

Peroneal Tenodesis and Plantar Fasciotomy for Diabetic Forefoot Ulceration, Case Series

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Statement of Purpose

Plantar ulceration is common amongst the neuropathic, diabetic population. This is due to persistent hyperglycemia, the production of advanced glycosylation end products, pursuant tendon stiffness with musculature imbalance, and the ultimate effect of increased plantar pressures. Even with the most aggressive offloading and local wound care, recurrence rates remain elevated up to 60%. Deformity is often driven by musculature imbalance, eventually producing a compensatory flexible cavus foot with pursuant contracted plantar fascia and eventual ulceration. This case series evaluates peroneal tenodesis and plantar fasciotomy as a way of eliminating these deforming forces, balancing the foot, and reducing plantar pressures to heal and prevent ulcerations.

Methods

Five patients underwent peroneal tenodesis and plantar fasciotomy to offload the first metatarsal head in a flexible cavus foot. A full workup to exclude osteomyelitis, peripheral vascular disease, and failure of a long course of multi-modal conservative care including offloading devices and local wound care were performed prior to surgical intervention.

Patient age/Gender	Lesion	Co-morbidities	Time to healing	Follow up	Complications/Recurrence
62 Female	Ulcer	DMI, HTN, Stroke, MS, COPD, CKD, CHF, Graves	6 weeks	15 months	None
57 Male	Ulcer	DMII, TBI, Bipolar, Asthma	7 weeks	12 months	None
66 Male	Ulcer	DMII, HTN, COPD, MS	5 weeks	13 months	None
38 Male	Callus	DMII, HTN, HLD	8 weeks	14 months	None
56 Male	Ulcer	DMII, HTN, Asthma, Depression	6 weeks	13 months	Ruptured tenodesis

Procedure

An incision is made posterior and superior to the lateral malleolus, approximately 4 cm in length, isolating and exposing the peroneal tendons. The peroneus longus tendon is then identified by plantarflexing the first metatarsal and a wedge of the tendon is removed. The proximal portion is then sutured to the peroneus brevis tendon under physiological tension utilizing poly ethylene terephthalate suture. A small incision is then made within the instep of the medial longitudinal arch, isolating and transecting the plantar fascia.

Results

Plantar ulcerations and pre-ulcerative lesions achieved 100% healing at an average of 6.4 weeks with no recurrence of ulceration or pre-ulcerative lesions at final follow up. Average length of follow up of 13.4 months. There was a minor callus formation overlying prior ulceration site in one patient, with no underlying ulceration or intradermal hemorrhage noted. Callus did not recur after initial paring. One complication of a ruptured tenodesis site occurred, without recurrence of deformity or ulceration.

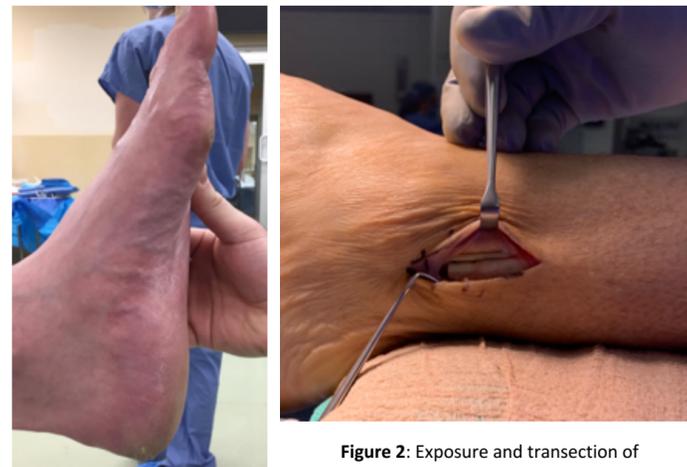


Figure 1: Pre-operative evaluation for flexible plantarflexed 1st ray

Figure 2: Exposure and transection of peroneus longus tendon with tenodesis to underlying peroneus brevis tendon



Figure 3: Pre-operative photograph of plantar 1st metatarsal head ulceration



Figure 4: Post-operative plantar 1st metatarsal head prior ulcerative site at 1 year follow up

Analysis and Discussion

The plantar aspect of the first metatarsal head is a common location for neuropathic ulcer development. This can be a disastrous area, given the consequences of osteomyelitis of the first metatarsal and the biomechanical abnormalities of pursuant amputation. This provides a strong incentive to remove the deforming forces early in an attempt at limb preservation.

Prior to performing a tendon transfer, a flexible, semi-rigid, or dynamic plantarflexed first metatarsal must be established clinically to ensure that the deformity may be balanced with soft tissue procedures (1,2,3). Another consideration must be given to releasing the plantar fascia in a high arched or cavus foot. The deformity is exacerbated with a long history of neuropathy and the creation of an intrinsic-minus foot type, leading to retrograde forces of the created hammertoes on the metatarsals. This leads to an increased metatarsal declination angle and in-turn allows the plantar fascia to contract in this fixed position (4). This is worsened with a longstanding history of diabetes, producing a thickened, contracted, plantar fascia due to persistent hyperglycemia and non-enzymatic glycosylation (5).

Performing a plantar fasciotomy, rather than a posterior heel cord lengthening, may be preferable to reduce the potential creation of a calcaneal gait in a cavus foot. Care must be taken in performing posterior lengthenings in the cavus foot as pseudoequinus may lead to the incorrect diagnosis of equinus and increase the likelihood of the creation of a calcaneal gait and pursuant heel ulceration.

The evidence supporting peroneus longus to peroneus brevis tenodesis is limited, with no known studies evaluating this procedure in isolation to cure or prevent ulceration of the plantar first metatarsal head. The studies performed by *Dayer et al.* and *Hamilton et al.* do show that peroneal tenodesis is an effective means to reduce the deforming forces and therefore the increased pressures in this area (6,7).

Up to 43% of patients with diabetes and a foot ulcer progress on to an amputation(8,9,10). It is critical to treat ulceration early, with lasting measures. Additional amputations are often inevitable after the sentinel amputation. Re-amputation rates have been shown to be as high as 26.7% after one year, 48.3% after three years, and 60.7% after five years, demonstrating the importance of preventing the progression of ulceration and avoiding the initial amputation event (11,12,13). The etiology of the ulceration must be evaluated to ensure adequate, lasting treatment is provided. Peroneal tenodesis combined with plantar fasciotomy appears to be a viable procedure for curative surgery of plantar 1st metatarsal head ulcerations in the flexible, dynamic cavus foot, but more research is needed in this area.

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