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Seminars in Cutaneous Medicine and Surgery

Cosmeceuticals Used in Conjunction with Laser Resurfacing

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The use of laser resurfacing for cutaneous rejuvenation has become an important tool in the modern dermatologist's armamentarium. To ensure a successful outcome, proper preoperative and postoperative skin care is essential. Incorporating cosmeceuticals into the perioperative skin care regimen can promote a better overall patient experience by hastening postoperative healing, reducing common side effects, and enhancing overall rejuvenation. This article aims to explore the use of various cosmeceuticals in conjunction with laser resurfacing procedures. In particular, the overall mechanisms of action behind each selected therapy will be discussed, followed by a brief discussion of the existing literature on each agent's use with laser resurfacing. Theoretical considerations and a limited body of evidence suggest a potential benefit for the use of these agents in conjunction with laser resurfacing procedures; however, further placebo-controlled studies are needed to truly confirm these benefits.

Semin Cutan Med Surg 30:156-162 © 2011 Elsevier Inc. All rights reserved.

KEYWORDS cosmeceuticals, photorejuvenation, antioxidants, vitamins, laser therapy

Laser resurfacing for cutaneous rejuvenation began in the 1980s with the development of ablative carbon dioxide lasers. Using water as the target chromophore, ablative CO_2 lasers result in extensive thermal tissue damage and adjacent coagulation necrosis, leading to full-thickness epidermal and dermal denudation. Epidermal reepithelialization and dermal repair via neocollagenesis together lead to dramatic improvements in the appearance of photodamaged skin and allow for impressive overall rejuvenation. Because of the extensive healing requirements after these ablative procedures, they are associated with a prolonged postoperative recovery and an extensive side-effect profile. Efforts to minimize downtime and side effects led to the development of nonablative resurfacing, which induces dermal thermal injury, leading to collagen remodeling while preserving the epidermis.[1] Although nonablative techniques allow for a much quicker recovery, clinical improvement is minimal compared with ablative procedures.

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Conflict of Interest Disclosures: Both authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest and none were reported.

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The concept of fractional photothermolysis was introduced in 2003, and its clinical application was employed by Manstein et al in 2004.[2] Fractional resurfacing combines the theory of fractional photothermolysis with the technology of the traditional full-field ablative lasers. Thermal damage is produced in confined microscopic regularly spaced columns of epidermal and dermal tissue, with intervening unaffected tissue serving as a reservoir of cells for regeneration of the ablated tissue. Because only a fraction of the skin surface is affected, recovery is much faster and is associated with fewer complications with almost comparable outcomes with the traditional ablative resurfacing procedures. Both nonablative and ablative fractional resurfacing lasers exist, with their main difference being the extent of wavelength absorption by water.[2]

Each of the aforementioned modalities differs in its method of thermal damage, with varied levels of efficacy, different lengths of postoperative recovery, and unique side effect profiles. As such, each is associated with its own unique skin care requirements. With ablative and fractional ablative technologies, the stratum corneum is compromised, necessitating focus in the first postoperative week on reepithelialization through the use of emollients for barrier establishment and repair. Because nonablative and fractional nonablative techniques allow for an intact stratum corneum, skin care regimens can be initiated immediately after resurfacing.[3] The use of certain cosmeceutical products in conjunction with

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doi:10.1016/j.sder.2011.06.002

laser resurfacing procedures can serve to enhance healing, extend the duration of treatment benefits, reduce common side effects, and improve overall rejuvenation.

Vitamin A

Both natural and synthetic derivatives of vitamin A are used in topical preparations and are collectively known as retinoids. Tretinoin, or all-*trans*-retinoic acid, is considered the most bioactive retinoid, leading to its classification as a drug only available by prescription.[4] Within cosmeceutical formulations, various derivatives of vitamin A can be found, including retinol, retinaldehyde, retinyl esters, and the oxoretinoids.[5] Ultimately, these vitamin A derivatives are all converted by endogenous enzymatic reactions to the bioactive form of vitamin A in the skin. By interacting with nuclear receptor proteins, vitamin A gene transcription and protein expression, leading to increased levels of type I and III procollagen gene expression and ultimately increased deposition of collagen in the dermis. This increased collagen expression in part accounts for the well-known antiaging effects of topical retinoids. Retinoids are also known to have positive effects on wound healing; one study demonstrated a 50% reduction in the size of wounds induced on forearm skin pretreated with tretinoin compared with those pretreated with a placebo.[6] Other scientifically proven effects include epidermal thickening, glycosaminoglycan deposition, increased fibroblast proliferation, inhibition of metalloproteinases (leading to reduced collagen degradation), decreased melanosome transfer to keratinocytes, and reduced expression of tyrosinase.[7] Clinically, these effects translate to a reduction in fine lines, pigment normalization, and improvement in overall skin texture.

The use of topical retinoids is often recommended before laser resurfacing procedures because of their beneficial effects in accelerating wound healing, enhancing collagen production, and activating fibroblasts. Theoretically, the use of retinoids before laser resurfacing allows for more rapid healing and quicker reepithelialization during the postoperative period.[8,9] Additional proposed benefits to preoperative retinoid use include a decreased risk of postoperative milia development, decreased postoperative hyperpigmentation rates, as well as better penetration of the laser beam because of a thinner stratum corneum.[10-12] Weinstein[13] argues that the minimal thermal-induced dermal injury produced by the erbium lasers results in a decreased stimulus for collagen production, thus making the priming contribution of tretinoin to neocollagenesis potentially more significant.

Although pretreatment with topical retinoids is a common practice in laser resurfacing procedures, the rationale for this is often based on prior studies involving their use before dermabrasion and chemical peeling.[14] The authors of several studies examined the effects of topical retinoids on laser resurfaced skin. In one such study, the authors looked at the effect of topical tretinoin on porcine skin treated with the UltraPulse CO_2 (Coherent Medical Group, Palo Alto, CA) laser.[15] Half of the treatment sites were pretreated with tretinoin cream for 29 days; the other half received no pretreatment. Significantly faster healing was seen in the tretinoin-treated halves compared with the placebo-treated halves. In another study using a guinea pig model, more rapid healing occurred after CO_2 laser resurfacing in those animals pretreated with tretinoin.[9] Mordon et al[16] demonstrated via ultrasound imaging increased dermal thickness in patients treated with daily topical 0.05% retinaldehyde before nonablative laser resurfacing compared with the control group. In addition, retinaldehyde has been shown to contribute to quicker resolution of postlaser erythema.[16] In contrast to the aforementioned studies, Orringer et al[14] found no significant differences in collagen formation, reepithelialization, or resolution of erythema between forearm skin pretreated with tretinoin and skin treated with placebo before CO_2 laser resurfacing. The authors hypothesized that the lack of benefits may be attributable to the short pretreatment period of only three weeks and suggested that a longer pretreatment period may be necessary before the beneficial effects of retinoids are seen.

Considering their well-characterized and scientifically proven beneficial effects on wound healing and collagen formation, the use of retinoids before laser resurfacing procedures appears warranted. In fact, a survey of 339 dermatologists and plastic surgeons revealed that 80% of respondents recommended preoperative treatment with topical retinoids before laser resurfacing procedures.[17] Preoperative use can begin anywhere from months to weeks before the procedure; most physicians employ an approximately 2-4 week pretreatment regimen.[14] After ablative resurfacing, retinoid use should be discontinued until reepithelialization has occurred, at the earliest. Some authors cite waiting until at least 3 months after ablative resurfacing to allow reepithelialization and skin maturation.[12] Studies assessing the use of retinoids with laser resurfacing procedures overall suggest a positive impact on wound healing; further human placebo-controlled studies would be advantageous to strengthen these findings.

Vitamin C

Vitamin C, also known as L-ascorbic acid, has numerous scientifically proven beneficial effects supporting its use in cosmeceuticals. Normally found in human skin, vitamin C is a naturally occurring antioxidant that functions as a free radical scavenger, providing protection from oxidative stress. Vitamin C also helps regenerate the oxidative form of vitamin E, a lipid-soluble antioxidant that helps to prevent oxidative damage in the lipid cell membrane.[18] L-ascorbic acid serves as a cofactor for prolyl and lysyl hydroxylases, enzymes involved in posttranslational processing in collagen biosynthesis. Ascorbate has been shown to directly stimulate collagen synthesis by activating its transcription and stabilizing procollagen mRNA.[19] In addition to these roles, vitamin C has been shown to have photoprotective effects as well as antiinflammatory properties. It is believed that vitamin C exerts its antiinflammatory properties by suppressing activation of nuclear factor kappa-B and inhibiting tumor necrosis factor-alpha.[18,20] Taken together, these properties likely contribute to the overall improvement in photodamaged skin seen with

the use of the cosmeceuticals containing vitamin C. In particular, vitamin C-containing cosmeceuticals have been shown to promote collagen synthesis, improve fine rhytides and decrease hyperpigmentation; they have also been recognized for their anti-inflammatory and photoprotective properties.[21]

After laser resurfacing, postoperative erythema is common, with the exact length of erythema depending on the modality and technique used. Prolonged erythema has been reported following both nonablative and ablative fractionated procedures, occurring in fewer than 1% and more than 12.5% of patients, respectively.[22] Either multiple laser passes or inadvertent stacking during fractionated resurfacing procedures can increase the risk of prolonged postoperative erythema. Taking this into consideration, one can conclude that products that assist in minimizing postoperative erythema and inflammation, such as those containing vitamin C, can be a valuable adjunct in assuring patient satisfaction.

Theoretical benefits to the use of topical vitamin C with laser resurfacing procedures include minimizing postprocedural inflammation and erythema, increasing new collagen formation, and enhancing the photoprotective effects of sunscreens. One group recommends both preoperative and immediate postoperative application of topical vitamin C for antioxidant protection, improvement in dyspigmentation, and stimulation of new collagen formation.[23] Goldman[24] recommends beginning an every-other-day application of a vitamin C solution approximately 14 days after resurfacing procedures and slowly advancing to daily application by the third or fourth postoperative week to assist in reducing erythema. Because vitamin C can cause significant burning upon application, many dermatologic surgeons will delay postoperative use until the reepithelialization process is complete. Alster and West[25] studied the effect of topical vitamin C on post-CO_2 laser resurfacing erythema. In this split-face study, 21 patients who had undergone facial CO_2 laser resurfacing were treated with topical vitamin C applied to half of their face and a petrolatum-based cream applied to the other half, initiated at least two weeks after the procedure. Two formulations of vitamin C were used, one with an aqueous base (11 patients) and the other with a cream base (10 patients). A reflectance spectrometer was used to record cutaneous erythema measurements. Significantly decreased erythema was observed in skin treated with topical 10% L-ascorbic acid in aqueous formulation compared to skin treated with placebo. Researchers hypothesized that the reduction in erythema seen with topical vitamin C application was due to its antiinflammatory effects. Further enhancement of these antiinflammatory effects may be potentiated by laser treatment itself, as topical uptake of ascorbic acid was shown to be enhanced by ablative lasers and microdermabrasion devices.[26]

Topical formulations containing vitamin C can also enhance the photoprotective effects of sunscreens. Because of its role as an antioxidant, vitamin C is able to scavenge ultraviolet (UV) light-induced free radicals and thus prevent UV-induced DNA damage. Topical application has been shown to decrease erythema and sunburn cell formation after UVB and UVA phototoxicity.[27] Considering the importance of sun avoidance in minimizing postoperative complications, the additive photoprotection obtained from topical vitamin C is useful.[23,25]

Vitamin E

Vitamin E functions to prevent lipid peroxidation in human skin by scavenging free radicals, ultimately reducing the risk of carcinogenesis. It is a potent antioxidant found in plasma, cellular membranes, and tissues. There are 8 forms of naturally occurring vitamin E, with alpha-tocopherol comprising approximately 90% of the tocopherols in animal tissue.[28] Because of limited stability alone, vitamin E in tissues is quickly depleted. Other antioxidants, such as vitamin C, are required to maintain adequate tissue levels and regenerate vitamin E back to its reduced form after oxidation.[5,21] Thus, topical vitamin E formulations require vitamin C for its stabilizing effects. Numerous beneficial effects have been reported with topical vitamin E use, including reduction of UV-induced erythema, scar prevention, and improvement in dyspigmentation and photoaging.[5,7]

Although topical vitamin E preparations have been marketed to assist in wound healing and in minimizing postsurgical scarring, data supporting these claims often are contradictory. Although topical vitamin E has been shown to accelerate the healing of chemotherapy-induced mucositis[29] and dermal incisions,[30] it has also been shown to decrease the tensile strength and hydroxyproline content of healing incision wounds.[31] In one study, the authors showed no difference in cosmetic appearance of burn wounds treated with vitamin E compared with vehicle alone but did report a greater incidence of contact dermatitis in the vitamin E treated patients.[32]

Several studies exist examining the effects of topical vitamin E on wound healing after laser resurfacing, all with conflicting results. In one split-face study investigators examined the effects of a topical formulation consisting of 4% tocopherol acetate, 4% pyruvic acid sodium salt, 6% lecithin, and fatty acids in a melting petrolatum vehicle compared with melting petrolatum alone on wound healing after erbium: YAG laser resurfacing. The authors reported decreased time to reepithelialization as well as decreased pain, redness, and swelling when the formulation containing tocopherol acetate was used compared with the vehicle alone.[33] However, the additional ingredients in the vitamin E-containing formulation may have been responsible for these positive findings, making the contribution of vitamin E questionable. In another study researchers looked at the effects of topical vitamin E on the skin of Yorkshire pigs treated with low, medium, and high doses of light emitted by copper vapor and argon lasers. In this study, wounds were treated with either hydrogel dressing, intramuscular vitamin E, topical vitamin E, or no treatment. The authors found that topical vitamin E decreased the healing time compared with untreated sites in all the study groups; however, this was only statistically significant in the medium dose copper-vapor group.[34] This improved healing was attributed to a reduction in inflammation and prevention of peroxide accumulation and its effects on lysosomal and cell membrane stability.

Although topical formulations containing vitamin E may prove useful in the future, conflicting data, the potential for contact dermatitis, and the overall lack of well-designed studies assessing its overall effectiveness preclude any recommendations at this time regarding the use of topical vitamin E in conjunction with laser resurfacing procedures.

Vitamin K

Systemically, vitamin K is an essential cofactor in the hepatic biosynthesis of clotting factors II, VII, IX, and X, with deficiencies in vitamin K leading to problems with hemostasis. Topical vitamin K preparations have been marketed to decrease postsurgical bruising.[35] Although commonly seen after treatment with pulsed dye lasers, delayed purpura arising after fractional laser skin resurfacing has been reported as well.[36] Because postsurgical bruising can be upsetting for patients, agents aimed at minimizing this complication can be useful.

Considering the role of vitamin K in clotting, Elson examined the effects of topical vitamin K in the treatment of iatrogenic bruising. After injecting autologous whole blood into the forearms of 6 adult subjects to produce bruising, he treated one arm with 1% vitamin K cream applied twice daily; the contralateral forearm received no treatment. Bruising resolved in 5-8 days in the treated arm and in 11-13 days in the untreated arm, leading the authors to conclude that topical vitamin K hastened the disappearance of extravascular blood.[37] In another study, Elson showed that actinic purpura healed faster using twice daily applications of vitamin K cream compared to control cream in 12 patients with purpura on their hands and arms.[37]

Topical vitamin K has also been studied for its effects on laser-induced purpura. One study applied 5 different concentrations of vitamin K to each of 5 laser-treated normal skin sites and compared each site along with a control site receiving no topical treatment. Faster resolution of laser-induced purpuric discoloration was seen in sites treated with combination 1% vitamin K and 0.3% retinol than in sites receiving no topical treatment.[38] It is unclear whether these effects were attributable to the vitamin K or to the addition of retinol because no change was seen in sites treated with vitamin K alone. In addition, there was no site treated with retinol alone for comparison. In a randomized double-blinded, placebo-controlled split-face study, 20 subjects were treated with a pulsed dye laser with subsequent application of vitamin K oxide gel to half of the face twice daily for 10 days after the procedure. Investigators saw greater resolution of purpura with vitamin K oxide gel compared with placebo. Although differences in active vs. placebo scores didn't reach statistical significance, there was a trend toward faster resolution of purpura with topical vitamin K oxide treatment.[39]

Another double-blinded, randomized placebo-controlled split-face study assessed the effects of topical vitamin K on bruising with applications both before and after laser treatment. Twenty-two patients were split into 2 groups; the first group applied topical vitamin K to one half of their faces and a placebo vehicle to the remaining half 2 weeks before laser treatment. The other group did the same for two weeks after laser treatment. The sides treated with vitamin K before laser therapy showed no difference in bruising as compared to placebo. The sides treated with vitamin K after laser treatment had significantly lower scores of bruising severity when compared to placebo-treated sides. Although treatment with vitamin K did not decrease the overall duration of purpura, it did decrease the severity of bruising, particularly in the initial ten days of application.[40]

In summary, application of a topical formulation containing vitamin K after laser resurfacing may allow for quicker resolution of bruising. The mechanisms responsible for this effect are largely unknown and remain speculative. One author suggested a role of gamma-glutamyl carboxylase, an enzyme involved in the activation of clotting factors, as it is present both in the liver and epidermis.[28]

Growth Factors

Growth factors are regulatory proteins that act as signaling agents between and within cells, having important roles in wound healing, immunity regulation, cell division, and tissue regeneration.[28] Numerous growth factors, such as transforming growth factor beta and fibroblast growth factor, have vital roles in the wound healing process, including initiating collagen and fibronectin synthesis and stimulating fibroblasts to produce glycosaminoglycans, resulting in dermal repair and regeneration. Topically applied growth factors have been shown to accelerate wound healing in both acute and chronic wounds.[41] Furthermore, topically applied human growth factors have been shown in multiple studies to reduce the appearance of photoaging, demonstrating statistically significant reductions in fine lines and wrinkles and increased dermal collagen synthesis.[42]

Several anecdotal reports exist supporting the benefits of topical growth factors used in conjunction with laser resurfacing. Gold et al demonstrated favorable results using a 1% sodium hyaluronate serum (*Hyalis*; Neocutis, Inc, San Francisco, CA) followed by an oil-in-water-based skin cream containing a mixture of human growth factors and cytokines (Bio-Cream—Bio-restorative Skin Cream with PSP; Neocutis, Inc) 1 month before and 2 months after micro laser peels (MicroLaserPeel Profile Contour 2940 nm Er: YAG laser system; Sciton, Palo Alto, CA).[43] This same group reported the use of the aforementioned skin care cream containing human growth factors and cytokines (Neocutis Bio-restorative Skin Cream with PSP, Neocutis, Inc) for the treatment of 2 patients with severe phototoxic reactions after photodynamic therapy. In both cases, skin returned to normal tone and texture after twice daily application for seven days. Based on these results, the authors suggested the use of topical human growth factors and cytokines as a possible alternative to traditional postprocedural laser and light source skin and wound care.[44]

Theoretically, the use of these agents in conjunction with laser resurfacing could enhance overall effects and speed recovery; however, few placebo-controlled studies exist examining this application. One such study looked at the application of a topical product containing growth factors, specifically vascular en-

dothelial growth factor, keratinocyte growth factor, and interleukin-8 on 49 patients after fractional laser resurfacing. In this study, HCCM topical skin care gel (ReGenica Facial Rejuvenation Complex; Histogen Esthetics, San Diego, CA) was applied immediately after resurfacing on 24 of the subjects, whereas the remaining 25 were treated with vehicle placebo gel. Patients receiving the active formulation had more rapid recovery and greater improvement in erythema and reepithelialization compared with those using placebo.[45] In another recent randomized controlled split-face study, investigators assessed the effects of topical growth factors (Neotis SGF61; Caregen, Co, Ltd, Mediway, Korea) applied to one-half of the face of 15 subjects after treatment with a CO_2 fractionated laser. The other half of the face was treated with normal saline. The authors examined the number of microcrusts (micronecrotic debris in areas of laser beam penetration) between the 2 sides because they hypothesized that the presence of these microcrusts correlated with patient downtime and recovery. No significant differences were noted in the number of microcrusts between the 2 sides, although the mean number of microcrusts on the side treated with growth factors was slightly lower than on the side treated with normal saline.[46] Another study is currently underway to evaluate the efficacy of a mixture of growth factors compared to platelet-rich plasma applied topically after CO_2 laser resurfacing.[41]

As a major mechanism of action of laser resurfacing involves dermal collagen remodeling, the additive stimulatory effects of topically applied growth factors on neocollagenesis could theoretically serve to enhance overall rejuvenation and to accelerate the wound healing that occurs after laser resurfacing procedures. Because of their large protein size and charge, the penetration of topical growth factors past the stratum corneum is somewhat limited in normal skin. After ablative laser resurfacing procedures, however, the lack of an effective epidermal barrier may allow for greater penetration of active ingredients. Because keratinocytes have been shown to express receptors for growth factors, topical application after nonablative resurfacing procedures may be beneficial as well and may serve to enhance the response through growth factor-mediated communications between the epidermis and dermis.[42] Further studies are needed to assess the application of topical growth factors with laser resurfacing; however, these cosmeceutical agents represent an exciting and promising additional therapeutic domain.

Skin-Lightening Agents

One of the most common adverse effects after laser resurfacing is postinflammatory hyperpigmentation. Postprocedural inflammation is associated with the release of melanocyte-activating inflammatory mediators, such as cytokines and chemokines, leading to increased production and dispersion of melanin by melanocytes. Those patients with darker skin types (Fitzpatrick IV–VI) are more prone to developing this complication but lighter skin types are at risk as well. The risk of postoperative hyperpigmentation correlates with the depth of laser damage and is more commonly seen when injury extends to the papillary dermis.[1] Although transitory, this sequela can be especially bothersome to patients and deserves particular attention in regards to both prevention and treatment.

Many dermatologic surgeons advocate preoperative treatment with skin lightening agents to decrease the risk of postoperative hyperpigmentation.[24,47] In a previously mentioned survey of members of the American Society for Laser Medicine and Surgery, 69% of respondents report the use of preoperative hydroquinone before resurfacing procedures to decrease postprocedural hyperpigmentation.[14] Other agents commonly used for pretreatment prevention of hyperpigmentation include kojic acid or azelaic acid.[10] These agents all act by inhibiting tyrosinase, the main enzyme involved in melanin synthesis. In addition, hydroquinone is cytotoxic to melanocytes.[48] Advocates of pretreatment regimens hypothesize that these lightening agents will decrease the melanin content of melanocytes and suppress the production of new melanin, thus decreasing the risk of postoperative hyperpigmentation.[14] Commonly used regimens include daily to twice-daily application of hydroquinone for 3 to 4 weeks before the procedure; some laser surgeons will limit pretreatment to those patients with skin types III or higher as these patients are more likely to develop postprocedural hyperpigmentation.[24,47,48]

West and Alster[48] studied the use of a topical skin lightening regimen before CO_2 laser resurfacing and examined its effects on the incidence of postprocedural hyperpigmentation. In this study, 100 patients were randomized to receive preoperative treatment with either 10% glycolic acid cream twice daily or hydroquinone, 4% cream daily along with tretinoin, 0.025% cream twice daily versus no pretreatment for 2 weeks before the procedure. There was no significant difference in the incidence of postprocedural hyperpigmentation between the treatment and nontreatment groups. The authors hypothesized that the topical treatments were unable to reach the follicular melanocytes that serve to repopulate the epidermis after ablative resurfacing. In concordance with these findings, another group has found no advantage to pretreatment with hydroquinone and tretinoin for the prevention of hyperpigmentation.[49] Despite these negative findings, the preprocedural use of hydroquinone and other skin lightening agents remains a popular practice.

If postoperative hyperpigmentation does develop, a combination of topical bleaching agents, mild peeling agents, and sunblock can be used to hasten resolution.[48] Hydroquinone can be combined with retinoids, azelaic acid or kojic acid for additive effects. Additionally, glycolic acid can be added to hydroquinone to increase effectiveness.[24,50,51] Superficial peeling agents, such as glycolic acid, can assist in desquamating the "pigmented" keratinocytes and improving the appearance of the dyspigmentation. Lightening agents are usually begun immediately after reepithelialization is complete, or 2-6 weeks postoperatively.[10,49] A fundamental component in treatment of dyspigmentation is a broad-spectrum sunscreen and vigilant sun avoidance. Fortunately, postoperative hyperpigmentation is temporary with resolution usually occurring within several weeks to months.[23]

Moisturizers

Ablative laser resurfacing leads to a partial-thickness wound that must heal by reepithelialization from cutaneous appendages; this is similar to healing that occurs after burns and in skin graft donor sites.[10] It is well-known that a moist wound environment is key to successful reepithelialization and healing. Maintaining a moist wound environment helps to prevent eschar development, which has been shown to impair keratinocyte migration and delay reepithelialization.[49] There is debate regarding whether an "open" method using occlusive ointments is better for healing than a "closed" method using semiocclusive dressings. If an open method is chosen, considerations should be given to limiting the occlusiveness of ointments, as acneiform pustules and milia have been reported to develop in up to 83.5% of patients after ablative nonfractionated laser resurfacing and in up to 19% of patients treated with fractionated technologies.[10,22] In addition, contact dermatitis using petroleum jelly after laser resurfacing has been reported.[52]

Many dermatologic surgeons report the use of Aquaphor healing ointment (Beiersdorf, Inc, Wilton, CT) as part of their postprocedural treatment regimen.[10,47,53,54] In a recent study the authors compared Aquaphor Healing Ointment (AHO) with Biafine Topical Emulsion (BTE) (Orthoneutrogena, Los Angeles, CA) on wound healing after fractional CO_2 laser resurfacing of the perioral area. Twenty subjects applied AHO and BTE to opposite sides of the face 4 times daily after resurfacing. AHO resulted in significantly less erythema and crusting/scabbing and greater epithelial confluence than BTE, as well as less subjective irritation and greater overall patient satisfaction.[54] One study reported faster wound healing for postlaser wound care with BTE compared with white petrolatum.[55] Another study found that AHO demonstrated superior wound healing compared with antibiotic-based ointments after laser resurfacing.[56] Numerous postprocedural moisturizing agents exist, and further comparative studies between different moisturizers following laser resurfacing would be beneficial. Regardless of the specific moisturizing agent chosen, focus should be kept on adjusting the specific formulation to meet the patient's needs at different stages of healing postoperatively.

Sunscreens

Sun avoidance is crucial during the postoperative period because of the sensitivity of resurfaced skin to the effects of UV light. Furthermore, protection from the sun will reduce the risk of postinflammatory hyperpigmentation. Because pigmentation is mostly caused by UVA light, a sunscreen containing UVA-blocking elements, such as titanium dioxide or zinc oxide is essential. Titanium dioxide has been associated with less irritation and less chance of causing an allergic contact dermatitis.[49] Consideration should be given to sunscreens formulated with silicone bases as these are less occlusive and less irritating than formulations containing paraffin, petrolatum, or mineral oil and will minimize postoperative acne and milia formation.[49] It has been recommended that strict sun avoidance be maintained for the entire duration of postlaser erythema.[1,10] A tinted sunscreen with anti-red tints will assist in minimizing the appearance of erythema, perhaps enhancing patient compliance with vigilant sunscreen application.

Conclusions

The concomitant use of a variety of cosmeceuticals with laser resurfacing procedures can be beneficial in numerous ways. The addition of these topical formulations to perioperative skin care regimens can serve to enhance the overall response of the patient's skin to resurfacing procedures and can allow for quicker healing, shorter recovery times, and fewer complications. Furthermore, the alteration in the epidermal barrier by ablative resurfacing procedures may serve to potentiate the effects of these topical agents by allowing deeper penetration into the dermis. More placebo-controlled studies are needed to confirm these purported benefits; until then, theoretic considerations and preliminary studies show a promising future for the use of cosmeceuticals in combination with laser resurfacing procedures.

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