

# Topical Management of Postsurgical Scars

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The proper management of wounds that result from surgical procedures is important in preventing the formation of excessive scarring, as both functional and aesthetic alterations secondary to surgical scars can cause psychologic problems for patients. Dermatologists are becoming more involved than ever in the cosmetic management of patients postprocedure. The mechanism behind abnormal scar formation is not fully understood, but histologic factors in connection with a hereditary component are believed to be involved. Postsurgical scars usually are hypertrophic or keloidal in nature. Hypertrophic scars (HTSs) and keloids result from excessive collagen deposition and can lead to substantial morbidity, as well as pruritus, pain, restriction of motion, or disfigurement. Clinically, HTSs are firm, erythematous, and raised, and they are defined by an increased expression of collagen coupled with collagen lysis during the matrix remodeling phase of wound healing.<sup>1</sup> Hypertrophic scars usually form within the first month of initial injury and can regress over time. All HTSs remain within the border of injury.<sup>2</sup> Keloids are raised, dusky, and nodular scars that are firmer than HTSs. Keloids, which tend to affect patients with darker skin types, can extend beyond the margins of the original wound and may develop weeks to years after the initial injury. Both HTSs and keloids usually affect body areas that exhibit slow wound healing or present in pressure- or movement-dependent areas. Although these scars can develop at any age, patients aged 10 to 30 years are most often afflicted.<sup>3,4</sup>

It is well-known that the final cosmesis of a scar will depend on numerous factors, including the patient's ethnicity, wound location, surgical technique, suturing materials, and tension of the wound. The avoidance of infections, foreign bodies, and hematomas also contribute to a better outcome of scars.<sup>5</sup> There is no universally accepted standard of care for the treatment of HTSs or keloids that is secondary to surgical procedures. In recent years, many topical treatments, either prescription or over-the-counter (OTC), have become established through widespread use; however, only a small number of these treatments have been prospectively studied with adequate control groups.<sup>6</sup> Quantifying the objective changes of the scars can be difficult and their natural tendency to improve over time poses a challenge to accurately assess the efficacy of different treatment options.<sup>2</sup> This article will serve as a focused review of the studies involving silicone gel, onion extract, imiquimod cream 5%, and vitamin E in the topical management of postsurgical scars.

## Silicone

Silicone is one of the oldest topical therapies employed in the treatment of scars. Now mostly formulated as a gel-based vehicle, silicone represents an extremely comfortable treatment modality with high compliance rates. A randomized controlled trial that compared the twice-daily use of silicone gel versus a control cream (zinc oxide) in fresh surgical wounds for 60 days after the removal of stitches revealed that pathologic scarring occurred in only 27% (18/65) of the treatment group compared to 55% (25/45) of the control group.<sup>6</sup> Due to its lack of absorption, silicone forms a membrane or artificial stratum corneum that is permeable to gases but not water. This occlusive protective action increases local hydration, which in turn inhibits the proliferation of fibroblasts and their capacity to produce collagen. Silicone gel also reduces the incidence of erythema, telangiectasia, pain, and pruritus. Furthermore, those participants in the treatment group with scars in photoexposed areas (eg, face,

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neckline, forearm, hand) did not develop any pigmentary alterations. The authors hypothesized that silicone also has the additional benefit of providing a secondary sun-screen effect.<sup>6</sup> A 2006 Cochrane meta-analysis of the use of silicone gel sheeting for the prevention or treatment of HTSs or keloidal scars provides limited additional support for the use of silicone dressings.<sup>7</sup>

### Onion Extract

Allium cepa, or onion extract, is an ingredient in a number of scar treatment products. Patients value this remedy because of its ease of use, relatively low cost, “botanical” characteristics, and widespread availability. Onion extract exhibits anti-inflammatory, bacteriostatic, and collagen downregulatory properties. One study utilized allium cepa gel to improve the appearance of scars following excision.<sup>8</sup> Sixty participants with symmetric seborrheic keratoses on the chest were enrolled and the lesions were excised with a scalpel shave. After the surgical sites healed for 2 to 3 weeks, participants were split into 2 randomized groups to receive treatment with onion extract gel or no treatment. The frequency of use of the study product was not revealed in this report; however, blinded investigator assessment at weeks 4, 6, and 10 revealed that the allium cepa gel significantly improved the softness, redness, texture, and global appearance of scars at the excision site ( $P < .05$ ).<sup>8</sup> None of the other published randomized control trials involving onion extract that used a control-based comparator product (ie, petrolatum-based ointment) reported a statistically significant difference, which indicates the questionable efficacy of this topical treatment.<sup>9,10</sup>

### Imiquimod Cream 5%

The use of imiquimod cream 5% postexcision has shown favorable results in minimizing the postoperative recurrence of keloids; however, its role in preventing primary HTSs or keloids is still controversial. One study involving 20 participants, each with 2 melanocytic nevi, compared nightly application of imiquimod cream 5% and a vehicle petrolatum-based cream.<sup>5</sup> Treatment was initiated the same night as the surgical excision and continued for 4 weeks. Although all of the participants who completed the study reported that imiquimod was a tolerable treatment option, the surgical wounds treated with the study drug demonstrated vigorous inflammatory responses characterized by erythema and pigmentary alterations with decreased cosmesis compared to those treated with the vehicle.<sup>5</sup> A comparable study that employed imiquimod versus a petrolatum-based vehicle or no treatment

was conducted on women who presented with scarring from breast surgery.<sup>11</sup> In this particular study, treatment with imiquimod cream 5% was initiated 8 weeks postprocedure and continued twice weekly for 8 weeks. Cosmesis evaluations performed 6 months after surgery revealed that scars treated with imiquimod had significantly better scar quality compared to the control scars ( $P < .05$ ).<sup>11</sup> It has been established that several profibrotic cytokines are involved in the acute wound-healing process, such as transforming growth factor  $\beta$ , platelet-derived growth factor, IL-1, and insulinlike growth factor 1. Some interferons act as antifibrotic cytokines to reduce the excessive production of collagen and glycosaminoglycans by fibroblasts as well as the formation of granulation tissue. Theoretically, imiquimod is an ideal option to alter the formation of excessive scar tissue, as its mechanism of action involves the promotion of these antifibrotic cytokines to generate a cell-mediated immune response that increases collagen breakdown.<sup>12</sup> The optimal point at which imiquimod should be started to benefit from the antifibrotic effects while offsetting the proinflammatory nature of this treatment hopefully will be ascertained in future studies.

### Vitamin E

Vitamin E includes a family of essential micronutrients composed of lipid-soluble tocopherols and tocotrienols. When topically applied, this strong antioxidant penetrates the reticular dermis and reduces the formation of oxygen radicals that impede healing and damage DNA, cellular membranes, and lipids. Vitamin E also has unique antihistamine properties, which have been hypothesized to decrease collagen production in fibroblasts.<sup>13</sup> A recent double-blind, randomized, control trial evaluated topical tocotrienol 5% in the prevention of HTSs following surgical incisions compared to placebo.<sup>14</sup> More than 100 participants with recently healed postsurgical scars were randomized to use either topical vitamin E or a placebo twice daily for 6 weeks. No statistically significant differences in scar reduction were established.<sup>14</sup> Another single-blinded study (428 sets of participants) observed results in pediatric participants who were treated preoperatively with either topical vitamin E or a petrolatum-based ointment 3 times daily for at least 15 days on the intended incision site for an inguinal hernia repair and then twice daily for an additional 30 days postsurgery.<sup>15</sup> Overall, cosmetic results were graded as very good by 96% of the parents whose children utilized topical vitamin E as compared to 78% of the parents whose children were treated with the control product. Additionally,

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no keloids developed in the vitamin E arm compared to 7% of the participants who were treated with the control product.<sup>15</sup> Thus far, a veritable conclusion regarding the benefits of topical vitamin E for fresh surgical scars has yet to be established.

## Summary

In conclusion, no one topical product has been shown to be a true front runner in the standard of care of post-surgical scars. Because many patients inquire about OTC products for scar treatment, it is important for the dermatologist to be familiar with the latest research on this topic. In 2009, Morganroth et al<sup>16</sup> published a review of 20 best-selling scar products for postsurgical patients utilizing the Web site [www.drugstore.com](http://www.drugstore.com) in addition to reports in the medical literature with data supporting the use of OTC products for postsurgical wounds. Of the products reviewed, the mean cost was \$38.99, with the top 3 best-selling products ranked among the most expensive. Silicone was the only active ingredient listed, which also had evidence-based medicine substantiating its use. The authors cautioned that the silicone gel trials reviewed were of poor quality, but of all the OTC products reviewed, it appeared that silicone gel prevented abnormal scarring in high-risk individuals.<sup>16</sup>

Thus far, not enough clinical data have been reported to support the benefits of onion extract, imiquimod, or topical vitamin E as means of treating fresh surgical scars. Future research into the timing of initiation of these products (ie, preprocedure or postprocedure) as well as head-to-head comparative trials will provide the dermatologist with valuable insight into making substantiated recommendations while dispelling unrealistic expectations about the advertised benefits of these products.

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