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(CASE REPORT)

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Use of endolaser associated with fractional CO_2 laser for facial rejuvenation: Clinical experience in Brazil

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Abstract

Background: The Endolaser used in aesthetic procedures in Brazil is characterized by the use of equipment that emits wavelengths of 1470 nm and 980 nm. Its main therapeutic action is to generate intense heat in the subcutaneous tissues to damage adipose tissue and heat the skin to stimulate collagen production. The CO2 laser is recommended for different dermatological and aesthetic conditions and is a great resource for skin rejuvenation. The association of these two resources is viable due to their therapeutic actions on the skin.

Objective: Considering that the Endolaser is already associated with several therapeutic resources, including fractional lasers, this study aimed to describe the clinical experience of the authors in Brazil regarding its use associated with the fractional CO2 laser for the treatment of facial aging.

Material and Methods: This study is characterized by exploratory research presented through a narrative review, to describe the action of the Endolaser associated with the fractional CO2 laser in the treatment of facial aging. In addition to the literature review, some clinical findings obtained through a retrospective analysis of medical records were added to describe the authors' clinical experience in Brazil of using Endolaser associated with fractional CO2 laser in the treatment of facial aging.

Results: The association of the Endolaser with the fractional CO2 laser proved to be effective and safe under the conditions described in this work. The Endolaser is the first resource to be applied, followed immediately by the fractional CO2 laser. After using the lasers, drug delivery is carried out with a cosmeceutical solution, and in order to accelerate the product's drying on the skin, we cooled the skin with a jet of cold air. Then, with the skin dry, we sealed the treated region by applying 10% retinoic acid. The treatment is completed at home with the application of dexamethasone acetate, moisturizing cream and sunscreen.

Conclusion: The combined treatment of Endolaser and fractional CO2 Laser proved to be efficient and safe, as long as the parameters and protocols suggested in this study are followed. Mainly respecting dermal tolerance to skin heating in order to enhance the results, as with this laser equipment we can optimize performance in different layers, as we understood that they are complementary therapies.

Keywords: Endolaser; Endolift; Laser CO_2; Resurfacing; Rejuvenation

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1. Introduction

Around 2005, a minimally invasive subdermal laser method intended for treating aesthetic dysfunctions called Endolift™ (LASEMAR1500™ machine, Eufoton s.r.l.) became popular in Europe. Developed by an Italian doctor named Roberto Dell'Avanzato, who provided care to more than 4,000 patients using a diode laser with a wavelength of 1470 nm emitted through an optical fiber inserted into the subcutaneous tissue, this technique also became known as "Technique Dell'Avanzato" [1].

In some countries, this therapeutic procedure was also known as endolaser, mainly when used in purely aesthetic procedures, but using equipment that emits wavelengths of 1470 nm and 980 nm [2, 3, 4, 5]. This subdermal laser technique has as main therapeutic goal the generation of intense heat in the subcutaneous tissues to damage adipose tissue and/or heat the skin to stimulate collagen production [6, 7, 8, 9, 10].

Endolaser may be used in various aesthetic conditions on the face and neck, including aging and sagging skin, rosacea, acne vulgaris, acne scars, etc. In the body, lipodystrophies such as localized adiposities and cellulite are the conditions most treated with this technique [4, 6-12].

In order to enhance its results, authors reported that the subdermal laser might be associated with other therapeutic resources such as Microfocused Ultrasound [1, 13, 14], non-ablative fractional laser [12, 15], photobiomodulation [16], and biostimulators [17, 18]. In Brazil, authors [4] reported their four-year experience with the endolaser in association with microneedling, chemical peeling, cryolipolysis and biostimulators.

The fractional CO_2 laser has been used as a skin resurfacing method since 2007, with its efficacy and safety confirmed by clinical practice described in the literature [19]. Therefore, it is a great resource for skin rejuvenation through ablative laser skin resurfacing, however, a careful approach is required to adjust treatment parameters for minimizing complications and to optimize results [20]. It is also indicated for the treatment of different dermatological conditions, as well as for various aesthetic disorders [21].

It has a wavelength of 10600 nm, its main chromophore is water [20]. Therefore, it uses the process of fractional photothermolysis to produce its results through the creation of microscopic thermal wounds on the surface of the skin. Such wounds are divided by areas of unaffected tissue necessary for tissue recovery, thus avoiding side effects and prolonged recovery [22].

Considering that the endolaser is already described as a resource that can be associated with several other therapeutic resources, including fractionated lasers [12, 15], this study aimed to describe the clinical experience of the authors in Brazil using the Endolaser technique associated with fractional CO_2 laser for the treatment of facial aging. For this, a retrospective analysis of medical records was carried out to gather information on the unsightly conditions treated, personal protocols and treatment results, as well as a brief discussion of some data described in the world literature.

2. Methodology

This study is characterized by exploratory research, presented through a narrative review to describe the action of the endolaser associated with the fractional CO_2 laser in the treatment of facial aging. The review explored scientific articles published and available in the following databases: MEDLINE (Medical Literature Analysis and Retrieval System Online), PubMed (National Library of Medicine), SCIELO (Scientific Electronic Library Online), LILACS (Latin American and Caribbean Literature in Health Sciences) and Google Scholar.

As inclusion criteria, sources were selected since mentioned the unsightly condition aging and its pathophysiological foundations, as well as its treatment with endolaser or fractional CO_2 laser. Sources that did not present a summary, those that were not allocated to scientific journals and did not address the topic of the study, and those that did not support the collection of reliable data were discarded.

The bibliographic survey was carried out in Portuguese, English, Spanish and Italian, with the following descriptors: *endolaser, endolift,* CO_2 *laser, resurfarcing, rejuvenation.*

In addition to the bibliographical review, this study included the collection of data obtained through a retrospective analysis of medical records of patients treated for approximately two years (2022 to 2024) in the city of Goiânia, state of Goiás, Brazil, in order to describe the clinical experience of the authors who used the endolaser associated with the

fractional CO_2 laser in the treatment of patients with complaints of facial aging. Personal protocols and treatment results were also described.

3. Results and discussion

3.1. Endolaser

The use of subdermal laser through endolaser fiber optics has become extremely popular in Brazil in recent years, and many professionals use it to treat various aesthetic conditions with great success [23].

It is a technique considered non-invasive [7, 24-26] or minimally invasive [11, 12, 27] and is indicated to improve the appearance of aging skin, minimizing sagging and facial wrinkles. Especially glabellar expression lines. and nasolabial, unsightly conditions of the mandibular border and marionette lines, as well as reducing periorbicular changes in the eyes [6, 7, 24, 28, 29].

3.1.1. Dosimetric parameters used in endolaser clinical practice

To perform a good subdermal laser therapy technique, it is important to master the adjustment parameters of each endolaser equipment used in the treatment. One of these adjustments is the choice of the laser emission regime: continuous or pulsed.

Using continuous mode is preferable to reach the dose of accumulated energy (in joules) more quickly and has a high capacity for tissue damage. Authors have recommended its use for the treatment of bodily conditions that involve both skin and subcutaneous tissue. But it can even be used with some safety in submental fat and the cheek region (middle 1/3 of the face), as long as it is possible to control the speed of energy accumulation and local temperature. The pulsed mode is normally indicated for the treatment of aesthetic disorders involving the skin of the face once it can result in less damage to the tissue adjacent to the target site of laser irradiation, especially in nervous structures. In addition, the accumulation of energy is slower, allowing greater control over temperature increase, generating greater safety [30].

When pulsed mode is chosen, it must be adjusted the duration of the pulse (ON Time or T.On) along with the interval between them (OFF Time or T.Off). Most equipment makes these adjustments in milliseconds or microseconds [30]. And the correct choice of these settings is important because when the laser beam reaches the tissues and is absorbed, a thermal effect will be generated. Thus, the heat generated is then dissipated from the absorption site, mainly by diffusion [31], therefore, this heating and cooling relationship will guide treatment's safety and effectiveness.

In this study, as this is facial rejuvenation, we only used the pulsed mode as the ideal emission regime in the endolaser used, and adjusted T.On to 75 and T.Off of 25 ms. With a small difference, but somewhat corroborating our protocol, some authors [8, 10, 32, 33] reported the use of pulsed mode in subdermal laser procedures, adjusting pulse times (ON Time) around 25ms and interval between pulses (OFF Time) of 50 to 75 ms for both facial and body applications.

Another dosimetric parameter considered very important in the clinical practice of the endolaser is Power. The laser emission power corresponds to the energy release rate, or the amount of light energy emitted by the device every second. It is measured in Watts (W) and is equivalent to 1 Joule per second (1W = 1J s-1). In other words, it can be represented by the formula where the average laser power is equal to the output energy during a certain exposure time: Power (W) = energy (J) / time (s) [34, 35].

In the clinical practice of the Endolaser, power adjustment plays a very important role in the safety and effectiveness of the treatment, as commonly in facial treatments the power levels are lower, normally not exceeding 4 Watts. But in the body the doses are higher and sometimes exceed 7 Watts, depending on the skill and dexterity of the professional, however some authors [5, 30] recommended in these cases, that skin temperature control systems be used. For example, thermographic cameras and/or thermometers infrared so that there are no burns, as the greater the power, the faster the energy accumulation and the greater the speed of local heating.

In our clinical practice we treated regions such as the face, eyelids, neck and submental region, and the power used ranged from 1 to 3 Watts of power (Table 1). This corroborates some authors [3, 8, 9, 13, 17, 18] who used 2 to 3 Watts for treating eyelids and the facial region.

As important as the adjusted power, it must be paid attention to the amount of energy (Joules) that will be accumulated in the tissues treated with the endolaser.

Energy is the amount of power (Watts) deposited in the tissue in each time interval. It is measured in Joules (J) and is the parameter that governs the thermal response of the tissue according to the amount of light energy (Power) delivered by the equipment through optical fiber. It is represented by the formula: E(J) = power (W) x time (s) [34].

As mentioned previously, when we chose the continuous mode (CW) the energy deposit is much faster than in pulsed mode (PW), therefore, the use of continuous mode in some places on the face (for example, forehead, periorbicular region of the mouth and eyes) is not recommended. It happens because even at low powers, energy is deposited faster than in pulsed mode and this will require a lot of attention from the professional to avoid burns or nerve damage. On the other hand, in body areas, the use of pulsed mode can delay the execution of the procedure, as the accumulation of energy occurs more slowly in larger areas [30].

In our clinical practice at apply Endolaser we used a thermographic camera properly calibrated for measurements in health treatments (model C5, manufactured by Teledyne FLIR® LLC), in order to control the skin temperature, which was between 37°C and 41°C (Table 1). Authors [36] mentioned that the safety range for the temperature measured on the skin during the use of the subdermal laser was set between 36°C and 40°C. However, according to some studies [16, 37], the safe and effective skin temperature when using subdermal laser can be between 40°C and 41°C.

In Table 1 it is described some parameters of power, energy and temperature reached in the skin, and thickness of the optical fiber, used in our clinical practice in the Endolaser procedure according to the region treated.

Table 1 Description of dosimetric parameters (power, energy and temperature reached on the skin) and thickness of the optical fiber used with the Endolaser, according to the region treated

Treated area	Power (W)	Accumulated energy (J)	Optical fiber	Reached temperature
Eyelids	1 a 1.8 Watts	Up to 200 Joules	200 or 300 microns	37 to 38 °C
Face	2,5 Watts	250 to 700 Joules by hemiface	400 or 600 microns	41 °C
Neck	3 Watts	1500 Joules in the whole nec	600 microns	41 °C
Submental	3 Watts	500 to 700 Joules	600 microns	41°C

3.2. Fractional CO_2 Laser

The CO_2 laser was one of the first pieces of equipment that used gas as an active medium, having been designed by Kumar Patel in 1964 [38]. In the CO_2 laser production process, after stimulating the gas contained in the tube, the atoms contained in the gas reach higher energy levels through high-energy electrical discharges, emitting photons with a wavelength of 10600 nm when they return to the previous state of rest [39].

The laser beam with a wavelength of 10,600 nm is strongly absorbed by the water in the tissues. Its penetration depth will depend on the water content and not on the melanin or hemoglobin present in the irradiated area. On average, with a pulse duration of less than a millisecond, CO_2 laser light can penetrate tissues about 20-30 μ [40].

Fractional technology photothermolysis was introduced to the market to decrease the side effects and downtime of previous ablative laser technologies while improving comparatively less effective non-ablative lasers. The safety and efficacy of fractional photothermolysis present in the fractional CO_2 laser, have been established since its introduction in 2003 in various skin conditions, including but not limited to, acne, scars, pigmentation and wrinkles [41].

Photohyperthermia effect is used by the fractional CO_2 laser to produce its therapeutic action. Thus, at the moment the light energy from this laser reaches the tissues, the temperature around irradiated area can rise to 100 °C. Hence the intra and extracellular fluids boil and the tissue can be eliminated by vaporization [42, 43]. However, the temperature of the irradiated area can rise above 200°C, producing a carbonization effect as the pulses are repeated. Then, starting from the heating points on the skin, the temperature progressively decreases towards the surrounding tissues (those not directly irradiated with the laser) (Figure 1) [44]. And as this thermal energy is distributed to nearby areas at the point of laser action, there may be varying degrees of thermal damage such as coagulation at around 60°C; protein degradation at 50°C and protein denaturation above 40°C [45].

The fractional photothermolysis present in the CO_2 laser produces thermal microwounds on the surface of the skin, together with regions of unaffected tissue. Those wounds are necessary for the repair process through the different

phases of healing in which cellular action is significantly activated [22, 45]. These microlesions coagulated by the laser are known as micro thermal zones (MTZ). Thus, the fractional CO_2 laser procedure does not remove the epidermis, which makes it known as non-ablative fractional resurfacing. As a result, a deep laser action is observed, but without breaking the skin integrity. There is a staggered tissue exchange with a faster recovery period. MTZS are not visible to the naked eye [46].

Figure 1 Points of thermal injury on the skin generated by the photothermal action of the CO2 laser, surrounded by intact skin responsible for dissipating the heat generated at the points of injury

The heat transfer by the laser is responsible for the denaturation of collagen in the skin. When dissipated by the cells adjacent to the points of injury, this heat causes the so-called residual thermal effect, which also acts as a stimulus for collagen production. Collagen denaturation contributes to the visible contraction of the skin during the procedure and is important for improving wrinkles and sagging in view of the neocollagenesis that normally occurs during the initial six months after the procedure [44-46].

The fractional laser is already described as an effective resource to be associated with the endolaser. Sadoughifar et al. [12] used a non-ablative fractional laser (Erbium - 1540 nm) for the treatment of acne vulgaris immediately after using the Endolift™ subdermal laser technique (1470 nm). It aimed to produce microscopic damage under the skin, promote neocollagenesis to reduce acne scars and destroy sebaceous glands (they used 200 micron optical fiber). As a result, 70% of patients reported improvements after 3 to 4 weeks, and the number of acne and inflammation was significantly reduced. Authors [15] reported the treatment of acne scars combining the subdermal laser (1470 nm) with a non-ablative fractional laser (Erbium - 1540 nm) aiming to reduce scars and depressions in the skin (they used 300 micron optical fiber). Also, 65% of patients in this study reported immediate scar softening with just one application, and for the remaining 35%, 2 to 3 treatments were required.

3.2.1. Endolaser associated with Fractional CO_2 – Clinical experience in Brazil

In the present study, we described our clinical practice in Brazil with the use of the endolaser associated with the fractional CO_2 laser used in face and neck rejuvenation. The services were carried out at the *Regenera Estética Especializada* clinic, located in the city of Goiânia, state of Goiás, and the equipment used was *Genenys* – CO_2, produced by Advice Master (Brazil).

The authors' clinical experience describes the use of the aesthetic endolaser associated with the fractional CO_2 laser through the analysis of medical records that elucidated the treatment of cases with aging skin on the face, submental region and neck. The services took place between 2022 and 2024, with around 50 patients.

The association described here has as its main characteristic the use of the endolaser first, just followed by the application of the fractional CO_2 laser.

During the appointments, we prioritized the use of the CO_2 laser in fractional mode as a basic setting, 75 mJ of energy, and we also prioritized the use of stack 3 to overlap the shots to further deepen the effects and obtain skin contraction. According to some authors [47] it is possible to achieve collagen remodeling with the use of lower power levels associated with stacked pulses. A study [48] showed that the use of lower power associated with pulse stacking can

sustain greater macroscopic tissue contraction after 60 days, compared to the use of high energy with a single pulse. Gnesotto et al. [49] performed fractional CO_2 laser sessions for the treatment of onychomycosis using stack 3 shot overlap.

Right after the shots during the procedure, regarding patients with a higher skin phototype (phototype 3 and 4), the skin showed whitish thermal injury points (Figure 1), as they were lesions with more superficial characteristics. However, in lower phototypes the skin lesions were deeper, and that is the reason they had a brown appearance (Figure 2). This corroborates the reports of Trelles et al. [50] who identified that the skin had a brownish color, particularly in the areas that received extra laser passes.

Our experience also showed that most of the patients treated had downtime between 3 and 7 days, depending on the degree of the injury generated by the laser, and this is supported by several published reports. According to Hoogstra [51], using low energy in CO_2 laser rejuvenation, a skin recovery time of 5 to 7 days is calculated with very low risks of hyperpigmentation. Alcolea López et al. [52] identified that the thin crusts that originate on the skin with the use of fractional lasers disappear 4 or 5 days after treatment. One study [53] described the experience of several authors who reported that reactions such as erythema and moderate pain resolve within 1 week, but in maximum two days after the procedure patients can resume their normal activities. Authors [54] have also reported that treatments in which part of the epidermis but not all, is removed including lasers, are typically associated with intermediate downtime greater than 1 or 2 days, but less than 1 week.

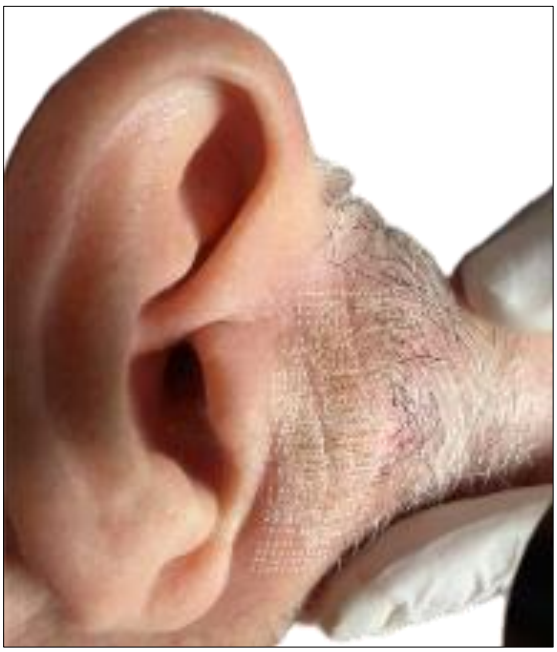

Figure 2 Points of thermal injury on the skin with a "brown" color characterized by a deeper photothermal injury using the fractional CO_2 laser

For the comfort of patients during the procedures, desensitizing measures were adopted with the use of anesthetic substances. As the treatment protocol in this study began with the use of the Endolaser, the anesthetic procedure used in this procedure already produces the comfort necessary for using fractional CO_2 laser. And for the Endolaser technique, a modified Klein solution was applied, which has the following composition: 100 mL of saline solution, 15 mL of 2% lidocaine without vasoconstrictor, 5 mL of 2% lidocaine with vasoconstrictor, 2 mL of sodium bicarbonate. sodium, 2 mL of tranexamic acid 50mg mL-1, and 2 mL of benzopyrone 5mg.

Some authors [7, 10, 25, 32, 56] highlighted the importance of anesthesia to reduce common discomfort during the use of subdermal laser in aesthetic procedures. Likewise, the use of fractional CO_2 laser was described by authors [51, 57-59] as a resource that can generate intense discomfort and consequently, its application may require local desensitizing substances.

The use of tranexamic acid was described by some authors [60, 61] as a substance that can be associated with fractional CO_2 laser, especially when the procedure involves melasmic hyperpigmentation. On the other hand, benzopyrone has an important action in the prevention and treatment of edema after inflammatory injury [62, 63]

For the local anesthesia procedure, before applying the Endolaser vectorized fan-shaped figures are drawn to guide the injection of the anesthetic solution. Thus, approximately 1 mL of Klein's solution is inserted in the direction of each vector in a retroinjection movement using a 23G 70mm microcannula. And before the introduction of the anesthetic through the microcannula itself, a distension of subdermal layers is performed in order to facilitate the optical fiber passage that will be used in the Endolaser. On average, the maximum amount of anesthetic solution used is 30 mL per patient.

Faria et al. [62] reported that the adoption of markings on the skin in the form of vectorized figures allows calculating the volume of injectable product needed for each patient depending on the size of the area to be treated and the topographic characteristics of the region. The authors also reported that the vectors allow a homogeneous distribution of the injectable product and, consequently, optimization of results.

After performing the Endolaser, we immediately applied the fractional CO_2 laser, thus taking advantage of the anesthetic effect obtained with the injection of Klein's solution previously performed for the use of the subdermal laser.

Finishing the procedure, we adopted the delivery of cosmeceutical active ingredients through the lesions produced on the skin. Immediately after treatment with the fractional CO_2 laser, we applied approximately 1 mL of the cosmeceutical solution composed of EGF1%, IGF1% and TGFB3 1% to the entire treated region, manufactured by Victa®, in a manipulation lab (São Paulo, Brazil).

The practice drug delivery using fractional CO_2 laser is well described in the literature [65-69]. And it is characterized by the formation of tissue ablation columns surrounded by coagulation tissue. These channels penetrate the stratum corneum and ensure direct access to the viable lower layers, facilitating the delivery of products applied to the skin [65]. The efficacy and safety of drug delivery associated with fractional CO_2 laser depends on the type of laser used, the configuration of the equipment, the size of the treatment area, the biology of the treatment area and the nature and concentration of the medication used [69]. Some of these parameters, such as the type of wave and pulse duration used in the fractional laser, allow modulating the degree of ablation and the thickness of the coagulation column adjacent to the MTZs. If it is too thick, this coagulation column can impair the diffusion of the medication applied in drug delivery to areas adjacent to MTZs. Furthermore, the use of very high energies can cause deeper injuries, which can reach the vessels, and with this the active ingredient used can enter the bloodstream, an effect that is not desired for drugs that act on the skin [65].

In order to accelerate the drying of the product on the skin, we cooled the skin with a jet of cold air (Freedo® - Fabinject Technology, Taubaté, SP, Brazil). Once the skin is dry, we sealed the treated area by applying 10% retinoic acid.

This practice of cooling the skin using air blasting at low temperatures during the fractionated CO_2 utilization has been described in the literature for some time [70-72]. However, we did not find any reports reporting the use of cold air blasted onto the skin after CO_2 laser, which makes the protocol described here innovative, safe and effective for preparing skin to use retinoic acid.

One study showed that retinoic acid (0.05%) was applied to the skin of pigs 28 days before they underwent CO_2 laser resurfacing. The skin on the control side only received laser resurfacing. The authors concluded that retinoic acid pretreatment can reduce laser resurfacing lesion depth and accelerate healing rates [73]. However, another study showed that the association of microneedling and retinoic acid peeling can be an innovative, reproducible and safe proposal [74]. These authors demonstrated that a retinoic acid solution for peels can be used safely after procedures that lead to loss of skin barrier integrity. This report justifies the safety of sealing with retinoic acid used in the protocol described by our experience.

Finally, the patient is then instructed to wash the skin with water 4 to 6 hours after all procedures (this normally occurs at home) and then apply a dexamethasone acetate cream (1mg g-1) to soothe the injured skin. From the next day onwards, apply Cicaplast® moisturizing cream (La Roche-Posay) and sunscreen for up to 10 days (during this period, avoid using makeup).

The adoption of anti-inflammatory medications after fractional CO_2 laser application is described as effective in reducing post-treatment effects and accelerating recovery of treated skin [75-77]. And there is a possibility of skin dryness after using the fractional laser [78], because of this, it is recommended hydration at home using a moisturizing cream.

Until preparing this study, we did not find reports showing the association of the fractional CO_2 laser with the Endolaser technique or another type of subdermal laser in facial rejuvenation. We therefore considered the experience of the authors described here as unprecedented work in literature on the subject.

3.3. Clinical cases

In the following, we describe some clinical cases treated with the use of the Endolaser associated with the fractional CO_2 laser. The modulation parameters adjusted in both equipment followed specific criteria according to the target area and therapeutic objective. All patients were duly informed about the risks and discomfort associated with the procedures and gave their informed consent to receive the treatment.

- Case 1: Female patient, 60 years old, undergoing treatment for infraorbital sagging and upper eyelid lifting (Figure 3).

Before endolaser procedure, we applied the anesthetic solution (modified Klein solution), with a 25Gx50mm microcannula across the entire area to be worked on. We injected 0.5 mL of solution into each eyelid, as well as intraoral infraorbital block with mepivacaine added of vasoconstrictor.

We settled the endolaser equipment to a power of 1.2 Watts, pulsed mode, 75ms On and 25ms Off. The total energy accumulated in the upper eyelid was 100 Joules and in the lower eyelid 120 Joules, totaling 220 Joules of energy accumulated on each side. We used a 200 micron optical fiber. Finishing the endolaser procedure, we immediately performed the procedure with a fractional CO_2 laser with energy of 90 mJ, a distance of 1.0 mm between the points of thermal injury, overlapping twice. Ninety days after the first session, the CO_2 laser application was repeated using the same parameters.

Figure 3 Result obtained two months after the second treatment session combining the Endolaser and fractional CO_2 laser. It is seen the improvement in the aesthetic appearance with the reduction of sagging and wrinkles in the lower eyelids, as well as the improvement in sagging skin and lifting of the upper eyelid

- Case 2: Male patient, 59 years old, undergoing treatment for sagging and infraorbital wrinkles (Figure 4).

Before the endolaser procedure, we apply the anesthetic solution (modified Klein solution) with a 25Gx50mm microcannula, across the entire area to be worked on. We injected 0.5 ml of solution into each lower eyelid, as well as intraoral infraorbital block with mepivacaine added of vasoconstrictor.

We settled the endolaser equipment to a power of 1.5 Watts, pulsed mode, 75ms On and 25ms Off. The total energy accumulated in the lower eyelid on each side was 150 Joules; We used a 300 micron optical fiber. At the end of the endolaser procedure, we immediately performed the procedure with a fractional CO_2 laser with an energy of 75 mJ, a distance of 1.0 mm between the points of thermal injury, overlapping 3 times.

Figure 4 Result obtained eight days after a single treatment session combining the Endolaser and fractional CO2 laser. It is seen the image that there is still a slight edema and erythema in the treated area, but we have already noticed an improvement in the texture and irregularities of the skin, as well as in wrinkles (still recovering)

- Case 3: Female patient, 60 years old, undergoing treatment for infraorbital sagging and upper eyelid lifting, as well as treatment for complete facial sagging (Figure 5).

Before the endolaser procedure, we applied the anesthetic solution (modified Klein solution) with a 25Gx50mm microcannula across the entire area to be worked on. We injected 0.5 mL of the solution in each eyelid region, as well as intraoral infraorbital block, with mepivacaine added of vasoconstrictor. In the facial region, we injected 8 mL of the anesthetic solution into 8 vectors drawn on each hemiface (1 mL per vector).

For treatment in the eyelid region, it was settled the endolaser equipment to a power of 1.5 Watts, pulsed mode, 75ms On and 25ms Off. The total energy accumulated in the lower eyelid on each side was 120 Joules, and in the upper eyelid 100 joules, totaling 220 Joules of energy accumulated on each side. We used a 300 micron optical fiber. For facial treatment, 2.5 Watt power was used, pulsed mode, 75ms on and 25ms off. The total accumulated energy was 720 Joules per hemiface. Also, we used a 400 micron optical fiber on the face.

Figure 5 Result obtained four months after the third fractional CO2 laser session. It is seen the improvement in the aesthetic appearance with the reduction of sagging and wrinkles in the lower eyelids, improvement in sagging skin and lifting of the upper eyelid, as well as an improvement in sagging across the entire face, promoting global rejuvenation

Finishing the endolaser procedure, we immediately performed the procedure with a fractional CO_2 Laser with energy of 90 mJ, 1.0mm distance between the points of thermal injury, overlapping 3 times. This protocol was used on both the eyelids and the face.

Forty-five days after the first treatment using the combination of laser equipment, the application of only the CO_2 laser was repeated using the same parameters. Forty-five days after the second treatment with fractional CO_2 laser, the application of this laser was repeated, using the same parameters used in the two previous sessions.

In all sessions regarding the treated region, drug delivery was performed immediately after using the fractional CO_2 laser, with a mixture of growth factors (EGF1%, IGF1% and TGFB3 1%), and finished with retinoic acid 10%. Also, the patient was instructed to rinse her face after 6 hours. Retinoic acid was not applied to the eyelid region.

- Case 4: Female patient, 72 years old, undergoing treatment for infraorbital wrinkles (Figure 6).

Before the endolaser procedure, it was applied the anesthetic solution (modified Klein solution), with a 30G needle into papules, in the entire area to be worked on. We injected 1 mL of solution in each infraorbital region, as well as intraoral infraorbital block, with mepivacaine added of vasoconstrictor.

We settled the endolaser equipment was settled to a power of 1.5 Watts pulsed mode, 75ms On and 25ms Off. The total energy accumulated in the lower eyelid on each infraorbital side was 120 Joules and it was used a 300 micron optical

fiber. Finishing the endolaser procedure, we immediately performed the procedure with a fractional CO_2 laser with energy of 110 mJ, a distance of 1.0 mm between the points of thermal injury, overlapping 3 times.

Sixty days after treatment using both laser equipment, the application of only the fractional CO_2 laser was repeated using the same parameters as the previous session.

Figure 6 Result obtained seven months after the second fractional CO_2 laser session. It is seen the improvement in the aesthetic appearance with the reduction of sagging and wrinkles in the lower eyelids, as well as the improvement in the general texture of the skin

- Case 5: Patient, female, 83 years old, undergoing treatment for wrinkles and sagging on the face and infraorbital regions (Figure 7).

Before the endolaser procedure, we applied the anesthetic solution (modified Klein solution), with a 25Gx50mm microcannula, across the entire area to be worked on. We injected 1 mL of solution into each eyelid, as well as intraoral infraorbital block, with mepivacaine added of vasoconstrictor. In the facial region 10 mL of anesthetic solution was injected into 10 vectors drawn on each hemiface (1 mL per vector).

For treating the eyelid region, we settled the endolaser equipment to a power of 1.5 Watts pulsed mode, 75ms On and 25ms Off. The total energy accumulated in the lower eyelid on each side was 120 Joules; We used a 300 micron optical fiber. For facial treatment, 2.5 Watt power was used, pulsed mode, 75ms on and 25ms off. The total accumulated energy was 720 Joules. per hemiface. Also, we used a 400 micron optical fiber on the face.

Finishing the endolaser procedure, we immediately performed the procedure with a fractional CO_2 Laser with energy of 70 mJ, 1.0mm distance between the points of thermal injury, overlapping 3 times. This protocol was used on both the eyelids and the face.

Forty-five days after the first treatment using the combination of laser equipment, the application of only the fractional CO_2 laser was repeated using the same parameters as the previous session.

On the face, in all sessions drug delivery was immediately performed after using the fractional CO_2 laser, with a mixture of growth factors (EGF1%, IGF1% and TGFB3 1%), and finished with retinoic acid 10%. The patient was instructed to rinse her face after 6 hours. Additionally, retinoic acid was not applied to the eyelid region.

Figure 7 Result obtained four months after the second fractional CO2 laser session. It is seen the improvement in the aesthetic appearance with the reduction of sagging and wrinkles in the lower eyelids, as well as the improvement in the general texture of the skin

- Case 6: Male patient, 49 years old, undergoing treatment for facial sagging and wrinkles (Figure 8).

Before the endolaser procedure, we applied the anesthetic solution (modified Klein solution) with a 23Gx70mm microcannula to the entire area to be worked. As well as intraoral infraorbital block with mepivacaine added of vasoconstrictor.

For treatment in the facial region, we set the Endolaser equipment to a power of 2.5 Watts, pulsed mode, 75ms On and 25ms Off. The total energy accumulated in the hemiface of each side was 500 Joules; We use a 600 micron optical fiber.

A power of 2.5 Watts was used, pulsed mode, 75ms on and 25ms off. Total energy accumulated 500 Joules on each side, using 600 micron fiber.

Finishing the endolaser procedure, we immediately performed the procedure with a fractional CO_2 Laser, with energy of 90 mJ, 1.0mm distance between the points of thermal injury, overlapping 3 times.

Figure 8 Result obtained ten days after treatment. We can also see dark crusts from the fractional CO2 laser in the image, still promoting peeling. We observed a reduction in the nasolabial cushion, as well as a significant improvement in infraorbital wrinkles

4. Conclusion

Procedures that use high-power lasers for aesthetic purposes must follow safe protocols that respect dermal tolerance to skin heating. This combination must be properly adjusted to skin thickness, phototype, degree of sagging and aging. The expected results, combining the Endolaser and the fractional CO_2 laser, aim to retract the skin, produce collagen, elastin, neovascularization and increase dermal thickness.

It must also be considered that there is a limit considered therapeutic for aesthetic procedures carried out with local anesthesia in an office environment, without the patient needing to rest. None of the clinical cases presented complications or adversities.

We conclude, therefore, that rejuvenation by combining the endolaser and fractional carbon dioxide (CO_2) laser, as long as the parameters and protocols suggested in this study are followed, proved to be safe and effective by presenting lasting, progressive results and with a high level of customer satisfaction. It is because with the association of these laser equipment it was possible to optimize performance in different tissue layers, as we understand that they are complementary therapies.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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