CHAPTER **31**

HALLUX VARUS REPAIR BY EXTENSOR HALLUCIS BREVIS TENDON TRANSFER

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INTRODUCTION

The causes of hallux varus and its clinical evaluation have been well-described by previous Podiatry Institute authors. The goal of this update is to describe the extensor hallucis brevis (EHB) tendon transfer in a case study as well as re-explore the step-wise surgical approach to hallux varus that has been historically recommended by the Podiatry Institute.

THE PODIATRY INSTITUTE STEP-WISE SURGICAL APPROACH (SWSA)

The SWSA to hallux varus, as described initially by Banks et al in 1988[1] and further described in the Podiatry Institute Updates '88 and '92,[2,3] is what the author has traditionally used as her personal step-wise approach to hallux varus correction. On the whole, it accurately defines a logical approach to dealing with the various deforming forces and possible etiologies of the deformity. There are, however, some recommendations within the step-wise approach that the author believes should perhaps be reconsidered depending on the case. These are minor compared with the overall comprehensiveness of the approach itself, but major if you are going to consider the EHB tendon transfer to correct a hallux varus deformity.

To review, the SWSA includes 5 major components: soft tissue release, correction of the structural deformity, tendon release/transfer, tibial sesamoidectomy, and joint destructive procedures (Table 1). The author proposes a slight modification to the SWSA if clinically the deformity is flexible and there is no definitive structural deformity. At the soft tissue release portion, the author recommends that the intermetatarsal ligament not be transected as part of the release, as this is an essential component in the successful use of the EHB tendon transfer. The author feels that its potential benefit as a fulcrum for the EHB tendon transfer outweighs its benefit as part of the lateral release in the SWSA, particularly if the deformity is flexible. Secondly, if the deformity is flexible enough, tendon transfers should be tried or considered before a metatarsal osteotomy, unless a structural deformity is the obvious cause such as with a negative proximal articular set angle. Sometimes a negative intermetatarsal angle will be secondary to the retrograde force of the hallux in its varus position, rather than because of an overcorrection of the bunion osteotomy itself. The EHB tendon transfer should be considered in the step-wise surgical approach to hallux varus as a valuable tool for deformity reduction.

EXTENSOR HALLUCIS BREVIS TENDON TRANSFER

The EHB tendon transfer was first discussed in hallux varus repair by Skalley and Myerson in 1994.[4] In 1996, the procedure was outlined by Myerson and Komenda with biomechanical cadaver analysis by Juliano, Myerson, and Cunningham.[5,6] The procedure is recommended for patients with a flexible hallux varus deformity, particularly those that are young, active with good first metatarsophalangeal joint

Table 1

STEP-WISE SURGICAL APPROACH TO HALLUX VARUS

I. Soft Tissue Release
   - A. Skin incision
   - B. Medial capsulotomy
   - C. Lateral release/transection of intermetatarsal ligament
   - D. Total intracapsular release/ deglove 1st metatarsal

II. Correction of Structural Deformity
   - A. Negative intermetatarsal angle
   - B. Negative proximal articular set angle

III. Tendon Release/Transfer
   - A. Adductor hallucis
   - B. Abductor hallucis
   - C. EHL

IV. Tibial sesamoidectomy

V. Joint destructive procedures
   - A. Implant Arthroplasty
   - B. Keller Arthroplasty
   - C. 1st MPJ Arthrodesis

range of motion and no arthritic changes, and if soft tissue releases have failed to fully reduce the deformity intra-operatively.[4-6] The EHB is an ideal tendon to utilize for hallux repair because of its natural insertion into the dorsolateral base of the proximal phalanx. Once completed, the tendon transfer serves as a static restraint to the extension and varus deformity typical of hallux varus.[4-6] In your preoperative assessment, if the hallux can be pushed over and held there with tape and if this reduction with tape appears well-aligned on a weightbearing DP radiograph than the author feels there is a good chance an EHB tendon transfer can be successful without an osteotomy. The author feels that the EHB transfer can also be used to augment the surgical correction of hallux varus even after a reverse osteotomy is used.

PROCEDURE

The author typically performs a dorsomedial incision to approach the first metatarsophalangeal joint. After soft tissue releases fail to fully correct the varus deformity, the dorsomedial incision is extended proximal and distal in line with the EHB tendon, which is first identified distally at the first metatarsophalangeal joint. The EHB insertion is left intact distally and the tendon sheath is incised to its myotendinous junction. The proximal tendon portion is tagged with suture and the tendon is cut at the junction.

The tendon is then passed beneath the deep transverse intermetatarsal ligament from distal to proximal. The intermetatarsal ligament will thereby serve as a fulcrum to pull the hallux out of extension and out of its varus position. The tendon can be secured at the first metatarsal once re-alignment of the hallux is achieved. Myerson suggested placing the hallux into 5 degrees of valgus and he used a bone tunnel starting 1.5 cm proximal to the joint and drilling from dorsomedial proximal at the first metatarsal to plantar, distal, and lateral.[4-6] The tendon was than secured proximal to the bone tunnel with a proximal cancellous screw as described by Myerson.

Other options include suturing the tendon to the medial capsule after coursing through the bone tunnel or foregoing the bone tunnel and securing the tendon to the lateral aspect of the first metatarsal by suture techniques or suture anchor. Securing the tendon laterally may particularly be useful if repair needs to be augmented with a reverse distal osteotomy in which a bone tunnel may interfere with the osteotomy or fixation. Of note, Downey has described using a suture anchor in lieu of the EHB tendon in a similar manner through a bone tunnel that would require a smaller bone tunnel than one requires for the EHB tendon (Downey M: personal communication).

CASE STUDY

The patient was a 38-year-old woman who presented with an iatrogenically caused flexible hallux varus after a closing base wedge osteotomy 3 years prior by another physician. The hallux was adducted, extended, and had only slight hallux interphalangeal joint flexion. Clinically, the deformity was flexible, reducible, and without crepitation or restriction in range of motion. Radiographs (Figures 1, 2) demonstrated a resected first metatarsal head medial sagittal groove, tibial sesamoid peaking, adducted and extended first metatarsophalangeal joint, and apparently preserved and non-arthritic joint. It was the author's feeling that there was a possibility that the intermetatarsal angle was largely secondary to medial retrograde pressure of the hallux.

Overall, it was felt that the joint was salvageable. The surgical plan reflected joint preservation, including medial capsulotomy and soft tissue release and rebalancing, possible extensor hallucis brevis tendon transfer, and if not completely reduced, a reverse head osteotomy procedure. Intra-operatively, residual deformity was still present, but flexible after soft tissue releases typical of the Podiatry Institute step-wise surgical approach to hallux varus,

Figure 1. AP and oblique preoperative radiographs.

Figure 2. Lateral preoperative radiograph.

except the deep intermetatarsal ligament was left intact.

The EHB tendon was harvested and transferred as described previously (Figures 3-6). An intra-operative Mini C-arm was utilized to confirm that good reduction was achieved after the extensor hallucis brevis tendon transfer was performed (Figures 7-10). In this case, the bone tunnel was created at the distal screw hole that had originally been used during the closing base wedge procedure. After the screws were removed from the previous surgery, a 2.5 mm drill was utilized to redirect the bone tunnel distal, plantar and lateral from the distal screw hole. The tendon was secured with a Krakow suture using 3-0 Fiberwire and passed through the bone tunnel to the medial portion of the first metatarsal. The fit was so tight within the bone tunnel that it was deemed appropriate to simply suture the distal portion of the

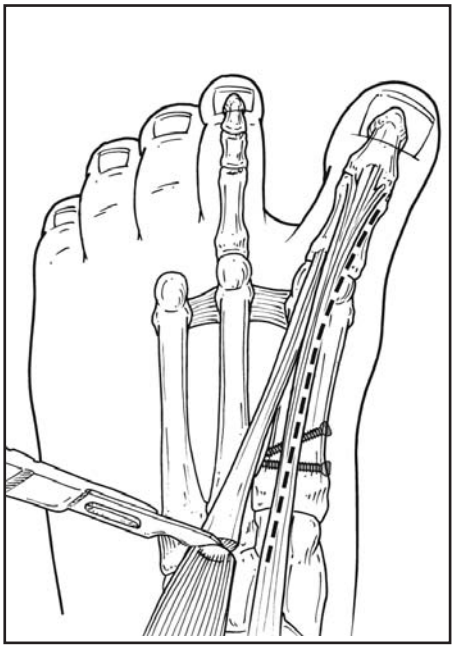

Figure 3. Harvesting the EHB tendon.

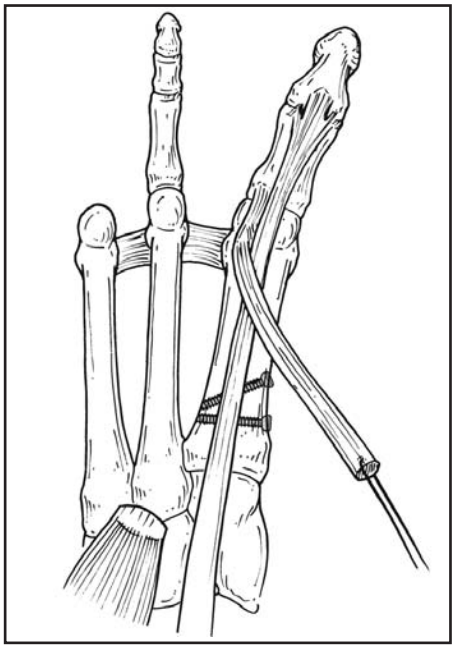

Figure 4.

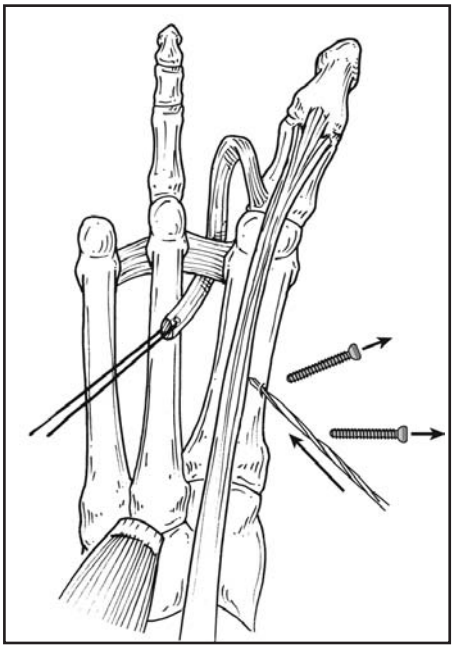

Figure 5. Routing the tendon underneath the intermetatarsal ligament.

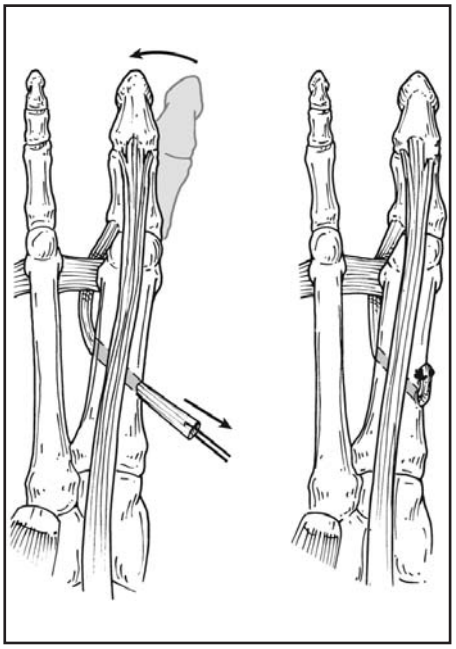

Figure 6. Passing the tendon through a bone tunnel and securing the tendon to the medial aspect of the first metatarsal.

tendon medially with the Fiberwire to the medial capsule/periosteum after the hallux reduction was achieved in a few degrees of valgus.

Postoperatively, the patient was placed in a posterior splint nonweight bearing for 2 weeks, than weight bearing in a fracture walker boot for 4 weeks. She began light range of motion exercises 4 weeks postoperative at the first MTPJ. The patient than progressed to full-weight bearing first in a postoperative shoe and finally into a running shoe. She had no significant complications (Figures 11-15).

A reported complication of this procedure is decreased dorsiflexion (mean 10 degrees), but plantarflexion is typically unaffected. Due to the EHB attachment, it is also possible to have slight supination of the hallux, but this typically is non-symptomatic.[4-6]

Figure 7. Intra-operative image before pulling the EHB tendon through the bone tunnel. This confirmed that good reduction could be achieved via the tenodesis.

Figure 8. Image after pulling the EHB tendon.

Figure 9. Immediate intra-operative view after completing the EHB tendon transfer.

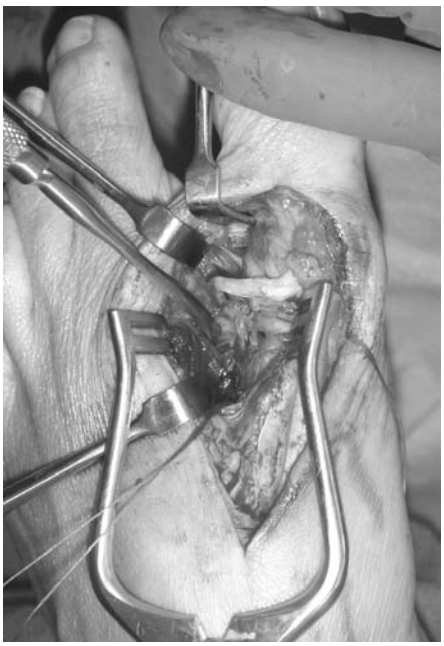

Figure 10. Intra-operative clinical with the Freer at the intermetatarsal ligament as the EHB tendon is being routed under the ligament.

CONCLUSION

The author has presented a case study of hallux varus repair by extensor hallucis brevis tendon transfer. Successful use of this tenodesis has prompted the author to propose possible slight modifications to the step-wise surgical approach to hallux varus historically recommended by the Podiatry Institute faculty when approaching this challenging deformity, particularly if it is flexible and no arthritis is present.

Figure 11. Long term follow-up AP and lateral radiographs demonstrate good hallux alignment.

Figure 13. Postoperative long-term follow-up clinical photo demonstrates excellent alignment of the hallux non-weightbearing.

Figure 12. Preoperative clinical photo demonstrating the hallux varus deformity.

Figure 14. Weightbearing postoperative view.

Figure 15. Postoperative view.

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