Eyelid Tightening and Improved Eyelid Aperture through Nonablative Fractional Resurfacing

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BACKGROUND AND OBJECTIVE The effects of fractional resurfacing on eyelid tightening and aperture are unknown. Our purpose was to retrospectively examine the potential for eyelid tightening and eye-aperture opening in patients treated with nonablative fractional resurfacing for facial photorejuvenation.

STUDY DESIGN/MATERIALS AND METHODS Fractional laser treatments using a 1,550-nm erbium-doped fiber laser system on the upper and lower eyelids were given at a pulse energy of 17 to 20 mJ at 125 micro-thermal zones (MTZ)/cm^2 to a final density of 500 to 750 MTZ/cm^2. Each patient had 3 to 7 treatments. Standard pre- and post-treatment photographs were taken at each visit. Physicians who graded 31 preselected patient photographs using a 4-point scale evaluated eyelid tightening. Increase in eyelid aperture was also evaluated.

RESULTS All patients had some degree of eyelid tightening; 19% achieved 1% to 25% tightening, 26% achieved 25% to 50%, 26% achieved 50% to 75%, and 29% achieved 75% to 100%. Increase in eyelid aperture was seen in 55.9% of patients. Postoperative wounding, hypopigmentation, hyperpigmentation, persistent erythema, and scarring were not observed. All patients experienced mild or no edema for a few days after treatment.

CONCLUSION Fractional resurfacing tightens and increases eyelid aperture without wounding, downtime, or long-term complications.

Dr. Geronemus is a shareholder in Reliant Technologies.

Eyelid laxity is often the cause of senile ectropion and entropion. It may also be associated with epiphora[1,2] and laxity of the medial and lateral canthal tendon.[2,3] Lower eyelid laxity is a common problem in patients undergoing lower eyelid blepharoplasty.[3] A variety of surgical techniques are available to tighten eyelids.[4] Complications include overcorrection, undercorrection, suture abscess, exposed sutures, and suture breakage.[4] A 20% reduction in blepharoplasty procedures from 2004 to 2005 suggests an increasing interest in nonsurgical options for eyelid rejuvenation.[5] Nonsurgical options include laser resurfacing,[6] chemical peels,[7] and radiofrequency (RF) energy.[5,8]

Fractional photothermolysis (FP) has recently been introduced[9] and reviewed in detail.[10] The device is a 1,550-nm erbium-doped fiber laser system that produces arrays of micro-thermal zones (MTZs) of injury while sparing the surrounding tissue. These MTZs have 3-dimensional arrangements and are formed at specific depths in the skin. Although the entire epidermis is affected, only 20% of the epidermis (the MTZs) is treated in a single session. The stratum corneum is not damaged and acts as a natural bandage that protects the microscopic wounds as they heal within 24 hours. Unlike ablative and other nonablative laser devices, the FP device penetrates up to 1.4 mm into the skin. Erythema is mild, and downtime is minimal, permitting patients to apply cosmetics immediately after treatment. As in other laser modalities, multiple treatments are required for optimal results.

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FP treatment leads to collagen remodeling and new collagen formation after the incipient inflammatory cascade. Short-term adverse effects of full face treatment have been described.[11] These most commonly included transient post-treatment erythema, facial edema, dry skin, flaking, a few superficial scratches, pruritus, and bronzing. The use of forced cold air during treatment has been shown to reduce discomfort.[12] The technique has been used to treat scars,[13–15] poikiloderma of Civatte,[16] pigmentation,[17,18] poor skin texture,[18] melasma,[19,20] and facial aging.[21]

Our purpose was to retrospectively examine the potential for eyelid tightening and eye-aperture opening in patients undergoing fractional resurfacing for facial photorejuvenation.

Methods

The records of 31 patients with a mean age ± standard deviation of 55.3 ± 11.3 and primarily Fitzpatrick skin types I and II (one Asian patient was skin type IV) were evaluated. Patients with reproducible photography adequate for comparative purposes were included in this study. The Fraxel 750 SR laser (Reliant Technologies Inc., Mountain View, CA), a 1,550-nm erbium-doped fiber laser system, was used to treat the upper and lower eyelids at a pulse energy of 17 to 20 mJ at 125 microthermal zones (MTZs)/cm^2 to a final density of 500 to 750 MTZ/cm^2 using the 15-mm treatment tip. Each patient had 3 to 7 treatments, 2 to 3 passes per area, after application of topical anesthesia. Eye shields were not used during treatments. Our technique for upper eyelid treatment was to retract the eyelid skin over the orbital rim while the patient maintained closed eyes. Treatment sessions were 3 to 4 weeks apart. Treatment time for the eyelids was just seconds. Standard pre- and post-treatment photographs were taken at each treatment session. Posttreatment photographs were taken 3 to 4 weeks after the last treatment in all cases. Three physicians assessed eyelid tightening from photographs of 31 patients using a 4-point evaluation scale (1 = 1–25%, 2 = 26–50%, 3 = 51–75%, and 4 = 76–100%. Eyelid apertures were judged as larger or not changed. If eyelid aperture appeared to decrease (as when the patient blinked), the result was recorded as "not changed." Only patients with multiple evaluable photographs were selected for the study. Hooding of the upper eyelids was included as a feature for tightening and was not evaluated separately.

To ascertain the source of eyelid tightening after fractional resurfacing, measurements of all our standard photographs were made. A horizontal line connecting the medial and lateral canthi of each eye was used as a standard for the purposes of comparison of pre- and post-treatment photographs. From this line, a perpendicular vertical line through the pupil to the supraorbital fold was constructed and measured. A similar measurement was made to the upper margin of the brow. Percentage change in the position of the supraorbital fold and brow was calculated for each eye.

Results

Grades of the 3 evaluating physicians were analyzed using Kruskal-Wallis analysis of variance (ANOVA), the non-parametric equivalent to 1-way between-subject ANOVA. The median grades of the 3 physicians for all patients did not differ significantly ($p = .22$) from one another, indicating unbiased grading among the physicians.

All patients achieved a degree of eyelid tightening; 28% achieved 1% to 25% improvement, 26.9% achieved 25% to 50%, 25.8% achieved 50% to 75%, and 19.4% achieved 75% to 100% (Figure 1). Increase in eyelid aperture was seen in 55.9% of patients (mean of 21/31, 15/31, 16/31). Scarring, hypopigmentation, hyperpigmentation, persistent erythema, and postoperative wounding were not observed.

Measurements of standardized photographs showed that the percentage of eyelids demonstrating a lift in

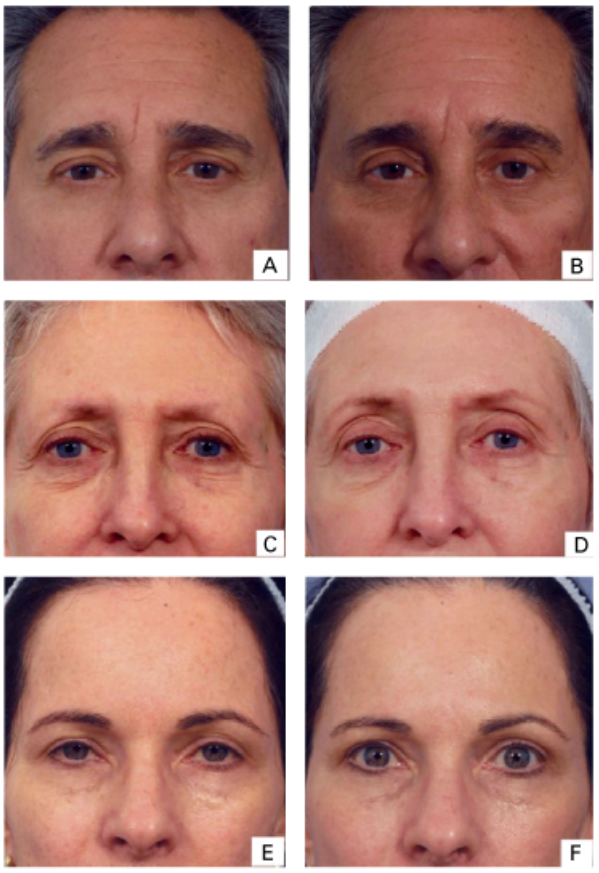

Figure 1. Baseline (A, C, and E) and follow-up (B, D and F) photos 1 month after third fractional photothermolysis treatments of upper and lower eyelids from the lid margin to the orbital rims at a pulse energy of 17 to 20 mJ at 125 MTZ/cm^2 to a final density of 500 to 750 MTZ/cm^2.

the brow position was 26%, compared with 44% showing lifting of the supraorbital fold.

Discussion

This retrospective study suggests that the eyelids of most patients treated using fractional resurfacing can be tightened at least 25% and that the eyelid aperture can be increased in more than half of patients without wounding or downtime.

It is likely that the improvement in eyelid aperture and eyelid tightening resulted from treatment of the eyelids themselves, concomitant treatment of the forehead and upper cheeks that may improve aperture and lid laxity by creating a brow lifting effect or lower-cheek tightening, or a combination of these factors. Because all patients had full face treatments, we sought to establish the source of the clinically observed effect. This was done by quantitating improvement in brow position and supraorbital fold position to see whether changes in these could account for what was clinically observed. The data clearly demonstrate that far more improvement arose from actual lid tightening that resulted in changes in the supraorbital fold position, whereas only a small contribution to eyelid tightening came from changes in brow position achieved through forehead lifting. Future work will establish whether solitary treatment of the eyelid with exclusion of the forehead would achieve similar results.

Protective eye shields were not used in the treatments included in this study because none of the treatments were performed directly overlying the globes. Upper lid treatments are done by retracting the upper lid over the orbital rim. Our practice is to limit our treatment areas to the part of the eyelid that can be retracted over the orbital rim; the treatment tip is never placed below the orbital rim directly over the orbit. In addition, treatment settings for eyelids are typically lower than those for non-eyelid skin because of the thinness of eyelid skin. Should treatment of the entire lid, including the lid margin, be attempted, it would be advisable to use eye shields to ensure safety of the globe.

The use of lasers in the treatment of eyelids is not new but is often limited by prolonged postoperative wounding, persistent erythema, and the potential for hypopigmentation and ectropion. The carbon dioxide laser, for example, has been evaluated for eyelid resurfacing, including wrinkle reduction.[6] Wrinkles were reduced at least 70% 3 to 6 months after treatment in 65% of cases, and improvement continued for up to 6 months. Adverse effects included erythema that resolved in 4 weeks in 80% of patients and edema that resolved after 4 to 6 weeks. The authors also reported a small degree of tissue contraction.

Lower eyelid laxity has also been corrected by nonablatively treating the periorbital area with RF energy.[8] In a 9-patient study, Ruiz-Esparza attributed cosmetic improvement of the eyelids to skin contraction. Improvement occurred gradually, patient satisfaction was high, and complications were not observed. This procedure did not correct fat herniation and muscle atrophy in the lower eyelid. Efficacy was assessed by evaluating photographs taken at various times after the single treatment.

A recent 72-patient study[5] of the use of RF energy (Thermage, Inc., Hayward, CA) delivered through a 0.25-cm^2 tip for the treatment of eyelids showed that upper eyelid tightening was achieved in 88% of subjects and lower eyelid tightening was achieved in 71% to 74% of patients. Most patients obtained at least 25% improvement, which is comparable with the results of the present study. However, the RF technique is slow and laborious, and a single treatment session requires up to 1 hour for the eyelids, whereas the nonablative fractional resurfacing technique requires only seconds. In addition, the nonablative fractional resurfacing technique requires no special preparation or attachments other than what is required to treat the remainder of the face.

Studies on increasing the eyelid aperture are few. The integrity of the eyelids and the surrounding orbital structures affect the palpebral aperture.[22] Abnormalities have been corrected surgically,[23] and increases have been achieved by injecting botulinum-A toxin.[24] Fractional resurfacing appears to be a new treatment option for widening this opening, with no postoperative morbidity, appreciable discomfort, scarring, persistent redness, or permanent pigmentary alteration.

The effects on eyelids described in this study were unanticipated and were not intended at the time of treatment. Indeed, one weakness of this study is its retrospective nature. The treatments were originally intended to improve texture through photorejuvenation of the entire face. No attempts were made a priori to standardize treatments with respect to number of treatments and number of passes, because we typically tailor our therapy to each patient's individual needs and tolerability. Future prospective work may lead to improved methods of achieving equivalent or better results than those presented here. This rapid method of treating eyelids may also be further improved using modifications or refinements of the technique and as fractional technology advances.

Conclusion

Fractional resurfacing effectively tightens and increases the aperture of eyelids, giving a more youthful appearance to the aging face without wounding, downtime, or long-term complications.

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