Methacrylate Polymer Powder Dressing for a Lower Leg Surgical Defect

Matthew J. Lin, MD; Danielle P. Dubin, MD; Richard L. Torbeck, MD; David A. Kriegel, MD

PRACTICE **POINTS**

- Lower leg surgical wounds are difficult to manage, as venous stasis, bacterial colonization, and high tension may contribute to protracted healing.
- A methacrylate polymer powder dressing is user friendly and facilitates granulation and reduction in size of difficult lower leg wounds.

To the Editor:

Surgical wounds on the lower leg are challenging to manage because venous stasis, bacterial colonization, and high tension may contribute to protracted healing. Advances in technology led to the development of novel, polymer-based wound-healing modalities that hold promise for the management of these wounds.

A 75-year-old man presented with a well-differentiated squamous cell carcinoma with a 3-mm depth of invasion on the left pretibial region. His comorbidities were notable for hypertension, hypercholesterolemia, varicose veins, myocardial infarction, peripheral vascular disease, and a 32 pack-year cigarette smoking history. Current medications included clopidogrel bisulfate and warfarin sodium to manage a recently placed coronary artery stent.

The tumor was cleared after 2 stages of Mohs micrographic surgery with excision down to tibialis anterior fascia (Figure 1A). The resultant defect measured 43×33 mm in area and 9 mm in depth (wound size, 12,771 mm^3). Reconstructive options were discussed, including random-pattern flap repair and skin graft. Given the patient's risk of bleeding, the decision was made to forego a flap repair. Additionally, the patient was a heavy smoker and could not comply with the wound care and elevation and ambulation restrictions required for optimal skin graft care. Therefore, a decision was made to proceed with secondary intention healing using a methacrylate polymer powder dressing.

After achieving hemostasis, a novel 10-mg sterile, biologically inert methacrylate polymer powder dressing was poured over the wound in a uniform layer to fill and seal the entire wound surface (Figure 1B). Sterile normal saline 0.1 mL was sprayed onto the powder to activate particle aggregation. No secondary dressing was used, and the patient was permitted to get the dressing wet after 48 hours.

The dressing was changed in a similar fashion 4 weeks after application, following gentle debridement with gauze and normal saline. Eight weeks after surgery, the wound exhibited healthy granulation tissue and measured 5×6 mm in area and 2 mm in depth (wound size, 60 mm^3), which represented a 99.5% reduction in wound

From the Division of Dermatologic Surgery, Department of Dermatology, Icahn School of Medicine at Mount Sinai, New York, New York.

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Correspondence: Matthew J. Lin, MD, Division of Dermatologic Surgery, Department of Dermatology, Icahn School of Medicine at Mount Sinai, 234 E 85th St, 5th Floor, New York, NY 10028 (matthew.lin@mountsinai.org).

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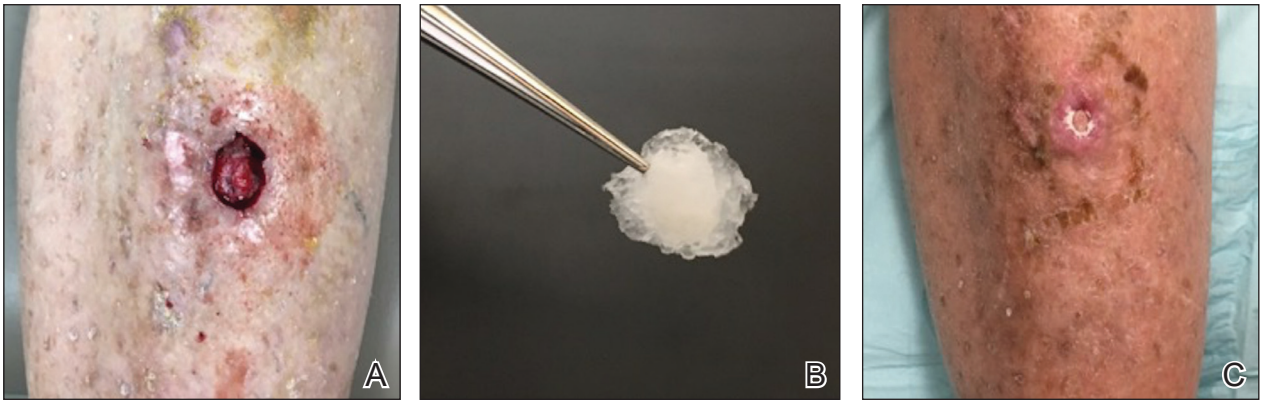

FIGURE 1. A, A wound on the left pretibial region following Mohs micrographic surgery. B, A methacrylate polymer powder dressing was applied to the wound. C, Eight weeks after surgery, the methacrylate polymer was no longer intact, and moist wound healing was encouraged by daily cleaning with soap and water and application of liquid petroleum jelly. The wound reduced in size by 99.5%.

FIGURE 2. A, Methacrylate polymer powder. B, Aggregation of the methacrylate polymer powder after application of normal saline medium.

size (Figure 1C). The dressing was not painful, and there were no reported adverse effects. The patient continued to smoke and ambulate fully throughout this period. No antibiotics were used.

Methacrylate polymer powder dressings are a novel and sophisticated dressing modality with great promise for the management of surgical wounds on the lower limb. The dressing is a sterile powder consisting of 84.8% poly-2-hydroxyethylmethacrylate, 14.9% poly-2-hydroxypropylmethacrylate, and 0.3% sodium deoxycholate. These hydrophilic polymers have a covalent methacrylate backbone with a hydroxyl aliphatic side chain. When saline or wound exudate contacts the powder, the spheres hydrate and nonreversibly aggregate to form a moist, flexible dressing that conforms to the topography of the wound and seals it (Figure 2).[1]

Once the spheres have aggregated, they are designed to orient in a honeycomb formation with 4- to 10-nm openings that serve as capillary channels (Figure 3). This porous architecture of the polymer is essential for adequate moisture management. It allows for vapor transpiration at a rate of 12 L/m^2 per day, which ensures the capillary flow from the moist wound surface is evenly distributed through the dressing, contributing to its 68% water content. Notably, this approximately three-fifths water composition is similar to the water makeup of human skin. Optimized moisture management is

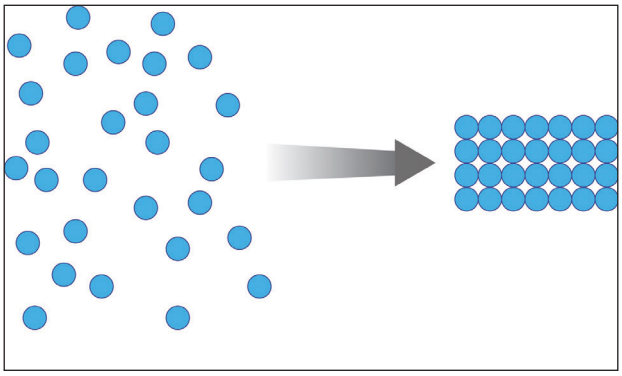

FIGURE 3. Mechanism of methacrylate polymer powder. When saline is added to the methacrylate polymer powder, the particles form an aggregated, organized honeycomb structure with pores 4 to 10 nm in diameter that serves as capillary channels. The small size allows for wound moisture management but does not permit bacterial transmigration. Illustration courtesy of Ni-ka Ford, MS (New York, New York).

theorized to enhance epithelial migration, stimulate angiogenesis, retain growth factors, promote autolytic debridement, and maintain ideal voltage and oxygen gradients for wound healing. The risk for infection is not increased by the existence of these pores, as their small size does not allow for bacterial migration.[1]

This case demonstrates the effectiveness of using a methacrylate polymer powder dressing to promote timely wound healing in a poorly vascularized lower leg surgical wound. The low maintenance, user-friendly dressing was changed at monthly intervals, which spared the patient the inconvenience and pain associated with the repeated application of more conventional primary and secondary dressings. The dressing was well tolerated and resulted in a 99.5% reduction in wound size. Further studies are needed to investigate the utility of this promising technology.

REFERENCE

1. Fitzgerald RH, Bharara M, Mills JL, et al. Use of a nanoflex powder dressing for wound management following debridement for necrotising fasciitis in the diabetic foot. *Int Wound J*. 2009; 6:133-139.