

Use of a Microcurrent Generating Device in Wounds of Complex Etiologies

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BACKGROUND

Wound care strategies that expedite healing and reduce bioburden in stalled wounds that have failed traditional treatments is currently a subject of increased study. Electrical stimulation is known to enhance cell migration (1-2), and on a clinical scale, energy-based modalities have been shown to accelerate wound healing (3-4). An antimicrobial microcurrent-generating device (MCD) (a) has been observed to stimulate and expedite wound healing in acute and chronic wounds (5-6) and enhance the wound microenvironment through decreased interleukin 1- α (7) and increased keratinocyte migration (8). The self-contained device is wireless, conformable and contains a matrix of batteries on a flexible surface. The device generates a sustained 2-10 micro Amperes of therapeutic low-level microcurrent at its surface in the presence of a conductive fluid.

METHODS

A case series was conducted to observe the effects of a microcurrent generating device on five patients with chronic wounds with complex etiologies of greater than 3 months duration that had failed to respond to standard of care and other advanced modalities. All wounds were treated once per week with a microcurrent generating device used as a primary contact layer and secured in place with standard secondary devices. Wound healing progression was assessed at follow-up visits in the clinic.

RESULTS

A marked improvement was observed following the application of the microcurrent generating device, with wound healing initiation in all cases. In case 1, a pressure ulcer that had failed to respond to SOC for 439 days resulted in complete re-epithelialization following the application of the MCD at 57 days. In Case 2, a surgical dehiscence, the MCD was immediately applied post-dehiscence and wound achieved complete re-epithelialization at day 86. Cases 3 and 4 were both non healing acute wounds, and began healing initiation and closure with the application of the MCD under two weeks. In Case 5, a recurrent plantar foot ulcer, the application of the MCD was observed to promote healing, with complete wound closure at day 87.

CONCLUSION

The presented cases demonstrate the versatility and utility of the MCD in the application of wounds of varying etiology and chronicity, and in patients with several comorbidities (4 of 5 with DM). The application of microcurrent generating devices in wounds failing all other methods may be a beneficial option in promoting wound healing initiation in chronic wounds, and may serve as an effective alternative to other costly advanced treatments and therapies.

REFERENCES

1. Sheridan DM, Isseroff RR, Nucitelli R. Imposition of a physiologic DC electric current alters the migratory response of human keratinocytes on extracellular matrix molecules. *J. Invest. Dermatol* 1996; 106: 642-646.
2. Nishimura KY, IR, Nucitelli R. Human keratinocytes migrate to the negative pole in direct current electric fields comparable to those measured in mammalian wounds. *Journal of Cell Science* 1996; 109:199-207.
3. Wolcott LE, Wheeler PC, Hardwicke HM, Rowley, BA. Accelerated Healing of Skin Ulcers by Electrotherapy. *Southern Medical Journal* 1969; 62(7):795-801.
4. Sinityn, Razvoza. Effects of Electrical Microcurrents on Regeneration Processes in Skin Wounds. *Ortop Travmatol Protez*, Feb. 1986
5. Blount A, Foster S, Wilcox R. Use of Bioelectric Dressings for Faster Wound Healing: A Prospective Case Series. [abstract] *Plastic & Reconstructive Surgery* 2010; 126(4) :97.
6. Whitcomb E, Monroe N, Hope-Higman J, Campbell P. Demonstration of a Microcurrent-Generating Wound Care Device for Wound Healing within a Rehabilitation Center Patient Population. *Journal of the American College of Clinical Wound Specialists* 2013; 4(2):32-39.
7. Harding AC, Gil J, Valdes J, Solis M, Davis SC. Efficacy of a Novel Bio-electric Dressing in Healing Deep Partial-thickness Wounds in a Porcine Model. *Ostomy Wound Manage.* 2012;58(9):50-55.
8. Banerjee J, Ghatak P, Khanna S, Roy S, Sequin E, Subramaniam V, Sen C. Improvement of Human Keratinocyte Migration and Wound Healing by a Redox Active Bioelectric Dressing. [abstract]. Presented at the Symposium on Advanced Wound Care, Denver, CO. April 2013; (suppl): W8.

Case 1: PRESSURE ULCER

69 year old diabetic male with hx of infected pressure ulcer to right heel x 6 months. Patient referred to office by home health RN for second opinion. Patient was offered free rotational flap via plastic surgery, but declined. PMH: HTN, DM, CAD, PAD, previous amputation left foot hallux, second toe. Initial wound measurements: 6.5 cm x 4.5 cm x 1.5 cm. Patient additionally diagnosed with calcaneal OM. Bone resection and debridement performed on 2-22-13. Previous Tx: Dermal repair scaffold (b), NPWT, collagen based gel (c), collagenase (d), TCC, SIS extracellular matrix (e). Wound stalled around mid-March 2013. Wound measurements were approx 2.5 cm x 1.5 cm x 0.2 cm. MCD started 5-17-2013, with 6 weekly treatments and complete healing noted by 7-12-2013.



Initial Wound

Day 439 SOC

MCD Applied

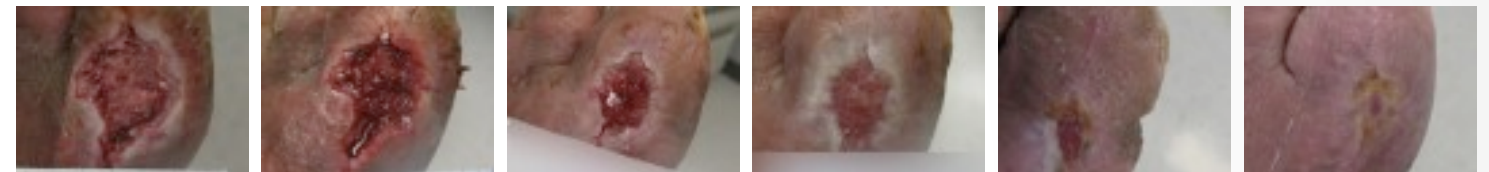
Day 20 MCD

Day 39 MCD

Day 57 MCD

Case 2: SURGICAL DEHISCENCE

66 year old male patient with surgical dehiscence to right great toe following a 1st MPJ replacement. Patient is diabetic, with obesity and hypertension. Started patient immediately on MCD post-dehiscence; followed for 11 weeks. First visit: 6-16-2013 Last Visit: 9-9-2013 Number of MCD applications: 10



Initial Wound

Day 12 MCD

Day 26 MCD

Day 33 MCD

Rapid epithelialization

Day 86 MCD

Case 3: TRAUMATIC INJURY

76 year old diabetic female with traumatic injury to left anterior leg. Wound non-progressive for 2 weeks with topical antibiotic therapies administered by home health RNs. Patient seen at request of PCP. Med HX: DM, HTN, PAD, Abnormal Gait First Visit: 6-20-2013 Final Wound Closure: 7-1-2013



Initial Wound

Day 4 MCD

Day 11 MCD

Case 4: LACERATION

85 year old female patient seen for 3 week non-healing laceration injury to her anterior right leg. PMH: PAD, A-Fib, anti-coagulant therapy (INR > 2.5), abnormal gait, neuropathy, dementia. First visit: 5-14-2013 Final visit: 5-29-2013



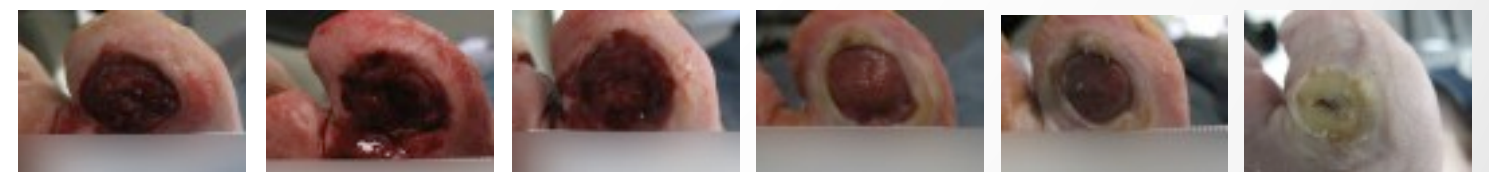
Initial Wound

Day 8 MCD

Day 15 MCD

Case 5: DFU

56 y/o diabetic male with previous hx of MRSA resulting in a partial hallux amputation with recurrent neuropathic plantar foot ulcer. PMH: IDDM, HTN First visit: 5-22-2013 Final Visit: 8-16-2013 Note: lost patient to follow-up due to insurance change from 7-8-2013 through 8-16-2013. Patient was given supply to change dressing at home. Patient came to office on 8-16 with resultant healed wound, and did not seek other treatment. MCD was changed out every 5 days.



Initial Wound

Day 21 MCD

Day 35 MCD

Day 41 MCD

Day 49 MCD

Day 87 MCD