Our Experience Treating 500 Lipodystrophic Areas with a 924/975 nm Laser, a New Device That Induces Lipolysis and Heating of the Dermis and Fibrous Septa of Fatty Tissue

Moreno-Moraga J[1,2] *and Royo J*[1]

Affiliations: [1]*Instituto Medico Laser (IML) and* [2]*Universidad Complutense de Madrid, Madrid, Spain*

ABSTRACT

BACKGROUND AND OBJECTIVE

Demand from the general public has led to the development of laser-assisted lipolysis. We designed a working protocol to assess the clinical results of a new laser-assisted lipolysis system, SlimLipo™.

MATERIALS AND METHODS

We studied 500 areas treated with laser-assisted lipolysis. Dosimetry was established and heating was assessed using thermographic photography. Pre- and postfat thickness in the treatment area was measured using ultrasonography. We assessed tightening, firmness, and regularity. Patients were questioned about tolerance, downtime, effectiveness, and fulfillment of expectations.

RESULTS

In most cases, the SlimLipo™ laser enabled us to achieve a 50% reduction in the thickness of the fatty tissue. A satisfactory response was obtained in all the parameters assessed, and patients were satisfied with the skin response and with the volume reduction too. Most patients considered the procedure very tolerable and were satisfied with the results, and more than 80% felt that their expectations had been met.

DISCUSSION AND CONCLUSION

Laser-assisted lipolysis is a technique that is still being developed. We arbitrarily set our dose considering that a 924 nm wavelength is absorbed by fat seven times more than a 1064 nm wavelength. Further studies are necessary to improve dosimetry with this device. Tightening, firmness, and regularity were satisfactory in most patients. Patients were very satisfied with regard to tolerance, pain, downtime, results, and fulfillment of expectations. In summary, we believe that this new laser is a safe and minimally invasive option for satisfactory correction of contour and volume.

Keywords: Adipose Tissue, Laser-Lipolysis, Skin Tightening

Correspondence: Moreno-Moraga, Instituto Medico Laser (IML), Paseo del General Martínez Campos, 33, 28010, Madrid, Spain. Tel: +34-917-024-627; Fax: +34-917-024-893; e-mail: consulta@iml.es

INTRODUCTION

Since the 1990s, tumescent liposuction has been the most effective method for body contouring, especially in the treatment of lipodystrophic areas. This technique is ideally indicated for patients with localized fat deposits and a low degree of obesity.[1–3]

Confidence in the safety of the technique and years of experience mean that we can now treat increasingly large areas, with longer surgical time and increased doses of anesthetic. Treatment of large areas and very long surgical times in turn may have led to fatal risk situations in some cases.[3–5] Furthermore, tightening of the skin has not been satisfactory in several areas.[1,3–5]

These drawbacks have not diminished public demand for body contouring, and there has been a considerable increase in the search for noninvasive, less risky techniques that require lower doses of anesthesia and have little or no downtime. Thus, ultrasound, radiofrequency, and cryolipolysis have proven effective at reducing unwanted fat deposits.[6–10] The defining characteristic of these treatments is that they induce an effect, the intensity of which affects the quality of the result. Unlike the result of liposuction, which depends on the skill of the surgeon, individual outcomes vary and often fall below the expectations of both doctor and patient.

Laser treatment of body contour disorders has been introduced as adjuvant therapy in liposuction. Lipolysis reduces the invasiveness of suction and increases its selectivity. Heating the

Journal of Clinical Dermatology drm000015 3/9/2010 14:23:34

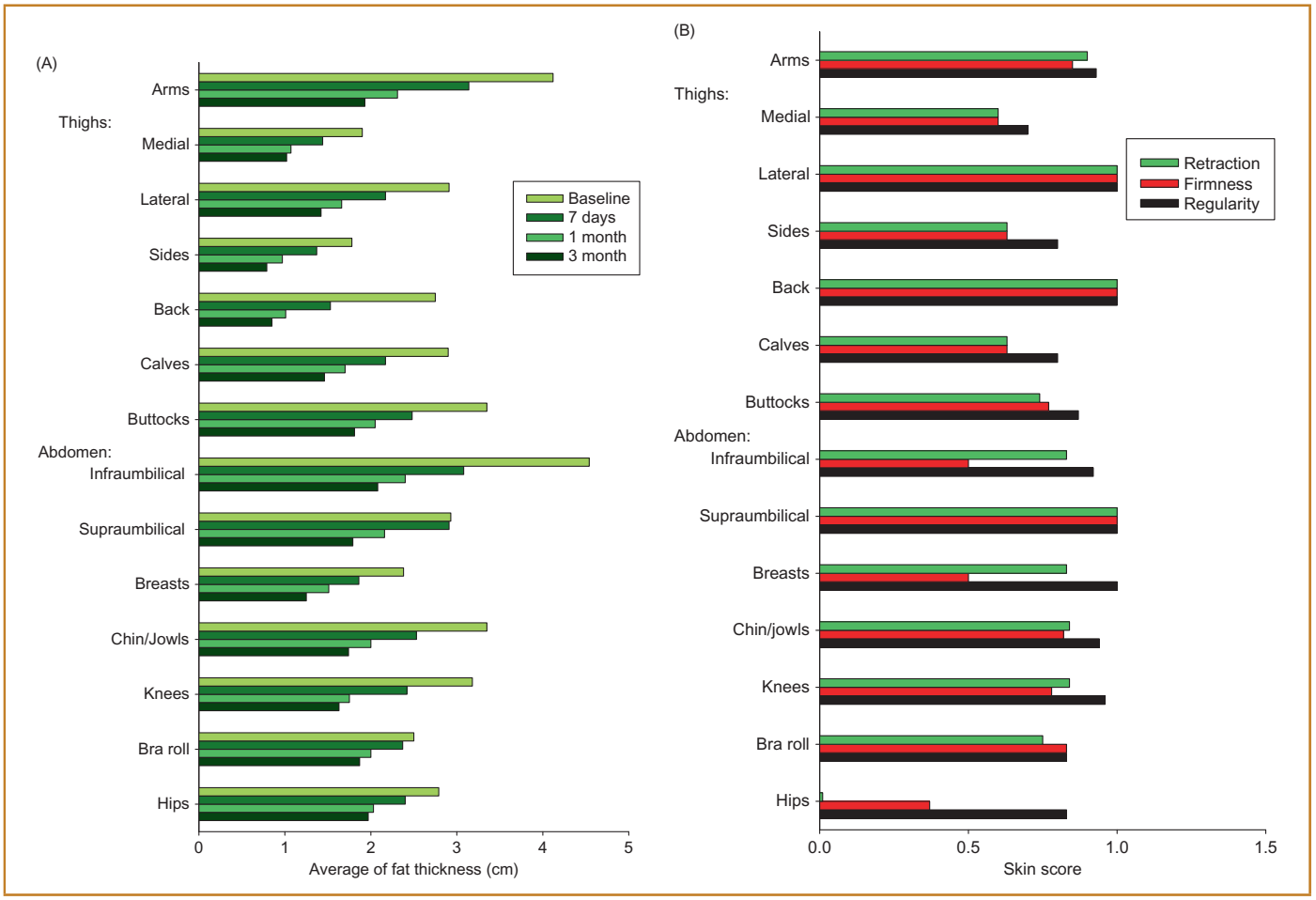

Figure 1. Average of fat thickness (panel A), skin score (panel B), PSI tolerance to the procedure (panel C), satisfaction index (panel D), and effectiveness and tolerance of procedure (panel E) in patients included in this study. Tolerance of procedure was done according to the Visual Analogue Scale (VAS, a standard diagnostic tool for rating pain), occupational disability; effectiveness of the procedure: perceived degree of improvement (Global Aesthetic Improvement Scale [GAIS]), expectations fulfilled, and willingness to recommend the procedure to others. Patient's overall opinion of tolerance and effectiveness questionnaire is included in Table 3.

6

dermis and fatty tissue septa aims to improve the skin's ability to tighten.[11]

The objective of our study is to verify the efficacy and safety of a laser, the Aspire SlimLipo™, which causes lipolysis as well as heating and coagulation of the most water-rich structures in fatty tissue (dermis and fibrous septa) in an open study. We evaluated the correction in terms of volume and form, and assessed the skin's ability to tighten. Our aim was to optimize working protocols, both in terms of dosimetry and in terms of applicability, in order to take full advantage of the capabilities of this tool.

RESULTS

Fat thickness decreased by approximately half that recorded in the preoperative ultrasound scan. The reduction was noticeably lower on the arms and anterior thighs, and very high in patients with gynecomastia and pseudogynecomastia (Figure 1, panel A). The reduction was progressive and reached a peak at 3 months. In particular, there was additional reduction of approximately 10% from the first month after the final follow-up at 3 months. The ultrasound scan at day 7 revealed an overall increase in echogenicity and loss of the habitual pattern of the fatty tissue, with linearly distributed liquid areas under the skin (Figure 2). At 1 month, the ultrasound pattern was normal.

The quality of the skin response reached an average score of 2.42 (3, excellent; 2, acceptable). The best—almost excellent—results were achieved on the calves, pectoral area (gynecomastia and pseudogynecomastia) (Figure 3), under-chin (Figure 4), and outer thighs (Figure 5). The results for the abdomen were very satisfactory (Figure 6), and the worst results (regular or no improvement) were observed for the arms and bra roll (Figure 1, panel B). Some patients showed considerable regularization and improvement in skin texture, and the quality of the response was better than that of the adjacent areas (Figure 7).

The patients reported that intraoperative pain (score, 1.99) (Table 3) and postoperative pain (score, 2.02) were mild and very tolerable. Mean consumption of analgesics was 1.3 capsules per patient. No patient had a downtime greater than 3

Journal of Clinical Dermatology drm000015 3/9/2010 14:23:34

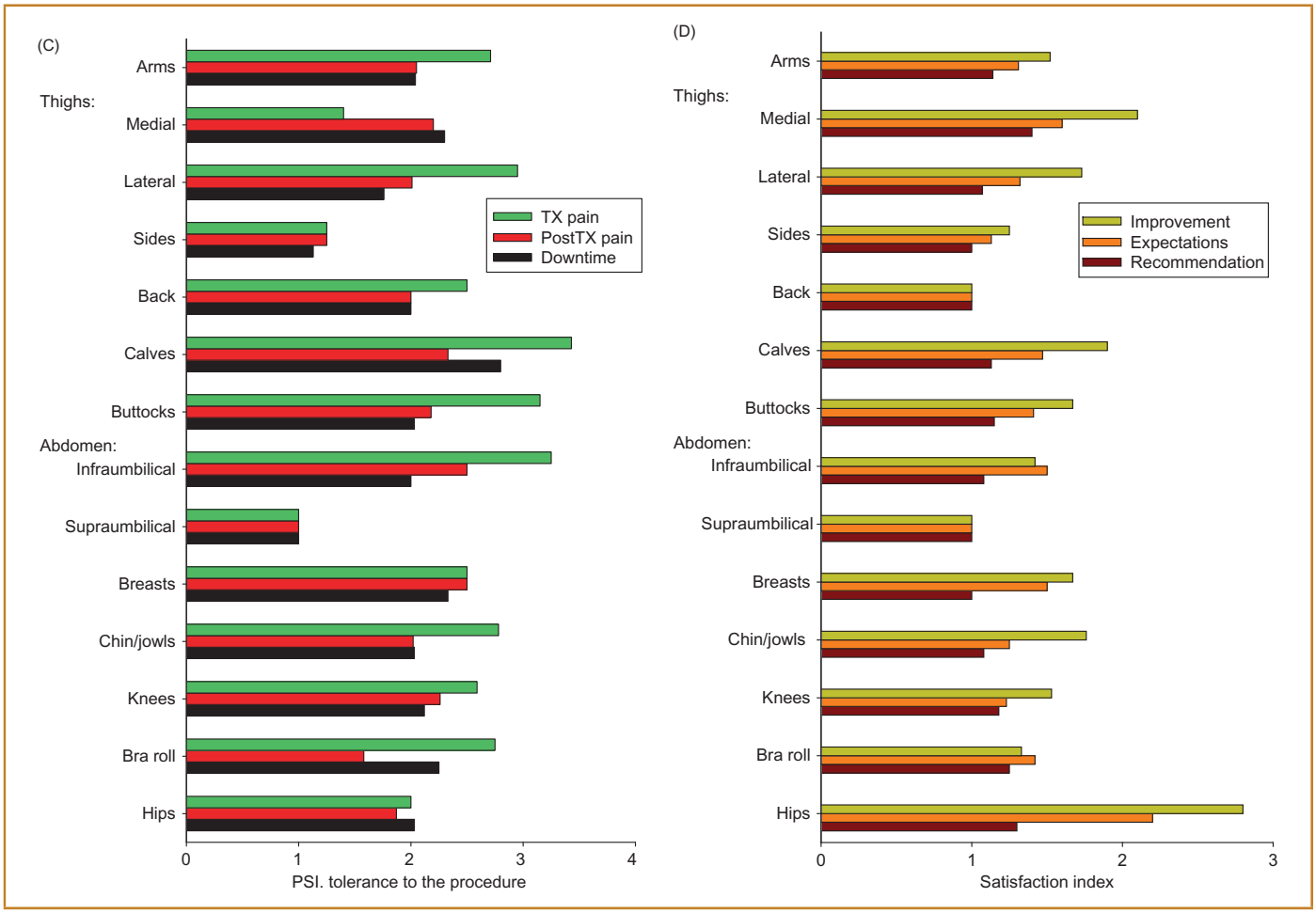

Figure 1. (Continued)

days (score, 2.39; more than 3 days equals four points) (Figure 1, panel C).

Patients evaluated their degree of improvement as 3.15 (4, very much improved; 0, not improved). Their expectations were met in more than 80% of cases, with a mean score of 3.70 (90–100% scored 4 and 70–90% scored 3). Even in cases where the improvement was not very satisfactory, patients were satisfied with the volume reduction (arms, bra roll). Lastly, 90% of patients would recommend the treatment to others (Figure 1, panel B and D).

The overall opinion of the patient and investigator in terms of effectiveness and tolerance were similar (scores, 3.14/3.26; 4, very good; 3, good), although there were differences in cases where the skin did not respond satisfactorily. In these cases, the investigator had a poorer opinion than the patient (Figure 1, panel E).

The relationship between the satisfaction score and the difficulty score shows that the presence of previous liposuction, scarring, or even severe trauma and severe varicose veins does not affect the result: 77.8% of cases showed a good result compared with 0.8% with a poor result or no improvement. More than one-third of the cases of liposuction performed on the arms had a poor result or no improvement, and patients with no improvement had no previous degree of difficulty. In most areas, the reduction in fat thickness was greater in the areas where the fatty tissue was thickest at baseline (Table 1).

There were no severe complications in any of the patients. No fever, seroma, severe hematomas, skin burns, or prolonged pain or sensitivity were found.

DISCUSSION

Laser-assisted lipolysis is a new technique that is still being developed. Its main objectives are to increase safety, reduce time for recovery, tighten skin, and make the procedure easier for the surgeon.[12] Given the small diameters of both the optical fiber and the aspiration cannula, this approach has been considered minimally invasive compared with traditional liposuction techniques.[11] The transfer generated when laser energy is absorbed by the receptive chromophores produces sufficient heat to cause the desired thermal damage. This heat in turn can produce reversible and irreversible damage in the fat cells and the extracellular matrix. In adipose tissue, the adipocytes contain more than 90% lipids and are grouped close together in the form of fat lobules, between which lie structures composed mainly of water. These include septa, nerves, vessels, capillaries, and connective tissue. The water-rich structures are

Journal of Clinical Dermatology drm000015 3/9/2010 14:23:34

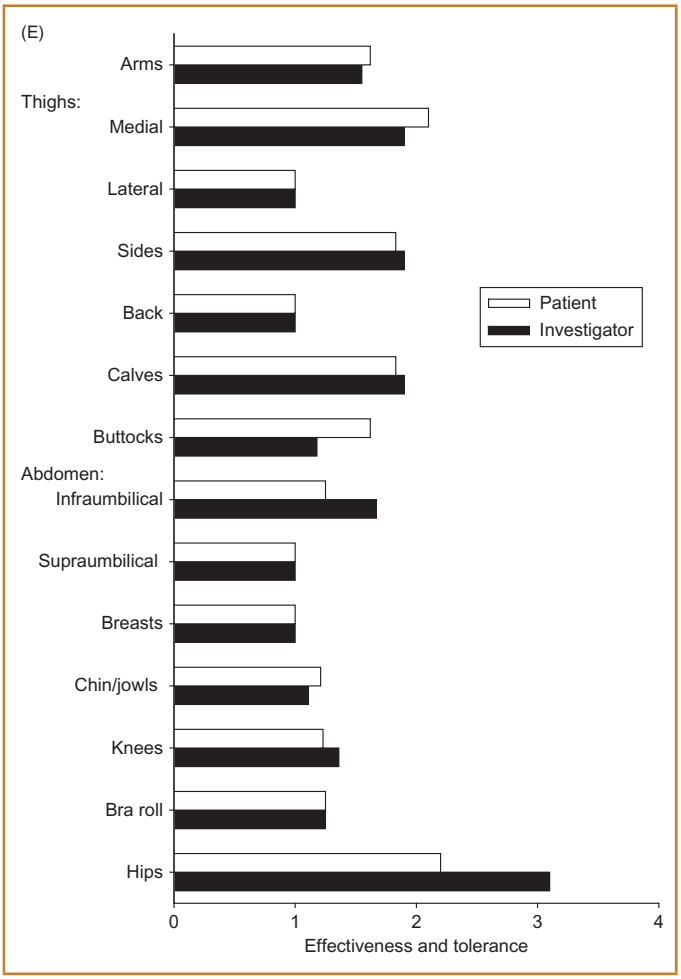

Figure 1. (Continued)

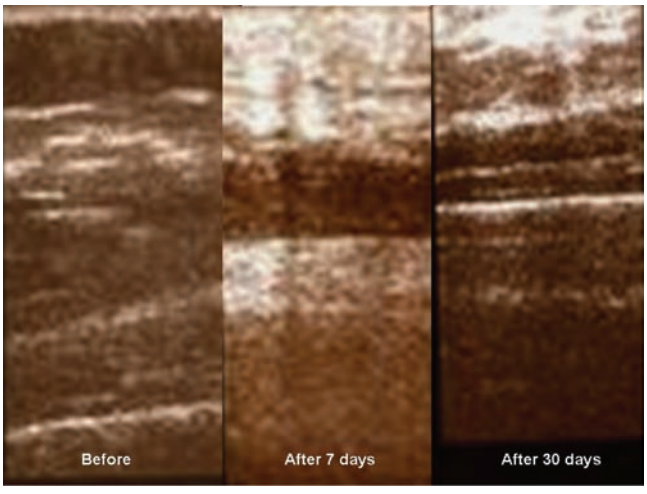

Figure 2. Ultrasound scan at 7 days showing increased echogenicity, areas of liquefaction, and loss of the usual structures of the fatty tissue.

Figure 3. Gynecomastia. Note the skin tightening without detachment of breast skin.

Figure 4. Double chin. Note the marked skin tightening in a 68-year-old patient.

less uniformly distributed in the fatty tissue than the fat lobules. Badin et al.[13] and Mordon et al.[14] have shown that the size of the adipocytes can be increased to 100 μm using a low-energy laser both at 980 nm and at 1064 nm. The heat generated by the laser alters the sodium and potassium balance in the cell membrane and this in turn allows extracellular liquid to enter the cell. At higher energies, there have been reports of adipocyte rupture and coagulation of collagen fibers and small vessels.[15] The rupture of the membrane allows the lipases released by the adipocyte to liquefy the tissue, thus facilitating aspiration.[11] Coagulation of the small vessels reduces surgical injury.[13] Traditional liposuction removes large amounts of blood and serum, and these losses can be physiologically significant, to the extent that they cause metabolic abnormalities. Laser-assisted lipolysis, on the other hand, can destroy large amounts of fat with no hemodynamic and serum lipid consequences.[13,16] At 1064 nm and at 980 nm, absorption by water is greater than by fat.[17–20] When a water-absorbing wavelength is used, the laser has a small "target" in the fatty tissue,

Journal of Clinical Dermatology drm000015 3/9/2010 14:23:34

Figure 5. Saddle bags. Good regularity and elevation of the subgluteal fold.

Figure 7. Saddle bags. Marked improvement in the area treated compared with the adjacent areas.

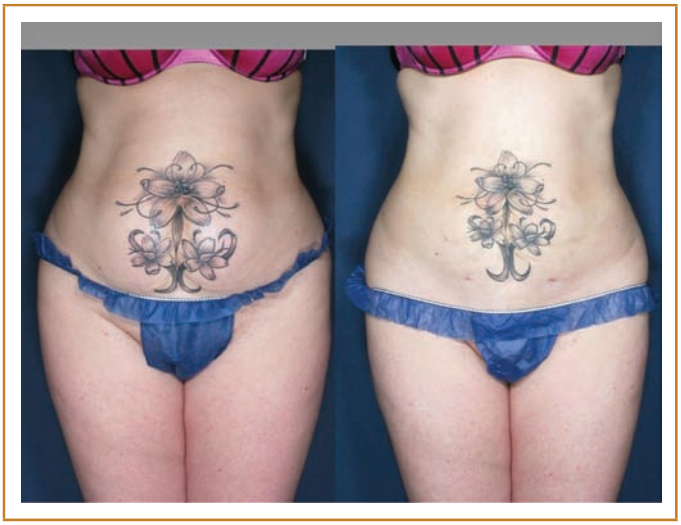

Figure 6. Abdomen. Marked skin tightening seen in the reduced size and shape of the tattoo.

and these lower volumes absorb only part of the emission. Pulsed Nd:YAG allows the small packets of energy to heat up the fat-rich areas slowly by means of convection and conduction. Water-absorbed wavelengths enable high temperatures to be reached in water-rich structures (relatively scarce in fatty tissue), although only if these structures are sufficiently close to the tip of the optical fiber, where the energy density is high. Emissions at 1064 nm and 980 nm do not seem to be suitable, given the large amount of fatty tissue to be heated, since conduction and convection are slow processes and difficult to monitor.[20]

At between 900 nm and 950 nm, absorption of fat is greater than absorption of water. At 924 nm, the fat absorption coefficient is 7-fold greater than at 1064 nm. At 975 nm, the peak absorption by water is greater than at 1064 nm.[17–19] In our study, we arbitrarily set at 10 cc/kJ the amount of fatty tissue that could be permanently damaged by dual emission of the SlimLipo™ laser at 924 nm and 975 nm. This approximate value was used as the basis for the calculation of the dosimetry to be applied to destroy the volume of fat in the treatment area. Mordon et al.[11] set this amount at 1.6 cc/kJ at 1064 nm and 980 nm. In this sense, we speak of thermal damage of the adipocyte and not fat vaporization, which would require much higher emissions.[18,21] Our results show the reduction in the thickness of the fatty tissue by ultrasound, which was close to 50%, although considerably less on the arms and anterior thighs. Nevertheless, our evaluation of the volume in the treatment area is subject to error, given that for an area of 100 cm we measured the point of maximum projection in all the calculations, with the result that a cubic volume was applied in conical areas. Therefore, in many cases, the volume calculated was greater than the real volume. We applied 1 kJ to destroy 10 cc of fatty tissue with the aim of reducing volume by 60% (volume of fat in the area × 60/1000 = energy [kJ] to be applied). Volume reduction was around 50% in most areas, that is, the ability to damage fatty tissue was lower than when using the arbitrary calculation (1 kJ of dual emission at 924 nm and 975 nm at 24 W cannot destroy 10 cc of fatty tissue). We must also remember that part of the reduction could be due to the aspiration itself (and not to the laser effect), as well as to the adipocyte damage caused by tunneling, as reported in the literature.[11,18] The noticeable differences in reduction on the arms[22] and anterior thighs could be due to the different characteristics of fat in different areas[23]; however, in these areas, where there are no points of maximum projection, the volume calculation was closer to reality, and dosimetry was therefore proportionally lower. In any case, the dosimetry was not well adjusted for the emission characteristics of this system, and further investigation is necessary. Most published studies do not measure volume reduction.[15,24,25] Using magnetic resonance imaging, Kim and Geronemus[26] achieved a 25% reduction compared with the presurgical study. At present, the degree of correction in form and volume depends on the surgeon's aesthetic criteria. Most patients considered the reduction good to excellent (satisfaction score: 3.26).

Table 1. Relationship between Satisfaction Index and Degree of Previous Difficulty

Scores Difficulty	Satisfaction n and (%)																Total Cases (n)
	Good				Regular				Little				None				
	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	
Arms	8 (25.00)				10 (31.25)	2 (6.25)			4 (12.50)	2 (6.25)			6 (18.75)				32
Thighs:																	
Medial	8 (66.67)				2 (16.67)				2 (16.70)								12
Lateral	58 (80.56)				10 (13.89)	2 (2.78)	2 (2.78)										72
Sides	88 (77.19)	2 (1.75)	2 (1.75)		14 (12.28)	2 (1.75)			6 (5.26)								114
Back	6 (100.00)																6
Calves	2 (100.00)																2
Buttocks	8 (66.67)		2 (16.67)		2 (16.67)												12
Abdomen:																	
Infraumbilical	26 (74.29)	1 (2.86)			5 (14.29)				1 (2.86)	1 (2.86)					1 (2.86)		35
Supraumbilical	21 (72.41)	1 (3.45)			4 (13.79)	2 (6.90)									1 (3.45)		29
Breasts	4 (100.00)																4
Chin/jowls	8 (100.00)																8
Knees	50 (80.65)	4 (6.45)			2 (3.23)	2 (3.23)			2 (3.23)					2 (3.23)			62
Bra roll	4 (40.00)				2 (20.00)				2 (20.00)				2 (20.00)				10
Hips	80 (78.43)	4 (3.92)	2 (1.96)		6 (5.88)		2 (1.96)			2 (1.96)			2 (1.96)	2 (1.96)	2 (1.96)		102
Total cases	371 (74.20)	12 (2.40)	6 (1.20)		57 (11.40)	10 (2.00)	4 (0.80)		17 (3.40)	5 (1.00)			10 (2.00)	4 (0.80)	4 (0.80)		500

Difficulty score is evaluated as accumulative positive response: previous liposuction (+1), presence of injury or scarring in the treatment area (+1), and presence of varicose veins (+1). Satisfaction score is measured as accumulative positive response: improvement good to excellent (+1), expectations fulfilled (+1), and recommendation of treatment to others (+1) as indicated in Materials and Methods section. The results are shows as % or sample size (*n*).

Skin tightening was evident in our cases. The interaction between the laser and the tissue led to a reduction in fat volume and remodeling of collagenous tissue. Heating of the deep reticular dermis and septa has been reported by Mordon et al.,[11] and the temperatures reached are similar to those reported for other nonablative lasers.[27,28] Tissue repair involves the creation of new collagen and elastin fibers and, consequently, tightening. This is confirmed by Badin et al.[13,29] and Avram,[30,31] who used histopathologic samples to demonstrate the neosynthesis of collagen and improved appearance of the skin. Our patients were as pleased with the appearance of the skin as with the reduction in volume. Patients who underwent liposuction of the arms were less satisfied than those who underwent liposuction of the anterior thighs, although volume reduction was similar in both cases. Nevertheless, the overall evaluation of the appearance of the skin was better on the anterior thighs (good to excellent) than on the arms (regular-to-no improvement). We believe that this is because the treatment area on the arms was relatively small for the proportion of skin tightening desired. In our experience, the best results for skin tightening were achieved in large areas (eg, abdomen, outer thighs, and buttocks). Most patients were satisfied with the skin tightness and regularity obtained.

Overall tolerance of the procedure was good. Intraoperative pain and postoperative pain were very tolerable, and consumption of painkillers was very low. Mean downtime was under 3 days, and no patients needed longer before returning to work. Other authors have also reported a short convalescence period for this procedure.[1,3,25,29,32] In addition to the reduced invasiveness of laser-assisted liposuction, we highlight the importance of restricting aspirate volume and avoiding the need for major anesthetic procedures.

The procedure fulfilled patients' expectations in more than 80% of cases, and more than 90% would recommend the procedure to family and friends.

Journal of Clinical Dermatology drm000015 3/9/2010 14:23:34

In summary, laser-assisted lipolysis causes irreversible damage to adipocytes, although it is more sparing of septa and tissue structures and produces less bleeding than traditional liposuction. Our approach to sculpting body contour was minimally invasive: the volume of fat removed was limited, the procedure involved low doses of anesthesia, and lipolysis was laser-assisted. The SlimLipo™ laser reduced volume effectively and provided favorable results for skin tightening, regularity, and firmness in most of the areas treated. Tolerance was satisfactory and downtime short. Patients were also satisfied in terms of effectiveness and fulfillment of expectations. More than 90% would recommend the treatment to others. Further studies are necessary to adjust dosimetry and to explain the different responses in different areas.

We believe the approach we adopted was safe, with good correction of form and volume, and good tolerance and satisfaction. The skin response was satisfactory in most cases, a result that cannot be achieved with traditional liposuction. No complications worthy of note were detected.

MATERIALS AND METHODS

Inclusion and Exclusion Criteria

We included all patients of both sexes who attended our center and who wished to enhance their body contour because of localized fat deposits. Fat distribution by area is shown in Table 2. Mean age was 42.7 years (21–69 years). In order to be included in the study, patients had to have a body mass index (BMI) of between 18.5 and 30.0. The exclusion criteria were pregnancy, patients with a history of coagulation disorders or who have taken anticoagulants, patients with a history of allergy to the active ingredients or excipients of the anesthetics used, and patients with a history of sensitivity to laser treatment or intense pulsed light laser or BMI outside the range 18.5–30. We also excluded all those patients who did not undergo the 90-day check-up due to a change of address or intercurrent disease.

Table 2. Distribution of the Series by Patients and Area Treated

Areas Treated	Number of Areas (%)	Number of Patients (%)
Abdomen		35(13.46)
Infraumbilical	35(7.00)	
Supraumbilical	29(5.80)	
Arms	32(6.40)	16(6.15)
Thighs: medial	12(2.40)	6(2.30)
Thighs: lateral	72(14.40)	36(13.84)
Sides and flanks	114(22.80)	57(21.92)
Complete back	6(1.20)	6(2.30)
Calves	2(0.40)	1(0.38)
Buttocks	12(2.40)	6(2.30)
Gynecomastia	4(0.80)	2(0.76)
Chin/jowls	8(1.60)	8(3.07)
Knees	62(12.40)	31(11.92)
Bra rolls	10(2.00)	5(1.92)
Saddlebags	102(20.40)	51(19.61)
Total	500(100.00)	260(100.00)

Data are shown in absolute number and percentage.

Satisfaction Indexes

Patient

(a) Tolerance of procedure: intraoperative and postoperative pain, according to the Visual Analogue Scale (VAS, a standard diagnostic tool for rating pain), occupational disability; (b) effectiveness of the procedure: perceived degree of improvement (Global Aesthetic Improvement Scale [GAIS]), expectations fulfilled, and willingness to recommend the procedure to others.

Clinician's Opinion

(a) Tolerance and effectiveness. (b) Skin response: in order to evaluate the skin response, we gave one point for each of the following: (1) skin tightening after volume reduction (considered positive when the degree of tightening reached was more than 80%), (2) firmness (considered positive if no differences were detected between the area treated and adjacent areas), and (3) regularity (considered positive if no irregularity was observed). Three points represented an excellent result, two points an acceptable result, and one point a regular result. Zero points indicated no improvement. All results were measured at the same site.

Patient's Overall Opinion

Patient's overall opinion of tolerance and effectiveness questionnaire are included in Table 3.

Scores

These included difficulty score (difficulty resulting from previous liposuction, injuries and/or scarring in the area, and presence of moderate-to-severe varicose veins), satisfaction score (very much improved to worse, satisfaction with expectations, and willingness to recommend the treatment to others), and relationship between both indexes (the satisfaction score is compared with the difficulty score for all the cases).

Description of the Device

We used the SlimLipo™ (Palomar Medical Technologies, Inc., Burlington, MA, USA), a diode laser that applies continuous wave technology to emit wavelengths of 924 nm and 975 nm continuously at 100 μs either individually or in combination, preset at 924/975 nm in a 2:1 ratio, to a maximum of 24 W. We chose the 27.5 cm optical fiber (1.5 mm diameter) due to its greater flexibility.

Approach to Patient

All patients provided their signed written informed consent. An analytical work-up was performed (complete blood count, triglycerides, AST/ALT/GGT, coagulation profile CT/BT/PT). Presurgical photographs were taken using the Intellistudio system (Canfield Scientific Inc., Fairfield, NJ, USA).

Journal of Clinical Dermatology drm000015 3/9/2010 14:23:34

Table 3. Satisfaction Index Questionnaire for Patient and Practitioner

Parameter	Score
1. Tolerance	
Did you experience pain during the procedure?	
NO (VAS 0–2)	1
YES	
Slight (VAS 3–4)	2
Normal (VAS 5–6)	3
Severe (VAS 7–8)	4
Very severe (VAS 9–10)	5
Did you feel discomfort after the procedure?	
NO (VAS 0–2)	1
YES	
Slight (VAS 3–4)	2
Normal (VAS 5–6)	3
Severe (VAS 7–8)	4
Very severe (VAS 9–10)	5
Has the procedure prevented you from working or interfered with your daily activities?	
NO	1
YES	
1 day	2
2 days	3
3 days	4
>3 days	5
2. Effectiveness of the procedure	
How do you perceive the improvement brought about by the procedure?	
Very much improved	4
Much improved	3
Improved	2
No change	1
Worse	0
Has the treatment fulfilled your expectations?	
90–100%	4
70–90%	3
40–70%	2
10–40%	1
<10%	0
Would you recommend this treatment to others?	
YES	1
NO	2
3. Overall opinion of the investigator	
Effectiveness and tolerance	
Very good	4
Good	3
Normal	2
No change	1
4. Overall opinion of the patient	
Effectiveness and tolerance	
Very good	4
Good	3
Normal	2
No change	1
Worse	0

Tolerance of the procedure, effectiveness of the procedure, and overall opinion of the investigator and of the patient as described in Materials and Methods section.

Calculation of Amount of Fat to Be Removed

We measured the thickness of the fat in the area of maximum projection using ultrasound (SonoSite Titan, SonoSite, Bothell, WA, USA) and calculated the volume of fat for a surface area of 10 × 10 cm. We marked the lipodystrophic area to be corrected and drew a 100 cm^2 grid inside this area. The total volume of the lipodystrophic area is the volume calculated for the first square multiplied by the number of 100 cm^2 areas in the treatment area. The total amount of fat to be removed was 60% of the total volume calculated.

For reasons of safety, we limited the maximum amount of fat to be removed at each session to 25 mL per kg of body weight (ie, 1500 mL of pure fat for a patient weighing 60 kg). Total aspirated volume was greater than the pure fat volume (blood, anesthetic infiltrate). More than one procedure was necessary in patients with several areas to be corrected.

Dosimetry

Following the mathematical model proposed by Mordon et al.[11] and other authors,[17,28,19,33,34] we arbitrarily set the laser dose at 0.1 kJ for the destruction of 1 mL of fat. The emission mode used was 924/975 nm.

Thermographic photographs were taken before, during, and after treatment.

Procedure

All patients received 3.5 mg of sublingual midazolam 30 minutes before the procedure and were monitored using an electrocardiogram. Heart rate and blood pressure were also monitored.

Infiltration

Klein tumescent solution[24,35,36] was administered by injection pump. The maximum dose was 1 mL per 0.75 kg of body weight (ie, the maximum dose for a patient weighing 60 kg was 4.5 L of anesthetic solution).[24,35,36]

Lipolysis

As mentioned above, we estimated that dual emission (924/975 nm) of 1 kJ can cause lipolysis of 10 cc of fatty tissue. All patients received the necessary quantity in kJ calculated to reduce the volume of fatty tissue in the treatment area by 60%. Total energy was applied using a back and forth fanning motion, crisscrossing from several points and in the deep plane.

Aspiration

This was performed with an aspirator at a maximum negative pressure of 1 bar. We used a 3-mm cannula with only two orifices aligned on the underside.

The macroscopic appearance of the aspirate, which is characteristic in laser-assisted lipolysis,[1,34] was monitored to ensure its homogeneity. The aspiration was stopped if these characteristics varied (eg, larger fragments of fatty tissue). If the surgeon

Journal of Clinical Dermatology drm000015 3/9/2010 14:23:34

considered that the correction was not complete, a further 5 kJ were applied to the area. An additional aspiration was then performed, with the same requirements. The procedure was also stopped if the blood component of the aspirate reached 20% of the total.

Heating of the Dermis and Fibrous Septa

This was performed using the optical fiber in the superficial plane and dual emission. We chose this emission mode as we believe that the lipolytic capacity at 924 nm could lyse the fat underlying the dermis and the emission at 975 nm could coagulate the collagen fibers and thus lead to better skin tightening as a result of water uptake. We applied a sufficiently high dose to reach 42°C in the treatment area, as measured by the thermographic camera.

Monitoring of patients revealed no alterations that could have led to interruption of the procedure.

Postoperative Care

All patients were instructed to wear a 280 DEN compression garment (7 days) that had to extend 10 cm beyond the treatment area. Vital signs were checked. All patients left the clinic within 60 minutes of the procedure. They were prescribed dexketoprofen (25 mg twice daily for 6 days) and amoxicillin (500 mg, three times daily for 4 days). Metamizole magnesium was prescribed for pain (575 mg every 6–8 hour). Patients were advised to report any abnormality to the clinic immediately.

Postoperative Care

All patients underwent a check-up at days 3, 7, 30, and 90 after the procedure. The check-up at day 3 was not carried out in the case of 23 patients who lived more than 300 km from the clinic. At days 7, 30, and 90, photographs (IntelliStudio, Canfield Scientific) and ultrasound scans (thickness of the fatty tissue in the treated area) were taken and a clinical evaluation was performed. Patients completed the questionnaire on pain (VAS) at the day-7 visit, and the questionnaires on correction index and satisfaction index (SI) at the 90-day visit. The physician's opinion was recorded at day 90. We also recorded complications such as fever, seroma, severe hematoma, skin burn, and prolonged pain or sensitivity abnormalities.

No patients received additional treatment such as lymph drainage, endermology, or radiofrequency.

Statistical Analysis

All analyses were performed using Statistical Package for Social Sciences software (SPSS for Windows version 11.0; SPSS Inc., Chicago, IL, USA). Satisfaction scores were calculated in relation to difficulty, skin quality, and volume reduction.

Acknowledgment: The authors would like to thank IFC SA for its technical support in this study.

Disclosure: The authors declare no conflict of interest and funding.

REFERENCES

1. Apfelberg DB, Rosenthal S, Hunstad JP, Achauer B, Fodor PB. Progress report on multicenter study of laser-assisted liposuction. *Aesthetic Plast Surg*. 1994,18(3):259–264.
2. Barsky AJ, Kahn S, Simon BE. *Principles and Practice of Plastic Surgery*. 2nd ed. New York: McGraw-Hill; 1964:564.
3. Rohrich RJ, Broughton G, II, Horton B. The key to long-term success in liposuction: a guide for plastic surgeons and patients. *Plast Reconstr Surg*. 2004;114:1945–1952; discussion 1953.
4. Matarasso A, Swift RW, Rankin M. Abdominoplasty and abdominal contour surgery: a national plastic surgery survey. *Plast Reconstr Surg*. 2006;117:1797–1808.
5. Grazer FM, de Jong RH. Fatal outcomes from liposuction: census survey of cosmetic surgeons. *Plast Reconstr Surg*. 2000;105:436–446; discussion 447–448.
6. Moreno-Moraga J, Valero-Altés T, Martínez-Riquelme A, Isarría-Marcos MJ, Royo de la Torre J. Body contouring by non-invasive transdermal focused ultrasound. *Lasers Surg Med*. 2007;39:315–323.
7. Teitelbaum SA, Burns JL, Kubota J, *et al*. Noninvasive body contouring by focused ultrasound: safety and efficacy of the Contour I device in a multicenter, controlled, clinical trial. *Plast Reconstr Surg*. 2007;120:779–789.
8. Manstein D, Laubach H, Watanabe K, Farinelli W, Zurakowski D, Anderson RR. Selective cryolysis: a novel method of non-invasive fat removal. *Lasers Surg Med*. 2008;40:595–604.
9. Pino ME, Rosado RH, Azuela A, *et al*. Effect of controlled volumetric tissue heating with radiofrequency on cellulite and the subcutaneous tissue of the buttocks and tights. *J Drugs Dermatol*. 2006;5:714–722.
10. Narins RS, Tope WD, Pope K, Ross EV. Overtreatment effects associated with a radiofrequency tissue tightening device: rare, preventable, and correctable with subcision and autologous fat transfer. *Dermatol Surg*. 2006;32:115–124.
11. Mordon SR, Wassmer B, Reynaud JP, Zemmouri J. Mathematical modeling of laser lipolysis. *BioMed Eng*. 2008;7:10–18.
12. Ichikawa K, Miyasaka M, Tanaka R, Tanino R, Mizukami K, Wakaki M. Histologic evaluation of the pulsed Nd:YAG laser for laser lipolysis. *Lasers Surg Med*. 2005;36(1):43–46.
13. Badin AZ, Gondek LB, Garcia MJ, Valle LC, Flizikowski FB, de Noronha L. Analysis of laser lipolysis effects on human tissue samples obtained from liposuction. *Aesthetic Plast Surg*. 2005;29(4):281–286.
14. Mordon S, Eymard-Maurin AF, Wassmer B, Ringot J. Histologic evaluation of laser lipolysis: pulsed 1,064-nm Nd: YAG laser versus CW 980-nm diode laser. *Aesthet Surg J*. 2007;27(3):263–268.
15. Goldman A. Submental Nd:Yag laser-assisted liposuction. *Lasers Surg Med*. 2006;38(3):181–184.
16. Mordon S, Wassmer B, Rochon P, *et al*. Serum lipid changes following laser lipolysis. *J Cosmet Laser Ther*. 2009;11:74–77.
17. Anderson RR, Farinelli W, Laubach H, *et al*. Selective photothermolysis of lipid-rich tissue. *Lasers Surg Med*. 2006;38:913–919.
18. O'Dey D, Prescher A, Poprawe R, Gaus S, Stanzel S, Pallua N. Ablative targeting of fatty-tissue using a high-powered diode laser. *Lasers Surg Med*. 2008;40:100–105.
19. Khoury JG, Saluja R, Keel D, Detwiler S, Goldman MP. Histologic evaluation of interstitial lipolysis comparing a 1064, 1320 and 2100 nm laser in an ex vivo model. *Lasers Surg Med*. 2008;40:402–406.
20. Altshuler GB, Anderson RR, Manstein D, Zenzie HH, Smirnov MZ. Extended theory of selective photothermolysis. *Lasers Surg Med*. 2001;29:416–432.
21. Wanner M, Avram M, Gagnon D, *et al*. Effects of noninvasive, 1,210 nm laser exposure on adipose tissue: results of a human pilot study. *Lasers Surg Med*. 2009;41:401–407.
22. Ducelzak J, Hussain M, Goldberg DJ. Laser lypolysis of the arm, with and without suction aspiration: clinical histologic changes. *J Cosmet Laser Ther*. 2009;11:70–73.
23. Querleux B, Cornillon C, Jolivet A. Anatomy and physiology of subcutaneous adipose tissue by in vivo magnetic resonance imaging and spectroscopy: relationship with sex and presence of cellulite. *Skin Res Technol*. 2002;8:118–124.
24. Lillis PJ. Liposuction surgery under local anesthesia: limited blood loss and minimal xylocaine absorption. *J Dermatol Surg Oncol*. 1988;14:1145–1148.

Journal of Clinical Dermatology drm000015 3/9/2010 14:23:34

25. Prado A, Andrades P, Danilla S, Leniz P, Castillo P, Gaete F. A prospective, randomized, double-blind, controlled clinical trial comparing laser-assisted lipoplasty with suction-assisted lipoplasty. *Plast Reconstr Surg*. 2006;118(4):1032–1045.
26. Kim KH, Geronemus RG. Laser lipolysis using a novel 1,064 nm Nd:YAG Laser. *Dermatol Surg*. 2006;32(2):241–248.
27. Muccini JA, Jr, O'Donnell FE, Jr, Fuller T, Reinisch L. Laser treatment of solar elastosis with epithelial preservation. *Lasers Surg Med*. 1998;23(3): 121–127.
28. Mordon S, Capon A, Creusy C, *et al*. In vivo experimental evaluation of skin remodeling by using an Er:Glass laser with contact cooling. *Lasers Surg Med*. 2000;27(1):1–9.
29. Badin AZ, Moraes LM, Gondek L, Chiaratti MG, Canta L. Laser lipolysis: flaccidity under control. *Aesthetic Plast Surg*. 2002;26(5):335–339.
30. Avram MM. Cellulite: a review of its physiology and treatment. *J Cosmet Laser Ther*. 2004;6:181–185.
31. Wanner M, Avram M. An evidence-based assessment of treatments for cellulite. *J Drugs Dermatol*. 2008;7:341–345.
32. Sandhofer M, Douwens KE, Sandhofer-Novak R, Blugerman GS. Laserlipolyse und liposkulptur. *Aesth Chir*. 2002;3:20–26.
33. Weiss R. The selective laser-induced melting procedure—advanced laser body sculpting. *Aesthetic Dermatol*. 2008;3:1–5.
34. Childs JJ, Smirnov M, Zelenchuk A, Yaroslovsky I, Altshuler G. *Selective Laser Induced "Melting"*. Burlington, MA: White Paper Palomar Medical Technologies Inc.
35. Klein J. Tumescent technique. *Am J Cosmet Surg*. 1987;4:263–267.
36. Klein JA. Tumescent technique for regional anesthesia permits lidocaine doses of 35 mg/kg for liposuction. *J Dermatol Surg Oncol*. 1990;16:248–263.

Journal of Clinical Dermatology drm000015 3/9/2010 14:23:34

Authors Queries

Journal: **Journal of Clinical Dermatology**

Paper: **drm000015**

Title: **Our Experience Treating 500 Lipodystrophic Areas with a 924/975 nm Laser, a New Device That Induces Lipolysis and Heating of the Dermis and Fibrous Septa of Fatty Tissue**

Dear Author
During the preparation of your manuscript for publication, the questions listed below have arisen. Please attend to these matters and return this form with your proof. Many thanks for your assistance

Q1	Please provide the expansion for "YAG".	
Q2	Is the abbreviation "BMI" OK here?	
Q3	Is the change of "Are" to "All" OK?	
Q4	Please provide the expansion for "AST/ALT/GGT".	
Q5	Please provide the expansion for "CT/BT/PT".	
Q6	Please check the usage of semicolon, colon, and comma in the sentence "Tolerance of procedure was done according . . ." for clarity of the sentence.	
Q7	Please check if the alignment of entries in the column "Areas Treated" is correct.	

Journal of Clinical Dermatology drm000015 3/9/2010 14:32:34