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ORIGINAL ARTICLE BREAST SURGERY

Extended Latissimus Dorsi Kite Flap (ELD-K Flap): Revisiting an Old Place for a Total Autologous Breast Reconstruction in Patients with Medium to Large Breasts

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Abstract

Background The latissimus dorsi (LD) flap represents one of the most reliable methods for autologous breast reconstruction. However, in many patients, the exclusive use of this technique may not guarantee the restoration of an adequate volume and projection. We report our experience with the extended latissimus dorsi kite flap (ELD-K flap), an alternative surgical approach to maximize the volume of the fleur-de-lis pattern LD flap, for total autologous breast reconstruction.

Methods Between 2016 and 2018, 23 patients were subjected to mastectomy and immediate autologous reconstruction with "extended latissimus dorsi kite flap" (ELD-K flap), technique that employs an extended version of the LD musculocutaneous flap, based on the skeletonized thoracodorsal pedicle and a trilobate skin incision with an inferiorly based vertical branch. The BREAST-Q questionnaire was administered preoperatively, and one year after surgery to evaluate the quality of life results of the patients. BREAST-Q latissimus dorsi module was also provided.

Results Average body mass index was 29.7 kg/m^2 (range 25–40 kg/m^2). Mild complications occurred in only six cases, and eight patients underwent treatment to improve the donor site scar outcome. Patients indicated high scores in quality of life measures with an increase in all BREAST domains from the preoperative to the postoperative period. A statistically significant increase ($p < 0.05$) was noted in: "overall satisfaction with breasts" ($p < 0.05$), "psychosocial well-being" ($p < 0.05$), "physical impact of the surgery" ($p < 0.05$). Within the LD module, participants reported a mean score of, respectively, 73.8 and 67.9 for "satisfaction with back" and "satisfaction with shoulder and back function" domains.

Conclusions The extended incision allows the recruitment of additional tissue to provide enough volume to complete the reconstruction without implants. The isolation of the vascular pedicle allows for extreme freedom and mobilization of the flap, ensuring adequate filling of the breast. ELD-K flap may expand the indications for a total autologous LD immediate breast reconstruction, representing an additional and reliable alternative in selected cohorts of patients.

Level of Evidence IV This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

Keywords Breast reconstruction · Latissimus dorsi flap · Total autologous · Large breasts

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Introduction

The latissimus dorsi (LD) musculocutaneous flap was described by Iginio Tansini in 1906 and first applied to breast reconstruction during the 1970s [1–3]. The optimal clinical outcomes obtained with the rediscovered Tansini's procedure, made it a widely adopted flap that became part of the breast reconstruction armamentarium in its own right [4, 5]. In spite of the very dependable and constant vascularity of the flap, it generally does not purvey enough volume to fill breast deficiency. In the majority of cases, a breast implant placed under the flap is needed in order to achieve the appropriate size, contour and projection [6, 7]. In fact, the primary purpose of this flap was to provide better coverage for a silicone implant. Nevertheless, the use of implants can produce a number of complications, including exposure, infection, capsular contracture, particularly after radiotherapy [8–13].

In 1983, Hokin introduced the extended latissimus dorsi myocutaneous flap with the recruitment of additional adipose tissue by the lumbar fat above the iliac crest, as an alternative to breast prostheses [14].

Since then, several authors attempted their own modifications to the original technique, with the ambition to improve cosmetic outcomes by recruiting as much tissue as possible and enhancing the volume of the flap.

Lately, lipofilling to the LD flap turned out to be an effective tool that permits to directly increase breast volume without using an implant. Yet, LD flap, together with fat transfer, has proved successful in accomplishing an entirely autologous reconstruction of small and medium breasts exclusively [15–17].

In the present study, we report our experience with the extended latissimus dorsi kite flap (ELD-K flap), an alternative surgical approach to maximize the volume of the LD flap for total autologous breast reconstruction. The flap is harvested as a myo-dermo-cutaneous island flap, with its proximal and distal division from the insertions and pedicle dissection from itself [18]. It can be mostly deepithelized and easily reshaped to fill completely the area of mastectomy, restoring the internal pole fullness by moving freely on its pedicle, despite its important volume. The ELD-K flap represents a reliable and alternative solution for the plastic surgeon to reconstruct selected patients with medium to large breasts, who underwent conservative mastectomies and contextual axillary procedures, with no need of implants or fat grafting.

Patients and Methods

A prospective non-controlled (cohort) study was designed. Between January 2016 and May 2018, a total of 23 patients were selected to undergo unilateral immediate breast reconstruction with the ELD-K flap, following mastectomy. Only therapeutic "skin-sparing" mastectomies were considered.

Inclusion criteria were as follows: patients willing and eligible for immediate autologous breast reconstruction, with medium to large breast size, body mass index (BMI) between 25 and 40 kg/m^2 and presenting contraindication for prosthetic or abdominal procedures. Prior to surgery, patients were informed about all reconstructive options, and their preference, body habitus, comorbidities and prior abdominal surgery were evaluated. Follow-up ranged from 12 to 24 months.

Patient's satisfaction and cosmetic outcome evaluation were registered using the preoperative and the postoperative BREAST-Q modules for reconstructive surgery [19].

The BREAST-Q is a validated procedure-specific, patient-reported outcome measure to assess health-related quality of life (HRQOL) after breast surgery. The questionnaires were administered to patients prior to surgery and 1 year after, during follow-up visits (Table 1). The reconstruction form covers the topics expressed in Tables 2 and 3, which also present the results of the questionnaire. The raw data from patients' answers were converted into the equivalent Rasch-transformed score (0–100) using the specific module conversion table (Memorial Sloan Kettering Cancer Center and The University of British Columbia) [20].

BREAST-Q responses before and after treatment were compared, and results were analyzed with *t*-test after normality checking with Shapiro–Wilk test. Higher scores indicate greater satisfaction and residual function. A p value less than 0.05 was considered statistically significant. The BREAST-Q latissimus dorsi module, which evaluates "satisfaction with back appearance" and "satisfaction with Shoulder and Back Function", was also administered, producing a scale of values of aesthetic and functional impact on patients after surgery (Tables 2, 3).

Surgical Technique

The flap design is marked preoperatively with the patient in standing position. Marking consisted in a "fleur-de-lis" like design with an incision that usually runs obliquely from superomedial to inferolateral along the relaxed skin tension lines of the back. The horizontal skin paddle was placed over the thoracolumbar and lower lumbar fat pad where there is the maximum expression of fat compartments, oriented following the folds between these two compartments [21] (Figs. 1, 2, 3c), usually placed inferiorly 3–5 cm cranial to the iliac crest, 2 cm away from the spinous processes and superiorly above the lower rib spine to reach the fat of the parascapular fat compartment. An inferior vertical *V*-shaped segment is outlined downward

Table 1 BREAST-Q scores recorded preoperatively and one year postoperatively, expressed as mean ± standard deviation

Domain	Preoperative mean (± SD)	Postoperative mean (± SD)	Delta mean	*p* value
Satisfaction with breasts	66.2 (± 12.5)	72.2 (11.3)	6	0.0030*
Psychosocial well-being	67.7 (± 11.5)	74.2 (± 11.4)	6.5	0.0049*
Sexual well-being	58.7 (± 8.02)	60.7 (± 8.6)	2	0.0824
Physical well-being (chest)	83.3 (± 8.8)	87.1 (± 7.5)	3.8	0.0136*
Overall satisfaction with outcome	–	73.6 (± 13.5)	–	–

Changes in scores are expressed as delta (postoperative score minus preoperative score)

*$p < 0.05$

Table 2 BREAST-Q latissimus dorsi module: satisfaction with back appearance

Item	None of the time	A little of the time	Some of the time	Most of the time	All of the time
a. The location of your back scar	14 (60.8)	6 (26.1)	2 (8.7)	1 (4.3)	–
b. The length of your back scar	13 (56.5)	6 (26.1)	4 (17.4)	–	–
c. How noticeable your back scar is to others	10 (43.5)	9 (39.1)	3 (13.0)	1 (4.3)	–
d. The sides of your back not matching	15 (65.2)	8 (34.8)	–	–	–
e. How your back looks	11 (47.8)	7 (30.4)	4 (17.4)	1 (4.3)	–
f. The shape (contour) of your back	14 (60.8)	9 (39.1)	–	–	–
g. How your back scar looks	10 (43.5)	9 (39.1)	3 (13.0)	1 (4.3)	–
h. Wear certain clothes to hide your back scar	13 (56.5)	8 (34.8)	1 (4.3)	1 (4.3)	–

Recorded one year postoperatively

Number of participants choosing each option (% of those patients)

Table 3 BREAST-Q latissimus dorsi module: satisfaction with shoulder and back function recorded one year postoperatively

Item	None of the time	A little of the time	Some of the time	Most of the time	All of the time
a. Shoulder stiffness	11 (47.8)	7 (30.4)	3 (13.0)	2 (8.7)	–
b. Shoulder pain	10 (43.5)	8 (34.8)	5 (21.7)	–	–
c. Back pain	8 (34.8)	7 (30.4)	6 (26.0)	2 (8.7)	–
d. Difficulty doing activities with your arms above your head	9 (39.1)	7 (30.4)	5 (21.7)	2 (8.7)	–
e. Difficulty doing activities with your arms outstretched	12 (52.2)	6 (26.0)	4 (17.4)	1 (4.3)	–
f. Weakness in your arm	10 (43.5)	7 (30.4)	5 (21.7)	1 (4.3)	–
g. Difficulty doing activities that repeatedly use shoulder and back muscles	12 (52.2)	9 (39.1)	2 (8.7)	–	–
h. Tightness when you stretch your arm	11 (47.8)	7 (30.4)	5 (21.7)	–	–
i. A pulling feeling in your back	13 (56.5)	7 (30.4)	3 (13.0)	–	–
j. Difficulty reaching for objects	14 (60.8)	8 (34.8)	1 (4.3)	–	–
k. Difficulty carrying heavy objects	10 (43.5)	7 (30.4)	3 (13.0)	3 (13.0)	–

Number of participants choosing each option (% of those patients)

from to the horizontal ellipse, in order to recruit additional tissue. Flap width and the amount of subcutaneous tissue in these compartments were previously estimated by using the pinch test. The rationale of this approach is supported by Marshall et al. experience, showing how subcutaneous tissue is mainly located over the lower part of the muscle [22] (Fig. 4).

During the first step, mastectomy is performed, and axillary dissection is carried out, when indicated. Breast pocket creation and the pedicle identification and

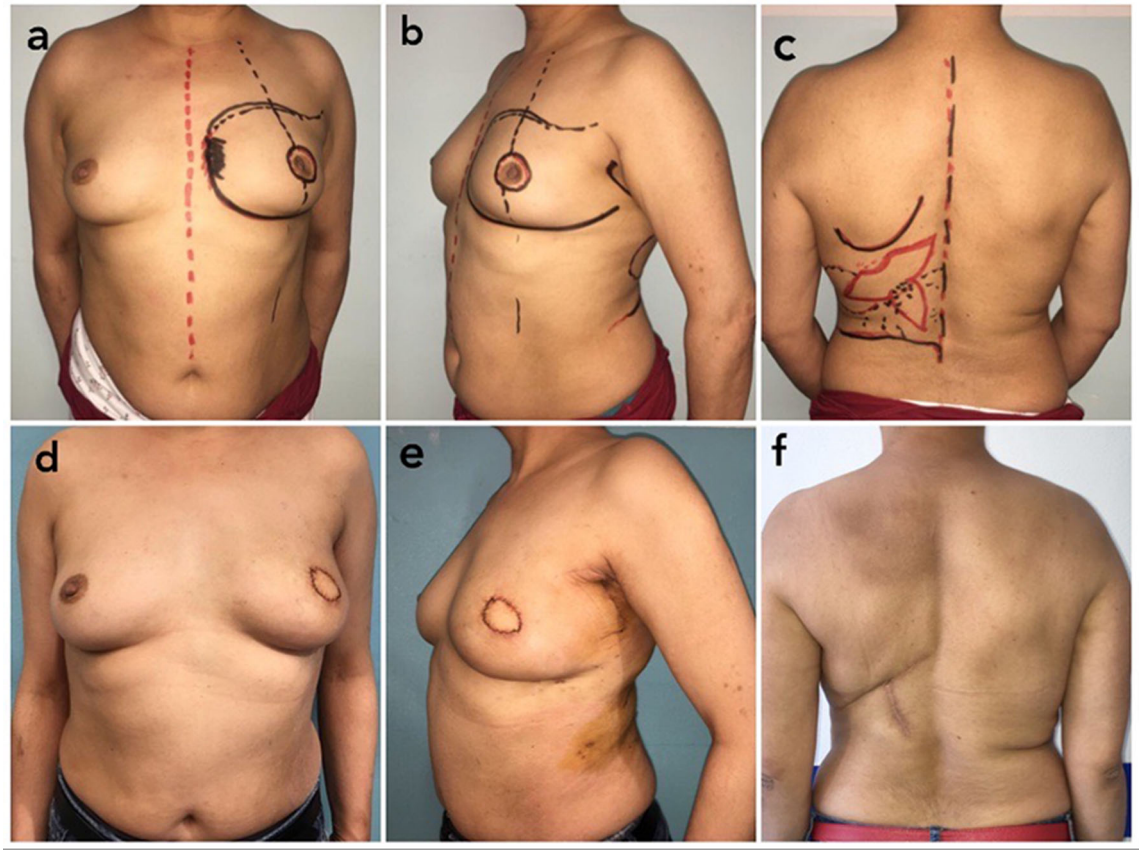

Fig. 1 Patient submitted to left SSM and ipsilateral lymph node dissection (LND). Preoperative (**a–c**) and 2 weeks postoperative (**d, e**). Back scar one year after surgery (**f**)

dissection are carried out through the same anterior approach, in order to fully skeletonize the thoracodorsal bundle (Fig. 5). The thoracodorsal nerve and the humeral insertion of the muscle are transected in order to minimize postoperative muscular contraction, animation deformity and axillary bulk. Meticulous dissection sets the pedicle free, making it extremely mobile and able to reach the inferior and internal pole of the skin envelope. Patient is now ready to assume lateral decubitus position with the shoulder elevated 90 degrees. Skin islands are incised, and the anterior border of the LD muscle is identified. The muscle is dissected off the overlying skin up to the axilla. The flap is raised from ventrally to the spine, separating the LD muscle from the thoracolumbar fascia and carrying out its insertion distally from the iliac crest and posteriorly from its origin along the thoracic and lumbar spines. All thoracolumbar perforators are carefully coagulated or ligated. Dissection is performed anteriorly to separate the LD from the serratus muscle. The harvested subcutaneous tissue is extended up to the parascapular fat compartment and down to the suprailiac compartments. De-epithelialization of the skin paddle of the flap is carried out "a la demande." Once the harvesting has been completed, the flap is interpolated through a lateral thoracic tunnel. The inset begins medially first at the sternal margin and then joined laterally along the inframammary fold, until the level of the anterior axillary line. At the same time accomplishing the division of the latissimus tendon, the flap is mobilized on pure island vessels, so it can easily reach and restore the internal and the upper poles. Fat is the volume that must be positioned first and fixed to the pectoralis major fascia, to determinate the overall breast shape. The inset places the bulk of the fat in the central-inferior breast looking for better definition of the inframammary fold. The flap is molded in a conical fashion folding on itself the vertical *V*-shaped segment, providing additional volume, useful for the tip projection of the cone (Video 1). We do not use an inverted inset (180° rotation), and the flap is transposed directly from the back to the chest; therefore, the most lateral part of the muscle is not found medially, rather laterally, solidarized at the level of the anterior axillary line. The inferior and internal pole fullness is restored. One suction drain is positioned in the pocket. An additional drain may be used depending on axilla management. Breast skin is closed over the new breast mound. Donor site is sutured by using progressive tension sutures

Fig. 2 Patient submitted to SSM + ipsilateral LND and ELD-K flap reconstruction. Preoperative (**a–c**) and 2 weeks postoperative (**d, e**). Back scar one year after surgery (**f**)

from the superficial to deep fascia, and the skin closed in layers. A single vacuum drain is placed at the donor site (Fig. 6).

Results

A total of 23 women were enrolled in this study. Table 4 summarizes the demographic features of the participants. The mean age at the time of breast reconstruction was 49.04 years (range 35–65 years). The mean BMI was 29.7 kg/m^2 (range 25–40 kg/m^2). Average surgical time was 3.5 h. Every woman underwent axillary surgical procedure: Fourteen (60.8%) patients had contextual axillary dissection. Nine (39.13%) patients were subjected to an intraoperative biopsy of the sentinel lymph node (SLNB), four of which (44%) underwent axillary clearance.

Drains from the reconstructed breast area were removed between the fourth and ninth postoperative day (mean value 6.5 days). Drain from the donor site was removed between the seventh and fourteenth day (mean value 12 days).

No complications requiring a second major surgery were registered (Table 5).

We reported three cases (13.04%) of seroma at the donor site that occurred after drainage removal. They resolved, respectively, by two and three sessions of ambulatory percutaneous aspirations on a weekly basis, and two cases (8.7%) of wound dehiscence. Two cases of mild infection (one of the recipient site and the other of the donor site) were detected and treated with oral antibiotic therapy. After one year, fat grafting was required in four patients (17.4%) to improve the donor site scar outcome. Three patients (13.04%) underwent contralateral mastopexy and one patient (4.3%) reduction mammaplasty for breast symmetrization. Four (17.4%) patients were subjected to revision surgery for dog-ears on the back scar with the use of local anesthetics. Sixteen (69.5%) of the participants received radiotherapy to the regional lymph nodes and chest wall; however, no significant difference was observed between those who underwent radiation therapy and those who did not, in terms of additional surgical treatments and complications. Patients subjected to ELD-K flap were generally highly satisfied with their

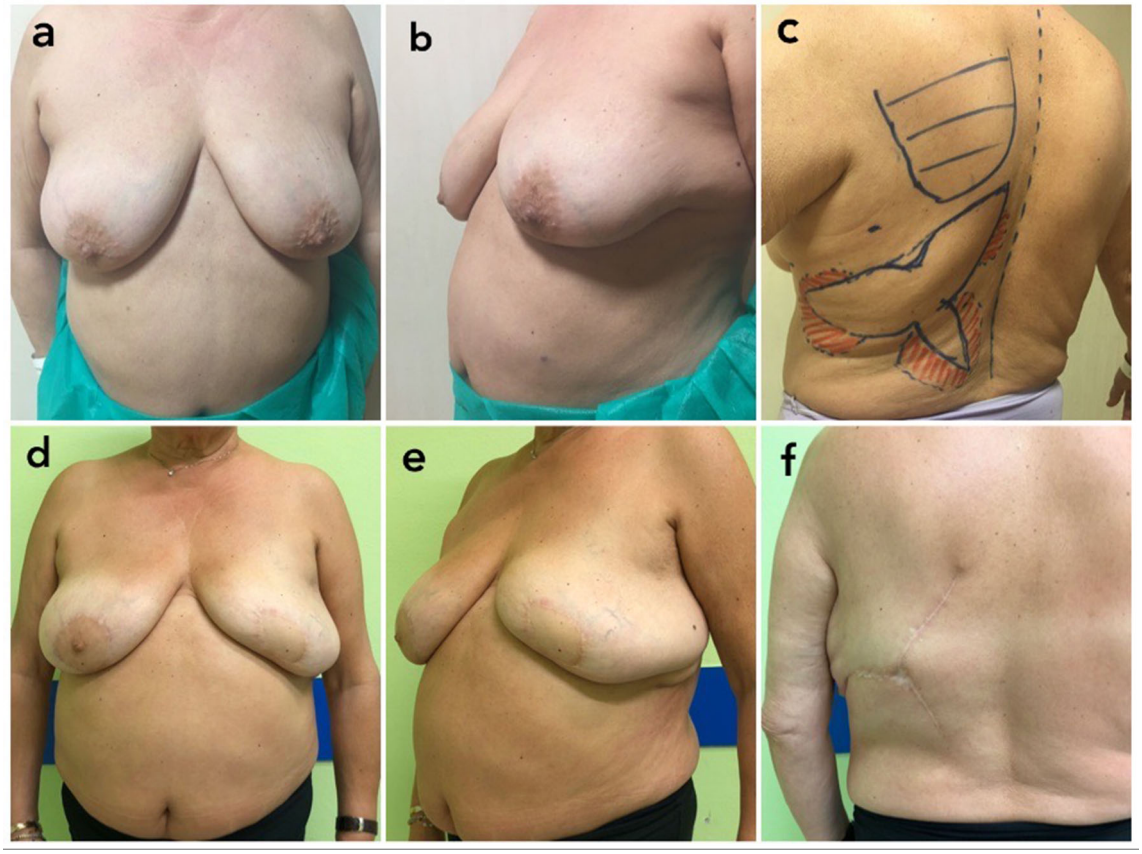

Fig. 3 Patient undergoing left SSM and contralateral round-block mastopexy. Preoperative (**a–c**) and 1 year after ELD-K (**d–f**). On the right, the scar result from delayed healing

results, as expressed by "overall satisfaction with outcome" parameter measured postoperatively. The scores tended to improve for overall satisfaction with breasts ($p < 0.05$), psychosocial well-being ($p < 0.05$) and physical impact of the surgery ($p < 0.05$) at 1-year follow-up. The value for sexual well-being also improved from the preoperative to postoperative evaluations, but this was not observed to be statistically significant. Wounds at the donor area healed fair, and despite the additional scar, patients were generally satisfied with their outcomes. They reported good levels of satisfaction with the appearance and morbidity of their back 1 year after surgery, with a mean score of, respectively, 73.8 for the domain "satisfaction with back" and 67.9 for the domain "satisfaction with shoulder and back function." Results from the BREAST-Q Latissimus Dorsi module are listed in detail in Tables 2 and 3.

Discussion

The standard design of latissimus dorsi flap contributes with viable tissue to fulfill post-mastectomy oncological defects, but generally it does not provide sufficient volume to recreate itself a breast mound without the use of heterologous implants [12, 23–27]. Breast prostheses, on the other hand, are burdened by a series of complications such as infection, exposure, Breast Implant-Associated Anaplastic Large Cell Lymphoma (BIA-ALCL) and capsular contracture [28–34]. In this regard, capsular contracture often represents a cause of pain, distortion and stiffness of the breast, which would seem to happen more often after radiation therapy treatments [11, 12, 35–38].

In the literature, several authors have reported their own modifications to the original technique of LD flap, with the ambition to improve cosmetic outcomes by recruiting as much tissue as possible and enhancing the volume of the flap [21, 39, 40].

Back in 1983 Hokin reported the extended latissimus dorsi myocutaneous flap, introducing the idea of recruiting additional adipose tissue by including lumbar fat extension [14].

In 1991, Mccraw and Papp described a totally autogenous LD breast reconstruction, with a fleur-de-lis skin island design, transforming the classic crescent shape, to include a vertical extension of posterior axillary skin and fat [12]. Following this trend, Aitken and Mustoe managed

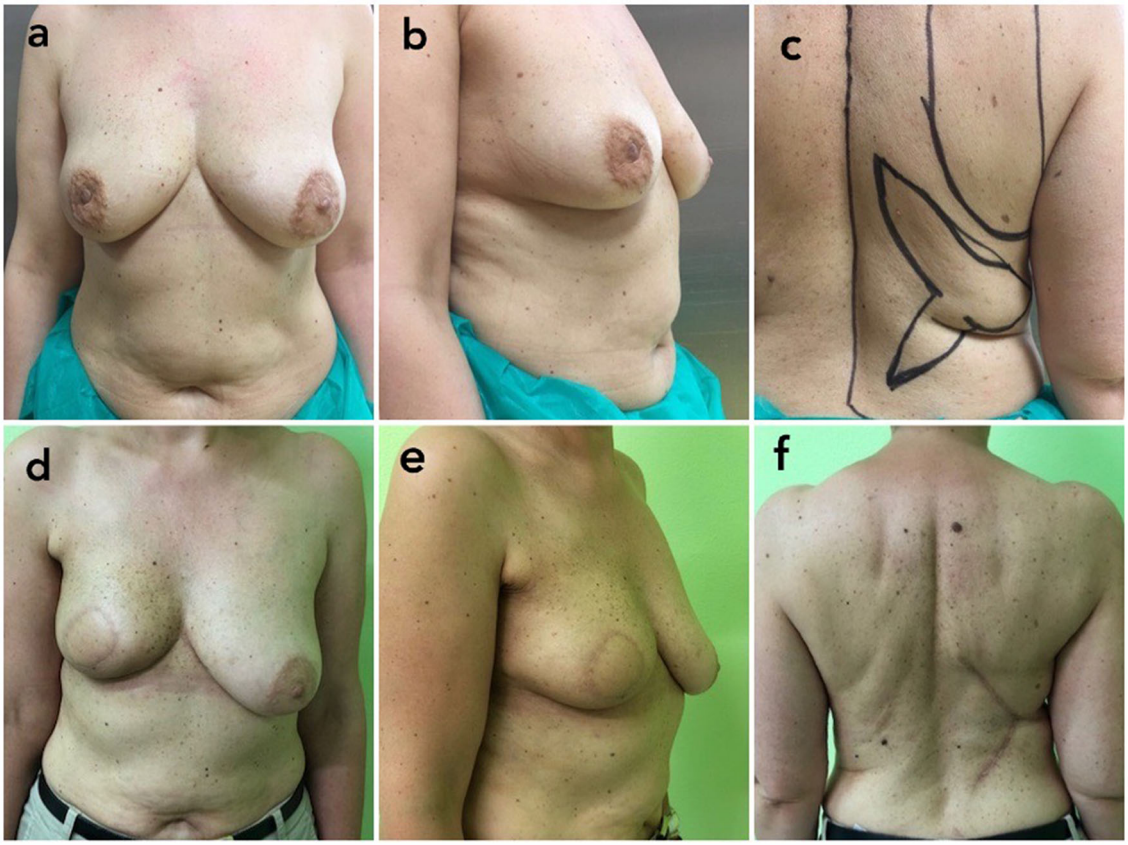

Fig. 4 Woman with right breast heteroplasia with NAC retraction and ipsilateral lymph node positivity. Preoperative (**a–c**) and 1 year postoperative (**d–f**)

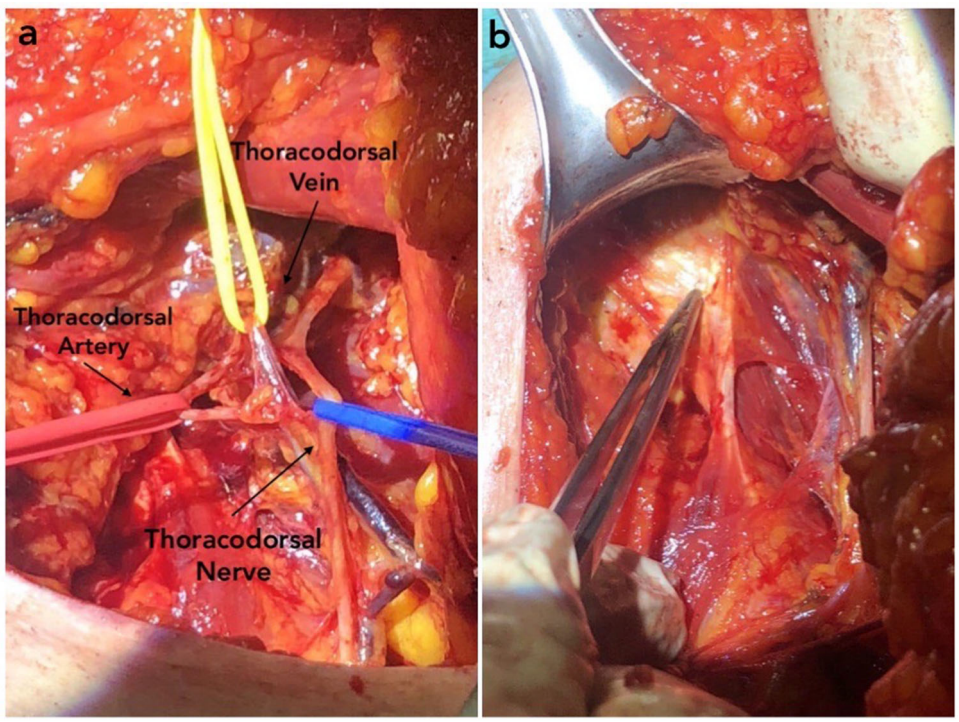

Fig. 5 Intraoperative details. Skeletonized neurovascular pedicle (**a**) and the anterior view of the tendon of LD muscle following axillary dissection (**b**). Safe and complete tendon interruption under direct view allows for complete flap release and mobilization as well as vascular bundle preservation

Fig. 6 The concept of the flap relative to its anatomic details, is shown

to optimize the layout of the fleur-de-lis LD flap, minimizing the size of the implanted prosthesis [41].

The long history of the latissimus dorsi is full of experience aimed at modifying the original technique, in order to modulate its indications. Breast reconstruction represents the main field of application, but its versatility makes it extremely useful in the reconstruction of numerous body areas. Ciudad et al. remarkably described the extreme versatility of the extended fleur-de-lis LD flap. In their first interesting paper on this topic, they used an ELD flap to cover large defects in the lumbar area while maintaining perfusion through the thoracodorsal pedicle [42]. More recently, they reported a series of more than 20 patients treated with modified extended fleur-de-lis LD flap, both pedicled and as a free flap, in the reconstruction of complex defects [43]. In 2010, through a detailed analysis of the deposition of back fat, Bailey et al. [21] described a low transverse extended LD flap harvest technique that increases flap volumes and improves donor-site aesthetics in a selected group of obese patients. Instead, J. Correia Anacleto et al. described a new approach that consists of harvesting the muscle until its external limit is reached, completely skeletonizing its pedicle in an attempt to reduce the bulkiness under the axilla [44]. Nowadays, fat transfer to the LD flap has been recognized as a useful tool to directly achieve augmented breast volume. However, the combination of LD flap and lipofilling has proved to be useful in accomplishing a totally autologous reconstruction of small and medium breasts only [15–17]. In fact, lipoaugmentation of the LD flap may serve as a useful alternative to microsurgical or implant-based reconstruction, but in spite of the high volume of fat transferred in a single round, it is estimated that roughly 66% of injected fat is expected to survive at final follow-up [16, 45]. Despite many interesting variations to this flap, its use in autologous breast reconstruction remains limited because of insufficient volume and donor-site tissue disposal. In this respect, the design of our flap is deeply inspired by these previous experiences and the final concept is the result of technical modifications and the selection of different targets and setting, such as its application for a total autologous breast reconstruction in medium to large breast-size patients. We report our results with an innovative extended latissimus dorsi kite flap (ELD-K flap), which introduces a modification to Bayley and Correia Anacleto techniques, and builds on the teachings of McCraw and Aitken to expand the indications for a total autologous LD immediate breast reconstruction. Quoting eminent authors of our discipline: "…the specialty of plastic surgery is characterized by innovation and ingenuity… is continually evolving by not only new ideas and inventions but also by recycling old ideas, revisiting old places, and refining historical techniques" [46]. Following in the footsteps traced by our predecessors, we revisited the original techniques by harvesting the ELD-K flap as a myo-dermo-cutaneous fleur-de-lis island flap, dividing it from its distal and proximal insertions and fully dissecting the pedicle. It can be completely deepithelized and easily reshaped using the additional dermal component to fill the entire area of mastectomy, restoring the internal pole fullness by moving freely on its pedicle [12, 41].

Relying on the anatomical study of back fat compartments proposed by Bailey et al. [21], we modified the flap design taking advantage from an additional vertical V-shaped incision to recruit as much volume as possible from the back, avoiding the use of an implant and accomplishing a single stage reconstruction. In our series, although the parascapular/scapular fat compartment was recruited, the largest amount of subcutaneous dermo-fat was gained inferiorly in the lumbothoracic, lumbar and suprailiac subcutaneous pad, following the four topographic folds. In this way, we gain additional and well-vascularized dermo-adipose tissue that can be useful in patients who have medium to large breasts, cup sizes C or D, undergoing conservative mastectomies with or without axillary dissection. The recruitment of a vertical *V*-shaped deepithelized segment provided more volume to achieve better projection and optimize breast contour and ptosis in overweight patients with a BMI that would not be high

Table 4 Demographic features of patients

Patient	Age	BMI	Risk factors	Comorbidity	Type of mastectomy	Type of reconstruction	Timing	Radiotherapy	Follow-up (mo)	Complications
1	51	25	Smoke	IHD	SSM	Unilateral	Immediate	Y	12	Seroma
2	65	32	–	–	SSM	Unilateral	Immediate	Y	12	–
3	54	37	–	–	SSM	Unilateral	Immediate	Y	12	–
4	40	26	Smoke	–	SSM	Unilateral	Immediate	N	14	–
5	50	29	–	HCV	SSM	Unilateral	Immediate	Y	24	Dehiscence
6	60	30	–	–	SSM	Unilateral	Immediate	Y	17	Seroma
7	51	28	–	Diabetes	SSM	Unilateral	Immediate	Y	13	–
8	48	32	Smoke	–	SSM	Unilateral	Immediate	Y	12	–
9	51	27	–	–	SSM	Unilateral	Immediate	Y	12	–
10	51	33	–	–	SSM	Unilateral	Immediate	Y	12	–
11	56	26	–	–	SSM	Unilateral	Immediate	N	12	–
12	47	34	–	Diabetes	SSM	Unilateral	Immediate	N	12	Dehiscence
13	38	25	Smoke	–	SSM	Unilateral	Immediate	Y	12	–
14	42	27	–	–	SSM	Unilateral	Immediate	N	12	–
15	40	30	–	–	SSM	Unilateral	Immediate	N	12	Seroma
16	35	40	–	–	SSM	Unilateral	Immediate	Y	12	–
17	47	33	–	Diabetes	SSM	Unilateral	Immediate	N	12	–
18	42	31	–	–	SSM	Unilateral	Immediate	Y	14	–
19	41	26	–	–	SSM	Unilateral	Immediate	Y	12	–
20	62	34	–	Hypertension	SSM	Unilateral	Immediate	N	12	–
21	56	25	–	–	SSM	Unilateral	Immediate	Y	12	–
22	51	25	–	–	SSM	Unilateral	Immediate	Y	22	–
23	50	28	–	–	SSM	Unilateral	Immediate	Y	14	–

BMI body mass index; *SSM* skin-sparing mastectomy; *IHD* ischemic heart disease; *Y* yes; *N* no

Table 5 Incidence of complications at the flap and donor site

Complications	*N*	%	Treatment
Flap			
Seroma	–	–	–
Hematoma	–	–	–
Infection	1	4.3	Antibiotic therapy
Partial loss	–	–	–
Donor site			
Seroma	3	13.04	Percutaneous aspiration
Hematoma	–	–	–
Infection	1	4.3	Antibiotic therapy
Wound dehiscence	2	8.7	Surgical revision

enough to guarantee a total autologous reconstruction through the mere recruitment of adjunctive adipose tissue as described by Bailey et al (Fig. 7).

Nonetheless, we applied the very same flap design even in patients with more elevated BMI as the dermal substrate provides reliable vascularization to the additional recruited fat [47].

Our data demonstrate the safety and reliability of this technique, reporting very satisfactory results among patients at 1-year, low complication rates and high overall satisfaction. Concerns on this technique may arise in relation to the size, location and appearance of the additional scar on the back. In this regard, a large prospective study conducted by Browne JP et al. in 2018, on more than a thousand patients undergoing breast reconstruction with LD, found that concern for the aesthetic result at the donor site level was rare, and mean total score on "back appearance" scale was 76.7. Important functional impairment proved to be more common but still involved a minority of patients. Patients undergoing a totally autologous procedure with LD flap had a slightly greater morbidity, mean score on the "back and shoulder" scale 66.3 than the classic procedure (mean = 67.4). In the same year, Koh et al. in a case-controlled study compared the BREAST-Q scores of patients who had undergone mastectomy alone and those who had undergone LD flap breast reconstruction. The latter reported an average score of 75.42 and 81.18, respectively, in the domains "satisfaction with outcome" and "satisfaction with back" [48, 49].

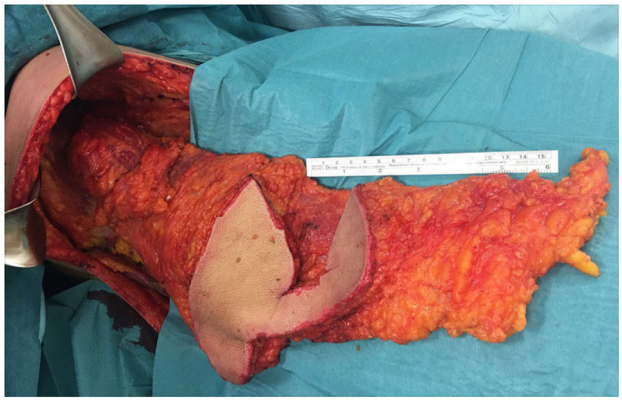

Fig. 7 Intraoperative view of the harvested ELD-K flap with the recruited vertical V-shaped segment and the subcutaneous tissue, extended up to the parascapular fat compartment and down to the suprailiac compartments

Although feedbacks reported by our patients were generally good, surprisingly, the final recorded results were higher than we expected, even when compared to the above-mentioned studies in the literature reporting similar BREAST-Q data on the latissimus dorsi flap.

In our daily practice, often the fear of more extended or additional donor site scars are potentially perceived as a main drawback more by the surgeon point of view, rather than by the patients' perspective. It is mandatory to provide complete and clear information about all the technical aspects of the surgery, in order to consolidate patients' compliance during preoperative consultation.

In support of this, technical aspects such as the harvesting of a larger skin paddle and the closure of the donor area with progressive tension sutures with no loose and/or shear forces result in higher tension applied to the deep layers. In this way, dead space may be reduced while improving donor-site evolution and aesthetic outcome [50–53].

Furthermore, the closure of the *T*-shaped donor area in different axes, following the natural creases of the lower back, distributes tension away from the skin incision and reduces the tendency to develop wide scars [21].

When required, a beneficial component to this technique is represented by scar revisions or fat grafting to the donor site, performed as outpatient minimally invasive second-stage procedures, to correct any postoperative contour deformities, perhaps including the reconstruction of the nipple [54]. Dermopigmentation for medical purposes also known as medical tattooing can also represent a valid alternative to improve scar appearance and complete the reconstructive path [55, 56].

A potential limitation of this study might be represented by limited follow-up, especially when considering revisional surgeries after the procedure.

Conclusions

Autologous reconstruction remains the technique associated with the highest patient satisfaction and represents the gold standard in reconstituting breast salience.

Proper patient selection and surgical planning are essential in achieving good results. ELD-K flap can be performed safely and may expand the indications for a total autologous LD immediate breast reconstruction, representing an additional and reliable alternative in selected cohorts of patients.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval Approval was obtained from the ethics committee. The procedures used in this study adhere to the tenets of the Declaration of Helsinki.

Consent to Participate Informed consent was obtained from all individual participants included in the study.

Consent to Publish Patients signed informed consent regarding publishing their data and photographs.

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