Three-dimensional Superficial Liposculpture of the Hips, Flank, and Thighs

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Background: In the last 3 decades, liposuction has become a mainstay of the plastic surgeon’s armamentarium, and the technique has evolved considerably. We retrospectively review all of the liposuction procedures that we performed over the past 20 years.

Methods: The principles of superficial 3-dimensional liposuction with respect to preoperative, intraoperative, and postoperative management of patients scheduled to undergo liposuction of the hips, flanks, and thighs were described.

Results: A total of 4000 patient charts were reviewed. The results indicated that 50 patients experienced a postsurgical seroma that was resolved after syringe aspirations. One patient developed a major mycobacterial infection that was resolved after antibiotic therapy. Twenty patients complained of minor asymmetries that were corrected 6 months later under local anesthesia; 18 patients suffered from minor skin irregularities, which improved after lipofilling. In 6 cases, transient hyperpigmentation (6–12 months) of the skin before the use of suction drainages in the removal of large adiposities in patients with light skin was experienced, and in 2 cases, transient paresthesia (8 and 10 months) was experienced. No skin necrosis, deep vein thrombosis, or death occurred.

Conclusions: If performed correctly, 3-dimensional superficial liposuction of the trunk, hips, and thighs can yield very satisfying outcomes because of the excellent contour and the enhanced skin retraction provided by the thin cutaneous adipose flap. Three-dimensional liposuction is a reliable method with proven results. A careful application of the technique combined with accurate surgical planning, a thorough preoperative explanation of real expectations, and postoperative care is crucial. (Plast Reconstr Surg Glob Open 2015;3:e291; doi: 10.1097/GOX.0000000000000241; Published online 13 January 2015.)

Since the 1980s and after its presentation by Illouz1,2 in the medical literature, traditional liposuction or suction-assisted liploplasty has become the most commonly performed cosmetic surgical procedure.3 The procedure is principally executed in accredited outpatient plastic surgery facilities.4 In competent hands, suction-assisted liploplasty has low rates of complications, predictable recovery periods, and high patient satisfaction.5–8 According to a 2012 report by the American Society for Aes-
thletic Plastic Surgery,9 liposuction was the second and first most frequently performed cosmetic surgical procedures in women and men, respectively, in 2011.

In this review article, we present a brief history and overview of the 3-dimensional superficial liposuction of the trunk, hips, and thighs and describe our personal approach. In addition, we retrospectively review all of the liposuction procedures performed by the senior authors (Y.X.Z., M.F.C.) over the past 20 years.

**HISTORICAL PERSPECTIVE**

In the last 3 decades, liposuction has become a mainstay of the plastic surgeon’s armamentarium and the technique has evolved considerably. When first described,1,2 the technique by its very nature had certain limitations. Candidates for liposuction were restricted to generally younger individuals with good skin elasticity to avoid postoperative laxity. The volume that could be extracted was constrained by the considerable blood loss, and the large diameter of the cannulas restricted the use of the technique in certain anatomic areas. As a matter of fact, in the beginning, the procedure was performed under general anesthesia and large cannulas with a diameter of 6 mm up to 1 or 1.2 cm were used resulting in a high level of postprocedure discomfort and significant bruising. Large size cannulas were recommended to aspirate only deep fat deposits (1–2 cm below the dermis level) to preserve the integrity of the superficial fat and to prevent the occurrence of postoperative skin irregularities.10,11 In addition, Klein’s12,13 description of the tumescent technique, in which dilute buffered lidocaine and epinephrine were injected into the tissues to be suctioned to the point of turgidity, allowed liposuction to be performed with the patient under local or conscious sedation anesthesia with an excellent safety profile, principally minimizing blood loss and the risks of general anesthesia. In the 1990s, some histological and clinical investigations of the subcutaneous tissue distinguished a stiffer and more superficial areolar fat layer and a softer and deeper lamellar adipose tissue layer that were separated by the superficial fascial system.10,11 The areolar layer thickness usually remains stable during massive weight increase or loss because it acts as a pad, serving as a protection and shock absorber, whereas the deeper lamellar layer volume greatly changes during fattening or thinning and it is considered the real energy storage place of the body and is evidently present in areas where the body fattens the most.10,11 The focus of liposuction changed: the suction of the deep lamellar layer could provide a stable reduction of the thickness of the fat deposits and the changes made on the structural areolar layer allowed for a permanent change of the shape achieved with the suction. The new anatomical knowledge combined with the introduction of fine cannulas allowed for the introduction of superficial liposuction that dramatically changed the indication for lipoplasty through which it was possible to reduce the volume of fat deposit while promoting the skin to contract and retract significantly.10,11,14–16 Therefore, superficial liposuction extended the range of treatable patients and the number of anatomic sites and improved the quality of results.

**SUPERFICIAL 3-DIMENSIONAL LIPOSCULPTURE**

Currently, liposculpture is a very sophisticated method that goes beyond the simple aspiration of adipose tissue and allows the surgeon to modify the shape of the body and recontour the profile. Three-dimensional liposculpture approaches the subcutaneous adipose accumulations by using specific cannulas, which provides a natural body contouring and more round shapes compared with traditional liposuction. As it will be explained throughout the present article, there exists a plane in the subcutaneous tissue, that is the lamellar layer just below the superficial fascia, through which the cannula can be moved back and forward with less resistance. This is the correct layer in which fat deposits should be aspirated. The remodeling properties of superficial liposculpture should be used not only to reduce fat volumes but also for promoting skin retraction. The thinning of the skin flap is therefore necessary to allow the skin itself to retract and adapt to the new shape. The application of an elastic bandage combined with a compressive garment will correctly guide the redistribution of the skin.

Effectively, the philosophy of the 3-dimensional liposculpture benefits is based on the properties of the retraction of the skin and the better retraction achieved by a thin cutaneous flap rather than a thicker and heavier one. The thinner the skin is, the greater its retraction is. Obviously, the more the skin is sagging, the thinner the cutaneous flap should be made to promote its retraction as much as possible. The goal is to use the thinner adipocutaneous flap.

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of the area treated with the superficial liposculpture as a dynamic support that should adapt to the new shape and volume and hold the remodeled fat. The skin should no longer be considered a passive element during superficial liposuction, but instead as an active, structural, and dynamic constituent.

**PRESURGICAL TREATMENT PLAN**

**Physical Examination**

The first step towards a detailed presurgical plan should include the evaluation of the patient fully disrobed and standing up, to note static asymmetries due to different fat distribution and dynamic asymmetries due to body posture and habitus. The pinch test is used to assess the thickness of the subcutaneous fat and the distribution of fat in the trunk, hips, and thighs with a site-specific physical examination.

The evaluation of the skin elasticity of the areas to be treated is another important key aspect to understand the possible degree of skin retraction after surgery for patients seeking liposuction. In addition, during skin inspection, any asymmetry or contour irregularities should be noted and discussed with the patient, including wrinkles, scars, area of laxity, dimpling, and retractions. This is true also in revisional liposuctions in which major visible skin irregularities, such as severe dimpling and retractions due to excessive fat removal, can be appreciated only after the healing process and areas that are insufficiently reduced by lipospiration. In these secondary cases, false depressions (concavities due to the undertreatment of the surrounding areas) should be distinguished from true depression (overcorrected regions) because areas of excessive or insufficient fat removal can yield an asymmetrical, unnatural, or otherwise disappointing result.

Cellulite is an alteration of the topography of the skin that affects mainly the hips and buttocks where fat depositions appear to be under the influence of estrogen and outwardly gives the skin an unsightly lumpy or peau d’orange-like appearance. Patients should be clearly informed before the treatment that liposuction cannot cure cellulite, and on occasion, the procedure may sometimes worsen its appearance. Cellulite should be differentiated from dimpling which is usually considered to be a more isolated area of concavity that may be secondary to an underlying scar or fascial attachments and which may be improved by the liposuction process. The surgeon should include in the informed consent the preoperative pictures of the patient and a description of the preoperative evaluation. The patient should be aware difficulties of achieving complete correction of dimpling or asymmetry intraoperatively, especially in secondary cases and should, therefore, be informed about the possible persistent asymmetry, depressions, and dimpling after the operation.

**Preoperative Marking**

Preoperative drawings should be precise and accurate and are essential to achieving satisfactory outcomes. The patient should be drawn in the upright or standing position. Different colored fiber-tip pens should be used to mark areas to be aspirated (black or blue) and eventual areas to be filled (red). In addition, adherences should be identified carefully and marked, especially in revision surgery.

Some suggestions from our long experience are described in following paragraphs.

1. Use a solid straight line to indicate the adipose tissue to be aspirated until it reaches the point of transition between the deformed and the regular area. The point of top projection of the deformity also needs to be marked.

2. Use “+” and “−” symbols to classify the level of aspiration to be performed on the patients during the presurgical drawing to re-establish a natural profile. It is suggested that this process is executed during the presurgical phase because the position of the patient (mostly in lateral or supine position) during the operation makes it impossible to identify the deformity. At this time, identify and mark all of the asymmetry between the 2 sides.

3. Use a different color to mark the hypotrophic areas that need to be filled with fat filling (lipofilling) to create an optimal contour.

4. Through the pinching maneuver, the approximate amount of fat to be removed from each area should be written.

5. Contour irregularities, such as severe dimpling, retractions, and dermal depressions, should be recognized preoperatively to avoid their attribution to technical mistakes of the surgeon during the operation. In secondary liposuction, both major visible skin irregularities due to excessive fat removal and areas that were insufficiently reduced by previous liposuction should be marked.

6. Evaluate the amount of fat that needs to be removed and when to stop the suction by performing a simple maneuver: press inward on the lateral femoral deformity to clearly assess the new form to obtain and then mark a line just below the hand in this new position. This will be the new level we want to obtain on the femoral side profile. During the operation, the suction will be interrupted once this level is reached.
All the marked defects should be corrected in all 3 spatial dimensions according to the principles of the 3-dimensional liposculpture to achieve to provide a better and more harmonic contour.

**SURGICAL TECHNIQUE**

**The Position of the Patient**

The main purpose of the intraoperative position during liposuction of the hips, buttocks, and thighs is to recreate the anatomic position and minimize the distortion of subcutaneous fat influenced by the position of the subjacent musculoskeletal structures that may prevent a smooth result. For this reason, we prefer to avoid the supine position for these patients because in our experience, the body weight may cause a compression to the fat deposit in anteroposterior direction which subsequently forms a lateral bulge that flattens the thighs. In addition, the supine position limits the number of available surgical accesses and warps the position and the volume of fat deposits to be treated. The ideal intraoperative position of the patient undergoing liposuction of the flank, hips, and thighs is a lateral decubitus position, such that the intrasurgical position of the thigh could produce a precise presentation of the anatomic position. Both legs should be straight to create a nice alignment of the shoulder, the hip, the knee, and the ankle (Figs. 1, 2). A pillow is inserted between both thighs to reduce the trochanteric pseudobulge by abducting the uppermost thigh caused by the anterior pressure. The presence of a pillow also makes possible a rotation of the femur and of the trochanteric tubercle anteriorly and medially reducing the risk of the surgeon creating a trochanteric depression due to suction overtreatment. Subsequently, an adequate lateral position minimizes the risk of the nuances and subtleties of the preoperative shape during the surgery.

**Infiltration**

After the patient is prepared and draped in sterile fashion, the tumescent solution is infiltrated. The solution consists of saline solution (500 ml), 1:500,000 epinephrine, and 2% lidocaine (20 ml). The operation is performed under spinal anesthesia combined with conscious sedation or with the laryngeal mask airway depending on the compliance of the patient. This is the reason why although the recommended dose of lidocaine is less than 7 mg/kg with published articles demonstrating lidocaine use up to 55 mg/kg without complications, we prefer far lower doses (less than 1 mg/kg) achieving satisfactory analgesia with systemic anesthesia.17–22 The infiltration with a multi-hole needle starts in the deep adipose layers and proceeds superficially, covering all of the superficial adipose layers until the shape of the area to be treated is clearly highlighted. At the end of the infiltration process, a sterile ice package is usually applied over the infiltrated region to promote further vasoconstriction (Fig. 3).

For minor deformities requiring a treatment under local anesthesia, 25 ml of 1% lidocaine and of
8.4% sodium bicarbonate (7 ml) are added to the above solution.

**Incision Placement**

The suctioning of the fat deposits should be made using multiple incisions (Fig. 4) for cannulas, especially in revision liposuctions. This will prevent the occurrence of depressions and contour deformity around a single access site and will minimize the amount of trauma and friction on the single incisions. Whenever possible, the visibility of the subsequent scars should be limited by hiding the incisions in between natural skin folds and asymmetrically. Two incisions of 2–3 mm (scalpel n.11 blade) are necessary as access points for every region to be treated, the first being located in the upper side of the marking and the second in the lower part, where the subcutaneous fat begins to shrink.

**Surgical Technique**

The definition of the right plane of aspiration is obtained through a gentle pretunnelling (ie, the back and forward movement of the cannula without suctioning in regular radiating tunnels). Before starting with the aspiration, it is useful to harvest three to four 50 ml syringes of fat that should be used to fill the defects that have been drawn preoperatively. The pretunnelling maneuver allows for the detachment of the intermediate and superficial layers of the area to be treated.

A 2.5- to 4-mm-sized cannulas are used to liposuction the deep and intermediate layers of trochanteric area fat until a meaningful amount of fat deposit reduction is progressively provided. With the cannula in one hand, the other hand is used as guide to check the plane of aspiration constantly. The progress of the aspiration can be identified by pinching the tumescent fat. It is strongly suggested for the surgeon to check the amount of fat that has been removed from the trochanteric area regularly. This could be achieved by straightening the patient’s leg and by medially rotating the toe to point toward the floor. This maneuver rotates the trochanter anteriorly and flattens the area of the lateral thigh that is particularly likely to suffer from excessive liposuction. This area immediately overlying the trochanter should look flat but never concave.

Once the deep aspiration is ended, an improvement of the area seems to be achieved. However, with few maneuvers, it can be easily noticed that some residual untreated fat is left and it can only be noticed only when the patient stands up in the orthostatic position. To replicate this condition in the current position, the buttock is pressed down so that the remaining subdermal fat layer excess is clearly visible (Fig. 5). A 3-mm cannula is utilized to remove this residual adipose through a superficial liposculpture with very superficial crossed tunnels. The crisscross tunnelling technique just below the dermis provided by the superficial liposuction creates a very thin flap that will retract easily. Finally, a 2.5-mm cannula is used to refine with a superficial suction the treated area and those surrounding. During the superficial liposuction, the angulation/flexion of a cannula aids back and forward movements parallel to the skin in the superficial layer to exert the necessary force efficiently (Figs. 6–8).

When minor irregularities occur, further aspiration with the cannula should be avoided, and a cannula disconnected from the suction device should be used to achieve the disruption of all of the adher-
ences between the skin and the subcutaneous layer. Alternatively, the remaining fat deposits should be remodeled using finger pressure. The thickness of the cutaneous flap should be slightly different in the treated areas to achieve a harmonious 3-dimensional distribution of the curves and volumes. Liposuction ends once the planned ideal profile is achieved with a concave flank, a convex hip, and a round well-defined buttock.

A superficial liposuction should be performed to the infragluteal deposit of fat, allowing the removal of superficial fat combined with a significant skin retraction without removing the deep fat supporting the buttock to prevent the collapse of the gluteus structure. Saline solution is used to wash the treated area to distinguish the level of nearby areas without any depression deformity. Finally, a pinching test is performed to check the symmetry on both sides.

At the final stage of the operation, 4/0 and 5/0 stitches are used to suture the access points, and a negative pressure suction drainage is inserted with a cannula through the lowest incision access for the minimization of ecchymosis and permanent hyperpigmentation (Fig. 9).

Fig. 5. To replicate the standing-up position during the operation, the buttock is pressed down so that the remaining subdermal fat layer excess is clearly visible.

Fig. 6. During the superficial liposuction, the angulation/flexion of a cannula aids back and forward movements parallel to the skin in the superficial layer to exert the necessary force efficiently.

Fig. 7. The thinness of the cutaneous flap shown with the cannula.

Fig. 8. The pinch test to check the amount of fat that has been removed and the thinness of the cutaneous flap.
Postoperative Compression

Generally, the patients are allowed to go home 24–48 hours after the surgery, depending on the areas involved and the fitness level of the patient itself. Patients who are involved in a large volume liposuction (defined as a total aspirate of 5000 ml or more) \(^\text{17,20}\) are recommended to be hospitalized for a night during which the drainages are maintained, wearing compression stockings on the legs to prevent thromboembolic events. The process of skin adaptation to the new volume and shape is provided through an elastic bandage with Tensoplast (held for 48–72 hours) reinforced with patches applied on the suctioned areas with the tension applied from the caudal to cranial direction to adequately guide skin retraction. The patient is asked to wear an overlying compressive garment for 1 month after the operation. To produce a balanced distribution of pressure because of an otherwise disproportional pressure due to the presence of compressive garment, a Reston dressing (left for 48–72 hours) is applied on the flank area (Fig. 10). After 1 week, when the patients refer that the compressive girdle is not more tightening enough, we suggest to change to a smaller size garment or to wear compressive collants over the garment and continuing to do so until 1 month postoperatively. Some examples of significant cases are shown in Figures 11–15.

Combined Procedures

The traditional suction-assisted lipoplasty connected to an external source of suction remains still the most commonly performed method to remove fatty tissue, and based on the initial clinical situation, concomitant procedures are usually applied to enhance the individual final outcomes. Ultrasound-assisted, power-assisted, radiofrequency-assisted, laser-assisted, and water-assisted lipoplasties have been widely described and applied with the most varying indications.\(^\text{17–22}\) There is no actual consensus on which combined liposuction technique is best suited for all patients in all circumstances. Although we have enough preliminary experience with all those tools, the predictability of the results and the long experience of the senior authors pushed us to use the superficial suction-assisted liposuction alone in patients seeking a reshaping of the hips, flanks, and thighs. Beginning the suctioning in the deep layers with the right-hand manual control of the cannula and the continuous pinching made with the left hand allows for a very sensitive checking (almost lobule by lobule) of the progression of the aspiration that proceeds to the superficial layers as a “touch up.” The superficial 3-dimensional liposuction approach can provide in this way a controlled defatting of the volume of the thick lamellar fat layer of these areas while achieving a practically permanent ideal shape due to the skin retraction with no need of any alternative forms of liposuction. Although Kim et al\(^\text{22}\) concluded that superficial liposuction is at increased risk for complications compared with conventional suction techniques, we believe that the use of traditional back and forth manual movement of the cannula with only the suction assisted avoid an overzealous suctioning of superficial layer and prevent the most frequent complication of superficial liposuction that is postoperative contour irregularity.
Fig. 11. A, Preoperative view of a 25-year-old woman undergoing trochanteric and flank liposuction. B, The excellent contour at 23-month postoperative view.

Fig. 12. A, Preoperative view with markings of a 38-year-old woman undergoing trochanteric, upper posterior thigh, and inner thigh liposuction. B, The excellent contour at 11-month postoperative view.
Fig. 13. A, Preoperative view of a 38-year-old woman undergoing trochanteric and flank liposuction. B, The excellent contour at 15-month postoperative view.

Fig. 14. A, Preoperative view with markings of a 47-year-old woman undergoing trochanteric, upper posterior thigh, and inner thigh liposuction. B, The excellent contour at 7-month postoperative view.
RESULTS

After almost 4000 cases of superficial liposculpture performed, the long-term results in terms of body contouring and skin retraction have also been maintained in those patients who had pregnancies (9%) and weight losses or increases (37%) after the surgery.

The following complications were experienced in the remaining 2% of the patients:

1 major mycobacterial infection, which was most likely caused by contamination of lipofilling resolved after antibiotic therapy.

20 minor asymmetries that were corrected 6 months later under local anesthesia.

18 minor skin irregularities improved after lipofilling.

6 cases of transient hyperpigmentation (6–12 months) of the skin, before the use of suction drainages in the removal of large adiposities in patients with light skin.

2 cases of transient paresthesia (8 and 10 months).

50 cases of seroma which were resolved after several weekly syringe aspirations.

Fifty cases of seroma over 4000 patients are not enough to presume a correlation of seromas and the amount of removed fat or a specific site. Anyway, we believe that the low incidence of seroma in our series compared with the other series in the literature is due to the use of closed suction drainage and to compressive bandage and girdle worn by the patients immediately after surgery for 1 month until the inflammation has completely disappeared. Although numbness was frequent and usually resolved over the next 6–12 weeks following liposuction, we considered it as a complication only if prolonged or worsened such as in the cases of transient paresthesia. No skin necrosis occurred in our series. Although rare, it is possible for the nerves not to heal completely, and this can create chronic pain or discomfort; anyway we experienced no case of perioperative chronic pain.

CONCLUSIONS

If performed correctly, 3-dimensional superficial liposuction of trunk, hips, and thighs can yield very satisfying outcomes because of the excellent contour and the enhanced skin retraction provided by the thin cutaneous adipose flap. Based on our 20 years of experience and observations on 3-dimensional liposuction, we can suggest it as a reliable method with proven results. A careful application of the technique combined with an accurate surgical planning, a thorough preoperative explanation of real expectations and postoperative care, is crucial.
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