Effect of Pretreatment on the Incidence of Hyperpigmentation Following Cutaneous CO\textsubscript{2} Laser Resurfacing

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BACKGROUND. Transient hyperpigmentation is the most common complication seen following cutaneous carbon dioxide (CO\textsubscript{2}) laser resurfacing.

OBJECTIVE. The purpose of this study was to determine whether the use of a topical skin lightening regimen prior to cutaneous laser resurfacing reduces the incidence of post-laser resurfacing hyperpigmentation.

METHODS. One hundred consecutive CO\textsubscript{2} laser resurfacing patients (skin types I-III) were randomized to receive preoperative treatment with 10% glycolic acid cream twice daily ($n = 25$), hydroquinone 4% cream qHS and tretinoin 0.025% cream twice daily ($n = 25$) or no pretreatment ($n = 50$, control) for at least 2 weeks. Clinical and photographic assessments were performed prior to laser resurfacing and at 4 and 12 weeks following treatment.

RESULTS. There was no significant difference in the incidence of post-CO\textsubscript{2} laser resurfacing hyperpigmentation between subjects who received pretreatment with either topical glycolic acid cream or combination tretinoin/hydroquinone creams and those who received no pretreatment regimen.

CONCLUSION. It is postulated that reepithelialization after cutaneous laser resurfacing includes follicular melanocytes that have not been affected by topical pretreatment. When instituted as a component of the skin care regimen postoperatively, topical hydroquinone, tretinoin and/or glycolic acid preparations may be helpful in reducing post-laser resurfacing hyperpigmentation.

TRANSIENT HYPERPIGMENTATION is the most common complication seen following cutaneous carbon dioxide (CO\textsubscript{2}) laser resurfacing.\textsuperscript{1-3} It is observed more frequently in patients with darker skin tones but can potentially occur in all types of skin, most commonly occurring within the first postoperative month. Many laser surgeons advocate the preoperative use of tretinoin, hydroquinone, and/or glycolic acid in order to reduce the incidence of post-treatment hyperpigmentation.\textsuperscript{4-13} However, no clinical or controlled studies have been performed to determine these agents' effectiveness in reducing dyspigmentation after cutaneous laser resurfacing. The purpose of this study was to determine whether the use of a topical skin lightening regimen prior to cutaneous laser resurfacing reduces the incidence of post-laser resurfacing hyperpigmentation.

Materials and Methods

One hundred consecutive CO\textsubscript{2} laser resurfacing patients (skin types I-III) were randomized to receive preoperative treatment with 10% glycolic acid cream (GlyDerm Cream Plus, ICN Pharmaceuticals, Costa Mesa, CA) twice daily ($n = 25$), hydroquinone 4% cream Qhs (Solaquin Forte, ICN Pharmaceuticals, Costa Mesa, CA) and tretinoin 0.025% cream (Retin-A, Ortho Pharmaceuticals, Raritan, NJ) twice daily ($n = 25$), or no pretreatment ($n = 50$, control) for at least 2 weeks. All patients were at least 18 years of age (age range, 28–57 years; mean, 45 years). A non-chemical sunscreen with a sun protection factor higher than 15 was used by each patient for at least 4 weeks pre- and postoperatively. Clinical skin evaluations were performed prior to the laser resurfacing procedure and at 4 and 12 weeks following treatment. Photographs were taken using identical lighting and camera settings preoperatively and at each follow-up visit (Mirror Image, Virtual Eyes, Inc., Kirkland, WA). Simultaneous projection of pre- and posttreatment photographs were evaluated for presence of hyperpigmentation independently by two blinded assessors. The incidence of post-inflammatory hyperpigmentation in the two treatment arms was compared to that observed in the control patients who received no pretreatment.

Results

The overall incidence of hyperpigmentation following cutaneous CO\textsubscript{2} laser resurfacing was 11.1% ± 0.074 in patients with skin type I, 32.3% ± 0.06 for skin type II, and 50% ± 0.112 for skin type III (average rate = 31% for all skin types). (Figures 1–4) The aver-
age time of onset of hyperpigmentation was 4.1 weeks (range, 3–5 weeks) following the laser resurfacing procedure. The incidence of post-laser resurfacing hyperpigmentation did not significantly differ between the pretreatment regimens when skin phototypes were matched ($p = 1.0$ for skin types I and III, $p = 0.8864$ for skin type II).

**Discussion**

Several studies report that the use of tretinoin cream prior to cutaneous resurfacing procedures such as dermabrasion or deep chemical peeling accelerates reepithelialization.14–19 There is no data, however, to indicate that the use of tretinoin, hydroquinone or alpha-hydroxy acids prior to such procedures influences posttreatment pigmentation. In a recent survey of physician members of the American Society of Laser Medicine and Surgery, Duke and Grevelink reported that 80% of 106 respondents pretreat cutaneous laser resurfacing patients with tretinoin, while 34% use glycolic acid cream, and 69% prefer hydroquinone.20

Hydroquinone is cytotoxic to melanocytes, alters melanosome structure, and decreases melanosome formation by inhibiting tyrosinase.21 Several authors have assumed, based on its mechanism of action, that pretreatment of the skin with hydroquinone prior to laser resurfacing or chemical peeling may decrease the incidence of postprocedural hyperpigmentation by “down-regulating” melanocytes. Retinoic and glycolic acids are known to decrease corneocyte adhesion. Topical application of retinoic acid also results in a clinical reduction in melanin by additional, as yet unknown, mechanisms.

Hyperpigmentation has been reported to occur in upwards of one-third of all patients following cutaneous CO$_2$ laser resurfacing.1–3 In this investigation, we demonstrate that downregulation of melanocytes by various topical agents prior to cutaneous CO$_2$ laser resurfacing has no significant effect on the incidence of posttreatment hyperpigmentation, probably due to the repopulation of the epidermis by new melanocytes originating from the follicular unit. In addition, the use of hydroquinone and tretinoin frequently induces an irritant

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**Figure 1.** Incidence of Hyperpigmentation in Different Skin Phototypes and Pre-Treatment Protocols.

**Figure 2.** Hyperpigmentation in a patient with skin type II four weeks following full face CO$_2$ laser resurfacing. Patient received pretreatment for 6 months with 10% glycolic acid cream.

**Figure 3.** Patient with skin type II who was treated for 6 weeks preoperatively with 0.025% tretinoin and 4% hydroquinone creams demonstrated hyperpigmentation six weeks following full face CO$_2$ laser resurfacing.
contact dermatitis, which may paradoxically lead to an increase in the incidence of postinflammatory hyperpigmentation following the laser resurfacing procedure.

When instituted as a component of the skin care regimen postoperatively, topical hydroquinone, tretinoin, and/or glycolic acid preparations may be helpful in reducing post-laser resurfacing hyperpigmentation. It is thought at this time that activated melanocytes may be most susceptible to topical therapy and the desired lightening effect seen. Retinoic acid may still be considered for preoperative treatment to hasten reepithelialization.

Summary

There was no significant difference in the incidence of post-CO₂ laser resurfacing hyperpigmentation between subjects who received pretreatment with either topical glycolic acid cream or combination tretinoin/hydroquinone creams and those who received no pretreatment regimen. It is postulated that reepithelialization after cutaneous laser resurfacing includes follicular melanocytes that have not been affected by topical pretreatment.

References


