Debridement of Wounds with Ultrasound

Technological advances have made this a superior wound healing method.

BY KAREN C. SHUM, DPM

Methods of Debridement

The term “debridement” was first coined by Desault in Paris, France referring to surgical removal of necrotic material from open wounds.1 Debridement of foreign devitalized and contaminated tissue from traumatized or infected areas is a vital step in the wound healing process. The presence of senescent cells can leave wounds in a chronic inflammatory state stalling the wound healing process. Studies have demonstrated that wounds that have undergone serial debridement have lower infection and better healing rates than wounds that are less frequently debrided.2,3 There have been recent innovations with respect to ultrasound debridement used in the treatment of acute and chronic wounds.

Presently, there are many methods of debridement, with sharp surgical debridement being the most widely applied. However, this method is aggressive and may result in pain, excess bleeding, and non-selective removal of viable tissue. Autolytic and enzymatic debridement are slow processes and require management of exudates and monitoring for signs of infection. A long-standing method of mechanical debridement includes wet to dry dressings. This technique is easy to perform; however, it is non-selective and requires frequent dressing changes. Biological debridement with the use of maggot therapy is a selective process but may not be aesthetically pleasing for patients. The method chosen for wound debridement should ideally be selective, efficient, and enhance the wound healing process.

Ultrasound Technology

Ultrasound technology has a variety of applications in the field of medicine. This includes diagnostic imaging and therapeutic capabilities. The use of therapeutic ultrasound has been widely reported in bone healing and muscle and tissue repair. Studies have demonstrated that wounds that have undergone serial debridement have lower infection and better healing rates than wounds that are less frequently debrided.2,3 The energy that is released and pressure change from the cavitation loosen the targeted non-viable tissue. This hydrodynamic effect depends upon the frequency of the ultrasound wave and produces mechanical disruption, fragmentation, and emulsion of tissue. Non-viable tissue can then be removed from the wound bed through fluid irrigation.

The selective aspect of tissue debridement is essential to proper wound bed preparation because foreign material, dry crust or eschar within a wound bed acts as a physical barrier. These barriers prevent the normal course of wound contraction, and interfere with cell epithelializa-

High intensity, low frequency contact ultrasound is a mode of selective and efficient debridement that has shown to improve wound healing.

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Additional to the use of nontoxic biological debridement methods, the pressure to control contamination and infection by bacterial organisms is paramount.

The therapeutic benefit to using ultrasound in wound care is further demonstrated by the fact that emitted acoustic energy upregulates and increases cellular activity.10

The ability to adjust the intensity level and selection of specific probe tips can affect how aggressively the wound is debrided.
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Setup of the device is fairly quick and simple. The probe tips are either disposable or can be reused. The ultrasound device is portable and is applicable in the outpatient setting or the operating room. This proves to be especially useful and convenient in patients who are non-surgical candidates. The design of these ultrasound units is becoming more widely available due to compact units and ease of portability.

The effectiveness of wound debridement with the use of ultrasound can reduce the total number of debridements a patient undergoes, leading to considerable cost-savings. A clinical trial by Steed revealed that regular debridement of wounds lead to improved effectiveness of the therapeutic agent used as an adjunct to promote wound healing. Wounds debrided regularly have a wound base that is properly prepared, maximizing the effect of adjunctive wound care modalities. This allows the clinician to use skin graft substitutes to enhance healing or apply an autogenous skin graft for definitive wound closure. Evidence has shown improved outcomes in the proportion of wounds healed and wound volume reduction with the use of ultrasound compared to standard wound care.

Ultrasound debridement can be used on wounds with various etiologies. It is indicated for use in burns, infected wounds, wounds with impaired circulation, pressure ulcers, diabetic foot ulcers, and venous ulcers. A meta-analysis of eight randomized controlled trials in ultrasonic debridement of all of the aforementioned wound types shows a short-term clinical benefit in healing and reduction in wound area. The overall increase in rate of wound healing may lead to overall satisfaction of the patient.

Conclusion

Ultrasound debridement is one of many forms of debridement techniques available for use today in wound care. The therapeutic benefits of ultrasound debridement are multifactorial and go beyond just “cleaning” the wound base. There is evidence that it has bactericidal effects and enhances the wound healing process on the cellular level. In general, ultrasound has been found to be a safe way of debriding wounds. There are still questions that remain about the optimal therapeutic effect of ultrasound debridement, including the appropriate amount of time for debridement, intensity, and frequency of the ultrasound waves and the rate of epithelialization of superficial wounds in the skin of the young domestic pig. Nature. 1962; 193:293–294.


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The numerous benefits of ultrasound debridement shown thus far in clinical studies should lead a clinician to strongly consider the use of this device and incorporate it into their routine clinical practice. PM

References


Dr. Shum is the Medical Director of the Amputation Prevention Center at Torrance Memorial Medical Center in Torrance, CA and on the teaching staff at Cedars-Sinai Medical Center in Los Angeles.