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THERMAL VECTORIZATION USING 980NM ENDOLASER TECHNOLOGY IN HARMONIZATION FOR THE TREATMENT OF SAGGING SKIN WITH TISSUE LIFTING: TECHNIQUE, CLINICAL REASONING AND PROTOCOL FOR OPTIMIZING RESULTS

VETORIZAÇÃO TÉRMICA UTILIZANDO TECNOLOGIA ENDOLASER DE 980 NM EM HARMONIZAÇÃO PARA O TRATAMENTO DA FLACIDEZ CUTÂNEA COM LIFTING TECIDUAL: TÉCNICA, JUSTIFICATIVA CLÍNICA E PROTOCOLO PARA OTIMIZAÇÃO DOS RESULTADOS

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ABSTRACT

Skin laxity represents one of the main challenges in contemporary aesthetics, being associated with the degradation of the extracellular matrix, the reduction of collagen synthesis, alterations in the subdermal fibrous septa, and the loss of tissue retraction capacity. Endolaser technology has been used as a minimally invasive alternative to promote tissue remodeling, controlled lipolysis, and stimulation of neocollagenesis. In this context, the Thermal Vectorization Technique (TVT) was developed, an original protocol that proposes the targeted application of thermal energy using a 980 nm endolaser, respecting anatomical traction vectors in order to optimize the lifting and tissue retraction effect.

Objective: *To systematize and describe the clinical, physiological, and biomechanical reasoning of the Thermal Vectorization Technique, establishing criteria for patient selection, vector planning, choice of energy parameters, and post-procedure care, aiming for greater predictability and safety in the results. A prospective descriptive study was conducted with 50 female patients complaining of body flaccidity in different regions, who underwent endolaser application with wavelengths of 980 nm.*

Results: *it was observed that the vectorized application of thermal energy favors the retraction of fibrous septa, the controlled denaturation of collagen, and the stimulation of neocollagenesis, resulting in the reorganization of the extracellular matrix and the improvement of tissue support. The choice of the 980 nm wavelength allows for gradual and homogeneous heating, reducing the risk of disorganized fibrosis and increasing the predictability of the lifting effect. The alignment of the applied energy with the anatomical traction vectors seems to contribute to a biomechanically oriented lifting effect, differentiating the technique from diffuse thermal applications.*

Conclusion: *The Thermal Vectorization Technique with endolaser presents itself as a safe, reproducible, and promising method for treating skin laxity, allowing for targeted tissue remodeling and improvement of body contour with a minimally invasive profile.*

Keywords: Endolaser, thermal vectorization, skin laxity, tissue retraction, non-surgical lifting, dermal remodeling, neocollagenesis; body flaccidity.

RESUMO

A flacidez da pele representa um dos principais desafios na estética contemporânea, estando associada à degradação da matriz extracelular, à redução da síntese de colágeno, a alterações nos septos fibrosos subdérmicos e à perda da capacidade de retração tecidual. A tecnologia endolaser tem sido utilizada como uma alternativa minimamente invasiva para promover a remodelação tecidual, a lipólise controlada e a estimulação da neocolagênese. Nesse contexto, foi desenvolvida a Técnica de Vetorização Térmica (TVT), um protocolo original que propõe a aplicação direcionada de energia térmica utilizando um endolaser de 980 nm, respeitando os vetores de tração anatômicos a fim de otimizar o efeito de lifting e retração tecidual.

Objetivo: Sistematizar e descrever o raciocínio clínico, fisiológico e biomecânico da Técnica de Vetorização Térmica, estabelecendo critérios para a seleção de pacientes, planejamento vetorial, escolha dos parâmetros de energia e cuidados pós-procedimento, visando maior previsibilidade e segurança nos resultados. Um estudo descritivo prospectivo foi conduzido com 50 pacientes do sexo feminino queixando-se de flacidez corporal em diferentes regiões, as quais foram submetidas à aplicação de endolaser com comprimentos de onda de 980 nm.

Resultados: observou-se que a aplicação vetorizada de energia térmica favorece a retração dos septos fibrosos, a desnaturação controlada do colágeno e a estimulação da neocolagênese, resultando na reorganização da matriz extracelular e na melhora do suporte tecidual. A escolha do comprimento de onda de 980 nm permite um aquecimento gradual e homogêneo, reduzindo o risco de fibrose desorganizada e aumentando a previsibilidade do efeito lifting. O alinhamento da energia aplicada com os vetores de tração anatômicos parece contribuir para um efeito lifting biomecanicamente orientado, diferenciando a técnica das aplicações térmicas difusas.

Conclusão: A Técnica de Vetorização Térmica com endolaser apresenta-se como um método seguro, reprodutível e promissor para o tratamento da flacidez cutânea, permitindo a remodelação tecidual direcionada e a melhora do contorno corporal com um perfil minimamente invasivo.

Palavras-chave: Endolaser, vetorização térmica, flacidez da pele, retração tecidual, lifting não cirúrgico, remodelação dérmica, neocolagênese; flacidez corporal.

1. INTRODUCTION

Skin laxity, clinically described as tissue hypotrophy or ptosis, is one of the main challenges in modern aesthetic medicine. It results from progressive loss of structural integrity of the dermis, hypodermis, fibrous septa, and the Superficial Musculoaponeurotic System (SMAS), leading to decreased elasticity, reduced mechanical resistance, and loss of tissue support (Fisher et al., 2002; Varani et al., 2006; Ruiz-Silva, 2024). These alterations compromise skin architecture and are strongly associated with aging processes and extracellular matrix (ECM) degradation (Goldberg, 2008; Di Bernardo & Reiser, 2014).

Skin aging involves intrinsic and extrinsic mechanisms. Intrinsic aging is characterized by reduced fibroblast activity, decreased collagen types I and III synthesis, and structural disorganization of elastic fibers, while photoaging accelerates ECM degradation through activation of matrix metalloproteinases induced by ultraviolet radiation (Fisher et al., 1996; Varani et al., 2006; Makrantonaki & Zouboulis, 2001).

Massive weight loss, increasingly common after bariatric surgery and pharmacological therapies, also contributes to tissue laxity. Rapid reduction of subdermal volume generates excess skin and mechanical failure of elastic fibers and fibrous septa, reducing the capacity of tissue retraction and requiring techniques capable of promoting effective structural remodeling (PMC, 2024; Moleiro & Ruiz, 2025).

Hormonal and genetic factors also influence skin integrity. Estrogen plays a fundamental role in collagen synthesis, dermal thickness, and extracellular matrix hydration, and its reduction during menopause is associated with significant loss of dermal support. Genetic factors related to collagen and elastin regulation may explain individual differences in aging patterns (Brinczek et al., 2015; Hall & Phillips, 2005; Cheng et al., 2018; Degenhardt et al., 2016).

In the context of functional aesthetics, current treatments aim not only at cosmetic improvement but at restoration of tissue biomechanics. Endolaser technology has emerged as a minimally invasive method capable of promoting subdermal thermal remodeling. The use of 980 nm wavelength allows controlled photothermal interaction with chromophores such as water, hemoglobin, and lipids, promoting collagen denaturation, septal retraction, and extracellular matrix remodeling, contributing to tissue tightening with greater safety and predictability (Wolfenson, 2021; Lukac, 2023; Alexiades-Armenakas, 2021; Badin, 2022).

The TVT (Thermal Vectorization Technique) capitalizes on the photothermal properties of the 980 nm wavelength, which presents balanced absorption in water, hemoglobin, and lipids, allowing controlled subdermal heating and collagen remodeling. Studies demonstrate that diode lasers at 980 nm promote rupture of collagenous septa, dermal contraction, and tissue tightening with a favorable safety profile when energy delivery is properly controlled (Reynaud et al., 2009; Kamamoto et al., 2021; Lukac, 2023).

By directing energy along anatomical traction vectors, vectorization may enhance the mechanical effect of thermal remodeling, allowing effective tissue retraction with reduced risk of excessive fibrosis and improved structural harmonization.

1.1. Mechanism of Action and Selective Photothermolysis

The 980 nm diode laser presents balanced absorption in water, hemoglobin, and lipids, allowing controlled photothermal interaction in dermal and subdermal tissues according to the principles of selective photothermolysis (Anderson & Parrish, 1983). Thermal conversion induces adipocyte disruption, microvascular coagulation, and collagen denaturation, resulting in immediate fiber contraction followed by a controlled inflammatory response that stimulates fibroblast activation, neocollagenesis, and extracellular matrix remodeling. Internal temperatures between 50–65 °C promote collagen shrinkage and subsequent synthesis of type I and III collagen, contributing to progressive tissue tightening and improved mechanical resistance (Alexiades-Armenakas, 2021; Badin, 2022; Moleiro & Ruiz-Silva, 2025).

1.2. Subdermal Remodeling, Septal Retraction, and Biomechanical Vectorization (scientific Condensed Version)

The hypodermis is organized by fibrous septa connecting the dermis to the Superficial Musculoaponeurotic System (SMAS), forming a structural network responsible for soft-tissue support. Subdermal laser heating induces thermal shortening of these septa, generating traction toward deeper fascial planes and contributing to contour repositioning and tissue lifting (Dell'Avanzato, 2022; Rohrich, 2019).

The Thermal Vectorization Technique (TVT) applies laser energy along predefined anatomical traction vectors, converting diffuse thermal stimulation into a biomechanically oriented remodeling process. This approach is supported by principles of mechanotransduction, in which fibroblasts and myofibroblasts respond to both thermal stimulus and directional mechanical tension, reorganizing collagen deposition according to force gradients (Wang et al., 2016; Humphrey et al., 2014).

Vector-guided energy delivery promotes aligned collagen remodeling, septal contraction, and functional integration between dermis, hypodermis, and fascial planes, resulting in more predictable lifting, improved tissue support, and reduced risk of irregular fibrosis. This strategy allows reproducible modulation of tissue tension by combining anatomical planning, linear thermal delivery, and controlled temperature distribution, optimizing safety and durability of clinical outcomes (Moleiro; Ruiz-Silva et al., 2025).

2. METHODS – THERMAL VECTORIZATION TECHNIQUE (TVT)

The Thermal Vectorization Technique (TVT) was developed as a structured approach for subdermal laser-assisted tissue remodeling, aiming to optimize skin tightening and lifting through anatomically oriented energy delivery. The technique involves careful patient selection, pre-procedural marking based on traction vectors, and controlled subdermal photothermal stimulation to induce collagen remodeling, septal contraction, and biomechanically guided tissue repositioning.

2.1. Patient Selection

Indication for endolaser treatment using the Thermal Vectorization Technique is based on clinical evaluation of skin quality, dermal thickness, degree of laxity, and presence of localized adiposity.

Ideal candidates present the following characteristics:

Mild to moderate skin laxity

The Glogau classification for photoaging (Glogau, 1994) can be used as an indirect reference for tissue quality. Patients classified as types I and II generally show better response to thermally induced neocollagenesis, while types III and IV may present advanced elastosis and require combined treatments or have limited response when TVT is used as monotherapy.

Adequate dermal thickness
Patients with severe dermal atrophy may show reduced response to collagen remodeling. High-frequency ultrasound may be used for pre-procedural evaluation of dermal and subdermal thickness, allowing better planning of energy delivery.Realistic expectations

Patients must be informed that TVT is a minimally invasive procedure designed to improve tissue firmness and contour through gradual remodeling, and should not be considered equivalent to surgical lifting.

Absence of contraindications

Contraindications include pregnancy, lactation, active infection in the treatment area, uncontrolled autoimmune disease, coagulation disorders, or use of anticoagulant medication (Borges et al., 2024).

2.2. Marking and Vectorization Planning

Marking is a fundamental step of the Thermal Vectorization Technique, converting endolaser application from a diffuse thermal procedure into a biomechanically oriented intervention. The planning phase aims to define the direction of tissue traction, respecting anatomical support lines and the relationship between dermis, fibrous septa, and fascial planes.

Vector orientation is determined according to the desired lifting effect and the regional biomechanics of the treated area.

2.3. Pinch Test and Determination of Treatment Vectors

The pinch test is used to identify areas of greater laxity and to estimate the thickness of the skin-fat layer. By manually compressing the tissue, the operator evaluates skin mobility, adipose volume, and septal resistance, allowing more accurate definition of traction vectors and insertion depth of the optical fiber.

This maneuver helps to align the energy delivery with natural tension lines, improving the efficiency of septal contraction and dermal remodeling, and contributing to more predictable lifting results (Lee, 2023).

3. MATHEMATICS OF THERMAL ENERGY CONCENTRATION AND TIGHTENING

The effectiveness of TVT in tissue tightening is intrinsically linked to the strategic concentration of thermal energy. Energy delivery is modulated to create a controlled thermal gradient along the vector.

3.1. Choice Of Application Vectors

The vectors are designed in a lifting direction, starting from the area of greatest laxity towards strategic anatomical anchor points in the body areas. The underlying clinical reasoning is that healing and subsequent tissue retraction will follow these thermal coagulation lines, inducing a directional traction effect. The optical fiber is introduced into the opening and energy is delivered predominantly in a retroinjection motion, ensuring that tissue healing follows the application vectors, resulting in a repositioning of soft tissues (Moleiro & Ruiz-Silva, 2025).

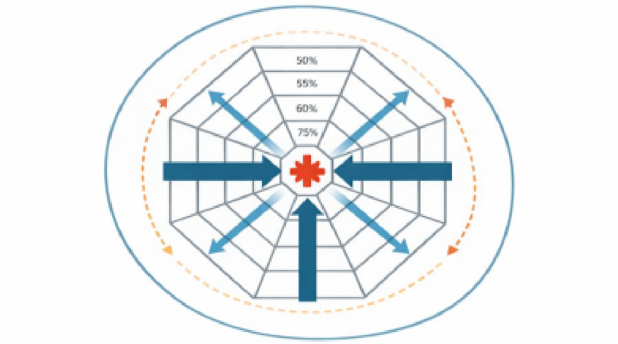
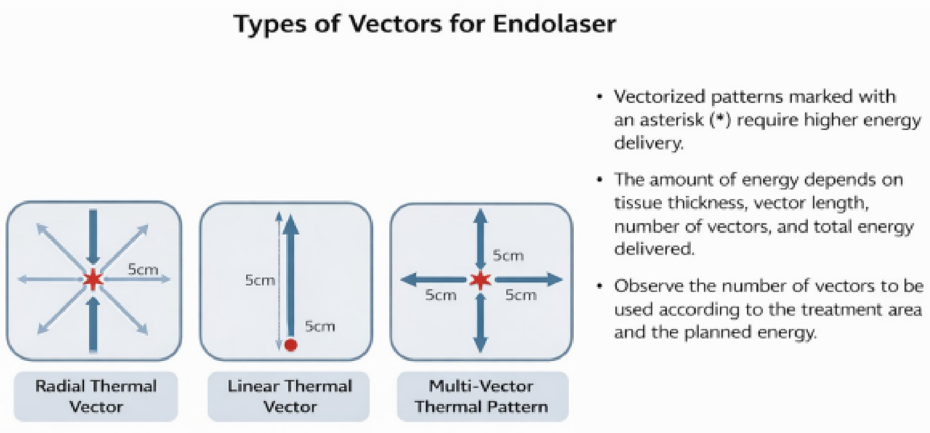


Figure 1. Vector-based marking scheme illustrating the concept of energy distribution in the Thermal Vectorization Technique (TVT), demonstrating directional delivery of subdermal thermal energy to optimize tissue repositioning and lifting.



- Vectorized patterns marked with an asterisk (*) require higher energy delivery.
- The amount of energy depends on tissue thickness, vector length, number of vectors, and total energy delivered.
- Observe the number of vectors to be used according to the treatment area and the planned energy.

Figure 2. Types of thermal vectorization patterns used in Endolaser procedures.

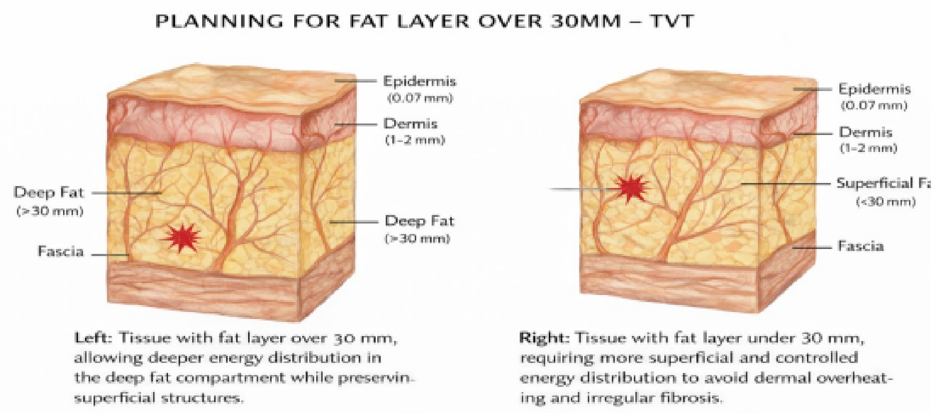
Examples of anchor points for body areas:

Abdomen: Iliac crest, upper abdominal midline, costal margin.

Arms (Triceps Region): Deltopectoral groove, axilla (posterior border), olecranon.

Buttocks: Gluteal sulcus, iliac crest, sacral region.

Inner Thigh: Genitocrural sulcus, ischial tuberosity, medial epicondyle of the femur.



Left: Tissue with fat layer over 30 mm, allowing deeper energy distribution in the deep fat compartment while preservin. superficial structures.

Right: Tissue with fat layer under 30 mm, requiring more superficial and controlled energy distribution to avoid dermal overheating and irregular fibrosis.

Figure 3. Treatment planning according to subcutaneous fat thickness for Thermal Vectorization Technique (TVT).

4. TECHNICAL PARAMETERS AND REGIONAL ADAPTATION IN THERMAL VECTORIZATION (TVT)

The effectiveness of the Thermal Vectorization Technique (TVT) depends on precise adjustment of 980-nm endolaser parameters according to regional anatomy, dermal thickness, and adipose volume. Energy delivery is based on linear energy density (J/cm), which better represents subdermal thermal deposition than surface energy density in laser-assisted tissue remodeling (Goldberg, 2023; Borges et al., 2024).

Power typically ranges from 3–8 W, with lower values used in thinner or more sensitive areas and higher values in regions with greater adipose volume. Retroinjection speed directly influences thermal accumulation, with slower speeds increasing energy per centimeter and promoting greater septal contraction. The total energy per vector must be sufficient to induce collagen denaturation without carbonization, and surface temperature should be maintained around 40–42 °C, corresponding to internal temperatures capable of reaching the collagen shrinkage threshold (~60–65 °C) (Goldberg, 2023; Alexiades-Armenakas, 2021). Multiple passes with lower energy are preferred over a single high-energy pass to reduce the risk of localized overheating and irregular fibrosis (Dell'Avanzato, 2022).

Parameter modulation varies according to anatomical region. Larger areas with thicker adipose tissue, such as the abdomen and buttocks, allow higher power and greater total energy, whereas thinner and more delicate regions, including arms and inner thighs, require lower power and stricter thermal control. Vector orientation follows biomechanical traction lines to enhance fibrous septa contraction and improve lifting efficiency (Rohrich, 2019; Dell'Avanzato, 2022).

Controlled parameterization is essential to promote organized neocollagenesis without pathological fibrosis. Excessive or abrupt heating may induce dense and disorganized scar formation, compromising tissue elasticity and clinical outcomes. The 980-nm wavelength provides balanced absorption in water, hemoglobin, and lipids, allowing gradual and homogeneous heating, favoring physiological extracellular matrix remodeling and improved tissue retraction (Alexiades-Armenakas, 2021; Bollero, 2025; Badin, 2022).

Infrared thermography is an important tool for intraoperative monitoring, enabling indirect assessment of subdermal temperature and ensuring that the delivered energy remains within the therapeutic window, increasing safety and reproducibility, particularly in extensive body areas (Lukac et al., 2023).

For patient comfort and safety, tumescent anesthesia with Klein solution is used, providing analgesia, vasoconstriction, and hydrodissection, facilitating fiber movement and protecting adjacent structures from excessive heat (Klein, 2000). Lidocaine dosage must be calculated individually, respecting the recommended maximum dose of 7 mg/kg with epinephrine, with continuous monitoring during the procedure (American Academy of Dermatology, 2023).

5. MATERIALS AND METHODS

5.1. Study Design And Population

This is a descriptive and prospective study, conducted with more than 50 female patients who presented to the clinic with the main complaint of body flaccidity in different regions (buttocks, abdomen, thighs, and arms). All participants signed an informed consent form to participate in the study, including authorization for photo documentation and clinical follow-up.

5.2. Initial Assessment

Before applying the technique, all patients were assessed for tissue thickness, degree of laxity, skin elasticity, and adipose tissue distribution, using clinical evaluation, circumference measurement, adipometry, and standardized photographic records. This initial documentation allowed establishing an objective baseline and planning the endolaser application vectors in a personalized way.

5.3. Planning And Marking

Based on the initial assessment, anatomical markings were made defining anchor points and traction vectors, respecting the direction of the anatomical perimeter edge where tissue retraction was expected. The planning followed the clinical reasoning of the thermal vectorization technique, which consists of applying controlled energy to the tissue sequentially, leading to retraction and remodeling in the desired direction for a lifting effect.

Figure 4. Pre-procedural marking of the gluteal region for endolaser application, performed with the patient in the prone position, using the TVT vectorization technique, highlighting the vectors and planned areas of action.

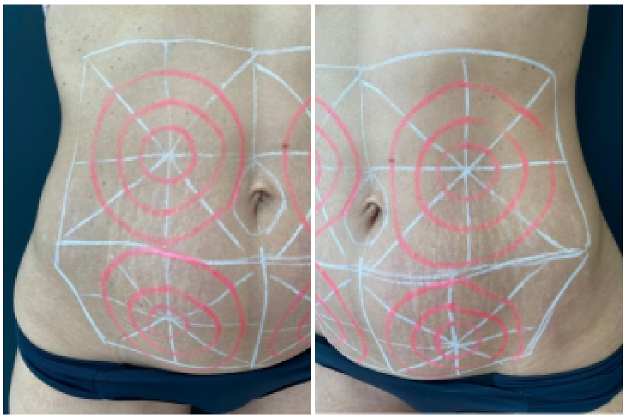


Figure 5, 6. Pre-procedural marking of the abdominal region for endolaser application, performed with the patient in an upright position, using the TVT vectorization technique, highlighting the vectors for lifting and tissue retraction and the largest adipose layer in the planning area.

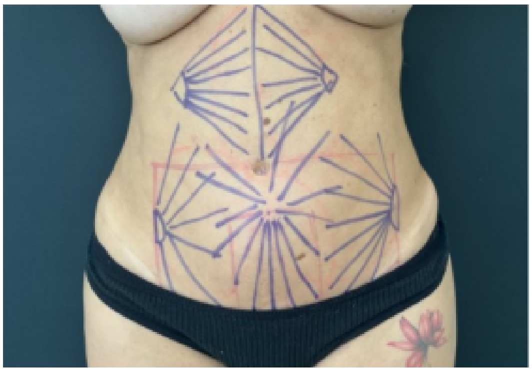


Figure 7. Pre-procedural marking of the abdominal region for endolaser application, performed with the patient in an upright position, using the TVT vectorization technique, highlighting the vectors for lifting and tissue retraction and the largest adipose layer in the planning area.

5.4. Application Of The Thermal Vectorization Technique

The endolaser application followed a standardized protocol:

Selection of wavelength, thickness of the laser conduction fiber, and appropriate according to the depth and type of flaccidity (pinch test);

Application of energy in previously planned vectors, approaching the edge of the anatomical perimeter;

Monitoring of tissue temperature and observation of clinical endpoints, such as visible tissue contraction and a comfortable warming sensation for the patient.

Figure 8. Anesthetic

Performance of a local anesthetic point to prepare the access site, using a 30G needle, with punctual application of lidocaine at a dose of 0.1 ml. The procedure was performed locally, with the aim of promoting adequate analgesia at the fiber optic entry site, minimizing patient discomfort and ensuring safe conditions for the introduction of the device.

Figure 9. Access point created with an 18G needle, after prior local anesthesia, for the introduction of the Endolaser optical fiber.

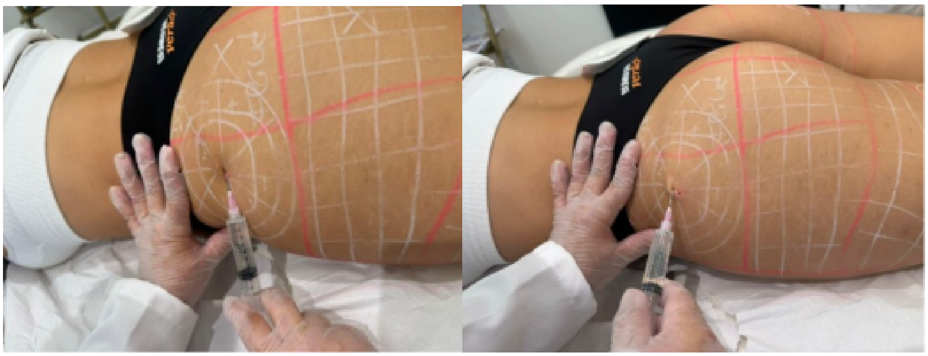


Figure 10, 11. Application of Klein's solution to the treated area, performed using an 18G cannula and a 10ml syringe via retrograde injection, with homogeneous distribution along the previously defined vectorization lines, respecting the maximum limits of Klein's solution anesthetic per patient, according to total body weight, as described previously.

Figure 12,13. Application of Klein's solution to the abdominal region, performed using an 18G cannula and a 10ml syringe via retrograde injection, with homogeneous distribution along the previously defined vectorization lines, respecting the maximum limits of anesthetic per area and per patient, according to total body weight, as described previously.

Figure 15, 16. Endolaser application in the abdominal region with the patient in the supine position using a 600 µm optical fiber, wavelengths of 980 nm, employing the TVT technique as described in this study, with retro-applied and controlled thermal accumulation.

5.5. Monitoring And Evaluation Of Results

Patients were followed through standardized photodocumentation and clinical evaluation at three time points: immediate post-procedure, 30 days, and 60 days. The immediate evaluation focused on initial tissue retraction and contour changes, while the 30-day assessment allowed observation of the early remodeling phase. At 60 days, progressive collagen remodeling and consolidation of the lifting effect were analyzed.

To improve reproducibility, documentation was performed under controlled conditions, including standardized lighting, positioning, distance, and muscle contraction.

Objective measurements were incorporated whenever possible, such as circumference at fixed anatomical landmarks, skinfold thickness (diplometry/adipometry), and ultrasound evaluation to estimate subdermal thickness. These measures reduce subjective bias and allow correlation between vector planning and clinical evolution over time.

Therapeutic endpoints were also defined to ensure safety and technical consistency. Intraoperatively, adequate superficial heating within a safe range, palpable tissue contraction, and absence of signs of overheating were used as reference parameters. During follow-up, results were assessed using photographic comparison, flaccidity scales, patient satisfaction scores, and objective measurements, allowing evaluation not only of improvement but also of the magnitude and stability of the lifting effect.

6. TECHNIQUE DESCRIPTION: THERMAL VECTORIZATION WITH ENDOLASER

6.1. Photodocumentation And Planning

Standardized photographs were obtained in frontal, 45º, and 90º views. The treated region was divided into anatomical quadrants to guide vector distribution. Tissue thickness was evaluated using diplometry, allowing adequate selection of application depth and energy parameters.

6.2. Wavelength Selection And Energy Parameters

A 980-nm endolaser was used for subdermal application. The 1470-nm wavelength has higher absorption in water, favoring rapid heating of infiltrated solution and adipocytolysis, whereas the 980-nm wavelength shows balanced absorption in hemoglobin, lipids, and water, allowing better thermal control, vascular coagulation, and safer tissue remodeling (Goldberg, 2023; Badin, 2022).

Energy was delivered in areas of approximately 10 × 10 cm, with total energy ranging from 1000 to 1500 J depending on tissue thickness measured by diplometry and plicometry. Vectors were planned with approximately 1-cm spacing to ensure homogeneous energy distribution and controlled septal retraction.

6.3. Clinical Considerations

Accurate anatomical marking, correct fiber positioning, and adequate parameter selection are essential for safety and effectiveness. The use of the 980-nm wavelength allows simultaneous adipose reduction and dermal tightening with a lower risk of complications and shorter recovery time.

7. POST-PROCEDURE CARE IN THERMAL VECTORIZATION TECHNIQUE (TVT)

Post-operative management is essential to optimize tissue remodeling, reduce complications, and stabilize the lifting effect.

7.1. Immediate Post-operative Period (0–72 H)

This phase is characterized by a controlled inflammatory response necessary for neocollagenesis.

- Compression therapy is recommended for 48–72 h continuously to reduce edema, prevent seroma formation, and improve tissue adherence (Klein, 2000).

- Cryotherapy may be used during the first 24–48 h to reduce pain and swelling without interfering with remodeling (Dover, 2018).

- Analgesics may be prescribed when necessary; anti-inflammatory drugs should be used cautiously to avoid excessive suppression of the reparative response.

- Adequate hydration and relative rest are recommended during the first week.

7.2. Late Post-operative Period (after 72 H To 6 Months)

This phase corresponds to fibroblast proliferation and extracellular matrix remodeling.

- Compression may be maintained for 2–4 weeks.

- Manual lymphatic drainage should begin after 5–7 days to reduce edema and prevent fibrosis (Godoy, 2010).

- Gentle massage and tissue release techniques may help prevent adhesions.

- Skin hydration and strict photoprotection are recommended to prevent post-inflammatory hyperpigmentation.

- Clinical follow-up at 1, 3, and 6 months allows evaluation of tissue retraction and collagen remodeling.

7.3. Management Of Complications

TVT with endolaser is considered safe when properly performed.

- Edema and ecchymosis are usually self-limited.

- Nodules or irregularities may be treated with drainage and massage.

- Post-inflammatory hyperpigmentation requires photoprotection and topical therapy.

- Infection is rare and should be treated promptly with antibiotics.

8. RESULTS

it was observed that the vectorized application of thermal energy favors the retraction of fibrous septa, the controlled denaturation of collagen, and the stimulation of neocollagenesis, resulting in the reorganization of the extracellular matrix and the improvement of tissue support. The choice of the 980 nm wavelength allows for gradual and homogeneous heating, reducing the risk of disorganized fibrosis and increasing the predictability of the lifting effect. The alignment of the applied energy with the anatomical traction vectors seems to contribute to a biomechanically oriented lifting effect, differentiating the technique from diffuse thermal applications.

The figures below are part of the 50 patients treated with the endolaser technique at the author's clinic.

9. DISCUSSION

Skin laxity remains one of the main challenges in aesthetic medicine, especially in patients with aging-related structural changes, hormonal decline, or massive weight loss. These conditions are associated with degradation of the extracellular matrix, fragmentation of elastic fibers, and loss of dermal support, resulting in reduced tissue elasticity and contour definition (Fisher et al., 2002; Varani et al., 2006; Goldberg, 2008). In this context, minimally invasive technologies capable of inducing controlled collagen remodeling have become increasingly relevant.

Subdermal laser-assisted remodeling has been described as an effective method for promoting skin tightening through selective photothermal interaction with water, hemoglobin, and lipids, leading to collagen denaturation followed by neocollagenesis and tissue retraction (Goldberg, 2023; Alexiades-Armenakas, 2021; Badin, 2022). However, conventional endolaser techniques are often based on diffuse energy delivery, which may produce heterogeneous heating and variable clinical outcomes.

The Thermal Vectorization Technique (TVT) was developed to improve the predictability of endolaser-induced remodeling by organizing energy delivery along predefined traction vectors. This approach is based on the concept that subdermal thermal stimulation should follow anatomical support lines and biomechanical tension pathways, allowing the induced fibrosis and collagen deposition to occur in a directional manner. Previous anatomical studies demonstrate that fibrous septa connect the dermis to the superficial musculoaponeurotic system (SMAS), and their shortening may contribute to tissue repositioning and lifting

(Rohrich, 2019; Dell’Avanzato, 2022). By aligning thermal energy with these structures, TVT promotes septal contraction and redistribution of adipose compartments, resulting in improved contour and support.

The choice of the 980-nm wavelength plays an important role in the safety profile of the technique. This wavelength shows balanced absorption in water, hemoglobin, and lipids, allowing gradual and homogeneous heating of the subdermal plane. Compared to wavelengths with higher water absorption, such as 1470 nm, the 980-nm laser provides better thermal control and reduces the risk of excessive fibrosis or carbonization (Alexiades-Armenakas, 2021; Bollero, 2025; Lukac et al., 2023). Controlled heating within the therapeutic window (approximately 60–65 °C in the deep plane) induces collagen shrinkage followed by organized neocollagenesis, which is essential for stable tissue retraction.

Another important aspect of TVT is the use of linear energy density (J/cm) as a parameter for energy control. Unlike surface-based measurements, linear energy better represents the amount of heat deposited along the fiber path, allowing more precise modulation according to tissue thickness and anatomical region (Goldberg, 2023; Borges et al., 2024). The combination of adequate power, controlled retroinjection speed, and multiple low-energy passes favors gradual heating and reduces the formation of hot spots, which are associated with irregular fibrosis and contour deformities (Dell’Avanzato, 2022).

Thermographic monitoring further increases the safety of the procedure by allowing indirect evaluation of subdermal temperature in real time. Maintaining surface temperature within a safe range helps ensure that collagen denaturation occurs without exceeding the threshold for thermal necrosis, improving reproducibility and reducing operator-dependent variability (Lukac et al., 2023).

Post-operative management also plays a significant role in the final outcome. Compression, lymphatic drainage, and controlled mechanical stimulation may influence collagen organization and tissue adhesion, contributing to better contour definition and stability of the lifting effect (Klein, 2000; Godoy, 2010; Dover, 2018). These measures support the concept that the final result of thermal remodeling depends not only on intraoperative energy delivery but also on the biological response during healing.

The clinical follow-up performed in this study demonstrated progressive improvement between the immediate postoperative period and the 60-day evaluation, which is consistent with the known timeline of collagen remodeling. The gradual consolidation of tissue retraction supports the hypothesis that vector-guided thermal stimulation promotes organized extracellular matrix remodeling rather than diffuse fibrosis.

The main limitation of the present study is the absence of histological analysis and the relatively short follow-up period. Future studies with longer observation time, objective imaging methods, and larger patient samples are necessary to confirm the biomechanical effects of thermal vectorization and to better define standardized parameters for different anatomical regions.

Despite these limitations, the results suggest that the Thermal Vectorization Technique represents a reproducible and safe approach for non-surgical lifting and body contour improvement, combining anatomical planning, controlled photothermal interaction, and biomechanically oriented tissue remodeling.

10. CONCLUSION

The Thermal Vectorization Technique (TVT) represents a structured approach for the use of Endolaser in the treatment of cutaneous flaccidity, based on anatomical planning, fat layer thickness evaluation, and directional thermal energy delivery. By respecting tissue depth, vector orientation, and total energy distribution, the technique allows controlled collagen contraction, septal tightening, and progressive tissue remodeling with a favorable safety profile.

Proper selection of vector patterns and energy planes appears to be essential to obtain predictable tightening while minimizing the risk of dermal injury, irregular fibrosis, and overheating. The differentiation of treatment according to adipose thickness, particularly using the 30 mm reference as a planning parameter, contributes to safer and more consistent results.

Although the clinical observations obtained with TVT are promising, additional controlled studies with standardized measurements are required to establish precise parameters, confirm long-term outcomes, and support the technique as a reproducible protocol in minimally invasive tissue tightening procedures.

The integration of anatomical knowledge, biomechanical vector planning, and controlled thermal stimulation may represent an important advancement in non-surgical skin tightening techniques using Endolaser.

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