Clinical Evaluation of a Single-Wavelength Fractional Laser and a Novel Multi-Wavelength Fractional Laser in the Treatment of Photodamaged Skin

Laurel Naversen Geraghty, BA and Brian Biesman, MD*
Department of Ophthalmology, Otolaryngology, Dermatology, Vanderbilt University Medical Center Laser and Facial Surgery, 345 23rd Ave., N. Suite 416, Nashville, Tennessee 37203

Background and Objectives: Nonablative fractional lasers are well recognized for rejuvenating photoaged skin. We previously reported favorable outcomes with short follow-up after the use of 1,440-nm Nd:YAG laser energy used alone or in combination with a 1,320-nm laser to effect rejuvenation and wrinkle reduction. We now report longer follow-up data.

Study Design/Materials and Methods: Nineteen Caucasian subjects (average age 47 ± 8.4; range 33–62) exhibiting mild-to-moderate photoaging of the face and neck were treated four times (average interval 18.1 ± 4.1 days; range 11–37 days) with the 1,440-nm Nd:YAG fractional laser (average fluence $3.7 \pm 0.3\,J/cm^2$) or the 1,320/1,440-nm multiplex Nd:YAG fractional laser (1,320-nm average fluence $8.4 \pm 0.4\,J/cm^2$; 1,440-nm average fluence $2.3 \pm 0.2\,J/cm^2$). Outcomes were assessed by subjects and the treating physician using a quartile scale to evaluate skin tightening, surface texture, rhytids, dyschromia, erythema, and global appearance after 1, 3, and 6 months. Retroauricular punch biopsies from three patients were used to evaluate wound healing. Three patients withdrew from the study prior to evaluation, one missed the 1-month evaluation, and one missed the 6-month evaluation.

Results: Assessment by subjects and the treating physician revealed clinical improvement for all outcomes after 1, 3, and 6 months. The differences between the treatment groups were not statistically significant. Subjects demonstrated the greatest average 6-month improvements in surface texture and global skin appearance. Subjects treated with the multiplex laser reported more skin tightening than the group treated only with the 1,440-nm laser. Histological evaluation revealed wound healing within 10 days and significant neocollagenesis at 3 months. No adverse events were reported in any subject.

Conclusion: The 1,440-nm Nd:YAG and 1,320/1,440-nm multiplex Nd:YAG lasers safely and effectively produced improved surface texture, rhytids, dyschromia, erythema, global skin appearance, and skin tightening. Histopathologic findings correlated with clinical observations. Lasers Surg. Med. 41:408–416, 2009.

Key words: fractional photothermolysis; fractional nonablative resurfacing; photorejuvenation; photoaging; dyschromia; erythema; rhytids; skin laxity; skin tightening; surface texture

INTRODUCTION

Since the advent of carbon dioxide (CO_2) skin resurfacing in the 1990s, there has been an explosion of new laser technologies designed to improve the appearance of photodamaged skin [1,2]. Traditional ablative therapies, such as CO_2 and Erbium:YAG (Er:YAG) lasers, are highly effective because they remove the entire epidermis, allowing for its complete regeneration, and generate extensive dermal remodeling [3–5]. However, ablative resurfacing requires significant downtime and may involve persistent erythema, hypo- or hyperpigmentation, infection, or scarring. Nonablative (subsurface) resurfacing lasers involve minimal or no downtime but require several treatment sessions and typically deliver only modest and unpredictable results [3,5,6].

The more recently introduced fractional technology (FT), using a process known as fractional photothermolysis (FP), strikes a balance between traditional ablative skin resurfacing and nonablative technologies, offering an intermediate level of downtime, tissue injury, and clinical outcomes [1–3]. FP targets pixilated areas of the skin to create microscopic, pillar-like zones of thermal injury surrounded by healthy tissue [3,7,8]. The approach coagulates the dermis and epidermis while leaving the stratum corneum intact. This allows for a rapid wound healing response as keratinocytes from untreated areas migrate swiftly to the treatment zones, regenerating the epidermis and effecting improvements in texture, wrinkling, and pigmentation

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*Correspondence to: Brian Biesman, MD, Department of Ophthalmology, Otolaryngology, Dermatology, Vanderbilt University Medical Center Laser and Facial Surgery, 345 23rd Ave., N. Suite 416, Nashville, Tennessee 37203.
E-mail: bbies@comcast.net
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[1,4–8]. Previous study supports FP's safe and effective use on the body as well as the face for the treatment of actinic damage, acne scarring, dyschromia, melasma, rhytids, and lentigines [2,4–10].

Histological evaluations have shown that epidermal healing completes within 7 days of FP, and collagen is fully regenerated within the treatment zones in less than 3 months [1,2]. The migration of keratinocytes to the treatment zones prompts the appearance of microscopic, melanin-containing necrotic debris. These round or oval necrotic collections appear within 1 day of treatment, superficial to the treatment zones and deep to either the granular layer or the stratum corneum. As the skin heals from the dermis upward, necrotic debris is shed within approximately 7 days, reducing epidermal pigment [3,4,11].

Several fractional resurfacing devices are now commercially available, differing in wavelength, the depth of penetration, pulse duration, treatment times, and other parameters [1,2,12]. Recently, FT has been applied to ablative resurfacing. Fractionated carbon dioxide, Er:YAG, and 2,790-nm YSGG lasers provide many of the therapeutic benefits of ablative resurfacing, but with accelerated healing, reduced downtime and a relatively decreased risk of complications [4,5]. A novel nonablative fractional resurfacing device, 1,440/1,320-nm Nd:YAG multiplex laser (Cynosure, Inc., Westford, MA), combines two wavelengths in an effort to achieve both photorejuvenation and skin tightening [2]. Both wavelengths fall within the infrared spectrum, and therefore target water. The 1,440-nm energy produces coagulative changes to a depth of approximately 300 μm, while the 1,320-nm energy produces much deeper thermal effects.

The objective of this study is to evaluate the efficacy and safety of a novel fractional coagulative resurfacing laser in 1,440-nm and combined 1,440/1,320-nm Nd:YAG modes in the treatment of cutaneous photoaging.

MATERIALS AND METHODS

Subjects

Enrolled in the study were 20 patients exhibiting signs of mild-to-moderate photoaging (Fitzpatrick 4–7), including dyschromia, textural change, and rhytids of the facial and neck skin, as evaluated by an experienced clinician. Some subjects had mild depressed acne scarring in addition to photoaging. All patients provided informed consent to participate in the study. One subject disenrolled before undergoing treatment due to illness. The study population consisted of 19 Caucasians, Fitzpatrick skin types I–III. Seventeen subjects were female and two were male. The average age was 47 ± 8.4 (range 33–62). Exclusion criteria included previous cutaneous laser treatment, surgery, filler or Botox injections, recent use of cosmeceuticals, pregnancy, active localized or systemic infection, hypersensitivity to light, recent use of photosensitizing agents, unreasonable treatment expectations, or inability or unwillingness to meet the treatment and follow-up criteria. Randomization was balanced across all subjects and was accomplished via a random number generator. Fifteen patients with mild-to-moderate wrinkling, textural irregularities, and skin laxity were treated with the 1,440-nm Nd:YAG laser only (Cohort 1) and four subjects were treated with the combined 1,440/1,320-nm Nd:YAG multiplex device (Cohort 2). Three patients (one from Cohort 1, two from Cohort 2) underwent all laser treatments but withdrew from the study prior to evaluation. One Cohort 1 patient missed the 1-month follow-up visit only, and another subject from the same group missed the 6-month follow-up visit only.

Laser Treatments

Both the 1,440-nm and combined 1,440/1,320-nm Nd:YAG devices employ proprietary technology to convert the single beam exiting the laser cavity into fractionated beams at the skin's surface. This combined apex pulse (CAP) technology utilizes a diffractive optical array to create a microthermal effect. The beam profile produces areas of greater energy density surrounded by areas of lower energy density. Each hexagonally shaped diffractive microlens is 350 μm wide, and the microlenses are arranged in interlocking honeycomb fashion so that the centers of adjacent microlenses are 350 μm apart and there are nearly 1,000 microlenses per square centimeter. This configuration generates approximately 1,000 high-fluence pulses per square centimeter of skin. When used in multiplex mode, the laser sequentially emits 1,320- and 1,440-nm laser light separated by a 15-millisecond delay.

Patients underwent four treatments at an average interval of 18.1 ± 4.1 days (range 11–37 days). Two passes were made during each treatment session. In both cohorts, energy was delivered via a 14-mm spot containing a diffraction grating that produced 100-μm microspots spaced 200–500 μm apart. Pulses were delivered in a nonoverlapping manner taking care to avoid pulse stacking. The full face and anterior neck were treated at each session. The crow's feet region was treated but the eyelids were not included in the treatment field. External ocular protection was provided with metal shields (OculoPlastik, Montreal, Canada).

All treatments were performed without topical or systemic anesthesia or sedation, although cold air emitted by the SmartCool device (Zimmer Elektromedizin, Irvine, CA) was used to enhance patient comfort and provide epidermal protection. SmartCool settings ranged from 3 to 5, with a mean SmartCool setting for the first, second, third, and fourth treatments of 3.9 ± 0.5, 3.7 ± 1.3, 3.9 ± 1.4, and 4.5 ± 0.4, respectively. The average overall SmartCool setting was 4.0 ± 1.0.

Treatment energy for both cohorts was increased by approximately 10% in each treatment session. When only the 1,440-nm Nd:YAG laser was used, the average initial treatment fluence was $3.13 \pm 0.2\,J/cm^2$ (range $3–3.5\,J/cm^2$). The average fluence across all treatments was $3.74 \pm 0.3\,J/cm^2$ (range $3–4.2\,J/cm^2$). Subjects treated with the multiplex device received lower energies than if either wavelength were used alone. The starting fluence for all

TABLE 1. Improvement Rankings by Subjects and Physician After 1 Month

	Subject evaluation			Physician evaluation		
Area of improvement	1,440-nm laser	Multiplex laser	All patients	1,440-nm laser	Multiplex laser	All patients
Surface texture	2.3 ± 0.8	2.5 ± 0.7	2.3 ± 0.7	2.2 ± 0.8	1.0 ± 0.0	2.1 ± 0.9
Wrinkles	1.0 ± 1.0	2.0 ± 0.0	1.1 ± 1.0	1.8 ± 0.8	1.5 ± 0.7	1.7 ± 0.8
Pigmentation	2.0 ± 1.2	2.0 ± 1.4	2.0 ± 1.1	2.4 ± 1.0	1.0 ± 0.0	2.2 ± 1.0
Global appearance	2.1 ± 1.0	2.0 ± 1.4	2.1 ± 1.0	2.7 ± 0.8	1.0 ± 0.0	2.4 ± 0.9
Redness reduction	1.8 ± 1.4	0.5 ± 0.7	1.7 ± 1.4	N/A	N/A	N/A
Skin tightening	1.6 ± 0.7	2.0 ± 0.0	1.7 ± 0.6	N/A	N/A	N/A

subjects in Cohort 2 was $2.0 \pm 0.0\,J/cm^2$ for the 1,440-nm laser and $8.0 \pm 0.0\,J/cm^2$ for the 1,320-nm laser. The average fluence for all multiplex laser treatments was $2.3 \pm 0.2\,J/cm^2$ (range $2–2.8\,J/cm^2$) for the 1,440-nm laser and $8.4 \pm 0.4\,J/cm^2$ (range $8–9\,J/cm^2$) for the 1,320-nm laser.

Outcome Analysis

Clinical evaluation was performed 1–3 days following the first treatment, and 1, 3, and 6 months following the final treatment. The subjects and treating physician subjectively assessed improvements in surface texture, rhytids, dyschromia, and global skin appearance. After 1 month, the subjects also evaluated the level of skin tightening and redness reduction. Standardized photography was used at each visit. The investigator's outcome analysis using photographic assessment was blinded with respect to the 1,440-nm laser alone versus the multiplex laser. Outcomes were ranked on a quartile scale: 0 = no improvement, 1 = ≤25% improvement or less, 2 = 26–50% improvement, 3 = 51–75% improvement, or 4 = > 75% improvement. Subjects were provided with a post-treatment log sheet to track the duration and severity of side effects, including post-treatment pain and redness (Table 4).

Histological Evaluation

Retroauricular treatment was administered to three patients treated with the 1,440-nm laser alone to allow for histological evaluation of laser effects using hematoxylin and eosin (H&E) staining. Punch biopsies were taken immediately after the first treatment; 1, 2, 4, 7, 10, and 15 days post-treatment; and 3 months post-treatment. All specimens were processed simultaneously and were evaluated by a single dermatopathologist experienced in evaluation of cutaneous effects of infrared lasers.

RESULTS

Subjective Evaluation of Improvement

Assessment by subjects and a physician (BSB) revealed clinical improvement for all outcomes after 1, 3, and 6 months. The small sample size allowed only observational data. Subjects demonstrated the greatest average 6-month improvements in surface texture and global skin appearance, and increasing improvement in wrinkles over 6 months. Cohort 2 subjects, who were treated with the multiplex laser, reported more skin tightening than Cohort 1 subjects, who were treated with the 1,440-nm laser only. None of the differences between the treatment groups were statistically significant.

Immediate improvement was noted in five patients following the first treatment. On average, immediate improvement was noted for laxity (1.3 ± 0.8), rhytids (1.0 ± 1.0), pigment (0.6 ± 0.6), and vascular appearance (0.4 ± 0.6).

After 1 month, Cohort 2 subjects reported a slightly higher average improvement in skin tightening (2.0 ± 0.0) compared to Cohort 1 (1.6 ± 0.7; Table 1). The difference between the groups was not statistically significant.

The average improvements among Cohort 1 subjects after 1, 3, and 6 months are summarized in Tables 1–3 and Figures 1a, 2a, and 3a. Cohort 1 subjects reported the greatest average improvements for surface texture (2.3, 2.1, and 2.7 for months 1, 3, and 6, respectively), global skin appearance (2.1, 2.2, 2.8), and pigmentation (2.0, 2.1, 2.7), followed by redness reduction (1.8, 1.8, 1.7) and the appearance of wrinkles (1.0, 1.5, 1.8). The physician ratings

TABLE 2. Improvement Rankings by Subjects and Physician After 3 Months

	Subject evaluation			Physician evaluation		
Area of improvement	1,440-nm laser	Multiplex laser	All patients	1,440-nm laser	Multiplex laser	All patients
Surface texture	2.1 ± 0.8	2.0 ± 0.0	2.1 ± 0.7	2.2 ± 0.9	1.0 ± 0.0	2.1 ± 0.9
Wrinkles	1.5 ± 0.7	1.5 ± 0.7	1.5 ± 0.6	2.0 ± 0.8	1.5 ± 0.7	1.9 ± 0.8
Pigmentation	2.1 ± 1.0	1.0 ± 0.0	1.9 ± 1.0	2.5 ± 0.9	1.0 ± 0.0	2.3 ± 1.0
Global appearance	2.2 ± 0.8	2.0 ± 0.0	2.1 ± 0.7	2.4 ± 0.9	1.0 ± 0.0	2.4 ± 0.8
Redness reduction	1.8 ± 1.2	1.5 ± 0.7	1.8 ± 1.2	N/A	N/A	N/A

TABLE 3. Improvement Rankings by Subjects and Physician After 6 Months

	Subject evaluation			Physician evaluation		
Area of improvement	1,440-nm laser	Multiplex laser	All patients	1,440-nm laser	Multiplex laser	All patients
Surface texture	2.7 ± 0.6	3.0 ± 0.0	2.7 ± 0.6	1.9 ± 1.0	2.5 ± 0.7	2.0 ± 0.9
Wrinkles	1.8 ± 0.8	2.5 ± 0.7	1.9 ± 0.8	2.0 ± 0.7	1.5 ± 0.7	1.9 ± 0.7
Pigmentation	2.7 ± 1.2	2.0 ± 0.0	2.6 ± 1.1	2.1 ± 1.0	1.5 ± 0.7	2.0 ± 1.0
Global appearance	2.8 ± 0.8	3.0 ± 0.0	2.8 ± 0.8	2.2 ± 0.9	2.5 ± 0.7	2.3 ± 0.9
Redness reduction	1.7 ± 1.5	2.5 ± 0.7	1.8 ± 1.4	N/A	N/A	N/A

of average skin improvements among Cohort 1 were generally higher than the subjects' ratings after 1 and 3 months (Figs. 1a and 2a), but generally lower than the subjects' ratings after 6 months (Fig. 3a). The clinician reported the following average improvements among Cohort 1 subjects: global skin appearance (2.7, 2.4, and 2.2 for months 1, 3, and 6, respectively), pigmentation and dyschromia (2.4, 2.5, 2.1), surface texture (2.2, 2.2, 1.9), and wrinkles (1.8, 2.0, 2.0).

The average improvements of Cohort 2 subjects after 1, 3, and 6 months are summarized in Tables 1–3 and Figures 1b, 2b, and 3b. Cohort 2 patients reported average improvements in global skin appearance (2.0, 2.0, and 3.0 after 1, 3, and 6 months, respectively), surface texture (2.5, 2.0, 3.0), the appearance of wrinkles (2.0, 1.5, 2.5), redness (0.5, 1.5, 2.5), and pigmentation (2.0, 1.0, 2.0). The clinician's evaluations of the improvements were equal to or lesser than the subjects' average ratings

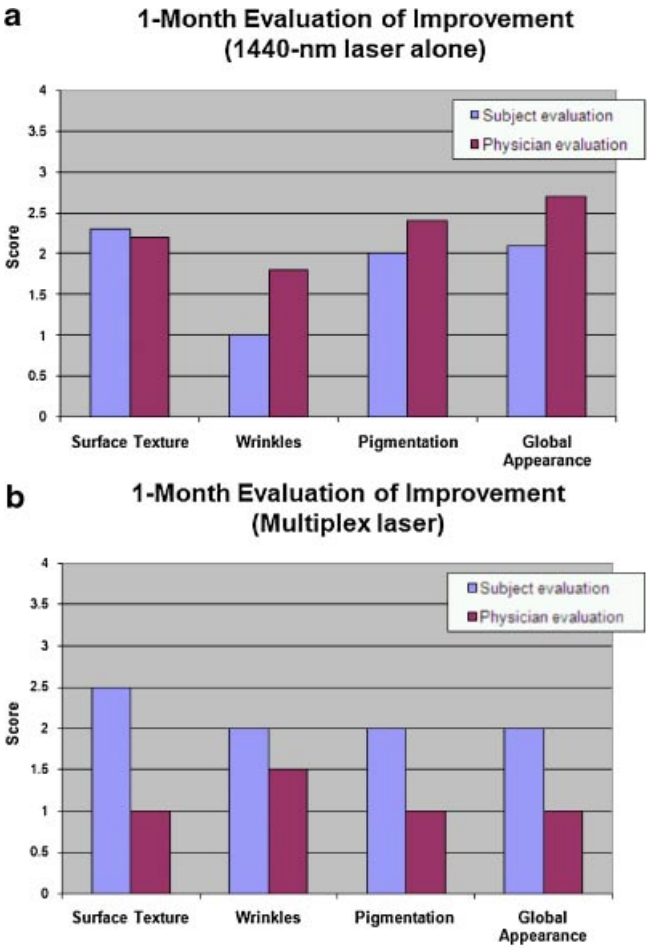

Fig. 1. Improvement rankings by subjects and physician after 1 month for (**a**) Cohort 1, treated with the 1,440-nm laser alone and (**b**) Cohort 2, treated with the multiplex laser.

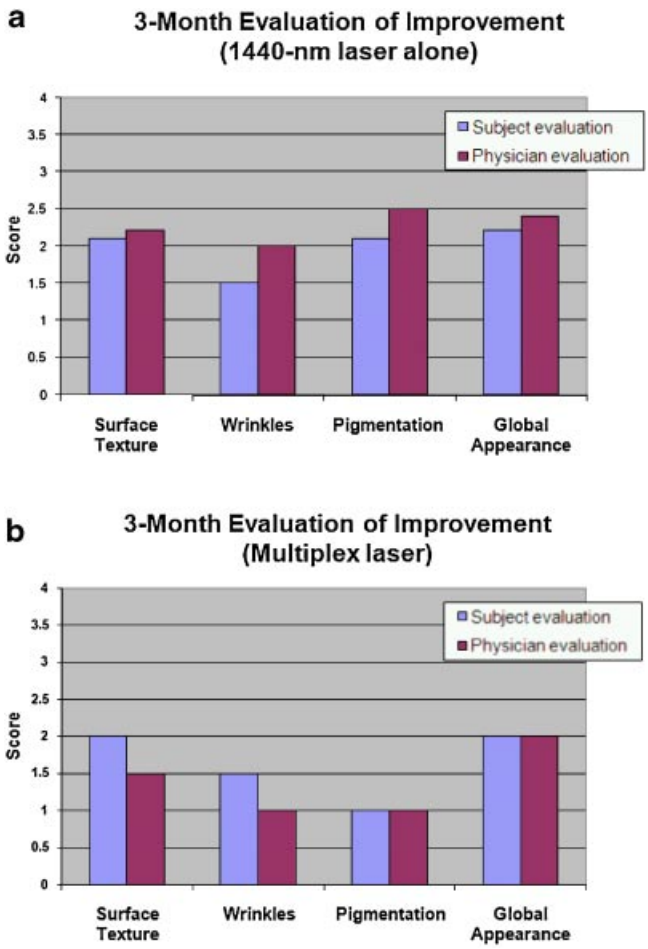

Fig. 2. Improvement rankings by subjects and physician after 3 months for (**a**) Cohort 1, treated with the 1,440-nm laser alone and (**b**) Cohort 2, treated with the multiplex laser.

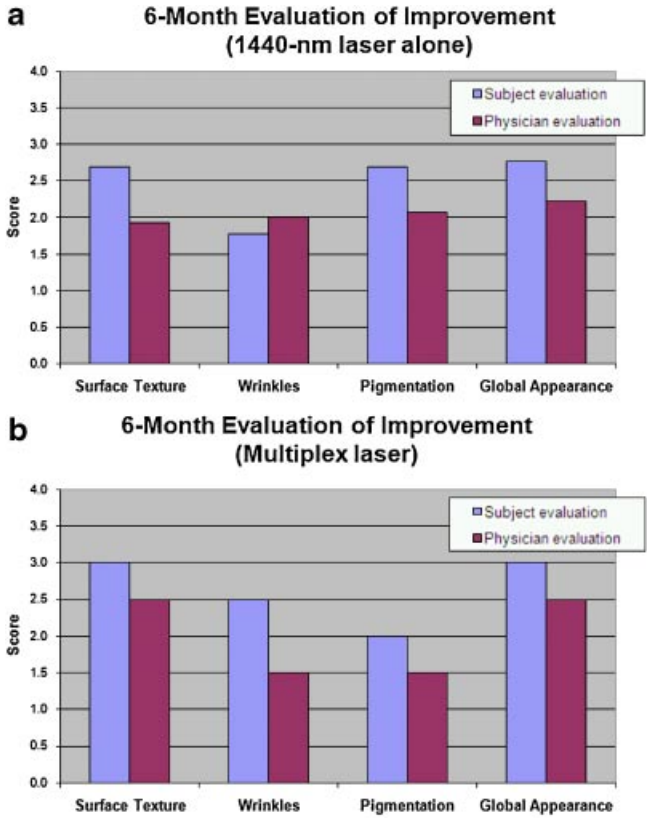

Fig. 3. Improvement rankings by subjects and physician after 6 months for (**a**) Cohort 1, treated with the 1,440-nm laser alone and (**b**) Cohort 2, treated with the multiplex laser.

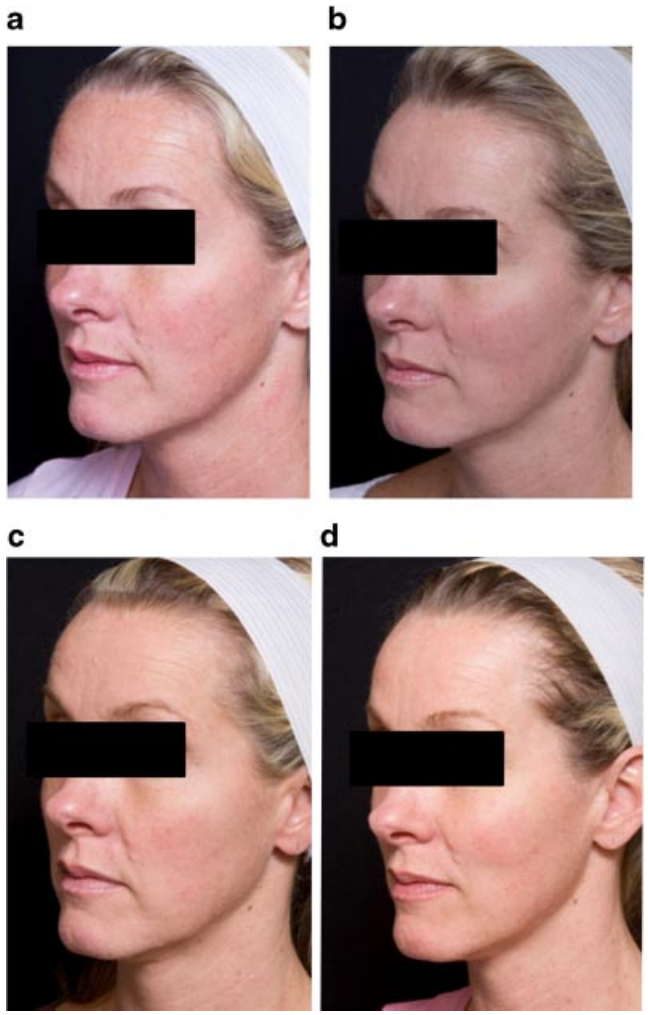

Fig. 4. **a**: Prior to treatment with the 1,440-nm laser alone. **b**: One month, (**c**) 3 months, and (**d**) 6 months post-treatment with the 1,440-nm laser alone.

(Figs. 1b, 2b, and 3b). The clinician reported the following mean improvements after 1, 3, and 6 months, respectively: global skin appearance (1.0, 2.0, 2.5), surface texture (1.0, 1.5, 2.5), wrinkles (1.5, 1.0, 1.5), and pigmentation and dyschromia (1.0, 1.0, 1.5) (Figs. 1b, 2b, and 3b).

Histological Findings

Histological evaluation using H&E staining revealed the effects of treatment, as evidenced by epidermal debris, basophilic change in the dermis, and neocollagenesis. The dermal treatment zone, the area of coagulated collagen that forms in the dermis following thermal injury, was apparent in the biopsies immediately following treatment with the 1,440-nm laser (Fig. 7A) and was clearly visible through Day 15 (Fig. 7F) and Day 17. The maximum depth of the treatment zone was 192 μm, and the average maximum depth was 168.5 μm. The average depth of injury measured on all follow-up visits was 120.4 μm.

Biopsies taken immediately following treatment with the 1,440-nm laser demonstrated sub-epidermal blister formation, vacuolar change, and distorted keratinocytes, consistent with coagulative thermal injury (Fig. 7A). On Day 1 following treatment, histology confirmed that re-epithelialization had occurred and necrotic debris had appeared superficial to the treatment zones (Fig. 7B). Histology revealed wound healing and the complete extrusion of necrotic debris by Day 9 (Fig. 7E) or Day 10. Three months after treatment, the dermal treatment zone revealed mild inflammation, fibroblasts, and significant neocollagenesis (Fig. 7G). These results are similar to previous histological observations following FP with coagulative resurfacing devices [3–5,11,13].

Adverse Events

No adverse events occurred throughout the study. On a scale of 0 (none) to 5 (severe), patients in both groups reported pain ranging from 0 to 4.75, with an overall average of 2.8 ± 1.1 per laser treatment. The mean pain level reported during the four treatments was higher for Cohort 1 (2.9 ± 1.1) than Cohort 2 (2.6 ± 0.8). The average reported pain levels for Cohort 1 during the first, second, third, and fourth laser treatments were 2.8 ± 1.0, 2.5 ± 1.1, 3.2 ± 1.1, and 3.2 ± 1.3, respectively. The average reported

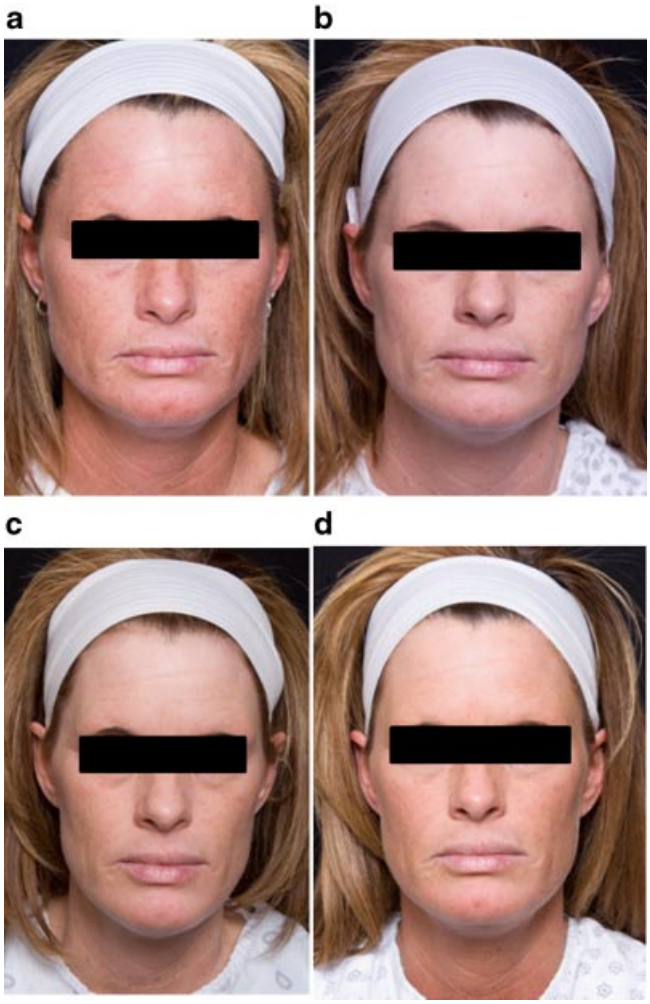

Fig. 5. **a**: Prior to treatment with the 1,440-nm laser alone. **b**: One month, (**c**) 3 months, and (**d**) 6 months post-treatment with the 1,440-nm laser alone.

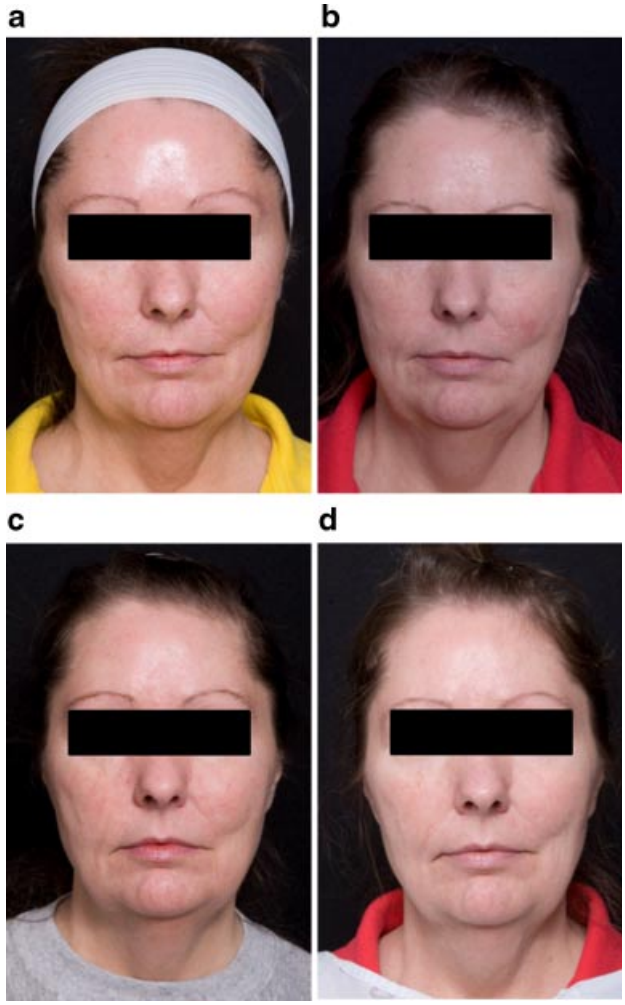

Fig. 6. **a**: Prior to treatment with the multiplex laser. **b**: One month, (**c**) 3 months, and (**d**) six months post-treatment with the multiplex laser.

pain levels for Cohort 2 during the four laser treatments were 2.5 ± 1.1, 2.6 ± 0.8, 2.5 ± 1.1, and 2.6 ± 0.8, respectively. The increasing fluence used in subsequent treatments likely explains higher average pain levels reported in some of the later treatments. No patients reported residual pain following treatment (Table 4). No subjects experienced crusting, blistering, or permanent changes in pigment or skin texture as a result of the treatments.

As summarized in Table 4, Cohort 1 patients reported an average, immediate post-treatment erythema of 2.0 ± 1.3 on a scale of 0 (none) to 5 (severe). Cohort 2 patients reported an average redness of 1.5 ± 0.7 and the average for both cohorts was 1.9 ± 1.2. These effects generally lasted no more than 1 day, and often resolved within 1–2 hours.

DISCUSSION

This study evaluated two approaches to nonablative fractional resurfacing: one that produces fractional coagulative resurfacing only and another that combines coagulative fractional resurfacing with deeper dermal heating. The latter device, the multiplex laser, was developed to produce a greater degree of deep dermal remodeling than the 1,440-nm laser alone. One would expect treatment with the multiplex device to produce a greater degree of skin tightening and perhaps wrinkle reduction than the 1,440-nm laser used alone. In our study, greater skin tightening was observed for the multiplex laser after 1 month. However, the multiplex device did not demonstrate superior wrinkle reduction compared to the 1,440-nm laser. None of these differences achieved statistical significance, but this may be due to the small sample size for which follow-up data were available.

When delivering both 1,320 and 1,440-nm Nd:YAG energy nearly simultaneously, 1,440-nm energy had to be delivered in smaller doses to avoid epidermal injury with blistering and crusting. Pilot studies with the multiplex device on in vivo human buttocks skin helped determine

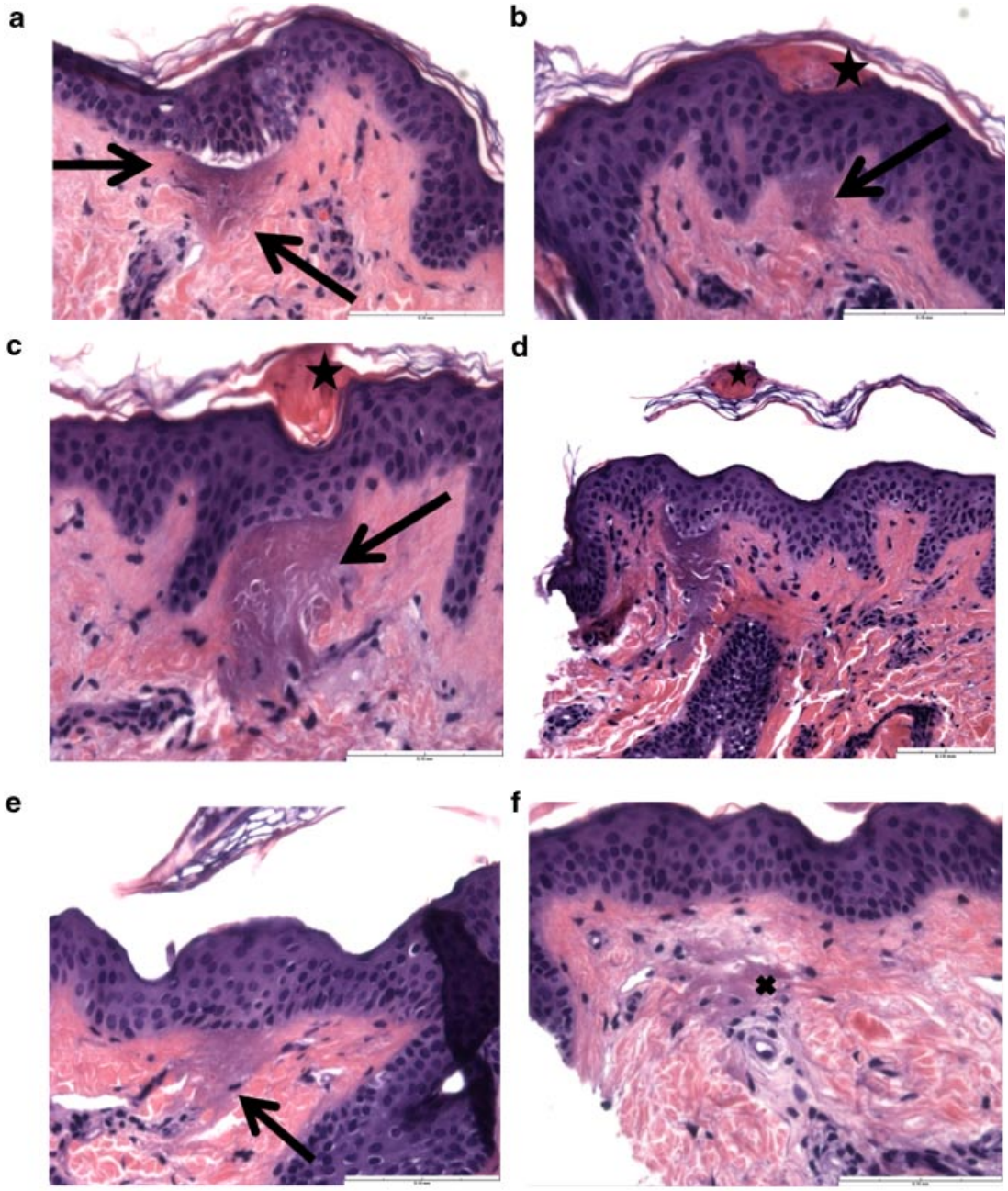

Fig. 7. **a**: Day 0 (40 × magnification). The dermal coagulative zone is evident (arrows). Subepidermal blister formation, vacuolar change, and distorted keratinocytes are noted. **b**: Day 1 (40 × magnification). Re-epithelialization has occurred, and necrotic debris (star) is visible superficial to the treatment zone (arrow). **c**: Day 2 (40 × magnification). Re-epithelialization and extrusion have occurred, with necrotic debris (star) visible over the treatment zone (arrow). **d**: Day 9 (20 × magnification). Extrusion of necrotic debris (star) is complete. **e**: Day 15 (40 × magnification). The dermal treatment zone (arrow) is still clearly evident. **f**: 3 months (40 × magnification). Mild inflammation, fibroblasts, and new collagen (×) are noted in the treatment zone.

the safe working range (unpublished data). It is reasonable to ask whether decreasing the 1,440-nm fluence from an average of 3.74 J/cm^2 (as in Cohort 1) to an average of 2.3 J/cm^2 in the multiplex treatment (as in Cohort 2) would decrease the treatment efficacy with respect to pigmentation and surface texture. Although none of the differences in the study are statistically significant, the 1,440-nm laser group indeed showed greater improvements in pigmentation after 1, 3, and 6 months. However, skin texture improvement trended slightly better over 6 months in the

TABLE 4. Transient Post-Treatment Side Effects, as Recorded by Subjects

Side effect	Cohort 1: 1,440-nm laser	Cohort 2: multiplex laser	All patients
Residual pain	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0
Erythema	2.0 ± 1.3	1.5 ± 0.7	1.9 ± 1.2

subjects who underwent multiplex treatment. After 3 and 6 months, improvement in wrinkling and global skin appearance also seemed to trend slightly higher in the multiplex group. Patients treated with the 1,440-nm Nd:YAG laser alone reported more immediate post-treatment erythema, on average, than those treated with the multiplex device.

Forced cold air was used in conjunction with all treatments to improve patient comfort and provide epidermal protection. Although not quantified, higher laser energies at both 1,320 and 1,440 nm could clearly be delivered safely and comfortably if cold air was used for pre-, parallel-, and post-cooling. It could be argued that because the cold air cools the target zone, it may reduce the efficacy of laser treatment. However, this argument fails for at least two reasons. First, the depth of histopathologic changes produced by the laser correlates directly with laser energy [13]. Maximizing laser energy is expected to produce a deeper thermal effect. Second, the cold air exerts a tissue effect with a reverse thermocline, where the skin is coldest at the surface and warmer at greater depths, due to regional blood flow. Cold air thus imparts an epidermal protective effect (as evidenced by the lack of crusting or blistering in any subjects, despite delivery of energy above threshold levels required to produce tissue injury), but does not prevent dermal injury (as evidenced histologically).

Treatment with both the 1,440-nm Nd:YAG laser and the multiplex device demonstrated efficacy comparable to other devices used in the treatment of photodamage [5,9,11,14]. For the outcomes assessed in the present study, most improvements ranged from 1.5 to 2.5 on a quartile scale. Wanner et al. [9] reported similar results after evaluating a nonablative 1,550-nm erbium-doped fiber laser in the treatment of photodamage, rhytids, and dyspigmentation. Fifty subjects underwent three treatments at 3- to 4-week intervals. Using a quartile grading scale, the mean clinical improvement after 3 months was 2.23 and 1.85 for facial and nonfacial skin, respectively; after 6 months, the average improvement was 2.10 and 1.81 for facial and nonfacial skin, respectively. Jih et al. [14] conducted a study evaluating the improvements among 10 patients with visible photodamage of the hands. Subjects underwent five treatments of one hand with a 1,550-nm diode-pumped erbium fiber laser. One and 3 months following treatment, pigmentation improved an average of 51–75%, while rhytids and roughness improved 25–50%, as rated by subjects and a clinician.

In the current study, subjects in both groups exhibited mild-to-moderate improvements in rhytids and surface texture after 1, 3, and 6 months. This is consistent with a study by Manstein et al. [11] that assessed the effectiveness of FP for treating periorbital rhytids and skin texture. Thirty subjects underwent four laser treatments in 2–3 weeks. Mild-to-moderate improvements were reported by the patients and a study investigator after 1 and 3 months. The surface texture improvements observed in our study are similar to those of other published reports. Fisher et al. [15] examined the use of FP in 17 patients with textured acne scars. After five laser treatments at 1- to 3-week intervals, the mean improvements, as assessed by digital photography, ranged from 25% to 50%; typographic imaging revealed mean improvements of 22–62%; and patient questionnaires recorded improvements ranging from 29% to 67%. In addition, Chapas et al. [16] assessed 13 subjects with moderate-to-severe acne scars who underwent two to three treatments with an ablative fractional laser at 1- to 2-month intervals. Quartile grading by patients and investigator demonstrated 26–50% improvement in texture, atrophy, and overall appearance, and topographic analysis revealed a mean improvement of 67% in acne scar depth.

CONCLUSION

The 1,440- and 1,440/1,320-nm Nd:YAG lasers evaluated in this study proved safe and efficacious in the treatment of mild-to-moderate photoaging of the face and neck. The outcomes observed in this study are similar to those reported with other coagulative fractional resurfacing devices.

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