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Rapid, economical healing of two large Mohs surgery wounds with transforming powder dressing

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Dr. Smith and Dr. Konnikov are consultants for and serve on the Scientific Advisory Board of Uluru, Inc.

Abstract

As dermatology has evolved into a medical/surgical specialty, care for the patient with difficult postsurgical wounds has emerged as an aspect of practice for an increasing number of dermatologists. Here, we present a transforming powder dressing which yielded fast, cost-effective healing of two such wounds, while also relieving the patient and his family of any wound care responsibility.

KEYWORDS
Surgery, Therapy topical

1 | CASE REPORTS

A 94-year-old man underwent three stages of Mohs micrographic surgery for removal of a large squamous cell carcinoma of the central scalp vertex. The Mohs procedure resulted in a 4.6 × 4.2 cm defect extending to the periosteum (Figure 1). The large defect size precluded reconstruction with local tissue and the patient declined any other reconstructive procedures, including skin grafting. The patient's age and solitary living situation, along with the location of the defect, made independent wound care impossible.

Transforming powder (Altrazeal, Uluru, Inc., Addison, TX) was applied to the defect and covered with a transparent film dressing (Nexcare Tegaderm, 3M Company, Maplewood, MN).

One week later, the wound was covered with a bloody gel, which was removed with forceps. The underlying area contained moist, bloody granulation tissue. Transforming powder was reapplied to the wound and again covered with a transparent film dressing.

After two weeks, the wound bed appeared nearly fully granulated (Figure 2). Transforming powder was again applied to the wound and moisturized with normal saline solution to immediately form a gel dressing.

Three weeks postoperatively, the entire defect was almost completely granulated. The wound dimensions were now 4.4 × 3.9 cm and reepithelialization had begun at the perimeter. Transforming powder was reapplied with normal saline moisturization and covered with a transparent film dressing.

Transforming powder was applied and covered with a transparent film dressing both four and five weeks postoperatively. Wound dimensions were 4.0 × 3.2 cm and 3.6 × 2.9 cm, respectively, as reepithelialization continued.

By six weeks postoperatively, the wound dimensions had been further reduced to 2.9 × 2.6 cm. The wound was nearly fully reepithelialized. Transforming powder was applied one final time.

A final check of the wound occurring two months postoperatively revealed complete healing with an excellent cosmetic result (Figure 3).

This final check coincided with a second large Mohs surgery procedure on the now 95-year-old patient. A lesion of the left frontal scalp, which showed squamous cell carcinoma upon biopsy, had transformed during the healing of the scalp vertex wound from a thin plaque into an enlarging nodule. The patient, who had been hoping to avoid additional scalp surgery, now desired surgical treatment of the rapidly enlarging tumor, which was located in an area of the scalp of significant fibrosis, from repeated cryotherapy as well as a previous Mohs surgery.

The patient underwent two stages of Mohs surgery to remove the malignancy. The defect measured 5.0 × 2.0 cm and again extended to the periosteum. The near-total lack of mobility and elasticity of the fibrotic skin made reconstruction extremely difficult. A widely undermined advancement flap reduced the defect size, but it still remained 4.0 × 1.1 cm. One of the redundant skin triangles removed during flap mobilization was not fibrotic and was placed into the remaining defect as a Burow's graft. This still left a 1.0 × 1.1 cm defect, extending to periosteum.

The patient again declined any additional reconstructive procedure, including the harvesting of a second skin graft from a more

FIGURE 1 Mohs surgery wound

FIGURE 2 Two weeks postoperatively

distant site. Therefore, transforming powder was applied to the defect and covered with a transparent film dressing. Transforming powder was additionally applied to the Burow's graft as well as the lateral suture lines of the flap portion of the repair.

The patient returned one week postoperatively. The defect was covered with a moist, slightly hemorrhagic gel. Removal of the gel

FIGURE 3 Final wound appearance

with forceps revealed a layer of granulation tissue overlying the wound base. The Burow's graft was also covered with a thin, moist gel, under which the graft appeared pink and fully viable. The incision lines of both the flap and the graft were completely reepithelialized. Transforming powder was reapplied to the remaining defect and the adjacent graft and covered with a transparent film dressing.

Two weeks postoperatively, the graft was completely pink and viable. Moreover, the adjacent defect was moist and completely filled with granulation tissue. All sutures were removed and transforming powder was now applied only to the defect and covered with a transparent film dressing.

Three additional applications of transforming powder resulted in complete healing of the wound eight weeks postoperatively, with no depression and an overall excellent cosmetic result. The portion of the surgical defect treated with transforming powder was indistinguishable from that covered with the Burow's graft.

2 | DISCUSSION

Transforming powder is composed of 84.8% poly-2-hydroxyethylmethacrylate, 14.9% poly-2-hydroxypropylmethacrylate, and 0.3% sodium deoxycholate. Upon contact with wound exudate, the polymer particles aggregate irreversibly into a flexible gel, which contours precisely to the underlying wound care. Hence, each wound is covered by what amounts to a moist, custom dressing. In some instances (such as less exudative wounds), application of sterile saline via mist or droplets is advisable to accelerate the transformation of

the powder into a gel dressing. The aggregation of the polymer particles creates a dressing of high porosity that enables the passage of oxygen to the wound (Fitzgerald, Bharara, Mills, & Armstrong, 2009). A constantly moist wound bed is maintained, while excess moisture is drawn through the dressing by evaporation occurring at the wound surface (Fraccalviri, Morozzo, Salomone, Ruka, & Fava, 2014). As the pores are too small for exogenous bacteria to penetrate, a clean environment is maintained.

The dressing remains in place for 7–14 days. It is easily removed by saturating with water or saline and then lifting away with forceps. Since the newly formed wound tissue is unable to penetrate the dressing, removal causes no harm to the granulating wound and hence no disruption of the wound healing process. Importantly, it is also completely painless. The powder is reapplied and forms another gel dressing. This process is repeated until the wound is healed.

Not only are dressing changes painless, but there is evidence that the application of transforming powder often causes a significant reduction in wound pain and discomfort. This has been seen in a variety of settings, including venous leg ulcers, pyoderma gangrenosum, sickle cell ulceration, and split thickness skin graft donor sites (Assadian et al., 2015; Milne & Serendipity, 2010; Vlahovic, Lee, & Oliver, 2009). Possible mechanisms for such pain reduction include reduction in inflammation, high moisture vapor transmission rate, substance P blockade, and the binding of bacterial toxins (Fitzgerald et al., 2009; Milne & Serendipity, 2010).

Transforming powder dressing can be used alone or with a secondary dressing. In wounds with significant exudate, an absorbent secondary dressing can be applied to control excess moisture. In this case, a waterproof transparent dressing was placed over the treated wound to minimize the risk of inadvertent gel removal during washing of the scalp. The risk was felt to be enhanced in this patient due to the location of the wound and the resultant inability of the patient to visualize it. It has been the authors' experience that if a wound is kept dry for the initial 48 hr after transforming powder application, then the gel dressing formed will not be easily removed by washing or showering of the site (unless the wound is completely submerged in water).

Importantly, transforming powder dressing eliminates the need for wound care by the patient or a caretaker. Therefore, compliance is no issue. This is particularly advantageous in the elderly population. Furthermore, the need for and associated high cost of skilled nursing visits are eliminated, dramatically reducing overall wound healing costs for patients and/or third-party payers.

There is a further economic benefit to novel transforming powder, namely, its relatively inexpensive cost. Each of the 13 applications of transforming powder to these two large wounds required only a single 0.75 g blister of powder. Given that one sheet of cryopreserved placental allograft (Grafix Prime, Osiris Therapeutics, Columbia, MD) sufficient to cover the larger defect alone is roughly twice as expensive as all 13 transforming powder blisters combined, the overall economic advantage of this wound healing regimen is obvious.

Because of their large sizes and extension to periosteum, combined with the patient's advanced age (plus the extensive adjacent fibrosis at the second defect site), these two wounds were clearly at risk for very protracted and expensive courses of healing, as well as nonhealing. Not only did both wounds heal rapidly, they did so without any patient or skilled nursing care. As a comparison, De Angelis et al. (2015) reported on a group of 10 elderly patients who underwent excision of either basal or squamous cell carcinoma of the scalp, with excision extending only to the galeal layer and with a mean defect size of 12.51 cm^2. The eldest patient in this group was 84 years old, a full decade younger than our patient. These smaller and more superficial wounds were fully reepithelialized slightly faster than our patient (mean time: 39.5 days). However, the protocol involved covering the wound bed with a dermal regeneration template, an artificial dermis with a silicone epidermis (Integra Double Layer, Integra Life Sciences, Plainsboro, NJ), which requiring a surgical procedure followed by a minimum hospitalization of 48 hr. The cost of the product and hospitalization combined was markedly more than the entire cost of transforming powder dressing employed for both of our patient's wounds.

In our experience, patients (especially elderly ones) have been delighted to be relieved of all wound care responsibilities. Moreover, we as health care providers are equally delighted to remove the issue of patient compliance from the wound healing regimen. Finally, in a medical world increasingly driven by cost–benefit analysis, the low product cost and the elimination of skilled nursing care are two powerful drivers of a highly economical wound healing paradigm.

3 | CONCLUSIONS

Transforming powder facilitated rapid, economical healing of two large postsurgical scalp wounds in an elderly patient unable to comply with a wound care regimen. The powder transforms into a customized gel dressing that allows oxygenation of the wound, along with maintenance of a sterile, moist wound bed. Dressing changes are required only every 7–14 days, eliminating the need for and expense of skilled nursing visits. Transforming powder satisfies many of the characteristics of an ideal dressing and does so extremely economically. It should be considered for use by dermatologists facing postsurgical wound healing challenges.

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