

Wound Clinic 22.5kHz Contact Ultrasonic Powered Wound Debridement Increases Options for Limb Salvage: Decrease Cost is Advantageous

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Paraplegic Amputee with Pressure Ulcers, Stasis Dermatitis and Profound Arterial Ischemia Refuses Amputation



Right 5th metatarsal head ulcer is macerated and carries a large bioburden. The wound is painful and patient refused sharp debridement. Patient had a previous L BKA and refused a second BKA. Paraplegia keeps this limb dependent. Pre-tibial (6mm) edema was significant at presentation.



Three ulcers on R foot are the result of multiple comorbidities including occlusive arterial disease, no palpable pulses in leg, paraplegia with pressure from motorized wheel chair foot plate, venous insufficiency, and neglect. Since four wound comorbidities are present, two vascular surgeons (including the author) recommended a R BKA.

Presentation:

Wound comorbidities:

- Occlusive arterial disease
- No palpable pulses in leg
- Paraplegia with pressure from motorized wheelchair foot plate
- Venous insufficiency
- Neglect; patient refused amputation and sharp debridement



Painful wounds were easily debrided with 22.5 kHz contact ultrasonic handpiece* and probes set to intermittent low energy. Obvious clean wound, moderate bleeding and corrow furrows in the wound granulation tissue. Corrows are the result of longitudinal yarn compression elastic used to control extensive edema.



22.5 kHz Handpiece* and probe enables immediate, compassionate outpatient debridement of this painful wound. Patient refused BKA in the care, at this point in time, is palliative wound management.



Five weeks after bioengineered human skin substitute the ankle wound is nearly healed. Notice how pristine the healing bioengineered skin cells appear. Key to this healing is 22.5 kHz contact ultrasonic debridement that was done weekly for three weeks, to control biofilm bacteria. Enzymes released by biofilm bacteria are known to prevent the "take" of skin graft cells.



Ulcer after 7 weeks of treatment. Patient received weekly dressing changes that included the use of 250ppm HCl solution** to sterilize biofilm bacteria at weekly dressing changes and an application of bioengineered skin and Paraplegia keeps this limb dependent. Pre-tibial (6mm) edema was significant at presentation. Longitudinal yarn compression elastic compression stockinet** used to control edema has created furrows in the skin and in wound granulation tissue.

Treatment:

- 22.5 kHz Contact ultrasonic debridement*
- Bioengineered human skin substitute¹

Outcome:

- Two board certified vascular surgeons recommended BKA. Patient refused R BKA.
- 22.5 kHz Contact ultrasonic powered debridement enabled debridement to be performed on a patient that refused sharp debridement due to pain
- It is believed that the use of 22.5 kHz Contact ultrasonic powered debridement controlled wound bioburden and as a result saved this limb



Healing of the 5th metatarsal head ulcer is nearly complete after 5 weeks. Note that the skin is no longer red and edema is no longer present.



Notice how pristine the healing bioengineered skin cells appear. Current wound thinking holds that the key to this patient's dramatic healing is control of biofilm bacteria. Enzymes in bacteria in wound biofilm prevent skin graft cells, migrating local epithelial cells and circulating stem cells from taking hold in wound granulation tissue.

Hemodialysis Patient Referred With Unrecognized Left Leg Arterial Embolic Lesions



22.5 kHz contact ultrasonic debridement, set on intermittent low power, allowed immediate, comfortable debridement of this complex, limb threatening, infected ischemic leg.



22.5 kHz Contact ultrasonic powered debridement system has a small footprint. The unit, kept on a small cart, is rolled room to room as needed in the outpatient clinic.



Exudate saturates the modified Robert Jones dressing after 48 hours. Longitudinal yarn compression textile** was used to control extensive edema.



L foot 48 hours after 22.5 kHz contact ultrasonic debridement. Medial compartment muscle and tendon below the medial malleolus was necrotic.

Presentation:

- Necrotic wounds with heavy bioburden and invasive infection
- Arterial ulcers probably due to emboli
- ESRD on Hemodialysis

Treatment:

- 22.5 kHz contact ultrasonic powered debridement was performed at first visit
- Robert Jones dressing applied at first visit.
- Systemic antibiotics
- Hospital admission for arterial and cardiac workup

Outcome:

- Patient's infected ischemic wounds were able to be debrided immediately in the wound care clinic with the use of contact ultrasonic debridement
- Wounds would not have been debrided in such a timely manner if the patient needed to go to the operating room
- Cost savings benefits of effective debridement in an outpatient setting vs. the operating room, can be estimated to start at \$6,000
- Unfortunately, the patient died on day #11 in ICU due to MI with multiple complications

Results

The use of contact ultrasonic powered debridement provided an immediate means to debride a wound in patients with complex wounds. Photos document the chosen treatment therapy and decision making. Wounds healed in one patient with ABI of 0.0. (no Doppler signals in feet), which prevented a BTK amputation. Two additional patients with ABI <0.2, were able to benefit from immediate debridement in the outpatient clinic, but unfortunately died of multiple complications, including hemodialysis. Painful necrotic wounds were debrided in a timely manner with a 22.5kHz contact ultrasonic powered hand piece in the wound clinic setting. As a result of the use of the contact ultrasonic debridement procedures being done in the clinic, the costs associated with six operating room procedures with anesthesia, were avoided.

Summary

22.5 kHz Contact Ultrasonic powered debridement in the wound care clinic setting appears to reduce wound care costs by reducing/preventing trips to the OR and decreases amputation in patients referred for "limb salvage".

References

1. F J Veith, S K Gupta, et al, Progress in limb salvage by reconstructive arterial surgery combined with new or improved adjunctive procedures. Ann Surg. 1981 October; 194(4): 386-401.
2. Dormandy J, Heeck L, Vig S. Major amputations: clinical patterns and predictors. Semin Vasc Surg. 1999 Jun; 12(2):154-61.

* SonicOne® Misonix, Inc., Farmingdale, NY
 **Vashe®, PuriCore, Malvern, PA
 †Apligraf®, Organogenesis Corp, Canton, MA
 ‡EdemaWear®, Compression Dynamics, LLC, Omaha, NE

Necrotic Right Calf Skin Patches on Hemodialysis



Washcloth on right calf is saturated with 250ppm solution of hypochlorous acid to soften eschar and sterilize biofilm prior to 22.5KHz** powered debridement.



Left leg shows dry scales of dermatosclerosis due to venous insufficiency. Note multiple patches of necrotic black skin on R calf. The necrotic skin patches suggest that arterial emboli are responsible.



Isolated black patches of necrotic skin seen on the right leg, suggest arterial emboli are the problem. The heart and aorta are common sources for this type of arterial emboli. Black patches of skin usually mean arterial insufficiency is present. The weeping and dermatitis that covers the entire calf is worrisome; Strep cellulitis or a necrotizing infection may be present. The right leg skin is inflamed and swollen and infected and has two necrotic areas that are black. The weeping dermatitis was debrided superficially with the use of contact ultrasonic. The black slough was completely debrided using the powered handpiece and probe (see example below).

Presentation:

- Hemodialysis hypertension
- No palpable pedal pulses
- Infected critically ischemic limb needing immediate debridement
- Renal failure
- Venous insufficiency
- Weeping dermatitis/cellulitis

Treatment:

- Hospital admission
- Contact ultrasonic powered debridement* in wound clinic
- Robert Jones dressing

Outcome:

- Patient was able to receive immediate 22.5 kHz contact ultrasonic powered debridement* in wound clinic; providing an immediate means to control wound bioburden
- Costly trip to the operating room was avoided because the treatment could be performed in the clinic. Based upon the outcome, costly trip to the OR for wound debridement would have been an unnecessary step for this patient.
- Unfortunately, death from sepsis and multiple organ failure occurred within 5 days



An example of the ultrasonic powered handpiece and one of the available probes. The wide choice of available probes, provides the clinician the opportunity to choose the shape that will allow the most effective and efficient for the required debridement.



Upon referral to wound center, reveals a limb threatened by arterial ischemia with comorbidities: renal failure, venous insufficiency and a weeping dermatitis/cellulitis.

Problem

New technologies, pneumatic compression for arterial disease and hyperbaric oxygen to name two, are increasing wound clinic referrals for "limb salvage". Patients seeking a second opinion for limb amputation frequently self refer to wound clinics. Attempting limb salvage for chronic complex wounds, in patients with nonreconstructable arterial disease, taxes both the patient and the clinic resources.

Decisions to salvage the limb, risk vs. benefit, limb vs. life, are difficult to make. Costly operating room procedures for debridement and closure seem a poor choice when amputation risk is ≥ 50%. In cases such as this, ultrasonic contact debridement of limbs referred for amputation, is a practical first step for limb salvage.^{1,2}

The following case studies focus on the use of contact ultrasonic debridement as an immediate method of debridement in patients that might otherwise not be able to go to the operating room due to existing medical conditions. The use of ultrasonic debridement provides an opportunity to reduce tense clinical situations and potentially avoid unwanted/not necessary amputation.

Methods

22.5 kHz Contact Ultrasonic powered debridement* was used in three patients referred for limb Salvage. All patients presented with complex limb threatening wounds, arterial insufficiency and multiple comorbidities, particularly venous insufficiency.



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