



High-definition laser-assisted lipoaspiration

Lipoaspiração laser-assistida de alta definição

RODRIGO PINHEIRO MOTTA ^{1*}

■ ABSTRACT

Introduction: Since the introduction of the liposuction technique, the improvement of body contour has been gaining new horizons. Superficial liposuction has been used in favor of aesthetics; the use of technologies, such as VASER and diode laser at 915- and 980-nm wavelengths, helps reduce complications and improves post-time, healing time, and cutaneous retraction. **Methods:** Fourteen patients submitted to high-resolution laser lipolysis were studied between 2014 and 2016. The level of patient satisfaction regarding the treatment outcome was assessed. **Results:** The majority of the patients were men, with a mean age of 39 years and a mean pain score of 2.3 on the visual pain scale (0 to 10), presenting lasting results after 1 year, with no complications and an early return to work and physical activities. **Conclusions:** The use of diode laser at the wavelengths of 915 and 980 nm in high-definition liposculpture promoted satisfactory, promising results and should be tested in a larger sample of patients.

Keywords: Lipolysis; Lipectomy; Lasers; Personal satisfaction; Aesthetics.

■ RESUMO

Introdução: Desde a introdução da técnica de lipoaspiração, a melhora do contorno corporal vem ganhando novos horizontes. O uso da lipoaspiração superficial passou a ser usado a favor da estética e, com isso, o uso de tecnologias, tais como o VASER e o laser de Diodo, nos comprimentos de 915 e 980 nm, diminuem as complicações, com melhora da dor pós-operatória, tempo de cicatrização e retração cutânea. **Métodos:** Foram estudados, inicialmente, 16 pacientes submetidos à laserlipólise de alta definição, entre o período de 2014 e 2016. O nível de satisfação em relação ao resultado foi questionado aos pacientes. **Resultados:** A maioria dos pacientes foi do sexo masculino, idade média 39 anos, com média de dor de 2,3 de na escala de visual de dor (0 a 10), apresentando resultados duradouros após 1 ano, sem complicações e retorno às suas atividades de trabalho e físicas precocemente. **Conclusões:** Desta forma, o uso do laser de Diodo com comprimentos de ondas de 915 e 980nm, associado à Lipoescultura de Alta Definição, promoveu resultados satisfatórios, promissores devendo ser testado numa amostragem maior de pacientes.

Descritores: Lipólise; Lipectomia; Lasers; Satisfação pessoal; Estética.

Institution: Belledevi Plástica & Dermatologia,
São José do Rio Preto, SP, Brazil.

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¹ Belledevi Plástica & Dermatologia, São José do Rio Preto, SP, Brazil.

INTRODUCTION

Improvements in body contour via fat removal have been constantly refined. Between 1970 and 1980, Schrudde published the use of a curette to remove fat in areas such as the lower limbs^{1,2}. Illouz then published the use of blunt cannulas with holes for fat suction³. The initial problems of bleeding, unexpected aesthetic results, and difficult recovery have been resolved with the introduction of new compression loops and local anesthetics as used in the tumescent technique described by Hunstad⁴. The recent technological advances observed, such as the development of ultrasonic liposuction and vibrolipoaspiration, have yielded patient benefits, including reduction of tissue trauma and especially physical stress experienced by surgeons during the surgery⁵.

Athletes constantly complain that even if they perform physical activities, they cannot achieve defined abdominal muscles, i.e., the desired “washboard.”

The traditional abdominal liposuction involves liposuction of the deep layer and usually leaves a layer of fat throughout the wall of the abdomen, preserving the subdermal fat, which minimizes irregularities. The treatment of this layer alone fails to reach the goal of a “tiny belly” because the subdermal fat disrupts the visibility of the muscular details⁶.

The superficial liposuction technique is performed using a thin cannula to refine the skin fold or groove; it was first reported by Illouz to improve the appearance of the infragluteal fold. It is a frequent cause of persistent grooves and sequelae, producing contour irregularities^{6,7}.

In 1993, Mentz et al.⁶ published for the first time a work on high-definition liposuction for athletic men who could not define their abdominal muscles through bodybuilding and called it “abdominal etching,” used only for the anterior wall of the abdomen and for patients with less than 15% fat in the body. In 1997, Ersek and Salisbury published their work, also of the same name, customized, and proposed a specific cannula design for superficial liposuction⁸.

Alongside traditional suction-assisted lipoplasty, other options include ultrasonic, vibratory, and laser lipoplasties. Studies on alternatives and new tools seek to reduce the downtime, operator effort, and bleeding, promote cutaneous retraction, and facilitate surgery in previously operated fibrotic areas^{9,10}.

In 2003, Hoyos presented an improvement of the technique described by Mentz in the Bolivian National Congress, expanding its use to simulate all the muscles of the abdomen, back flanks, and legs, specifically pectorals in men and glutes in women, which denominated high-definition liposculpture (HDL). It was a breakthrough

technique, but required highly trained surgeons for its accomplishment. The technique is exhausting for surgeons and very painful and traumatic for patients. The adverse consequences of the procedure include a slow recovery and prolonged edema¹¹. In 2007, Hoyos and Millard¹² published an association of VASER use with HDL.

The first studies on laser lipolysis were published by Apfelberg between 1992 and 1996 using the neodymium yttrium aluminum garnet laser inside the cannula employed for liposuction¹³. Widely used in Europe and Latin America, laser lipolysis (also called laser lipoplasty) was introduced in North America in 1994^{10,14} and approved by the Food and Drug Administration in October 2006¹⁵⁻¹⁷.

The application of the laser in liposuction promotes a reduction of the mechanical trauma to the surrounding tissues, which results in less formation of fibrosis, reduced bleeding via coagulation of the blood vessels, less pain, and faster recovery, favoring postoperative comfort. In addition, immediate and late marked tissue retraction occurs via stimulation of collagen, which is better evaluated after the third postoperative month¹⁷⁻²⁵. Minor complications, such as ecchymosis, edema, and temporary decrease in sensitivity in the operated region, burns, nodularities, and seromas, are correlated with the use of laser in liposculpture^{5,10,19,22,26-28}.

The wavelengths 1064 nm and 980 nm are better absorbed by water than by fat. Between 900 nm and 950 nm, absorption in fat is greater than absorption in water. The fat absorption coefficient is seven times higher at 924 nm than at 1064 nm. Further, the water absorption peak is greater at 975 nm than at 1064 nm^{29,30}.

OBJECTIVE

The purpose of this study was to evaluate the outcomes of diode laser at 915-nm and 980-nm wavelengths in HDL.

METHODS

In this study, we selected 14 patients treated by the same author using high-definition laser-assisted liposuction, starting in 2014. Only one patient had a sedentary lifestyle. Two patients who had less than 30 postoperative days were excluded. The mean age of the patients (eight men and six women) was 39 years (ranging from 23 to 64 years).

All patients were examined, and the risks and procedures were discussed. They underwent routine preoperative examinations, were released by the cardiologist, signed a preoperative consent form, and

authorized the disclosure of their surgical results. The study followed the rules of the Declaration of Helsinki, and there are no conflicts of interest.

Some patients underwent combined surgeries. Patient 3 underwent mammoplasty with prosthesis implantation and abdominoplasty scar retouching; patient 6 underwent pectoral prosthesis implantation, rhinoplasty, and gynecomastia surgery; patient 10 underwent facial minilifting; and patient 13 underwent plication of the aponeurosis of the rectus abdominis muscle.

Detailed preoperative markings were performed with the patients in the orthostatic position. The patients were asked to flex and contract their abdominal muscles to help define the details of the musculature. The medial and lateral areas of the rectus abdominis muscle were marked on the linea alba and semilunaris. The transverse interstices of the rectus abdominis muscle were also marked separately. With the patients on their back, the flanks and back were delimited (Figure 1).



Figure 1. Preoperative markings.

The patients were anesthetized, intubated, and left with an artificial ventilatory support and wore surgical compression socks and intermittent external pneumatic compression device in the legs (Phlebo Press® DVT, Mego Afek, Israel). All of them received antimicrobial prophylaxis with 2 g cefazolin at the anesthetic induction or up to 1 hour before surgery and were positioned first in the ventral horizontal decubitus for treatment of the posterior region. The areas to be treated were then degermed using chlorhexidine degermant and antiseptic solution consisting of chlorhexidine alcohol.

Punctures were performed using scalpel blade n15 in the upper medial intergluteal region and lumbar medians to access the flanks. In case treatment of the upper dorsal region was needed, two other punctures were performed on each side, one medial and another superolateral to the region.

The anesthetic solution used was uniformly distributed xylocaine (0.05 to 0.1%) with adrenaline (1: 1000) at a concentration of 1: 250,000 U/mL using a Klein needle.

Fibers of 600-800 nm in diameter and initially at the wavelength of 915 nm were used for lipolysis, continuous pulse, and individualized potency according

to the medical evaluation and treatment protocols of the device manufacturer (Delight®, Vydence Medical, Brazil) (Figure 2).



Figure 2. Delight® apparatus - Vydence Medical.

Thereafter, liposuction was performed using a Mercedes curved cannula and 3-mm straight vacuum connected to the aspirator (Medela Dominant 50®, Switzerland) and adjusted to a vacuum pressure of 50 cmHg. The pinch test was performed to assess the thickness of the residual subcutaneous tissue.

The wavelength of 980 nm was then fired in the treated regions to promote tissue contraction.

The proportions between the 915- and 980-nm wavelengths were inconstant and dependent on the main action that the operator most preferred, individually defined lipolysis or cutaneous retraction.

Mononylon 5.0 sutures and occlusive dressings (Terracortril®) were used.

The patients were then moved to the dorsal horizontal position and inserted with a bladder catheter for relief or delay and after new asepsis and antiseptic, performed bilaterally on the pubic bone bilaterally, superiorly and within the umbilical scar, another in the upper region of the linea alba, and another 2 on each side, in the semilunar lines, for the treatment of the transverse inscriptions of the rectus abdominis, external oblique, and anterior serratus muscles.

After infusion of the solution, the same sequence of procedures described above was performed, seeking to intensify the markings of the muscular limits superficially.

After finishing the treatments, closing the punctures, and applying dressings, the patients were applied with a compression mesh.

After an average of 6 to 8 hours postoperatively under appropriate conditions, the patients were

RESULTS

discharged with antibiotic prophylaxis for another 4 days (cefadroxil 500 mg) and analgesics, such as dipyrone or codeine in combination with paracetamol.

The chemoprophylaxis for deep venous thrombosis with low molecular weight heparin (enoxaparin) was analyzed in each case, i.e., whether with risk factors, longer surgical time and longer recovery time, prolonged trips before or after the procedure, at a dose of 40 mg per day for 7 days. The compression stockings were used for a mean of 1 to 7 postoperative days.

The first follow-up was performed on the first postoperative day to start the treatment with lymphatic drainage and electric current ultrasound (Manthus®, KLD Biosistemas, Brazil), ranging from 10 to 20 sessions, based on the presence of local edema and swallowing condition.

The stitches were removed between 7 and 12 days postoperatively, and the micropore was maintained up to 3 months in the evident scars.

The majority of the patients were allowed to perform physical activities after 7 days.

To evaluate the results, a questionnaire regarding expectations and postoperative satisfaction was prepared, which was delivered and answered by the patients personally or via e-mail (Tables 1 and 2).

Ten patients underwent only high-definition laser liposuction. All of them were discharged on the same day; those who were working returned to work after an average of 4.25 days and physical activities after an average of 12.2 days. The patients who underwent combined surgeries had to return to work and physical activities late. The average aspirated volume was 1875 mL, ranging from 700 mL to 2800 mL.

The average accumulated energy delivered by the optical fiber was 11273.5 J in the abdomen and 6106.3 J and 5769.8 J in the right and left flanks, respectively (Table 1).

The mean pain score was 2.42 (on a scale of 0 to 10; ranging from 0 to 6). Eight patients had more than 6 months of follow-up. Of them, two (25%) reported having lost the aesthetic result because they had gained weight. One of these eight patients became pregnant before completing 1 year of postoperative follow-up and stated that she did not lose the result despite her pregnancy.

No seroma was detected in any of the patients studied. There were no serious bruises. Only small bruises were observed in nine patients (69.23%).

All 14 patients in this study were satisfied. Twelve patients (85.71%) reported higher than expected results,

Table 1. Profile of the study patients and surgical parameters.

Patients	Sex	Age	Postoperative recovery	Total aspirated volume (mL)	Combined surgery	Accumulated energy in the abdomen (J)	Accumulated energy in the right flank (J)	Accumulated energy in the left flank (J)
Patient 1	Male	28	2 years	2500	No	18515	6084	6056
Patient 2	Male	33	2 years	1000	No	3190	1500	1500
Patient 3	Female	38	1 year and 11 months	4050	Yes	12312	9178	9092
Patient 4	Male	31	1 year and 10 months	1500	No	19216	10592	10652
Patient 5	Female	36	1 year and 9 months	1900	No	14006	4630	5012
Patient 6	Male	44	1 year and 1 month	2100	Yes	12796	4128	4140
Patient 7	Male	64	10 months	1500	No	9990	1000	1000
Patient 8	Female	47	7 months	1500	No	11160	3145	3145
Patient 9	Male	27	4 months	1500	No	8360	8448	8494
Patient 10	Male	61	2 months	700	Yes	2638	3144	3351
Patient 11	Male	38	2 months	2800	No	18508	10246	6912
Patient 12	Female	23	2 months	1600	No	6442	5490	5084
Patient 13	Female	37	1 month	2000	Yes	14630	7036	8352
Patient 14	Female	39	1 month	1800	No	6066	10868	7988
Average		39		1875		11273.5	6106.3	5769.8

Table 2. Study patient responses.

Patients	Pain level	Practice physical activity	Return to work (days)	Return to physical activities (days)	History of liposuction	Is laser lipolysis more or less painful than regular liposuction?
Patient 1	4	Yes	14	15	Yes	Less
Patient 2	0	Yes	7	7	No	–
Patient 3	1	Yes	30 (vacation)	90	Yes	Less
Patient 4	5	Yes	3	15	No	–
Patient 5	6	Yes	7	30	No	–
Patient 6	3	Yes	14	180	Yes	Less
Patient 7	0	Yes	1	1	Yes	Less
Patient 8	3	Yes	3	14	Yes	Less
Patient 9	1	Yes	3	1	No	–
Patient 10	0	Yes	7	30	Yes	Less
Patient 11	0	Yes	22 (vacation)	30	No	–
Patient 12	3	Yes	2	2	Yes	Less
Patient 13	5	Yes	20 (vacation)	30	Yes	Less
Patient 14	3	Yes	1	7	Yes	Less
Average	2.42					

and two (14.28%) stated that their results adequately met their expectations. All indicated that they would undergo the same procedure if necessary (Table 2). All patients who had already undergone liposuction using only cannulas previously (9) stated that the procedure using laser was less painful.

No patient had skin burns. Some had dyschromias in the puncture site due to the friction of the liposuction cannula, but did not express a desire to touch up the scars. In sequence, some cases are reported in Figures 3 to 7.

DISCUSSION

Lipoplasty of the deep layer only does not achieve the desired “taupe belly” result in patients. The increasing search for an athletic body has been demanding among professionals, using their labor skills and more advanced techniques to improve the results. Surface layer treatment is necessary to optimize results⁶.

In this study, diode laser at the wavelengths of 915 and 980 nm using a high-definition technique was employed.

These wavelengths in laser lipolysis led to fat liquefaction and vessel coagulation, reducing bleeding, trauma, pain, edema, and cutaneous retraction, preventing increased sagging, mainly supraumbilical sagging, decreasing the “downtime” among patients, and finally allowing an early return to their physical activities^{5,9,10,14,17,20}.

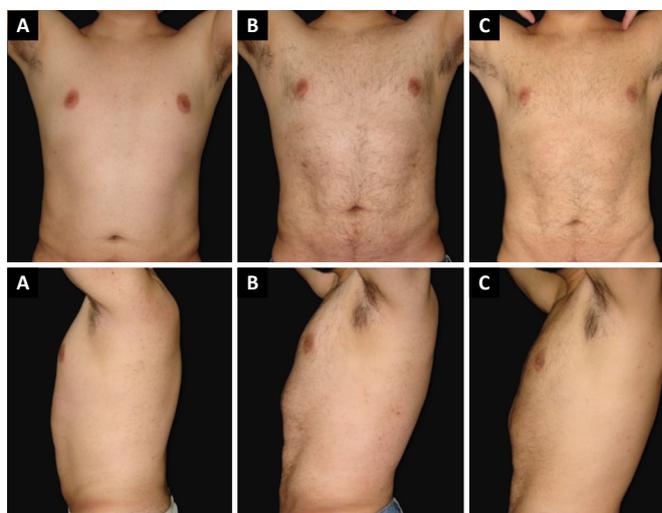


Figure 3. Patient 1. A: Preoperative; B: 3-months postoperative; C: 1-year postoperative.

In 2007, Hoyos and Millard¹² presented that their VASER-assisted high-resolution liposculpture achieved an 84% satisfaction rate among their patients. Seromas were observed in 6.5% of cases and resolved with punctures. The use of drains was standardized for 48 to 72 hours. Of the 306 cases, 3.92% presented a loss of definition.

The results were persistent during pregnancy in the study by Hoyos and Millard¹² as in our study.

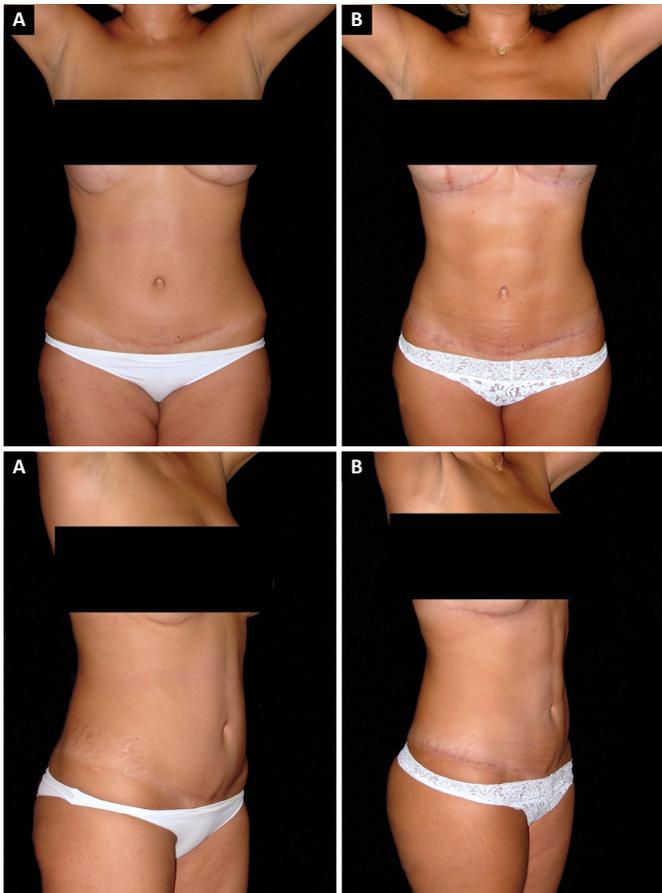


Figure 4. Patient 3. A: Preoperative; B: 6-months postoperative.

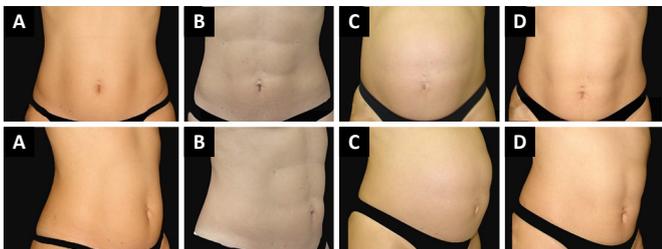


Figure 5. Patient 5. A: Preoperative; B: 2-months postoperative; C: Postoperative period of 1.4 years and 26 weeks and 4 days of gestation; D: 3-months puerperium.

Regarding pain on a scale of 1 to 5, Hoyos and Millard¹² published a scale between 3 and 4. In this sample, the mean score was 2.42 (on a scale of 0 to 10). In the study by Dornelles et al. in which laser lipolysis at 980 nm was used in 400 cases, patients who have had an experience with cannulated liposuction have reported postoperative evolution with less pain and recovery of a more rapid discomfort compared with their previous experience. The action of the laser in the innervation surrounding the path of the laser fiber promotes

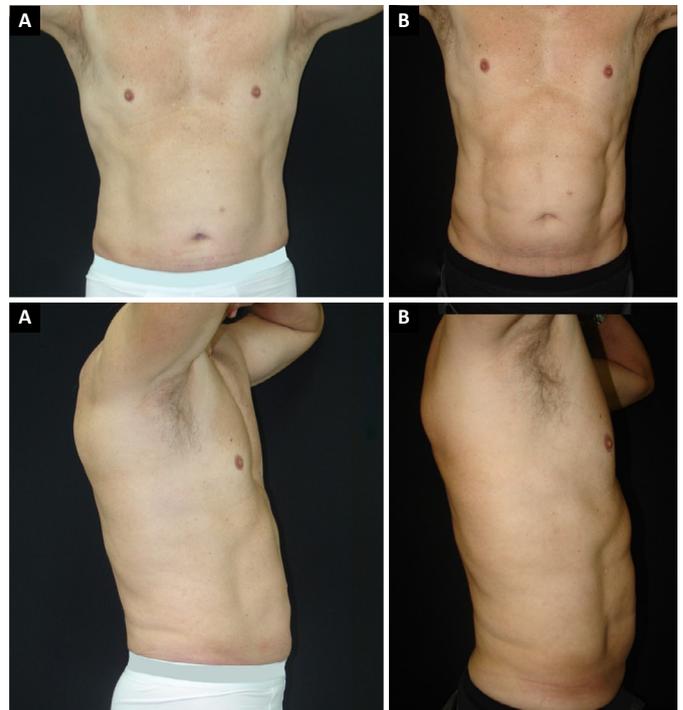


Figure 6. Patient 7. A: Preoperative; B: 9-months postoperative.

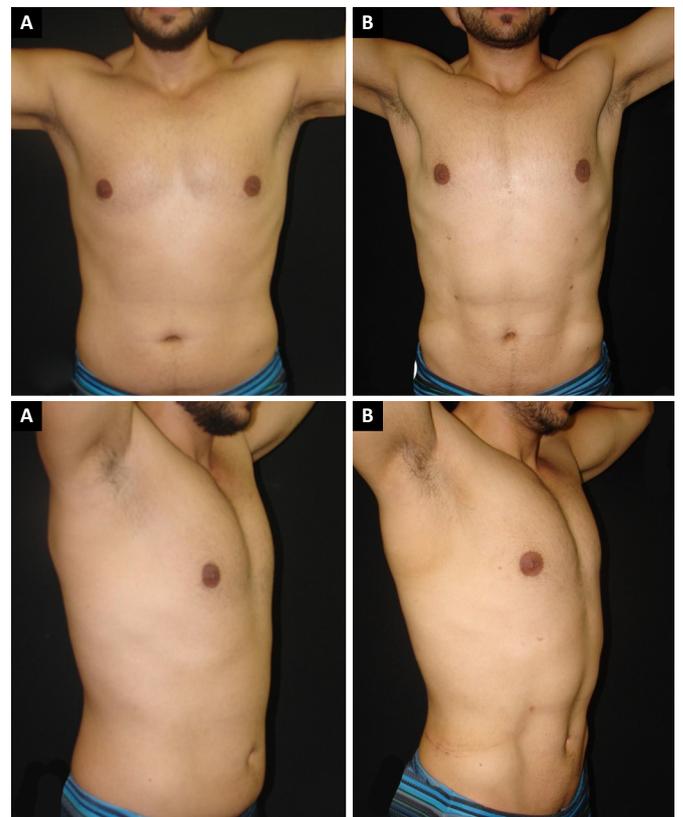


Figure 7. Patient 9. A: Preoperative; B: 3-months postoperative.

paresthesia and even transient anesthesia, making the postoperative period more comfortable⁵. In agreement with our observations, the findings of these studies are in favor of the lower index of pain and faster recovery using laser in lipoplasty.

The technique presented here, specifically for those patients who want to have a highly defined and athletic-looking abdomen, showed minimal risks. Despite the increase in the duration of the procedure, the thermomechanical energy of the laser seemed to reduce the risks of complications, such as bleeding and hemodynamic changes, although we were not able to affirm this because these factors were not part of this study. Abdelaal and Aboelatta²⁴ conducted laboratory studies in supernatants of liposuction on the side where laser-assisted liposuction was performed and reported that there was a 50% reduction in the amount of hemoglobin and red blood cell loss. Badin et al.²⁵ histologically analyzed the region submitted to the laser and also showed decreased bleeding.

The patient satisfaction exceeded the expectations in the study cohort. With proper patient selection and use of the high-definition laser-assisted technique, improved sculpting the abdomen can be achieved, enhancing natural folds, defining muscular contours, and achieving a larger and more natural cutaneous retraction than that in deep lipoplasty.

In the study by Mentz et al.⁶ regarding superficial layer treatment in specific anatomical regions, they concluded that this treatment could be used for specific patients who want to have a muscular abdomen and could exceed expected satisfaction. Ersek and Salisbury⁸ concluded that sculpting the abdominal musculature promotes a high level of outcome for experienced plastic surgeons. Holes and Millard¹² concluded that this definition can reach an audience that had never thought about undergoing a body contouring procedure but would seek to achieve definitions in the body they could not achieve with diets and exercises.

In our study, two patients were older than 60 years and demonstrated that the desire to have a "small abdomen" is not restricted to young men, as also evidenced in the study by Hoyos and Millard¹².

In the analysis of 534 laser lipolysis procedures by Reynaud et al.¹⁰ in 2009, 83% of patients reported no pain or discomfort in the first week, and 17% reported average pain or discomfort. Some of the study patients underwent aspiration after laser lipolysis.

Moreno-Moraga and Royo de La Torre²¹ also demonstrated a low pain intensity and level of satisfaction, and more than 80% of patients achieved their expectation after laser lipolysis.

In 2013, Senra²² published in his study on laser lipolysis that 96% of patients considered their results

as satisfactory and that the complaints of pain were discrete.

Coinciding with our observations, the findings of these studies are in favor of a lower pain index and faster recovery using laser in lipoplasty.

However, comparative studies between VASER and diode laser are needed. It was not found, also other works, using the laser in the technique of HDL.

Although the technique presents a high learning curve and a longer surgical time, the recovery of the patients without combined surgeries was fast, with an early return to their work and physical activities.

The use of diode laser at the wavelengths of 915 and 980 nm in HDL yielded satisfactory outcomes.

COLLABORATIONS

RPM Analysis and/or interpretation of data; statistical analyses; final approval of the manuscript; conception and design of the study; completion of surgeries and/or experiments; writing the manuscript or critical review of its contents.

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Corresponding author:*Rodrigo Pinheiro Motta**

Avenida Murchid Homsí, 2200, 7 andar - Quinta das Paineiras - São José do Rio Preto, SP, Brazil

Zip Code 15080-325

E-mail: drrodrigo@belledevi.com.br