

Use of 2,940 erbium fractional laser in the treatment of facial photodamaged skin. 15 months follow-up

Laser de érbio 2940nm fracionado no tratamento do fotoenvelhecimento cutâneo da face - avaliação após 15 meses

Authors:

Ane Beatriz Mautari Niwa¹
 Juliana Marcondes Macéa²
 Danielle Shitara do Nascimento³
 Luís Torezan⁴
 Nuno Eduardo Sanches Osório⁵

¹ Dermatologist at Private Practice.

² Dermatologist at Private Practice.

³ Dermatologist at Private Practice.

⁴ Master in Dermatology from the Medical School of University of São Paulo (USP) - São Paulo (SP), Brazil.

⁵ Master in Dermatology from the Medical School of University of São Paulo (USP) - São Paulo (SP), Brazil.

Correspondence:

Dra. Ane Beatriz Mautari Niwa
 Rua Dr. Eduardo de Souza Aranha 99
 Conj 11 Itaim Bibi
 CEP: 04543-110, telefone 3849-1888,
 email: aneniwa@gmail.com

ABSTRACT

Introduction: Fractional ablative procedures offer more robust results, with shorter recovery time and lower risk of adverse effects compared to non-fractional ablative methods.

Objective: To evaluate the effects of a new fractional ablative technology employing Erbium laser (2,940nm) in facial photoaging.

Methods: Female patients with moderate facial photodamage were subjected to treatment with a 2,940nm fractional Erbium laser (Palomar Inc., Burlington MA). The parameters varied from 5 to 9 mJ/μb, with pulses of a duration from 250 microseconds to 5 milliseconds. Two to six passes with a 50% overlap were carried out. The clinical evaluations occurred 3 days, 1,4,8 and 12 weeks, and 15 months after the procedure. Three dermatologists who were not involved in the study evaluated the global improvement of the photodamage before and 3 months after the procedures, by reviewing digital pictures, and classified the results according to the following scale: grade 1 = improvement less than 25%; grade 2 = improvement of 26% to 50%; grade 3 = improvement of 51% to 75% and grade 4 = improvement from 76 to 100%.

Results: Female patients (n =12), aged 48 to 78 were studied. After 3 months, 23% of the patients were classified as grade 3, 55% as grade 2 and 22% as grade 1. Significant improvement (grade 2) was observed in 78% and 63% of the periorbital and perioral wrinkles, respectively. Two patients developed transitory post-inflammatory hyperpigmentation.

Conclusion: The fractional Erbium laser was shown to be effective and safe in the treatment of moderate photoaging

Keywords: erbium; lasers; ablation techniques; rejuvenation; laser therapy

RESUMO

Introdução: Os procedimentos fracionados ablativos oferecem resultados consistentes, com menor tempo de recuperação e menor risco de efeitos adversos do que os ablativos não fracionados.

Objetivo: Avaliar os efeitos de uma nova tecnologia fracionada ablativa com laser de érbio (2.940nm) no fotoenvelhecimento facial.

Métodos: Pacientes femininas com fotodano moderado na face foram submetidas ao tratamento com laser de érbio 2,940 nm fracionado (Palomar Inc., Burlington MA). Os parâmetros variaram de 5 a 9 mJ/μb com duração de pulso de 250 microssegundos a 5 milissegundos. Foram realizadas duas a seis passadas com 50% de sobreposição. As avaliações clínicas ocorreram 3 dias, 1,4,8 e 12 semanas, e 15 meses após o procedimento. Três dermatologistas não envolvidos no estudo avaliaram a melhora global do fotodano antes e após 3 meses, através de fotografias digitais e de acordo com a seguinte escala: grau 1=melhora menor que 25%; grau 2=melhora de 26-50%; grau 3=melhora de 51-75% e grau 4=melhora de 76 a 100%.

Resultados: Doze pacientes (n=12) femininas, com idade variando de 48 a 78 anos foram incluídas. A avaliação após 3 meses, demonstrou que 23% das pacientes obtiveram grau 3, 55% grau 2 e 22% grau 1. Melhora significativa (grau ≥ 2) foi observada em 78% e 63% das rugas periorbitárias e periorais respectivamente. Dois pacientes desenvolveram hiperpigmentação pós-inflamatória transitória.

Conclusão: O laser com érbio fracionado mostrou-se eficaz e seguro no tratamento do fotoenvelhecimento moderado.

Use of 2940 Erbium fractional laser in the treatment of photodamaged skin: clinical evaluation and follow up

Palavras-chave: érbio; lasers; técnicas de ablação; rejuvenescimento; terapia a laser

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INTRODUCTION

The treatment of photoaging through resurfacing with ablative lasers such as CO₂ and Erbium lasers has been shown to be effective in several studies (1–3). However, because they are painful procedures, with a long recovery process and the risk of adverse effects such as infections, dyschromias, scars and persistent erythema, their indication is limited at the present time (4–6).

The use of fractional technology for cutaneous non-ablative rejuvenation, in turn, has been shown to be safe and effective in the treatment of light and moderate rhytids^{7,8}, acne scars^{9,10}, other scars¹¹, dyschromias^{12,13}, and in the photorejuvenation of extra-facial areas¹¹. This method employs a medium infrared spectrum laser (1.550 nm), producing microscopic columns of epidermal necrosis and the denaturation of collagen⁷. Since the tissue surrounding the treatment columns remains intact, the reepithelialization process is swift, taking place within 24 hours after the procedure^{14,15}, with minimum risk of adverse effects, particularly compared with non-fractional ablative lasers. Nevertheless, the clinical efficacy of fractional procedures cannot be compared to the results obtained with ablative lasers, especially in the treatment of moderate and deep rhytids^{7,8}. The development of fractional ablative technology combines the high efficiency of ablative lasers with the high safety of non-ablative fractional lasers, in addition to short recovery periods.

OBJECTIVE

The objective of this open, prospective clinical study was to evaluate the effectiveness of a new Erbium laser (2.940 nm) based ablative technology in treating facial photoaging.

METHODS

The fractional Erbium laser employed was a Starlux® platform (Palomar Inc., Burlington, MA) that employs a yttrium, aluminium and garnet crystal (YAG) containing Erbium ions that are excited by the light pulse from a flashlamp, emitting a laser beam with a wavelength of 2.940 nm. Two handpieces attached to the base unit for treatments: 1) 10x10 mm for lighter resurfacing, and 2) 6x6 mm for more aggressive treatments. The fractional emission standard consists of an array of focused microbeams that reach an energy level of 9 mj/ μ b and a density of 920 μ b/cm². The number of microbeams distributed on the skin depends on the handpiece used, the distance among the microbeams themselves, and the number of passes. In addition, this laser offers the option of

operating in dual pulse mode: one short, fixed pulse of 250 μ s that predominantly promotes cutaneous ablation, and another, longer pulse of 3 to 5 milliseconds used for coagulation.

The study involved female patients of phototypes I and III according to the Fitzpatrick classification. The norms of good clinical practice were observed. During the clinical examination, patients presented light to moderate facial photodamage, including alterations in the texture and thickness of the skin, depigmentation, and the presence of rhytids. The following exclusion criteria were applied: use of botulinum toxin injections, fillers or chemical peels in the involved areas in the previ-

ous 6 months; history of keloids; use of systemic isotretinoin in the previous 12 months; ablative laser resurfacing procedure in the previous three years; and pregnancy.

The face was subdivided into areas including the forehead and periorbital regions, perioral and lateral areas of the face, totalling 31 treatment areas. Six patients had the entire face treated and six received localized treatment in the periorbital (4), perioral (3) and forehead (1) areas. One hour before the procedure an anesthetic ointment of lidocaine 23% and tetracaine 7% was applied. The parameters used were: energy level between 5 and 9 mj/ μ b, and pulse duration of 3 or 5 ms for the dual pulse mode of 250 μ s. Two to six passes were accomplished with an overlap of 50%, with a greater number of passes in the areas with deeper rhytids.

After the treatment, the patients were instructed to clean the treated area and apply solid Vaseline three to four times a day for four days. The anti-herpetic viral prophylaxis was only given to patients with a previous history of infection.

In the clinical follow up, the patients were always monitored by the same professional as for the recovery of the skin and the emergence of adverse events immediately after the procedure, three days later, and one, four, eight and 12 weeks, and 15 months after the procedure. Three dermatologists who were not involved in the study evaluated the global improvement of the photodamage before and three months after the procedure using digital pictures standardized for distance and room illumination, according to the following scale: grade 1 = less than 25% improvement; grade 2 = 26–50% improvement; grade 3 = 51–75% improvement, and grade 4 = 76–100% improvement.

RESULTS

The participants (n=12) were aged 48 to 78 years. Immediately after treatment, all patients presented light to moderate erythema and edema in the treated areas. Small bleeding spots were

observed in a scattered pattern, and the dead skin was shed on the fourth day after the procedure, revealing red and swollen skin (Figure 1). The skin recovered by the end of the first week, with slight erythema and edema remaining particularly in the deepest rhytids; at this point it was already possible to observe a natural texture and tone in the treated areas.

The evaluation carried out three months after treatment showed that 23% of patients presented grade 3 of improvement of the rhytids in general (Figure 2), 55% presented grade 2, and 22% grade 1. A significant improvement (grade 2) was observed in 78% and 63% of the periorbital rhytids (Table 1, Figure 3) and perioral rhytids (Table 2, Figure 4), respectively. In addition to the rhytids, we observed a significant improvement of the dyschromias, particularly of the solar lentiginos, and of the texture of the skin.

The treatment was well tolerated, and most of the patients classified the pain level as moderate (average of 4.8 in a scale of 0 to 10) during the procedure.

Adverse events were limited and transitory. One patient



FIGURE 1A: Aspect before the procedure

FIGURE 1B: ASPECT IMMEDIATELY AFTER THE PROCEDURE

FIGURE 1C: Eight days after

FIGURE 1D: Four weeks after



FIGURE 2: Aspect before the procedure and twelve weeks after – submalar area

experienced an acneiform eruption on the sixth day after the procedure, which was attributed to the excessive use of Vaseline, while two others presented post-inflammatory hyperpigmentation in the periorbital (Figure 5) and perioral areas, which improved within two months with the use of corticosteroids and a topical whitening substance. In the evaluation 15 months after the procedure, no scars or hypochromic areas were detected.

DISCUSSION

The ablation achieved using a traditional Erbium laser produces a limited zone of thermal damage due to the high absorption coefficient of the water and the short duration of the pulse, in the magnitude of microseconds. An innovative characteristic of the fractional Erbium laser is its ability to generate a long pulse (in the magnitude of milliseconds) that promotes dermal coagulation around the microcolumns of ablation, deepening the tissular thermal damage zone. A long pulse also allows the practitioner to perform a deeper cutaneous ablation, without diffuse bleeding when it reaches the dermal vessels. In contrast to the ablative lasers, the fractional system of distribution of the

microbeams allows faster cutaneous regeneration, with histological studies ¹⁶ demonstrating fast reepithelialization in up to 12 hours after treatment. With the increase in the number of passes, however, there is an increased probability of microcolumns merging or overlapping, thus increasing the thermal damage and, consequently, the recovery time.

In our study, the advantages of the fractional system were confirmed through the fast regeneration of the skin. Four days after treatment, patients displayed only discreet erythema and edema, which disappeared in up to two weeks in most cases. After 15 months of follow up, no scars or dyschromias – which can appear later after ablative procedures – were observed ².

It is important to note that the results obtained using fractional non-ablative lasers with a wavelength of 1550 nm required an even shorter recovery time, with erythema and

Table 1 - Improvement of periorbital rhytids three months after treatment with fractional Erbium laser

Number of treated areas	Energy level	Number of passes	Rhytids improvement Grade ≥ 2
10	3-8 mJ/ μ b	4-6	78%

Improvement grades: grade 1 = less than 25%; grade 2 = 26-50%; grade 3 = 51-75%, and grade 4 = 76-100%

Table 2 - Improvement of perioral rhytids three months after treatment with fractional Erbium laser

Number of treated areas	Energy level	Number of passes	Rhytids improvement Grade ≥ 2
9	5-9 mJ/ μ b	4-6	63%

Improvement grades: grade 1 = less than 25%; grade 2 = 26-50%; grade 3 = 51-75%, and grade 4 = 76-100%

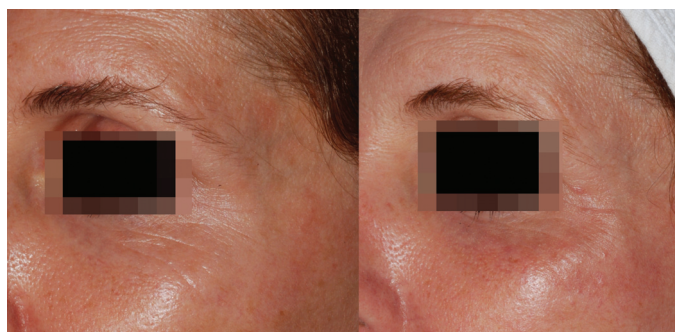


FIGURE 3: Aspect before the procedure and twelve weeks after – periorbital area

edema for up to three days, followed by a “tanned” appearance of the skin and thin desquamation in less than 40% of the patients treated ⁷. Nevertheless, according to our personal experience and reports in the literature ^{7,11}, this procedure has had limited success treating deep wrinkles.

Another advantage of fractional resurfacing is the need for topical anaesthesia only, compared with the sedation required for traditional ablative treatments. The fractional procedures were well tolerated by most of the patients, who classified the pain level as moderate during the application of the laser. In addition, the postoperative period was simplified, without the use of an occlusive bandage, with patients instructed only to apply solid petrolatum to the treated site.

Our results are consistent with those reported by Dierickx and others ¹⁶, which showed an improvement of the periorbital rhytids equal to or higher than one point (on a 0–9 scale) in more than 90% of the studied patients. In the perioral rhytids, more than 50% obtained an improvement of two or more points. Those authors did not observe post-inflammatory hyperpigmentation, possibly due to the prevalence of patients with lighter skin than the patients included in our study.

This is a pilot study in the use of this new ablative technology in the cutaneous rejuvenation of the face. Comparative studies between traditional ablative and fractional ablative lasers are necessary for a better evaluation of both the efficacy and adverse effects, and of the recovery time required by the new technology.



FIGURE 4: Aspect before the procedure and twelve weeks after – perioral area

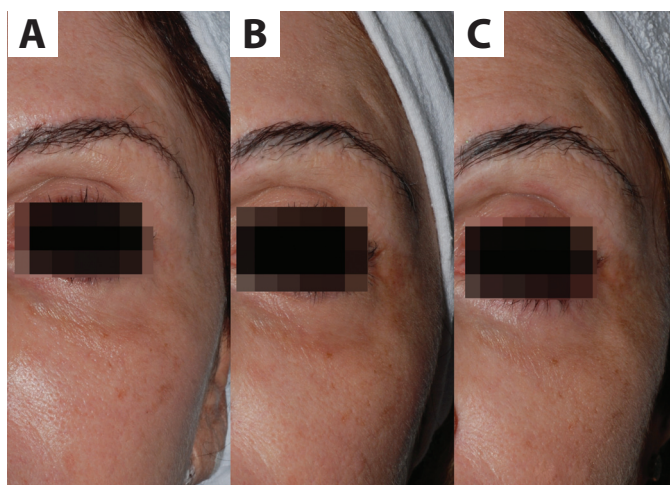


FIGURE 5A: Aspect before the procedure / **5B:** Post-inflammatory hiperpigmentation / **5C:** twelve weeks after

CONCLUSIONS

The fractional ablative treatment with 2.940 nm Erbium laser has achieved an effective and safe reduction of light to moderate degree facial photoaging. Further studies are necessary to better

determine the parameters of energy level, density and pulse duration that maximize the efficacy and safety margin and minimize the recovery time. ●

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