

Low-Frequency Ultrasound Therapy of Lower Extremity Wounds Significantly Increases the Peri-wound Skin Perfusion Pressure

Kazu Suzuki DPM CWS¹, Lisa Cowan MS-I, PhD², and Joel Aronowitz MD¹.
¹Tower Wound Care Center, Cedars-Sinai Medical Towers, Los Angeles, CA
²Keck School of Medicine, University of Southern California, Los Angeles, CA



Introduction:

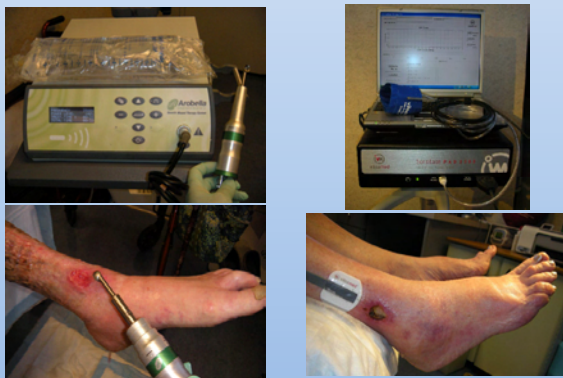
Currently, there are several ultrasound wound therapy devices approved by FDA and available in the U.S. market today. Therapeutic ultrasound has been studied extensively for many decades and is known to promote tissue restoration in various tissues and organs. The benefit of therapeutic ultrasound application for wound healing is mainly two-fold: **(1) Cavitation effect:** assists in fragmentation/debridement of non-viable, necrotic tissues, and it is also bacteriocidal, **(2) Stimulatory effect:** cells are stimulated to release NO (nitric oxide) resulting in resolution of vasospasm and vasodilatation of blood vessels and an increase in blood flow to the treated site.

Purpose:

Low-frequency ultrasound therapy stimulates the generation of nitric oxide in the endothelium via fluid shear-stress, which in turn, increases blood flow via vasodilatation. This study was designed to verify the increase in blood flow (post-ultrasound treatment) of the peri-wound skin in lower-extremity wounds using the laser-Doppler based Skin Perfusion Pressure (SPP) monitor.

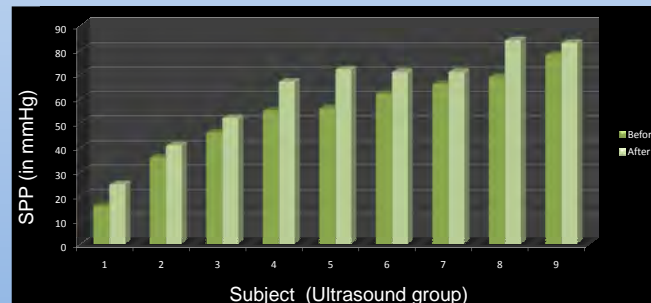
Methods:

17 lower extremity wound patients were enrolled in this study, as non-randomized, clinical case series of two treatment groups: **(control group):** conventional sharp debridement with scalpel, followed by room-temperature saline irrigation, or **(ultrasound treatment group):** low-frequency ultrasound debridement with room-temperature saline irrigation (35 kHz ultrasound for 5 minutes). The SPP values were measured at the same location (peri-wound area) "before" and "after" sharp debridement or ultrasound treatment.

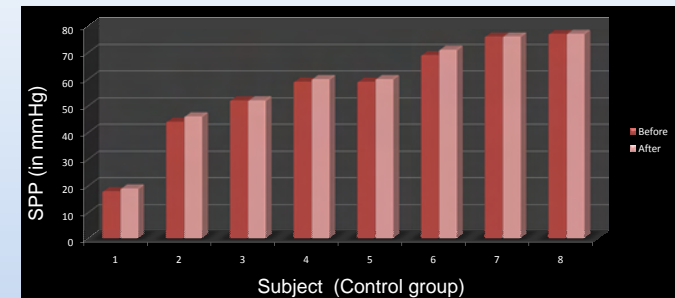
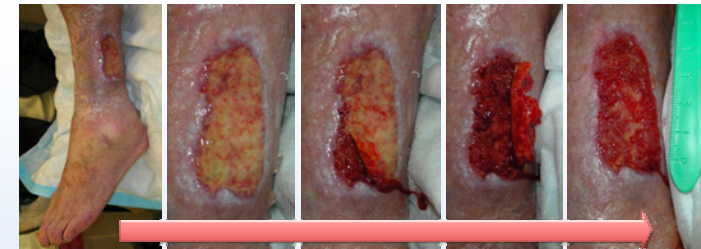


The devices used in this study.
 (Left) Low-frequency ultrasound debridement device: Quostic Wound Therapy System, Arobella Medical LLC.
 (Right) Laser-Doppler based Skin Perfusion Pressure monitor: Sensilase, Vasamed Inc.

Low-Frequency Ultrasound Treatment Significant increase in SPP values observed



Conventional Sharp Debridement with #10 blade Negligible increase in SPP observed



Results:

Nine subjects in the ultrasound group showed significant increase in SPP values [mean = 9.11 mmHg, SD = 4.34] after 5 minutes of low frequency ultrasound therapy. For comparison, 8 subjects in the control group showed negligible increase in SPP values [mean = 1.2 mmHg, SD = 0.84].

Conclusions:

This study supports the application of low-frequency ultrasound, which generates a vasodilatation effect and increased skin perfusion, in treating lower extremity wounds. **This data shows a statistically significant increase in SPP values post-ultrasound wound treatment (p < 0.001).**

Discussions:

The low-frequency ultrasound treatment of wounds have been shown to increase the wound closure rate versus standard care (Kavros *et al.* Adv in Skin & Wound 2007) and sham-control treatment (Ennis *et al.* OWM 2005). We believe the increase in SPP values in response to the ultrasound treatment may be one of the positive effects in wound healing, perhaps by promoting the angiogenesis of the wound bed. Future work will investigate the permanence of SPP increase and probable increase in growth factors within the wound bed tissue in response to the ultrasound treatment.