



# Lessons Learned: The Implementation of a novel Neuromuscular Electro-Stimulation (“NMES”) Device

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## OBJECTIVE

To examine the effectiveness of a portable neuromuscular electrical stimulation device in the healing of a chronic diabetic ulcer.

## BACKGROUND

The device is a small, battery operated neuromuscular electrical stimulation (NMES) device. It is applied to stimulate the common peroneal nerve, activating the calf muscle pump. A study by Tucker et al (2010), at St Bartholomew’s Hospital in London, UK, demonstrated that use of the portable neuromuscular electrical stimulation device resulted in increases in blood flow velocity, venous volume flow and microcirculation – all positive indicators for improved wound healing. Similar results were found by Jawad et al (2011) and Jawad et al (2012).

## CASE

A 62 year old female presented with a chronic diabetic ulcer on the plantar aspect of the left 1st metatarsal phalangeal joint of initial origin in January 2009. There have been brief periods of closure with the longest single period being 4 weeks on one occasion only. The lesion has been offloaded with a Darco Wound Care Shoe and orthotics for regular shoe wear. Routine debridement has occurred on average every 2–3 weeks. Phototherapy has been used to promote healing with indefinite results. At the outset of the study, the lesion had remained open uninterrupted for 11 months.

Patient has well-controlled Type 2 diabetes, hypertension, diabetic peripheral neuropathy and loss of protective sensation. She consumes approximately 2 alcoholic drinks per year, has never smoked, has a surgical history of breast lumpectomy, tubal ligation and partial toenail avulsions. Medications include Metformin 1000mg BID, Lipitor 10mg OD, Furosemide 40mg OD, Glyburide 10mg BID, Diovan 160mg OD, Atenolol 100mg OD and Entrophen EC 81mg OD.

## METHOD

The patient was instructed on the use of the portable neuromuscular electrical stimulation device and provided with a supply of devices. Devices were to be applied on both legs, to take full advantage of the body’s calf muscle pump. Use was based on a graduated schedule: Week 1, up to two hours per day; Week 2, up to four hours per day; Week 3 up to six hours per day. Device use was daily and discontinued on the weekends to allow the skin to “rest”. The patient was seen on alternate weeks for callus debridement and wound measurement.

## RESULTS

The lesion showed progressive improvement (decrease in diameter and depth) at each subsequent visit following initiation of the NMES device use. The patient developed a contact dermatitis at the site of application of the device at Week 6 and briefly interrupted the device use to allow it to settle, then restarted it which re-initiated the rash. The patient completely discontinued use of the device at that point. The lesion was closed at week 8, and remained closed at week 18 showing that healing continued even after use of the portable neuromuscular electrical stimulation device had ended.



WEEK 0



WEEK 6

## CLINICAL IMPLICATIONS

Portable neuromuscular electrical stimulation device use can be an important adjunct therapy to improve healing in the treatment of diabetic foot ulcers as it results in:

- demonstrated increase in arterial, venous and microcirculatory blood flow
- improved healing of diabetic foot ulcers
- improved healing continues for a period even after discontinuation of use of the NMES

## REFERENCES

1. T. Tucker, A. Maass, D. S. Bain et al. Augmentation of venous, arterial, and microvascular blood supply in the leg by isometric neuromuscular stimulation via the common peroneal nerve. *Int. J. Angiol.* 2010; 19 (1): e31–e37
2. Jawad, H., et al., The effect of OnPulse In Improving Lower Limb Blood Flow In Healthy Volunteers, 2011: *Prakt.Flebol.* p. 41
3. Jawad, H., DS. Bain, H. Dawson, K. Adams, A. Johnston, AT. Tucker, A. Potential Management for Venous Thromboembolism, 2012: *OnPulse™*