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Postabdominoplasty Scar Improvement after a Single Session with an Automated 1210-nm Laser

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Background: Abdominoplasty, one of the most commonly performed aesthetic procedures, aims at correcting excess abdominal skin and fat, but generates a long abdominal scar. The efficacy of an automated portative 1210-nm laser in improving the appearance of surgical scars has been previously demonstrated in a double-blind randomized controlled trial. The purpose of this work was to document the use of this laser in real-life practice.

Methods: Eighteen patients undergoing abdominoplasty and treated with the evaluated laser (UrgoTouch, Laboratoires Urgo; one single session immediately after the surgery) were included in this prospective, mono-center, observational study. Change in scar characteristics was assessed using the validated Observer Scar Assessment Scale, and the patients' and surgeon's satisfaction was rated using a four-point scale.

Results: The aesthetic outcome of the scars was very positive with a mean Observer Scar Assessment Scale score of 17.0 (SD 4.6) and 14.4 (SD 3.8) on the 6–60 point scale (60: the worst possible outcome) at 6 and 12 months, respectively. A high degree of satisfaction was also expressed by both surgeon and patients at 6 weeks, 6 months, and 12 months. No laser-related incident was reported during the study, including in patients with darker phototypes.

Conclusions: These findings seem to be consistent with previous clinical evidence on the use of this laser on fresh incisions. The high degree of satisfaction reported by both surgeon and patients seems to comfort the benefits of this procedure at short- and long-term and support the use of this laser in daily practice of plastic surgery.
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INTRODUCTION

Abdominoplasty is one of the most commonly performed cosmetic procedures,[1–3] requested to restore prepregnancy appearance, maintain youthful figure, or lose weight. The excess skin is transversely excised, leading to one long horizontal scar, which might, in some cases, be displaced, asymmetric, or nonaesthetic.[4–7] The patients have high expectations regarding their body and scar appearance and usually wish to regain a normal skin appearance as soon as possible.[8,9]

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To reduce the aesthetic impact of surgical scars, guidelines recommend adapting the amount of measures depending on the risk factors for abnormal scar formation and the level of aesthetic concern of each patient.[10–13] General preventive measures include sun protection, dressings, maintaining a moist environment, and moisturizing cream or oil.[10–13] Additional measures may include silicone-based products, compression therapy, pressure garments, and laser interventions.[7,11–18]

Laser interventions seem to gain broader application in scar management each year,[16,18–20] and the benefits of an early intervention are highlighted by several systematic reviews[19,20] and guidelines.[11,12,17,18] Five randomized controlled trials (RCTs) have notably established that a single session of various lasers performed the day of the surgery, can improve the appearance of the treated scars compared with untreated control scars.[21–25] The modalities by which such interventions are modifying the wound healing process are not completely understood yet, but seem to, at least, involve the induction

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of heat shock response.[26] The laser-assisted skin healing technique defines a laser procedure that modifies the immediate postoperative wound healing process by increasing temperature within the skin.[18,21–23] This technique has been developed following experimental works showing that moderate hyperthermia (45°–55°C) can induce the overexpression of heat shock proteins, naturally involved in protecting the body from various types of stress.[27–33] This heat shock response seemed notably to attenuate the inflammatory response, better organize the collagen fibre networks in the dermis, and thus improve the healing process.[27,33,34] A key element for the success of this procedure is an appropriate selection of the laser parameters, to reach the targeted increase of skin temperature, without generating thermal damage (above 55°C).[22]

Following the laser-assisted skin healing technique principles, the 1210-nm laser system UrgoTouch (Laboratoires Urgo, France) is an automated diode laser providing a controlled elevation of skin temperature to 53 ± 3 °C in all patients, without requiring any parameter settings or adjustments by the user. The performance and safety of this laser system have been assessed in a double-blind RCT (the Scar after Laser-Assisted Skin Healing [SLASH] study), conducted by five surgeons in France with 40 women (phototypes II to VI) undergoing bilateral breast reduction.[23] The laser treatment (one single session) was randomly performed on one breast immediately after the placement of the intradermal sutures (the other breast was used as control). The vascularity, pigmentation, thickness, relief, and surface area of the scars were subjectively rated over 1 year by two different physicians based on standardized photographs, and the scar characteristics were objectively quantified using a three-dimensional image analysing software validated in scar assessment.[35,36] The results showed better scar appearance for the laser-treated scars than for the control 6 weeks after the surgery, supporting an early effect of the laser treatment during this inflammatory stage. More favourable subjective scores for the treated scars were also reported at 6 and 12 months, corroborated by significant objective improvements of the volume, surface, and roughness of the scars, while the patients expressed a preference for their laser-treated scar ($P = 0.025$), supporting the benefits of this laser procedure at short-, medium- and long-terms. Since this double-blind RCT, positive aesthetic outcomes and patient satisfaction with the use of this laser system have also been reported in real-life practice in various other types of surgery, such as mastopexy with or without implant, revision of mastopexy scars, abdominoplasty, brachioplasty, body lift, or gynaecomastia.[37]

Based on this clinical evidence, and encouraged by positive initial experiences with the laser in his own practice, the author decided to document the implementation of the use of this laser in his daily practice, focussing on abdominoplasty because of its specific associated challenges, with particularly long incisions, skin tension, and potential scarring complications.

Takeaways

Question: How can we prevent nonaesthetic scar outcomes after an abdominoplasty?

Findings: In this article, we describe an 18 individual observational case series with 1 year follow-up after the laser-assisted skin healing technology application to assess the evolution of scars in abdominoplasty procedures. The scars were assessed at 6 months and at 12 months using Observer Scar Assessment Scale with very satisfactory outcomes at 6 and 12 months.

Meaning: Using UrgoTouch laser treatment in the OR may improve the scar appearance after abdominoplasty procedures, leading to high satisfaction for both patients and surgeons.

PATIENTS AND METHODS

This observational study was conducted as a prospective, single-arm, mono-center, study. The abdominal procedures were all performed by the same surgeon (36 years of experience in plastic surgery) in Creu Blanca Hospital, Barcelona. All patients who underwent abdominoplasty surgery and were treated with the evaluated laser during the inclusion period were eligible to participate, after giving their informed and written consent to share their anonymous data, including photographs. The authors followed the principles outlined in the Declaration of Helsinki.

Between February 2017 and August 2018, 18 individuals were included: All patients were women with a mean age of 43.6 years (range: 24–67 years). The mean weight before the intervention was 66.3 kg, and the mean BMI 25.5 kg/m^2. The comorbidities, surgical history, and skin phototype of each patient are reported in Table 1. Surgical history was available in 13 patients (72%), related to the abdominal region in 12, with caesarean being the most prevalent (six patients). Patients' skin phototypes ranged from I to V, phototypes III and IV being the most common (83%).

The abdominoplasty surgery was planned to aesthetically improve the body contour in 15 patients and to revise an aesthetically unsatisfying abdominal scar in three (patients 1, 8, and 9). These scars, resulting from previous procedures performed by other surgeon teams, were too visible to the patients, mainly because of their location, width and shape. During the operation, two patients also underwent a mastopexy with implant, and another one a bilateral breast reduction and a brachioplasty.

Abdominoplasty was performed using the Baroudi technique for most patients (n = 14). The Fleur-de-lis technique was used in two patients with abdominoplasty history (patients 1 and 8), a mini-lipectomy (W-plasty) was performed for an abdominal scar revision (patient 9), and a mini-abdominoplasty with straight plication was performed in patient 7. According to the Baroudi technique, patients were marked with a distance of 7 cm from the anterior vulvar fork to the incision line in the pubis.[38] Then, to reduce undermining and achieve a better

Table 1. Anthropometrics, Comorbidities, Surgical History, and Skin Phototypes of Study Individuals

Patient	BMI	Age	Arterial Hypertension	Cardiac History	Diabetes	Smoking	Others	Surgical History	Skin Phototypes
P1	31.8	—	Na	No	No	No	Obesity	Abdominoplasty; gastroplasty	III
P2	23.7	58	No	No	No	No	Hyperthyroidism	Liposuction	III
P3	24.6	39	No	No	No	No	No	Caesarean	III
P4	25.4	67	No	No	No	No	No	Sarcoma right hand; 1 caesarean section	V
P5	24.2	—	No	No	—	—	—	No	III
P6	21.7	51	No	No	No	No	No	Rhinoplasty	III
P7	21.7	35	No	No	No	No	No	No	IV
P8	27.8	42	No	No	No	No	No	Abdominoplasty; rhinoplasty; breast reduction	IV
P9	21.6	—	No	No	No	No	No	Inguinal hernia	IV
P10	28.7	61	No	No	Yes	No	No	Appendectomy and caesarean section	III
P11	27.5	39	No	No	No	No	No	Inguinal hernia	III
P12	25.9	42	No	No	No	No	No	3 caesareans	V
P13	22.0	27	No	No	No	No	No	Caesarean	IV
P14	24.4	43	No	No	No	No	No	Tubal ligation by laparoscopy	IV
P15	29.4	35	No	No	No	No	No	No	IV
P16	27.3	38	No	No	No	No	No	2 caesareans	I
P17	24.2	53	Yes	Cardiac ablation (PVC)	No	No	No	No	IV
P18	27.1	24	No	No	No	No	No	No	III
Mean	25.5	43.6							
SD	2.9	12.2							

PVC, premature ventricular contractions.

abdominal contour definition and upper flap adaptation, tumescent infiltration for liposuction was performed with Klein solution into the flanks and abdominal flap in all patients.[39] The abdominal flap was lifted suprafascially to the xiphoid area in the center to allow plication of the rectus abdominis muscles. The plication was performed with nonresorbable inverted points both in the longitudinal and transverse directions, with the patient in sitting position.[40] The excess skin of the flap was resected, and the umbilicus was placed in its new position, fixed to the abdominal skin with single stitches. Suction drains were placed and incisions sutured in three planes, following local standard procedures, with common surgical suture materials (Monocryl 3/0 and Vicryl 2/0 and 3/0, Ethicon) compatible with the laser use.

The laser treatment, a single session with only one pass over the abdominal incision, was performed immediately after the placement of the intradermal sutures (the patients being still under general anesthesia) by the operating surgeon who had previously received training on the use of the laser. The laser diode UrgoTouch (Laboratoires Urgo, Chenove, France) is a secure, automated, portable laser. Its 1210-nm wavelength, weakly absorbed by melanin, allows for a homogeneous and in-depth heating of the skin tissue (to the dermis, 1-2 mm), regardless of the patient skin phototype. Following the manufacturer's instructions, the sterile safety strips containing the microchips that authorize the laser shots were positioned along the horizontal suture. The shot duration (and therefore the energy delivered) was determined and controlled by the laser software itself, based on the patient's skin temperature detected by the pyrometer integrated in the laser system. This "scar control system" technology automatically stops the shot when the target skin temperature (53°C) is reached, ensuring both shot reproducibility and patient safety, without any parameter setting or adjustment, before use or during the treatment.

After the laser treatment, the sutured incisions were covered with a nonadherent lipidocolloid dressing (Urgotul) and some protective gauzes, kept in place with a girdle of elastic bands. The suction drains were removed 3–4 days after the surgery and the umbilicus stitches, after 10–12 days. The only systematic recommendation for postoperative care was the topical application of Rosa Mosqueta oil or cream. Silicone patches were needed on the umbilical scar (untreated by the laser) of two patients. No other topical treatment was used during the study, and no scar revision surgery was required afterward.

Follow-up visits were scheduled 6 weeks, 6 months, and 12 months after surgery. The change in scar appearance was assessed by the surgeon, at 6 and 12 months, using the reliable and validated Observer Scar Assessment Scale (OSAS).[41–43] This scale measures the quality of scar considering six scar parameters: its vascularity, pigmentation, thickness, relief, pliability, and surface area. Each item is scored using a 10-point system: a score of 1 representing normal-appearing skin and 10, the worst imaginable scar. The scores of the six items are summed to produce the OSAS score (6–60 points). Additionally, the surgeon assessed the overall scar aesthetic (observer overall opinion) with a 10-point scale (10 being the worst possible aesthetic scar).[23] Finally, the degree of satisfaction regarding the scar appearance, from both the patient's and the surgeon's perspectives, was assessed at each follow-up visit, using the

Table 2. Scar Characteristics and Change in OSAS Scores between 6 and 12 Months Postprocedure

		6 Months OSAS								12 Months OSAS							
Patients	**Length of Scar (cm)**	**V**	**P**	**Th**	**R**	**Pl**	**S**	**OO**	**OSAS**	**V**	**P**	**Th**	**R**	**Pl**	**S**	**OO**	**OSAS**
P1	65	3	3	2	3	2	2	2	15								
P2	49									3	4	3	3	3	3	3	19
P3	40																
P4	50									2	2	2	2	2	2	2	12
P5	44									4	4	3	4	4	3	4	22
P6	12	3	3	3	2	2	2	3	15	3	2	2	3	2	3	3	15
P7	28	3	2	2	2	2	2	2	13	2	2	2	2	2	2	2	12
P8		5	5	5	5	4	4	4	28	2	2	2	2	2	2	2	12
P9	17																
P10	44	4	2	3	3	3	3	3	18	2	2	2	1	2	2	2	11
P11	46	2	2	2	2	2	2	2	12	3	2	2	2	2	2	3	13
P12	40	4	3	3	3	4	3	3	20	3	3	2	2	2	2	2	14
P13	34	4	3	3	4	4	4	4	22	5	4	3	3	3	4	4	22
P14	38	3	2	3	3	3	2	3	16	1	2	2	2	2	2	2	11
P15	45									2	2	2	2	2	2	2	12
P16	42	2	2	2	2	2	2	2	12	2	2	2	2	2	2	2	12
P17	40	4	2	4	3	2	2	4	17	2	2	3	2	3	3	2	15
P18	44	3	2	2	3	3	3	3	16								
MEAN	39.9	3.3	2.6	2.8	2.9	2.8	2.6	2.9	17.0	2.6	2.5	2.3	2.3	2.4	2.4	2.5	14.4
SD	12.3	0.9	0.9	0.9	0.9	0.9	0.8	0.8	4.6	1.0	0.9	0.5	0.7	0.6	0.6	0.8	3.8
Change in OSAS scores between 6 and 12 months									Mean	−0.9	−0.3	−0.8	−0.8	−0.6	−0.2	−0.2	−3.6
									SD	1.4	1.1	0.9	1.1	1.0	0.9	0.9	5.2

V, vascularity; P, pigmentation; T, thickness; R, relief; Pl, pliability; S, surface area; OO, overall opinion.

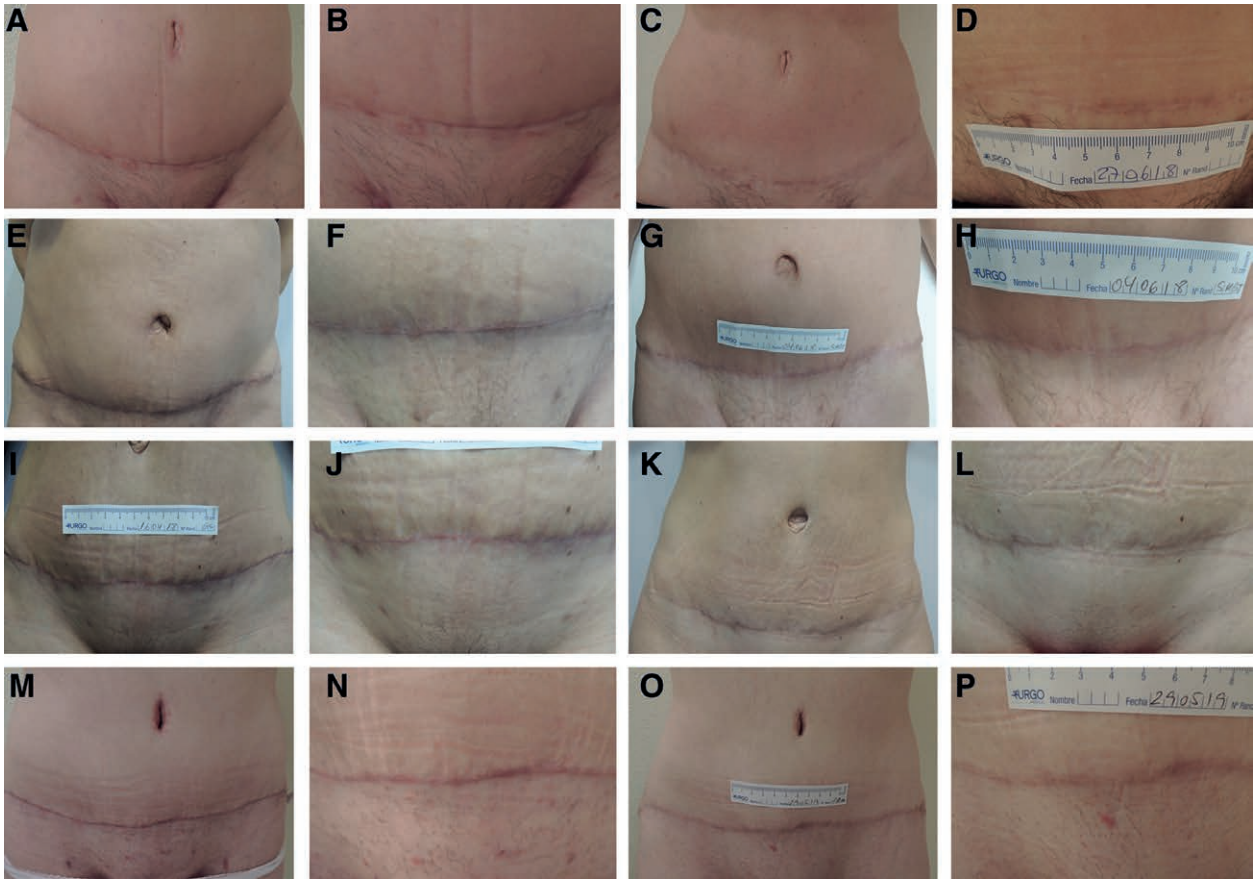

Fig. 1. Photographs of the abdominal scar appearance over the course of the study period. A, Full abdominal scar of patient 4 at 6 weeks. B, Close-up on the central third of the scar of patient 4 at 6 weeks. C, Full abdominal scar of patient 4 at 12 months. D, Close-up on the central third of the scar of patient 4 at 12 months. E, Full abdominal scar of patient 10 at 6 weeks. F, Close-up on the central third of the scar of patient 10 at 6 weeks. G, Full abdominal scar of patient 10 at 6 months. H, Close-up on the central third of the scar of patient 10 at 6 months. I, Full abdominal scar of patient 13 at 6 weeks. J, Close-up on the central third of the scar of patient 13 at 6 weeks. K, Full abdominal scar of patient 13 at 12 months. L, Close-up on the central third of the scar of patient 13 at 12 months. M, Full abdominal scar of patient 18 at 8 weeks. N, Close-up on the central third of the scar of patient 18 at 8 weeks. O, Full abdominal scar of patient 18 at 10 months. P, Close-up on the central third of the scar of patient 18 at 10 months.

same four-point Likert scale (very satisfied = 1, satisfied= 2, unsatisfied= 3, and very unsatisfied = 4), from which mean patient and observer satisfaction scores were calculated at short-, medium-, and long-term.

OSAS scores between 6 and 12 months were compared using a *t* test. Two, six and four evaluations were missing at 6 weeks, 6 months, and 12 months, respectively, because patients did not attend these visits as scheduled.

RESULTS

The mean length of the abdominal scars was 39.9 cm (range: 12–65 cm). The laser treatment took 4–5 minutes on average (6 seconds/cm), depending on the scar length, plus the time to position the security strips.

Six months after the laser procedure, the mean OSAS score was 17.0 on the 6–60 point scale (median value: 16, range: 12–28). The mean values of each parameter are reported in Table 2. As expected at this stage of the scarring process after the laser treatment, the lowest values (the most similar to a normal skin) were reported for the pigmentation (2.6) and surface area (2.6) of the scars, while a higher value was reported for vascularity (3.3). The good overall opinion of the surgeon about the scar appearance was characterized by a mean score of 2.9. At 12 months, the mean OSAS score decreased to 14.4 (median value: 12.5, range: 11–22), with a mean difference of −3.6 points (P = 0.068). This improvement in scar appearance resulted from an improvement in all parameters documented by the OSAS and correlated with an improvement in the surgeon's overall opinion. The most improved parameters were the vascularity, thickness, relief, and pliability of the scar, with the two less improved (pigmentation and surface area) being those that had the best scores at 6 months.

An illustration of the change in scar appearance in several patients is given in Figure 1, and additional details on the scar appearance at 12 months are shown in Figure 2.

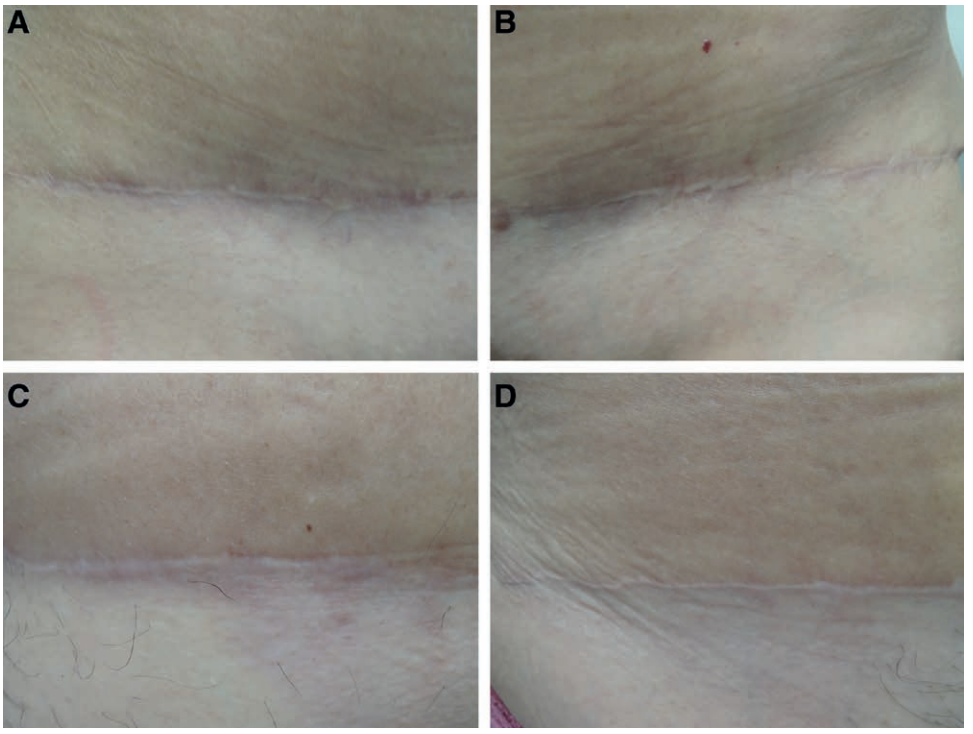

Fig. 2. Close-up photographs of some details of the abdominal scars, 12-months after the surgery and the laser treatment. A, Close-up photograph of details of the abdominal scar area of patient 2 at 12 months. B, Close-up photograph of details of the abdominal scar area of patient 2 at 12 months. C, Close-up photograph of details of the abdominal scar area of patient 17 at 12 months. D, Close-up photograph of details of the abdominal scar area of patient 17 at 12 months.

As reported in Table 3, 6 weeks after the surgery, all patients except one were "very satisfied" or "satisfied" with their scar (94%), resulting in a mean satisfaction score of 1.7. Similar results, with a mean satisfaction score of 1.8, were reported for the surgeon, who was "unsatisfied" or "very unsatisfied" with only two scars. After 6 months, a similar trend was observed, the patients and the surgeon being mostly "satisfied" or "very satisfied" (in 92% of the cases for the patients and in 83% for the surgeon), with satisfaction scores of 1.9 for the patients and 1.9 for the surgeon. At 12 months, the degree of satisfaction reported by the surgeon and the patients were again very similar, as they were "very satisfied" or "satisfied" with the appearance of the more mature scar in 86% of the cases, with the best satisfaction scores since the beginning of the evaluation for both the patients (1.5) and the surgeon (1.6). At this final evaluation, the number of patients declaring themselves "very satisfied" (64%) was the greatest, having steadily increased at each visit. In particular, the two patients who had previously undergone abdominoplasty (patients 1 and 8) and the one who required scar revision (patient 9) all reported being "satisfied" or "very satisfied" at their last follow-up evaluation, as well as the two patients who had a phototype V.

During the course of this study, a few cases of suture extrusion were observed, as commonly reported in the literature with this type of surgery.[26] No other adverse event or complication such as seroma, haematoma, wound dehiscence, skin necrosis, hypertrophic scar, infection, or burn occurred, including in the patients who missed some follow-up visits. More specifically, no laser-related incident was reported during the laser procedure, including in patients with the darkest phototypes (IV and V).

DISCUSSION

The scar is an important part of the outcome of any surgical procedure, especially the abdominoplasty scar because of its length. As patients expect the least visible scars possible, including in the weeks following these invasive operations, surgeons are investing efforts to obtain the most aesthetic scar outcomes. The UrgoTouch laser had previously been shown in a double-blind RCT to improve scar volume, surface, and roughness, after a single session performed the day of the surgery.[23] The purpose of the present evaluation was therefore not to re-demonstrate its efficacy, but to document in abdominoplasty the appreciation of the scar outcomes obtained according to an experienced surgeon who has just begun to use it in his practice and to his patients.

The results showed that the overall scar appearance after the laser treatment were perceived by the surgeon as close to normal, with OSAS scores of 2.9 and 2.5 on the 1–10 scale, at 6 and 12 months respectively. Despite being subjective, the scale used is a reliable and validated

Table 3. Patient and Surgeon Satisfaction with the Scar Appearance 6 Weeks, 6 Months, and 12 Months after the Surgery

	6 Weeks		6 Months		12 Months	
Patients	Specialist	Patient	Specialist	Patient	Specialist	Patient
P1	2	2	2	2		
P2	2	2			2	1
P3	4	3				
P4	2	2			1	1
P5					3	2
P6			2	2	2	3
P7	2	2	1	2	1	1
P8	1	1	3	2	1	1
P9	1	1				
P10	2	2	2	2	1	1
P11	2	2	1	1	1	1
P12	3	2	2	2	2	2
P13	2	2	2	3	3	3
P14	1	1	2	2	1	1
P15	1	1			1	1
P16	1	1	1	1	1	1
P17	1	1	3	2	2	2
P18	2	2	2	2		
MEAN	1.8	1.7	1.9	1.9	1.6	1.5
SD	0.8	0.6	0.7	0.5	0.8	0.8
"Very satisfied"	38%	38%	25%	17%	57%	64%
"Satisfied"	50%	56%	58%	75%	29%	21%
"Unsatisfied"	6%	6%	17%	8%	14%	14%
"Very unsatisfied"	6%	0%	0%	0%	0%	0%

Patients and surgeon assessed their satisfaction regarding the aesthetic of the scar using the same four-point Lickert scale: 1: "Very satisfied," 2: "Satisfied," 3: "Unsatisfied" and 4: "Very unsatisfied." Missing data correspond to missing control visits as initially scheduled.

tool in scar assessment,[41–43] and its scoring is standardized by the analysis of six different scars characteristics. The good OSAS scores were also corroborated here with a high degree of satisfaction reported by the surgeon, who had a wide experience measuring and assessing scars and their impact in patients' distress. In the early stage of the scarring process, the surgeon also reported less inflammatory symptoms (such as itching, redness, swelling, or local pain) than usual, with less patient complaints. In addition, a visible difference between the laser-treated areas and untreated areas could be noted on some occasions, for example, on the umbilical area or when patients underwent different procedures during the operation and the laser treatment was not performed on all the incisions. This feedback, of course, needs to be taken with caution, but overall, comparing with previous experience before using the laser, the benefits of this laser treatment were perceptible to the surgeon, who felt convinced of the interest of this procedure so early in the scar process.

The operating surgeon was also the scar assessor, but his degree of satisfaction was confronted with that of patients at each follow-up visit. In aesthetic surgery, the patients' perspective may be as important as the surgeon's, as patients are usually judging the quality of the surgery (and of the surgeon) based on the visibility of their scar. Plus here, they were the payers of the procedure. For this satisfaction assessment, the same scale was used for both the surgeon and patients, and the results showed a strong correlation between their answers, both at short- and long-term. A majority of patients were notably already "satisfied" or "very satisfied" with their scar appearance at 6 weeks, which is not that common in the literature,[8,9] but consistent with the previous clinical evidence on the use of this laser.[23,37]

Overall, the included patients had no specific history of scarring disorders (even for the patient who underwent a scar revision) and no specific wound healing risk factor (eg, diabetes, hypertension, high preoperative BMI, and smoking habits). Nonetheless, this surgery is known to be at risk of complications due to the incision length, central flap tension, or proximity of pubic hair, which can be associated with higher risk of wound breakdown, skin necrosis, infection, and nonaesthetic scarring.[6] And any laser procedure also carries its own set of risks of adverse events or complications.[22,44,45] In this clinical evaluation, no incident, adverse event, or complications occurred, regardless of patient skin phototype. The automated laser was judged safe, easy, and rapid to use, and the fact that no parameters had to be set or adjusted during the procedure was particularly appreciated by the surgeon who has also started to use this laser in other procedures (mastopexy, reduction mammaplasty, posterior trunk lipectomy, W-plasty of burn scars) with similar satisfactory results and no complications.

This study had some limitations: no control group, no blind evaluation and a small cohort, but was fully representative of the real-life practice in this setting (approximately all the abdominoplasties performed during the study period). As real-life studies conducted with laser procedure remains scarce in the literature,[6,7] this experience

documented over a constraining period of 1 year seemed worth sharing. Future research including larger cohorts and various types of surgery in real-life practice would be interesting, as well as comparing in an RCT the effects of this single laser treatment with those of multiple laser sessions or of its combination with other preventive measures.

CONCLUSIONS

This laser procedure, a single session with the automated UrgoTouch laser system, performed in the operating theatre immediately after the surgery, was associated with a high degree of satisfaction regarding the scar appearance, from both the patient's and surgeon's perspective, at each stage of the scarring process (6-weeks, 6-months, and 1-year). The rapidity and simplicity of this secured procedure were appreciated by the surgeon. These findings in abdominoplasty are consistent with the previous clinical evidence on the use of this laser in other types of surgery and scar locations, and comfort the benefits of its use in real-life practice.

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