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### Submission Category:

Case Series/Study

### Covered Topics:

Complex/Difficult-To-Heal Wounds  
Diabetes-Related Wounds  
Pressure Injuries/Ulcers

### Introduction

Chronic diabetic foot ulcers (DFUs) affect ~25% of people with diabetes during their lifetime. Despite advances in treatment approaches, ~20% of patients have unhealed DFUs at one year and recurrence is common, with a rate of ~40% within the first year. The use of a percutaneous cutting tool to remove diseased tendon in circumstances of chronic refractory tendinopathy prompted the development of a novel ultrasonic system\* that can also be used in the management of DFUs that targets both the tissue and bone beneath the wound. We report outcomes on eight patients who presented with DFU and were treated using this system.

### Methods

The system imparts ultrasonic energy by way of the hollow "micro tip" sharp cutting tool that is activated by a foot pedal. Irrigation and cooling of the needle occurs through an outer sheath and debris is aspirated through the lumen of the needle, removing it from the field of treatment. The micro tip is inserted through two to four 3-5mm "stab" incisions  $\geq 1$  cm from the ulcer edge to facilitate removal of both the scar tissue and osseous prominence. Each portal allows removal of the diseased tissue using a back-and-forth motion. The entire ulcer is treated using successive portals. All cases were performed under local anesthesia/MAC. All patients received prophylactic intravenous antibiotics the day of surgery. All patients were allowed protective weight-bearing post-op, with forefoot ulcer patients in a surgical shoe, and midfoot/rearfoot ulcers in a walking cast boot until wounds were closed.

### Results

Patient demographics were: 4 male/4 female, mean age 58.1 years (30, 79), mean duration of ulcer 20.68 months (2.5, 42). Ulcer size at presentation varied, with mean length 2.61 cm (1.0, 2.5), mean width 1.91 cm (0.7, 3.0), and mean depth 0.37 cm (0.2, 0.5). Eight out of eight cases healed without recurrence or post-operative infection. Mean days to healing post treatment was 55.75 days (20, 182).

### Discussion

Traditional approaches to debridement focus on the wrong side of the wound. Debriding the underside of the ulcer effectively decreases any venous congestion and corrects any arterial insufficiency that may be present by removing necrotic tissue, decreasing bacterial burden and biofilm, and reducing inflammatory cytokines. Further, removing the cortical bone beneath the ulcer not only decompresses the wound but releases intrinsic growth factors that reside in that cancellous bone. Our findings suggest that this approach should be considered for all patients with recalcitrant neuropathic DFU.

# A Novel Approach To Subulcer Ultrasonic Debridement Of Chronic Diabetic Foot Ulcers



Pre-Op Ulcer Closure: 35 Days

#### Case 1

- 68 y/o diabetic male
- Right sub 3rd MTH ulcer present 22 months
- 1.3 cm x 0.7 cm, 0.4 cm depth, exposed joint capsule
- Hx of previous partial 2nd ray amp right foot



Pre-Op Ulcer Closure: 35 Days

#### Case 2

- 71 y/o diabetic female
- Bilateral medial column Charcot collapse
- Ulcer right foot present for 3-1/2 years
- 2.0 cm x 1.8 cm, 0.5 cm deep



Pre-Op Ulcer Closure: 182 Days

#### Case 3

- 43 y/o diabetic male
- Ulcer present for 2 years
- Charcot midfoot collapse with plantar prominence
- 5 cm x 4 cm, 0.5 cm depth with heavy exudate



Pre-Op Ulcer Closure: 10 Days

#### Case 4

- 79 y/o diabetic female
- B/L Charcot deformity
- Ulcer plantar right foot off & on for 1 year



Pre-Op Ulcer Closure: 56 Days

#### Case 5

- 53 y/o diabetic female
- Plantar medial column ulcer left foot, chronic recurring for over 3 years; 2.5 cm x 2.2 cm, 0.4 cm deep
- Shave biopsy at wound center; Atypical cells
- Punch biopsy in office; Negative malignancy



Pre-Op Ulcer Closure: 112 Days

#### Case 6

- 30 y/o diabetic male
- Partial fifth ray amp right 11/26/21
- Open TMA right 11/29/21
- Referred by WC to me, ulcer present for 2 years
- Plantar stump ulcer 5 cm x 3 cm, 0.3 cm deep



Pre-Op Ulcer Closure: 42 Days

#### Case 7

- 67 y/o type 2 diabetic female
- History of right ankle fracture
- Developed weakness of peroneal tendons in NWB cast
- Flexible cavovarus
- On anticoagulation therapy
- Ulcer plantar lateral fifth metatarsal base x 3 months
- 1.5 cm x 1.0 cm x 0.2 cm



Pre-Op Ulcer Closure: 20 Days

#### Case 8

- 54 y/o type 2 diabetic male
- History of 1st MPJ fusion and pan metatarsal head resection right foot
- Developed ulcer under 3rd metatarsal distal end
- Ulcer present 2 1/2 months
- 1.0 cm x 0.7 cm x 0.3 cm



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