

The Ergonomic FALD Flap for One-stage Total Breast Reconstruction

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Background: The fat-augmented latissimus dorsi (FALD) flap combines this pedicled flap with immediate intraoperative fat transfer. Very little is described concerning its inset at the mammary site. Our efforts have concentrated on seeking the best flap orientation and skin-adipose paddle shaping, to improve the aesthetic outcome and to obtain a complete breast reconstruction (BR) in one stage.

Methods: A prospective clinical study was performed in patients who underwent BR with FALD flaps, between December 2020 and March 2022. Patients were randomly enrolled into two groups: ergonomic inset of the FALD flap with vertical orientation of the skin-adipose paddle (group A) and FALD flap with traditional horizontal paddle orientation (group B). The study's endpoints were the evaluation of the aesthetic outcomes (from patients' and surgeon's perspectives) and complications.

Results: Thirty-two FALD flaps (23 patients) were performed for group A, and 31 FALD flaps (25 patients) for group B. The two groups were homogeneous in terms of demographic and surgical data ($P > 0.05$). The overall complication rate was homogeneous among the groups, without statistically significant differences ($P = 1.00$). The surgeon's assessments showed a statistically significant superior aesthetic outcome in group A regarding volume, symmetry, and shape ($P < 0.05$). Higher satisfaction was observed in group A patients, in terms of breast size ($P < 0.00001$), shape ($P = 0.0049$), and overall satisfaction ($P = 0.00061$).

Conclusions: The ergonomic vertical FALD flap technique enables surgeons to perform one-stage total BR, with excellent breast projection and upper pole fullness. These refinements in flap shaping and molding reduced the need for further autologous fat transfer, obtaining a brilliant totally autologous BR without the need for microsurgical experience. (*Plast Reconstr Surg Glob Open* 2023; 11:e5262; doi: 10.1097/GOX.0000000000005262; Published online 18 September 2023.)

INTRODUCTION

Autologous breast reconstruction (BR) should always be preferred over implant-based BR, when the patient's

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donor tissues are available, due to the well-known benefits in terms of aesthetic outcomes and to avoid implant-related complications.^{1–3} The latissimus dorsi (LD) flap is a work-horse flap for BR, owing to the reliability of its anatomy and its versatility.^{4–6} It is frequently used in combination with implants to improve breast size, but with noticeable risk of complications, especially in women undergoing radiotherapy.^{7–10} The extended-LD flap, on the other hand, is known to be associated with a higher complication rate at the donor site, such as seromas, wound dehiscence, and lumbar hernias, which is estimated to be around 38.7%.^{11–13} The introduction of the fat-augmented LD (FALD) flap has allowed surgeons to overcome the limitations of the previously described techniques, enabling a totally autologous reconstruction of small-sized and medium-sized breasts.¹⁴ This technique combines the harvesting of the LD flap together with the immediate intraoperative autologous

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fat transfer (AFT), to obtain a larger volume of the reconstructed breast. As of today, there are still few studies in the literature on FALD flap reconstruction, especially about technical refinements needed to improve the aesthetic outcome of this BR.^{15–17} Above all, very little is described concerning the flap positioning and the orientation of the flap skin-adipose paddle at the mammary recipient site, where it is classically oriented transversely.¹⁴ Because the fat-augmented skin paddle over the muscle represents the main volumetric component of the flap, the aim of this study was to compare two different insets of this paddle at the recipient breast site, the classical horizontal orientation, and an innovative vertical orientation, comparing aesthetic results and complications.

The shaping of the novel FALD flap vertical orientation described in the present study was based on the concept of restoring breast shape, trying to reproduce its anthropometric characteristics and to respect tissue peculiarities.

PATIENTS AND METHODS

Between December 2020 and March 2022, we prospectively enrolled all patients scheduled for FALD flap BR at our institute, the Policlinico Tor Vergata University Hospital, for a prospective clinical study, in accordance with the tenets of the Declaration of Helsinki.

Inclusion criteria were (1) patients undergoing immediate BR after nipple-sparing mastectomy (NSM) or skin-sparing mastectomy (SSM) type I-III¹⁸ and axillary lymph node dissection or sentinel node biopsy; (2) patients undergoing secondary BR with breast expander or implant removal, but without the need to add skin to the breast envelope; (3) preoperative small-sized (<400 cm³) to medium-sized (from 401 to 600 cm³) breasts; (4) contraindication for free abdominal flaps. Exclusion criteria were the following: paraplegic, climbing, windsurfing patients, and breast candidates for Modified Radical Mastectomy or delayed reconstructions that required addition of skin tissue. Patients were enrolled into two groups, using a computerized random-number generator for simple randomization of participants: group A included BR using FALD flaps with ergonomic vertical orientation of the skin-adipose paddle, whereas group B included BR using FALD flaps with conventional inset and horizontally oriented skin-adipose paddle.

Data collected included demographics, smoking history, laterality, type of mastectomy, skin paddle size, preoperative breast volume, intraoperative AFT volume, additional AFT sessions required, operative times, and complications. Preoperative breast volume assessments were performed using the BREAST-V mobile application.¹⁹

Complications were recorded as flap-related and general complications. Particularly, flap-related complications included total flap necrosis, partial flap necrosis (tissue loss >10% of the flap), and fat necrosis (any solid, cystic lesion with diameter between 1 and 5 cm). General complications included seroma, hematoma, infection, delay in wound healing, and chronic pain.

Takeaways

Question: We aimed to improve the aesthetic outcome of autologous breast reconstruction with the fat-augmented latissimus dorsi flap.

Findings: Our innovative modeling technique enables us to perform a one-stage total autologous reconstruction, with excellent aesthetic results and without the need for microsurgical experience.

Meaning: We obtained excellent aesthetic results with the fat-augmented latissimus dorsi flap.

Study Endpoints

The primary endpoint of the study was to compare the aesthetic outcomes obtained with the two types of skin paddle orientations. The aesthetic evaluation was performed by three blinded plastic surgeons, based on preoperative photographs and photographs at 9 months from surgery, using the Aesthetic Items Scale (AIS).²⁰ We used standardized photographs of the breast area from five different angles: frontal view, from each lateral side, and at an angle of 45 degrees between frontal and lateral view at each side. The aesthetic outcome evaluation included breast volume, shape, symmetry, scars, and nipple areola complex. Each item was graded on a five-point Likert scale, which represented scores of very dissatisfied (1), dissatisfied (2), neutral (3), satisfied (4), and very satisfied (5). Furthermore, patient satisfaction for each group was assessed at 9-month follow-up, with specific questions concerning breast size, shape, symmetry, scars, and nipple areola complex using the same AIS. The second endpoint concerned the analysis of complications in the two groups of patients.

Surgical Procedure

The largest possible transverse skin paddle is drawn on the back using the pinch test, typically measuring between 10 and 12 cm in height (Fig. 1). The FALD flap is outlined and harvested in a standard fashion, as fully described in our previous article.²¹ The design and harvest of the skin paddle at donor site were the same for both cohorts of patients. The dissection of the muscle is performed in the “suprafascial plane,” taking great care to leave the fascia intact superficially to the muscle and leaving the thoracodorsal nerve intact to avoid long-term atrophy.

After dissecting the LD muscle up to its humeral insertion and rotating it through a subcutaneous tunnel to the mammary recipient site, we proceed with the “filling time” using the AFT. Lipoaspiration is performed with 2.4-mm cannulas and 10-mL syringes, later centrifuged using the Coleman technique at 3000 rpm for 3 minutes. Purified fat is injected through 1.2-mm cannulas on three anatomical planes, as follows: (1) the deep adipose layer of the skin paddle over the LD muscle, in which we infiltrate near 40% of the fat obtained from liposuction; (2) the connective areolar space between major and minor pectoralis muscles, favoring the inferomedial and parasternal region to improve the cleavage appearance, which can accommodate another 40% of

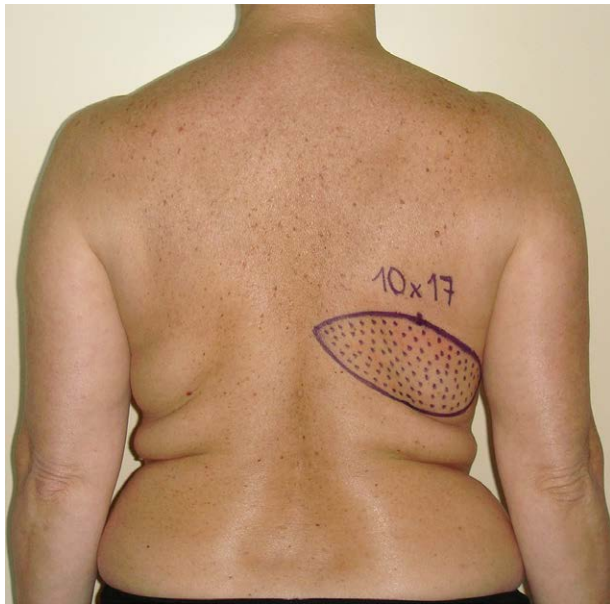


Fig. 1. Photograph showing FALD flap design on the back. The largest possible skin paddle is drawn using the pinch test, typically measuring between 10 and 12 cm in height.

the AFT [See Video 1 (online), which shows fat infiltration in the loose areolar tissue between the major and minor pectoralis muscles]; (3) below the superficial fascia of the LD muscle, cranially and caudally to the skin paddle, for the remaining 20% of the collected fat [See Video 2 (online), which shows the autologous fat grafting below the superficial fascia of the LD muscle flap, just cranially and caudally to the skin paddle]. In case of secondary BR, a further target infiltration site is represented by the mastectomy skin flaps, precisely in the space between the periprosthetic capsule and skin. We determine the fat needed to be infiltrated by intraoperative calculation of the difference between mastectomy weight and flap volume, measured by the water displacement technique. This measurement is conducted using the water displacement technique, immersing the flap in a container with a scale, filled with 1000 mL of saline. The flap volume is represented by the volume of liquid displaced. We then multiply this result by 1.30 (considering 30% of fat reabsorption), obtaining the volume of fat needed. When performing the FALD flap with vertical orientation, the lower third of the skin paddle is folded back, and the lower apex is sutured posteriorly to the LD muscle (Figs. 2 and 3); [See Video 3 (online), which shows modeling of the skin paddle]. This procedure allows for a good projection and adequate upper pole fullness of the reconstructed breast, replicating the shape of an anatomical implant (Figs. 4 and 5). Because the injection of AFT stiffens the treated tissues, the folded portion must not be infiltrated to avoid reduced compliance and to enable easy shaping of this flap's portion. Conversely, the upper two-thirds of the skin paddle are filled with adipose tissue, ensuring adequate volume to the upper breast quadrants (Fig. 6). The LD muscle is carried as

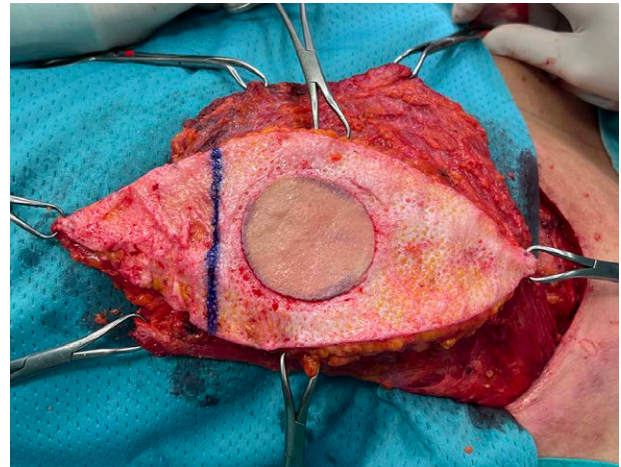


Fig. 2. The de-epithelialized skin paddle of the FALD flap with circular skin for the future NAC. The drawn line, placed between lower third and the upper two-thirds, represents the folding point.

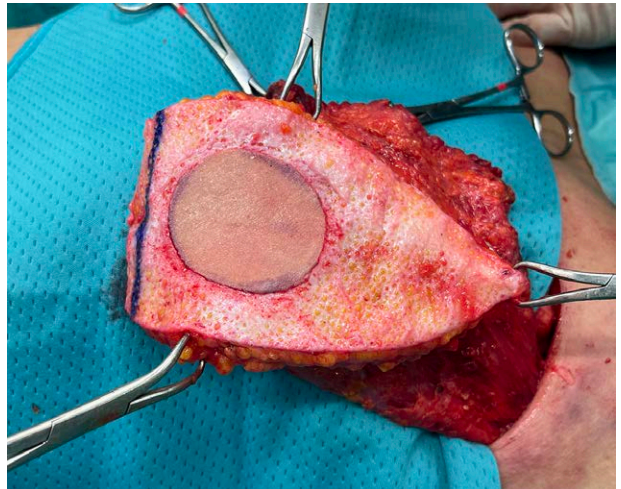


Fig. 3. The lower third of the skin paddle was folded back, and the lower apex was sutured posteriorly to the LD muscle, using 2-0 reabsorbable multifilament interrupted stitches.



Fig. 4. The de-epithelialized skin paddle folded back.



Fig. 5. The reconstructed breast immediately after the ergonomic inset of the flap, trying to replicate the shape of an anatomical implant, with good projection of the lower pole and appropriate filling of the upper pole.

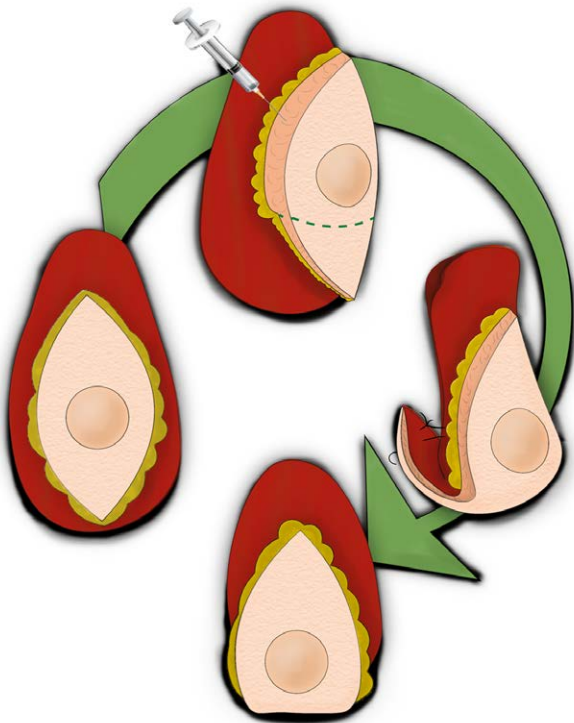


Fig. 6. Illustration showing the process of fat transfer to the flap and shaping of the skin paddle. The folded portion (the lower third) must not be infiltrated with AFT, to allow for this folding. Conversely, the upper two-thirds are filled with adipose tissue, ensuring adequate volume to the upper breast quadrants.

medially as possible and folded in this region, creating a bulge in the parasternal area, which will ensure an excellent cleavage appearance. Subsequently, the folded portion of the skin-adipose paddle (ie, the border between

the upper two-thirds and the lower third) is sutured to the inframammary fold. Contrarily, in the case of transversal inset, the LD skin paddle was entirely injected with AFT and oriented horizontally, with the anterior apex sutured as medially as possible. In this case, the lower edge of the skin-adipose paddle was positioned at the IMF of the breast pocket, and the distal muscle portion was folded onto itself, achieving extra bulk and projection to the lower pole.¹⁴ [See Videos 1–3 (online)].

Statistical Analysis

All data regarding demographics, surgical report, and complications were collected in a database (Microsoft Excel Office 365; Microsoft Corp, Redmond, Wa.). Statistical analyses were performed using SPSS statistics version 20 (SPSS, Chicago, Ill.). A value of *P* less than 0.05 was considered significant. The chi-square and Fisher exact tests were used for categorical variables. Regarding continuous variables, Kolmogorov-Smirnov tests were performed before using the *t* test, and whenever the Kolmogorov-Smirnov test was significant, the Mann-Whitney test was used instead of the *t* test. Based on our experience and a preliminary pilot study, we expected a mean difference in the overall satisfaction score of 0.5, with an SD of 0.5. After fixing a significance level of 5%, it could be computed that 23 patients per group would guarantee a power of at least 90% for a *t* test.

RESULTS

During the study period, 32 FALD flaps (23 patients) were performed for group A, and 31 FALD flaps (25 patients) for group B. The mean age was 50.5 years (SD 9.51, range 33–70) for group A and 50.4 years (SD 9.66, range 40–80) for group B. No statistically significant difference was observed regarding preoperative breast volume (*P* = 0.549), particularly, 298.74 cm³ (SD 99.69, range 120–520) for group A and 288.75 (SD 78.81, range 130–430) for group B. There were no significant differences (*P* > 0.05) between the groups regarding age, body mass index, active smoking status, laterality, mastectomy type, preoperative volume assessment, and contralateral balancing (Table 1).

As concerns surgical information, there were no significant differences regarding mean intraoperative AFT volume (*P* = 0.684), which was 173.9 cm³ (SD 34.0) per flap for group A and 177.7 cm³ (SD 43.9) for group B. Conversely, a statistically significant difference was observed concerning additional AFT sessions required to achieve the final result (*P* < 0.00001). Patients from group A required a mean of 0.17 (SD 0.39, range 0–1) additional AFT procedures, whereas patients from group B required a mean of 1.40 (SD 0.71, range 0–3) additional sessions. Group A included a mean operating time of 321.9 minutes (SD 99.0), whereas in group B, the average operating time was 291.6 minutes (SD 73.5). Globally, the difference in mean operative time between the two groups was not significant (*P* = 0.398). The mean skin paddle size was 20.2 x 10.6 cm for group A and 19.9 x 10.7 cm for group B, with no significant differences in width (*P* = 0.691) and height (*P* = 0.205).

Table 1. Patient Characteristics among the Two Groups

	Group A	Group B	P
No. flaps	32	31	
No. patients	23	25	
Mean age (y)	50.5 (SD 9.51, range 33–70)	50.42 (SD 9.66, range 40–80)	0.471
Mean BMI (kg/m ²)	23.93 (SD 3.58, range 18.9–35.8)	23.08 (SD 2.69, range 18.6–30.4)	0.206
Smoking history	6 (26.1 %)	7 (28.0 %)	0.882
Laterality	Unilateral: 14 (60.9 %) Bilateral: 9 (39.1 %)	Unilateral: 19 (76.0 %) Bilateral: 6 (24.0 %)	0.259
Mastectomy type	SSM: 9 (28.1 %) NSM: 13 (40.6 %) Secondary: 10 (31.3 %)	SSM: 4 (12.9 %) NSM: 11 (35.5 %) Secondary: 16 (51.6 %)	0.177
Preoperative breast volume (cm ³)	298.74 (SD 99.69, range 120–520)	288.75 (SD 78.81, range 130–430)	0.370
Contralateral balancing	6 (26.1%)	6 (24%)	0.867
Radiotherapy	Yes: 10 (31.2%) No: 22 (68.8%)	Yes: 11 (35.5%) No: 20 (64.5%)	0.929

Table 2. Clinical and Operative Data among the Two Groups

	Group A	Group B	P
No. flaps	32	31	
No. patients	23	25	
Mean intraoperative AFT (cm ³)	173.9 (SD 34.0, range 115–245)	177.7 (SD 43.9, range 100–280)	0.351
Mean intraoperative AFT in the skin paddle (cm ³)	69.5 (SD 13.6, range 46–98)	71.1 (SD 17.5, range 40–112)	0.350
Mean intraoperative AFT between pectoralis muscles (cm ³)	66.9 (SD 12.8, range 48–96)	59.43 (SD 13.9, range 40–80)	0.063
Mean intraoperative AFT below LD fascia (cm ³)	34.8 (SD 6.8, range 23–49)	35.5 (SD 8.8, range 20–56)	0.351
Mean intraoperative AFT in the mastectomy flaps (cm ³)	73.0 (SD 14.2, range 46–98)	80.7 (SD 14.2, range 52–112)	0.073
Mean operative time (min)	321.9 (SD 99.0, range 180–600)	291.6 (SD 73.5, range 180–420)	0.162
Skin paddle width (cm)	20.2 (SD 1.32, range 18–22.5)	19.9 (SD 1.07, range 17–22)	0.288
Skin paddle height (cm)	10.6 (SD 0.86, range 9.5–12)	10.7 (SD 0.89, range 9–12)	0.205
Additional AFT sessions	0.17 (SD 0.39, range 0–1)	1.40 (SD 0.71, range 0–3)	<0.00001
Global complications*	2 (6.25 %)	2 (6.45 %)	0.973

*Global complications include both flap-related and general complications. Statistically significant values are shown in boldface ($P < 0.05$).

Concerning flap-related complications, no cases of total or partial FALD flap necrosis were reported among the two groups, whereas fat necrosis occurred only in one case in group B (3.2%). Regarding general complications, two cases (6.25%) of back wound dehiscence occurred for group A, whereas one case (3.2%) of persistent seroma at the donor site occurred in group B, solved using needle aspiration in the outpatient setting. No infection, hematoma, or chronic pain occurred in our series. Global rate of complications was homogeneous among the two groups, without statistically significant differences ($P = 1.00$). Average follow-up period of group A was 11.62 months (SD 2.02, range 9.0–15.3) and 12.64 months (SD 2.88, range 9.0–19.4) for group B ($P = 0.075$). **Table 2** summarizes operative data and complication rate among the two groups. **Figure 7** and **Video 4** show a result of a patient belonging to group B, who underwent left SSM and immediate BR using the FALD flap with a horizontally oriented skin paddle [**See Video 4 (online)**], which shows preoperative (on the left) and postoperative (on the right) pictures of a patient belonging to group B in different projections at 9-month follow-up]. In this group of patients, the lower projection and the upper pole hollowing of the reconstructed breast can easily be noticed. **Figures 8–13** depict a patient from group A, who underwent immediate

bilateral BR using the ergonomic FALD flap with a vertical orientation of the skin-adipose paddle, in frontal and oblique views. **Figures 14–19** show another patient undergoing bilateral ergonomic FALD flap reconstruction after bilateral SSM. [**See Video 4 (online)**].

Aesthetic Outcome

Concerning surgeons' assessment 9 months after the procedure, the mean global score evaluation showed a statistically significant difference between the two groups, with superior aesthetic outcomes in group A. Particularly, we found statistically significant differences in terms of breast volume ($P < 0.00001$), symmetry ($P = 0.00023$), and shape ($P < 0.00001$) in favor of group A (**Table 3**). Furthermore, regarding patients' satisfaction, we found statistically significant differences regarding breast size ($P < 0.00001$), shape ($P = 0.0049$), and overall satisfaction ($P = 0.00061$; **Table 4**).

DISCUSSION

Since its introduction, the FALD flap received outstanding attention because it represents a totally autologous reconstruction, is easy to harvest, and does not need microsurgical experience.^{22–24} With the proper patient selection, this flap can guarantee a pleasant aesthetic



Fig. 7. Postoperative photograph in the lateral view of a patient belonging to group B, who underwent left SSM and immediate BR using the FALD flap with a horizontally oriented skin paddle. The lower projection and the upper pole hollowing (black arrow) of the reconstructed breast can be easily appreciated.

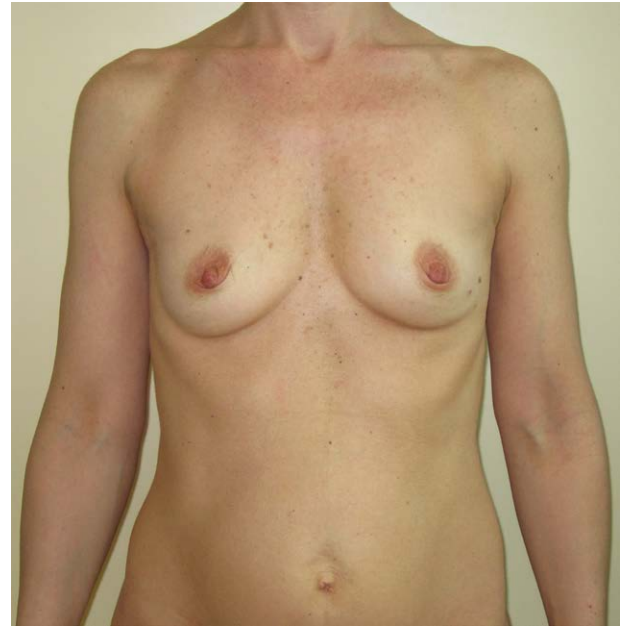


Fig. 8. Preoperative frontal view photograph of patient from group A.

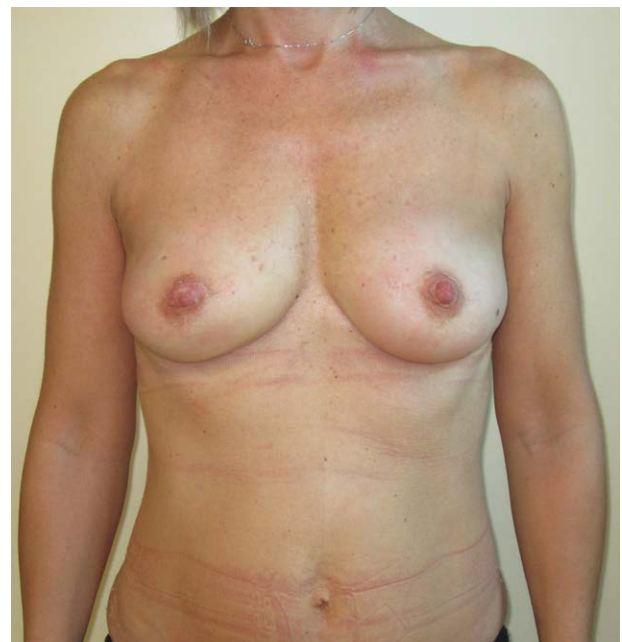


Fig. 9. Postoperative frontal view photograph of the same patient from group A at 9-month follow-up, who underwent bilateral NSM and immediate reconstruction using the ergonomic FALD flap. An immediate AFT of 160 cm³ was performed for each breast.

outcome and adequate breast volume in a single operative session.²⁵ As a result, the FALD flap has become increasingly popular and utilized.^{26,27} However, still little is described in the literature regarding the inset and skin paddle shaping of this flap. The aesthetic outcomes are generally affected by poor projection and hollowing of the upper breast pole. Therefore, refinements of its molding are mandatory.

Cha et al described their surgical technique on shaping the FALD flap to the mastectomy site.²⁸ They placed the de-epithelialized skin paddle transversally, suturing its two ends to the LD muscle to produce a gradual curvilinear line. Taminato et al, in their interesting case series on the FALD flap, mainly used the skin paddle to form the lower pole of the breast, placing the skin paddle and grafting fat tissue in the upper breast pole to fill the insufficiencies.²⁹ Although this is a useful approach to bypass the limitations of the traditional horizontal orientation of the skin paddle, in our opinion, the vertical placement allows us to reach an excellent and improved fullness of the upper pole directly in one session. The ergonomic principle behind the vertical orientation and molding the FALD flap this way comes up with a flap that mimics the morphology and the dynamics of natural breast tissue in

its vertical and horizontal positions.³⁰ Specifically, in our described technique, each area of the flap is carefully used to give volume where it is needed, making the most of every single portion and achieving a one-stage total BR.³¹

Taminato et al also reported a median skin paddle height of 5 cm (range 4–7), which is unfortunately inadequate to ensure satisfactory volume. The ergonomic



Fig. 10. Preoperative left oblique view of the same patient (group A).



Fig. 12. Preoperative right oblique view of the same patient (group A).



Fig. 11. Postoperative left oblique view (group A).



Fig. 13. Postoperative right oblique view (group A).

vertical orientation of the fat-augmented skin paddle allows us to reproduce the shape of an anatomical implant and to considerably increase breast projection also, by

folding the distal third of the skin paddle at the lower breast pole. The height of the skin paddle on the back should never be less than 10 cm, because orienting the

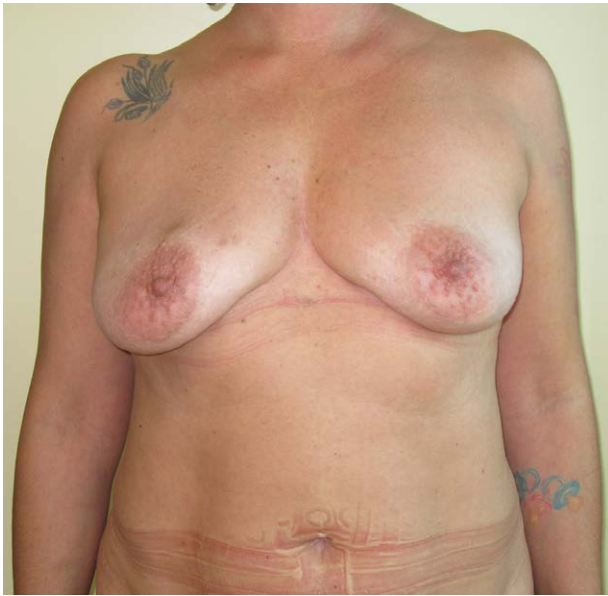


Fig. 14. Preoperative frontal view photograph of patient from group A, scheduled for a bilateral SSM.



Fig. 16. Preoperative left oblique view of the same patient (group A).



Fig. 15. Postoperative frontal view of the same patient at 3-month follow-up visit. The patient underwent bilateral SSM and immediate reconstruction with ergonomic FALD flap. The immediate AFT was 180 cm³ per breast.

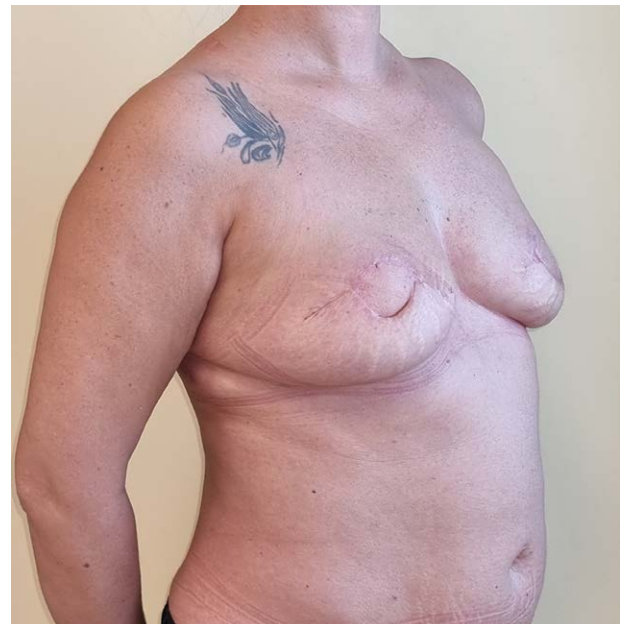


Fig. 17. Postoperative left oblique view (group A).

island vertically, this length will represent the new breast base width (Fig. 20).

We prefer to infiltrate the AFT not only into the adipose tissue of skin paddle over the LD muscle, but also into the space between the major and minor pectoralis muscles, under the superficial fascia of the LD muscle and into the mastectomy skin flaps (only in secondary BR procedures). By selecting multiple recipient bed scaffolds, the amount of infiltrated adipose tissue is greater, preventing excessive rise

of interstitial fluid pressure with a higher percentage of graft survival and significantly contributing to increasing the volume of the single-stage reconstruction.³² In cases of previous irradiation of the breast tissue, the advantages of fat grafting are even greater; given the recognized regenerative capacity of the adipose tissue.^{33,34} Regarding the subcutaneous tissue of the skin paddle, the AFT is preferentially performed under the Scarpa fascia because superficial infiltration could lead to stiffening of the paddle and hyperpigmentation of



Fig. 18. Preoperative right oblique view of the same patient (group A).



Fig. 19. Postoperative right oblique view (group A).

Table 3. Aesthetic Analysis through Surgeons' Evaluation among the Two Groups

	Volume	Symmetry	Shape	Scars	NAC
Group A	4.23 (SD 0.73)	3.83 (SD 0.69)	4.36 (SD 0.73)	3.87 (SD 0.73)	3.61 (SD 0.71)
Group B	3.27 (SD 1.07)	3.28 (SD 0.98)	2.72 (SD 0.94)	3.93 (SD 0.78)	3.51 (SD 0.70)
<i>P</i>	<0.00001	0.000091	<0.00001	0.306	0.194

Statistically significant values are shown in boldface ($P < 0.05$).

Table 4. Patient Satisfaction with the Aesthetic Result

	Size	Shape	Symmetry	NAC Appearance	Scars	Overall Satisfaction
Group A	4.57 (SD 0.51)	4.30 (SD 0.57)	4.04 (SD 0.69)	3.96 (SD 0.51)	4.00 (SD 0.67)	4.39 (SD 0.49)
Group B	3.40 (SD 0.82)	3.80 (SD 0.58)	4.08 (SD 0.76)	4.16 (SD 0.69)	3.96 (SD 0.89)	3.84 (SD 0.47)
<i>P</i>	<0.00001	0.00179	0.429	0.121	0.433	0.00014

Statistically significant values are shown in boldface ($P < 0.05$).

the skin, besides accommodating not much adipose tissue compared with the deep adipose layer.^{35,36} Furthermore, we did not infiltrate directly into the muscle to avoid any kind of potentially fatal embolization.³⁷⁻³⁹

Couto-González et al, discussing his results on FALD flap BR, reported 1.61 ± 0.64 mean number of procedures per case, whereas only one operation was required in 47.4% of patients.⁴⁰ Placing the skin paddle horizontally, further fat grafting procedures are subsequently required, especially to fill the upper pole. In our cohort, using the ergonomic vertical orientation of the skin paddle, we observed a statistically significant difference in the extra AFT sessions required to achieve a small to medium breast volume size (0.17 for group A versus 1.40 for group B; $P < 0.00001$), despite homogeneity between the two groups in preoperative breast volumes (298.74 cm³ versus 288.75; $P = 0.549$). The primary endpoint of the study was to compare the difference in long-term aesthetic results among the two skin-adipose paddle orientations. The surgeons'

evaluation showed that the vertical orientation provides a superior aesthetic result compared with the classic horizontal orientation. Particularly, a statistically significant difference in terms of breast volume ($P < 0.00001$), symmetry ($P = 0.00023$), and shape ($P < 0.00001$) resulted from the analysis in favor of group A. Furthermore, the patient self-assessment survey showed a significant greater satisfaction of the vertically oriented skin paddle group regarding breast size ($P < 0.00001$), shape ($P = 0.0049$), and overall satisfaction ($P = 0.00061$). These satisfaction ratings confirmed the excellent results of the ergonomic orientation of the skin paddle, significantly improving the long-term aesthetic result in the patient's self-evaluation. Regarding the second endpoint of the study, the similar global rate of complications among the two groups (6.25% versus 6.45%; $P = 1.00$) confirms that this procedure can be safely performed.

However, the vertical positioning of the FALD skin paddle has some limitations. Firstly, it cannot be performed on patients who are candidates for modified

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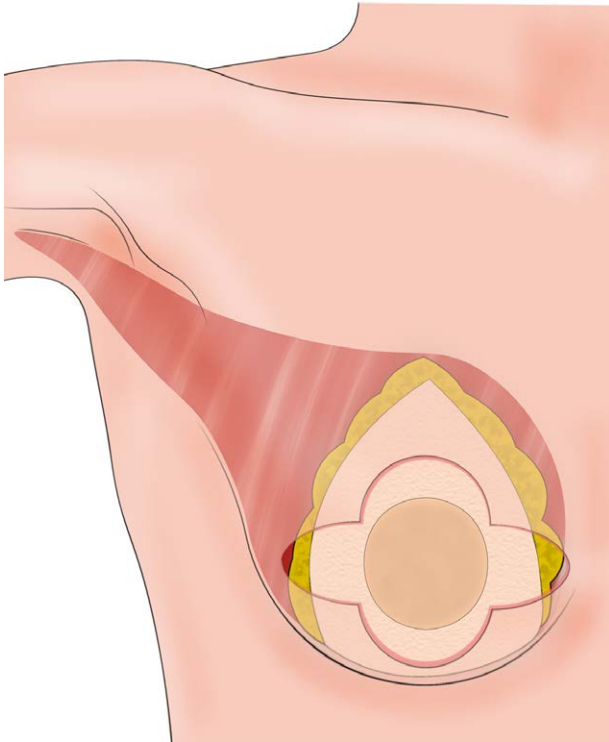


Fig. 20. Illustration showing the ergonomic FALD flap inset. The height of the skin paddle should never be less than 10cm because this length will represent the new breast base width, as can be easily seen from the picture.

radical mastectomy, because this type of mastectomy includes a large transversal skin excision, which requires a reconstruction with horizontal orientation of the flap skin paddle. For this reason, we excluded from the study patients who were candidates for this type of mastectomy. Moreover, in patients where the height of the skin paddle cannot exceed 8cm, it is not recommended to position the island vertically, as the breast base would be too narrow in this case.

The following study has some limitations: particularly, the use of the AIS, which although representing a scientifically validated tool,²⁰ has low intraclass correlation coefficients for patients, besides a moderate methodologic weakness. Another limitation is the nonuse of the BREAST-Q evaluation questionnaire. In our opinion, this technique for flap modeling is a key technical refinement that converts a standard BR into an excellent one, for patient satisfaction and surgeon happiness.

CONCLUSIONS

The ergonomic vertical orientation of the skin-adipose paddle of the FALD flap represents a valuable technical refinement to achieve a one-stage total autologous BR. Compared with the standard horizontal orientation, this technique reduced the need for further sessions of AFT, obtaining an excellent breast projection, a good definition of the lower and upper pole, and a pleasant appearance of the cleavage, as reported by patients' satisfaction and surgeons' evaluation.

DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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