CHAPTER **3**

INDICATIONS AND TECHNIQUE OF THE WEIL OSTEOTOMY

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INTRODUCTION

The Weil osteotomy has become a popular technique for the surgical treatment of resistant lesser metatarsalgia. Metatarsalgia is a vague, catch-all term that represents tenderness and pain in the plantar forefoot. Metatarsalgia can develop from osseous, soft tissue, neurologic, vascular, or dermal etiologies. It is a somewhat common presenting complaint that can interfere with normal ambulation, work, fitness, and recreation.

Physical evaluation of the patient can determine the underlying etiology. Metatarsalgia can be subdivided into primary versus secondary causes as well as structural versus functional causes (Table 1). A different combination of these underlying factors can characterize symptoms that occur during the stance phase of gait versus the propulsive phase.

The surgical treatment of metatarsalgia has been somewhat controversial. Ideally, conservative treatment should be exhausted before surgical options are considered. To date, more than 25 different lesser metatarsal osteotomies have been described. Weil described an osteotomy made parallel to the weightbearing surface, then sliding the metatarsal head proximally, thus providing axial decompression. The Weil osteotomy has recently gained in popularity based upon the simple technique, stable fixation, excellent union rates, and predictable results.

Indications for the Weil osteotomy have been extended to include a relative long or plantarflexed metatarsal(s), transverse plane deformities of the metatarsophalangeal joint, subluxation/dislocation of the metatarsophalangeal (MTP) joint, crossover toe deformity, correction of a rheumatologic deformity at the MTP joint and generalized recalcitrant metatarsalgia, which is refractory to conservative care (Figures 1-5).

The overall physical examination must include the evaluation of concomitant deformities such as hammertoe contractures, hallux valgus, and hypermobility of the first ray. If these deformities are present, they must be surgically addressed as well.

The Weil osteotomy has replaced a number of preceeding osteotomies by its ability to shorten the metatarsal head without elevation or depression of the metatarsal head. The shortening and transverse plane position can be carefully controlled intra-operatively. A mini-C arm may be employed to check the position of the capital fragment in surgery. The osteotomy is usually stabilized with a solitary screw driven from dorsal to plantar in the metatarsal head. The advantage to this osteotomy is the decompression of the metatarsophalangeal joint and the resultant relaxation of the surrounding soft tissues. Generally the osteotomy is most often used on the second metatarsal. However, the same

Table 1

CAUSES OF METATARSALGIA

- **Primary**
  - Plantar soft tissue lesions
  - Abnormal metatarsal parabola
  - Morton's foot
  - Neuroma
  - Trauma
  - Brachymetatarsia
  - Bone Tumors
- **Secondary**
  - Iatrogenic
    - First ray shortening
    - Metatarsal head resection
  - Neurogenic
    - Referred pain
    - Tarsal tunnel syndrome
  - Osteoarthritis
  - Rheumatoid arthritis
  - Atrophied plantar fat pad
  - Stress fracture
  - Capsulitis/bursitis/tedinitis
  - Frieberg's infraction
  - Foot structure and function
    - Pes cavus
    - Pes planus
  - Inappropriate shoegear

considerations including length patterns, transverse plane deformities, subluxations, and intractable plantar skin lesions sometime merit the osteotomy to be preformed on the third and fourth metatarsal.

Possible complications of the Weil osteotomy include a dorsiflexed, nonpurchasing toe, pain on MTP joint dorsiflexion, reduced MTP joint range of motion, proximal interphalangeal joint contracture and a floppy toe. The relaxed tension of the plantar fascial insertion at the base of the proximal phalangeal base may produce a floating toe. Long or prominent plantar fixation can also cause postoperative pain and stiffness and needs to be removed once the osteotomy is healed.

Figure 1. Preoperative and postoperative view of a long second metatarasal.

Figure 2. Preoperative and postoperative view of a shortened first ray.

Figure 3. Preoperative and postoperative view of hallux varus.

Figure 4. Preoperative and postoperative view of hallux abducto valgus with second ray adductus.

Figure 5. Preoperative and postoperative view of digital adductus.

TECHNIQUE TIPS AND PEARLS

A 3.5- to 4.0-cm linear incision is made over the distal third of the lesser metatarsal ending at the base of the proximal phalanx. This will reduce the chance of scar formation that can contribute postoperative dorsal contracture. If digital work is done at the same time, a lazy-S incision is made over the MTP joint as the incision ends dorsally over the middle phalanx.

The extensor tendons are then retracted laterally and the dorsal periosteum and capsule are incised with the toe dorsiflexed to protect the articular cartilage. The collateral ligaments are partially incised to fully expose the metatarsal head. They do not need to be completely resected. Next, a McGlamry elevator may be used to release the plantar plate adhesions at the joint especially in the case of a significant contracture. The McGlamry elevator strips the plantar synovial attachments (vincula), allowing the plantar plate to shift more proximally with the osteotomy. There is rarely vascular compromise to the capital fragment and avascular necrosis of the head is extremely rare.

The McGlamry elevator can double as a retractor for the ensuing osteotomy. The head should be fully visualized before the osteotomy is made. The osteotomy is started 2-mm inferior to the most dorsal aspect of the articular cartilage at an approximately 25° angle with respect to the metatarsal shaft. The osteotomy can be as long as 2.5- to 3-cm in standard foot conditions.

The plane of the osteotomy is made parallel to the ground as if the foot was bearing weight. The angle of the osteotomy may vary according to the angle of the metatarsal declination. The angle of the osteotomy must increase toward the more lateral metatasals because they are less plantarflexed than the second metatarsal.

In severely plantarflexed metarsals, a second osteotomy is performed in effect to remove a slice of bone to further dorsiflex the capital fragment. An easier, more stable tip is to use a double saw blade or a thicker saw blade to obtain the same goal of removing more bone to dorsally elevate the metatarsal head.

When the osteotomy is completed, the metatarsal head will suddenly shift to a more proximal position. There is a certain neutral position that reflects the relaxation of the surrounding soft tissues that feels just right. Then with manual pressure, a solitary K-wire or bone clamp is used to temporarily fixate the osteotomy. The position can be checked by fluoroscopy at this time. The metatarsal head position can be changed from 2- to 10-mm with 3- to 5-mm being the normal amount of shortening.

The osteotomy can be slightly angulated in the frontal plane if more dorsal excursion is desired. The head can also be rotated and translocated somewhat in more difficult transverse or crossover toe cases. However, too much manipulation of the osteotomy or displacement of capital fragment can sacrifice the overall stability of the construct. Do not be too extreme. A standard parallel Weil osteotomy, without any geometric modifications has been found to be successful in treating most forefoot malalignments.

A solitary screw driven from proximal dorsal to distal plantar into the metatarsal head is usually sufficient. There are a multitude of different screws that can be used for this purpose including the twist-off screw by Depuy. I prefer the Synthes modular hand set screws. These are noncannulated with a smaller head that is not prominent. They have excellent purchase due to the increased thread excursion, and they can be minimally tapped as they will self tap once started into the capital fragment.

The one consensus regarding screws is that a 12-mm screw will fit in the vast majority of adult metatarsals without penetrating the plantar metatarsal head. This obviates the need to measure the pilot hole. I usually use a 2.0-mm screw in most adults for fixation of the Weil osteotomy. A 2.4-mm screw is useful in larger adults and a 1.6-mm can be used in a very slight individual. The resulting dorsal overhanging bone ledge is then resected with a rongeur.

Postoperatively, most patients are maintained partial weightbearing in an Orthowedge shoe using crutches or a walker to support their upper body weight. The patient can be transferred into a standard surgical shoe at 4 weeks with early radiographic signs of osseous healing. A severely

dorsiflexed toe that is released may benefit from a 0.045 K-wire across the MTP joint for 4 to 6 weeks. In milder cases, splinting or a Betadine splint is useful for the initial three weeks. The patient should initiate rigorous sagittal plane exercises once early bone healing has occurred.

The most common reported complication is the floating toe. One theory suggests the Weil osteotomy changes the center of rotation of the MTP joint. The interosseous muscles then act more as dorsiflexors than plantarflexors contributing to a nonpurchasing toe. I usually will perform a proximal interphalangeal joint arthrodesis in concert with a Weil osteotomy when indicated. I strive to avoid excessively shortening the toe while performing the arthrodesis to preserve the stronger plantarflexory lever arm associated with an arthrodesis. The arthrodesis should be mildly flexed by bending the K-wire after it is inserted into the toe. In addition, the long extensor tendon is lengthened in a Z-plasty fashion as are all of the soft tissues that are dorsally contracted with the sequential release. A K-wire can be carefully passed across the reconstructed metatarsophalangeal joint to either side of the screw when necessary. These measures greatly decrease the incidence of a nonpurchasing toe. Significantly unstable, dorsiflexed toes will require a concomitant flexor tendon transfer.

The Weil osteotomy is an effective and safe procedure for the treatment of plantar, central metatarsal symptoms caused by a relatively long metatarsal. Complications can be controlled with a judicious amount of shortening of the metatarsal while avoiding plantar depression of the capital fragment. Ancillary procedures directed at correcting coexistent pathology must be considered in compound deformities.