ROYAL BELGIAN SOCIETY FOR PLASTIC SURGERY

Breast Surgery

No-Scar Breast Reduction Utilizing Power-Assisted Liposuction Mammaplasty, Loops, and Lipofilling

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Abstract

Background: In continued interest to develop and refine minimally invasive procedures, recent publications reported a scarless approach in breast lifting.

Objectives: The authors sought to describe a power-assisted lipomodeling technique combined with surgical loops to achieve breast reduction and reshaping with minimal scars.

Methods: Between 2014 and 2018, 94 patients underwent breast reduction by combined liposuction and loops. Following infiltration of the breasts, liposuction of the outer quadrants and the lower pole was achieved to reduce the breast footprint and the lateral and inferior heaviness of the breast. After multiaxial multiplanar tunnelization, 3 types of loops were taken around the breast to suspend and elevate the breast skin envelope and parenchyma. Each loop was guided through a 3-mm, 3-hole cannula passed through skin stab incisions. The first loop was designed to reduce the breast footprint and enhance the breast projection, whereas the second loop was designed to achieve breast conus remodeling. The third loop was passed circumferentially around the areola and then cephalad along the breast axis and pulled until the desired nipple-areola complex elevation was reached. Each loop was pulled to achieve the desired breast projection and shape.

Results: The authors achieved breast reduction with a mean nipple elevation of 7.3 cm, and 88% of patients were satisfied with their breast shape. The total complication rate was 1%, including mild cellulitis in 1 breast, treated efficiently with oral antibiotics.

Conclusions: The proposed technique is a novel, simple, and safe alternative to achieve breast reduction and reshaping without a scar.

Level of Evidence: 4

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Breast liposuction is a relatively new procedure. Since its first description in the 1980s[1] as an adjunct for breast surgery,[2-6] liposuction alone has been utilized as a primary modality for the treatment of breast hypertrophy.[7-22] Despite the confirmed ability of liposuction to reduce breast volume and weight, there are still many controversies regarding its ability to reshape the breast, elevate the nipple-areola complex (NAC), and treat ptosis. Hence, liposuction had been limited to fatty breasts with well-placed NACs.[9,14,17]

As senior author (M.H.A.), I utilized liposuction as an adjunct to an excisional technique and proved its safety in

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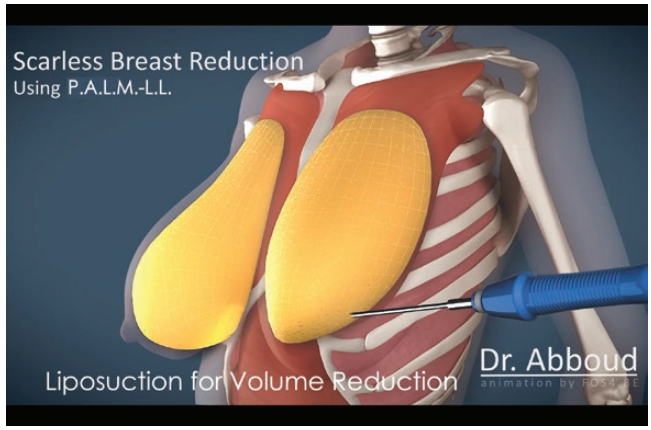
breast reduction.[2,5,23] To reduce complications associated with excisional techniques, especially in high-risk patients, I proceeded by utilizing liposuction only. I noticed that liposuction can elevate the NAC only up to 5 cm. However, this amount was not sufficient to treat breast ptosis, and breast reshaping was not achieved. In fact, the recurrence of ptosis was due to the lack of separation of the skin from the gland and the latter from the underlying fascia. To achieve a better result, I developed a new concept of matrix modeling based on a dissociation of subcutaneous subunits by means of aspiration and tunnelization to loosen and model tissue. Thereafter, loops were placed to act as an internal splint that conforms to the new shape of the breast (the 3-dimensional [3D] presentation of the technique is shown in Video 1).

In this article, we describe a new, scarless technique of breast reduction based on power-assisted liposuction (PAL)[24] and internal loops to reduce breast volume, improve breast shape, and reposition the NAC. The goals of this procedure are to ensure vascular security, form stability, minimize scars, preserve breastfeeding ability and breast sensibility, and reduce the rate of complications.



Video 1. Watch now at http://academic.oup.com/asj/article-lookup/doi/10.1093/asj/sjaa165

METHODS

Patient Selection

In this study, we included all patients with fatty breast hypertrophy who wanted to avoid extensive scars or had a predisposition to unaesthetic scarring. Patients with breast asymmetry as well as patients with irradiated breasts were included in the study as were diabetic patients and smokers. We excluded patients with glandular breasts and those who presented a suspicious mass on radiological control. Patients with a family or personal history of breast cancer were accepted only with the approval of their oncologist. The power-assisted liposuction mammoplasty (PALM) excisional technique was chosen in patients with glandular breasts, those who required NAC elevation of more than 10 cm, patients who accepted the scars of the excisional technique, and individuals who did not have the patience to wait for up to 6 months to see the final postoperative result.

Patients and Study

A total of 94 women (188 breasts) who underwent primary breast reduction with PALM utilizing liposuction and loops from January 2014 to January 2018 were evaluated in a prospective study. All patients received detailed information regarding the surgical procedure, risks, benefits, complications, and alternative procedures. Patients were informed about the possibility to convert to the excisional PALM technique[5] in case of difficulty in aspirating the breast. All patients provided written informed consent. Preoperatively, all patients underwent a clinical breast examination, mammography, and breast ultrasonography. Photos were taken preoperatively and postoperatively in the frontal, oblique, right lateral, and left lateral views with the arms elevated and in a resting position. Because all patients underwent surgery in a private practice, approval from an institutional review board or ethics committee was not obtained. The study adhered to the principles set forth in the Declaration of Helsinki.

Data Collection and Analysis

Demographic data including age, body mass index, smoking status, previous breast surgery, nipple to sternal notch distance, preoperative breast size, and comorbidities such as obesity, diabetes mellitus, coronary artery disease, hypertension, and breast cancer were noted. Intraoperative data were recorded including the total volume of fat aspirated per breast and the extent of NAC elevation. Complications including seroma, hematoma, partial NAC necrosis, total NAC necrosis, and infection were evaluated. The data were analyzed in a computerized database.

Operative Procedure

Preoperative Markings

Preoperative markings were conducted with the patient standing. Markings of the conventional excisional "PALM with scar" method were made in case there was a need for conversion.[5] The nipple-to-sternal notch distance for each breast was determined with a measuring meter and marked on the patient. The midline axis, the breast meridian, the vertical axis passing through the anterior axillary folds, and the horizontal axis joining the anterior axillary

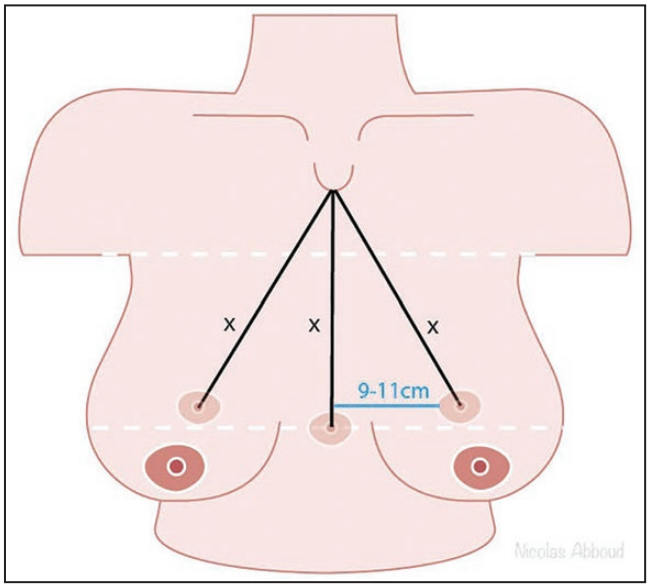


Figure 1. Preoperative markings: the midline, the interaxillary line, and the inframammary fold axis are marked. The new nipple-areola complex is positioned 9 to 10 cm from the midline, and its inferior border is positioned at the level of the inframammary fold. The distance from the new nipple to the sternal notch (X) is equal on both breasts and along the midline.

folds were marked. The inframammary fold and the new position of the NAC were also marked. The nipple was positioned at the level of the inframammary fold (Figure 1). Breast symmetry was checked.

The zones of liposuction at the outer quadrants, the lower pole of the breast, and the axillary region were marked (Figure 2). Zone 1 is the axillary region, zone 2 is the upper abdominal/thoracic region, zone 3 is the outer quadrants and lower pole of the breast, and zone 4 is the retroareolar region. The breast is assimilated into a pie shape and divided into 8 pieces to achieve symmetrical and precise markings. Then the pattern of the loops is marked. The first loop is designed to define the breast footprint. The second loop is the conus loop that divides the lower pole into thirds and is designed to increase projection and facilitate breast remodeling (Figures 3 and 4A). Finally, the parachute loop, which suspends the NAC like a parachute, is designed for NAC size reduction and repositioning (Figures 4B and 5; Supplemental Figures 1 and 2). The symmetry of the drawings was checked at all times. The preoperative markings and surgical technique are shown in Video 2.

Surgical Technique

Under general anesthesia, the patient was placed in the supine position with the arms abducted. A total of 2 g of intravenous cefazolin was administered 30 minutes before the intervention. Both of the breasts were infiltrated with a solution that contained 5 mL of exacyl 0.5 g/5 mL associated with epinephrine 1:100,000 per liter of normal saline utilizing a power-assisted liposuction system (Lipomatic, Eva SP, EUROMI SA, Verviers, Belgium) and a 3-mm multihole cannula. The infiltration volume was dependent on breast size and ranged from 150 mL to 600 mL (mean, 270 mL).

The same power-assisted liposuction system was utilized for liposuction of the breast. Liposuction was performed in the lower and outer quadrants and the inferior pole of the breast employing a 4-mm multihole cannula. The volume to be aspirated depended on the shape and size of the breast, the extent of breast ptosis, and the type of breast parenchyma. The aspirated volume was sent for anatomopathological examination. Tunnelization was performed in all quadrants of the breast with particular attention to the retroareolar space and the lateral aspect and lower pole of the breasts. We emphasize the importance of performing a thorough multiplanar tunnelization, more particularly to the deep plane, to liberate the attachments of the breast tissue to the pectoralis fascia (similar to the open technique) to allow subsequent modeling and reshaping with loops. Furthermore, a thorough tunnelization was performed on the soft tissue between the NAC and the anchor point to stimulate overlying skin retraction and allow the NAC to relocate upward. Tunnelization extended below the inframammary fold and into the axillary region to facilitate transposition of the breast to the desired position under minimal tension and redraping of the excess of the skin in the axillary, thoracic, and abdominal regions.

Three loops were taken around the breast to suspend and elevate the breast skin envelope and parenchyma. Each loop was guided through a 3-mm, 3-hole cannula passed through skin stab incisions. We utilized non-absorbable sutures for the footprint and the conus loop and absorbable suture for the NAC-parachute loop. Utilizing a non-absorbable suture (reel of Filapeau 2, 250 cm), the footprint and the conus loops are taken. The first loop, the footprint loop designed to reduce the breast footprint and enhance breast projection, spanned the superficial subcutaneous tissues at the lower quadrants of the breast and the deep plane in the upper quadrants of the breasts to allow for rigid fixation and to act as a medial anchor during repositioning. The thread was passed once following the same path to reduce the tension on the knot. The cannula and the thread must enter and emerge from the skin 4 to 5 times to allow the creation of a circular loop with a straight cannula.

The second loop, designed to achieve breast conus remodeling, spanned in thirds the area from the lateral border of the footprint to the lateral area of the NAC to distribute and minimize tension following medialization of the breast parenchyma. For the conus loop, the thread is

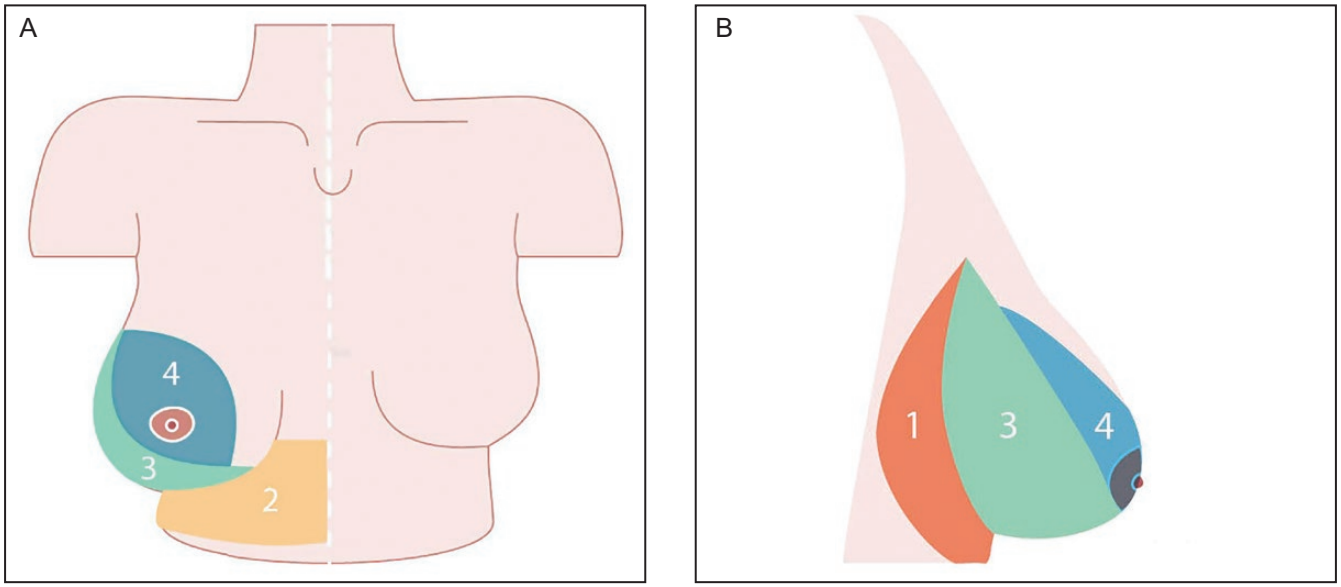


Figure 2. (A, B) Zones of lipoaspiration. Zone 1 (orange) in the axillary region, zone 2 (yellow) in the upper abdominal and thoracic regions, zone 3 (green) in the lower and outer quadrants of the breast, and zone 4 (blue) in the nipple-areola complex region.

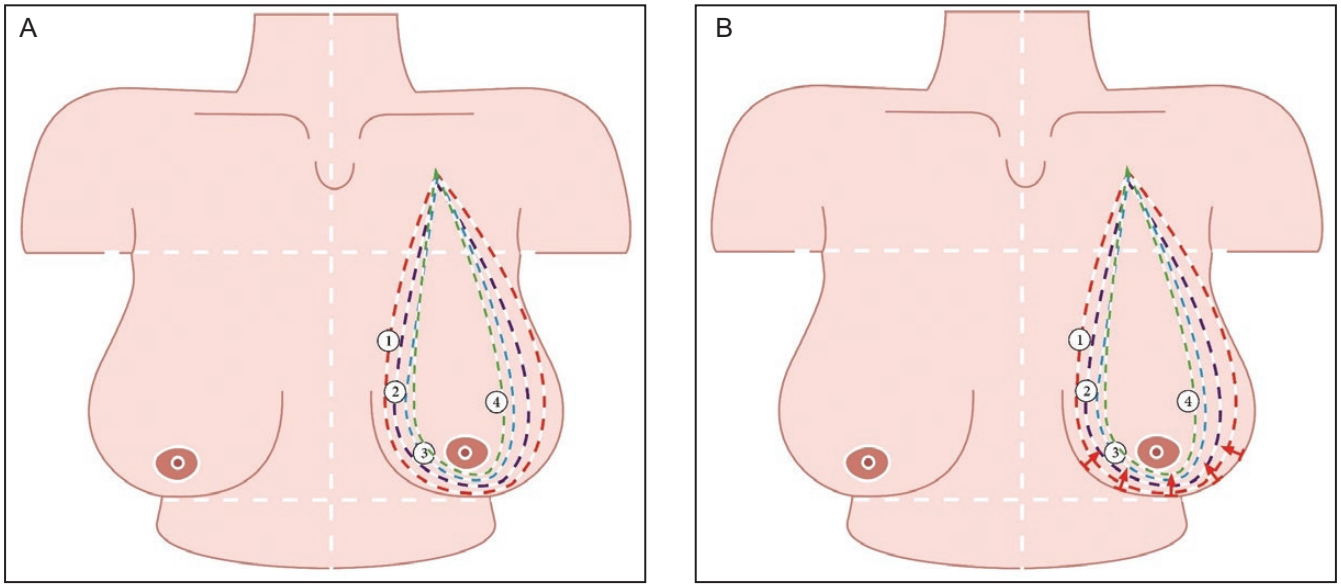


Figure 3. (A, B) The pattern of footprint loop (1) to reduce the breast footprint and conus loops (2, 3, 4) that span in thirds the area from the lateral border of the footprint to the lateral area of the nipple-areola complex to achieve glandular conus remodeling.

passed at least 3 times following the same path to model the lower breast pole and lift and project the breast. The thread is passed as many times as needed to achieve this purpose, and the number of passes depends mainly on the lower pole length and the heaviness of the residual breast tissue. Usually we do not need more than 5 passes to obtain this result. The loops were secured to the breast parenchyma, and the approximate depth of suture placement was 1 cm inferiorly and suprafascial in the upper pole. Each loop was pulled to achieve the desired breast projection and shape. The tension on the loop should be exact; over-tightening of the suture may result in postoperative pain, and under-tightening may yield insufficient results. Utilizing a number 0 V-Loc absorbable suture, the third

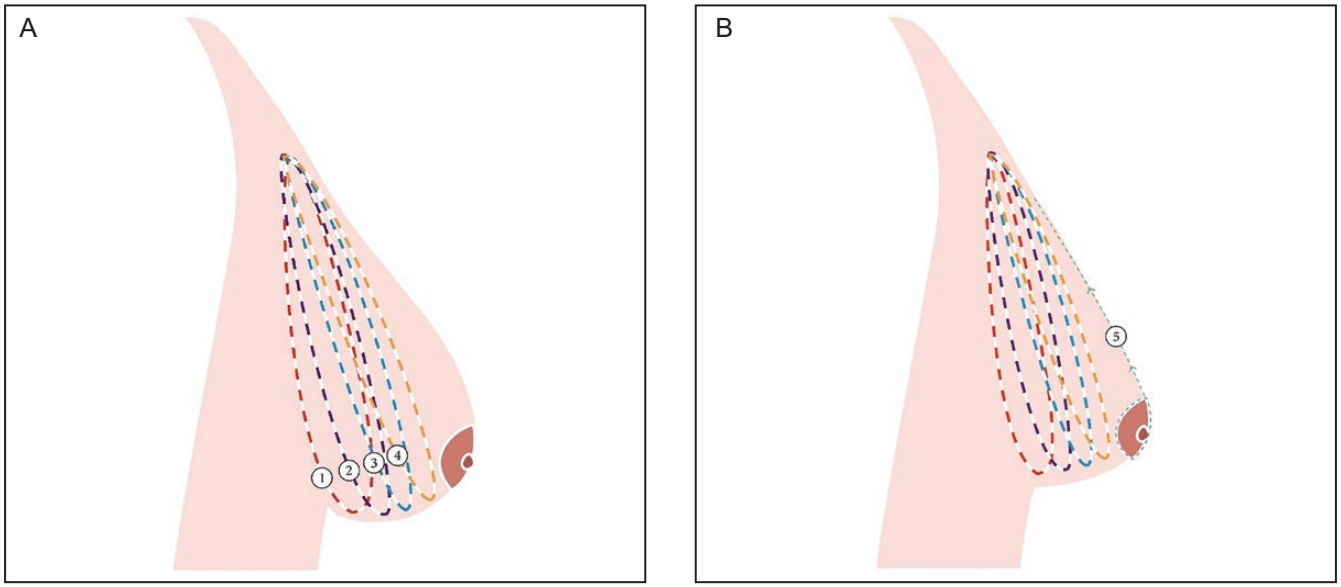


Figure 4. (A, B) Effect of liposuction, footprint, and conus loops on lateral view. Note the reduction in breast size as well as its footprint reduction. (1) Footprint loop, (2, 3, 4) conus loops, (5) parachute loop.

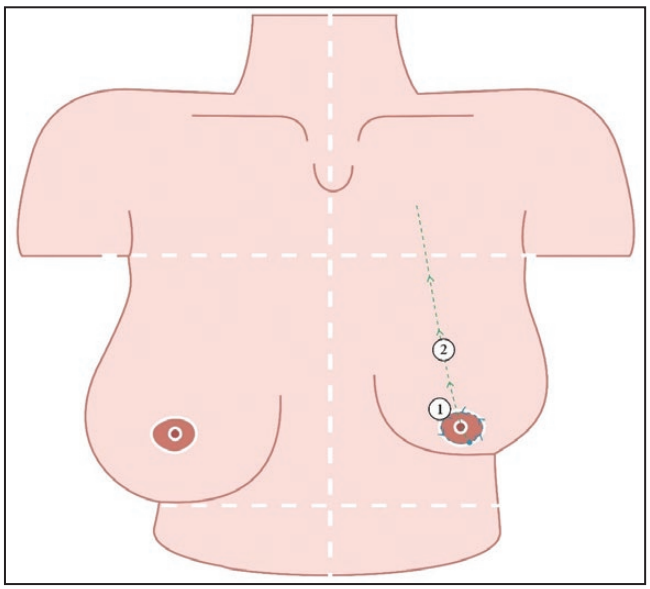
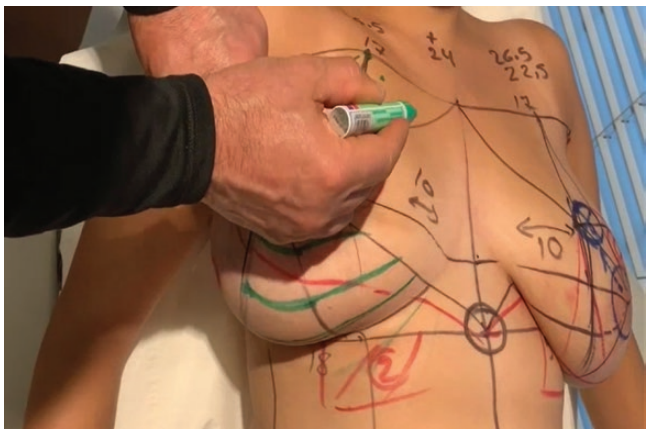


Figure 5. The parachute loop marking. (1) The loop is passed circumferentially around the areola to reduce the size of the nipple-areola complex, then (2) cephalad along the axis of the breast to elevate the nipple-areola complex and to better fixate the nipple-areola complex in its new position.



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loop (the parachute NAC loop) was passed circumferentially around the areola and then cephalad along the breast axis in a deep plane. The parachute loop is the loop that suspends the NAC in its position like a parachute. It was then pulled until the desired NAC elevation was reached. We overcorrect the position of the NAC when placing the parachute loops to prevent a recurrent postoperative ptosis, especially when the suture loosens and is eventually absorbed.

Finally, skin indentations or contour deformities were thoroughly released utilizing a double-ended varady extractor with a ball tip hook and blunt spatula. Lipofilling of the lower quadrants was performed when needed to enhance lower pole projection employing the PAL technique

Table 1. Patient Demographics and Operative Data (N = 94 patients [188 breasts])

Patient characteristics	
Characteristic	Incidence (%)
No. of patients	94
No. of breasts	188
Mean age, y (range)	37 (19-70)
Mean BMI, kg/m^2 (range)	29 (24-35)
No. of current smokers (%)	16 (17)
No. of diabetic patients (%)	14 (15)
No. of hypertensive patients	11 (12)
No. of irradiated patients (%)	12 (13)
No. of irradiated breasts (%)	12 (13)
Mean NAC elevation, cm (range)	7.3 (2-9)
Mean lipoaspirated volume per breast, mL (range)	665 (150-2000)

BMI, body mass index; NAC, nipple-areola complex.

of the senior author (M.H.A.).[24] In cases of peroperative nipple inversion, purse-string sutures around the nipple were placed to maintain nipple projection.

Postoperative Care

The patients were discharged the same day of the operation. Dressings were applied in a manner to lift the breast. The patients were instructed to keep the dressing on until their first postoperative visit when the surgeon changes it. The dressings were left on for 6 weeks. The patients were advised to keep wearing their sport bra for 2 months. The patients were informed about the wrinkled and shriveled breasts, which resolves after 3 months. It is crucial to assist patients during the recovery period and remind them that their breasts will regain a natural appearance after 3 to 6 months. All patients received postoperative breast imaging annually.

RESULTS

A total of 94 women (188 breasts) underwent breast reduction with PALM without a scar. The mean age of patients was 37 years (range, 19-70 years), the mean BMI was 29 kg/m^2 (range, 24-35 kg/m^2), and the mean NAC elevation was 7.3 cm (range, 2-10 cm).

A total of 16 of the 94 patients (17%) were current smokers. The mean lipoaspirated volume was 665 mL per breast (range, 150-1900 mL) (Table 1). To improve lower-pole fullness and projection, 43% of the patients received lipofilling in the lower quadrants. The average time of follow-up was 26 months (range, 12-48 months).

PALM without scarring preserves all the blood supply to the breast by preventing tissue resection. Therefore, the risk of complications is reduced to a minimum. In our study, we reported no seroma or hematoma was detected in any patient. No patient developed total or even partial necrosis of the areola. Only 1 patient developed skin redness of the breasts without fever, which occurred 6 days postoperatively. She was treated as having cellulitis and managed efficiently with oral antibiotics. Note that this patient was diabetic and a smoker. Nipple sensation was not affected. In addition, nipple inversion was not encountered. This is related to the immediate perioperative treatment by purse-string suture if inversion of the nipple was present. Eight of our patients (8.5%) presented contour deformities, shown as a bumpy appearance of the breast skin surface or the visible threads. We did not operate any planned scarless breast reduction with the PALM with a scar. Even in the young patients with glandular breast we managed to lipoaspirate, reduce the volume, and reshape with only liposuction and loops. However, we had to reoperate on 2 patients who were unsatisfied with the result utilizing the standard skin excision pattern.

Clinical cases are shown in Figure 6 and Supplemental Figures 3 and 4.

Assessment of Patient Satisfaction

At 6 months postoperation, the patients were asked to complete a questionnaire, prepared by the authors, to assess their satisfaction with the surgical outcome and the preoperative and postoperative care as well as to evaluate their psychological and physical well-being (Appendix A). The satisfaction survey was anonymous, conducted on paper, and distributed by the same nurse in the private clinic (V.L.).

Of the 94 patients, 85 (90%) completed the questionnaire at 6 months postoperatively (Figure 7). A total of 83 of the 85 patients (97%) indicated that they would repeat the surgical procedure or recommend it to a friend, 83 respondents (97%) were satisfied with their breast shape, and all respondents were satisfied with their breast scars. Eighty-one respondents (95%) were satisfied with the residual postoperative pain. None of the respondents reported a change in nipple sensitivity at 6 months postoperatively. Only 2 patients were not satisfied with the outcome, and their breasts remained ptotic. They were reoperated on employing the excisional PALM technique of the senior author (M.H.A.).[5] Most patients were highly satisfied with the postoperative outcome despite the minimal ptosis when evaluating the photos of our patients. We believe that this is mainly related

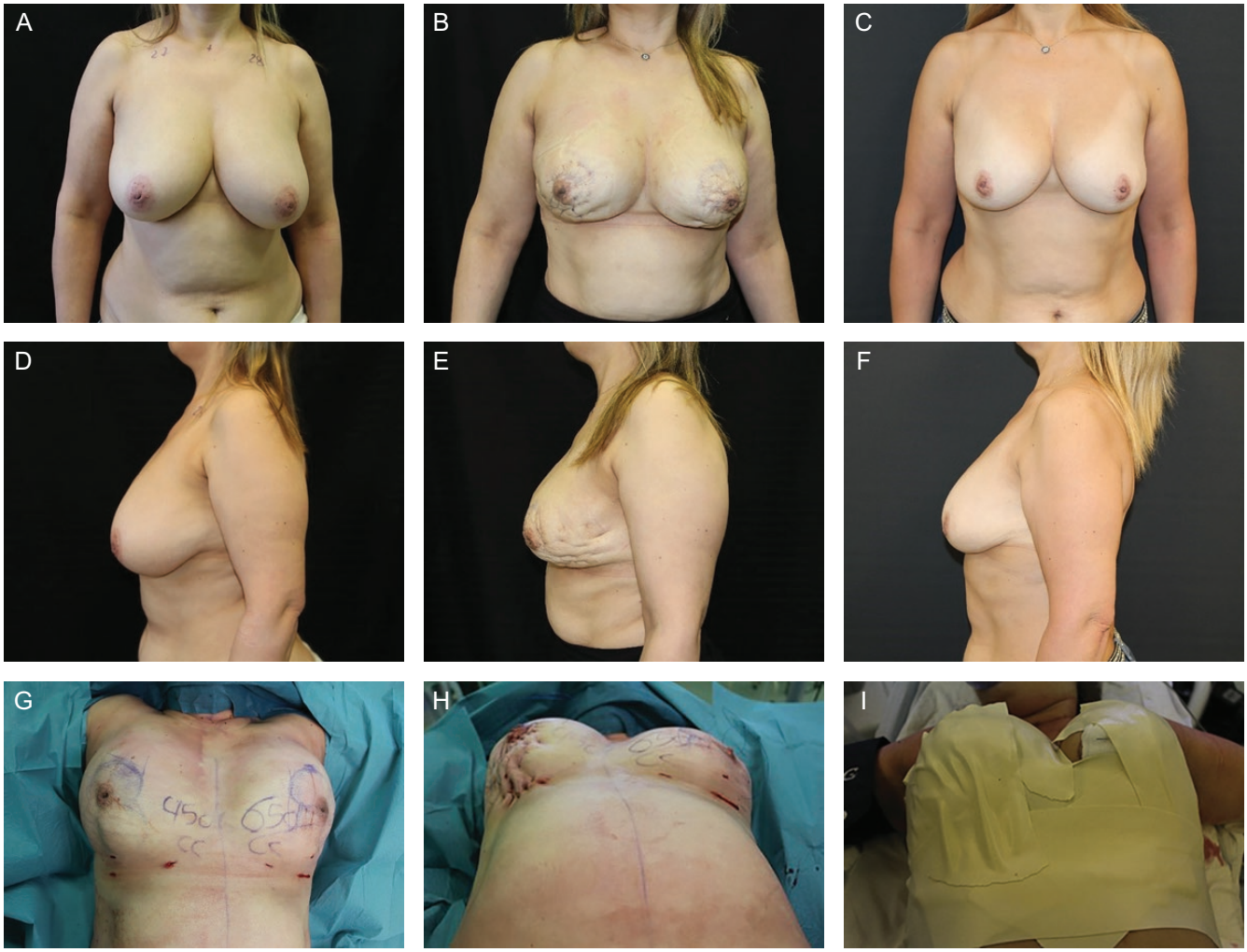

Figure 6. This 45-year old woman presented with asymmetric breasts and bilateral ptosis. She underwent a scarless power-assisted liposuction mammoplasty with a nipple-areola complex elevation of 5 cm on the right breast and 6 cm on the left breast and liposuction of 450 cc from the right breast and 650 cc from the left breast. (A-C) Frontal view with arms in resting position, (D-F) lateral view with arms in resting position. (A, D) Photographs were taken preoperatively, (B, E) 2 months postoperatively, and (C, F) 4 years postoperatively. (G, H) Intraoperative view after liposuction on both sides and placement of the internal loops in the right breast and (I) at the end of the operation with the molding dressing.

to the improvement of symptoms associated with reduction of breast volume, the improvement of the breast shape, and first and foremost to the limited scars.

DISCUSSION

Since its first description by Teimourian et al[1] in 1985, breast liposuction has evolved from an adjunct procedure in breast reduction[2,4,5,23] to a primary and single modality of treatment for breast hypertrophy.[7-15,18-22] Liposuction reduces breast weight and volume but is not sufficient for breast reshaping. Although many controversies remain about the ability of liposuction alone to elevate the NAC, liposuction alone is limited to moderate breast size with a well-positioned NAC.[9,10,14,17]

Surgical Technique

The experience of the senior author (M.H.A.) with liposuction started in the 1990s. I started utilizing liposuction with Professor Lejour in association with vertical mammaplasty.[2] In 1994, Lejour classified breasts radiologically into 3 categories: fatty, glandular, and semiglandular; at this time, liposuction was indicated mainly for fatty breasts.[23] Nevertheless, with the utilization of small-caliber cannulas and power-assisted technology, liposuction was feasible even in semiglandular breasts. I recently published my technique on PALM combining breast liposuction, resection, and reshaping of the parenchyma.[5]

However, in patients with fatty or semiglandular breasts who want to avoid extensive scars or are at high risk of complications, I utilized liposuction alone. At the beginning,

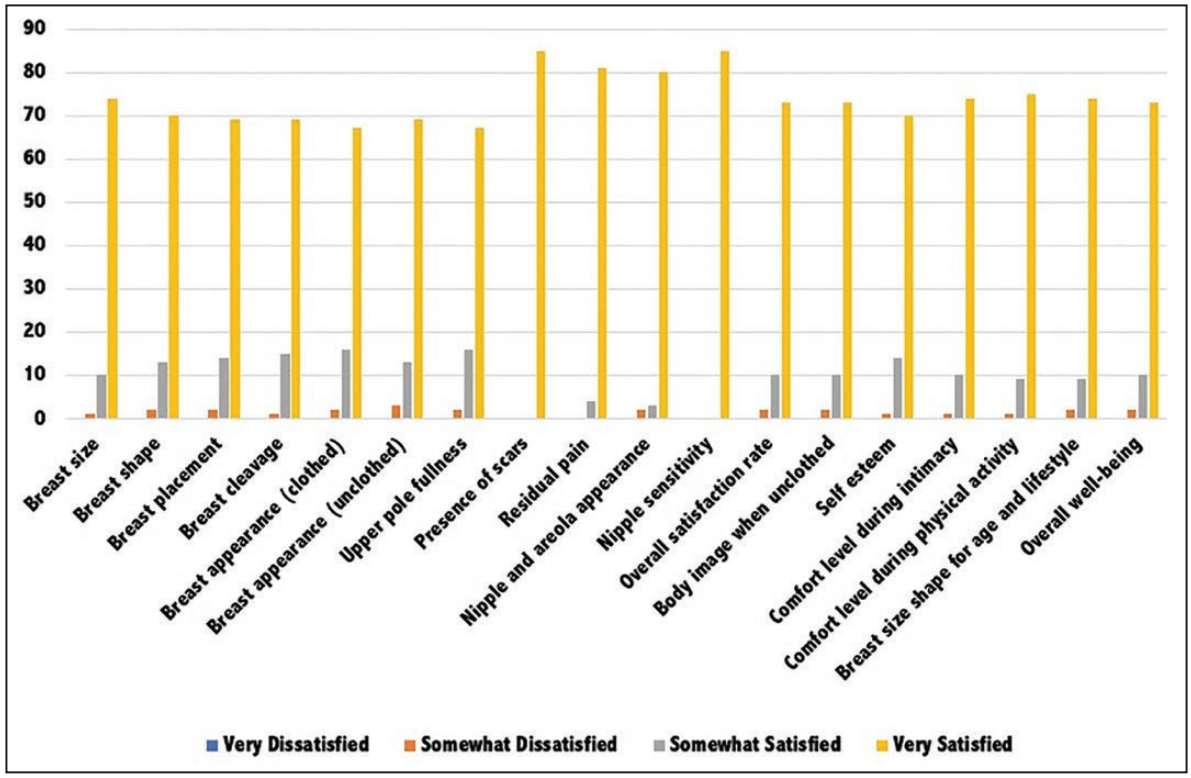

Figure 7. Results of the patient satisfaction questionnaire. Of the 94 patients included in this study, 85 completed the questionnaire prepared by the authors. Blue bars indicate patients giving "very dissatisfied" responses, orange bars indicate "somewhat dissatisfied," grey bars indicate "somewhat satisfied," and yellow bars "very satisfied." A total of 83 of the 85 patients (97%) indicated that they would repeat the surgical procedure or recommend it to a friend.

I started employing liposuction with an external bandage that was kept on for 6 weeks. I noticed that NAC elevation could reach 5 cm to 6 cm depending on the initial breast volume, but this amount of elevation was not sufficient and breast ptosis persisted. Furthermore, patient discomfort and blisters due to the modeling garment that had to be kept on for a long duration were considered major limitations for this technique.

I noticed that the recurrence of ptosis with only liposuction was due to treating the breast as a monobloc without dissociating the skin from the gland and dissociating gland from the underlying fascia. Therefore, I developed a new concept in breast remodeling based on dissociating the different subcutaneous tissues. This matrix modeling is a keystone in the procedure, and this concept was applied in arm remodeling, breast augmentation, and gluteal augmentation.[25-27] It consists of releasing the attachments of the skin to the gland and to the underlying fascia by means of PAL and then reorganizing the fibrous framework employing internal sutures. Loops are utilized as an internal bra to mold the breast and maintain the new tissue morphology until the healing ensues. In fact, the utilization of internal threads has been well established for soft-tissue suspension, especially in facelift procedures.[28-32] However, literature on its utilization in breast reshaping is scarce. Khouri[33-35] described breast reshaping for breast reconstruction and breast augmentation employing reverse abdominoplasty and fat transfer and breast mastopexy, Hamdi[36] reported the utilization of percutaneous purse-string sutures to reconstruct the inframammary fold, and Visconti et al[37] recently reported their experience with combining threads with fat grafting in breast augmentation. Moreover, Sulamanidze reported his experience with minimally invasive breast mastopexy that consists of anchoring the breasts around the clavicle combined with either the utilization of a cellular implant or thread lifting the breasts followed by mastopexy and hanging the breast on the clavicle employing APTOS needles.[38] Furthermore, Serdev described his closed approach suture lift, utilizing curbed semi-elastic Serdev needles and semi-elastic surgical sutures, which absorbs after 2 to 3 years. In his scarless breast lift technique, he suspends the breast tissue either to the clavicle for ptosis of 14 cm or more, to the pectoralis tendon for small lifts, or to the clavicular fixation in larger breasts for additional support.[39] Although these reports emphasize the importance of internal threads, we believe that the mainstay

of our technique is tunnelization and lipoaspiration by means of PAL to dissociate the matrix, create a gliding plane between the different structures, and subsequently model the breast with loops. To our knowledge, this is the first report of utilizing power-assisted liposculpture with internal loops to achieve breast reduction and reshaping. Our experience with loops has changed over time. At the beginning, loops were applied subcutaneously, working mainly on the skin; however, ptosis remained. Therefore, working on the skin only is not efficient to address the ptosis issue. Hence, we created the technique that we described in this article, utilizing matrix modeling, liposuction, and loops that work as an internal bra and address different breast components: the fat, the gland, the skin, and the NAC.

The pillars of our technique are dissociation and reconstruction of tissues employing PAL and molding utilizing loops.

PAL

The first component of this technique is PAL.[24] Thorough liposuction was performed in all of the planes, to the inferior pole, the outer quadrants, the retroareolar space, and the axillary and thoracic regions (Figure 2). We believe that this mass reduction is crucial to alleviate the gravitational effects, which is a primary cause of ptosis in breast hypertrophy. A key step in this procedure is multiplanar multiaxial tunnelization of the whole breast. In fact, deep tunnelization is realized to facilitate breast footprint remodeling and mobilization of the breast gland. Intermediate tunnelization of the breast is performed to achieve internal expansion. Superficial tunnelization is then performed to release subcutaneous attachments to the breast and to facilitate redraping of the skin and repositioning of the NAC. Utilizing superficial liposuction and tunnelization with blunt cannulas, we remove the subdermal fat and preserve all the interconnecting fascicles between the dermis and the fascia, which allows the skin and the Cooper's ligaments to contract and elevate the NAC.

Loops

The second component in this technique is the utilization of internal loops that act as an internal bra and are utilized to reshape the breast (Figures 3-5). The footprint loop is placed to achieve reduction of the breast footprint and to enhance breast projection. Moreover, this loop redrapes the breast excess of the skin in the axillary and thoracic regions. The placement of the footprint loop must ensure at least 8 cm of the lower pole, especially when the patient presents with lower-pole constriction. This is important to increase the projection of this latter and to release tension of the NAC. The conus loop is utilized for glandular breast remodeling. Initially, we utilized it for the footprint and conus absorbable sutures and had promising short-term results. However, in the long term, we noticed recurrent ptosis. Thus, we shifted to polypropylene sutures (prolene 1, 150 cm), but here we found the thread was too short and we encountered cases of thread rupture. Finally, a reel of Filapeau 2 (Péters Surgical, Bobigny, France), 250 cm of length, was employed. It passed through 2 facing holes in a 3-mm, 3-hole cannula transcutaneously through skin stab incisions. The threads were anchored in the breast parenchyma. They were secured to neither the ribs nor the clavicle. They were not radio-opaque and not visible on postoperative mammograms.

The parachute loop reduces NAC size and repositions it; this loop redrapes the excess of the skin in the upper pole of the breast to assist skin retraction. The loop employed here is an absorbable barbed suture with the needle removed (number 0 V-Loc 180, MEDTRONIC, Minneapolis, MN). An overcorrection of the NAC position is performed to prevent a recurrent postoperative ptosis, especially when the suture loosens and is eventually absorbed. To optimize our results, we tried the non-absorbable suture (non-absorbable Vloc 0) around the areola, but we encountered a pinched areola deformity that did not resolve with time. We had to cut the thread around the areola in the clinic to correct it and this resulted in recurrent postoperative ptosis. With the evolution of the technique, we continued utilizing the absorbable suture around the NAC, we refined the footprint and the conus loops employing non-absorbable sutures, and we achieved satisfying results. We believe that the absorbable suture around the areola acts as a temporary internal dressing that will be replaced by fibrosis when scarring ensues, thus yielding long-term shape stability. A comparative study between 3 groups—a first group without parachute loop, a second group with absorbable suture, and a third group with non-absorbable suture—may guide us to further refine the technique and study the precise effect of this loop. The loops converge in the same spot in the upper pole, and they are anchored to the pectoralis fascia and the deep subcutaneous tissues. We did not encounter problems related to the convergence of threads at the same point as a suture extrusion or exposure. However, the patients complained of mild postoperative pain located particularly at that point, which resolved with pain killers.

An important element to mention when placing loops is contour deformities, revealed as a bumpy appearance of the breast skin surface or the visible threads. In fact, at the beginning, the patients had wrinkled, pitted, and shriveled breasts because the threads were placed more

superficially and skin indentations were not released sufficiently. With the evolution of the technique, we placed the threads deeper, we released all skin indentations with a double-ended varady extractor, we performed a tunnelization employing the lipomatic machine with the cannula detached from the suction system, and finally we lipofilled to the whole breast skin surface to smooth the skin surface and avoid contour deformities. Moreover, the tension on the loops is an essential element to point out. In the beginning of the technique, we thought that the more tension we put on the thread, the more projection we achieve, and the better result we get. However, we encountered more skin deformities, and patients complained from postoperative pain and discomfort. Decreasing the tension on the loops allowed us to obtain similar results and reduced patient's discomfort. Therefore, we believe that the tension on the loop should be precise. The overtightening of the suture may result in postoperative pain and the under-tightening of the suture may lead to insufficient results.

Skin Retraction

Both loops and tunnelization act in synergy to help the skin retract more efficiently. We believe that skin retraction is multifactorial.[8,10,12,13,40,41] The reduction in mass, the decrease in gravitational effects placed on Cooper's ligaments, and skin redraping in the axillary and thoracic regions allow the skin to retract more efficiently. Skin redraping in the axillary and thoracic regions utilizing tunnelization and loops is a major factor that assists skin retraction. Moreover, the utilization of blunt cannulas preserves the fascicles that connect the fascia to the deep dermis and allows the preserved Cooper's ligaments to better contract. Additionally, the superficial lipoaspiration of the subdermal layer of fat and the induced dermal trauma stimulates myofibroblast contraction, inflammatory response, and hence the production of collagen and fibrosis. Although PAL is demonstrated to be handy, atraumatic, time and fatigue sparing, and specifically efficient in fibrotic areas, comparative studies on the skin-tightening effect with other techniques are still lacking. The senior author (M.H.A.) has been utilizing the power-assisted technology for more than 10 years and was satisfied with the results obtained in body contouring, especially regarding the skin tightening effect. We believe that the continuous motion of the reciprocating cannula with the power-assisted technology induces more dermal trauma and stimulates myofibroblast contraction, new collagen formation, and, hence, more skin tightening. However, this is a speculation, and further studies should be performed to ascertain the effect of PAL on skin retraction.

Heat-mediated tissue tightening has been proven to yield better long-term outcomes than traditional suction-assisted liposuction (SAL). McBean and Katz[42] demonstrated an 18% decrease in surface area with laser-assisted liposuction, indicating a significant skin-tightening effect, and DiBernardo[43] showed a statistically significant effect on skin tightening of the skin in the abdomen area with laser-assisted liposuction (62% at 3 months) compared with liposuction alone (5%). Moreover, Duncan[44] emphasized the importance of the heat-mediated tissue tightening with radiofrequency-assisted liposuction (RFAL). In her study, she showed a mean skin surface reduction of 28.5% with RFAL plus SAL vs 10.3% with SAL only at 6 weeks posttreatment. More interestingly, there was a significant increase in skin surface area reduction over time with RFAL plus SAL compared with SAL only (34.5% vs 8.3%, respectively, at 1 year).

These studies motivated us to combine our surgical technique with energy-based lipoaspiration devices. A prospective analysis is being conducted to evaluate the effect of combining RFAL with our surgical technique and compare it with the power-assisted technology.

Fibrosis and Long-Term Stability

Glandular fibrosis confirmed by the postoperative mammograms is a main element that yields long-term stability of the result. Utilizing liposuction only, Habbema[7] described a mean elevation of 3 cm, Moskovitz[14] of 4 cm, di Giuseppe[19] up to 5 cm, and Gray[13] of 6 cm (Table 2). In our study, we achieved nipple elevation of 7.3 cm utilizing liposuction and loops even in older patients. We consider, as stated by Bank et al,[45] that the inability of the skin to retract beyond the age of 40 is a misconception due to all the factors mentioned above. In addition to skin retraction and fibrosis, we over-elevate the NAC to prevent postoperative ptosis.

Mammography

In this study, preoperative mammograms were performed for 2 main reasons: first, to identify malignant or benign tumors; and second, to serve as a comparative baseline for follow-up mammograms. Mammograms should be repeated 1 year after the procedure to detect any calcifications that may have developed.

The follow-up mammograms showed smaller breasts with increased glandular density and marked fibrosis. Our results have been supported by other studies.[8,10,12,13,21] In fact, we believe that fibrosis revealed on the postoperative mammograms is responsible for the new aspect and consistency of the breast and that it yields long-term shape stability. No masses or clustered calcifications were seen. Intraparenchymal calcifications were noted in 4%

Table 2. Breast Reduction Utilizing Liposuction Only, Operative Data, Complications, and Nipple Sensitivity From the Literature

Study	No. of patients	Mean lipoaspirated volume	Mean NAC elevation	Complications	Nipple sensitivity
Di Giuseppe[11]	120	Up to 3 cup sizes (300-1200)	5 cm	2 skin necrosis and 1 hematoma referred by another surgeon, fat necrosis with secondary tissue induration treated with massage or with steroid infiltration	Loss of sensation limited to 3 wk, recovery in few weeks
Gray[18]	204	850 (300-2250)	6 cm (2-12 cm)	1 seroma, 1 hematoma	NA
Habbema[7]	77	542	3.6 cm	2 hematomas, 1 contact dermatitis, 2 blisters, 4 erythema dans liposuction, 2 retracted nipples	Intact
Matarasso[16]	NA	Up to 600 cc/breast	NA	Transient nipple inversion	Not affected
Mellul et al[8]	15	1021 (D), 837(G)	2.57 cm	1 patient with dysesthesia, 3 patients with prominent fibrosis	1 dysesthesia
Moskowitz et al[12]	20	1075	4 cm	0	Not affected
Moskowitz et al[21]	117	2 cups	70% of patients noted decrease in ptosis, 24% ptosis was same, 6% ptosis worsened	1 unilateral hematoma, 1 skin redness treated with antibiotics	NA
Sadove[13]	25	750	NA	4 mL hematoma treated by simple aspiration, temporary inversion of nipple	NA

NAC, nipple-areola complex; NA, not applicable.

of cases, and they were not confused with malignant calcifications. In fact, in 1991, the senior author (M.H.A.) reported an incidence of 11% of calcifications after breast liposuction, most of which were macrocalcifications that were easily distinguished from malignant calcifications. No suspicious calcifications were otherwise reported by other authors.[7,8,10,12,14,19,21]

Threads were not radio-opaques and hence unidentified on postoperative mammograms.

Irradiated Breasts

It is known that irradiated breasts are more rigid, fibrotic, and at high risk of complications when excisional techniques for breast reduction are performed.[46-49] We believe that our technique is a safe alternative in such high-risk patients. An overcorrection of the contralateral breast should be performed, knowing that the irradiated breast retracts more than the nonirradiated one. Utilizing our technique, we achieved an aesthetic and pleasing result without any major complications.

Breast Asymmetry

Asymmetry of the breasts is a common finding during initial consultation, but most women are neither concerned about nor, indeed, aware of any asymmetry. If the asymmetry is due to a difference in breast volume, this can be reduced by aspirating more fat from one breast than from the other. However, if the asymmetry is due to differences in the shape or position of the breasts, this can be solved utilizing loops in a way to reposition the NAC and obtain a symmetrical shape. We adopted this technique for breast symmetrization after tumorectomy and mastectomy. In this particular population, we performed our technique of scarless breast reduction to the contralateral breast and breast reconstruction to the affected breast employing the power-assisted liposuction loops and lipofilling technique. To achieve symmetry in the skin surface, the breast footprint, the breast volume, and the shape and position of the IMF. We believe that this technique reduces complications associated with the classical open techniques, especially when reoperating patients after tumorectomy or radiotherapy and yields satisfying results.

Capacity to Breastfeed

Of the 94 patients in this study, 9 patients (10%) became pregnant postoperatively, including 5 primary pregnancies and 4 secondary or tertiary pregnancies. All of these patients were able to breastfeed after scarless PALM. The preservation of breastfeeding capacity with scarless PALM is attributed to the absence of glandular resection and the maintenance of maximal breast parenchyma. Breastfeeding was unaffected, which was confirmed by the literature.[12,13]

Study Limitations

This study has several limitations. The authors' application of internal threads, tunnelization, and vibration is based on the results of clinical observation; basic research still is warranted to address the potential benefits and drawbacks of these procedures. In addition, our methods of breast reduction with liposuction and loops are still evolving. Work is ongoing to systematically compare techniques of liposuction alone and the utilization of each type of loop. We did not quantify skin shrinkage and skin tightening after the procedure; a future study may follow to determine objectively these endpoints.

CONCLUSIONS

Because no single procedure can be realized for all women, the decision on what technique to choose must be based on breast anatomy, patient desire and comorbidities, and the surgeon's experience.

No-scar PALM is an effective and safe alternative for breast reduction with a low complication rate and a high level of patient satisfaction despite the remaining mild ptosis. This technique achieves volume reduction and breast reshaping in women with fatty or semiglandular breasts, at a high risk of complications, and with asymmetrical or irradiated breasts. Combining liposuction with loops provides long-term shape stability with minimal scarring.

Supplementary Material

This article contains supplementary material located online at www.aestheticsurgeryjournal.com.

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REFERENCES

1. Teimourian B, Massac E Jr, Wiegering CE. Reduction suction mammoplasty and suction lipectomy as an adjunct to breast surgery. *Aesthetic Plast Surg*. 1985;9(2):97-100.
2. Lejour M. Vertical mammaplasty and liposuction of the breast. *Plast Reconstr Surg*. 1994;94(1):100-114.
3. Lejour M, Abboud M, Declety A, Kertesz P. [Reduction of mammaplasty scars: from a short inframammary scar to a vertical scar]. *Ann Chir Plast Esthet*. 1990;35(5):369-379.
4. Maia M, Pinto C. Bipedicle vertical mammoplasty associated with liposuction/lipotunnelization. *Aesthetic Plast Surg*. 2017;41(3):499-506.
5. Abboud MH, Dibo SA. Power-assisted liposuction mammaplasty (PALM): a new technique for breast reduction. *Aesthet Surg J*. 2016;36(1):35-48.
6. Nicoletti G, Scevola S, Faga A. Breast sculpturing: overcoming the limits of traditional approaches in breast reduction. *Aesthetic Plast Surg*. 2009;33(2):204-212.
7. Habbema L. Breast reduction using liposuction with tumescent local anesthesia and powered cannulas. *Dermatol Surg*. 2009;35(1):41-50; discussion 50.
8. Mellul SD, Dryden RM, Remigio DJ, Wulc AE. Breast reduction performed by liposuction. *Dermatol Surg*. 2006;32(9):1124-1133.
9. Brauman D. Reduction mammaplasty by suction alone. *Plast Reconstr Surg*. 1994;94(7):1095-1096.
10. Matarasso A. Suction mammaplasty: the use of suction lipectomy alone to reduce large breasts. *Clin Plast Surg*. 2002;29(3):433-43, vii.
11. Gray LN. Re-evaluating lipoplasty-only breast reduction. *Aesthet Surg J*. 2006;26(1):72-75.
12. Gray LN. Update on experience with liposuction breast reduction. *Plast Reconstr Surg*. 2001;108(4):1006-1010; discussion 1011.
13. Gray LN. Lipoplasty-only breast reduction. *Aesthet Surg J*. 2001;21(3):273-276.
14. Moskovitz MJ, Baxt SA. Breast reduction using liposuction alone. *Semin Plast Surg*. 2004;18(3):225-229.
15. Moskovitz MJ, Muskin E, Baxt SA. Outcome study in liposuction breast reduction. *Plast Reconstr Surg*. 2004;114(1):55-60; discussion 61.
16. Habbema L, Alons JJ. Liposuction of the female breast: a histologic study of the aspirate. *Dermatol Surg*. 2010;36(9):1406-1411.
17. Brumfield MJ, Dryden RM. Liposuction breast reduction. In: Mugea TT, Shiffman MA, eds. *Aesthetic Surgery of the Breast*. Berlin, Germany: Springer; 2015.
18. Jakubietz RG, Jakubietz DF, Gruenert JG, Schmidt K, Meffert RH, Jakubietz MG. Breast reduction by liposuction in females. *Aesthetic Plast Surg*. 2011;35(3):402-407.
19. Di Giuseppe A. Breast reduction with ultrasound-assisted lipoplasty. *Plast Reconstr Surg*. 2003;112(1):71-82.
20. Moskovitz MJ, Baxt SA, Jain AK, Hausman RE. Liposuction breast reduction: a prospective trial in African American

women. *Plast Reconstr Surg*. 2007;119(2):718-726; discussion 727.
21. Sadove R. New observations in liposuction-only breast reduction. *Aesthetic Plast Surg*. 2005;29(1):28-31.
22. Matarasso A. Suction mammaplasty: the use of suction lipectomy to reduce large breasts. *Plast Reconstr Surg*. 2000;105(7):2604-2607; discussion 2608.
23. Abboud M, Vadoud-Seyedi J, De Mey A, Cukierfajn M, Lejour M. Incidence of calcifications in the breast after surgical reduction and liposuction. *Plast Reconstr Surg*. 1995;96(3):620-626.
24. Abboud MH, Dibo SA, Abboud NM. Power-assisted liposuction and lipofilling: techniques and experience in large-volume fat grafting. *Aesthet Surg J*. 2020;40(2):180-190.
25. Abboud MH, Dibo SA, Abboud NM. Power-assisted gluteal augmentation: a new technique for sculpting, harvesting, and transferring fat. *Aesthet Surg J*. 2015;35(8):987-994.
26. Abboud MH, Abboud NM, Dibo SA. Brachioplasty by power-assisted liposuction and fat transfer: a novel approach that obviates skin excision. *Aesthet Surg J*. 2016;36(8):908-917.
27. Abboud MH, Dibo SA. Immediate large-volume grafting of autologous fat to the breast following implant removal. *Aesthet Surg J*. 2015;35(7):819-829.
28. De Masi EC, De Masi FD, De Masi RD. Suspension threads. *Facial Plast Surg*. 2016;32(6):662-663.
29. Sulamanidze M, Sulamanidze G. Facial lifting with Aptos methods. *J Cutan Aesthet Surg*. 2008;1(1):7-11.
30. Badin AZ, Forte MR, E Silva OL. Scarless mid- and lower face lift. *Aesthet Surg J*. 2005;25(4):340-347.
31. Sulamanidze M, Sulamanidze G. APTOS suture lifting methods: 10 years of experience. *Clin Plast Surg*. 2009;36(2):281-306, viii.
32. Sulamanidze MA, Paikidze TG, Sulamanidze GM, Neigel JM. Facial lifting with "APTOS" threads: featherlift. *Otolaryngol Clin North Am*. 2005;38(5):1109-1117.
33. Khouri R, Del Vecchio D. Breast reconstruction and augmentation using pre-expansion and autologous fat transplantation. *Clin Plast Surg*. 2009;36(2):269-280, viii.
34. Khouri RK, Eisenmann-Klein M, Cardoso E, et al. Brava and autologous fat transfer is a safe and effective breast augmentation alternative: results of a 6-year, 81-patient, prospective multicenter study. In: Rohrich RJ, ed. *Plastic Surgery Complete: The Clinical Masters of PRS: Breast Augmentation*. South Holland, The Netherlands: Wolters Kluwer/MR Books; 2014:1173-1187.
35. Khouri RK, Smit JM, Cardoso E, et al. Percutaneous aponeurotomy and lipofilling: a regenerative alternative to flap reconstruction? *Plast Reconstr Surg*. 2013;132(5):1280-1290.
36. Hamdi M, Anzarut A, Hendrickx B, Ortiz S, Zeltzer A, Kappos EA. Percutaneous purse-string suture: an innovative percutaneous technique for inframammary fold creation and improved breast projection in reconstructive surgery. *Aesthet Surg J*. 2018;38(12):1298-1303.
37. Visconti G, Salgarello M. Dual-anchor cog threads in fat grafting breast augmentation: a novel scarless method for defining breast footprint and enhancing shape. *Plast Reconstr Surg*. 2019;143(4):1039-1049.
38. Sulamanidze M, Sulamanidze G, Sulamanidze K. Mastopexy – how to reach consistent results – new methods. In: *Miniinvasive Face and Body Lifts: Closed Suture Lifts or Barbed Thread Lifts*. IntechOpen; 2013:241-247. doi: 10.5772/56317.
39. Serdev N. Serdev Sutures® lifts in body areas. In: *Miniinvasive Face and Body Lifts: Closed Suture Lifts or Barbed Thread Lifts*. IntechOpen; 2013: 127.
40. Becker H. Subdermal liposuction to enhance skin contraction: a preliminary report. *Ann Plast Surg*. 1992;28(5):479-484.
41. Gasperoni C, Gasperoni P. Subdermal liposuction: long-term experience. *Clin Plast Surg*. 2006;33(1):63-73, vi.
42. McBean JC, Katz BE. A pilot study of the efficacy of a 1,064 and 1,320 nm sequentially firing Nd:YAG laser device for lipolysis and skin tightening. *Lasers Surg Med*. 2009;41(10):779-784.
43. DiBernardo BE. Randomized, blinded split abdomen study evaluating skin shrinkage and skin tightening in laser-assisted liposuction versus liposuction control. *Aesthet Surg J*. 2010;30(4):593-602.
44. Duncan DI. Improving outcomes in upper arm liposuction: adding radiofrequency-assisted liposuction to induce skin contraction. *Aesthet Surg J*. 2012;32(1):84-95.
45. Bank DE, Perez MI. Skin retraction after liposuction in patients over the age of 40. *Dermatol Surg*. 1999;25(9):673-676.
46. Parrett BM, Schook C, Morris D. Breast reduction in the irradiated breast: evidence for the role of breast reduction at the time of lumpectomy. *Breast J*. 2010;16(5):498-502.
47. Spear SL, Rao SS, Patel KM, Nahabedian MY. Reduction mammaplasty and mastopexy in previously irradiated breasts. *Aesthet Surg J*. 2014;34(1):74-78.
48. de Andrade CBV, Ramos IPR, de Moraes ACN, et al. Radiotherapy-induced skin reactions induce fibrosis mediated by TGF-β1 cytokine. *Dose Response*. 2017;15(2):1-9.
49. Doré M, Hennequin C. [Late sequelae and cosmetic outcome after radiotherapy in breast conserving therapy]. *Cancer Radiother*. 2012;16(5-6):462-469.