ISSN 1855-9913

Journal of the Laser and Health Academy
Vol. 2016, No.1; www.laserandhealth.com

CASE REPORT: Skin Resurfacing with Er:YAG – the Lost Art of Deep Skin Resurfacing

Oleg Matyunin
Irina & 3K Laser Aesthetic Clinic, Syktyvkar, Russia

ABSTRACT

The process of aging affects all human organs, including the skin. In addition to the effects of chronological aging, human skin is also exposed to the outside environment. Ultraviolet (UV) radiation is of particular importance in so-called photo-induced skin damage. This can present as deep wrinkles, roughness, sallowness, hyperpigmentation, laxity and telangiectasia. Different treatment options are available for the treatment of skin affected by chronological and photo-induced aging, with chemical peels, dermabrasion and laser resurfacing being three of the most commonly used procedures. There seem to be several advantages of laser treatment over chemical peels and dermabrasion, with one of the most useful being the ability to control ablation depth. The most commonly used lasers for facial resurfacing are Er:YAG and CO_2 lasers, which both work by vaporizing the damaged layer of surface skin.

This paper reports on a case of treatment of a severely damaged skin utilizing a 2940 nm Er:YAG laser (Dualis SP, Fotona). Impressive visual results can be achieved using a combination of planar (full spot) and fractional ablative Er:YAG short pulses.

Key words: skin resurfacing, Er:YAG laser.

Article: J. LA&HA, Vol. 2016, No.1. pp.41-44.
Received: March 10, 2016; Accepted: December 5, 2016

I. INTRODUCTION

All human organs undergo chronological aging. Additionally, human skin is in direct contact with the environment and subject to the superposition of environmental damage, primarily ultraviolet irradiation from the sun (photoaging). Sun-induced skin ageing and chronological aging are both cumulative processes [1].

Chronological skin aging is atrophic. This results in a thinner epidermis and fragile skin. On the other hand, skin affected by photo aging can present with an epidermis that is either thinner or thicker than normal. This results in areas of the skin that are hypertrophic or atrophic, respectively. Photo damage causes profound alterations in skin appearance. Gilchrest characterized these changes as: "laxity, roughness, sallowness, irregular hyperpigmentation and telangiectasia"[2].

When the effects of chronological aging in combination with photoaging become bothersome for patients, there are different treatment options available. Chemical peels, dermabrasion or laser resurfacing are the three most commonly used. Dermabrasion has been declining in popularity in recent years. The main disadvantages of dermabrasion are the inability to control ablation depth and, if used by unprofessional personnel, a high risk of infection. Also the use of medium and deep peeling chemical agents has diminished. This may be due to the many benefits of laser treatment over the other two treatment methods. Firstly, with laser treatment, the ablation depth can be precisely controlled and the operator can adjust these depths as needed [3]. Additionally, the heating of the dermis tightens collagen fibers and stimulates new collagen formation. El-Domyati et al. discovered that fractional Er:YAG laser treatment for upper facial rejuvenation stimulates neocollagenesis for up to 6 months after treatment [4].

Erbium:yttrium-aluminum-garnet (Er:YAG) laser and carbon dioxide laser (CO2) are the two types of lasers most commonly used for skin resurfacing. These lasers vaporize damaged superficial skin cells. Following laser treatment, the epidermis re-epithelizes and new collagen fibers are laid down in the dermis [5].

Dramatic results in a patient's appearance are achievable with traditional ablative laser resurfacing, but in recent years the trend has been moving toward minimally invasive procedures with shorter post-procedure downtime. With fractional lasers, vertical columns of ablation are created with areas of spared tissue surrounding them; the aim is to achieve the clinical results observed with traditional ablative laser resurfacing, but with minimal downtime and side effects. However, in certain cases, when the patient is willing to accept the longer downtime connected with more invasive treatment, traditional ablative skin resurfacing can still be a good option to achieve optimal cosmetic effects.

In this case report, ablative laser treatment using 2940 nm laser (Dualis SP, Fotona) has been used for skin resurfacing of a face affected by chronological aging and photoaging. To improve the healing following the laser procedure even further, platelet rich plasma (PRP) was applied.

According to Marx, PRP is: "a volume of autologous plasma that has a platelet concentration above baseline". It is made from autologous blood, so the chance of disease transmission is reduced to zero [6]. PRP contains different growth factors that enhance the healing process through the stimulation of cell replication, promotion of angiogenesis, epithelization and the formation of granulation tissue [7].

II. CASE

a) Patient

A healthy, 67-year-old female, Fitzpatrick skin type 2, with significant signs of chronological and photo-aged skin (wrinkles, creases, ptosis of soft tissues of the face) presented at the Irina&3K Laser Aesthetic clinic with the aim of improving her skin condition (Fig. 1).

Fig. 1: Patient before laser resurfacing treatment, with signs of photoaging, the presence of deep wrinkles, creases and ptosis of soft tissue of the face.

b) Methods and parameters of treatment

DAY 1

Local anesthetic cream was applied to the treatment areas for 40 minutes and removed before the treatment. The patient took a peroral anxiolytic (Dormicum 7.5 mg). Before the treatment procedure, the patient underwent conduction anesthesia with 4% Ultracaine, which was applied bilaterally infraorbital, mental, and buccal at the coronoid process of the mandible. Anesthetic was also injected in the eyelid skin.

Skin resurfacing with Er:YAG (a combination of full-spot and fractional skin resurfacing)

2940 nm Er:YAG laser (SP Dualis, Fotona) was used in the SP regime (pulse duration of 300 usec), using a R04 handpiece with 700 mJ energy, 7 mm spot size and 15 Hz frequency. Using these settings, 2-3 passes were made starting from the forehead to the periorbital area, nasolabial triangle, the cheek, parotid and temporal regions and ending at the submandibular and submental area, until the intra-epidermal layer was reached (whitish coloring of the skin). After that, blue ice gel (2.0% Menthol) was applied to the treated skin (exposure time: 15 minutes) to induce an even further anesthetic effect. Using the same treatment settings as before, additional passes were made until a uniform yellow coloring of the skin had been reached (deep epidermal layer). On the most problematic areas, additional passes were made until the yellow layer had been removed and a shiny surface with drops of exudate had been reached. The next step was fractional resurfacing with the FSO1 handpiece (700 mJ energy, 7 mm spot size and 15 Hz frequency, SP mode). The whole area treated previously was uniformly covered in a single pass. In problematic areas, additional passes were made until punctate bleeding occurred (the papillary dermis had been reached).

Platelet rich plasma (PRP) therapy

PRP was prepared using RegenLab PRP. Then it was introduced in injections into the nasolabial folds first, and then to all areas of deep wrinkles. A cream was prepared (a mixture of PRP and Bepanthen (Dexapenthenol 5%) in a sterile container and handed to the patient. The patient then applied the cream 6 times per day for 3-4 days.

The patient had to take certain precautions, especially to avoid any damage to crusts and to moisten the skin regularly using Bepanthen (Dexpanthenol 5%), Kuriozin (cink hialuronat) and thermal water (Vichy). To avoid herpes infection, preventive doses of acyclovir were prescribed.

DAY 24, DAY 47 and MONTH 16

Botulinum toxin application

Clostridium botulinum toxin type A (Dysport) injections were administered to the forehead and periorbital area on the 24th day after first treatment – 110 ED, 47th day after treatment – 150 ED and 16th month after treatment – 110 ED.

MONTH 4 and MONTH 5 and MONTH 24

Platelet rich plasma (PRP) therapy

PRP therapy was repeated as described above in the 4th, 5th and 24th month after the first procedure.

III. RESULTS

The combination of planar (full-spot) and fractional Er:YAG revealed excellent aesthetic results. The skin condition before treatment is shown in Fig. 1; results of the treatment are shown in Figs. 2-7. In addition to better skin structure, there is a visible reduction of rhytides, laxity, and signs of photo aging.

Fig. 2: Patient immediately after treatment

Fig. 3: 5 days post treatment. Crust covering treated areas.

Fig. 4: 7 days post treatment. Residual redness in treated area.

Fig. 5: Patient 30 days post treatment.

Fig. 6: 4 months after laser treatment. Improvement is visible as a reduction of wrinkles, with rejuvenated and tightened skin.

Fig. 7: 20 months (Figure 1) and 30 months (Figure 2) after first treatment. There is still a significant improvement of skin condition in comparison to before the treatment.

IV. DISCUSSION

Laser skin resurfacing and rejuvenation procedures have been gaining in popularity over the past decade due to increasing demand for healthy, youthful skin. Selecting the appropriate treatment is critical for successful skin resurfacing. In this case, Er:YAG laser (Dualis SP, Fotona) was used with excellent results.

Laser treatment of different skin conditions dates back to the 1960s, when the first laser was invented. Continuous wave CO2 lasers became available in the 1980s and were mainly used for skin resurfacing, but side effects such as depigmentation, scarring and erythema were common. To reduce thermal injury to the tissue, pulsed and scanned CO2 laser systems and erbium-doped yttrium aluminum garnet (Er:YAG) laser systems were developed. Further investigation led to the development of the ablative fractional laser, which was able to deliver the laser beam in vertical columns that penetrate the epidermis and dermis. Fractional laser treatment results in less adverse effects and shorter downtime [8].

The method used in this clinical case was a combination of planar (full spot) and fractional laser treatment. Additionally, PRP was applied on the treated areas and botulinum toxin administered to the forehead and periorbital area.

The use of PRP is common in the field of orthopedic, because it is well known by its ability to increase bone, ligament and tendon healing. Nowadays it is also used for certain applications in dermatology [8]. The combination of PRP and fractional CO2 laser in a study performed by Shin et al. showed an objective improvement of skin elasticity and an increase in collagen density and the number of fibroblasts [9]. A study by Na et al. showed that the application of PRP enhances wound healing and reduces transient adverse effects after fractional laser treatment [10].

V. CONCLUSIONS

Deep skin resurfacing is a technique that is not commonly used in today's dermatology practices. Newer, less invasive techniques are available, and patients usually prefer minimally invasive procedures with shorter downtime. However, under certain circumstances, when patients are willing to accept a longer down-time, excellent aesthetic results can be achieved with traditional laser resurfacing.

REFERENCES

1. G. J. Fisher, et al. "Mechanisms of Photoaging and Chronological Skin Aging," Arch. Dermatol., vol. 138, no. 11, pp. 203–212, Nov. 2002.
2. B. A. Gilchrest, "A review of skin ageing and its medical therapy.," Br. J. Dermatol., vol. 135, no. 6, pp. 867–75, Dec. 1996.
3. T. Neil, "Skin Resurfacing - Laser Surgery: Background, Indications, Contraindications." [Online]. Available: http://emedicine.medscape.com/article/838501-overview. [Accessed: 22-Sep-2016].
4. M. El-Domyati, T. Abd-El-Raheem, W. Medhat, H. Abdel-Wahab, and M. Al Anwer, "Multiple fractional erbium: yttrium-aluminum-garnet laser sessions for upper facial rejuvenation: clinical and histological implications and expectations.," J. Cosmet. Dermatol., vol. 13, no. 1, pp. 30–7, Mar. 2014.
5. R. B. Weller, H. J. A. Hunter, and M. W. Mann, "Clinical Dermatology," 2014, pp. 330–331.
6. R. E. Marx, "Platelet-rich plasma (PRP): what is PRP and what is not PRP?," Implant Dent., vol. 10, no. 4, pp. 225–8, Jan. 2001.
7. J. A. Ross, "Platelet-Rich Plasma - Does It Really Work?," Pod. Manag., pp. 123–127, 2014.
8. M. M. Loesch, A.-K. Somani, M. M. Kingsley, J. B. Travers, and D. F. Spandau, "Skin resurfacing procedures: new and emerging options.," Clin. Cosmet. Investig. Dermatol., vol. 7, pp. 231–41, 2014.
9. M.-K. Shin, J.-H. Lee, S.-J. Lee, and N.-I. Kim, "Platelet-rich plasma combined with fractional laser therapy for skin rejuvenation.," Dermatol. Surg., vol. 38, no. 4, pp. 623–30, Apr. 2012.
10. J.-I. Na, J.-W. Choi, H.-R. Choi, J.-B. Jeong, K.-C. Park, S.-W. Youn, and C.-H. Huh, "Rapid healing and reduced erythema after ablative fractional carbon dioxide laser resurfacing combined with the application of autologous platelet-rich plasma.," Dermatol. Surg., vol. 37, no. 4, pp. 463–8, Apr. 2011.