



THE 4T REJUVENATION: ASSOCIATION OF PAN-FACIAL PMMA FILLING, FRACTIONAL CARBON DIOXIDE LASER, RADIOFREQUENCY, AND BOTULINUM TOXIN

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ABSTRACT

Introduction: The use of associated less invasive techniques can be an alternative skin rejuvenation treatment. **Objective:** To demonstrate the efficacy and safety of the 4T treatment. **Methods:** Retrospective study of patients that underwent rejuvenation treatment using 4 different techniques simultaneously: polymethylmethacrylate (PMMA) filling, fractional CO₂ laser, radiofrequency, and botulinum toxin. More than 1,400 patients who underwent this treatment between December 2009 and July 2019 were analyzed. **Results:** Results were very good in all patients submitted to the 4T technique as documented by pictures, assessment of the medical team and by the patients. Follow-up was similar to the single use of CO₂ laser with edema for 2-3 days, additional 3-4 days until complete skin scaling and decrease of the swelling (downtime 5-7 days). It was possible to reestablish the natural volumetric loss caused by ageing and there were no complications in any patient. **Conclusion:** Treatment with the 4T technique is effective and safe for facial rejuvenation and can enhance a good aesthetic result as assessed by physicians and patients.

KEYWORDS : rejuvenation; CO₂ lasers; facial aesthetic; polymethylmethacrylate; laser therapy

INTRODUCTION

There has been increased concern with looks and a healthier lifestyle. Some movements or repetitive contractions of the intrinsic muscles used for facial expression are the main cause of expression lines¹. Ageing carries an important decrease of elastin and collagen in the skin mainly due to genetic and environmental factors such as smoking, alcoholism, and exposure to sun light. The causes of facial ageing have to be known in order to suggest a rejuvenation treatment. There are 2 fundamental factors that lead to an aged appearance: loss of skin collagen and elastin and loss of volume. Facial rejuvenation treatments try to reverse the effects of ageing. For this purpose less invasive techniques are more and more used in cosmetic medicine^{2,3}. When these techniques are associated better results are obtained.

Nowadays lasers are used for skin rejuvenation. CO₂ laser has the capacity to apply high power with a short pulse thus effecting changes in the skin's look and function. This laser generates heat and shrinks the skin by denaturation of the collagen⁴. The main skin hardening process is caused by collagen shrinkage, but vaporization of the intracellular water and ablation also contributes. Next, scarring starts with high collagenase rates that degrade the collagen matrix and promotes the

reconstruction of the epidermis⁵. CO₂ laser generates micro-thermal zones (MTZ) and exposes the reticular dermis directly to the action of radiofrequency that stimulates new collagen formation even more and favors tissue contraction⁶. New collagen genesis occurs for months. When wrinkles are very deep they may exceed the ablation depth^{7,8}. Fractional CO₂ laser is the gold standard in ablation skin rejuvenation and radiofrequency is one of the main non-ablative treatments of wrinkles and flaccidity. The radiofrequency power accelerates tissue contraction as it stimulates cell proliferation, collagen deposit, and the formation of granulation tissue⁹. Both technologies act simultaneously and synergistically.

Not only must skin quality be improved, but there must also be the reestablishment of the facial volume lost with ageing. This is only possible with the use of volumizers. Soft tissue fillers are often used in facial rejuvenation. With this technique it is possible to remodel the aged face, to increase the volume and to decrease flaccidity with minimal side effects^{10,11}. Using polymethyl methacrylate (PMMA) filling presents the advantage of a non-absorbable material which therefore has a definitive effect¹⁰ stimulating collagen neogenesis at the implant sites¹².

To obtain an enhanced result in facial rejuvenation, mainly in the upper third of the face, treatment of hyperkinetic wrinkles with botulinum toxin is advised¹³. The toxin isolated from the *Clostridium botulinum* induces muscle palsy due to the inhibition of acetylcholine at the muscle junction¹⁴. This toxin is efficacious and safe for cosmetic treatments^{15,16}. In order to obtain a successful procedure it is necessary to know the physiology, anatomy and to be aware of its risks and complications¹⁷. Some precautions have to be taken to avoid undesired reactions. For instance, drugs and food intake have to be stopped before the procedure because aspirin, non-steroidal anti-inflammatory drugs, garlic and fish oil inhibit platelet aggregation and increase blood clotting time. The use of botulinum toxin is contraindicated in patients with peripheral motor neuropathy or functional neuromuscular disorders such as myasthenia gravis, Eaton-Lambert syndrome, skin infection or inflammation at the injection site, and pregnant or breastfeeding women. The use of botulinum toxin is a safe and efficient non-surgical method. Although rare, it is of utmost importance to know possible adverse effects (nausea, malaise, fatigue, skin rash)¹⁸.

The 4T treatment presented in this paper proposes the simultaneous use of 4 treatments (filling, CO₂ laser, radiofrequency, and botulinum toxin) in a single intervention performed at outpatient clinics with the patient awake under local anesthesia participating actively in the entire process. We start with the volumizer followed by the fractional CO₂ laser simultaneously with the radiofrequency and, finally, the botulinum toxin. The aim of this paper is to demonstrate the safety and efficacy of this treatment that associates polymethylmethacrylate filler, fractional CO₂ laser, radiofrequency, and botulinum toxin simultaneously in this sequence.

METHODS

First, the assessment file is completed with a patient history, record of previous treatments, signed informed consent and pictures of the before status. After the preliminary assessment some patients undergo skin preparation before the CO₂ laser in accordance with our facility's protocol, which includes skin type, ethnicity, and presence of pigmented dots. This is done to prevent the risk of post-inflammatory hyperpigmentation that happens in some cases and routinely we start with skin lightener creams in the third week according to the individual assessment of each patient. Also, preventive treatment for herpes is used in patients with previous history of infection.

Areas to be filled (zygomatic bone region, mandible area, sulci, temporal and frontal regions) are marked, topical anesthetic cream is applied (for the fractional CO₂ laser) and then we do supraorbital, infraorbital and mental nerve block after the oral painkillers were taken.

The 4T treatment starts with the subcutaneous filling with 70x90mm non-traumatic blunt-tip microcannulas to avoid blood vessel or nerve injury and to reduce the risk of bleeding or ecchymosis and not to allow the product to reach the dermal planes, as the CO₂ laser acts on the dermis. Filling with PMMA is done on deep planes, generally close to the periosteum in the malar, mandibular and mentonian areas and in the deep subcutaneous in areas with deep wrinkles or creases. The product is also used in the frontal and temporal regions and in some patients tiny amounts of filling are used all over the subcutaneous to stimulate collagen synthesis.

After the pan-facial filling, fractional CO₂ laser is associated to radiofrequency. At each CO₂ laser shot a radiofrequency shot is given simultaneously for 3 seconds. The DOT/RF CO₂ laser follows the same principles, care and precautions of the conventional laser. After the filling and the application of the fractional CO₂ laser associated to radiofrequency we use botulinum toxin as usual, even when the area presents hyperemia and decreased mobility due to anesthetic block. After the use of botulinum toxin the restructuring post-laser cream is used.

This study was approved by the Research Ethics Committee of the Veiga de Almeida University under protocol number 43306820. 5. 0000.5291.

RESULTS

After applying the 4T technique, results were considered very good by the medical team and the patients, as showed by the pictures (Fig. 1-4). Post-procedure followup was similar to the treatment using only CO₂ laser with swelling for 2-3 days and another 3-4 days till the complete scaling of the skin and reduction of the swelling (downtime: 5-7 days). It was possible to reestablish the natural volumetric loss of ageing and the skin was recovered without severe adverse effects or complications.



Figure 1. Before (left) and after (right). Review 14 days after the 4T rejuvenation technique (only 1 session, without complementation or photo editing); 24 ml of 10 and 30% filler were applied to the malar and mandibular regions, nasolabial fold, temporal area and lip contour. Fractional DT/RF CO₂ laser and botulinum toxin were used. Single intervention combining all 4 treatments.



Figure 2. Before (left) and after (right). Rejuvenation associating pan-facial filling (mandibular rim, nasolabial fold, and Marionette line, chin, lip contour and the "bar code"), fractional DOT/RF CO₂ laser and botulinum toxin.



Figure 3. Before (left) and after (right). 4T Rejuvenation – 60 years old patient: 26ml of pan-facial PMMA fractional DOT/RF CO₂ laser and botulinum toxin.



Figure 4. Before (left) and after (right). 4T Rejuvenation – filling of the whole facial subcutaneous tissue (frontal, temporal, malar, mandibular border, lip contour) with 33 mL of 30% filler associated to DOT/RF fractional CO₂ and botulinum toxin.

Significant improvement was noticed after facial filling not only affecting the facial features as with the reestablishment of the facial volume, but also with decreased flaccidity after fractional CO₂ laser. We obtained a natural-looking result in a single intervention using the same local anesthesia; the recovery time was similar to the sole application of CO₂ laser. Thus, we had an important synergistic effect at different dermal planes using hypodermic RF CO₂ laser with PMMA implant.

DISCUSSION

In this paper we show that 4 well know techniques can be associated, thus adding their benefits. The 4T treatment is minimally invasive, takes advantage of a single downtime, the same anesthesia and is performed in 1 day.

CO₂ laser treatments cause changes in the function and appearance of the skin⁴. When the physician knows the structure and physiology of the skin¹⁹, he obtains excellent and safe results without any complication. When the CO₂ laser is associated to radiofrequency it acts as the main non-ablative technology to overcome flaccidity. The association of these two techniques promotes cell stimulation and proliferation, granulation tissue and collagen deposit⁹.

Several filling agents are used to treat wrinkles and pan-facial dermal lipodistrophy²⁰. PMMA is a non-absorbable product that stimulates collagen¹⁰. It was applied to the deep dermal planes to reobtain the volume of the face before the use of DOT/RF CO₂ laser. There was no incompatibility between these treatments. Our experience with PMMA allow us to affirm that this product is efficient and safety, mainly when used in deep surface and in adequate volume^{21,22,23,24}.

The botulinum toxin inhibits the release of acetylcholine at the neuromuscular junction and induces muscle palsy that is largely used in cosmetic medicine due to its safety and efficacy^{14,15,16}. We applied the toxin according to the traditional methods and even after the CO₂ laser it was possible to mark the skin with white pencil and the procedure was totally painless in the frontal region due to the supraorbital nerve block.

We chose to use the botulinum toxin after the fractional CO₂ laser and radiofrequency to decrease the risk of inactivation of the toxin due to the high temperature, although several studies of combined treatments in which the toxin was injected 10 minutes before radiofrequency and jag laser showed no changes of the toxin after 3 weeks³. In one of our cases there was paralysis because of the botulinum toxin beyond the desired area, probably this happened by the vasodilatation caused by the fractional CO₂ laser, which was resolved using therapy with an electrical stimulus used to produce a local muscle contraction three times per week during one month.

The combination of treatments such as the 4T technique, which uses facial filling followed by fractional CO₂ laser, radiofrequency, and botulinum toxin promotes facial rejuvenation with more natural results and, additionally, has the advantage of being a non-invasive treatment²⁰. If used in several sessions these procedures would have no synergistic effect and the patient would have to be submitted to several interventions, reviews, anesthetics, and healing processes on different days.

CONCLUSION

Treatment with the 4T technique is effective and safe for facial rejuvenation and can enhance a good aesthetic result as assessed by physicians and patients.

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