Use of Jones Tenosuspension for Treating Plantar First Metatarsal Ulcers

Joshua Wolfe, BS1; Tyler Sorensen, BS1; Alexus Cox, BS1
1Second-year student College of Podiatric Medicine and Surgery, Des Moines University

Purpose
Neuropathic ulcers on the plantar aspect of the foot are a common complication in diabetic and nondiabetic patients. These ulcers are compounded by systemic and anatomical deformity. This condition can often lead to subsequent amputations. Surgical management of neuropathic ulcerations can reduce healing time and result in favorable outcomes. This case study illustrates the use of Jones Tenosuspension in patients to reduce pressure on the first metatarsal head, subsequently treating ulcers in diabetic and nondiabetic patients that also are non-weight bearing.

Introduction
Foot ulcers secondary to neuropathy present a difficult challenge for both the physician and patient alike. The prevalence of foot ulcers for patients with diabetes mellitus ranges from 4 to 10 percent with a 10 to 25 percent risk over their lifetime.1 This condition is due to increased pressure over a bony prominence on the plantar aspect of the foot. A relatively common location for ulcers in this patient population is beneath the first metatarsal head.2 Increased pressure on the plantar aspect of the first metatarsal is commonly associated with foot deformity, such as an isolated plantarflexed first metatarsal cuneiform or a mallet toe deformity of the interphalangeal (IP) joint with retrograde buckling.3 The latter is particularly due to a tendon imbalance of the extensor hallucis longus (EHL), flexor hallucis longus (FHL) and peroneus longus (PL) tendons.4,5 Conservative management of foot ulcerations primarily include off-loading of the affected area, but also must address effective blood glucose control, infection management as well as ulcer debridement, and appropriate wound dressings6. In the case of significant deformity it is not unusual for conservative measures to fail necessitating consideration of deformity correction. One surgical technique to consider for ulcers of the first metatarsal head includes the Jones Tenosuspension, where a transfer of the EHL, FHL tendons to the distal metatarsal neck is performed in conjunction with arthrodesis of the IP joint. This technique allows a reduction in plantar forces to the ulcer when ambulating and has historically been used in pes cavus deformities and mallet toe deformities of the great toe found in poliomyelitis clawing of the hallux, and chronic diabetic ulcers under the first metatarsal with other staged tendon balancing.6,7,8,9,10,11,12

Case Studies
Two cases were presented. The first case was a 45-year-old male that presented with a right plantar first metatarsal ulcer secondary to diabetic neupathy, pes cavus, and equinus deformities. Significant past medical history included hypertension, hyperlipidemia, and anxiety. Patient initially presented in November 2011 with multiple ulcers on the plantar aspect of the right foot. Two ulcers were noted. One on the plantar surface of the 1st metatarsal phalangeal joint that had the dimensions of 1.5x3.5cm deep. The second ulcer was located on the dorsolateral aspect of the 5th proximal interphalangeal joint and had dimensions of 0.8x0.5cm deep. In May 2012, patient continued to present with chronic ulceration of the 1st MPJ and developed acute cellulitis and osteomyelitis of the 1st metatarsal and 5th toe. Surgery was planned to address the primary cause of the ulcer which was the deformity. Since the time of the procedure, patient went onto successful healing and has remained ulcer free in that area.

The second case was a 44-year-old non-diabetic male that presented with a right plantar first metatarsal ulcer secondary to neuropathy and minor pes cavus. Patient was unable to walk at all before surgery. Significant past medical history includes alcohol and tobacco use. In August 2013, patient presented with foot ulcers, bilaterally. Patient had a 2x3x3mm deep ulcer on the plantar 1st metatarsal head of the right foot and a 3cm ulcer on the plantar-medial hallucis IPs of the left foot. In January 2015, the patient returned to the clinic with suspicion of a severe right foot infection with abscess secondary to chronic ulceration. These lesions were present plantarly on the right foot at the level of the MPJ.

Surgical Technique
With the patient in the supine position, the foot was scrubbed and prepared in the usual aseptic manner. The incision was made over the dorsal aspect of the foot on the first metatarsal with an incision over the hallucal metatarsophalangeal joint. The extensor hallucis longus tendon was then identified and transected at the level of the proximal phalanges. A 4.5 drill was used transversely across the first metatarsal neck. The tendon was passed from laterally to medially, and subsequently sutured back upon itself. First, attention was then directed to the hallucal interphalangeal joint. A capsulotomy was performed, exposing the joint and allowing for transaction of the medial and lateral collateral ligaments. A bone saw was used to resect the head of the proximal phalanges and the base of the distal phalanges followed by the insertion of a 4.5 partially threaded cancellous screw across the hallucal interphalangeal joint. After ensuring correct positioning under radiography the incision was irrigated and closed.

Second, the superficial ulcer on the plantar aspect of the first metatarsal was observed. The incision, approximately 4 cm in length, was made centrally down the first metatarsal head in the longitudinal fashion. There was scar tissue present from the chronic ulcerative lesion, which was subsequently removed. Next, the tendon was isolated and removed for gross histopathology. A bone cut was taken from the sesamoid. Following removal of the sesamoid, the fibular sesamoid was isolated and removed. The posterior brevis tendons were still partially intact but could not be fully repaired. The flexor hallucis longus tendon was fully intact and irrigated. No purulence was noted. The wound and incision were then closed.

Case Studies (continued)

The most lateral wound measured 15x30x3mm deep. The central wound measured 4x6mm with an area of tracking approximately 10mm. The most medial wound measured 6x2x1mm deep. X-rays were taken in three views and no soft tissue gas was noted. There was notable swelling around the 1st metatarsophalangeal joint (MTPJ) radiographically. The wound was debrided and cultured. Patient was placed on an empiric oral antibiotic regimen of Ciprofloxacin and Pneumecin, as well as an injection of Rocephin and Pneumecin.

The patient returned 2 days later with decreased redness, though still reported that they still had soreness in the right foot. Upon inspection, ulcerative lesions had improved with two primary ulcers. The one located laterally measured 25x30x1mm deep, while the medial lesion measured 2x2x15mm deep without any evidence of undermining or tunneling. Surgery was planned to address the primary cause of the ulcer which was the deformity. Since the time of the procedure, patient went onto successful healing and has remained ulcer free in that area.

Discussion
Plantar ulcers have been found to occur in 4 to 10 percent of diabetic patients with significant vascular and neuropathic risk.14,15,16 In these patients, one study found a 0.02 percent prevalence overall, with a 0.21 percent prevalence in those surveyed above 60 years old. There were some limitations to this study; however. The study authors acknowledged that this was a small sample over a short period of time16. Margolis et al. conducted a systematic review determining the healing time period for non-weight-bearing diabetic ulcer treatment with good conservative wound care and found only 24% and 31% heal at 12 weeks and 20 weeks, respectively17. In the presented case study with surgical intervention, post-operative healing time for the diabetic patient was 3 weeks and 10 weeks for the non-diabetic, neuropathic patient. Considering the decreased time period of ulcer healing with the Jones Tenosuspension technique, this could aid the surgical option in ulcer treatment.

Typically the Jones procedure is performed when there is a mechanical dysfunction of the first ray metatarsal. The dysfunction is thought to be due to the overactivity of one or more of the FHL, EHL and PL tendons.18,19 This chronic diabetic ulcers under the first metatarsal with other staged tendon balancing 14,20,21,22,23,24!

Rather demonstrated the only study to use the Jones Tenosuspension to increase rapid healing in diabetic ulcers under the first metatarsal, but this also included flexor hallucis longus transfer along with peroneus brevis transfer and/or Strayer procedure25. The same thought process is used when treating a refractory ulcer in patients with minor deformities. The idea is to extensively reduce the pressure of the first metatarsal head for allowing the plantar soft tissue layers to heal efficiently. The transfer of the extensor hallucis longus tendon to the distal portion of the first metatarsal allows for the pull of that tendon to no longer put pressure on the first metatarsal head, but rather works to alleviate that same pressure. To their knowledge, the authors believe that this is the first case to study using the Jones Tenosuspension surgical procedure alone to successfully heal and promote healing of ulcers in diabetic and non-diabetic patients.

The lack of available literature on patients that are not only neuropathic but also non-diabetic was of great significance in the evaluation of these cases. It has become apparent through the study of these cases that additional information is needed in the area of non-diabetic, neuropathic planter ulcer management. A systematic review of the literature may be of benefit to provide direction for additional studies to be performed.

Acknowledgements
Thank you to Dr. Katherine Frush, DPM, FACAPS and Dr. Paul Dayton, DPM, FACAPS for your guidance and allowing us to participate in this case.

References

Figure 1. Preoperative lateral radiograph

Figure 2. Preoperative dorsal-plantar radiograph

Figure 3. Postoperative lateral radiograph