# PODIATRY MANAGEMENT

THE MOST INFLUENTIAL PUBLICATION FOR THE PODIATRIC PROFESSION JANUARY 2010



## Are You Using Protocols in Your Practice?

**ALSO INSIDE:**

- Marketing Your Services on the Internet
- Running Injuries: Be Knowledgeable, Be Prepared
- Social Networking: Can It Benefit—or Harm—Your Practice?
- Managing Patient Expectations




www.podiatrym.com

# Advances in Techniques for Wound Closure

*Here's a review of the current methods of this essential procedure.*

By Nicholas J. Bevilacqua, DPM and Lee C. Rogers, DPM

Up to 25% of those with diabetes will develop a foot ulcer during their lifetime.[1] Foot ulcers allow bacteria a portal of entry which can lead to infection, and an infected wound is a significant risk factor for limb loss.[2] Eighty-four percent of lower extremity amputations are preceded by a foot ulcer.[2] In fact, foot ulcers are the most common antecedent event leading to an amputation.[2] Therefore, it stands to reason that healing a foot ulcer can prevent major limb amputations.

The treatment for diabetic foot ulcers is multi-factorial and the goal is to achieve wound closure and avoid amputation. The foundation of treatment is: infection control, recognition of vascular disease, and implementing an effective offloading device. Proper off-loading can be accomplished externally (total contact cast, etc.) or internally (surgery).

Implementation of these basic tenets of care should result in a 50% reduction in wound surface area after four weeks of treatment.[3] Sheehan, et al. conducted a prospective, controlled trial of diabetic foot ulcers that were not complicated by ischemia or infection, in which good clinical care was given, and found that wound area changes over a four-week period can strongly predict complete wound healing over a 12-week period.[3] Therefore, if the wound becomes stagnant and fails to reduce by half after four weeks, the physician should consider employing advanced therapies.

There are three general clinical phases of wound healing: debridement, promotion of granulation tissue, and wound closure. As such, a wound that is not complicated by infection and/or being ischemic should progress through these clinical phases of healing. There are many emerging technologies and advanced therapies available to help transition the wound through these three phases. Therefore, it is important to understand the goals of a particular therapy and realize where it fits into the overall treatment plan.

> *The treatment for diabetic foot ulcers is multi-factorial and the goal is to achieve wound closure and avoid amputation.*

## Debridment Technology

A relatively recent advancement in debridement technology includes the Versajet (Smith & Nephew, Memphis, TN). The Versajet is a hydrosurgical water knife that allows for accurate debridement in the operating room. Another technology for supplemental wound debridement involves ultrasound. Low-frequency ultrasound debridement is emerging as an effective method of debridement for many types of wounds. The goal of debridement is to remove all non-viable soft tissue and bone to achieve a healthy viable wound bed.[4]

## NPWT

One of the most effective modalities used to promote granulation tissue is negative pressure wound therapy (NPWT). NPWT applies localized negative pressure to the wound and has a cellular micro-deformational effect which helps remove interstitial fluid and infectious material and promote granulation tissue.[5]

NPWT helps transform a deep wound into a more manageable granular wound. Another technique that may be used to enhance granulation tissue is the injection/application of adult bone marrow-derived stem cells.[6] The goal of these treatments should be to achieve a fully granular wound bed rather than continue until complete closure.

After achieving a granular wound bed, techniques should be employed to obtain wound closure. The physician should follow the plastic surgery reconstruction ladder, which includes both basic and advanced techniques. Basic wound closure techniques include secondary intention, bio-engineered tissue, delayed primary closure, and split thickness skin grafts (STSG). The more advanced techniques include random, pedicle and free flaps. The majority of wounds can be closed using basic closure techniques.

*Continued on page 92*

## Wound Closure...

### Healing by Secondary Intention

The most basic technique on the plastic surgery reconstructive ladder is allowing the wound to heal by secondary intention. This technique requires a granular wound bed for epithelialization. This can be accomplished with basic wound care or may require "advanced" dressings including acellular orthobiologic scaffolds or bioengineered tissue alternatives.

The acellular scaffolds include GraftJacket®, Integra®, and Oasis®. These tissue matrixes act as scaffolding to allow the migration of host tissue across the wound surface with matrix proteins that are incorporated and utilized as the scaffold and are remodeled by the host. The matrix supports regeneration of dermal tissue and the patient's cells grow into the matrix to form the patient's own skin.

*There are three general clinical phases of wound healing: debridement, promotion of granulation tissue, and wound closure.*

### Cell-Based Technologies

Cell-based technologies help deliver exogenous growth factors to the wound bed and include APLIGRAF® (Organogenesis, Canton, MA) and Dermagraft® (Advanced Biohealing, La Jolla, CA). Recently, at our hospital, we performed a retrospective chart review on 31 consecutive patients who received Dermagraft® for a diabetic foot ulcer. All wounds were initially debrided to prepare the wound bed and weekly maintenance debridement was performed to remove surrounding hyperkeratotic tissue. All patients were placed in a removable cast walker throughout the duration. Overall, we had a 74% healing rate with an average of 3.9 pieces of Dermagraft® in an average of 6.8 weeks.

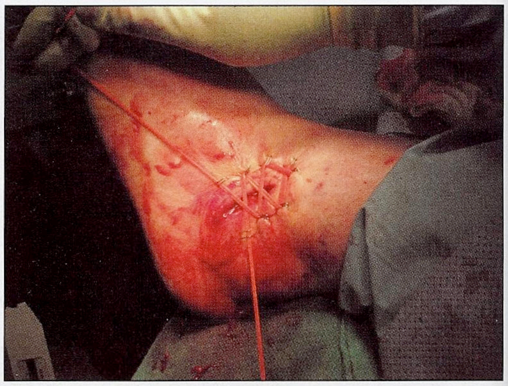

Figure 1: Delayed primary closure with the use of skin staples and vessel loops placed in a figure 8-type fashion.

### Delayed Primary Closure

Another very basic technique to achieve wound closure is delayed primary closure. Most often, this technique is considered after an incision and drainage is performed. After eradicating the infection, the resultant wound is often amendable to primary closure with minimal tension. A basic, inexpensive technique to achieve wound closure involves the use of skin staples and vessel loops placed in a figure 8-type fashion. This technique works well and affords skin approximation with minimal tension (Figure 1).

However, in situations in which there is a large defect, delayed primary closure may result in excessive tension on the skin edges. In these cases, an external tissue expander may assist in closure. The DermaClose™ RC (Wound Care Technologies) tissue expander may facilitate closure by applying a continuous, controlled force resulting in wound closure.

Figure 2: Dermaclose device placed on an elliptical wound. The device remained in place for three days.

The device should not be used on wounds with friable skin edges. The skin edges are excised, often resulting in an elliptical wound. The wound edges are slightly undermined, and the skin anchors are placed at approximately 1.5-2 cm from the skin edge and secured with skin staples. The monofilament wire is laced through the anchors in a radial or shoelace type fashion (Figure 2). The tension controller provides a constant pulling force of 1.2kg. No further adjustment is needed and the device is removed after three to five days, or until adequate skin apposition is noted. After removal of the device, the wound edges are sutured together resulting in complete closure (Figure 3).

Figure 3: Wound primarily closed after removal of the Dermaclose.

### Split-Thickness Skin Graft

Next on the plastic surgery reconstructive ladder is split-thickness skin graft (STSG). These grafts are commonly employed because of their broad application and ease of harvest. Common donor sites include the thigh, calf and the medial arch or plantar foot.[7,8] STSGs are the workhorse of wound closure and are very useful and effective in attaining wound closure in a variety of wounds. Generally, these grafts

*Continued on page 94*