Negative Pressure Wound Therapy

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KEYWORDS

• Negative pressure wound therapy • Dressings • Healing • Skin • Wound

KEY POINTS

- Negative pressure wound therapy (NPWT) transforms an open wound into a closed, moist environment through which a controlled vacuum is applied.
- The modality is widely used in human medicine in acute, subacute, and chronic open wounds; plastic and reconstructive surgery; dehiscences; open abdominal drainage; and closed incisions.
- NPWT has been shown to reduce interstitial edema, stimulate fibroplasia, and enhance angiogenesis, although some mechanisms remain to be elucidated.
- Veterinary studies have recently shown that NPWT is beneficial in open wounds, in which it promotes the early appearance of a smooth granulation tissue bed; NPWT also improves free graft survival and has been used in several other indications.
- Further studies are needed to refine NPWT protocols for different species, to identify different indications, and to determine which protocols are best suited for each application type.

Video content accompanies this article at http://www.vetsmall.theclinics.com.

INTRODUCTION TO NEGATIVE PRESSURE WOUND THERAPY

Open wounds are regularly addressed in veterinary medicine and can be challenging to manage, especially when there is significant loss of full-thickness skin (Fig. 1). Injuries include traumatic anatomic degloving wounds, shear injuries, penetrations, avulsions resulting in physiologic degloving, envenomations, burns, necrotizing fasciitis or vasculitides, incisional dehiscences, and surgical wounds left open to heal by second intention. Involvement of the underlying subdermal fat, fascia, muscle, and even bone may compromise perfusion and impede healing of the tissues. Traumatic wounds are typically contaminated or infected and additionally may contain devitalized tissues and foreign debris. Management of these wounds is intensive, requiring repeated debridement and lavage events. Multiple dressing changes over a prolonged

Disclosure: The author has nothing to disclose.
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Vet Clin Small Anim ■ (2017) ■–■
http://dx.doi.org/10.1016/j.cvsm.2017.06.006 **vetsmall.theclinics.com**

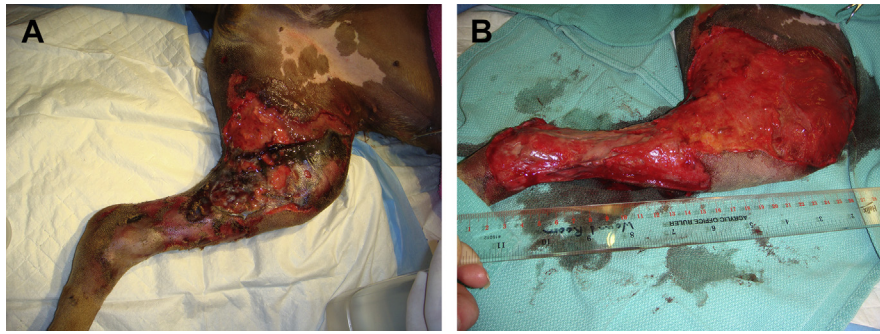

Fig. 1. Significant loss of full-thickness skin from a variety of causes is a frequent presentation in small animal medicine. (*A*) A 3-year-old spayed female boxer with physiologic degloving to medial left pelvic limb. (*B*) The same wound following cleansing, lavage, and debridement.

period have traditionally been necessary, often continuing through the inflammatory phase into the proliferative phase of healing. Intensive wound care continues until the wound is either suitable for a reconstructive procedure or until it has largely healed by second intention and can be managed in the home setting.

During the early phase of wound healing, dressings have historically been changed frequently with saline-dampened wet-to-dry dressings to aid in ongoing debridement and exudate management.[1] Although effective in the inflammatory phase, these bandage changes require daily sedation, and significant nursing time and expenditure on consumables. As the understanding of the cellular and molecular events orchestrating wound healing increased in the last half-century, the importance of the extracellular matrix was appreciated.[2–6] Subsequently, many modern wound dressings and biologics have been developed, not just to protect but also to nurture the wound, resulting in an extensive choice of products. Several mechanical adjuncts have also been developed to enhance wound healing over the last few decades, including electromagnetic stimulation, magnetic therapy, ultrasonography therapy, radiofrequency energy, low-intensity laser, hydrosurgical debridement, oxygen therapies, and negative pressure wound therapy (NPWT).[7–11] Of these, NPWT has shown particular clinical advantages, not only for open wound management but also in reconstructive, orthopedic, and general surgical applications.[12–17]

NPWT refers to the application of a vacuum evenly distributed across the surface of a wound, typically through a foam dressing. An open-cell polyurethane or polyvinyl alcohol foam is conformed to the wound and sealed from the environment with occlusive drapes. Specialized access tubing connects the dressing to a programmable vacuum pump, which subjects the entire wound to an evenly distributed negative pressure. Wound exudate is collected in a canister attached to the pump (**Fig. 2**). The level of vacuum is programmable, ranging from 75 to 150 mm Hg with 125 mm Hg being commonly used for open wounds.[18] NPWT can be continuously, cyclically, or intermittently applied.[19] There are several synonymous terminologies for NPWT, including topical negative pressure therapy, vacuum-assisted closure, subatmospheric wound therapy, closed-suction wound drainage, and microdeformational wound therapy.[20–24]

MECHANISMS OF ACTION

The aims of the NPWT modality are to remove wound exudate; decrease interstitial edema; draw wound edges together; promote blood supply to the wound; and, by