CHAPTER 3

FLEXOR DIGITORUM LONGUS TRANSFER FOR SECOND METATARSOPHALANGEAL JOINT DISLOCATION/SUBLAXATION

John M. Schuberth, D.P.M.
Richard Jensen, D.P.M.

There is growing recognition of a clinical entity involving primarily the second metatarsophalangeal joint (MPJ) in which the joint undergoes progressive subluxation and dorsal dislocation with transverse plane deviation, usually in a medial direction. This is accompanied by metatarsalgia, swelling, and local inflammation. As the toe dorsally dislocates, the proximal interphalangeal joint (PIPJ) becomes prominent in shoes, leading to a painful dorsal corn. If left untreated, the second toe often overrides the hallux. The toe can no longer dynamically plantarflex in the propulsive phase of gait, and the long flexor tendon cannot act as a sling under the metatarsal head. This leads to excessive pressure and plantar callosities under the second metatarsal head.

Symptoms of early subluxation and metatarsalgia are difficult to distinguish from intermetatarsal neuroma, and patients may have a history of failed neurectomy. Usually there is no history of pre-disposing trauma. Often, there is an associated condition that leads to abnormally increased weight-bearing on the second MPJ. This may be due to metatarsus primus elevatus, hallux abducto valgus with a resultant soft tissue supinatus, or an abnormally long second metatarsal. Decreased first MPJ weight-bearing can also be secondary to hallux valgus, or hallux limitus/rigidus corrective surgery that resulted in first metatarsal shortening or elevation.

Treatment is directed towards stabilizing the second MPJ, decreasing the weight-bearing pressures under the metatarsal head, and reducing chronic inflammation. Conservatively, this has included splinting of the second MPJ in plantarflexion and plantar padding to accommodate the metatarsal head. Treatment to decrease inflammation may include physical therapy modalities, nonsteroidal anti-inflammatories, or a short course of tapered oral glucocorticoids. Unfortunately, most patients do not seek treatment early in the natural course of the process. If long-standing significant deformity is present, and particularly if the deformities are rigid or only semi-reducible, conservative treatments rarely result in success. If the patient is not a surgical candidate secondary to peripheral vascular disease or other factors, accommodative orthoses in extra-depth shoes, or custom orthopedic shoes are indicated.

Numerous surgical approaches to hammertoes, clawtoes, and MPJ dislocations have been described. These have included multiple arthrodeses of the interphalangeal joints,[1] resection of the distal portion of the proximal phalanx,[2] resection of the base of the proximal phalanx,[3] resection of metatarsal heads,[4] combined soft tissue releases,[5] and various tendon transfers.[6-9] The purpose of this paper is to describe the author's preferred approach to the surgical treatment of lesser MPJ derangement with concurrent hammertoe deformity.

OPERATIVE TECHNIQUE

The operation is performed with the patient in the supine position, utilizing a mid-thigh pneumatic tourniquet at 250 mmHg. Spinal or general anesthesia is preferred. The leg is elevated and the tourniquet inflated. If needed, first ray corrective surgery is performed before addressing the lesser metatarsal or digital deformity. A dorsal linear incision centered over the PIPJ is made. Chronic dorsal callosities are ellipsed. The incision is carried proximally over the MPJ in a slight curvilinear fashion. The incision is deepened using sharp and blunt dissection, taking care to retract the dorsal neurovascular bundles. The extensor digitorum longus and brevis tendons are identified and the extensor wing and sling mechanisms are sharply released from the medial and lateral aspects of the

tendons (Fig. 1). The extensor apparatus is then transected with a dorsal capsulotomy just proximal to the PIPJ. The collateral ligaments and the attachment of the plantar plate of the PIPJ are released (Fig. 2). The head of the proximal phalanx is then resected at its surgical neck and the base of the intermediate phalanx is resected to subchondral bleeding bone. Both components are prepared as flat planar surfaces.

Attention is then directed to the dislocated MPJ. A stepwise approach to the release of the contracted soft tissues is performed. With the extensor tendons retracted laterally, a transverse dorsal capsulotomy is made. The medial and lateral collateral ligaments are identified and sectioned. Adhesions of the plantar plate and the flexor tendons to the metatarsal neck are sharply released. After each step in the sequence, the forefoot is loaded and the reduction of MPJ deformity is noted. It is important to adequately release all contracted soft tissue attachments to prevent recurrence of the deformity.[10]

Figure 1. Intraoperative photograph showing complete release of the long extensor tendon to the level of the metatarsophalangeal joint.

After full reduction of the MPJ deformity, attention is again directed to the digit. The plantar plate of the PIPJ is incised longitudinally. The flexor digitorum longus tendon is isolated and sectioned at the level of the *base* of the intermediate phalanx (Fig. 3). A drill hole is made in the *base* of the proximal phalanx, oriented from dorsal to plantar, to allow for passage of the long flexor tendon (Fig. 4). The tendon is then passed through the drill hole and secured with a clamp. Occasionally, the tendon is ensnared by the side cutting burr, facilitating its passage from plantar to dorsal.

A 0.062 inch K-wire is then driven through the base of the intermediate phalanx, exiting just inferior to the nail. The K-wire is then driven retrograde through the stump of the proximal phalanx, passing through and securing the flexor digitorum longus tendon. It is imperative to bring the base of the intermediate phalanx into close apposition with the stump of the proximal phalanx to accomplish the arthrodesis at the PIPJ. The digit is fixed in a plantarflexed and abducted, slightly overcorrected position. The K-wire is driven across the MPJ to maintain reduction. The FDL tendon is then

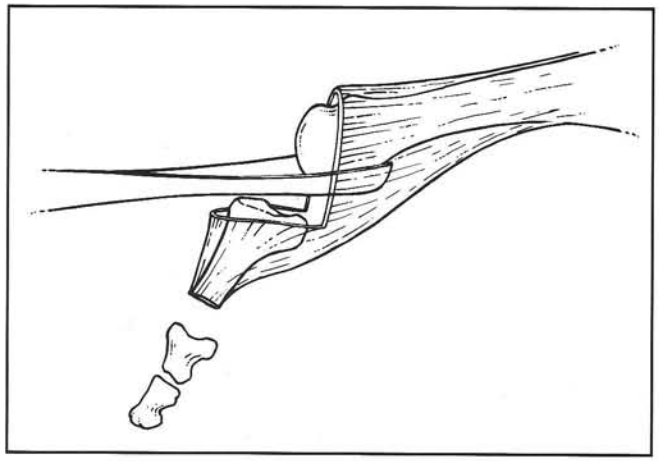

Figure 2. Plantar plate release with the use of a McGlamry Metatarsal Elevator.

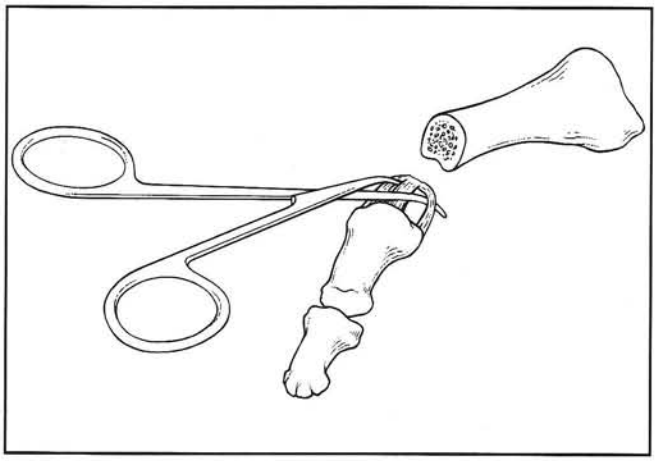

Figure 3. Dissection of the distal aspect of the FDL tendon at the level of the proximal interphalangeal joint.

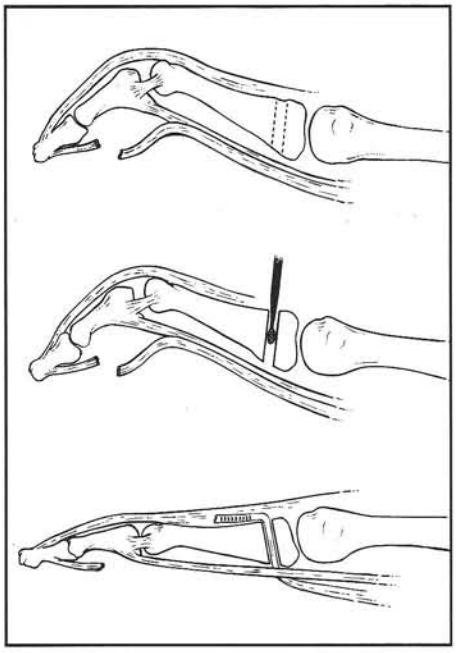

Figure 4. The location and orientation fo the drill hoe at the base of the proximal phalanx. Note the direction of the tendon after it passes from plantar to dorsal.

Figure 5. Postoperative x-ray depicting intramedullary position of Kirschner wire.

sutured into the extensors in an side-to-side manner with absorbable suture (refer to Fig. 4). The extensor tendon is then repaired at the level of the PIPJ. Redundant tendon tissue is excised. Occasionally a Z-plasty lengthening of the extensor tendon is required. The skin is then re-approximated and sterile dressings applied.

POSTOPERATIVE MANAGEMENT

If there is no contravening non-weight bearing hallux valgus procedure, then the patient is immediately allowed to weight bear as tolerated in a stiff soled postoperative shoe. The shoe or the dressings must have accommodation for the over-corrected position of the digit. This is accomplished with a stack of 4x4 gauze sponges incorporated into the plantar aspect of the dressing. Alternatively, a layer of 1/4 inch adhesive felt may be applied to the proximal aspect of the post-operative shoe. The skin sutures are removed 10 to 14 days postoperatively. The K-wire fixation is removed at approximately 6 weeks postoperative, after osseous fusion at the arthrodesis site. X-rays are taken immediately postoperatively to evaluate position and alignment of the drill hole, K-wire fixation, and the PIPJ arthrodesis (Fig. 5). X-rays are taken again at around 6 weeks to demonstrate fusion of the PIPJ arthrodesis. After removal of fixation the patient is able to return to normal shoes.

DISCUSSION

Current theories of the etiology of second metatarsal stress syndrome with MPJ dislocation and hammertoe deformity focus on factors that place excessive weight-bearing pressures on the MPJ. These may be a long second metatarsal, use of high-heeled fashion footwear,[11] or any other deformity that decreases first metatarsal loading, transferring the load laterally. With chronic inflammation and the action of proteolytic enzymes, the tenuous insertion of the plantar plate becomes disrupted. As the MPJ dislocates dorsally, the insertions of the intrinsics pass dorsal to the axis of rotation of the MPJ and there is a loss of the stabilizing function of the interossei. The lumbricals do not sublux dorsally as they are constrained passing plantar to the deep transverse inter-metatarsal ligament. However the steep angulation occurring with progressive hyper-extension may decrease their effect.[10] Once MPJ and PIPJ deformities are established, the actions of the long extensor and flexor tendons tend to increase them.[12]

The goal of surgical treatment is to reduce the dislocation of the MPJ and the contracture at the PIPJ, stabilize the two joints, and restore normal weight bearing to the MPJs. Stabilization of the MPJ has been accomplished with K-wire fixation and flexor to extensor tendon transfer.

The transfer of the long flexor tendon to the extensors has a long history. Originally utilized in the hand by Sir Harold Stiles in 1922,[6] the objective, then and now, was to replace lost function of the intrinsic musculature. Since that time there have been many modifications as to how that is accomplished. Forrester-Brown adapted the technique to the great toe in 1938.[6] Girdlestone applied the technique to lesser toes in 1947.[7] Pyper, in 1958, reported a series of 26 patients. He noted a problem with recurrence of deformity and stiffness in the digits. He recommended arthrodesing the interphalangeal joints as described by Lambrinudi.[8] Kuwada and Dockery described a modification in which the long flexor is passed through a drill hole in the *neck* of the proximal phalanx. This was intended for correction of flexible hammertoes.[13]

The deformities resulting from second metatarsal dislocation and crossover tend to be more rigidly contracted and with significant soft tissue adaptation in the dislocated position. When the tissues are placed in a corrected reduced position there is often ischemia and vasospasm due to tension on the neurovascular structures. This problem is usually addressed by longitudinally shortening the bony digital unit with a PIPJ arthroplasty or arthrodesis, relaxing the soft tissues.[10] In situations in which one cannot reasonably expect a return of normal intrinsic and flexor plate function, an arthrodesis of the PIPJ is indicated.[5] This is not possible using a drill hole in the neck of the proximal phalanx. The Kuwada procedure, modified as described by the authors, passing the flexor digitorum longus tendon through the *base* of the proximal phalanx, allows the surgeon to perform either an arthroplasty or arthrodesis procedure at the PIPJ.

Hyperextension at the MPJ is prevented by flexion forces exerted by the interossei, the lumbricals, the plantar aponeurosis, and the long and short flexors. The insertions of the interossei tendons, as described by Sarrafian, are the deep transverse intermetatarsal ligament, the plantar plate of the MPJ, the lateral capsule and the glenoid ligament, and the *base* of the proximal phalanx.[14] The authors feel that the procedure, as modified, produces a more anatomic recreation of the stabilizing function of the intrinsic musculature. This has been the goal of flexor transfer procedures from the outset. The authors believe that this procedure, utilized as indicated, yields predictable satisfactory results with reduction of deformity, elimination of painful skin lesions, and resolution of metatarsalgia. It must be stressed that concurrent procedures to restore normal weight-bearing function of the other MPJs are absolutely necessary for surgical success.

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