

DIEAP Flap Patients Equally as Satisfied with the Abdomen as Abdominoplasty Patients

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Background: The dermolipectomy of the deep inferior epigastric artery perforator (DIEAP) flap procedure is designed to give an end result as seen with abdominoplasty (AP). Several steps of an AP are, however, not routinely performed. This study compared the patient-reported outcomes between these 2 procedures with an emphasis on the abdomen.

Methods: Thirty-four patients reconstructed with a DIEAP flap (DIEAP group), and 30 patients with an AP (AP group) were asked to complete 2 study-specific questionnaires. The first questionnaire covered abdominal outcomes, whereas the second was concerned with general outcomes.

Results: The DIEAP group was significantly older compared with the AP group. Eighty-five percentage of the DIEAP group and 66 % of the AP group answered the questionnaires. Postoperatively, the DIEAP group was significantly more satisfied with their bodies when dressed ($P = 0.009$), and there was a trend of DIEAP patients being more satisfied with the appearance of the abdomen ($P = 0.085$). No significant difference was found comparing outcomes concerning umbilicus, muscle function, pain, scarring, and contour. The DIEAP group was more worried about their health than the AP group postoperatively ($P = 0.044$). AP patients had a significantly more altered body image ($P = 0.016$) and increased sexual desire ($P = 0.003$) than DIEAP patients. There was no significant difference regarding changes in self-image, social relationships, being naked with partner, and overall satisfaction.

Conclusion: DIEAP flap patients were equally as satisfied with the abdomen as AP patients. (*Plast Reconstr Surg Glob Open* 2018;6:e1876; doi: 10.1097/GOX.0000000000001876; Published online 8 August 2018.)

INTRODUCTION

Breast reconstruction with deep inferior epigastric artery perforator (DIEAP) flap is commonly presented as a two-in-one procedure reflecting the abdominoplasty (AP) performed. Niddam et al.¹ reported that having a simultaneous AP was the main reason of choosing a DIEAP flap reconstruction in 40 % of their patient group. The secondary benefits of the AP are, in other words, of major importance in terms of the patients' reconstruction preferences and goals.

The DIEAP flap abdominoplasty, however, varies in several ways compared with the routine steps of an AP: First, one does not usually perform liposuction due to the risk of perforator injury. Second, the extent of umbilical surgery varies in DIEAP flaps depending on the need to incorporate paraumbilical perforators. Third, rectus plication is not frequently undertaken—being both time-consuming and associated with postoperative complications such as respiratory distress^{2,3} and an increased risk of venous thromboembolism.⁴⁻⁶ The increased risk of venous thromboembolism is suggested to be caused by the high intraabdominal pressure generated by rectus plication, which is shown to interfere with lower extremity venous return.^{3,7}

Due to the differences in operative technique, unwanted aesthetic outcomes (eg, visible scar, lateral displacement of the umbilicus, and dog ears) are more commonly observed after DIEAP flap procedures.¹ As such, the proposed benefits of the DIEAP flap AP may not be as genuine as frequently suggested in literature and during

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preoperative counseling. Although most patients are primarily focused on the reconstructed breast, this may lead to patient dissatisfaction as the aesthetic outcomes of the abdomen are inarguably of high priority as well.

Seeing that abdominoplasty outcomes are an important influencer on patient satisfaction, recent studies have assessed modifications of the DIEAP flap procedure to better achieve an aesthetic outcome resembling an AP. Eom et al.⁸ suggest a “Low DIEAP Flap” to leave a more favorably located donor scar easily concealed by underwear. Munhoz et al.⁹ list a wide array of AP techniques applied during the donor defect closure to improve abdominal contour and waistline. Both studies, however, respectively, report a higher incidence of venous congestion and mortality (as 1 patient died due to pulmonary embolism). Although this may be purely coincidental, all plastic surgeons should be critical when it comes to adding surgery time and/or changing operative techniques in highly standardized procedures.

The aim of this study was to assess if there is in fact a statistically significant difference in patient-reported outcomes comparing DIEAP flap and AP patients and subsequently consider the need to modify operative technique accordingly.

METHODS

Study Design

The retrospective and questionnaire-based study compared patient-reported outcomes between DIEAP flap and AP patients. Both groups underwent surgery with the same department.

We provided information regarding the scope of the study and obtained written consent from all participants. The study was registered and published in the ClinicalTrials.gov database (ID number: NCT03209167).

Patients

DIEAP Flap Patients (DIEAP Group)

A group of 34 consecutive, unilateral DIEAP flap breast reconstructed patients were recruited to the study. All patients had undergone mastectomy due to breast cancer. Bilateral breast reconstructions and DIEAP flaps used in nonbreast reconstructions were excluded.

AP Patients (AP Group)

A group of 30 patients who had undergone AP with transposition of the umbilicus served as control group. All patients had a lipocutaneous overhang of the abdomen with a minimum of 2 centimeters.

The comparisons of baseline characteristics are shown in Table 1.

Surgical Technique

DIEAP Flap Breast Reconstruction

A standard DIEAP flap procedure as described by Blondeel et al.¹⁰ was performed. A 2-team approach (donor- and recipient-site) was carried out to reduce operative time. In the following text, we describe the abdominal wall surgery in detail:

Table 1. Baseline Characteristics

Characteristic	DIEAP Group (N = 34)	AP Group (N = 30)	P
Age	51.8±6.1	41.8±10.1	< 0.001*
Range	36.9–66.3	28.1–70.8	
BMI (km/m ²)	25.7±2.7	26.8±3.5	0.19*
Range	20.7–31.2	21.1–33.8	
Education, n (%)			
Primary and secondary school	5 (15)	3 (10)	0.81†
High school	6 (18)	9 (30)	
College	15 (44)	13 (43)	
University	5 (15)	4 (13)	
Missing	3 (8)	1 (3)	
Comorbidity, n (%)			
None	25 (73)	19 (64)	‡
Diabetes mellitus	0	4 (13)	
Heart or vascular disease	1 (3)	1 (3)	
Hypertension	2 (6)	1 (3)	
Other disease	6 (18)	5 (17)	
Complications, n (%)			
Bleeding/hematoma	1 (3)	1 (3)	‡
Infection	0	3 (10)	
Partial necrosis	2 (6)	1 (3)	
Reoperation due to complication	0	1 (3)	
Follow-up (y)	2.4±1.0	2.2±0.5	0.30*

Data are expressed as mean ± SD if not otherwise stated. Bold numbers qualify as significant.

*Independent *t* test.

†Mann-Whitney *U* Test.

‡Data too small for statistical analysis.

The preoperative markings of the DIEAP flap varied slightly according to the location of key perforators, which were planned to be incorporated. Most of the time the cranial incision was placed at the perimeter of or above the umbilicus. The caudal incision was positioned in the suprapubic crease—approximately 12–13 centimeters below the cranial incision. The incisions were extended laterally to the anterior superior iliac spine on both sides to make a symmetric, elliptical flap in the hypogastrium.

After dissecting the DIEAP flap with its perforators, undermining of the upper abdominal panniculus was performed to the level of the xiphoid process and along the costal margin. We did not use any infiltration. Nor was any liposuction done in the abdominal flap. Primary fascial closure was routinely achieved using polydioxanone suture (PDS) 0 running suture. No fascia was harvested in any of the patients, and no mesh was needed to reinforce the defect (except from 1 patient who had multiple fascia incisions during the perforator dissection and consequently needed a polypropylene mesh to prevent hernia formation). Tightening of the contralateral anterior sheath was not performed. None of the patients had a rectus plication done. The new umbilicus was externalized at a level equivalent to its natural position. A selective defatting at the exit-site was performed to achieve a natural umbilical depression. The donor defect was closed in 3 layers (Scarpa's fascia, deep dermally and intracutaneously), which is believed to reduce dermis tension and risk of wound disruption.^{11–13} The skin edges were approximated in a lateral-to-medial fashion, and pleating of the abdominal flap was performed to prevent dog ears. Progressive tension sutures were not applied. Two closed-system suction drains (18 French) were used. Compression garment was used for 4–6 weeks postoperatively.

Abdominoplasty

The AP was performed in supine position under general anesthesia. Tumescence liposuction was performed in most patients. The liposuction was routinely done in the flanks and upper abdomen, and in the lower abdomen (caudal to the flap) if this was found necessary.

After completing the liposuction, the lower abdominal segment was incised curvilinearly from the right anterior superior iliac spine to its contralateral counterpart. The incision was placed 5–7 cm superior to the anterior commissure and carried through to the level of deep fascia. Like the DIEAP flap procedure, cranial undermining of the panniculus was performed to the level of the xiphoid process and along the costal margin. Meanwhile undermining the panniculus, the umbilicus was incised ovally and its stalk freed. The excess panniculus was excised, and the wound was closed temporarily with clamps. The new umbilical position was marked and incised to fit the underlying umbilicus. The umbilical stalk was later identified, pulled through the opening, and sutured in place. Rectus plication was performed in a small number of patients who had a significant rectus diastasis with abdominal bulging preoperatively. The skin was closed in a similar fashion as in the DIEAP procedure.

Finally, 2 closed-system suction drains (18 French) were placed under the flap. No progressive tension sutures were used. Compression garment was used for 4–6 weeks postoperatively.

Questionnaire

All patients received 2 study-specific questionnaires: 1 of the questionnaires covered abdominal outcomes, whereas the second was concerned with general outcomes. Both questionnaires had questions with dichotomous (“yes” or “no”), ordinal (eg, “less,” “unchanged,” “more”) or numerical (eg, 1–10) answer alternatives. We piloted the questionnaires in 5 patients. This acted as a control measure for language, understanding and difficulty in answering the various questions. Patients did not report any misunderstanding. We sent nonrespondents a reminder.

Statistical Analysis

Descriptive statistics are presented using mean \pm SD and number (%). Ordinal data were compared using Ordinal Test (Gamma). In addition, cross-tabulation was performed to conduct Fisher’s exact test (with Freeman-Halton Extension) as appropriate. Dichotomous data were analyzed using Mann-Whitney *U* test. Comparisons of numerical data were done using independent *t* test and Mann-Whitney *U* test—primarily the latter due to low sample size and lack of normality. We chose a 5% significance level. *P* values between 5% and 10% were interpreted as trends. The Statistical Package for the Social Sciences version 25.0 (IBM, Armonk, NY) was used.

RESULTS

Table 1 lists the baseline characteristics of both groups. There was an age difference of a decade between the mean age within the DIEAP group (51.8 years; SD, 6.1) versus the mean age within the AP group (41.8 years; SD, 10.1).

Eighty-five percentage (29/34) of the DIEAP group and 66 % (20/30) of the AP group answered the questionnaires.

Seventy-five percentage (15/20) of the AP group and 0% (0/29) of the DIEAP group had a liposuction done. The mean removed fat volume in the AP group was 601 cc (SD, 287 cc; minimum 100 cc; maximum 1,000 mL). The mean total flap weight in the AP group was 1,400 g (SD 756 g; minimum 670 g; maximum 3,500 g). The mean total flap weight in the DIEAP group was 1,038 g (SD, 308 g; minimum 410 g; maximum, 1,580 g).

One of the AP patients required a reoperation within 1 week, whereas none of the DIEAP patients needed a reoperation due to donor-site complication(s). The mean follow-up time was rather similar—being 2.4 years in DIEAP group and 2.2 years in AP group.

In terms of abdominal outcomes (Table 2), no significant differences were found. Comparisons of the groups yielded insignificant *P* values concerning the appearance of the umbilicus, muscle function, pain, scarring, and contour. There was, however, a trend of DIEAP patients being more satisfied with the overall appearance of the abdomen (*P* = 0.085). Patients self scored their grade of satisfaction from 1 to 10 (with 1 being “very dissatisfied” and 10 being “very satisfied”). The DIEAP group had an average score of 7.7, whereas the AP group had an average of 6.7. Similarly, 59 % (17/29) of the DIEAP patients were more satisfied with the appearance of the abdomen after surgery compared with 50% (10/20) of the AP patients. These numbers did not, however, generate a significant *P* value with ordinal test analysis.

In our comparisons of general outcomes (Table 3), DIEAP patients were more satisfied with their bodies when dressed (*P* = 0.009). Postoperatively, only 4% (1/29) of the DIEAP patients were dissatisfied with her body when dressed, whereas dissatisfaction was noted among 35% (7/20) of the AP patients. On the other hand, the DIEAP patients were significantly more worried about their health after surgery compared with the AP group (*P* = 0.031). AP patients reported a significantly more altered body image (*P* = 0.016) and increased sexual desire (*P* = 0.003) after surgery. There was no significant difference regarding change of self-image, social relationships, being naked with partner (meaning how the woman herself feels about being seen naked by partner), and overall satisfaction. Similar numbers of DIEAP flap and AP patients would have gone through the same operation again (97% versus 100%) and recommended the operation to other patients (93% versus 95%). Moreover, the number of patients being overall satisfied with the operation (97% versus 85%) and preoperative counseling (90% versus 79%) were insignificantly different.

DISCUSSION

This is the very first study that compared patient-reported abdominoplasty outcomes between DIEAP flap and AP surgery. Overall, the data presented suggest equivalence between the procedures. Before drawing a conclusion, however, the following limitations with our study must be considered:

Table 2. Abdominal Outcomes

Question	DIEAP Group (N = 29)	AP Group (N = 20)	P
Satisfied with appearance of abdomen (0 = very dissatisfied, 10 = very satisfied)	7.7±2.5	6.7±2.7	0.085*
Satisfied with appearance of umbilicus (0 = very dissatisfied, 10 = very satisfied)	7.6±2.5	7.7±1.6	0.58*
Abdominal wall muscle function (0 = no reduced muscle function, 10 = completely lost muscle function)	3.2±2.9	2.2±1.5	0.33*
Abdominal wall pain (0 = no pain, 10 = severe pain)	2.0±1.4	1.6±1.6	0.51*
How blemishing is the scarring (0 = not blemishing, 10 = very blemishing)	4.0±3.3	5.3±3.8	0.18*
Amount of scarring, n (%)			
Less than expected	5 (17)	3 (15)	0.48†
As expected	17 (59)	10 (50)	
More than expected	7 (24)	7 (35)	
Visibility of scarring, n (%)			
Less than expected	7 (24)	5 (25)	0.75†
As expected	14 (48)	8 (40)	
More than expected	8 (28)	7 (35)	
Change of abdominal contour, n (%)			
None	18 (62)	14 (70)	0.76‡
Bulging	11 (38)	6 (30)	
Hernia	0 (0)	0 (0)	
More satisfied with appearance of abdomen after surgery, n (%)			
No	4 (14)	4 (20)	0.51†
Neither yes or no	8 (27)	6 (30)	
Yes	17 (59)	10 (50)	

Data are expressed as mean ± SD if not otherwise stated.

*Mann-Whitney U test.

†Ordinal test (Gamma).

‡Fisher's exact test (Freeman-Halton extension).

Table 3. General Outcomes

Question	DIEAP Group (N = 29)			AP Group (N = 15)			P
	Yes	Neither Yes or No	No	Yes	Neither Yes or No	No	
Satisfied with body when dressed	25 (86)	3 (10)	1 (4)	11 (55)	2 (10)	7 (35)	0.009*
Altered self-image	12 (41)	6 (21)	11 (38)	12 (60)	1 (5)	7 (35)	0.39*
Altered body image	17 (59)	3 (10)	9 (31)	17 (85)	2 (10)	1 (5)	0.016*
Sad about body image	3 (10)	1 (4)	25 (86)	3 (15)	2 (10)	15 (75)	0.36*
Angry about body image	1 (3)	1 (3)	27 (93)	2 (10)	0 (0)	18 (90)	0.68*
	Improved	Unchanged	Worse	Improved	Unchanged	Worse	
Social relationship	5 (17)	24 (83)	0 (0)	5 (25)	15 (75)	0 (0)	0.52*
Being naked with partner	10 (35)	16 (55)	3 (10)	11 (55)	7 (35)	2 (10)	0.22*
Sexual desire	4 (14)	20 (69)	5 (17)	8 (40)	12 (60)	0 (0)	0.003*
	Less	Unchanged	More	Less	Unchanged	More	
Worried about health	2 (7)	22 (76)	5 (17)	5 (25)	14 (70)	1 (5)	0.031*
	Yes		No	Yes		No	
Would have gone through the same operation again	28 (97)		1 (3)	20 (100)		0 (0)	0.41†
Overall satisfied with the operation	28 (97)		1 (3)	17 (85)		3 (15)	0.15†
Would recommend the operation to other patients	27 (93)		2 (7)	19 (95)		1 (5)	0.78†
Satisfied with the preoperative counseling	26 (90)		3 (10)	15 (79)		5 (21)	0.31†

Data are expressed as number (%). Bold numbers qualify as significant.

*Ordinal test (Gamma).

†Mann-Whitney U test.

The response rates of the 2 groups were different, and only 2 thirds of the AP group responded. There is, however, no agreed-upon standard for acceptable response rates. Some literature and medical associations state that a response rate of more than 50–60% is adequate.¹⁴ The lower the response rate, the higher is the likelihood of response bias (respondents not representing the patient group) and/or nonresponse error (nonrespondents differing from

the respondents in a way that could influence the results). Consideration for the possibility of bias from dependent misclassification is also noted; the tendency of respondents to systematically answer high or low on questions.

One can argue that the significantly different mean ages between our DIEAP and AP groups might be an important confounding factor. We chose, nonetheless, to not perform statistical tests with this in mind based on the

thought that most female patients in their early 40s or 50s have a rather similar life situation (eg, partner, children, work). Expectations related to body contour, weight, and fitness level might also be comparable.

Although not reported in baseline characteristics due to lack of data, the patient groups probably do differ in terms of psychiatric comorbidity: Cosmetic surgery patients (including our AP group) are more prone to psychiatric comorbidities (eg, body dysmorphic disorder) as several studies have shown this when compared with a normative sample.^{15,16} With regard to cosmetic surgery and patient-reported outcomes, von Soest et al.¹⁷ reported that preoperative psychological problems predict less satisfaction with surgical results. Their study indicated that patients with none or few psychological problems have a greater improvement and overall satisfaction with surgery. Furthermore, AP patients are more strongly associated with patient dissatisfaction.^{18,19} They may consequently have a tendency of reporting less improvement with surgery (although achieving aesthetically acceptable or superior results). Such considerations could explain why the AP group reported a lower level of satisfaction with the appearance of the abdomen and were significantly less satisfied with their bodies when dressed compared with the DIEAP group postoperatively.

One should, however, not underestimate the psychosocial impact of breast cancer treatment (such as mastectomy and alopecia), and the consequent risk of developing trauma- and stressor-related psychiatric disorders. This aspect has been thoroughly studied in the literature.^{20–22} Additionally, Becherer et al.²¹ have documented that the prevalence of psychiatric disorders actually increases after the breast reconstruction has been completed. Our results showing that DIEAP flap patients were significantly more worried about their health compared with AP patients postoperatively might support these data.

The contrasting patient group backgrounds may result in different expectations regarding the AP outcomes. The DIEAP patients go through major cancer treatment before opting for a breast reconstruction modality. The results of the abdominoplasty are probably (for most patients) less of a concern than the cancer treatment and breast reconstruction outcomes. The AP patients, however, seek cosmetic surgery mainly to achieve a higher level of body and self-image and do not share the same concerns. Evidently, their expectations of the aesthetic abdominal outcomes are somewhat dissimilar. This may also influence the level of satisfaction/dissatisfaction. Pusic et al.²³ have, in fact, documented the critical role of patient expectations. They reported that unfulfilled expectations are more strongly associated with dissatisfaction than actual technical success of the procedure. In other words, high abdominoplasty outcome expectations increase the risk of dissatisfaction.

Differences in complication and/or revision rates could have been a natural reason for the various satisfaction levels presented in the study. Although our complication data were too small for statistical analysis (Table 1), a larger meta-analysis by Salgarello et al.²⁴ found that the complication rates at the donor-site after DIEAP flap and AP procedures are comparable (apart from a higher se-

roma/hematoma rate among AP patients). With larger patient groups, we could have performed adjusted analysis based on complication type and number of revisions.

Despite having aforementioned methodological limitations, the data presented in the study make clinical sense, and are agreeable with several related publications:

First, based on the abdominal outcomes (Table 2), the DIEAP group reported more reduced abdominal wall muscle function and more abdominal wall pain. Although not significantly different from the AP group, these variations were expected as the intramuscular perforator dissection causes a greater rate of iatrogenic muscle and nerve damage.

Second, the overall satisfaction levels were comparable with similar publications: In a survey-based study, Niddam et al.¹ specifically assessed patient satisfaction regarding the abdominoplasty outcomes after DIEAP flap surgery. They reported that 52 % of their DIEAP flap breast reconstructed patients were satisfied with the aesthetic result of the abdomen. This percentage is similar to our finding, where 59% in the DIEAP group were more satisfied with the postoperative abdomen. Among a group of AP patients, Papadopulos et al.²⁵ reported matching percentages to ours in terms of overall satisfaction (84% versus 85%), and numbers of patients who would have done the same operation again (93% versus 100%) and recommended it to a friend (89% versus 95%).

Third, the significant improvements in general outcomes (eg, body image and sexual desire) have been similarly recorded for both DIEAP flap and AP patients: In a prospective study, Gopie et al.²⁶ reported a significant increase of both body image and sexual desire after completing DIEAP flap surgery. de Brito et al.²⁷ demonstrated that the AP procedure improves sexual desire. These 2 outcomes have, in fact, been shown to have a strong association as improvements in body image specifically increase sexual desire.²⁸ Such statistical correlations and common features do to some degree validate the methodology and data of the study.

Interestingly, none of the outcomes rendered in Table 2 are significantly different between the 2 groups (apart from a trend of DIEAP flap patients being more satisfied with the appearance of the abdomen). In terms of umbilical appearance, abdominal wall muscle function, abdominal wall pain, scarring, and contour, the patient groups were equally satisfied. These results were somewhat unexpected, considering the differences in the operative technique between the 2 procedures.

Since introducing DIEAP flap surgery in 2000 at our surgical department, we have experienced that the aesthetic abdominal outcomes are to some extent different from the AP procedures. The DIEAP flap patients more commonly experience high-positioned scars (not concealed by underwear), slight umbilical displacement, and dog ear formation. Some of the patients also get a varying degree of lumbar and/or epigastric fullness due to the lack of liposuction before harvesting the flap. This can be corrected with secondary procedures; however, patients themselves do not seem to bother with these outcomes. The better part of DIEAP flap patients seen at postoperative controls are, as presented in our study, very satisfied with the abdomen.

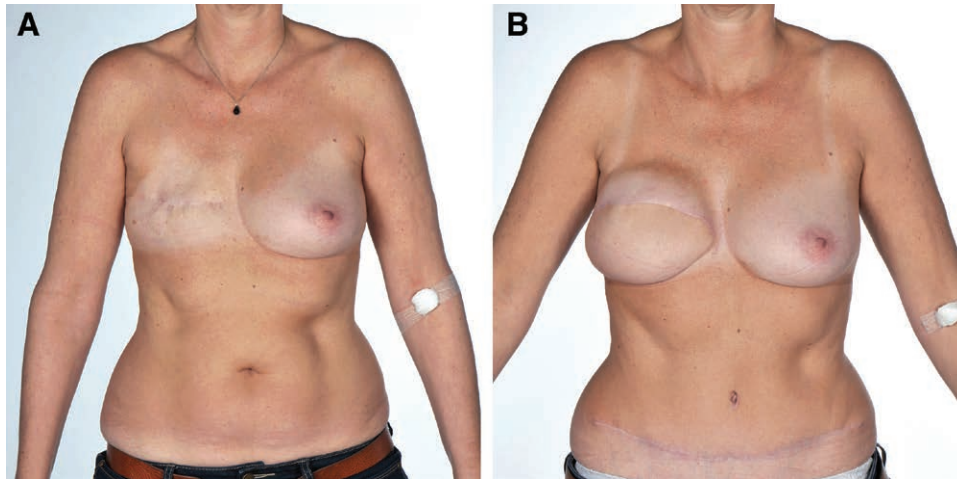


Fig. 1. Pre- and postoperative picture of DIEAP flap breast reconstructed patient. A, Preoperative picture. B, Postoperative picture showing a symmetric and slim abdomen with midline-positioned umbilicus. The scar is located above the underwear and without any dog ears. Photograph: Kari Samuelsen.

Like depicted in Figure 1, a tailored DIEAP flap donor-site closure (as described in Methods) does result in abdominal aesthetic outcomes resembling an AP.

In our opinion, the insignificant data comparing the abdominoplasty outcomes of DIEAP flap and AP surgery might be the most interesting results of the study. The data do not support the idea of progressively modifying the DIEAP flap abdominoplasty as suggested in referred literature. By achieving equally good satisfaction levels as an AP, the DIEAP flap procedure succeeds in both replacing malignant breast tissue and mimicking a tummy tuck. The results justify the description of a DIEAP flap breast reconstruction being a “two-in-one procedure”.

CONCLUSIONS

DIEAP flap patients were equally as satisfied with the abdomen as patients undergoing AP procedures. Although the DIEAP group had surgery to 2 regions (abdomen and breast), the AP group experienced a greater alteration of body image. The AP procedure had significantly greater positive effect on sexual desire. Overall satisfaction was good in both groups.

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