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UNI-WAVE OR DUAL-WAVE: WHICH ONE IS THE BEST CHOICE OF WAVELENGTHS WHEN USING ENDOLASER IN AESTHETIC TREATMENTS

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ABSTRACT

Background: The Endolaser technique is widely used for different aesthetic disorders due to its excellent response in lipolysis and tissue retraction. The 980 nm and 1,470 nm wavelengths can be used either individually or in combination, a technique named dual-wave. **Objective**: This article aimed to describe the principles that guide the choice of wavelengths considered safe and effective for using subdermal Endolaser in the treatment of aesthetic disorders. **Material and methods:** This study is characterized by exploratory research, presented through a narrative review to highlight the principles and criteria for the choice of wavelengths considered safe and effective for the performance of the Endolaser technique used in the treatment of aesthetic disorders. **Results**: The use of two wavelengths in combination has great support in the literature for tissue resection, especially in surgical procedures adopting high doses of energy. Based on the few published reports on the use of dual-wave equipment for endolaser, especially in aesthetic treatments, it is not possible to state that this is the best choice for these treatments, as we have not found any comparative studies that can support its use to the detriment of the many procedures using only a single wavelength (980 nm or 147nm) that have already been published. Therefore, it is prudent to still believe that the isolated use of a single wavelength is the best therapeutic option regarding diode laser in aesthetic procedures, since there are a greater number of published protocols that can be reproduced in outpatient procedures. **Conclusion:** We concluded that it is still premature to state that the use of endolaser with two associated wavelengths for the treatment of outpatient aesthetic dysfunctions is much better than the use of only a single wavelength (980 nm or 1,470 nm), since we have not found any specific comparative studies that reinforce this way of thinking.

KEYWORDS: Endolaser, Endolift, Subdermal laser, Dual-wave.

1. INTRODUCTION

Endolaser subdermal technique used in purely aesthetic procedures, has as one of its main characteristics the use of equipment that emits wavelengths of 1,470 nm and 980 nm.[1] This technique aims to generate heat within the tissues to damage the subcutaneous adipose tissue[2-4] and heat the skin to stimulate collagen production.[5-8] Still, the laser radiation is transmitted through an optical fiber directly inserted into the superficial subcutaneous tissue[5, 9-11] or inserted inside a cannula to facilitate its manipulation in the subcutaneous tissue.[12, 13]

Endolaser is recommended for the following aesthetic conditions: facial wrinkles such as "marionette lines", mid-facial and nasolabial folds and periorbicular changes of the eye. Also, for rosacea, acne vulgaris, and acne scars are also indications for facial treatment. In the body, lipodystrophies such as localized adiposity and cellulite are the most commonly used.[2, 3, 14-18]

The 980 nm wavelength has been used since the early 2000s in endovenous procedures[19-21] as well as in laser lipolysis techniques[22-24], but it also presents excellent results when the objective is to retract the skin.[10, 13] The 1,470 nm wavelength also began to be used in venous ablation treatments at this time[25, 26], while non-invasive or non-surgical lipolytic procedures started to occur in 2005[27], mainly with the technique called Endolift™, where its action proved to be more effective in aesthetic dysfunctions involving the skin.[3-9]

The combination of these two wavelengths, 980 nm and 1,470 nm in devices called Dual-Wave, is not widely used in aesthetic procedures, but its use in surgical procedures is well described in the literature.[28-32]

Torcartes et al.,[33] treated vaginal canal laxity as well as vaginal functional restoration, using a specific probe inserted internally to deliver laser energy to the vaginal canal. They compared groups using only 980 nm, 1,470 nm, or 980 nm/1,470 nm, and found the same pattern of therapeutic response for all wavelengths applied for the various abnormalities treated.

The combination of 980 nm and 1,470 nm is also described as an excellent resource for vascular treatment.[34]

In aesthetic procedures, we did not find too many reports associating these two wavelengths (980/1,470 nm). Saran et al.[35] used the two wavelengths sequentially in the treatment of three cases involving aesthetic dysfunctions in the face and neck. They initially used the 980 nm wavelength for lipolytic action and then the 1,470 nm wavelength to reach the immediately subdermal region to provide skin retraction. In another study[36] using the two wavelengths simultaneously, four patients with a voluminous abdomen due to excess fat were treated. The authors confirmed the effectiveness of this type of procedure with two wavelengths applied together and simultaneously.

Despite these reports involving the use of two wavelengths sequentially or simultaneously in aesthetic treatments, there was no comparative analysis between the wavelengths in these studies, something similar to what was described by Torcartes et al.[33] Therefore, it is understood that there is still a lack of foundations in order to guide a reliable indication about the use or not of the associated wavelengths instead of using only one of them.

Therefore, this study aimed to describe the principles that guide the choice of wavelengths considered safe and effective for using Endolaser subdermal in the treatment of aesthetic conditions.

2. MATERIAL AND METHODS

This study is characterized by exploratory research, presented through a narrative review to highlight the foundations and criteria for choosing wavelengths considered safe and effective for performing the Endolaser technique used in the treatment of aesthetic dysfunctions. 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) and LILACS (Latin American and Caribbean Literature in Health Sciences) and Google Scholar.

As an inclusion criterion, sources that described the use of 980 nm and 1,470 nm wavelengths related to the use of subdermal laser in surgical treatments or minimally invasive procedures were selected. Sources that did not present an abstract, those that were not allocated to scientific journals and did not address the topic of the study were discarded. Also, those that did not support the collection of reliable data excluded.

The bibliographic survey was carried out in Portuguese, English, Spanish and Italian, with the following descriptors: endolaser, endolift, subdermal laser, dual-wave.

3. RESULTS AND DISCUSSION

3.1. Diode laser

The relation between wavelengths and tissue absorption is a determining factor in the thermal and photoacoustic effects caused by using diode lasers. As shown in Figure 1, some interactions predominantly occur with water, while others show greater absorption by fat. The 980 nm diode laser has water as its primary chromophore, however it also demonstrates good absorption by fat, making it effective in lipolysis. This characteristic allows fat solubilization with lower energy expenditure. In turn, the 1,470 nm laser has a high affinity for both fat and water, which allows better absorption in tissues rich in these components, with less dispersion.[37]

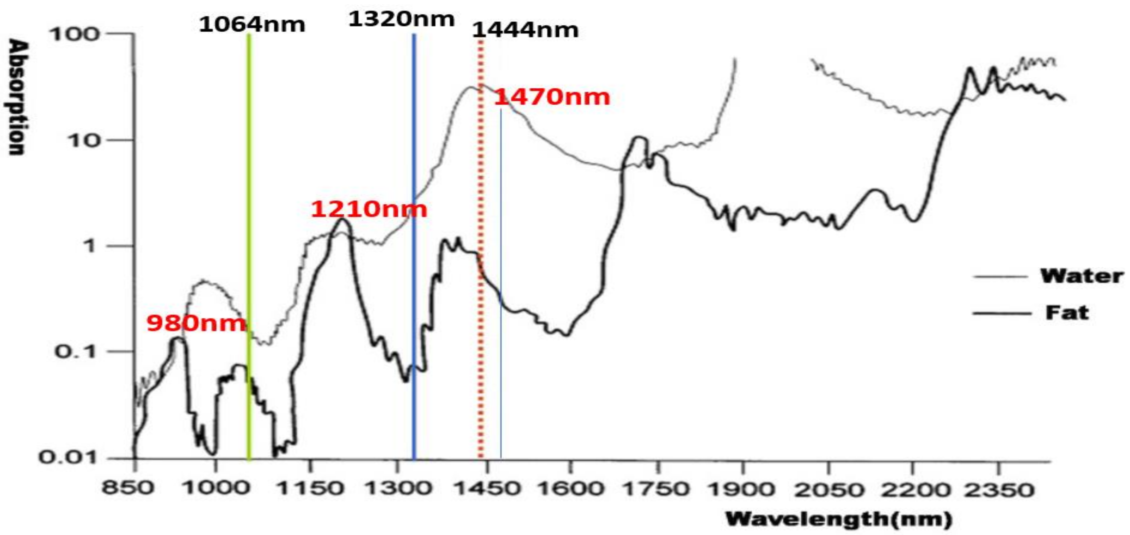

Figure 1: Laser absorption spectrum in water and fat (Adapted from Khoury et al.[37]).

Wavelengths of 924 nm and 975 nm were used simultaneously in laser lipolysis, and the authors found that they have high specificity for aesthetic treatments. The 924 nm wavelength might facilitate lipolysis by liquefying subcutaneous fat, while the 975 nm wavelength aims to stimulate collagen production by promoting skin retraction and remodeling or reducing sagging. They found, therefore, that both are effective in the treatment of body contour deformities, with quick recovery and low risk of complications.[38] Despite this, we observed that these two wavelengths are not commonly used in clinical practice for outpatient aesthetic procedures.

Meanwhile, the 980 nm diode laser frequently used in laser lipolysis procedures[39,40], can also trigger photocoagulation of blood vessels, either alone or during laser lipolysis procedures. Its use in procedures on fatty tissue results in less intraoperative bleeding and reduced tissue trauma.[34]

Thus, the 980 nm laser presents positive results in fat reduction during the laser lipolysis procedure.[24, 39, 40] In this context, a study compared traditional liposuction with laser-assisted lipolysis (lipolaser) and concluded that the use of the 980 nm diode laser is a safe and effective technique for skin toning and rejuvenation. The results suggest that laser lipolysis has advantages over traditional techniques, becoming a superior option.[41] According to some authors[42], when compared to conventional methods, the photothermal action of the 980 nm laser can result in the rupture of adipocyte membranes, while stimulating skin retraction through collagen remodeling with less tissue trauma, fewer bruises and faster recovery.

In the analysis of the 1,470 nm wavelength, especially in lipolaser surgery, it was possible to identify positive results in a study about the reduction of subcutaneous fat in the arm region.[43] The study demonstrated a significant decrease in the average amount of adipose tissue in all patients assessed. In addition, the procedure contributed to skin toning which was reported by both patients and researchers.

However, when the 1,470 nm diode laser was used outside the surgical context of laser liposuction, it proved to be extremely effective in both fat reduction and skin toning[2-9], as well as in the treatment of vascular disorders[25, 26], scars[27], and hyperhidrosis.[44]

3.2. Endolaser

Endolaser or subdermal laser is a technique that uses a laser beam with a wavelength between 980 and 1470 nm, emitted by an optical fiber inserted into the subcutaneous tissue. Its main objective is to promote skin toning through neocollagenesis and reduce subcutaneous fat.[1, 10, 45, 46]

This procedure consists of emitting laser radiation directly into the subcutaneous layer close to the skin, generating essential physiological effects for dermal tissue remodeling and the selective destruction of adipose tissue. The technique acts mainly through lipolysis/adipocytolysis and the stimulation of neocollagenesis.[1, 3, 4, 8, 10, 36]

Subdermal laser is considered a non-invasive or minimally invasive technique and might be used to improve skin texture and tone making it firmer, minimizing sagging and facial wrinkles, especially glabellar and nasolabial expression lines, unsightly mandibular borders, marionette lines, and changes around the eyes. It is also indicated for acne vulgaris and acne scars, as well as rosacea. It can also treat various lipodystrophies such as localized adiposity and cellulite, as well as double chin and others.[1]

The 1,470 nm wavelength stands out for its high thermal confinement, favoring the accumulation of energy in depth and minimizing heat dissipation.[1] Compared to other laser bands such as 980 nm for example, its absorption is greater in water and fat[37, 47], and this leads us to the understanding that its use requires a significantly lower amount of energy in watts to produce tissue heating and consequent skin retraction, as well as effective lipolytic action.

The endolaser using 1,470 nm has demonstrated excellent results in reducing localized fat and in the improvement of sagging in areas such as the chin, arms and abdomen.[2, 48] In addition, this same wavelength has been shown to be effective in the treatment of cellulite and lipodystrophy.[14, 49] The 980 nm wavelength, even presenting a lower degree of absorption than 1,470 nm, has also been widely used in outpatient aesthetic procedures, presenting excellent performance and results for conditions involving dermis and subcutaneous tissue.[10, 18, 50]

It is worth noting that the endolaser with two wavelengths (980-1,470 nm) used in outpatient aesthetic procedures is far from being something common and is still little reported in the literature.[35, 36]

3.3. Dual-Wave Association

The Dual-Wave technique represents a different approach to the use of diode lasers, since instead of a single wavelength, two wavelengths are simultaneously emitted.[28, 31-34, 38] Using this type of equipment has been characterized as an efficient resource for tissue resection, and so, in outpatient aesthetic conditions it is still not so common.

This technique uses individualized parameterization for the two wavelengths, thus seeking in most cases, the distinct effects of the two types of lasers. As an example, there is the combination of the 980 nm laser, which is predominantly absorbed by hemoglobin while the 1,470 nm laser has a greater affinity for water.[51]

The combination of two wavelengths might happen in any spectral range, but the idea is that there is distinct absorption and effects according to the irradiated chromophores. Authors[38] used a diode laser with two wavelengths, one specifically for liquefying adipose tissue (924 nm) and the other for acting on collagen fibers and elastin in the deep dermis (975 nm).

According to Saran et al.[35], to the simultaneous emission of two wavelengths, it is essential to use lower powers for each laser, unlike when they are commonly applied in isolation in aesthetic procedures. In addition, the authors recommended a pulsed delivery of energy, ensuring enough time for thermal relaxation of the biological tissue. This would avoid excessive thermal stress, preventing undesirable complications. However, when dual-wave equipment is surgically used, continuous mode is usually the mode of choice, in addition to higher powers in Watts.

3.3.1. Tissue Resection

Most studies involving the simultaneous use of two wavelengths are characterized as efficient resources for tissue resection or surgical procedures. However, when comparing the resection of the posterior laryngofissure of pigs using 980 nm and 1,470 nm lasers in isolation[52], the authors found that both wavelengths tested showed similar results in any turn of power levels combinations, with no significant differences in lateral thermal damage, and that they can therefore be effectively used in incisions in this type of tissue.

Authors[28] reported that the simultaneous application of 980 nm and 1,470 nm lasers promoted selective vaporization, enabling precise surgical cuts and in some cases, replacing the traditional scalpel. They reported few or no postoperative bleeding, which reduced the postoperative supplies to control bleeding, which is common with other laser or radiofrequency technologies. In a similar study[53], fourteen patients were treated with cervicourethral obstructions caused by benign prostatic hyperplasia and were treated using laser surgery with a dual-wavelength 980-1,470 nm laser using a power of 100-110 W. The authors demonstrated the efficacy and safety of this new technique in comparison with other surgical laser options, as well as in comparison with traditional surgery.

A study[54] verified the efficacy and safety of a dual-wavelength diode laser (980 – 1,470 nm) in laparoscopic partial nephrectomy as an innovative method in seventeen patients. The authors concluded that the laser technique is achievable and offered the benefit of shorter warm ischemia time, with effective coagulation and tissue hemostasis.

Authors[29] compared the effects of a synchronous dual-wavelength diode laser with conventional endoscopic knives for endoscopic dissection of the esophageal submucosa (in animals). They confirmed that the speed of procedure in the group that was cut with the laser was significantly faster compared to the endo-knife group. The number of intraoperative bleeding points and the use of hemostatic forceps were significantly lower in the laser group, and the histological evaluation showed that the injury to the muscularis propria was softer when using laser compared to using knife. In a similar study[55], authors compared the dual-wavelength laser of 980 nm/1,470 nm with an ultrasonic scalpel and found that the dual-wave laser was safe and viable, and also caused less damage to the blood supply of the parathyroid gland than an ultrasonic scalpel. In addition to presenting the same efficacy in open thyroidectomy, Other authors[30-32] have confirmed the power of the dual-wave laser as an excellent surgical cutting instrument in different types of tissue.

Based on the above, it is understood that the use of two wavelengths simultaneously makes the laser beam more powerful depending on specific parameterization and consequently more harmful, which makes it effective and necessary for tissue cuts, commonly used in surgical procedures.

3.3.2. Laser and vascular ablation

The use of endovenous laser in vascular conditions has been studied since the late 1990s. Its action is related to the conversion of absorbed laser energy into heat. One form of treatment involves heating the blood, vein walls and perivenous tissue by direct absorption of laser light emitted by the optical fiber and then spread by the blood toward other tissues. The other one is when the heat generated in the blood also diffuses to the vein wall.[56]

Authors[57] compared the use of 980 nm laser with 1,470 nm laser in endovenous ablation in a total of 152 great and small saphenous veins of 96 patients. The authors found that minor postoperative complications occurred in 29.4% of the members in the 980 nm group and in 25.6% of the members in the 1,470 nm group, thus understanding that endovenous ablation with the 1,470 nm laser has less energy deposition for occlusion and better response to treatment.

We found no studies on the use of dual-wave laser for endovenous ablation; however, authors[34] used a dual-wave equipment combining 980 nm + 1,470 nm for the transcutaneous treatment of vascular conditions. A total of 497 vascular lesions of the skin and lips were treated, such as cherry angiomas, venous lakes, labial hemangioma and spider nevi. Complete clearance of these conditions was achieved in 100% after a single treatment; patients with couperose and/or facial telangiectasia required many treatment sessions. The authors did not identify any adverse events, only mild to moderate pain during laser shots which was noticed in all patients.

3.3.3. Treatment of vaginal and vulvar conditions

The use of 980 nm, 1,470 nm and dual-wave (980/1,470 nm) diode laser proved effective in the treatment of vaginal sagging in 30 patients. The study showed statistically significant post-treatment results with total resolution of vaginal gases (980 nm: 50.0%, 1,470 nm: 50.0%; 980/1,470 nm: 50.0%) and absence of vaginal laxity (980 nm: 70.0%, 1,470 nm: 40.0%; 980/1470 nm: 90.0%), increased integrity and good pelvic floor muscle strength. In addition to an increase in sexual function of 18.7%, 29.0% and 23.4% for those treated with 980 nm, 1,470 nm and 980/1,470 nm, respectively.[33] They concluded that all forms of applicating wavelengths are effective, however dual-wave was more effective in the treatment of laxity of the vaginal canal.

A study[58] evaluated the efficacy of a dual-wavelength diode laser (980 + 1470 nm) (intravaginal applicator) in the treatment of menopausal vulvovaginal atrophy (VVA) in patients with or without a history of breast cancer. Twenty-nine patients were treated with three laser sessions at 4-week intervals. The results showed that the Vaginal Maturation Index and the Female Sexual Function Index showed significant improvement in all areas for the entire study population. They concluded that the dual-wavelength diode laser is an effective and safe option for the treatment of VVA in patients with and without a background of breast cancer.

3.3.4. Outpatient aesthetic procedures

The search for studies that demonstrated better performance of the dual-wave laser compared to the isolated use of 980 nm or 1,470 nm diode lasers was relentless until this study was written, but we were unable to prove that using the dual-wave laser assures better aesthetic results compared to the single-wave endolaser (980 nm or 1,470 nm).

However, we found studies[35, 36] with personal reports from authors who used the dual-wave laser and attested to its efficacy and safety for use in aesthetic endolaser.

In orofacial harmonization, the dual 980/1,470 nm laser was used for lipolysis and tissue retraction, but the use of the different wavelengths was not simultaneous, but rather sequential. First, the 980 nm wavelength was used to damage subcutaneous fat, and then the 1,470 nm wavelength was used to promote skin retraction through neocollagenesis. This combination provided natural results with minimal recovery time and was especially effective in areas such as the jawline and neck.[35]

Another study[36] demonstrated the use of dual-wave laser (980-1,470 nm) in patients with excess abdominal volume. The technique aimed to promote lipolysis and skin retraction simultaneously. Patients showed visible results 45 days after the procedure, including a reduction in body measurements and improvement in skin firmness, with quick recovery and no serious complications. The application of these wavelengths was performed simultaneously with high power (15 Watts adding the two wavelengths).

In our clinical practice, the use of two wavelengths such as 980 nm and 1470 nm is common and produces satisfactory and safe results (Figures 1 to 3), as long as the appropriate dosimetric fundamentals for the use of subdermal laser are observed.[59]

Figure 1: Result obtained 60 days after treatment using a dual-wave endolaser for localized fat in the abdomen and flanks. The wavelengths of 980 nm (5 Watts) and 1470 nm (3 Watts) were used simultaneously. There was a total energy deposit of 12,000 Joules in the abdomen and 2,800 Joules in each flank.

Figure 2: Result obtained 7 days after treatment using a dual-wave endolaser for localized fat in the abdomen. The wavelengths of 980 nm (6 Watts) and 1470 nm (3 Watts) were used simultaneously. There was a total energy deposit of 15,000 Joules in the abdomen.

Figure 3: Result obtained 90 days after treatment using dual-wave endolaser for arm sagging. Wavelengths of 980 nm (5 Watts) and 1470 nm (4 Watts) were used simultaneously. There was a total energy deposit of 8,000 Joules in each arm.

Based on the few published reports on the use of dual-wave equipment for the endolaser subdermal laser, mainly in aesthetic treatments, it is not possible to state that this is the best choice for these treatments. It is because we did not find any comparative studies that could support its use to the detriment of the different procedures using only a single wavelength (980 nm or 147nm) that have already been published. Therefore, it is prudent to still believe that the isolated use of a single wavelength is the best therapeutic option regarding diode laser in aesthetic procedures since there is a greater number of published protocols that can be reproduced in outpatient procedures.

CONCLUSION

Dual-wave has been shown to be a way of using diode laser equipment that emits two different wavelengths simultaneously. Generally intended to deliver high doses of energy, especially when the objective is tissue resection as in surgical procedures. In the case of purely aesthetic outpatient procedures, we concluded that the use of high doses is not necessary, given the existence of different publications about using a single wavelength (mainly 1,470 nm) reporting its efficacy and safety with low doses.[59] Therefore, believing that the use of two wavelengths associated with the treatment of outpatient aesthetic dysfunctions is much better than the use of just one (980 nm or 1,470 nm) is premature, as we still do not have specific studies that emphasize this way of thinking.

In view of this scenario, we concluded that there is not enough scientific evidence to state that Dual-Wave technology is better than the isolated use of 980 nm or 1,470 nm in the treatment of outpatient aesthetic dysfunctions. Some studies indicate possible benefits, but there is a lack of more robust comparative research that compares in detail the benefits and limitations of the isolated use with the combined use of these wavelengths, seeking to elucidate the best way to use them.

In addition, it is essential that professionals master the specificities and fundamentals of the subdermal laser technique in order to individualize aesthetic treatments to meet the specific needs of each patient, especially regarding the appropriate selection of wavelengths (isolated or combined) and their dosimetric parameterization in order to provide the appropriate dose of power and energy and, thus, ensure greater efficacy and safety in endolaser treatments.

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