



St. Mary's Medical Cent



A NOVEL VARIATION OF THE TRADITIONAL WEIL OSTEOTOMY FOR TREATMENT AND PREVENTION OF CHRONIC DIABETIC PLANTAR FOOT ULCERS Lawrence Chen (BS); Amreet Kaur (BS); Lydia Yun (DPM); James W. Stavosky (DPM, MS, CWS, FAPWCA, FACFAOM, FASPS)

Purpose and Introduction

Long plantarflexed metatarsal with bony eminence over chronic diabetic plantar foot ulcers provides focal plantar pressure points that are at high risk of ulcer exacerbation, leading to osteomyelitis and eventually to amputation (1,2,3). The purpose of this case study is to present our surgical protocol, a variation of traditional Weil Osteotomy, which allows shortening and dorsiflexion of the metatarsal. It is our hypothesis that size and recurrence rate of ulcer will decrease after our osteotomy. To our knowledge, there are no cases reported in the literature like ours in the past 30 years. This is the first published case of our osteotomy.

Chronic ulcer is defined as one month of non-healing status. Conservative treatments include mechanical offloading with felt and metatarsal pads, custom orthotics, and a strict non-weight bearing regime. If ulcers persist after initial treatment, surgical options are indicated, which are determined by clinical observation and preoperative radiographs (4). The osteotomy of choice for this literature is an oblique osteotomy from dorsal proximal to plantar distal from the metatarsal shaft to the metatarsal neck at a forty-five-degree angle (Figure 1). This osteotomy is indicated for long/ plantarflexed metatarsal and with enlarged, plantar eminence of the metatarsal head over chronic diabetic plantar foot ulcers. The osteotomy preserves the joint integrity of the MTPJ and simultaneously shortens and dorsally displaces the metatarsal head, decreasing plantar pressure under MTPJ, alleviating tissue stress on chronic diabetic plantar foot ulcers, leading to eventual healing of ulcers, and preventing recurrence of ulcers. Additionally, no fixation is used, further minimizing risks of infection

Case Study

A 67-year-old male with type 2 diabetes mellitus presents with neuropathic ulcer on the right foot plantar 5th MTPJ, measuring at 1x1x0.2 cm. Wound bed is 1-25% slough, 51-75% pink granulation base. Well demarcated hypertrophic border and surrounding skin. No erythema, no edema. Moderate amount of serosanguinous drainage noted which has no odor (Figure 5). At week 21, ulcer is at its maximal size and has received a status of not healed, measuring at 1.6x1.2x0.2 cm. Wound bed is 1-25% slough, 51-75% pink granulation. Well demarcated hypertrophic border and surrounding skin. No erythema, no edema. Moderate amount of serosanguineous drainage noted with no malodor (Figure 6). At week 47, one-month status post our osteotomy, the ulcer has received a status of healed, measuring at 0x0x0 cm. The patient reports a wound pain of level 0/10. The wound margin is flat and intact. Wound bed is 76-100% epithelialization. No eschar, tunneling, sinus tract, and undermining have been noted (Figure 7).

Methods & Surgical Technique

Obtain preoperative X ray 3 views of the foot to confirm long, plantarflexed 5th metatarsal over the chronic diabetic plantar foot ulcer (Figure 3a,b,c). A standard surgical procedure was used consisting of a single incision approach, dorsolinear overlying the identified MTPJ to mid metatarsal shaft of the 5th. Dissection is carried out by layers protecting all neurovascular structures by retraction. Periosteum is elevated to expose the metatarsal shaft and head. With a sagittal saw, an oblique osteotomy is made from proximal-dorsal to distal-plantar from the metatarsal shaft to the metatarsal head at a forty-five-degree angle to the long axis of the metatarsal (Figure 1). The foot is then loaded, and the distal fragment is allowed to migrate dorsally and proximally a 2-3mm and sit where it would naturally. Closure is then obtained by layers, using vicryl for deep closure, vicryl for subcu and Nylon for skin. Surgical site is then dressed in xeroform, 4x4 gauze, kerlix, and light coban. Patient is placed in a post-op shoe for protective weightbearing and allowed to weight bearing as tolerated, with plan to transition to custom diabetic shoes. Obtain one-week post-op x ray (Figure 4a,b,c). Obtain weekly clinical assessment of the area and volume of the ulcer. Area of ulcer is in the unit of sq. cm and is calculated by multiplying length with width of ulcer. Volume of ulcer is in the unit of cubic cm and is calculated by multiplying length, width, and depth of the ulcer. Debridement of ulcer is done as needed (indications including fibrosis, sough and hyperkeratosis).

Figure 1, 2: Osteotomy Diagram





One week status post our osteotomy plain films reveal shortening and dorsiflexion of the 5th metatarsal compared to preop films (Figure 2, 4a,b,c). Figure 8 is the chronic ulcer progress chart, which displays the area and volume of ulcer in terms of percentage of improvement/ decline. It normalizes the maximum size of the ulcer as 100% and the absence of ulcer as 0%. The ulcer remained healed during and after three months status post our osteotomy, which is the primary goal of the podiatric wound care.

The area and volume of the ulcer before our osteotomy is significantly larger than after the surgery. The average area of ulcer before surgery is 0.825 cm with standard error of mean of <u>+</u>0.116 cm. The average area of ulcer after surgery is 0.0150 cm with standard error of mean of <u>+</u>0.0150 cm (Figure 9a). The average volume of ulcer before surgery is 0.215 cm with standard error of mean of <u>+</u>0.0385 cm. The average volume of ulcer after surgery is 0.003 cm with standard error of mean of +0.003 cm (Figure 9b). Serial radiographs may be obtained which should show bone callus at the osteotomy site indicating healing by secondary bone healing.

The effect of the our osteotomy on preventing future plantar ulcer is statistically significant.

Paired t test for the area of ulcer before and after the surgery has a **P value of 0.0035**. Paired t test for the volume of ulcer before and after surgery has a <u>P value of 0.0015</u>. P value less than 0.05 is considered statistically significant.

Figure 3a, 3b, 3c: Preop X-ray, AP, MO, Lateral







Figure 4a, 4b, 4c: 1 Week Postop X-ray, AP, MO, Lateral







Figure 5,6,7: week 0, 21, and 44







Results



Discussion

In contrast to the traditional Weil Osteotomy, this osteotomy is an oblique osteotomy oriented from proximal dorsal to distal plantar from the metatarsal shaft to neck at a forty-five-degree angle. We allow the metatarsal head to shift on its own, allowing ground reactive forces to retract the metatarsal head proximally and dorsally to a neutral position reflexing relaxation of surrounding soft tissue that feels just right. This alleviates plantar pressure over chronic diabetic plantar foot ulcer for long, plantarflexed metatarsal with bony plantar eminence, preventing future exacerbation of chronic diabetic plantar foot ulcer.

The traditional Weil Osteotomy is an oblique osteotomy from distal dorsal to proximal plantar from the metatarsal neck to shaft at a forty-five-degree angle to the long axis of the metatarsal. In more severely plantarflexed metatarsals, a second osteotomy is usually indicated to remove a slice of bone to further dorsiflex the capital fragment (1,6). Our osteotomy negates the necessity for this second osteotomy.

Another advantage of the our osteotomy is the option and orientation of screw fixation. A 2.0 screw may easily be inserted dorsal distal to plantar proximal. We recommend orienting this screw between perpendicular to the osteotomy site and WB surface. In contrast to the traditional Weil osteotomy, this screw is driven from unstable distal fragment into the stable construct of the metatarsal shaft. We did not use any fixation in our study, however in order to minimize risk factors for infection in the event that re-ulceration did occur.

A major complication for both procedures is the development of floating toe when the intrinsic muscles become dorsiflexors, causing elevation of the phalanges. In addition, both procedures can lead to transfer metatarsalgia and union abnormalities such as delayed union, malunion, and nonunion (6).

In conclusion, our osteotomy is a powerful and effective osteotomy that may prevent future recurrence and exacerbation of chronic diabetic plantar foot ulcer. The current scientific data would benefit from further randomized controlled trials.

Appendix

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- **Disclosure:** The authors have no conflict of interest to disclose.
- Participants: The participant was recruited from San Francisco Center for Advanced Wound Care at Seton Medical
- Future work: Next phase of the study is to increase in sample size of the patient population
- Length of follow up: 15 months
- Level of evidence: 4 Case study and retrospective

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