Frontiers in Health Informatics
ISSN-Online: 2676-7104
www.healthinformaticsjournal.com
2024; Vol 13: Issue 6
Open Access

Efficacy of Endolaser for Submental Remodeling and Contouring

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Cite this paper as: Nagy Mohamed ELNaggar, Mahmoud Saber El-Basiouny, Maha Rafee, Aymen noaman (2024) Efficacy of Endolaser for Submental Remodeling and Contouring. *Frontiersin Health Informatics, 13* (6), 216-224

Abstract
Background: The standard of treatment for enhancing submental shape has been invasive surgical procedures, including targeted liposuction, direct fat excision, and laser lipolysis. The concepts that were originally reported as Endolaser or Endolaser are the foundation of the Endolasering procedure. A laser beam with a wavelength of 1470 nm is emitted via an optical fibre that is inserted into the subdermal tissue. This study purpose was to assess the efficacy and safety of the most recent diode laser 1470 nm as a novel treatment option for double chins in the context of cosmetic rejuvenation.
Methods: 15 patients with skin sagging or a double chin were involved in this interventional trial, which was conducted using an interstitial diode laser at 1470 nm. A clinical examination and laboratory investigations were conducted on all individuals. Biometric measurements (Cutometer, Mexameter, and Visioface), were assessed.
Results: After therapy, there was a substantial decrease in visioface parameters (volume, area, and depth) in comparison to prior to treatment ($P<0.05$). The thickness and density of the skin, dermis, and epidermis exhibited a substantial increase in skin ultrasonography following therapy compared to before treatment ($P<0.05$). The density, as determined by the cutometer, exhibited a substantial rise in R2, R5, and R7 following the treatment in comparison to the pretreatment ($P<0.05$).
Conclusions: Endolaser has proved to be an effective technique in facial rejuvenation as a new treatment modality in double chin. General anaesthesia and recovery time are not required for this method. Furthermore, our investigation demonstrated improved improvement grades, patients' contentment, and physician evaluations. Complications and discomfort were absent in all patients.
Keywords: Diode laser; 1470 nm Laser; Endolaser; Double Chin; Submental fat.

Introduction

A double chin and skin sagging are the results of submental fat build-up. In old and elderly individuals, skin sagging below the chin is indicative of ageing, whereas in young or middle-aged individuals, a double chin creates the illusion of an endomorphic form [1]. Fat removal from specific body sections is not possible by diet and exercise alone, and it may result in fat loss in undesirable regions. This is the reason why the concepts of facial remodelling and body contouring have been introduced [2].
Suction-assisted liposuction and surgical lipectomy are the conventional procedures of body and face reshaping [3, 4]. The standard of treatment for enhancing submental shape has been invasive surgical techniques, including laser lipolysis, direct fat removal, and targeted liposuction. Several disadvantages are associated with these invasive treatments, such as the danger of pulmonary emboli and seroma, protracted downtime, postoperative discomfort, ecchymoses, and bleeding [5]. Numerous minimally invasive fat reduction treatments, including laser-assisted lipolysis, cryolipolysis, radiofrequency (RF) devices, mesotherapy, and high frequency focused ultrasound (HIFU) energy devices using deoxycholic acid or phosphatidylcholine, are employed to address these

deficiencies. In the non-invasive body-contouring device sector, RF energy devices have garnered significant attention [6]

Carbon dioxide laser ablative laser and Erbium:YAG (Er:YAG) laser resurfacing is an excellent approach for skin rejuvenation; however, it is likely to result in adverse effects such as infection, persistent erythema, and scarring [7, 8]. Occasionally, non-ablative lasers, such as the neodymium: YAG (1320 nm) laser and the fractional erbium glass (1550 nm) laser, are combined to mitigate the adverse effects of ablative lasers. Though, they exhibit significantly lower levels of improvement and necessitate more treatment sessions [9, 10].

The 1470 nm wavelength laser has recently begun to be actively employed in surgical procedures. Laser equipment with a wavelength of around 1500 nm is characterised by its absorption in water, which produces unique biological effects. These lasers are mostly employed in urology and for endovenous obliteration of veins, and they are either water-absorbable or water-specific [11]. Nevertheless, the 1470 nm diode laser's high affinity for water and its ability to work on fat allow it to penetrate deeper into tissues, according to the authors. This is because it is widely recognised that the more water and fat a tissue contains, the more beneficial it is, this type of laser transmission and the smaller its dispersion [12]. Consequently, the utilisation of the 1470 nm wavelength in non-surgical Endolasering techniques has been increasingly prevalent in recent years. Some writers have already documented the potential of 1470 nm laser radiation to be used for clinical interventions in other medical fields, such as those that seek aesthetic effects by eliminating unattractive fat, since the early 2000s [13-15].

Initially reported as Endolaser or Endolaser, the endolasering technology is based on these notions. An optical fibre is placed into the subdermal tissue, and a laser beam with a wavelength of 1470 nm is emitted. Through nucleogenesis, this method decreases subcutaneous fat and tones the skin. [16, 17].

Recently the 1470nm diode wavelength has been used for submental lipolysis. Previous studies on the neck have used 1064 and 1320nm wavelengths. Human adipose tissue is approximately 75% lipid and 25% water. Based on the main chromophores in this tissue, coefficient of absorption data indicate that 1470nm would be absorbed at much higher levels than shorter wavelengths by both adipose tissue and the dermis. This technology can also be used to tighten the skin

Therefore, this study targeted to assess the safety and efficacy of the recent diode laser 1470 nm in facial rejuvenation as a new treatment modality in double chin.

Patients and methods

This study includes 15 patients, both male and female, aged 18–55, who were diagnosed with skin sagging or a double chin, had treatment with an interstitial diode laser at 1470 nm in this interventional trial. The patients were granted informed written consent prior to their enrollment in the study. This study was carried out at the National Institute of Laser Enhanced Sciences (NILES) Cairo university outpatient clinics, the study includes 30 patients from December 2022 to November 2023 was done in accordance with the established rules of the institutional ethical committee of National Institute of Laser Enhanced Sciences (NILES) Cairo university (Approval code:).

The inclusion criteria were individuals who presented to our clinic for a double chin and were deemed nonsurgical methods. They had a medical contraindication to surgery and were not willing to undertake invasive surgical procedures.

Exclusion criteria; Reasons for exclusion from participation in this research study comprised; prior cardiac surgery; chronic illness, like cardiovascular disease and diabetes mellitus, cancer, medical conditions that cause weight variations, swelling, or edema; pregnancy, breast feeding. Other exclusion criteria as local treatments prior surgical procedure for sculpting lower neck or mesotherapy for local slimming, use of other devices like cold sculpting, slimming massages, local RF; external trauma in the treated areas; defect in the coagulant system or take anticoagulant drugs, sensitivity to the injectable lidocaine.

diets as well as an intense physical activity program, mental or hormonal illness that needs some drugs which cause cellulite and fat tissue in the body In such a way, All participants underwent a comprehensive clinical examination, laboratory testing, and history-taking (CBC, PT, PC and INR, RBS).

Procedure:

The technique aims to lift tissues from deeper layers using an optical fiber as thin as a cannula 24G inserted under the skin in the superficial-middle hypodermis. Here it delivers the laser energy, without the need to cross the superficial layers of the skin (epidermis and dermis). This is one of the many advantages that

Endolaser® has over its counterparts such as radiofrequency which deliver targeted energy through the superficial cutaneous layer and therefore undergo homogenous dispersion of laser energy.
Before the operation, the face was coated with iodine and the marks were used to identify the precise location of the wrinkles. A 1-2 mm incision was made through which a cannula with an optical fibre was passed. Through this optical fibre a diode laser beam was fired. (VELAS™ by *GIGA Laser*,. Wuhan, China) was utilized in this trial. A sterilised set was made for each patient. Betadine galipot, injectable serum galipot, sterile gloves, sterile gauze, and sterile fibres for Endolaser comprise a sterile kit. Additionally, a syringe contains injectable lidocaine for anaesthesia.
The intervention area (submandublar area) was cleaned with betadine the submandublar area, which was the site of Endolaser fibre insertion into the skin, was numbened, and the fibre movement area was numbened using injectable lidocaine (2% percent).
The sterile fibre was inserted into the skin after local anaesthesia and pushed superficially in fanning motions to prevent a temperature increase in the intervention area. The laser diode was produced concurrently. The 300 µ fibre was employed in this treatment procedure. The energy and time required to complete the procedure in this area were adujest in every case according to fat layer thickness. The device's intensity and power are as follows: pulse: 3w, time on-time off: 75–25, shots are fires durig withdrawal of the fiber along the lines of the fanning. The patients received the treatment only once, and the device's intensity and power were consistent across all sites of intervention.
The patients were informed of the necessary post-treatment care. Acyclovir tablets were provided for patients with a history of herpes, and the antibiotic was prescribed to prevent potential infections after five days from the treatment. After the treatment the potential adverse consequences, including site infection, edoema or heamatoma brusing were observed and treated. There is no recovery period or downtime associated with this treatment approach. The patients were monitored for three months following the surgery, and they were subjected to skin analysis and biometry.
Assessment of sumental fat and skin qualities
The results of all patients were evaluated using an Ultrasound Imaging system employed in this study was a SonoSite MicroMaxx, this ultrasound equipment with a multi-frequency linear probe (SonoSite Inc., U.S.A.) that was placed perpendicularly to the skin of the submental area, Biometric parameters were measured before and three months after the therapy. The biomechanical qualities of the skin are assessed by the Cutometer. The Cutometer was employed to assess the skin elasticity, with a study of three factors: R2, R5, and R7. The major parameters of the Cutometer, R2 and R7, were used to assess the elasticity and ageing of the skin. R2 reported skin viscoelasticity, which encompassed viscous deformation, while R7 indicated biological elasticity. Net elasticity was reported by R5.
Subjects completed a satisfaction questionnaire at three months post-op, while a physician satisfaction questionnaire was completed at three and six months following
treatment. Satisfaction was graded on a 6-point scale: 1=extremely dissatisfied, 2=dissatisfied, 3=slightly dissatisfied, 4=slightly satisfied, 5=satisfied, 6=extremely satisfied.
Primary outcomes:
The primary outcome include the evaluation of the reduction in the submental fat and improvement of the facial contouring.
Secondary outcome measures:
Assessment of patients and physicians: Three dermatologists who were blinded assessed the impact of the Endolaser procedures on the double chin, and patients' satisfaction was also assessed as follows: no satisfaction, slightly satisfied, fairly satisfied, and well satisfied [18].
Pain assessment:
Pain assessment during treatment (Time Frame: Immediately following the therapy): The pain experienced by patients throughout the treatment will be documented using a validated numeric rating scale (NRS) (0-10), with 0 representing no pain and 10 being the most severe pain conceivable [19].

Statistical analysis:

SPSS v28 was employed to conduct the statistical analysis (IBM Inc., Armonk, NY, USA). The mean and standard deviation were used to present quantitative variables (SD). The paired sample t-test is a statistical method that is employed to compare the means of two correlated populations. Qualitative variables were analysed using the Chi-square test or Fisher's exact test, as appropriate, and provided as frequency and percentage (per cent). Statistical significance was defined as a two-tailed P value that was less than 0.05.

Results

The current study comprised 15 individuals, with a mean age of 37.5 ± 10.8 years. 11 patients (73.33 %) were male, whereas 4 patients (26.67 %) were female. **Table 1**

Table 1: Demographic data of the studied patients

		N=15
Age (years)		37.5 ± 10.8
Sex	**Male**	11 (73.33%)
	Female	4 (26.67%)

Data presented as mean ± SD or frequency (%).

Table 2 shows the biometric measurements, where the Visioface parameters (volume, area and depth) had significantly decreased following treatment in comparison with before treatment (P<0.001, <0.001, <0.001), and the mean % change was 59.99 ± 7.2, 36.07 ± 23.1 and 23.65 ± 7.96 respectively.

Additionally, the skin ultrasonography of skin, epidermis and dermis (density and thickness) had had increased significantly after treatment in comparison with before treatment (P<0.05). The mean % change of skin density and thickness was -67.40 ± 81.42 and -43.72 ± 30.71. The mean % change of epidermis density and thickness was -33.72 ± 52.42 and -35.04 ± 22.00. The mean % change of dermis density and thickness was -48.87 ± 9.31 and -38.69 ± 20.75 respectively.

The density as measured cutometer showed significant increase in R2, R5 and R7 after treatment in comparison with before treatment (P<0.001, <0.001, <0.001), and the mean % change was -21.72 ± 24.02, -45.39 ± 20.46 and -39.66 ± 10.61 respectively.

Table 2: Biometric measurements before and after treatment of the studied patients

	Before treatment	**After treatment**	**% change**	**P value**
Ultrsonography				
Volume	119.6 ± 19.1	47.6 ± 9.9	59.99 ± 7.2	**<0.001***
Area	13.6 ± 3.38	8.1 ± 1.6	36.07 ± 23.1	**<0.001***

thickness	9.9 ± 0.88	7.5 ± 0.5	23.65 ± 7.96	**<0.001***
Cutometer				
R2	0.65 ± 0.08	0.78 ± 0.08	-21.72 ± 24.02	**<0.001***
R5	0.51 ± 0.03	0.74 ± 0.11	-45.39 ± 20.46	**<0.001***
R7	0.43 ± 0.03	0.60 ± 0.02	-39.66 ± 10.61	**<0.001***

Data presented as frequency (%), or mean ± SD,*: statistically significant as p value <0.05.

Before treatment, no satisfaction was observed in 11 (73.33%) patients while 4 (26.67%) patients were slightly satisfied. After treatment, 4 (26.67%) patients were moderately satisfied, and 11 (73.33%) patients were well satisfied. The patients' satisfaction was significantly improved after treatment compared to before treatment (P<0.001). **Table 3**

Table 3: Patients' satisfaction of the patients studied

		Before treatment	After treatment	P value
Patients' satisfaction	**No satisfaction**	11 (73.33%)	0 (0%)	**<0.001***
	Slightly satisfied	4 (26.67%)	0 (0%)	
	Moderately satisfied	0 (0%)	4 (26.67%)	
	Well satisfied	0 (0%)	11 (73.33%)	

Data presented as frequency (%), *: statistically significant as p value <0.05.

As regard to the physician assessment, the mean assessment of physician 1 was 85.9 ± 3.41, the mean assessment of physician 2 was 81.1 ± 3.54 and the mean assessment of physician 3 was 80.7 ± 3.72. **Table 4**

Table 4: Physician assessment after treatment of the studied patients

		N=15
Physician assessment	**Physician 1**	85.9 ± 3.41
	Physician 2	81.1 ± 3.54
	Physician 3	80.7 ± 3.72

Data presented as mean ± SD.

Before treatment, 11 (73.33%) patients revealed mild improvement and 4 (26.67%) patients revealed moderate improvement. After treatment, 5 (33.33%) patients revealed good improvement and 10 (66.67%) patients revealed excellent improvement. After treatment, the treated patients exhibited significant improvement compared to before treatment (P<0.001). **Table 5**

Table 5: Improvement grades of the studied patients

		Before treatment	After treatment	P value
Improvement grades	**Mild**	11 (73.33%)	0 (0%)	**<0.001***
	Moderate	4 (26.67%)	0 (0%)	
	Good	0 (0%)	5 (33.33%)	
	Excellent	0 (0%)	10 (66.67%)	

Data presented as frequency (%), *: statistically significant as p value <0.05.

Fig 1**:** the result of a case with summandublaer fat before treatment (A) and three months after treatment (B).

Discussion

In comparison to the baseline, the principal findings of this study suggest that there is a substantial reduction in submental fat and an improvement in facial contouring. After therapy, there was a substantial reduction in submental circumference and fat thickness. Also, after treatment, Visioface parameters (volume, area and depth) had significantly decline, the skin ultrasonography of skin, epidermis and dermis (density and thickness) had had significantly increased and the density as measured cutometer showed significant increase in R2, R5 and R7.

This is the first report of the Endolaser that demonstrates its safety and efficacy in enhancing the appearance of the double chain, to the best of our knowledge.

Aesthetic medicine is a profession that is constantly expanding, and non-invasive fat removal is no exception. The gold standard in non-excisional body shaping is still considered suction-assisted liposuction. However, a growing number of patients are seeking non-invasive, cost-effective procedures with minimum downtime [20, 21]. Heating, cooling, laser, radiofrequency, and ultrasound sources have been implemented to enhance skin laxity and sagging. Ecchymosis, edoema, and discomfort may be reduced by these technologies [22, 23]. Cryolipolysis is a non-invasive method that employs controlled, localised cooling to produce an inflammatory reaction within adipose tissue and apoptosis of adipocytes, hence causing selective fat loss [24]. In theory, fat cells are more susceptible to cold than other tissues and may be destroyed by a cold stimulus at temperatures above freezing but below body temperature for a specific length. Numerous clinical investigations have demonstrated fat reduction [25-27]. Nevertheless, there is a possibility of temporary dysesthesia and a number of drawbacks, including a relatively lengthy application time (30–60 minutes for a single application), discomfort during treatment, and restrictions on the form of the applicator [28].

There is a lingering concern that the lipid profile may be impacted by the passage of fat from adipocytes into the bloodstream; nevertheless, this matter remains contentious [29, 30]. A new 1060 diode laser with a special affinity for adipose tissue was just introduced; nevertheless, clinical trial data are still required. [31]. Adipocytes can be lysed by ultrasound through the generation of heat and a mechanical compression wave (>20 kHz). Low intensity/low frequency nonthermal ultrasound and HIFU are the two primary categories into which ultrasound techniques can be classified. Mechanical stress created by inertial cavitation is employed by nonthermal ultrasound to destroy fat tissue. Nevertheless, cavitation is more difficult to manage and less predictable than HIFU [32]. HIFU delivers ultrasonic ablation energy to deep fat tissue that is targeted and high-intensity. The energy generates rapid heating in the targeted zone, which results in the ablation of adipocytes and the remodelling of collagen. The clinical response is evident; nevertheless, there is a dearth of long-term data that spans beyond three months [33, 34].

Ali et al. [35] assessed the efficacy of the Endolaser laser as a novel non-invasive approach for the treatment of horizontal neck wrinkles. Biometric alterations and patients' happiness were employed to assess the outcomes of their investigation. Additionally, the findings were evaluated by three blind dermatologists, and their Visioface results indicated that the Endolaser laser treatment dramatically reduced the depth and area of horizontal neck wrinkles. The density and thickness of the epidermis and dermis were greatly raised, as indicated by the skin ultrasonography results. Additionally, the cutometer results indicated that the Endolaser laser therapy has the potential to enhance skin elasticity. The efficacy of the Endolaser laser in the treatment of forehead wrinkles, acne scars, upper eyelid and eyebrow ptosis, arm and under belly fat, lower eyebags, skin laxity, jowl fat, nasolabial folds, and marionette lines has been previously assessed in other studies [16, 36, 37].

The present study was limited by its single-center design and the small sample size. **Conclusions:** Endolaser laser has proved to be an effective technique in facial rejuvenation as a new treatment modality in double chin. General anaesthesia and recovery time are not required for this method. Additionally, our study revealed an enhanced outcome, patients' satisfaction, physician assessment and better improvement grades. Complications and pain were absent in all patients.

Further larger studies are required to confirm our findings

Financial support and sponsorship: Nil

Conflict of Interest: Nil

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