

Correction of Liposuction Sequelae by Autologous Fat Transplantation

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Abstract

Background In many countries, liposuction is the most frequently performed aesthetic procedure. Although liposuction has been considered a safe surgical procedure, reports indicate that it can have significant sequelae. Irregularities ranging from “oversuctioning” to bumpy skin and asymmetries result from inadequate experience of the surgeon.

Methods A total of 57 consecutive female patients were operated on from June 2005 to June 2007. The age distribution of the patients ranged from 22 to 53 years, with a mean of 34.2 years. All the patients that were included in the study had undergone from one to three liposuction procedures. Overall satisfaction with the body appearance after autologous fat transplantation for correction of post-liposuction irregularities was rated on a scale of 1–5, where 1 is poor, 2 is fair, 3 is good, 4 is very good, and 5 is excellent.

Results The total amount of clean adipose tissue transplanted varied from 14 to 120 ml. There were no cases of liponecrosis, which developed in the grafted area, and no liponecrotic lumps were palpated on postoperative evaluation on any operated cases. There were no cases of

cellulitis at the donor or grafted area, no deep vein thrombosis, and no pulmonary embolism. There were nine cases that needed one additional session of fat grafting of 5–35 ml. Seven of those cases needed further fat grafting on the abdominal area and the remaining two needed further grafting of the infragluteal depressions. At 12 months, 68% reported that their appearance after autologous fat grafting was “very good” to “excellent” and 23% responded that their appearance was “good.” Only 9% of patients thought their appearance was less than good.

Conclusion With the overall acceptance of aesthetic surgery increasing and the number of patients undergoing liposuction increasing, it is likely that plastic surgeons will see more patients requesting secondary contour surgery in the future. The key to successful autologous fat grafting is familiarity with the technique, recognizing its limitations, and understanding the goals of the patient. This study has shown that the patient satisfaction rate observed after autologous fat transplantation produces aesthetically acceptable results in correcting post liposuction deformities.

Keywords Liposuction · Autologous fat grafting · Fat transplantation · Iatrogenic depressions · Post liposuction sequelae

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Introduction

In many countries liposuction is the most frequently performed aesthetic procedure. The development of liposuction provided plastic surgeons with a safe and effective way to sculpt the human figure [1–3]. Liposuction has evolved tremendously over the past three decades since its introduction by Illouz [4]. The goal of liposuction is the reduction of localized fatty tissue to produce

well-proportioned body contours. Although liposuction has been considered a safe surgical procedure, reports indicate that it can have significant sequelae [5]. The increasing number of liposuction procedures, often performed by inadequately trained physicians, has led to a growing number of iatrogenic post liposuction contour sequelae. These are classified as major or minor according to the size of the area, severity of the irregularity, difficulty of the correction, and the visual impact [6]. Sequelae include under correction, overcorrection, and irregular fat tissue removal with palpable and visible irregularities. Irregularities ranging from “over suctioning” to bumpy skin and asymmetries result from inadequate experience of the surgeon (Fig. 1). The abdominal area, the banana fold, and the sensuous triangle are difficult regions to work in and are responsible for serious local sequelae that are difficult to correct [1, 7]. Liposuction requires thoughtful planning and an artistic eye to achieve aesthetically pleasing postoperative results. Careful selection of patients, proper surgical technique, and diligent perioperative care of the patient help avoid contour irregularity sequelae. Outcome expectations should be based on realistic preoperative evaluation of the patient’s age, skin elasticity, volume of fat to be removed, and area of liposuction.

Patients and Methods

A total of 57 consecutive female patients were operated on from June 2005 to June 2007. The age distribution of patients ranged from 22 to 53 years, with a mean of 34.2 years. The preoperative body mass index (BMI) of the patients ranged between 17.4 and 23.2 kg/m², with a mean of 20.4, and was obtained in the first office visit. Of the 57 patients, 12 were smokers who were asked to refrain from smoking for 1 month before and after the surgical procedure. All the patients who were included in the study had undergone one to three liposuction procedures. Overall satisfaction with their body’s appearance after autologous fat transplantation for correction of post liposuction irregularities was rated on a scale of 1–5, where 1 is poor, 2 is fair, 3 is good, 4 is very good, and 5 is excellent. The patient satisfaction scale has been used in published papers and has been peer reviewed [8–10]. All patients were operated on by the authors.

Surgical Technique

Marking of the areas to be liposuctioned and fat grafted are made while the patient is standing. Preoperative sedation in the surgical suite is administered. Anesthesia consists of an epidural block and intravenous sedation. The patient is placed in the supine position. After the injection of normal

saline wetting solution containing 1:500,000 of adrenaline by a small-bore cannula and waiting 15 min, a 60-cc syringe attached to a 4-mm blunt cannula is inserted through two small incisions in the area to be liposuctioned. Each individual area to be aspirated is treated separately. Fat is aspirated using the syringe method in the dorsum and the flanks (Fig. 2a). The aspirated fatty tissue is treated in the following manner. With the syringe held vertically with the open end down, the fat and fluid are separated. Isotonic saline is added to the syringe, the fat and saline are separated and the exudate discarded. The procedure is repeated until the fat becomes yellow in color and free of blood and other contaminants (Fig. 2b).

Upon completion of the liposuction procedure, access to the post liposuction sequelae areas is gained through the same incisions that were used for the liposuction. Initially, a deep plane is created by the 3-mm cannula and dissection of the affected areas is done in order to release the scar tissue, as transplanted fat tends to shift to areas of less resistance (Fig. 2c). Then other planes are created by the same cannula in different trajectories, always from the deeper aspect to the more superficial plane. The fat is injected as the cannula is withdrawn (Fig. 2d).

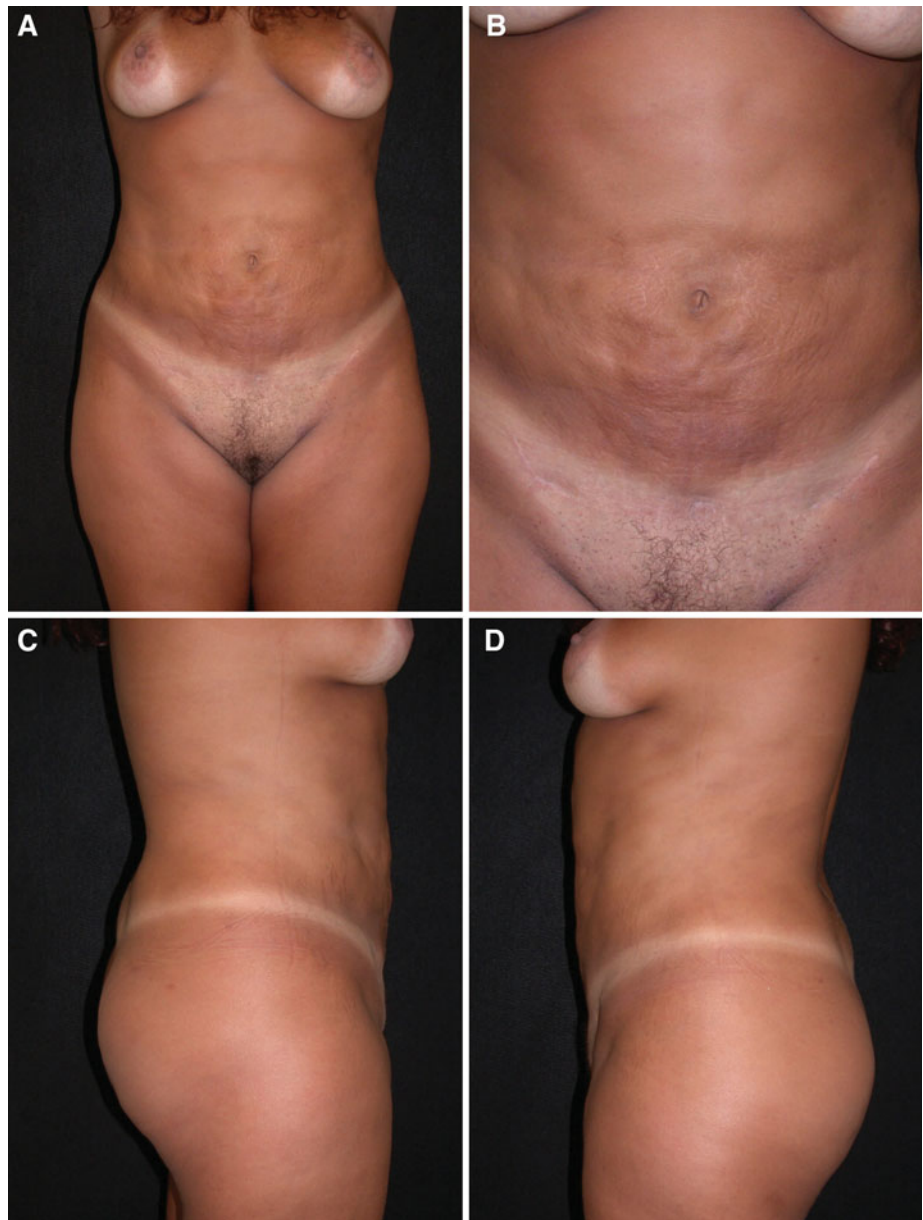
Access to the abdominal area is made using two incisions in the bikini area and one in the umbilicus. Liposuction (Fig. 3a) and lipografting (Fig. 3b, c) of the abdominal sequelae are then performed using the above-described principle. The perioperative result after autologous fat transplantation into the abdominal post liposuction sequelae is shown in Fig. 3d.

The patient remains hospitalized for 24 h. Antibiotics, analgesics, and anti-inflammatory medications are prescribed during the following seven postoperative days. Return to mild physical activities is allowed after the third postoperative week and lying down supine is allowed after 2 weeks. A non zippered pullover female body vest is placed on the second postoperative day and is kept on for 1 month.

Results

The total amount of clean adipose tissue transplanted varied from 14 to 120 ml (mean = 52 ml). There were no cases of liponecrosis, which developed in the grafted area, and no liponecrotic lumps were palpated on postoperative evaluation on any operated cases. There were no cases of cellulitis at the donor or grafted area, no deep vein thrombosis, and no pulmonary embolism. There were nine cases that needed one additional session of fat grafting of 5–35 ml (mean = 27 ml). Seven of those cases needed further fat grafting in the abdominal area and the remaining two needed further grafting of the infragluteal depressions.

Fig. 1 a–d Preoperative photos showing postliposuction sequelae



The postoperative BMI ranged between 17.8 and 25.6 kg/m², with a mean of 19.5 obtained at the 12-month office visit. At 12 months, 68% reported that their appearance after autologous fat grafting was “very good” (28%) to “excellent” (40%) and 23% responded that their appearance was “good.” Only 9% of patients thought their appearance was less than good (7% fair and 2% poor) (Fig. 4).

Patient 1

A 29-year-old woman presented in our unit requesting correction of her contour irregularities in her infragluteal area (Fig. 5a, b). She had undergone body liposuction

12 months earlier by a plastic surgeon in a different department. On examination, the patient had bilateral depressions on the infragluteal area which were marked when standing and lying down. Liposuction of the back and fat transplantation to the post liposuction sequelae were performed. A total of 95 cc of fat was injected. The follow-up for the patient has been 3 years with no complications and a satisfactory aesthetic result (Fig. 5c, d).

Patient 2

A 33-year-old woman presented to our unit after two previous liposuctions in a different plastic surgery unit. Three years ago she had given birth and she expressed the desire

Fig. 2 **a** Intraoperative photo of fat harvesting from the back. **b** Intraoperative photo of processed lipoaspirated fat. **c** Intraoperative photo of the 3-mm cannula dissecting the affected areas to release the postliposuction scar tissue. **d** Intraoperative photo of retrograde fat injection

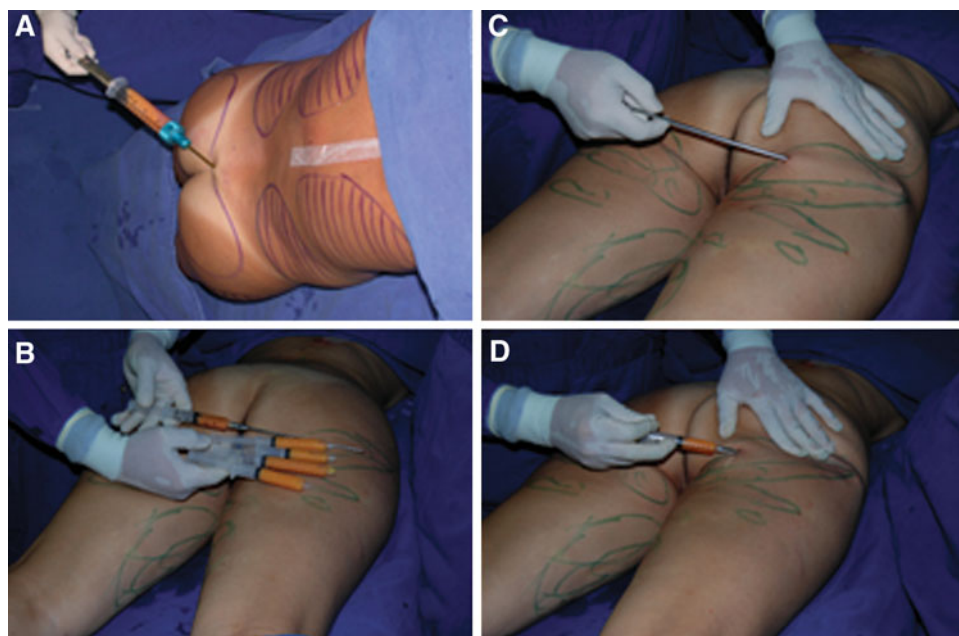
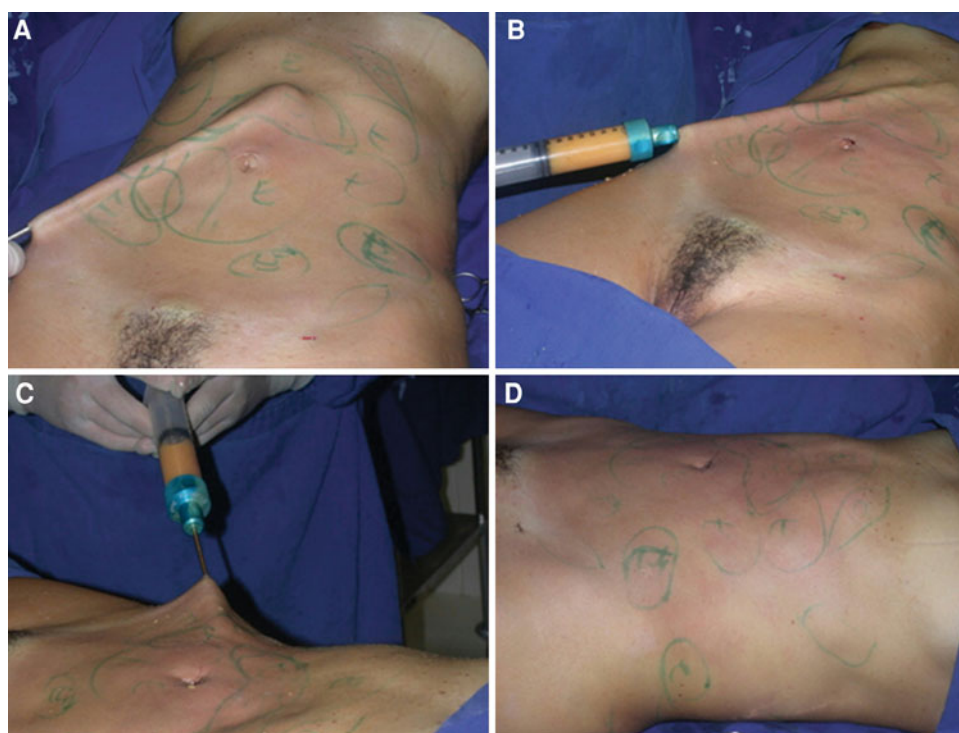


Fig. 3 **a** Intraoperative photo of liposuction of the abdomen. **b**, **c** Lipografting of the abdominal postliposuction sequelae. **d** Perioperative result after autologous fat transplantation of the abdominal postliposuction sequelae



to have a “normal belly.” Her last liposuction was performed 7 months prior to her visit. She underwent 20 sessions of endermologie in the last 2 months without noticing a significant change in her appearance. She complained about a “bumpy abdomen” and that she could no longer wear her bikini swim suit. On examination, she had iatrogenic abdominal depressions and a very prominent supraumbilical depression (Figs. 6a, b, and 8a). After

performing posterior and lateral syringe-assisted liposuction, the fat graft was obtained as described above (Fig. 7a). The supraumbilical depression was treated first (Fig. 7b, c), followed by the remaining abdominal contour deformities (Fig. 7d). A total of 35 cc of fat was injected into the abdominal area. The immediate postoperative photo is shown in Fig. 8b. The patient was reevaluated after 12 months (Fig. 8c) and decided to undergo a second



Fig. 4 Schematic representation of patient satisfaction rate 12 months after autologous fat transplantation

autologous fat transplantation procedure in which 7 ml of fat was transplanted into the supraumbilical area. Postoperative photos 4 years after the second procedure are shown, with no complications and a satisfactory aesthetic result (Figs. 6c, d, and 8d).

Patient 3

A 42-year-old woman presented with a prominent depression in her inner left thigh. On examination, she had an iatrogenic post liposuction depression (Fig. 9a). The authors performed abdominal liposuction and inner-thigh

fat grafting to correct the contour deformity (Fig. 10a, b). The total amount of 17 ml of fat was injected. The follow-up for the patient has been 5 years with no complications and a satisfactory aesthetic result (Fig. 10b).

Discussion

True body sculpting demands a three-dimensional artistic understanding of the anatomic and surgical adipose layers of the central trunk when performing liposuction [11]. This is essential in preventing sequelae from suction-assisted lipoplasty [12]. The best results are still obtained when treating moderate, localized fat deposits in a normal-weight patient that cannot be managed by diet and exercise. Physicians practicing liposuction surgery should have adequate training and experience in the field. This training and experience may be obtained in residency training, cosmetic surgery fellowship training, observational training programs, and CME accredited postgraduate didactic and live surgical programs with trained credentialed surgeons experienced in liposuction techniques [13, 14]. The following methods have been reported previously in the literature for the treatment of iatrogenic contour defects: liposuction of the area of protuberance, liposuction around the area of depression, simultaneous fat grafting, and dermolipectomy [6, 7, 15–17].

An important consideration for harvesting and refinement in preparation for autologous fat grafting is to respect and maintain the tissue architecture of living fat. Any mechanical or chemical insult that damages the fragile tissue architecture of fat will result in eventual necrosis of the injected fat. The transplanted fat must have access to

Fig. 5 a, b Preoperative photos of a 29-year-old woman requesting correction of her postliposuction irregularities in the infragluteal area. **c, d** Postoperative photos 4 years after autologous fat transplantation

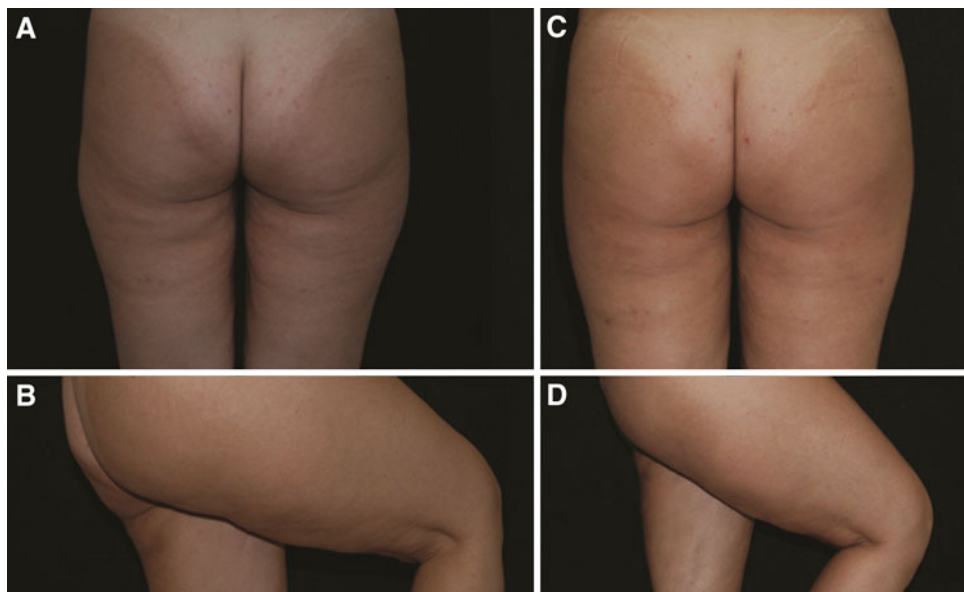
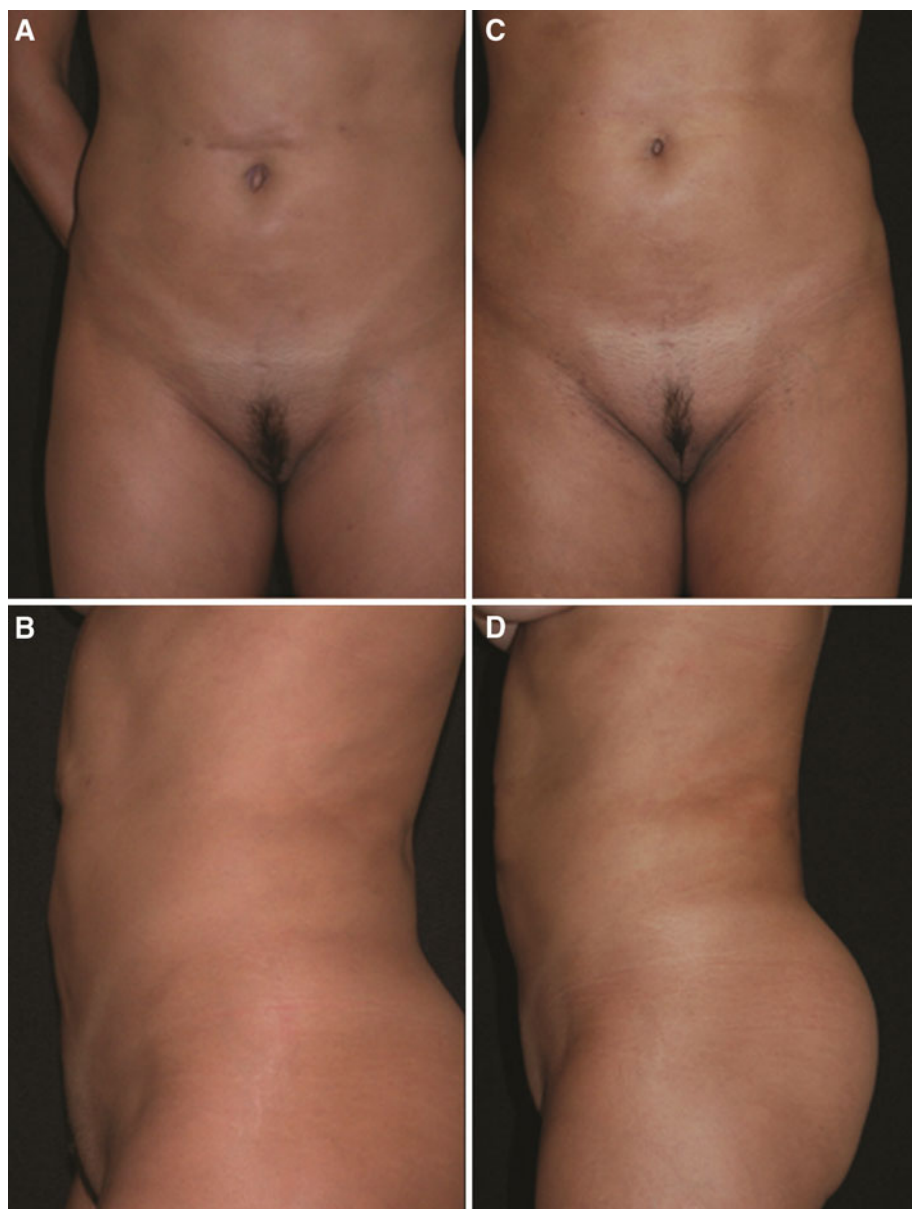


Fig. 6 **a, b** Preoperative photos of a 33-year-old woman requesting correction of her postliposuction irregularities in the abdominal area. **c, d** Postoperative photos 4 years after the autologous fat transplantation



blood supply [18]. The creation of multiple tunnels in post liposuction deformities ensures release of the scar tissue and adequate blood supply of the grafted fat. Excess fat should not be injected at one spot. For predictable results, the surgeon should refine the fat into relatively pure living tissue, using sterile conditions and avoiding external contact, thus preventing contamination. Transplanting a high percentage of nonviable components such as blood and local factors reduces the potential for accurate volume estimation. No statistical differences in adipocyte viability have been demonstrated among abdominal fat, thigh fat, flank fat, or knee fat donor sites [19, 20]. A recent paper has reported a significant difference of adipose cell concentration obtained at the different harvest sites. The adipose cell concentration was greater in the lower abdomen

than in other areas, but there was no significant difference found in relation to the inner thigh [21].

Our experience with liposuction and autologous fat transplantation in treating various tissue defects led us to use this technique for the correction of iatrogenic post liposuction tissue deformities [22–24]. We recommend a minimum of 6 months before any revision surgery. This period is critical for swelling and edema to recede so correct evaluation of the contour deformities is done.

The limitations of fat transplantation are well known, particularly the long-term unpredictability of volume maintenance [10, 25, 26]. With experience, the surgeon can predict the amount of volume needed to be grafted to produce the desired result [27, 28]. This study has shown that autologous fat transplantation produces aesthetically

Fig. 7 **a** Intraoperative photo of lipoaspirate before being processed. **b, c** Intraoperative photos of fat grafting of the supraumbilical depression. **d** Intraoperative photo of fat grafting of the postliposuction abdominal sequelae

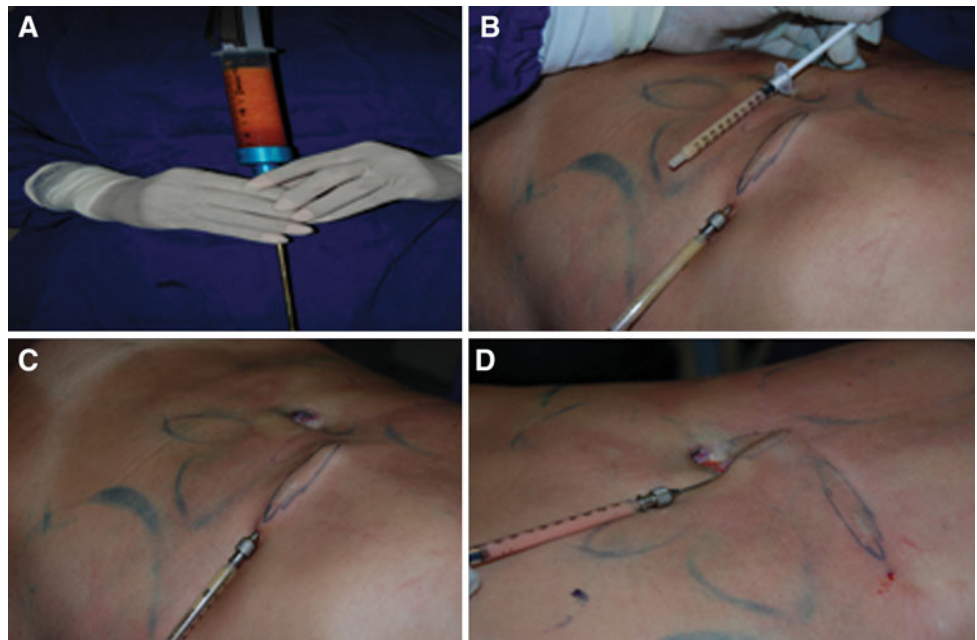
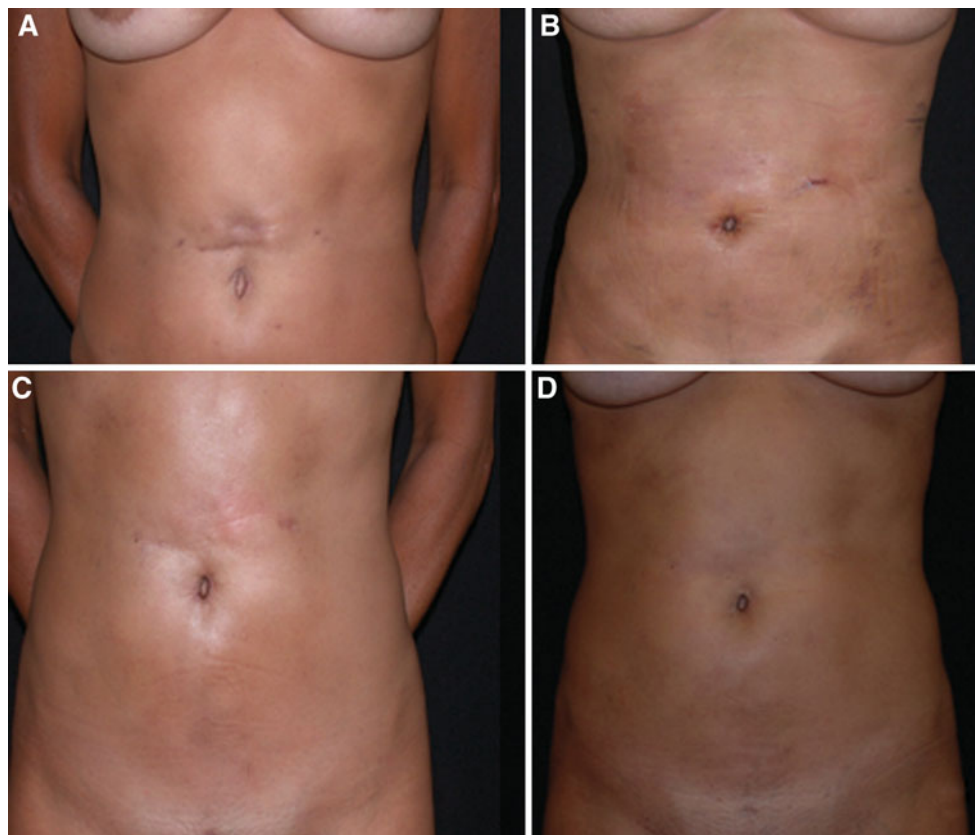


Fig. 8 **a** Preoperative photo of the supraumbilical depression. **b** Two days after the first procedure. **c** Twelve months after the first procedure. **d** Four years after the second procedure



acceptable results in post liposuction deformities, which are reflected in the patient satisfaction rate. However, the patient should be advised that a possible secondary fat transplantation may be needed. In cases 1 and 3, one procedure of autologous fat transplantation was sufficient to correct the deformities. In case 2, although there was a

significant improvement on the abdominal contour after the first intervention, there was still a contour deformity present which required a second procedure. A significant improvement in skin quality has been observed in the post liposuction deformed areas after autologous fat transplantation.

Fig. 9 **a** Preoperative photo of a 42-year-old woman with a prominent depression in her left inner thigh. **b** Five years after the autologous fat transplantation

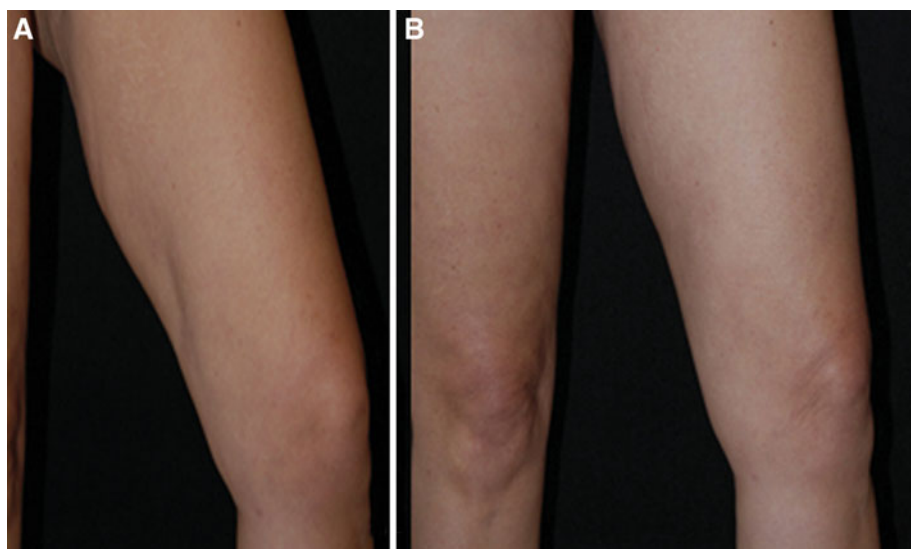
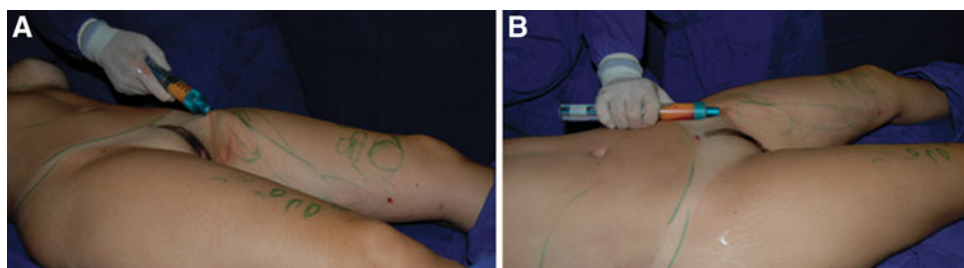


Fig. 10 **a, b** Intraoperative photos of abdominal liposuction and inner-thigh fat grafting in order to correct the postliposuction contour deformity



In this study, it was found that the abdominal post liposuction depressions needed more than one treatment sessions in the majority of the cases. Future studies examining the resorption rates after autologous fat grafting among different body areas need to be performed to confirm this observation.

There are cases where there is little or no fat reserve. This is common in young patients who have undergone extensive liposuction procedures. In those cases, the challenge for the surgeon is to obtain the maximum possible amount of fat without creating more contour defects. Regenerative cell-based strategies such as those encompassing the use of stem cells hold tremendous promise for augmentation of the soft-tissue space [29]. Preclinical studies and early clinical series show that adipose-derived stem cells (ADSCs) offer the possibility of finally fulfilling the key principle of replacing “like with like” as an aesthetic filler, without the drawbacks of current technology [30]. In cell-assisted lipotransfer (CAL), ADSCs are used in combination with lipoinjection. A stromal vascular fraction (SVF) containing ADSCs is freshly isolated from half of the aspirated fat and then recombined with the other half. This process converts relatively ADSC-poor aspirated fat to ADSC-rich fat. The preliminary results suggest that CAL is effective and safe for soft tissue augmentation [31, 32].

Conclusion

With the overall acceptance of aesthetic surgery increasing and the number of patients undergoing liposuction increasing, it is likely that plastic surgeons will see more patients requesting secondary contour surgery in the future. The key for successful autologous fat grafting is familiarity with the technique, recognizing its limitations, and understanding the goals of the patient. This study has shown that autologous fat transplantation produces aesthetically acceptable results in post liposuction deformities which are reflected in the patient satisfaction rate.

Disclosure The authors declare that they have no conflicts of interest to disclose.

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