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ORIGINAL ARTICLE

Superficial erbium:YAG laser resurfacing of photodamaged skin

JASON N. POZNER[1] & DAVID J. GOLDBERG[2]

[1]*University of Miami School of Medicine and Aesthetic Science Institute, Boca Raton, FL, USA, and* [2]*Skin Laser & Surgery Specialists of NY/NJ and Mount Sinai School of Medicine, New York, NY, USA*

Abstract

Background: Light chemical peels and microdermabrasion have enjoyed recent popularity for the treatment of mild photoaging. However, clinical improvement from these modalities is often minimal from both a patient's and physician's perspective. Erbium:YAG lasers have been effective in treating mild to moderate photoaging, but the need for either regional or general anesthesia, as well as the significant post-treatment recovery period has limited its use.
Objective: We sought to utilize a very low fluence approach to erbium:YAG laser resurfacing, with topical anesthesia, to ascertain its efficacy in treating mild to moderate photoaging.
Methods: A total of 250 subjects aged 28–80 years with skin types 1–4 and mild to moderate facial rhytids were treated with topical anesthesia and subsequently one pass of a 2940 nm erbium:YAG laser, using between 5 and 17.5 J/cm^2. In addition, 58 of the treated facial subjects underwent neck resurfacing with fluences between 5 and 15 J/cm^2 and eight treated facial subjects underwent upper chest resurfacing at fluences of 5–7 J/cm^2. A single treatment was received by 246 subjects; four subjects were treated a second time after a 1-month interval.
Results: Most subjects completely re-epithelialized by 3–4 days; healing time was depth dependent. Most subjects were able to start skin care regimens within 1–2 weeks after the procedure. Results were judged to be excellent in individuals with thin skin and good in subjects with thicker skin.
Conclusions: One pass of low fluence erbium:YAG resurfacing, under topical anesthesia, was effective for the treatment of mild to moderate photoaging.

Key words: *Erbium laser, facial rejuvenation, laser resurfacing*

Introduction

Light chemical peels and microdermabrasion have enjoyed recent popularity for the treatment or mild photoaging. However, clinical improvement from these modalities is often minimal from both a patient's and physician's perspective. Deeper resurfacing techniques, including medium depth chemical peels, dermabrasion and laser resurfacing have clearly been efficacious in treating photodamage. However, the need for intravenous sedation or general anesthetic and the protracted post-operative course associated with deeper procedures have caused many physicians and patients to seek alternative approaches.

Erbium:YAG (Er:YAG) lasers, with a wavelength of 2940 nm, allow for extremely precise skin ablation, with accurate assessment of the resurfacing depth (1–4). The Er:YAG laser is very efficiently absorbed by water and can be used to produce minimal thermal injury (approximately 5–10 μm) (3–6). A recent study of Er:YAG laser resurfacing, using topical anesthesia, showed improvement in treating photodamage, but the moderate results obtained appear to be both fluence and laser related (7). We sought to use a single pass, scanning, low fluence, Er:YAG laser to ascertain its efficacy in treating mild to moderate photoaging.

Materials and methods

A total of 250 subjects underwent full face single pass, scanning, low fluence, Er:YAG laser resurfacing with topical anesthesia. Some 58 of the 250 subjects patients underwent additional neck

Correspondence: Jason N. Pozner, 4800 North Federal Highway, Suite C101, Boca Raton, FL 33431, USA. Fax: 1 561 367 9102. E-mail: drpozner@asimd.com

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resurfacing and eight of the 250 subjects underwent additional chest resurfacing. Subjects ranged in age from 28 to 80 years. Four of the treated subjects underwent an additional procedure 1 month after the first.

No subjects were pre-treated with hydroquinone or retinoic acid. However, 220 of the subjects did receive prophylactic antibiotics (cephalexin 500 mg QID) and antivirals (valacyclovir 500 mg BID) and continued their use until epithelization was complete.

Topical anesthesia of 5% lidocaine and 3.5% prilocaine (Sea View Pharmacy, Santa Clara, CA, USA) was placed on the skin for 45–60 minutes under occlusion prior to laser treatment. The topical anesthetic was then removed and laser eye and skin safety precautions were observed (Oculoplastik, Montreal, Canada).

All subjects underwent Er:YAG laser resurfacing (Microlaserpeel™ technique, Sciton Lasers, Palo Alto, CA, USA) using a computer-generated scanning pattern with 50% overlap and a fluence of 5–17.5 J/cm^2. Those subjects whose necks were resurfaced were treated in an identical manner with fluences from 5 to 15 J/cm^2. Those subjects undergoing upper chest resurfacing were treated in an identical manner with fluences from 5 to 7 J/cm^2. (Table I.)

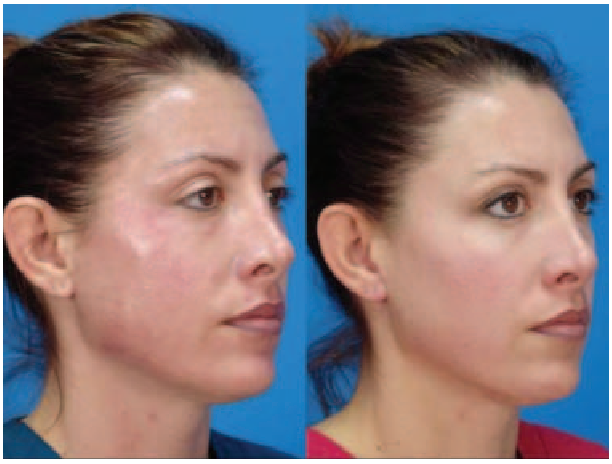
After treatment, moist dressings were used until full epithelialization occurred.

Results

All subjects were clinically improved. Two subjects who did who did not receive prophylactic antiviral treatment developed minor herpes simplex infections that responded to oral valacyclovir. No bacterial or fungal infections were observed. No contact or allergic dermatitis was noted; no permanent pigmentary change or scarring was seen. The four subjects who were clinically determined to have thicker skin re-epithelialized just as quickly after their second treatment as was noted after the first Er:YAG laser session. (Figures 1–3.)

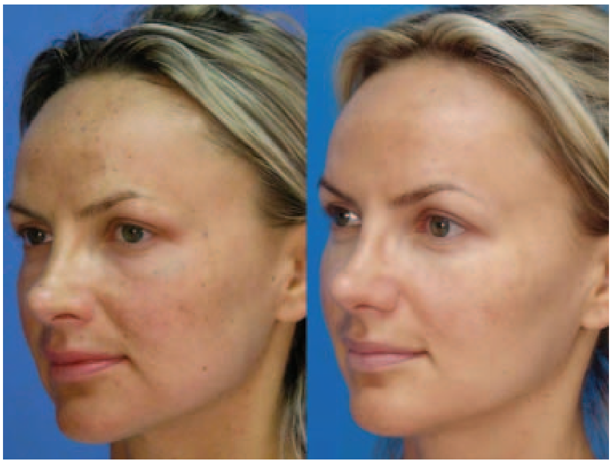
Table I. Laser settings.

Area	Ablative fluence (J/cm^2)	Passes	Density
Forehead	5–17.5	1	30–50%
Periorbital	5–17.5	1	30–50%
Perioral	5–17.5	1	30–50%
Cheeks	5–17.5	1	30–50%
Neck	10	1	30–50%
Chest	2.5–5	1	30–50%



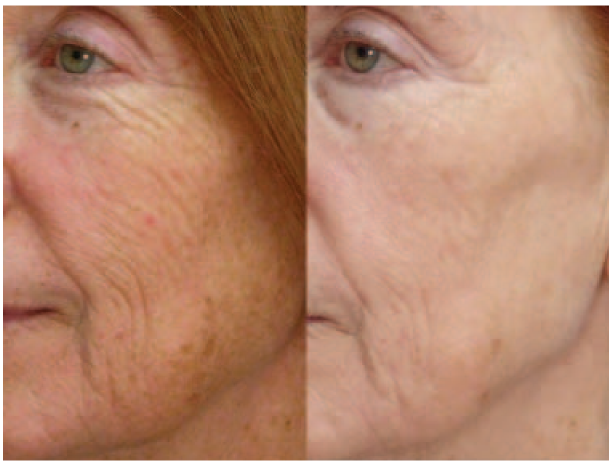
(A) (B)

Figure 1. (A) A 36-year-old female with mild photodamage 2 days following 60 μm superficial Er:YAG laser ablation. (B) At 4 days after treatment.



(A) (B)

Figure 2. (A) A 35-year-old female with moderate photodamage. (B) At 6 weeks after superficial Er:YAG laser ablation.



(A) (B)

Figure 3. (A) A 70-year-old female with moderate photodamage. (B) At 4 months following 40 μm superficial Er:YAG laser ablation.

Discussion

The Er:YAG laser with its wavelength of 2940 nm is 10 times more avidly absorbed by water than is the carbon dioxide laser (2). This laser is well suited for precise skin resurfacing due to its high water affinity and lack of thermal injury (2–6). The lessened thermal effect leads to less post-operative morbidity than is generally seen with the carbon dioxide laser in terms of prolonged erythema and permanent hypopigmentation (8). Early studies utilizing the Er:YAG laser at low fluences (<10 J/cm^2) have demonstrated its effectiveness for treating superficial (epidermal) skin lesions (9). The introduction of higher energy scanning Er:YAG lasers has also enabled higher fluences to be delivery to tissue and more confluent treatment (10–12). Er:YAG lasers have been proven to be effective (both short and long term) in the treatment of rhytids associated with photodamage, lentigines, as well as some facial scars (8–12).

However, the need for nerve blocks, intravenous sedation and/or general anesthesia has limited the universal use of this laser to patients needing deeper procedures. Patients with minimal to moderate photodamage have more commonly been treated with a light chemical peel or repeated treatments of microdermabrasion rather than undergoing a procedure requiring an anesthetic. In addition, new state regulations often requiring an anesthesiologist and accredited operating facility for performance of intravenous sedation has only added to the complexity of Er:YAG laser procedures.

The purpose of this study was to evaluate the results and healing process after superficial Er:YAG laser resurfacing. Epidermal facial depth varies from approximately 60 to 100 μm depending upon facial area and variations in skin thickness (6,10). We chose to use an Er:YAG laser with a proven precise ablation model as noted from previous histologic experiments (12) . In choosing our delivered Er:YAG laser fluences, our goal was to remove 50–70 μm of tissue. Since the Er:YAG laser projects an ablation depth equal to 4 μm per J/cm^2, 15 J/cm^2 would remove the desired 60 μm of tissue, as has been quantified elsewhere (12). Nevertheless, it should be noted that the combined utilized fluences, degree of pulse overlap, and use of potent topical anesthetics have all differed from that used in previous trials of topical Er:YAG laser resurfacing. This may in part account for our results (7,21).

It should be further noted that some of our early subjects did not receive prophylactic antiviral agents because we assumed they were not needed because of the superficial treatments we chose to deliver. This, in retrospect, was an error and all subsequent subjects did receive such prophylactic treatment, as is done with standard laser resurfacing (13,14).

In conclusion, superficial Er:YAG laser resurfacing does appear to play a role in the treatment of mild to moderate photodamage. Further studies are required to determine long-term photodamage clearance rates.

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