Dual-Mode Erbium-YAG Laser Skin Resurfacing

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Ablative laser skin resurfacing may give dramatic benefit in skin rejuvenation, although at the cost of significant risk, side effects, and healing time. Two lasers with significantly different physical effects but similar final surgical results are employed: short-pulse CO_2 and erbium-YAG (Er:YAG) lasers (Table 172.1). The absorption coefficient of water and tissue at the near-infrared wavelength of the Er:YAG laser is 18 times that of the CO_2 laser. For this reason, the Er:YAG laser at a short pulsewidth is almost purely ablative. The longer pulse duration and greater thermal damage in Table 172.1 for Er:YAG refer to lasers with a long pulse width coagulative mode. Moderate to deep chemical peels and dermabrasion can achieve results comparable to laser skin resurfacing in smoothing the skin and eradicating rhytids, with some similarities in healing.

The short-pulse CO_2 lasers were available first and are familiar to surgeons performing laser skin resurfacing. The Er:YAG lasers have been available for over 10 years, although the early lasers were underpowered and lacked both a thermal mode for deeper rhytids and a computerized pattern generator handpiece to achieve uniform application. There is a perception that Er:YAG lasers are only effective for fine wrinkles, and will not treat deeper rhytids.

Table 172.1 Comparison of physical properties of Er:YAG and CO_2 lasers

	Er:YAG	CO_2
Wavelength (nm)	2,940	10,600
Thermal damage (μm per pass)	5–100	50–75
Tissue ablation (μm)	20–120	50–60
Pulse duration (μs)	100–50,000	1,000

Multiple studies have documented CO_2 and Er:YAG treatment to be equivalent or near-equivalent in facial laser skin resurfacing. Hughes (1998) noted the measurable skin contraction with Er:YAG skin resurfacing which progressed over 6 weeks of healing and persisted throughout the study. Khatri et al. (1999) noted significantly less prolonged postoperative erythema after Er:YAG treatment with a much lower risk (5 % vs. 43 %) of hypopigmentation, and Ross et al. (2001) noted equivalent results between Er:YAG and CO_2 lasers when treated to equivalent depths.

For more than 16 years, I have used a Sciton Contour dual-mode Er:YAG laser that has not only a high power output (45 W) equal to the better CO_2 lasers but also a variable thermal mode achieved through the use of a longer pulse width, which delivers some thermal effect. This has been an effective and versatile laser, and with this device, I have been able to achieve surgical

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results in over 1,500 cases measured in rhytid reduction and correction of dyschromia that equal the results I was able to previously achieve with the CO_2 lasers. The ultimate advantage of the dual-mode Er:YAG laser is the faster healing time and the marked decrease in risk of scarring or permanent depigmentation. Reepithelialization time and duration of erythema both appear to be significantly less with Er:YAG treatment.

Key Elements of Procedure

Patient Selection and Preparation

Patients with Fitzpatrick 1 or 2 skin type are much easier to work with. Patients should strictly avoid sun exposure for a month before and 2 months after surgery. Patients who tan readily or have significant dyschromia will benefit from preoperative treatment with bleaching creams such as 4 % hydroxyquinone and/or a retinoid such as tretinoin 0.05 % cream.

Preoperative counseling must focus on a frank informed consent, which dispels any misinformation the patient may bring to the visit. A discussion of expected downtime and review of procedural and postoperative photographs of similar patients will promote a realistic appraisal of the plan at hand.

In patients with no history of herpes simplex outbreak who are undergoing upper facial treatment only, such as periocular treatment, I do not generally prophylax with an antiviral medication, and I have only seen one outbreak of herpes simplex ever in such patients. Patients undergoing lower face or full-face laser are prophylaxed with valacyclovir (Valtrex) 500 mg twice daily, beginning 2 days preoperatively and continuing for 5 days postoperatively. Antibiotic prophylaxis is generally determined by other patient features.

Procedure

Up to 2–3 aesthetic units can generally be treated in an office procedure room with nerve blocks and tumescent anesthesia using a buffered 0.2 % lidocaine mixture (epinephrine 1:800,000). It is possible to perform full-face treatment in office, although general anesthesia is preferred.

Table 172.2 Sciton Contour typical full-face settings (low-high)

Pass	Ablation (μm)	Coagulation (μm)
1	60–90	0
2	60–90	25–100
3	60–90	0–50

There are a number of treatment paradigms used by different practitioners. The parameters below are in reference to a Sciton Contour dual-mode Er:YAG laser. Micrometers of ablation are calculated at 4 μm/J/cm^2 energy fluence (Table 172.2).

It is appropriate to use the higher coagulative settings in areas of thick skin with the most profound wrinkles, such as the perioral area. An extra coagulative pass similar to pass two is often needed in those areas. Thinner skin areas such as the eyelids generally receive energies on the lower end of those noted above, as do the cheeks.

Postoperative

Immediately postoperatively the patient is occluded with petrolatum ointment such as Vaseline or Aquaphor Natural Healing Ointment. Alternatively, a sheet dressing such as second Skin (Spenco) may be applied and taped in place or held with a compressive stockinet. Dressings must be changed every day, and the ointments are generally reapplied after soaking with a dilute cool solution of white vinegar (1 ml vinegar/50 ml water) approximately every 3 h while awake.

Patients are seen routinely at days 1, 3, 6, and 12–14. Depending on the depth of treatment, cover-up makeup can be worn 8–14 days after surgery. Erythema is variable, lasting 1–6 months, depending on the patient's skin and depth of therapy. Ultraviolet light exposure is strictly avoided for the first month postoperatively. In patients in whom postinflammatory hyperpigmentation is likely to be a problem, this is initially apparent 4–6 weeks postoperatively.

Fig. 172.1 Patient shown (**a**) preoperatively and (**b**) 6 months postoperatively

Conclusion

Dual-mode Er:YAG laser skin resurfacing is an effective treatment for photoaging skin changes. Appropriate case selection, patient counseling, and preparation will allow for optimal results with appropriate surgical technique and postoperative care. Equivalent results to CO_2 skin resurfacing can be obtained with lesser amounts of postoperative erythema and risk of hypopigmentation (Fig. 172.1).

References

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