Resurfacing of Pitted Facial Acne Scars with a Long-Pulsed Er:YAG Laser

JEUNG-TAE JEO NG, MD AND YOUNG-CHUL KYE, MD
Department of Dermatology, Korea University Anam Hospital, Seoul, Korea

BACKGROUND. Conventional short-pulsed Er:YAG lasers show less effective hemostasis and weak photothermal damage on papillary dermis. Recently, newer long-pulsed Er:YAG laser systems has been developed.

OBJECTIVE. To evaluate the clinical and histologic effects of long-pulsed Er:YAG laser resurfacing for pitted facial acne scars.

METHODS. Thirty-five patients with pitted facial acne scars were treated with a long-pulsed Er:YAG laser. All patients had Fitzpatrick skin phototypes III–V. A pulsed Er:YAG laser with a 5 mm handpiece at a setting of 7.0–7.5 J/cm² with a 10-msec pulse duration was used. The laser was fired at 5 Hz, with four to five passes. In 28 patients, the results of laser treatment were evaluated for the degree of clinical improvement, duration of erythema, pigmentary change, and any adverse events at 2 weeks, 1 month, and 3 months. In seven patients, skin biopsy specimens were obtained at the following intervals: immediately, 1 week, 2 weeks, 4 weeks, and 8 weeks postoperatively for histologic examination.

RESULTS. The results of long-pulsed Er:YAG laser resurfacing for pitted facial acne scars were excellent in 10 patients (36%), good in 16 patients (57%), and fair in 2 patients (7%). Erythema occurred in all patients after laser treatment and lasted longer than 3 months in 15 patients (54%). Postinflammatory hyperpigmentation occurred in 8 patients (29%). But the pigmentation faded or disappeared within 3 months. One patient (4%) experienced mild hypopigmentation. Pruritic symptoms that required medical intervention occurred in 16 patients (57%). Mild to moderate postoperative acne flare-up occurred in 8 patients (29%). No other adverse effects such as scarring, bacterial infection, or contact dermatitis were observed.

CONCLUSION. In conclusion, resurfacing with a long-pulsed Er:YAG laser is a safe and very effective treatment modality for pitted facial acne scars.

LASER SKIN resurfacing has become a popular treatment option for many patients with wrinkles, photoaging, and acne scarring.1 Recently resurfacing with the new generation of carbon dioxide (CO₂) and Er:YAG lasers has come to be preferred for the treatment of facial acne scars.2–7 The Er:YAG laser, with a 2940 nm wavelength, has high absorption in water, so it is almost totally absorbed in a very thin, superficial layer of skin and can be used for precise and superficial tissue ablation.6,8,9 The main advantage of the Er:YAG laser is the precise depth control due to the lack of thermal injury.6,10,11 Healing is more rapid compared with the CO₂ laser. There is less postoperative morbidity and fewer complications.6,7 However, because of limited residual thermal damage, ranging from 20 to 50 μm after a typical resurfacing procedure, intraoperative hemostasis is difficult to achieve. Moreover, because the thermal effects of short-pulsed Er:YAG ir-radiation are substantially less than those of CO₂, the rates of intraoperative and postoperative collagen contraction are attenuated as well.12–14 In order to address the shortcomings of conventional Er:YAG laser resurfacing, newer Er:YAG laser systems have recently been developed with longer pulse durations.12 The purpose of this study was to evaluate the clinical and histologic effects of resurfacing of facial acne scars with a long-pulsed Er:YAG laser.

Materials and Methods

Thirty-five patients with pitted facial acne scars were included in this study. The patients’ ages ranged from 19 to 38 years, with an average age of 26.9 years. In 28 patients (17 men, 11 women), clinical improvement and side effects were evaluated. In seven patients, skin biopsy specimens were taken immediately and at 1, 2, 4, and 8 weeks postoperatively for histologic examination. All patients had Fitzpatrick skin phototypes III–V and underwent a pretreatment regimen at least 2 weeks prior to laser therapy. The pretreatment regimen consisted of 0.025% tretinoin cream which was applied nightly, broad-spectrum sunscreen, and cetaphil cleanser. For the anesthesia, topical EMLA cream was used 1 hour prior to the procedure. To maximize patient comfort and compliance during the procedure, intravenous fentanyl...
100 μg was used. All patients were treated with the variable-pulsed Er:YAG laser, a 5 mm handpiece at 7.0–7.5 J/cm² with a 10-msec pulse duration. The laser was fired at 5 Hz, with four to five passes. Laser overlapping was less than 10%. Following laser treatment, patients were managed with the closed technique, using petroleum jelly and gauze. Dressings were changed after 48 hours, and when necessary thereafter. After 7 days the dressings were removed. After laser treatment, oral prophylaxis consisted of acyclovir 200 mg five times and tosufloxacin 150 mg three times a day for 5 days. Also, to decrease postoperative edema, oral prednisone 10 mg three times a day for 5 days was prescribed. After 2 weeks of laser treatment, topical application of 0.025% tretinoin, 4% hydroquinone, and 1% hydrocortisone cream were recommended nightly for 4–6 weeks. Broad-spectrum sunscreen and cetaphil cleanser were also recommended. Facial photographs were taken at baseline and at 2-week intervals postoperatively.

For clinical assessment, photographs taken at pretreatment, 2 weeks, 1 month, and 3 months after laser treatment were evaluated by two independent physicians. Physicians categorized the improvement as follows: poor, improvement less than 25%; fair, improvement of 25–50%; good, improvement of 50–75%; excellent, improvement greater than 75%. And physicians evaluated the side reactions: duration of erythema, pigmentary change, and any adverse events.

**Results**

The results of long-pulsed Er:YAG laser resurfacing for pitted facial acne scars were excellent in 10 patients (36%), good in 16 patients (57%), and fair in 2 patients (7%), a 71% clinical improvement on average (Table 1, Figure 1).

Thermal damage extended approximately 80–100 μm beneath the vaporized layer and was observed immediately after laser resurfacing (Figure 2). Two weeks later, complete reepithelialization was observed (Figure 3). A biopsy specimen obtained at 8 weeks showed thickening of the epidermis, fine new collagen, and high vascularity on the upper dermis (Figure 4).

Posttreatment erythema was present in all patients. In 15 patients (54%), erythema lasted longer than 3 months. Postinflammatory hyperpigmentation occurred in 8 patients (29%), with a mild degree in 6 patients and moderate degree in 2 patients. Hyperpigmentation occurred at 2–4 weeks after laser treatment and lasted longer than 3 months in two patients. One patient (4%) experienced mild hypopigmentation, which began around 3 weeks after treatment and lasted longer than 3 months after treatment. Mild to moderate postoperative acne flare-up occurred in 8 patients (29%). Fifteen patients (54%) experienced an itching sensation that required medical intervention. The duration of itching was 3–21 days (average 8.3 days). No other adverse effects such as scarring, bacterial infection, or contact dermatitis were observed (Table 2).

| Table 1. Degree of Clinical Improvement After Laser Resurfacing |
|---|---|
| Improvement | Number of patients (%) |
| Excellent (>75%) | 10 (36%) |
| Good (50–75%) | 16 (57%) |
| Fair (25–50%) | 2 (7%) |
| Poor (≤25%) | 0 (0%) |

Figure 1. (A) Before treatment, and (B) 3 months after laser resurfacing.
Discussion

The newer variable-pulse Er:YAG lasers have CO\textsubscript{2} laser-like effects, while maintaining the advantages of Er:YAG lasers,\textsuperscript{15} therefore variable-pulse Er:YAG lasers are thought to be effective on pitted acne scars as well as rhytides. Also, long-pulsed Er:YAG lasers show effective hemostasis and some degree of collagen contraction intraoperatively.\textsuperscript{12} Thus long-pulsed Er:YAG laser resurfacing can offer the surgeon an effective compromise between CO\textsubscript{2} and short-pulsed Er:YAG laser resurfacing systems.\textsuperscript{12,16} Compared with short-pulsed Er:YAG lasers, more severe thermal necrosis on papillary dermis was observed on histologic findings.\textsuperscript{2,10} Complete reepithelialization occurred within 2 weeks, as with short-pulsed Er:YAG laser resurfacing. Although our study was not a side-by-side comparison, improvement of acne scars after long-pulsed Er:YAG laser resurfacing was better than the results from conventional short-pulsed Er:YAG laser resurfacing reported previously.\textsuperscript{2,17} The long-pulsed Er:YAG laser’s ability to abrade and its deep photothermal effects might have contributed to this favorable result.

Complications such as postinflammatory hyperpigmentation, prolonged erythema, itching, and acne flare-up were observed after long-pulsed Er:YAG laser treatment. Postinflammatory hyperpigmentation faded or disappeared within 3 months after laser treatment. To prevent or reduce the postinflammatory hyperpigmentation, proper postlaser treatments such as topical tretinoin, hydroquinone, and mild topical steroids in selected patients are thought to be important, especially in darker skinned patients. Though erythema appeared in all patients after laser treatment, the severity of erythema decreased gradually. Prolonged erythema may be due to deep thermal laser effects and postoperative use of topical tretinoin. In cases of mild hypopigmentation, long-term follow-up of at least 12–24 months is needed for the evaluation of late hypopigmentation. Itching was one of the major problems. More than half of the patients experienced an itching sensation that required medical intervention. Fortunately these symptoms were treated easily with oral antihistamines. Acne flare-up was also controlled easily by medical intervention. In conclusion, resurfacing

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<th>Table 2. Side Effects Following Laser Resurfacing</th>
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<td>Erythema</td>
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with a long-pulsed Er:YAG laser is a safe and very effective treatment modality for pitted facial acne scars.

References

Commentary
This study by our colleagues in Korea provides very useful information about laser skin resurfacing in Asian skin. The new so-called variable Er:YAG lasers have gained increasing popularity, especially for treating darker Fitzpatrick skin types. In this study one such Er:YAG laser was used in a “thermal” mode (10-msec pulse duration). While not as great as that of the pulsed CO₂ laser, this variable-pulse Er:YAG laser produces a distinct thermal effect that is significantly different from the shorter pulsed “ablative” mode associated with the “traditional” use of the erbium resurfacing laser.

About half of the patients in this study experienced 3 months or more of posttreatment erythema and nearly a third experienced transient postinflammatory hyperpigmentation. These clinical findings are consistent with the thermal effects produced by this mode of the variable Er:YAG laser. However, there were no significant permanent complications and the overall improvement was good. The results in this report of 35 patients should encourage clinicians that, with proper and skilled use, the new generation of variable-pulse Er:YAG lasers may help us to provide patients with darker ethnic skin new therapeutic options for treating pitted acne scars.

David H. McDaniel, MD
Virginia Beach, Virginia