone not in contact with proximal phalanx
Porter	1909	Remove two-thirds to three-fourths of metatarsal head
Mauclaire	1924	EHL. and adductor into first metatarsal head
Balog	1928	Adductor into medial aspect of first metatarsal head. Abductor into EHL
Stein	1938	Two incisions; adductor release and abductor dorsally sutured into capsule

EHL = Extensor Hallucis Longus

Contraction
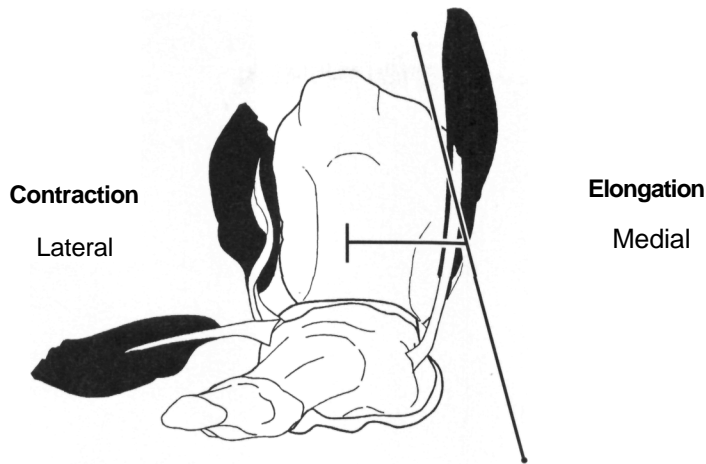
Lateral

Elongation

Medial

Fig. 7-1. With the first metatarsophalangeal joint as the fulcrum, the medial structures are stretched (the elevated part of the see-saw) and the lateral structures are contracted.

mately become deviated and jam medially, leading to premature degenerative joint disease.

Whenever the first metatarsophalangeal joint undergoes surgery, the malaligned structures should be repositioned as anatomically as possible. The contracted tissues need to be relaxed (laterally) and the elongated tissues secured (medially) more tightly. In essence, a capsule tendon balance (actually a rebalancing) must be created.[10] Failure results in undercorrection, recurrence, or, if overcorrected, hallux varus.

SURGICAL TECHNIQUES

Anyone who has attempted repair of a hallux abducto valgus realizes that the objectives are not so easily realized. For the purpose of this chapter, the following discussion presents the steps employed in the capsule tendon balance attempt.

A capsulotomy will open the medial or dorsimedial aspect of the first metatarsophalangeal joint, thus exposing the medial eminence. Any type may be used (e.g., U, T, inverted L, dorsolinear, semielliptical, etc.). The dorsal linear and T can easily overcorrect when tightened.[16] Although redundant capsule can be removed, there is no hard-and-fast rule to determine the amount. Suture placement in an oblique fashion can be effective in derotating the hallux when a semiellip-

tical capsulotomy is performed. The abductor hallucis can also be pulled more dorsally when oblique sutures are used. One should never, however, rely on the capsular closure to hold the ultimate position of correction.

Resection of the medial eminence depends on the procedures performed. In some instances no medial eminence need be removed, especially in the juvenile deformity. When a simple bunionectomy is warranted, the medial eminence can be resected almost flush with the first metatarsal medial shaft. Whether with an osteotome or power saw, the cut is made medial to the sagittal groove. This technique should be reserved for those patients who need the medial eminence resected for reason of a chronic bursal formation or a lesion over the eminence, or when complete correction is contraindicated (Fig. 7-2).

For those patients who need total correction of the deformity, the medial eminence should be removed medial to the sagittal groove, but the osseous blade should be angled to remove more bone from the dorsal surface than from the plantar (Fig. 7-3). When the correction is performed in this manner, the plantar articular tibial sesamoid surface is preserved. Hallux varus formation as a result of medially staking the head and tibial sesamoid peaking is prevented. Naturally, rough edges are always rasped smooth in motions away from the articular cartilage.

The lateral release should consist of completely

Fig. 7-2. (A) A 75-year-old patient with symptomatic hyperkeratotic lesion over the medial eminence. This patient is a poor candidate for osteotomy. (B) Postoperative radiograph with medial eminence removed. This eliminated the lesion.

tenotomizing the conjoined tendons (oblique and transverse) of the adductor hallucis, severing the deep transverse metatarsal ligament, and performing a lateral vertical capsulotomy and fibular sesamoid release. Completion will enable the hallux to move without restriction medially and repositions the sesamoids under the metatarsal head.

Historically, a separate incision of the first interspace was done to complete the lateral release. We now know that the interspace can be addressed through the initial dorsimedial incision when the superficial and deep fascial fibers are severed.

Retraction of the skin and extensor tendons exposes the most dorsal aspect of the first interspace. The back of a scalpel handle is used to bluntly dissect the interspace. The adductor tendons will be palpated, but the handle is able to proceed to the plantar surface proximal and distal to the adductor.

A successful and relatively quick technique for severing the tendons and ligament is to insert an opened curved hemostat from distal to proximal under the adductor and transverse ligament. Sharp dissection is then performed through the opened hemostat. No structures should impede the placement of the scalpel
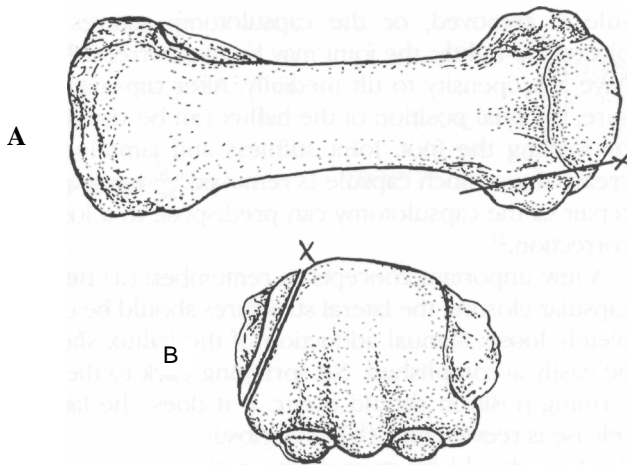
Fig. 7-3. (A) Angle of cut to preserve tibial sesamoid articulation. **(B)** Angle of cut when viewed dorsally. "X" indicates the sagittal groove.

handle when it is reinserted throughout the interspace. Complete release of the adductor tendons is the most important step of the lateral release.[6] Numerous veins are located in the interspace at this level, and thus hemostasis is critical. A release that is too proximal can jeopardize the deep plantar artery.

The fibular sesamoid is next addressed to be released. The capsule dorsal to the sesamoid is initially punctured, and the knife blade is moved distally then plantarly around the sesamoid. This incises the attachments of the adductor hallucis and flexor hallucis brevis to the proximal phalanx. A similar maneuver is performed around the sesamoid, proximally, then plantarly. A periosteal elevator may have to be inserted

superficial to the sesamoidal cartilage to aid in the sesamoid release (Fig. 7-4). The fibular sesamoid should appear in a more plantar position and is easily movable, adhering only by the intersesamoidal ligament. Degenerative joint changes of the metatarso-sesamoidal joint may hinder the sesamoid from dropping.

If upon its release there is no mobility whatsoever, then the fibular sesamoid may be removed. Also, with a very high intermetatarsal angle, and if the patient is a poor candidate for an osseous procedure, fibular sesamoid removal can decrease the intermetatarsal angle by a few degrees via the concept of reverse buckling.[17-19]

Removing this sesamoid can tilt the balance of the joint to the medial side, especially if too much eminence is removed and the tibial sesamoid begins to drift medially and peaks from beneath the metatarsal head. A hallux varus can result, and this will be even more predictable if the medial capsule is tightened excessively and the intermetatarsal angle approaches 0 or negative degrees (Fig. 7-5).

Fibular sesamoid removal is not easy, especially when the sesamoids are completely articulating with the metatarsal or have just begun to move within the first interspace. Ease of removal can be accomplished when a tag of capsule is created laterally so the surgeon can hold onto the bone via the tag and manipulate it around the knife's cutting surface. At no time is it more critical to incise tissue next to bone. Failure to follow this rule can lead to severance of the long flexor.

A vertical lateral capsulotomy is created from just below the extensor tendons to the plantar aspect of
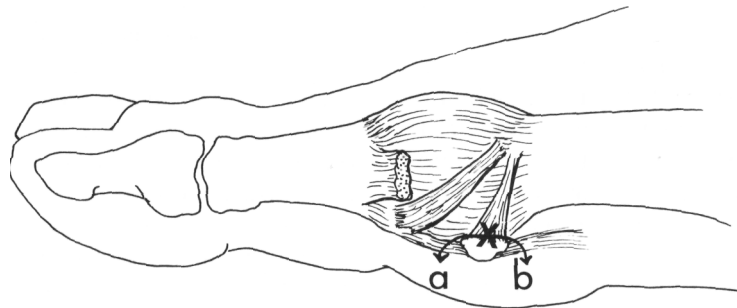

Fig. 7-4. Releasing fibular sesamoid. "X" is where blade is first inserted and is advanced to meet points a and b.

Fig. 7-5. Hallux varus. Note tibial sesamoid "peaking" from excessive resection of the medial eminence. Fibular sesamoid has been removed.

the joint. By distracting the joint distally and observing the puckering of the capsule, the joint is identified and the knife is inserted into the puckered area and moved plantarward.

After all the foregoing steps are completed, the hallux should be able to be manually placed in a corrected or slightly overcorrected position. Any hint of tightness laterally should warrant an inspection of the first interspace and determination of the structures that were incompletely released initially. Any found at this time are now released, as complete lateral release is paramount.

Capsulorraphy or reefing the medial capsule after all the prior steps have been performed can maintain the correction and balancing around the metatarsophalangeal joint. However, if too much redundant cap-

sule is removed, or the capsulotomy sutures are placed too tightly, the joint may be overcorrected and have a propensity to tilt medially. After capsular closure, the final position of the hallux can be visualized by loading the foot. Joint stiffness and jamming increase if too much capsule is removed.[6,20] Inadequate repair of the capsulotomy can predispose to a loss of correction.[21]

A few important concepts to remember: (a) Before capsular closure, the lateral structures should be completely loose. Manual adduction of the hallux should be easily accomplished. No springing back to the deforming position should occur. If it does, the lateral release is reevaluated. (b) After closure of the capsule, the foot should be moved into a simulated weight-bearing position. The hallux and first metatarsal should now be in proper and physiologic alignment, and thus all preoperative angles must be corrected. If reliance is placed on the capsular sutures or dressings to maintain the correction, it will not stand the test of time.

The literature contains diverse opinions as to whether the extensor hallucis brevis be tenotomized to complete the rebalancing of the first metatarsophalangeal joint.[8,17,22] No studies have been formulated as to whether tenotomizing the extensor hallucis brevis leads to a diminished recurrence rate.

Intraoperatively, while the tourniquet is inflated, is not the time to determine if the long extensor is contracted. Tourniquet elevation will lead to many false positives. Should the tendon be taut per preoperative determination, then a slide lengthening can be done. This is performed before closure of the capsule.[8] Lengthening the tendon in the presence of a hypermobile first ray may increase the hypermobility.[18] Currently the extensor hallucis longus tendon is rarely lengthened during hallux abducto valgus surgery.

Extensive bowstringing of the long extensor ultimately decreases with reduction of the intermetatarsal angle. In very severe deformities, a residual bowstringing may exist. With these cases, the most medial part of the extensor hood may be incorporated into the capsular closure at the metatarsal neck.[17] At no time is the tendon itself punctured.

Transfer of the adductor hallucis has been advocated to aid in the correction of the soft tissue procedures. The theory is that when the adductor hallucis is transferred to the medial capsule, the fibular sesamoid is rotated into a more anatomic position via the torque

of the medial capsule, which is transferred to the medial sesamoid via the tibial sesamoid ligament and on through the fibular sesamoid via the intersesamoidal ligament.[23] Forefoot splay is decreased as well as the intermetatarsal angle.

Adductor hallucis transfers are not performed in any patients with fibular sesamoid degenerative joint disease or atrophy of the tendon (which occurs frequently in older patients), or in those feet in which a structural intermetatarsal angle exists.[24]

Available length of the adductor tendon may preclude the transfer traversing all the way to the medial capsule via a route deep to the extensor hallucis longus at the metatarsal neck. In such cases, the tendon can be passed medially through a drill hole in the metatarsal or simply sutured to the lateral capsule [5,.8,11,18,25,26]

Adjunct soft tissue procedures when combined with an osseous procedure can be enhanced by suturing the capsules of the first and second metatarsals together with incorporation of the adductor hallucis.[27]

Extensive lateral releases have been implicated in the development of aseptic necrosis of the first metatarsal head when combined with distal osteotomies. Reports of 20 percent occurrence appear to be rather high.[28] Failure of a complete lateral release may lead to recurrence. Both aforementioned scenarios must be weighed carefully when performing this surgery.

CRITERIA FOR SOFT TISSUE PROCEDURES

Patients presenting to the physician's office for surgical correction of a bunion or hallux abducto valgus deformity not only want the pathology removed but also desire a "new foot. "[29] The agreement between their expectations and the final outcome may be less than ideal. Therefore, each case must be properly evaluated both clinically and radiographically to determine the proper procedure for not only the pathology but also for the patient's life-style, age. bone composition, and medical history.

Soft tissue procedures, namely the Silver and McBride procedures, may be used alone or in combination with osseous procedures (Fig. 7-6). As previously mentioned, the goal is to restore the balance around the first metatarsophalangeal joint. In the absence of any osteotomies (when used alone), patients

undergoing the Silver and McBride procedures will heal more rapidly and be afforded quicker return to shoe gear. Obviously there is no need to await bone healing. Therefore, the procedures can prove to be very attractive to those who desire a quick, easy fix. However, if certain criteria are not met, then the chance of deformity recurrence increases.

Proper evaluation of any patient with hallux abducto valgus, in addition to pertinent history and neurovascular examination, consists of the following:

1. Presence or absence of medial eminence and lesions overlying the eminence. Is an adventitious bursa present?
2. Amount of hallux drift laterally and position of second toe. Amount, if any, of valgus rotation of hallux.
3. Evaluation of joint to include presence or absence of any crepitus, effusions, pain, or restricted range of motion. Is the joint track bound?
4. When in corrected position, is there pain at the most medial aspect of the cartilage on the first metatarsal or is the range of motion decreased?
5. Evaluation of ligamentous laxity.[30]
6. General foot type.

Radiographic evaluation in the angle and base of gait will consist of the following:

1. Measurement of intermetatarsal, hallux abductus, metatarsus adductus, hallux abductus interphalangus, proximal articular set, and distal articular set angles
2. Evaluation of metatarsal protrusion
3. Evaluation of the tibial sesamoid position
4. Evaluation of the shape of first metatarsal head (round, ridged, square)
5. Determination of the presence or absence of degenerative joint disease within the first metatarsophalangeal joint
6. Determination of whether a deviated, congruous, or subluxed joint is present
7. Evaluation of structural deformity: Proximal articular set angle (PASA) + distal articular set angle (DASA) = hallux abductus angle (HAA)
8. Evaluation of positional deformity: PASA + DASA < HAA[31]

When all the foregoing are determined, the decision process begins. The soft tissue procedures when
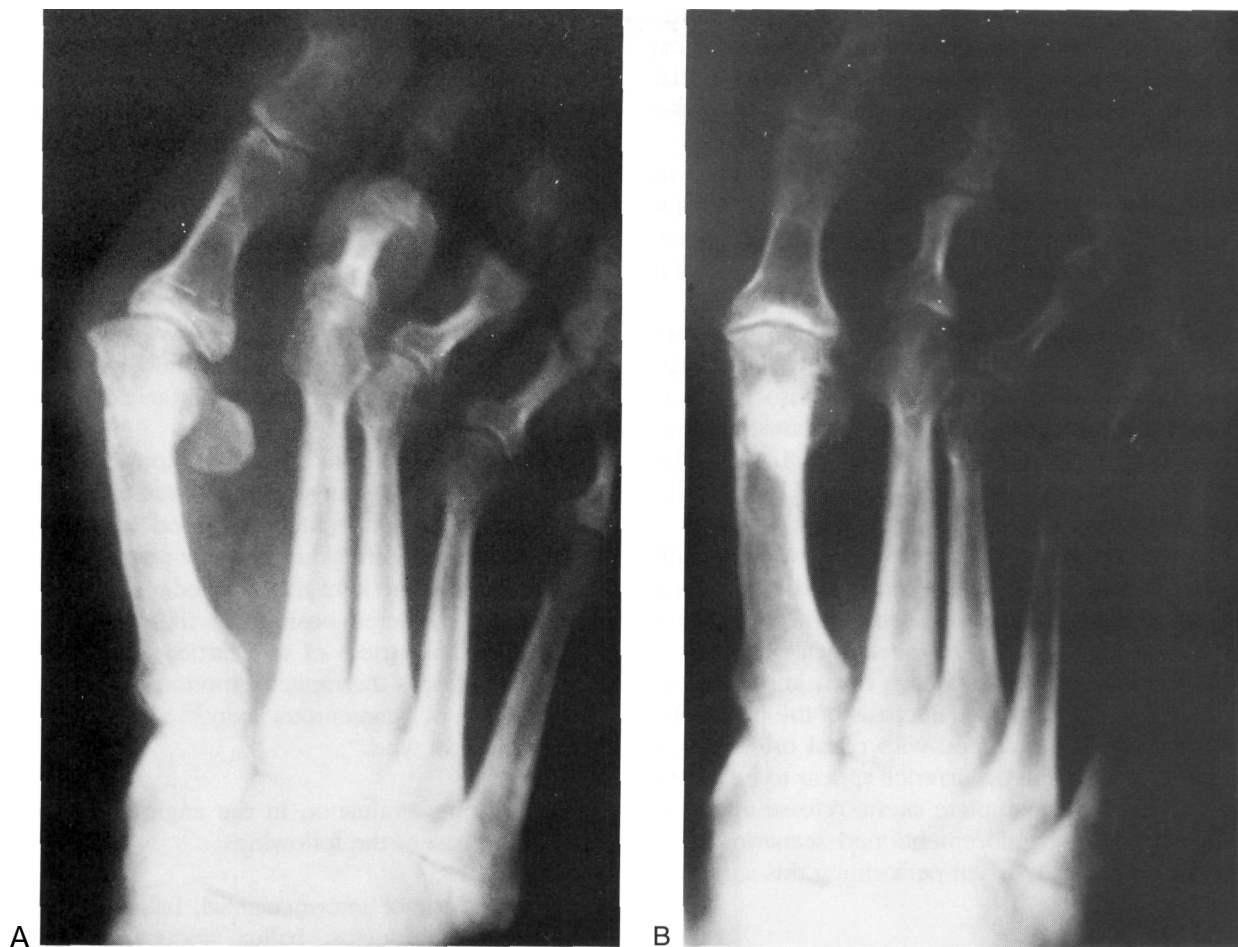
Fig. 7-6. Radiographs demonstrate the potential for correction of the adducto hallucis tendon after transfer on the intermetatarsal angle. (A) Preoperative radiograph of a patient who underwent previous forefoot surgery including bunionectomy of the first metatarsophalangeal joint; recurrence of the deformity is evident. (B) Postoperative radiograph after adductor hallucis transfer and fibular sesamoidectomy.

used alone should be performed only on positional deformities. Obviously, osseous correction would be necessary if structural deformities exist.[32]

When soft tissue procedures are used alone, there should also be no evidence of degenerative joint disease or restricted range of motion. No pain in the corrected or uncorrected position should be produced when the joint is stressed. A track-bound joint would be a contraindication. However, the first metatarsophalangeal joint should be deviated or subluxed, and preferably with a central ridge or squared. If it is congruous, the capsule tendon balance will more than

likely jam the joint medially and precipitate early degenerative joint disease. A rounded head can be unstable in the transverse plane and more easily disrupted if the capsule tendon balance is not adequate.

In general, the intermetatarsal angle should be less than 12°, and the hallux abductus angle less than 40°. Metatarsus adductus is not evident, and the metatarsal protrusion is negative.[20] Only mild pronatory changes are noted (Fig. 7-7).

The Silver bunionectomy, whereby just the medial eminence is removed, can be performed in the elderly especially when a lesion, bursa, or only bump pain are

Fig. 7-7. Large intermetatarsal and hallux abductus angles would preclude performing only a soft tissue procedure.

the complaints. In these cases there should be limited expectations. Other more complex procedures may be contraindicated because of poor bone composition or healing capabilities. The long-term prognosis is rather poor. One can see that the indications are limited and the procedure thus is rarely used.[17,33]

For this chapter, the modified McBride bunionectomy consists of medial eminence resection and extensive lateral release with the fibular sesamoid remaining in vivo. The angle measurements as just listed would be sufficient criteria for the selection of this procedure.

In the "true" McBride bunionectomy the fibular sesamoid is removed. Care must be taken to prevent hallux varus by means of judicious resection of the medial eminence. More is removed dorsally than plantarly. The capsular repair is not tight, thus never

placing the hallux in an overcorrected position. The fibular sesamoid can be removed[34] if the tibial sesamoid position is greater than 4 although others[6] advocated only removing the sesamoid if 6 or greater. Even though a fibular sesamoidectomy can reduce mild rotary component of the hallux, its use today is somewhat infrequent.

Another method to determine whether a soft tissue procedure would be appropriate is to wrap a 3-in. Ace bandage around the forefoot and take a dorsiplantar weight-bearing film. If the first metatarsocuneiform joint gapped medially then these procedures would not adequately correct the deformity[35]; osseous work would be required.

The modified McBride bunionectomy is used with osseous procedures when the deformity is moderate to severe. The osteotomies, whether distal or proximal on the first metatarsal, will structurally alter the intermetatarsal angle. Because of the consequences of the hallux abducto valgus around the joint, the capsule tendon complex must be balanced; therefore, the modified McBride bunionectomy is used as previously described. Completion of both these procedures should produce a foot without deformity postoperatively.

Adductor transfers broaden the criteria for soft tissue procedures. If the intermetatarsal angle is positional, the metatarsocuneiform angle less than 24°, the metatarsal split distance greater than 2 mm, and the first metatarsal deformation angle less than 8°, then the adductor transfer can be performed with a satisfactory reduction of the stated parameters.[24]

Assuming a soft tissue procedure seems the logical choice on the basis of all the preoperative data, one can analyze the final outcome intraoperatively. The steps of the soft tissue procedure are completed. If on reduction of the intermetatarsal angle manually the first metatarsal springs back into adduction, then an osteotomy also should be performed.[33] Careful preoperative analysis should lessen the need to use this test.

POSTOPERATIVE ANALYSES AND COMPLICATIONS

Surgical correction of hallux abducto valgus requires rigorous attention to anatomic dissection and surgical technique, and the capability preoperatively to analyze

the foot and then select the appropriate procedure for that deformity and the patient's medical status and lifestyle. Soft tissue procedures prove to be very attractive to the patient because they are relatively easy to perform, require a minimal amount of healing, and permit the patient to return to wearing shoes quickly. However, if criteria are stretched to produce a quick and easy solution to a complex pathology, then the long-term results are suspect.

Recurrence of the deformity is the number one complication whenever a soft tissue procedure is used alone. Usually the procedure is inadequate to correct the existing pathology.[2,36] Failure to adequately repair the medial capsule can also increase the probability for recurrence.[21] Attempting a soft tissue procedure on a joint that was congruous preoperatively will only jam the medial side when the capsule is tightened. Failure to adequately complete the lateral release also leads to recurrences.

The high recurrence rate in juvenile patients (reported to be as high as 75 percent) indicates that soft tissue procedures should not be performed on this type of deformity.[37,39] Osseous correction is necessary; they will maintain the correction over time.

Removal of the fibular sesamoid can lead to hallux varus. This is especially true if the medial eminence has been removed too aggressively, the intermetatarsal angle is 0° or a negative value, and the tibial sesamoid moves medial to the first metatarsal (peaks). More than 13 percent of hallux varuses have been reported after fibular sesamoidectomy.[3,4,40-42] Overly zealous tightening of the medial capsule after removal of the fibular sesamoid can also result in a hallux varus developing either immediately postoperatively or over time as the capsule tendon balance falters and pulls excessively medially.

DuVries' modified McBride procedure has been performed in more than 2,700 cases with good to excellent results being reported in 90 percent.[43] Of significance was the plication of the first and second metatarsal heads together.

Using soft tissue procedures alone can decrease the intermetatarsal and hallux abductus angles by as much as 5° and 14°, respectively.[3] Reverse buckling applies retrograde forces to the first metatarsal and allows the intermetatarsal angle to reduce.[19] This will be more easily accomplished if the first metatarsocuneiform joint is round.[44]

Any time an osseous procedure is performed, whether distal or proximal on the first metatarsal, a modification of the soft tissue procedures is performed to balance the structures around the first metatarsophalangeal joint. Reduction of the intermetatarsal angle to normalcy combined with an incomplete lateral release predisposes the patient to a recurrence of the deformity.

Therefore, whenever an osseous procedure is performed the medial capsule is sutured and the foot is placed in simulated weight-bearing. A timid lateral release can be evident as a laterally drifting hallux. Conversely, excessive medial capsule tightening can tilt the hallux into varus.

Assuming that the medial capsular sutures or the postoperative dressing will hold the correction is naive. The capsule tendon balance and any osseous correction inadequately performed cannot rely on a dressing or a few medial sutures in the capsule to maintain satisfactory long-term results.

POSTOPERATIVE COURSE

Soft tissue procedures have the shortest postoperative time periods for healing and returning to wearing shoes. This time period will be predicated on the amount of persistent edema. It is not always possible for the patient to alter shoe styles after one of these procedures.

As with any arthrotomy, the first metatarsophalangeal joint must be actively and passively exercised postoperatively.[45] Adhesions can render the joint stiff and lower the success rate. Exercises can be coupled with other physical therapy modalities to enhance the range of motion at the first metatarsophalangeal joint.

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