# Resurfacing With Er-YAG Laser for the Treatment of Facial Rhytides

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Recebido em 20 de Agosto 1998

Skin Resurfacing with lasers systems enables the treatment of cutaneous alterations which presented unsatisfactory results with conventional techniques. Er-YAG lasers promote controlled superficial skin ablation, decreasing the risks of hypertrophic scars and hypopigmentation. We performed skin resurfacing with Er-YAG laser for the treatment of facial rhytides in 12 patients. We present our clinical results and discuss the postoperative process. Laser research in our country is mandatory as foreign literature cannot define the treatment bases of our singular racial population.

## Introduction

In the past few years, skin resurfacing has virtually revolutionized the field of cosmetic surgery. Some laser systems yielded excellent clinical results but were limited by excessive heat conduction to the surrounding normal skin 1 Residual thermal damage to adjacent tissue could lead to undesirable fibrosis and scar formation [3]. The erbium:yttrium, aluminum, garnet (Er-YAG) laser produces light (at 2.94$\mu$m) in the near-infrared portion of the eletromagnetic spectrum. This broad water-absorption band extends from just under 2$\mu$m to beyond 10 $\mu$m, ensuring the superficial absorption of near-infrared light. When it is Q-switched, however, the Er-YAG laser ablates approximately 5 to 15 $\mu$m of skin and leaves such a thin layer of thermal damage that it is not at all hemostatic [2,7,9,10].

The aim of our study is to perform skin resurfacing with the Er-YAG laser for the treatment of facial rhytides and evaluate the results clinically, as well as the postoperative process.

## Casuistry and methods

Our study was conducted on 12 female patients with age ranging from 27 to 68 years, submitted to skin resurfacing with an Er-YAG laser. The system used was Derma 20, Yokneam-Industrial Park, Israel. It is a pulsed erbium laser emitting non-visible light, in the mid-infrared light. The laser beam was delivered by an articulated arm with a coincident aiming red beam. Irradiation parameters were: $\lambda$ = 2,94 $\mu$m, pulse width of 350 $\mu$m, pulse frequency of 12 Hz with energy of 1.7J and average power of 20W. The procedure was undertaken with a 3mm focused beam, providing 24,05 J/cm$^2$ of energy density per pulse.

All the patients were from the ambullatory of the Division of Plastic Surgery and Burns of the Hospital das Clínicas da Universidade de São Paulo. The skin type was classified according to Fitzpatrick and actinic damage according to Glogau's Classification.

Following authorization and instruction of the they signed an Informed consent. They underwent a pretreatment period with topic agents for at least 30 days. Preoperative skin preparation consisted of a tretinoin cream 0,025% every night with 2% hydroquinone for non - or mild hyperpigmentation and 4% hydroquinone for moderate to severe hyperpigmentation. A 10glycolic acid preparation with either 2% or 4% hydro-

quinone was applied in the morning, followed by a broad-spectrum sunscreen (SPF 15) every 4 hours. On the day of the procedure, treatment with an oral gram-positive antibacterial agent and acyclovir (1000 mg/d) was begun.

Facial photographs were obtained during the pre-, intra-, and postoperative period. Standardized views (on face, $45^o$ oblique, and $90^o$ profile) were used.

**Technique**

The anesthetic procedure was either performed with general anesthesia or local infiltration with 1% lidocaine hydrochloride and 0,5% bupivacaine hydrochloride with 1: 120000 epinephrine and sedation.

The laser was used with the goal of single-pulse vaporization. The treatment area was covered with confluent single pulses with minimal overlap (approximately 10%) by means of a 3mm collimated beam. A layer of non-vaporized, thermally denatured proteinaceous debris resulting from the first pass was removed with saline saturated gauze pads by rubbing vigorously. The second and subsequent passes had the profuse bleeding as stopping point.

Wound care after treatment was directed toward gentle debridement of serous exsudate and necrotic tissue by frequent soaking (Cetaphil). Maintenance of a moist tissue surface with continuous application of an antibacterial ointment (Bacitracin) or petroleum jelly (Vaseline) was used for this purpose. Preoperative topical medications were restarted 3 to 4 weeks postoperatively and continued for a minimum of 3 months (hydroquinone) to 6 months (tretinoin, sunscreen) postoperatively. If areas of itching or a sensation of tighness was noted, 1% hidrocortisone ointement was applied twice daily. Postinflammatory hyperpigmentation was treated with 0,025% retinoic acid cream with 4% hydroquinone every night and sunscreen every 4 hours daily.

**Results**

Results evaluation was based on a questionnaire, clinical and photographic analyses. The patient herself and 2 plastic surgeons analised the following parameters: superficial and deep wrinkles, perioral, periorbital, malar, frontal rhytides and nasolabial fold.

The clinical scoring system used was based on subjective evaluation of wrinkles and the grading system had a 0 to 10 scale based on wrinkles improvement: Excellent (9 and 10), Good (7 and 8), Satisfactory (5 and 6) and Weak (below 4). Medical evaluation resulted from the arithmetic mean of the grades given by both surgeons.

The period analised was 6 months. Postoperative analysis of pain, exsudate, bleeding, pruritus, Herpes simplex infection and postinflammatory hyperpigmentation is also presented.

Tabel 1: Rhytides and nasolabial fold. Patient x Medical Evaluation for Er-YAG

| | Superficial | | Deep | | Perioroal | | Periorbit | | Malar | | Front | | Nasolab | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N=12 | Pat/Med | | Pat/Med | | Pat/Med | | Pat/Med | | Pat/Med | | Pat/Med | | Pat/Med | |
| Excellent | 8 | 4 | 5 | 0 | 6 | 5 | 7 | 3 | 6 | 6 | 6 | 6 | 5 | 3 |
| Good | 4 | 8 | 5 | 6 | 6 | 6 | 6 | 5 | 4 | 6 | 4 | 4 | 7 | 5 |
| Satisfactory | 0 | 0 | 2 | 6 | 0 | 1 | 0 | 4 | 2 | 0 | 2 | 2 | 0 | 4 |
| Weak | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Tabel 2: Percentage Result of Patients and Medical Evaluation for Er-YAG, based on all parameters analised.

| N= 12 | Patient | Medical |
|---|---|---|
| Excellent | 51% | 33% |
| Good | 42% | 47% |
| Satisfactory | 7% | 20% |
| Weak | 0% | 0% |

Tabel 3: Postoperative alterations after Er-YAG laser ( n=12)

| | Pain | Exsudate | Bleeding | Pruritus | Herpes | Hyperpigmentation |
|---|---|---|---|---|---|---|
| N. Patients | 6 | 12 | 12 | 10 | 1 | 8 |

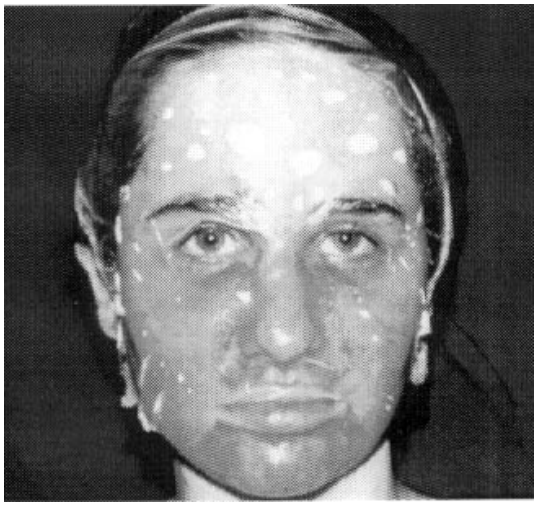

Figure 1. Patient with occlusive treatment -2nd postoperative day (Silon).

Figure 2. Preoperative view- Note superficial wrinkles and hyperpigmented spots.

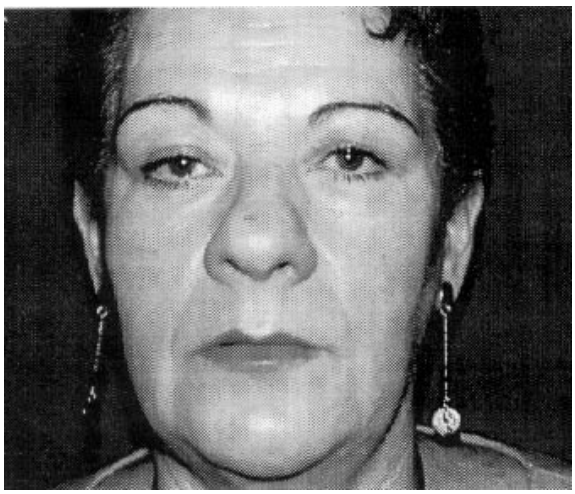

Figure 3. Postoperative view after 6 months. Note improvement of superficial wrinkles and facial laxity. No hyperpigmented spots are seen.

**Discussion**

Some of the patients included in this study should undergo facial and cervical lifting procedures, but only resurfacing was performed at this time. All of the patients took part into a lecture where the procedure was fully explained, after that and should no doubts be raised, an informed consent was signed.

Photodamage skin treatment with topic agents was initiated at least for 30 days before the procedure.

Er-YAG lasers are being used for the treatment of photodamaged skin, rhytides, traumatic and acne scars [8]. Despite the superficial ablation promoted by this system, we were conservative in the first cases in order to avoid possible complications, that resulted in weak results. As we acquired more experience, we were more confident and obtained better results.

Local infiltration and sedation was applied in cooperative patients and in those refusing general anesthesia. Patients with clinical and psychological conditions were submitted to general anesthesia. Regarding the type of anesthesia applied, we considered the general one more comfortable both for the patients and for the medical staff, and the procedure was also faster and more tranquil. Local infiltration and sedation, although possible and sufficient, requires longer surgical period and many repetitive anesthetic applications, leading to some discomfort.

We proceeded the resurfacing based on the Cosmetic Units of the Face, rubbing gauze pads embebbed with saline solution after each pass. We could not remove the entire epidermis after the first pass. The number of passes was based on the presence of bleeding [7] and clinical necessity of ablation. We usually stopped in the presence of profuse bleeding, which avoided further ablation.

All the patients had an oclusive dressing ( Silon ) up to the second postoperative day. Reepithelization occured between the fifth and the seventh day, from the central portion of the face, centrifugally. Pain was easily controlled with conventional analgesics. Despite the antiviral therapy with acyclovir, one patient presented accute onset of herpes simplex infection, with no cosmetic impairment.

Postoperative topic agents were reintroduced on the fifteenth postoperative day to avoid post-inflammatory hyperpigmentation [6,4]. In spite of this, 5 patients presented hyperchromic macules, which were bleached in 4 weeks with the topic treatment mentioned previously. Facial erithema persisted for a maximum of 3 to 4 weeks.

Wrinkles improvement were surprising during the first month, and some of them reappeared as edema

subsided from the second month on. Actinic rhytides showed better results than those caused by muscle movements as well as those of gravitational origin [5].

No complication such as hypertrophic scars, hypochromic spots or eyelids ectropium were evidenced in this study.

## Conclusion

The Er-YAG laser can be considered a good system for the treatment of facial wrinkles, especially the actinic and superficial ones. The erithema is not a problem to the patients as it subsides normally in 3 or 4 weeks. Postinflammatory hyperpigmentation is frequent and can be treated with bleaching agents.

Patients are more enthusiastic than the physicians during the postoperative evaluation.

## References

1. T. S. Alster, Laser Resurfacing of Rhytides. Manual of cutaneous Laser Techniques. Lippincott-Raven, 104-122, 1997.
2. Arndt; Dover; Olbricht. Laser Skin Resurfacing. Lasers in cutaneous and aesthetic surgery, 262-289, 1997
3. T. Halldorsen, J. Langerholc, Thermodinamics analysis of laser irradiation of biological tissues. Appl. Opl; **17**, 3948 (1978).
4. C. Ho, Q. Nguyen, N.J. Lowe, M.E. Griffin, G. Lask, Laser resurfacing in pigmented skin. Dermatol. Surg; **12**, 1035 (1995).
5. D. W. Lober, N. A. Fenske, Photoaging and the skin: differentiation and clinical response. Geriatrics; **45**, 36 (1990).
6. N.J. Lowe, G. Lask, M.E. Griffin, Laser skin resurfacing pre- and posttreatment guidelines. Dermatol. Surg.; **12**, 1017 (1995).
7. G. Teikemeier, Controlled dermabrasion with a newly developed erbium-YAG laser system. Report of a preliminary experience. Hautarzt **47**(7), 530 (1996).
8. G. Teikemeier, Skin resurfacing with the erbium-YAG laser. Dermatol. Surg. **23**(8), 685 (1997).
9. J.J. Walsh, T.J. Flotte, T.F. Deutsch, Er:YAG laser ablation of tissue: effect of pulse duration and tissue type on thermal damage. Lasers Surg. Med, **9**, 314 (1997).
10. M. Yarborough, Taking the confusion out of matching medical lasers to applications. Photonics Spectra oct: 88-94, 1992.