CHAPTER 17

Chronic Lesser Metatarsophalangeal Dislocations

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One of the most challenging forefoot deformities to treat is the chronically dislocated lesser metatarsophalangeal joint (MPJ). Conservative treatment is primarily palliative, and frequently does not provide adequate long-term relief. Although surgical treatment may appear to be relatively straight-forward, it is frequently difficult and the results are generally unpredictable. The literature is somewhat vague and there are few papers that have addressed the long-term results of correcting this deformity.

There is obviously no perfect method of correcting chronic lesser metatarsophalangeal deformities as each patient's deformity is different from one another. Likewise, one procedure is unlikely to be successful in treating all types of deformities. The surgical approach must address the type of dislocation, the degree of the deformity, and the health and activity level of the patient. The various deformities, specific surgical treatments, and the theories on which they are based will be reviewed.

ANATOMY OF THE LESSER METATARSOPHALANGEAL JOINT

To fully understand the pathologic anatomy of the lesser metatarsal phalangeal joint, it is first necessary to review the normal anatomy. The lesser metatarsophalangeal joint is an ellipsoid joint, where the spherical metatarsal head articulates with the oval concavity of the base of the proximal phalanx. Motion is primarily sagittal in orientation, with a lesser degree of transverse, side-to-side motion. The joint is covered with a fibrous capsule which is thin on the dorsal side. The collateral ligaments provide medial and lateral stability, and arise from the epicondyles of the head of the lesser metatarsal and insert into the base of the proximal phalanx. The lateral collateral ligament is thicker than the medial ligament.

The plantar plate is a thick, specialized ligament which lies directly underneath the plantar condyles of the lesser metatarsal head, and inserts into the base of the proximal phalanx. These two structures, the plantar plate and the proximal phalangeal base articulate with the metatarsal head. This relationship is important when understanding the pathology of the dislocation, because when the plate dislocates beneath the metatarsal head so does the digit. Adjacent plantar plates are connected on either side by the deep transverse intermetatarsal ligament, which creates stability between the metatarsal heads (Figs. 1A, 1B).

The extensor digitorum longus tendon courses across the dorsal aspect of the joint, and provides dorsiflexion of the digit. The extensor sling mechanism stabilizes the extensor pull on the digit, allowing the proximal phalanx to dorsiflex on the lesser metatarsal without bow-stringing. The flexor digitorum longus tendon crosses the lesser metatarsophalangeal joint inferior to the plantar plate, and is encased in a fibrous canal.

The intrinsic muscles are responsible for stabilization of the joint during gait, and help align and stabilize the vectors of force provided by the long extensor and long flexor tendons. The extensor digitorum brevis tendon inserts into the extensor digitorum longus tendon on the lateral side of the extensor hood mechanism. Plantarly, the quadratus plantae inserts into the conjoined flexor tendons, counteracting the medial course of the flexor digitorum longus. The flexor digitorum

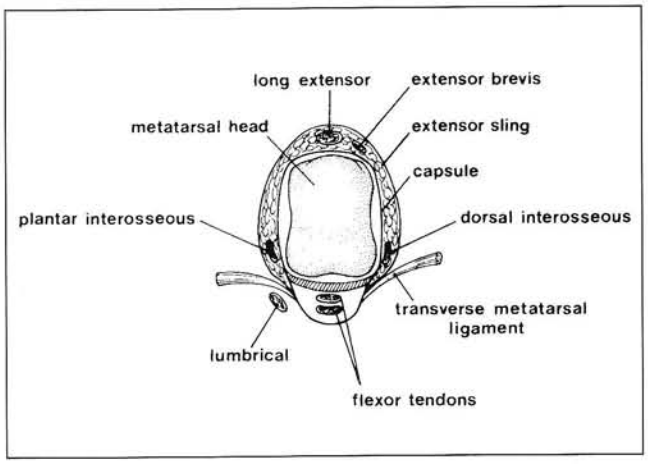

Figure 1A. Cross-sectional anatomy of the lesser MPJ.

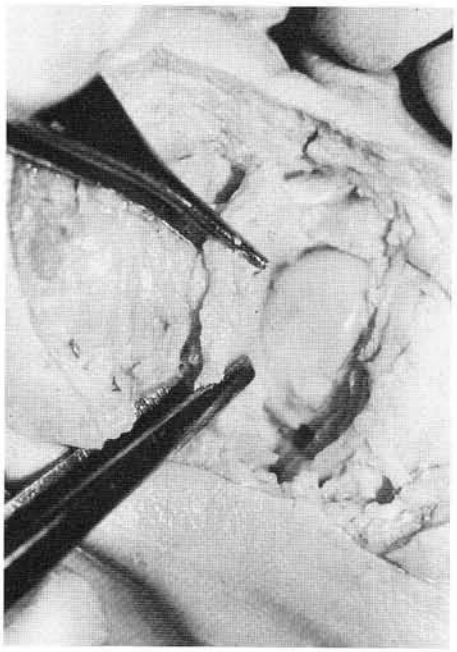

Figure 1B. Cadaver specimen demonstrating the thickness of the plantar plate.

brevis arises at the plantar calcaneal tuberosity and is part of the first layer of the plantar muscles. It passes through the long flexor tendons just distal to the lesser MPJ, and inserts into the base of the middle phalanx. The lumbricales originate from the long flexor tendons, course directly under the deep transverse ligament, and insert into the dorsal aspect of the sling mechanism. The dorsal and plantar interossei arise from the metatarsal shafts and bases, and insert into the base of the proximal phalanx to provide axial stability.

A complete understanding of this anatomically complex region is imperative as it dictates function and defines pathology. The ligaments and tendons which act around the joint each serve a specific function. When the anatomy of the joint and the dynamics affecting it are normal, then joint stability is preserved. However, loss of function of any component(s) can lead to weakness and eventual deviation or dislocation.

ETIOLOGY

The etiology of a chronically dislocated lesser MPJ is a biomechanical abnormality which, in the long-term, creates muscle-tendon imbalance surrounding the joint. This is usually a very slow process and can take years to fully evolve. The process can be accelerated when there is inherent weakness of the joint capsule or muscle-tendon imbalance. This can be secondary to a systemic arthrosis such as rheumatoid arthritis or diabetic charcot arthropathy. Trauma, such as a previously subluxed/luxated joint, or fracture of the metatarsal, can predispose to instability. Corticosteroid injections have also been known to create weakness within the joint. Regardless of the cause, the integrity of the joint has been destroyed enabling a dislocation to develop.

Dislocation occurs as the plantar plate slips out from under the metatarsal head. This can be either in a transverse or a sagittal orientation. In a transverse dislocation, the plantar plate shifts, either medially or laterally, out from under the inferior aspect of the metatarsal head. Since the plantar plate is securely connected onto the base of the proximal phalanx, the digit will move in the direction of the dislocation. Once the dislocation has occurred and the flexor plate has shifted out from under the metatarsal head, it is difficult to correct, especially if the deformity has developed over a long period of time.

With a sagittal plane dislocation there is associated buckling of the proximal inter-phalangeal joint due to overpowering of the flexor apparatus. This causes a flexion contraction at the proximal interphalangeal joint. The proximal phalanx thus dorsiflexes on the metatarsal head resulting in dislocation. Both the transverse and sagittal plane dislocations take several months to years to develop.

CLINICAL APPEARANCE

There are two primary types of lesser MPJ deformities, transverse and sagittal plane. Usually the dislocation is dominated by one of these components, although both maybe involved. Clinically, the transverse dislocation deformity is either medial or lateral. It is referred to as lesser metatarsophalangeal joint abductus or adductus. The digit may also be either sagittally contracted or rectus. The deformity is exaggerated upon weight-bearing when the flexor apparatus is loaded. This can also be evaluated by the push-up test which loads the flexor apparatus (Fig. 2).

The sagittal deformity often presents with a contracted digit, generally involving the proximal

interphalangeal joint (PIPJ), which over a period of time and in its end-stage dislocates on the lesser metatarsal head. This deformity is usually relatively rigid and does not change upon weight bearing. The metatarsal head is usually prominent with the

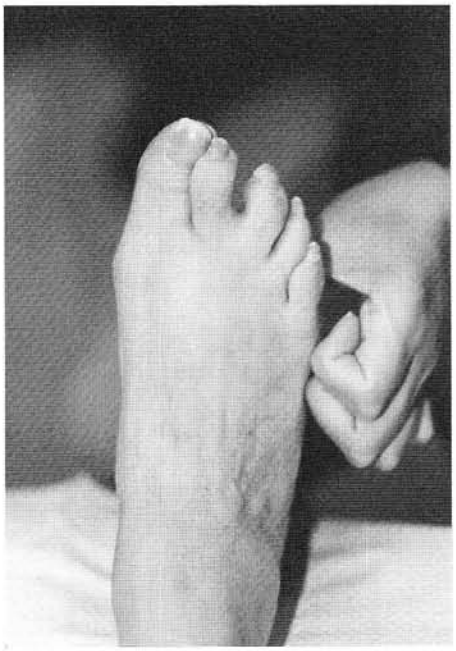

Figure 2. A transverse plane dislocation evaluated with the "Pushup test".

sagittal deformities and thus is usually associated with plantar callosities (Fig. 3).

A frontal plane deformity of the digit is present when a combination transverse-sagittal plane deformity exists. This will create a varus or a valgus appearance to the digit. The most common of the chronically dislocated lesser MPJs is the second, and it is usually associated with a hallux abducto valgus deformity. Frequently, the digit is the only part of the deformity which is symptomatic, but the hallux abducto valgus needs to be corrected in order to create space for the corrected digit (Fig. 4).

RADIOGRAPHIC APPEARANCE

Radiographic evaluation of the chronically dislocated lesser MPJ helps to identify the underlying relationship of the joint, which is sometimes difficult to determine clinically. Weight-bearing views are generally more indicative of the severity of the deformity. The dorsoplantar view will primarily

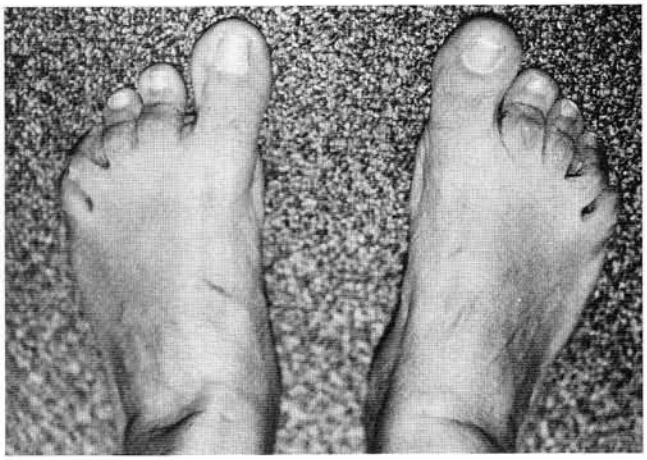

Figure 3. Weight-bearing appearance of sagittally dislocated MPJs.

help to evaluate the transverse type deformity. Likewise, the oblique view gives a better perspective of the sagittal plane deformity.

CONSERVATIVE TREATMENT

Conservative treatment consists of orthodigital devices, custom orthotics, and orthopedic shoe modification. The aim of this approach is to alleviate the patient's symptoms without correcting the deformity. In a relatively inactive patient or in someone who is not a surgical candidate, conservative care is the preferred treatment due to the sometimes unpredictable results of surgical correction.

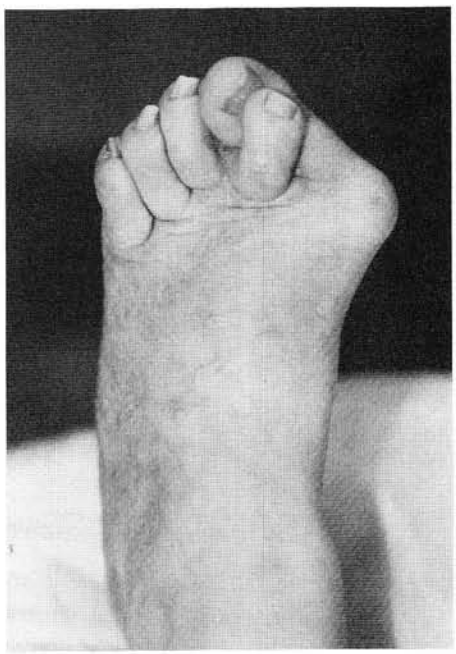

Figure 4. A medially dislocated second MPJ with a severe hallux abducto valgus deformity.

SURGICAL TREATMENT

In the active and medically stable patient, there are a number of specific surgical procedures that produce favorable results.

Digital Stabilization with Relocation of the Plantar Plate

This surgical approach has proven to be successful and involves the stabilization of the digit through arthrodesis of the PIPJ. This is followed by a release of the capsule, and then mobilization of the plantar ligamentous attachments of the metatarsal head with a metatarsal elevator. The plantar plate can then be relocated under the metatarsal head and pinned in place with a K-wire (Figs. 5A -5G)

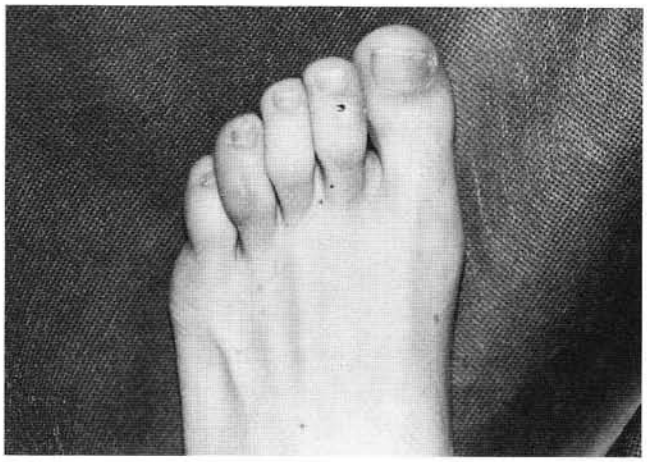

Figure 5A. Preoperative view of the sagittally dislocated lesser MPJ with a hammered digit.

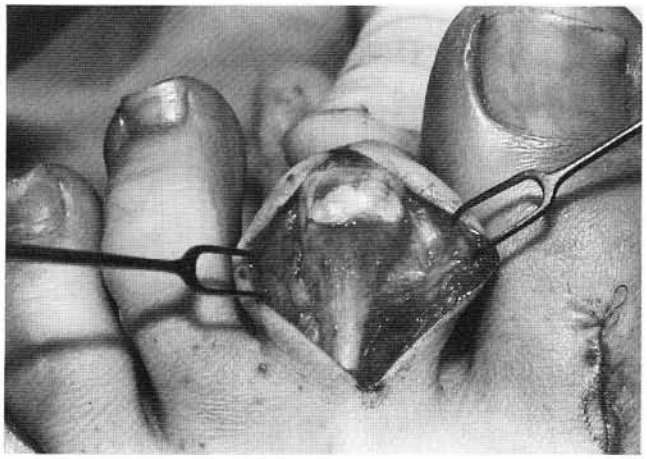

Figure 5B. Exposure of the PIPJ is performed through a transverse dorsal tenotomy.

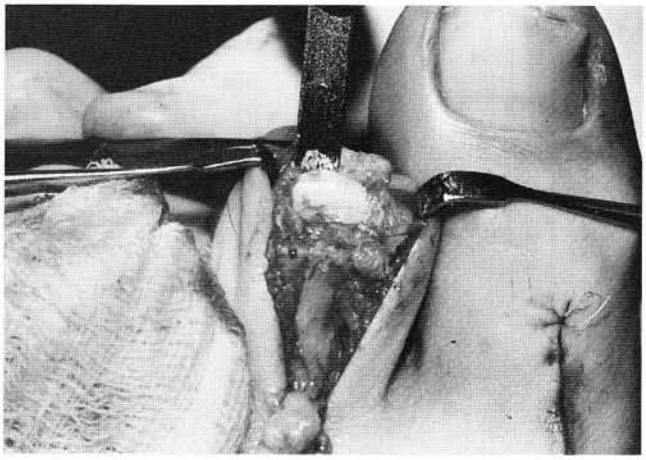

Figure 5C. An end-to-end arthrodesis is performed. Resection of the articular cartilage of the base of the proximal phalanx is demonstrated.

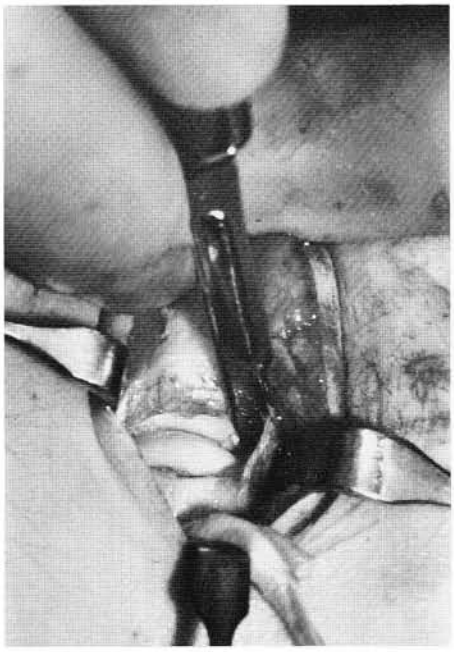

Figure 5D. Release of the medial and lateral collateral ligaments of the MPJ is performed.

Figure 5E. Mobilization of the plantar plate performed with the use of a metatarsal elevator.

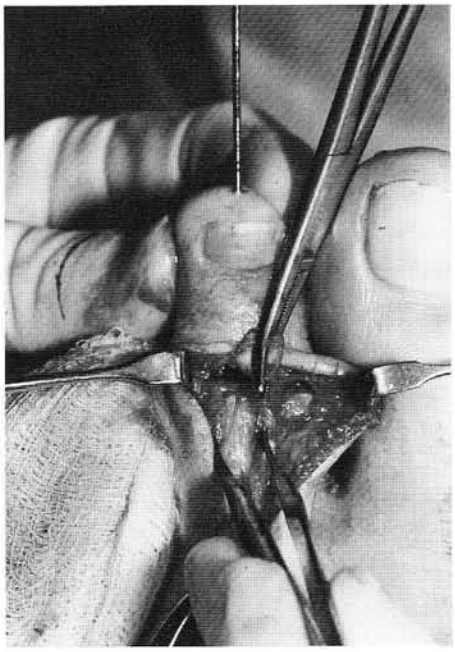

Figure 5F. A K-wire is placed across the digital arthrodesis site and the lesser MPJ.

Figure 5G. Postoperative radiographs following digital stabilization and relocation of the plantar plate.

Lesser Metatarsal Osteotomy

Lesser metatarsal head osteotomy is a relatively new approach that is being utilized for a transverse dislocation of a lesser MPJ. This involves an osteotomy of the metatarsal head, neck, or base. The distal fragment is then relocated in the direction of the dislocation. This is done in an attempt to relocate the metatarsal head back over the flexor plate. If there is an associated contracted digit, a PIPJ arthrodesis can be performed in conjunction with the lesser metatarsal osteotomy. This can be done with a mild to moderate transverse dislocation (Figs. 6A - 6C).

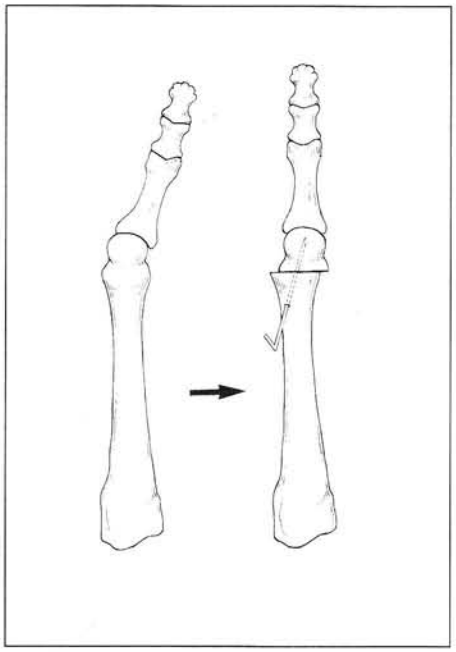

Figure 6A. Dorsal plantar view of a lesser metatarsal osteotomy for a dislocated lesser MPJ. The purpose of the osteotomy is to translocate the metatarsal head over the plantar plate. An osteotomy could theoretically be performed at the head, neck, or base and fixated by a variety of methods.

Figure 6B. Preoperative radiograph of a transversely dislocated lesser MPJ.

Figure 6C. Postoperative radiographs following osteotomy of the second and third metatarsals.

Implant Arthroplasty

An implant arthroplasty can be used in the mild to moderate dislocation that involves some arthrosis of the lesser MPJ. It is typically performed in conjunction with arthrodesis of the digit (Figs. 7A - 7J).

Figure 7A. Clinical view of a sagittally and transversely dislocated and arthritic second MPJ.

Figure 7B. Preoperative photograph of the patient in Figure 7A.

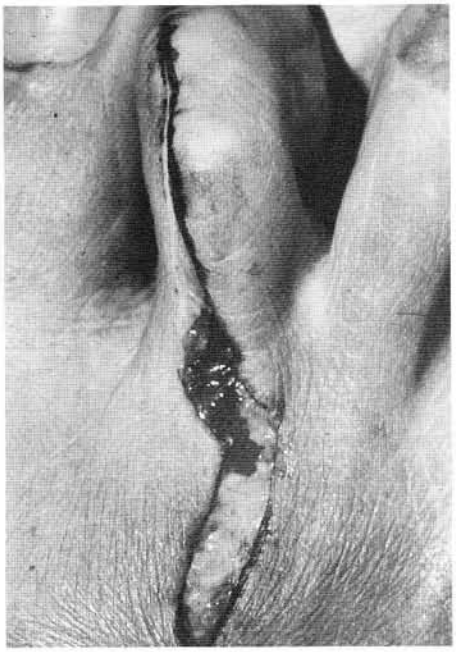

Figure 7C. A curvilinear incision is made over the second MPJ and PIPJ.

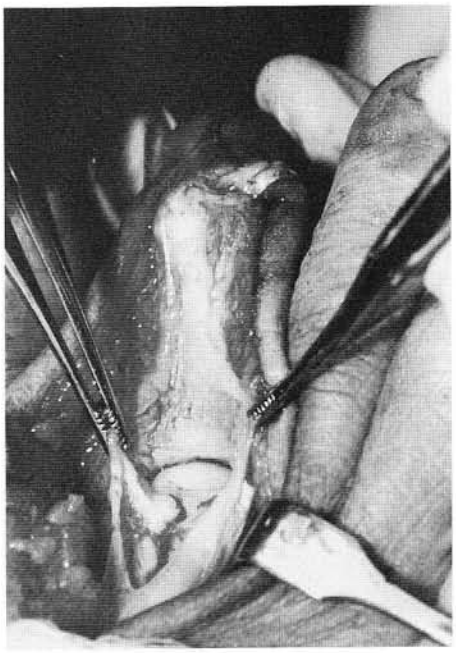

Figure 7D. A linear capsulotomy has been performed.

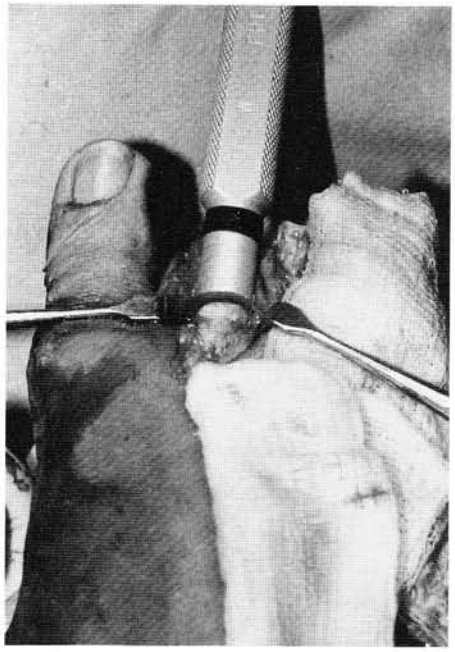

Figure 7E. Minimal resection of the metatarsal head has been performed. A lesser MPJ implant is used as a spacer. Intraoperative view demonstrates preparation of the metatarsal head with the appropriate sized reamer.

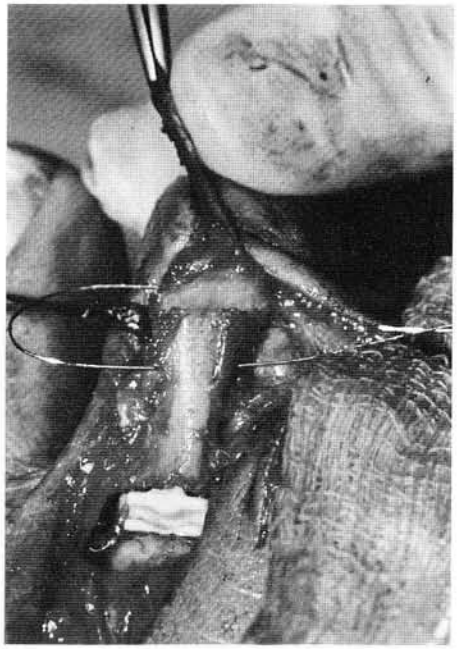

Figure 7F. The implant sizer is in place, and cerclage wire is used to fixate the PIPJ arthrodesis.

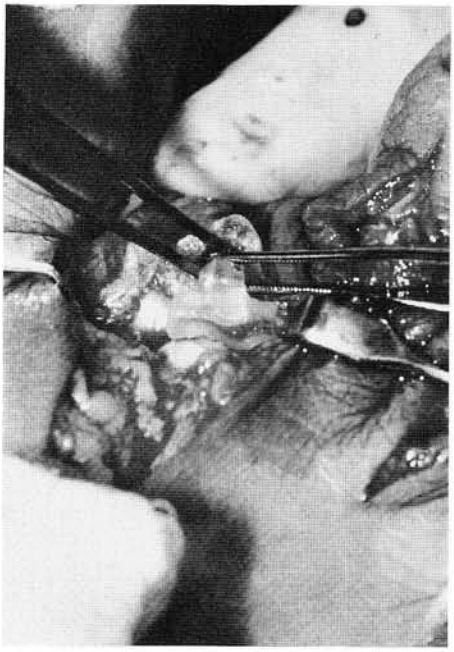

Figure 7G. The silicone implant is inserted into the proximal phalanx.

Figure 7H. Capsular closure has been performed.

Figure 7I. Immediate postoperative result. An additional K-wire was placed across the PIPJ for added stability.

Figure 7J. Postoperative radiograph demonstrates good alignment of the digit and MPJ. Note that the lesser MPJ implant has been inserted following minimum resection of the metatarsal head

Syndactyly with Proximal Base Resection

Syndactyly with proximal base resection is performed in the isolated severe transverse dislocation of a lesser MPJ. It is best suited for an active elderly patient who is not bothered with the appearance of a webbed toe. This procedure provides a very predictable result that will hold up with time (Figs. 8A - 8E).

Figure 8A. Preoperative photograph of a combined sagittal and transverse second MPJ dislocation, with an associated HAV deformity.

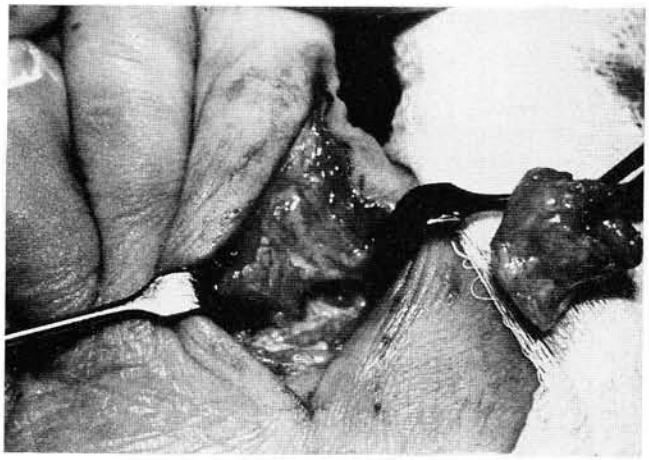

Figure 8B. Resection of the base of the second proximal phalanx has been performed.

Figure 8C. Incision planning for proposed syndactyly of the second interdigital space.

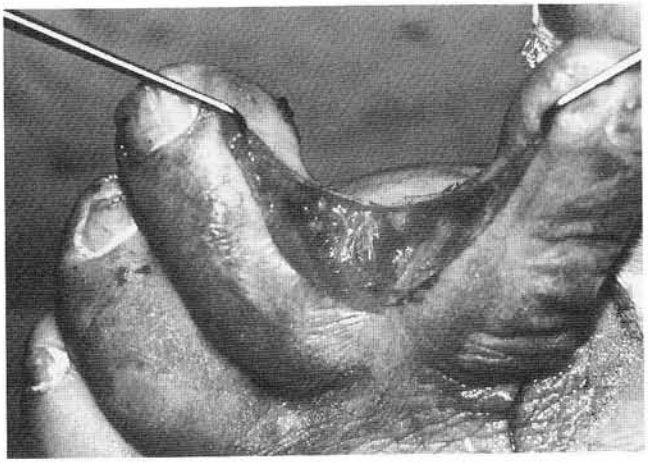

Figure 8D. The interdigital wedge of skin has been removed.

Figure 8E. Postoperative result following syndactyly and proximal phalangeal base resection.

POSTOPERATIVE CARE

Postoperative care depends on the specific procedure that is performed. Compression dressings are used for the first 2-4 weeks. In the digital stabilization procedures with release of the plantar plate, the K-wires are removed in 4-6 weeks. The patient can be partial weight bearing initially with a padded surgical shoe. Patients in which a lesser metatarsal osteotomy is performed should be non-weight bearing for up to 6-8 weeks, depending on the type of osteotomy.

COMPLICATIONS

Complications include infection, avascularity of the digit, recurrence of the dislocation, or lesser MPJ limitus. The patient should understand these before consenting to the procedure. These patients should be handled individually with respect to their specific underlying deformity, activity level, and general health. As most of these patients are elderly and some are of poor health, the appropriate treatment with the most probable outcome should be employed.

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