

FRACTIONAL REJUVENATION OF SKIN WITH PIXEL ERBIUM AND CO2 LASERS

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INTRODUCTION

Fractional Pixel lasers involve major advances in the treatment of facial aging “à la carte”. Thanks to their versatility we will be able to treat each stage of facial aging with ablative systems reducing to a minimum the patient’s recovery time.

OVERVIEW AND TYPES

Fractional Pixel lasers main feature is that they hold many spots per shot on the same area of treatment, hence, there is no uniform ablation of the skin on all of the surface that receives the shots, since it is not treated in full by the laser, just a certain percentage of the skin, that can be greater or smaller depending on the number of spots per area of treatment. This part is approximately 20% of the area of the tissue treated in every shot with Píxel. Therefore, in every laser shot we will treat a certain percentage of the area of the skin, leaving, between every spot, unharmed zones, and these uninjured zones help the skin heal quickly. Fractional Pixel lasers “drill” the skin leaving some areas unharmed, areas which will in turn produce a fast recovery of the skin. (Fig.21-1), (Fig.21-2)

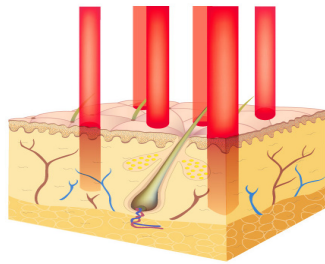


Fig.21-1. The laser spots penetrate the skin forming little micronecrotic columns.

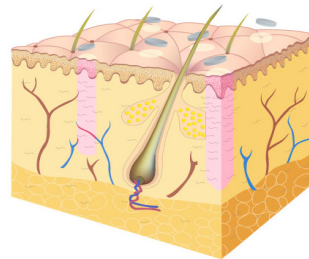
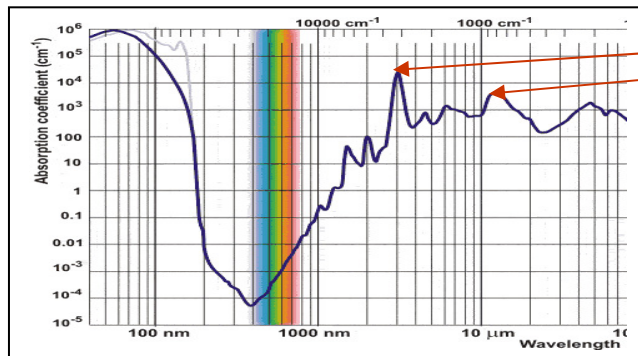


Fig.21-2. The epitelization is complete over the first 48 h producing the shrinking of the skin in three dimensions.

Fractional Píxel lasers will act on the water chromophore, whose absorption rate varies in accordance with the wavelength used. As regards the different wavelengths available, at present we have:

- The Fractional Erbium-Yag (Pixel 2940 nm). Laser
- The Fractional (Pixel CO2 - 10,600 nm). Laser



2940 Erbium-Yag
10600 CO2

Fig.21-3. Absorption rates of water for the different wavelengths of the different fractional lasers Pixel.

PHYSICS OF FRACTIONAL LASERS

Fractional Pixel lasers have a structure similar to that of non fractional lasers, i.e., a power supply unit, a tube that generates the laser emission and a handpiece or scanner that breaks the emission into fractions. By means of a lens a pixel-like area is produced, transforming the emission from the tube in multiple laser spots of varying diameter and number. These spots are applied on the skin in each shot. These micro spots are evenly distributed on the area selected by the handpiece of the device. (Fig.21-4).

The energy density delivered on the tissue will depend on the energy emitted by every beam, divided by the area of the spot in cm², resulting in joules per square centimeter. Thus:

$$ED = \text{Energy in Joules/Area of the Spot} == \text{Joules/cm}^2$$

From the point of view of the interaction Laser-Tissue, the biological effect produced on the tissue will basically depend on the Energy Density applied on that tissue, and on the energy this tissue absorbs.

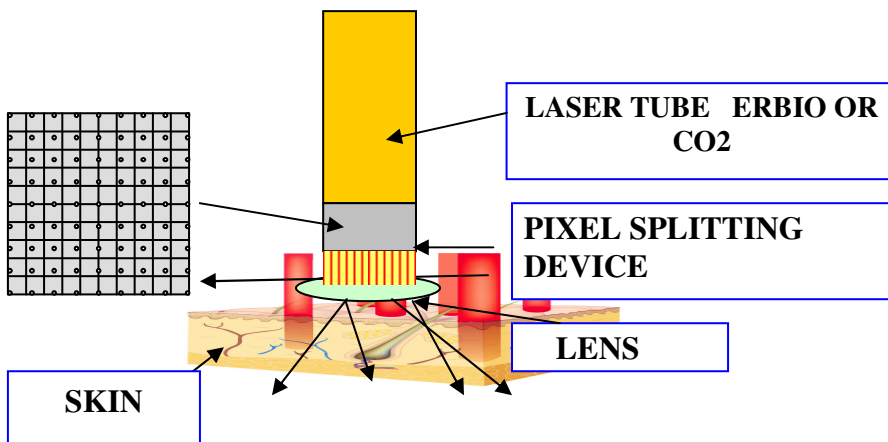


Fig.21-4. Operation Diagram of the fractional pixel laser. The beam is delivered from the laser tube and when it goes through the splitting device it is transformed into multiple spots which, once filtered by a lens, are applied on the skin.

INTERACTION LASER-TISSUE

Now that we have presented the manner of application of the Fractional Pixel lasers on the tissues, we could state the interaction between Laser-Tissue in the case of these devices, based on the physics of lasers. We need to know a number of concepts in view of the therapeutical usefulness of these systems.

Fractional lasers features are:

-Wavelength: 10.600, 2940. The penetration and the absorption of energy of the chromophores will basically depend on these wavelengths.

-Duration of the Pulse: The more the duration of the pulse the more the penetration will be.

-Area of the Tissue treated: Number of impacts on a surface, that correspond to a shot, or percentage of skin treated per area selected by the handpiece or scanner, per shot.

-Size of the Spot/s: It determines the penetration and the energy density applied, depending on the fluence.

-Penetration: It will differ in accordance with the wavelength, the spot and the duration of the pulse used. As a reference, we can establish the penetration of the different systems that exist at present::

*Fractional Erbio-Yag: 10-150 micras per shot.

*Fractional CO2: 25-300 micras per shot.

-Absorption: The target chromophore in these systems is water, taking into account that the percentage of water *stratum corneum* of the skin is 15%, that of the dermis is 70% and that of blood is 90%, so depending on the wavelength we have:

*10.600: Good absorption through water, though 20 times less than Erbio-Yag, high temperature transmission to surrounding tissue, great penetration.

*2940: Great absorption through water, 10 times greater than CO2 and lower temperature transmission to the surrounding tissue than CO2, low penetration.

DIRECTIONS FOR FRACTIONAL LASERS

If we set the indications based on the classification of skin aging after Fitzpatrick, depending of the depth of wrinkles and the elastosis, we could state:

-First degree, Elastosis 1-2-3: Píxel Erbio-Yag (1400mj), Píxel CO2.

-Second degree, Elastosis 4-5-6: Píxel Erbio-Yag (2500 mj),Píxel CO2.

-Third degree, Elastosis 7-8-9: Píxel CO2.

The dosimetric tables used will depend on the system used, the fluence, the density of energy applied, Fitzpatrick's type and personal characteristics of the patient (recovery prognosis). In general we could say, taking Fitzpatrick's classification as reference, that the degree of necessary ablation will depend on the depth of the wrinkles and that the necessary depth of heat will depend on the degree of elastosis in the tissue under treatment.

Fractional Píxel lasers allow us to treat areas that traditionally have been forbidden to other ablative non fractional systems, areas such as low neck, neck-line and hands, allowing us to treat those areas habitually, with fractional Erbio-Yag and CO2 lasers.

METHODOLOGY OF THE TREATMENT WITH FRACTIONAL LASERS

The methodology of the treatment of aged skin with these systems is as follows:

-Pre-Treatment: During 7 to 14 days before the treatment, the patient should use depigmentation creams, sunscreens of high protection factor and hydrating creams based on vitamine C. The use of depigmentation creams is more relevant in the case of patients who

belong to phototypes III, IV and V, to prevent post inflammatory hyperpigmentation.

The preventive therapy of Herpes Simplex virus Type 1 infection

administering valacyclovir (500mg/daily for 6 days starting the day before the treatment), is necessary and advisable.

Ciprofloxacin profilaxis (1gr/daily for 6 days starting the day before the treatment) is advisable in those treatments in which epidermolysis is more noticeable - like with fractional Erbio-Yag and CO2 lasers - as well as with patients with risk factors, such as diabetes.

-Design of the Áreas to be treated: We assess the depth of the wrinkles and the elastosis (Fitzpatrick), assessing the necessary number of passes and establishing an aesthetic recovery prognosis, i.e. informing the patient when he or she will be able to resume normal life. This practice is common to the use of all fractional Píxel lasers, since after the treatment all patients would be fit for daily life from the 4th day after the treatment, as from that day patients will be authorized to use make up and cosmetic products, to mask the erythema on the areas where the treatment was more intense.

-Anesthetic Method: In general and for facial treatments with fractional lasers, the indication of the anesthetic method will depend on the aging degree - according with Fitzpatrick's scale - of the patient and on the results he or she demands. In this way:

*Degree 1 (depth of the wrinkles), Elastosis (1-2-3): We will utilize anesthetic cream based on prilocain and lidocaine (Emla-r) - an occlusive dressing - for 75 minntes prior to the treatment.

Fractional Skin Rejuvenation

DIRECTIONS OF FRACTIONAL PIXEL LASERS ACCORDING TO FITZPATRICK'S AGING DEGREE

		<u>DEGREE OF ELASTOSIS</u>		
		1	2	3
W R I N K L E S	D E P T H	TYPE I	2940(1400mj) 10600	
		TYPE II	4 5 6 10600 2940(2500mj)	
		TYPE III	7 8 9 10600	
	FACE	LOW NECK	NECK LINE	2940 (1400-2500mj)

Fig. 21-6
Indicaciones de los
láseres fraccionales,
según grado de
envejecimiento
Fitzpatrick.

*Degree 2 (depth of the wrinkles), Elastosis (4-5-6): We will utilize anesthetic cream, the way we mentioned before, together with troncular blocks on areas of greater density of wrinkles, where we will have to fall more intensely passing over more times, to achieve the desired results. The blocks we mentioned will be those of the infraorbital and mentonian nerves, and this will guarantee a high degree of anesthesia in the perilabial line and the side of the face.

*Degree 3 (depth of the wrinkles), Elastosis (7-8-9): We will utilize two anesthetic options, anesthetic cream and propofol perfusion (0.05mg/kg/min) with the patient breathing room air spontaneously and conventional monitoring or nervous blocks plus the perfusion of propofol, previously mentioned.

We will not use corticoids I.V. for immediate post treatment.

-Treatment: All Fractional Pixel systems main features are: the physical properties of laser-tissue interaction that we have already mentioned and that in every shot, only a certain area of the skin is treated, approximately 20% per shot. And this will determine the number of passes to be made over an area, where we must take into account that in general, multiple passes generate that on each pass the heat accumulated in the tissue is greater than the ablation produced on the tissue. This effect is very striking in the case of fractional Pixel Erbium-Yag and CO2 lasers; the CO2 laser transmitting more heat to the tissue per pass than the Erbium-Yag laser. This heat transmission to the tissue must be controlled since it will be responsible in the future, for the time the patients will have erythema.

- Post Treatment: It is different, we will conduct a post immediate treatment, on the 1st, 2nd and 3rd days and another one on the 4th day after the session:

*Post immediate treatment and first three days: We will apply emollient creams based on volatile silicone on normal or mixed skins, utilizing regenerating gels on dry skins, applying both continuously, to prevent the formation of scabs. We will proceed to clean the tissue every 12 hs with chlorhexidine solution. Sun exposure will be forbidden.

*Treatment from 3rd-4th day: First, we will clean with Cold Cream soap, after that we will apply a depigmentation agent without glycolic, and then vitamine C cream, sunblock and compact make up. This treatment will have to be carried on until the following session.

CONTRAINDICATIONS OF FRACTIONAL LASERS

Fractional lasers must not be used in:

- Patients with Scarring Disorders:
- Phototypes V-VI:
- Pigmentation Disorders:
- Treatments with Retinoic acid 13-Cis :
- Psychological Disorders:

SIDE EFFECTS OF FRACTIONAL LASERS

Fractional lasers present less than 3% of side effects, which are less important than those produced by ablative non fractional lasers.

The side effects are referred to:

- Hypertrophic Scar or Keloid: It is quite unlikely.
- Millia: On seborrheic skins.
- Hyper or Hypo Pigmentation: Depending on the patients' phototype and on other factors related to predisposition.
- Infection: Very unlikely because of the antiherpetic profilaxis .

CONCLUSIONS

The main advantages of the use of the Fractional Pixel lasers are:

- Fractional lasers imply considerable advances in facial rejuvenation à la carte and in recovery and post treatment comfort, enabling the patients to resume daily activities within 1 to 4 days after the treatment, depending on the degree of intensity used, allowing to carry out the treatments in various sessions, with an interval of 15 to 30 days between sessions.
- It is possible to combine Fractional lasers in one patient, applying the treatment to the specific needs of each area of the zones to be treated.
- Fractional lasers are considered at present, the choice technologies for facial rejuvenation treatments, for patients Type I and II (Fitzpatrick), remaining Type III with an alternative treatment, with various sessions of Fractional CO2 laser .
- Fractional lasers can be applied on the neck line, the low neck and the hands, safely and forecasting the results.

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