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REVIEW ARTICLE

SIMULTANEOUS EMISSION OF WAVELENGTHS OF 980 NM AND 1470 NM FOR FACIAL REJUVENATION

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ABSTRACT

The search for non-surgical treatments to treat localized fat and sagging skin has been growing in recent years. Currently, there is a significant search for facial harmonization, with improved contour and tissue rejuvenation. Due to its physical and biological characteristics, endolaser has been investigated for this type of therapeutic approach, but there is no consensus on the best parameters to use, including the wavelength. Therefore, the aim of this study was to evaluate a treatment protocol using the association of two wavelengths emitted simultaneously to improve facial contour and rejuvenation. For this purpose, a 61-year-old patient with an ageing appearance and moderate to severe sagging skin was selected. Photographs were taken to compare before and after, as well as a cutometer assessment of the sagging degree. The results showed an improved appearance of the skin tissue with a significant improvement in skin elasticity and viscoelasticity. As a result, we can conclude that endolaser treatment using two wavelengths simultaneously can reverse the age-caused damage, mainly by improving the tissue matrix and sagging skin.

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INTRODUCTION

The use of high-powered lasers for minimally invasive treatments in dermatology and aesthetics is growing. In general, reports in the literature point to two different wavelengths, 980 nm and 1470 nm, both of which have the main affinity for water. Considering this fact, its application aims to significantly increase the temperature in the subcutaneous and cutaneous tissue layers, which reflects in a solidification of the adipocytes or else protein denaturation (Badin *et al*. 2001). Considering the mechanism of laser action, it is known that the target chromophore is directly related to the wavelength of interest. In the case of high-power lasers, the main effect to be achieved is selective photothermolysis. Selective photothermolysis is a heating mechanism using laser light, which is designed to destroy the target tissue. So, this therapeutic resource can be used to remove hair, remove blemishes and even reduce wrinkles, depending on the chosen application strategy (Petti, Stoneburner, and McLaughlin 2016; Woodhall *et al*. 2009). In the case of infrared lasers, selective photothermolysis is easily achieved by selectively absorbing a brief pulse of radiation, which generates and confines heat in target chromophores such as melanin or water. The heat is first confined and then dissipated by thermal diffusion to adjacent tissues. Generally, endolaser equipment has wavelengths above 900nm, and in this range of the light spectrum, selectivity is mainly aimed at water and hemoglobin. Considering that the subcutaneous and cutaneous tissues have a significant amount of water molecules, the technology is promising for achieving the expected results (Goldman, 2006; Khoury *et al*., 2008; Mordon *et al*., 2008; Neira *et al*., 2002; Anderson and Parrish, 1983; Weiss *et al*., 2005). Another advantage comes from the high temperature reached in the tissue, which denatures proteins such as collagen Several procedures are used in facial aesthetics to reverse or minimize the aging process. Among them, the high-power laser has been gaining ground, as it is

considered a minimally invasive technique, without long recovery periods and with clinically relevant results, mainly related to the structure of the tissue matrix and sagging (Kempeneers *et al*. 2022; Lawson *et al*. 2018). The literature points to investigations into the use of endolaser with isolated wavelengths, so there are few treatments that combine two different wavelengths in the facial region. The aim of this study was to evaluate an application protocol using the simultaneous emission of 980nm and 1470nm wavelengths in the region of the aged face.

Endolaser technology: Endolaser technology has advanced in recent years and is currently used for a variety of aesthetic approaches. The usual use of this type of technology is the 980nm or 1470nm wavelengths, which are used for surgical and vascular procedures. However, a distinguishing feature is the possibility of using these two wavelengths simultaneously in the same application. Myra equipment, developed and manufactured by the Brazilian Medical Equipment Industry - Ibramed, offers this possibility. In addition, the equipment has continuous and pulsed modes, with the main parameters for adjustment being 46W power, duty cycle (1 to 99%), frequency (1Hz to 20,000Hz) and energy (calculated by adjusting the power). Another advantage is the automatic calculation when the pulsed mode is chosen. Another interesting feature is that since the equipment allows visualization of the energy, it is possible to control the amount of energy per vector, as well as obtain the total energy value at the end of the procedure. Versatility lies in the possibility of using fibers of any type and size, as its input is universal and recognizes when the fiber is connected.

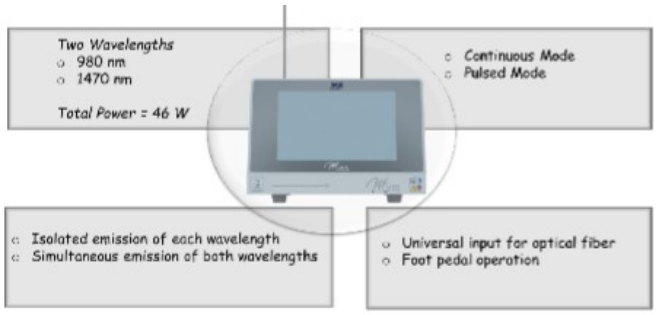

Figure 1. Differences in the Myra equipment

METHODS

Subjects Selection: The patient was selected through a previous anamnesis that identified their classification according to the inclusion criteria as aged skin, apparent wrinkles and moderate to severe skin laxity. Exclusion criteria included decompensated diabetes, coagulation problems, autoimmune diseases, active infections or dermatitis, cancer and autoimmune diseases, pregnant or lactating patients and those who did not agree to sign the informed consent form for this study. This clinical study was approved by the Research Ethics Committee of Centro Universitário Amparense - UNIFIA under No. 7.187.357.

Protocol: For this study, we used the Myra equipment, manufactured and developed by the Brazilian Medical Equipment Industry - IBRAMED. The clinical protocol used endolaser emission with two different wavelengths (980 nm and 1470 nm), both emitted simultaneously. First, the face was antiseptically cleaned. The treatment region was then marked out, thus isolating the main risk areas. Soon after, treatment vectors were considered to facilitate the application of 2 ml of lidocaine local anestheticdiluted in 8 ml of salinein the treatment region. After the area was properly anaesthetized, the laser was applied. It should be noted that the procedure was carried out in a sterile environment, with the therapist properly equipped and a sterile field at the application site, using 600 µm sterile fiber. To start the procedure, the fiber was inserted into the first vector and after it had been fully inserted, the high-powered laser began firing through the equipment's foot pedal, and it was interrupted when the final extension of the vector was reached. Subsequently, the second vector was applied, continuing until all the vectors established in the treatment region were completed, encompassing all the areas until the face as a whole was finished. The laser parameterization was set at 1.5 W of power, adjusted for each wavelength, peak power of 3.0 W, in pulsed mode with a duty cycle of 40%, 10 MHz frequency and simultaneous emission of both wavelengths (980 and 1470 nm). The total amount of energy in the the CK3 region on both sides was approximately 250J, considering 125J on each side of the face for this region, considering 6 vectors and 12 passes. In the lower cheek and jowl region, the energy accumulation reached 225J on both sides, being 112.5J for each side of the face, considering 6 vectors and 12 passes. In the chin region, approximately 60J of total energy was applied, considering 5 vectors and 8 passes.This treatment method does not require recovery time or downtime after the procedure. However, drainage sessions are considered, and in some cases, a containment band to assist in the establishment of local edema.

Evaluation: The evaluations were performed by the same evaluator blinded to the treatment at different times: before the treatment, one month and five months after treatment session.

Phototype classification: Skin phototype was classified according to the Fitzpatrick Scale (table 1).

Table 1. Fitzpatrick scale for classifying skin phototype

Phototypes	Characteristics	Sensitivity to the sun
I - White	Burns easily, never tans	Very sensitive
II - White	Burns easily, tans very little	Sensitive
III - Light Brunette	Burns moderately, tans moderately	Normal
IV - Moderate Brunette	Burns little, tans easily	Normal
V - Dark brunette	Burns rarely, tans a lot	Not very sensitive
VI - Black	Never burns, fully pigmented	Insensitive

Source: Suzuki *et al.,* 2011.

Photo analysis: For the photographic record, the iPhone 16 Pro camera was used at a standardized distance of 80 cm from the patient. To assist, a tripod was positioned 1.05 m from the floor, centered in a room with a white background intended for the photos, using standard lighting (central focus of white light). In addition, three positions were determined for the standardization of the photos: frontal, lateral and at 45° (between frontal and lateral), with the gaze directed towards the horizon. The captures will be made at 1.2 mm zoom, using a top flash. The images will be captured before the treatment, one month after the application and five months after the application.

Evaluation of skin elasticity and viscoelasticity: Skin elasticity will be measured using a cutometer® MPA 580 (Courage & Khazaka GmbH, Köln, Germany). The parameters

that will be measured are: R0 = skin viscoelasticity, elasticity total; R3 = maximum elasticity amplitude;R5= liquid elasticity; R7 = skin firmness. The acquisition of these measurements will be standardized on the CK3, temples and jowls points.

Evaluation of sagging skin: To assess the appearance of firmness, tissue texture and skin laxity, a questionnaire will be administered beforeand five months after the procedure, as described in the study by Jones *et al*., 2017.

- For firmness, 0=very firm and 10=serious lack of firmness.
- For texture, we considered 0=no wrinkles or rough appearance and 10=severe wrinkles
- For sagging, we considered 0= minimal sagging and 10= extreme sagging

Evaluation of expertise committee: To evaluate the before and after photos, three independent evaluators were recruited who were experienced in the field, blinded to the treatment, and did not take part in any step of the study design and data collection. The captured photos were sent to the three evaluators who, based on their field expertise, rated the progress of the treatment, mainly in terms of the improvement of the aesthetic aspect, also aiming to improve the facial contour.

Evaluation of the patient's sensory perception in relation to treatment: During the procedure, the volunteers will be asked about the sensations of pain, discomfort and warmth. To quantify this information, the individual indicated on the Visual Analogue Scale (VAS)the number that best represents the sensations at the moment the procedure. The VAS ranges are detailed in Table 2.

Table 2. Representation of the subjective visual analog scale

Grade	Description
0	No sensation
1 - 2	Light sensation
3 - 7	Moderate sensation
8 - 10	Intense sensation

Source: Adapted from Omi, 2017.

Evaluation of Satisfaction of the patient to the treatment: Patient satisfaction was evaluated using a subjective scale of 1-5 (1 = very dissatisfied/very uncomfortable, 2 = dissatisfied/uncomfortable, 3 = no difference/no opinion, 4 = satisfied/comfortable, 5 = very satisfied/very comfortable) (Noyman *et al*., 2021).

RESULTS

When comparing before and after, the morphological change in the skin tissue was visible. After treatment, the cheek area near the CK3 point is more swollen, resulting in support for this area and the appearance of tissue filling in the area. In addition, in the lateral and 45° positions, it was possible to identify a reduction in deep wrinkles, which in the case of this patient were very evident, clearly indicating an improvement in collagen and elastin proteins. The region of the nasolabial fold also underwent positive changes, possibly related to the re-establishment of the tissue matrix, which involves collagen synthesis. In addition, the areas that did not receive the technology, such as the sides of the eyes, benefited from the improvement achieved in the adjacent tissues. The reduction in the Jowls region and double chin is reflected in the improvement of the facial contour, which results in a youthful appearance. In general, the protocol used reversed the damage caused by photoaging by improving the structure of the extracellular matrix and the synthesis of new collagen fibers, as well as improving sagging. The results for the values found by the Cutometer evaluation are shown in Graphs A, B, C and

Figure 2 - Demonstrative image of the anterior region of the face. A - before the endolaser procedure, B - 30 days after the endolaser procedure and C - 5 months after the endolaser procedure

Figure 3. Demonstrative image of the right lateral region of the face. A - before the endolaser procedure, B - 30 days after the endolaser procedure and C - 5 months after the endolaser procedure

D, each of which refers to a factor evaluated, where R0 is the tissue's stretching capacity, R3 is the maximum amplitude the tissue is capable of reaching, R5 is liquid elasticity and R7 is skin firmness. When evaluating R0, all the areas evaluated showed a decrease in value over the time periods evaluated, as shown in the following graphs, related to the improvement in dermis thickness. In the R3 evaluation, all the points showed lower values in the periods evaluated after treatment, which is associated with improved mechanical properties of the skin, less wrinkles and tissue fatigue. R5, which is the factor related to net elasticity, showed improvement with higher values after treatment for the CK3 regions on both sides and the jowls, while no changes were found in the Jowl region. The evaluation of R7, which is the factor related to skin firmness, showed improvement in the same areas as R5. The patient was classified as phototype 4 and had no complications or adverse events during or after the procedure. In the classification of the proposed sagging scale, severe sagging was identified before

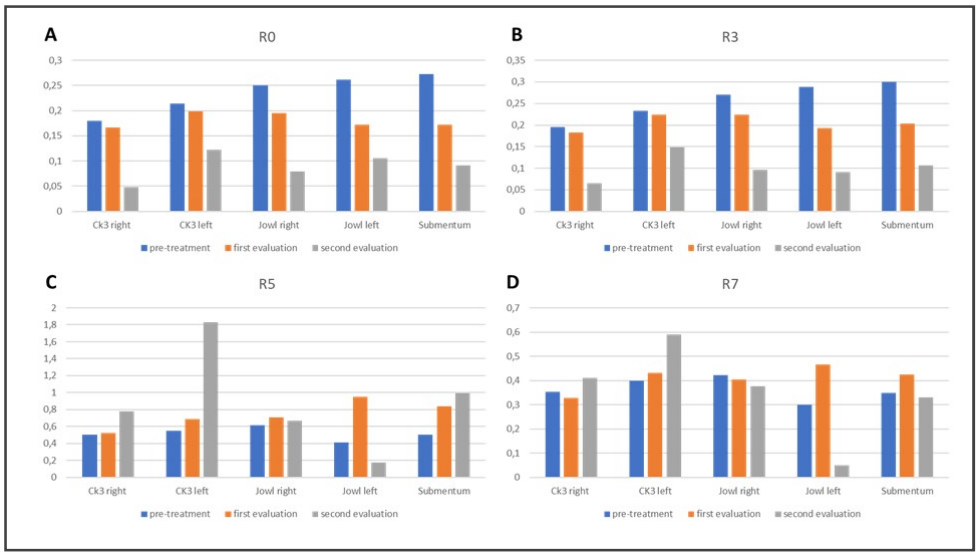

Figure 4 - Representative graphs on the values of R0, R3, R5 and R7. A- Comparison of R0 values for all regions evaluated in the pre-treatment period, first evaluation (1 month after treatment) and second evaluation (5 months after treatment). B- Comparison of R3 values for all regions evaluated in the pre-treatment period, first evaluation (1 month after treatment) and second evaluation (5 months after treatment). C- Comparison of R5 values for all regions evaluated in the pre-treatment period, first evaluation (1 month after treatment) and second evaluation (5 months after treatment). B- Comparison of R7 values for all regions evaluated in the pre-treatment period, first evaluation (1 month after treatment) and second evaluation (5 months after treatment)

the treatment, classified as 8, with a positive evolution to 6, called moderate sagging after the procedure. In terms of skin texture, the evolution was classified on a scale of 10, associated with severe wrinkles, and after treatment it reached a scale of 6, with a reduced amount of wrinkles in the treated area. In the assessment of skin firmness, the evolution was from 7 of moderate lack of firmness to 5, which is considered a transition between moderate and mild firmness. According to the expert committee's classification, the improvement of the tissue matrix after treatment was evident in the external appearance and good definition of the body contour, especially the results obtained in the Jowls and double chin area. In the evaluation of the patient's sensory perception, the report at the time of application was 2, a mild sensation in relation to the discomfort of the technique and heating. Regarding patient satisfaction after treatment, the report was 4, considered to be satisfied with the results obtained.

DISCUSSION

This study's objective was to evaluate the effects of a high-power laser, called an endolaser, with simultaneous emission of two different wavelengths for the treatment of skin ageing. High-power laser technology for lipolysis was introduced for this type of application in 1990. The advantages of this technology lie in its ease of application, with minimal bleeding due to its coagulation action, and superior results in terms of tissue improvement and vitality, which results in the reversal of moderate tissue sagging. This study's results showed a significant improvement in deep wrinkles, with restructuring of the dermal tissue matrix, which was reflected in the support of the tissue near the zygomatic, cheek and eyelid regions. In addition, the technique was applied to the jowl and double chin regions, intended to acquire a better contour of the facial region, which was observed after the treatment. It should also be noted that the results achieved were maintained for up to 5 months after the procedure. There is little information in the literature on this type of therapeutic approach for the facial region, especially using the simultaneous emission of two different wavelengths. The main findings of studies involving endolaser technology include the use of 980nm generally for localized fat and the 1470nm wavelength for sagging. Several authors have investigated the use of endolaser in the body region with variations in wavelength. Some studies have reported on the facial region, such as the one by (Valizadeh *et al*. 2016), who used a high-power laser with a wavelength of 980 nm and a power of between 6-8 W in continuous mode in the submentonian region. The results showed a reduction in subcutaneous tissue, which remained for two months after treatment, with no serious adverse events reported. In the authors' comparison between liposuction using the liposuction procedure and the endolaser, the findings showed superior results with the application of the high-powered laser, with improved skin appearance related to the dermal matrix and sagging, with greater patient satisfaction, corroborating our findings. Using a power close to the one used in our study, but emitting only the 1470 nm wavelength, Nilforoushzadeh *et al*., 2023 identified an improvement in skin elasticity through the cutometer measurement and superficialization of wrinkles in the neck region, corroborating our findings. Similarly, (Nilforoushzadeh *et al*. 2023), used the endolift technique in the nasolabial regions and the marionette lines. The results obtained were a decrease in nasolabial depth and a reduction in marionette lines. Interestingly, the authors report that ultrasound analysis showed an increase in the density of the dermis and epidermis layers, as well as an improvement in elasticity. These data corroborate our findings regarding the improvement of the tissue matrix and sagging, with a reduction in furrows and wrinkles. Although we do not present a measurement of the dermis and epidermis layer, as presented by Nilforoushzadeh et a., 2023, it is clear that this internal improvement is reflected in the external appearance, with a difference even in support. Regarding sagging, we found interesting results, such as an improvement in the skin's elasticity, represented by the values of R0, R3 and R5, and firmness, represented by the values found in R7. These findings corroborate the studies by Woo *et al*., 2014, Dobrev *et al*., 2005, Ryu *et al*., 2008 and Ohshima *et al*., 2012, who also assessed the results of the *R* curves using the cutometer and

found correlations related to the difference in skin characteristics depending on age, the region assessed and the quality of the collagen matrix. Lofti *et al*., 2023 evaluated the endolift technique using a laser with a wavelength of 1470nm, 3-5 W of power, for the improvement of eyebrow arching and sagging of the eyelid region. The results showed a 71.5% reduction in sagging and a 71.1% improvement in cosmetic results. Evaluation of the before and after photos showed an improvement in eyebrow arching and a reduction in sagging in the eyelid area. The authors conclude that the endolift technique is effective for aesthetic treatments of the face. In a brief comparison of techniques, we observed that laser application may be superior in tissue retraction. Frankel *et al*., 1997 and Starck *et al*., evaluated the results regarding the improvement of eyebrow arching and eyelid sagging and did not find results as satisfactory as those reported by Lofti *et al*., 2023. Therefore, despite the few studies comparing the results of endolaser on the face, it is possible to conclude that the technology is safe, minimally invasive and effective for facial rejuvenation, especially when it comes to improving sagging skin. However, future studies are needed to further investigate the protocols applied, the amount of energy emitted and the temperature reached in the tissues.

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