

A Retrospective Analysis of Outcomes Using Three Common Methods for Immediate Breast Reconstruction

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Background: Breast reconstruction outcome studies typically evaluate satisfaction, complications, or aesthetic results. Some studies report better outcomes with autologous reconstruction, whereas other studies report no difference in outcomes across multiple reconstructive methods.

Methods: The authors retrospectively studied all patients undergoing immediate breast reconstruction over a 5-year period. Questionnaires were sent to all patients to assess satisfaction; preoperative bra size, height, and weight; smoking history; radiation history; length of stay; narcotic use; and recovery time. All charts were reviewed for complications. Four blinded reviewers performed aesthetic evaluations of patient results.

Results: One hundred eighty-six consecutive immediate breast reconstruction patients were surveyed. Charts and photographs were reviewed for complication data and aesthetic results. The survey response rate was 42 percent, including 48 of 106 expander/implant patients, 13 of 28 latissimus patients, and 18 of 52 transverse rectus abdominis musculocutaneous (TRAM) flap patients. Patient satisfaction was rated as moderate or better for 93.8 percent of the expander/implant patients, 76.9 percent of the latissimus flap patients, and 83.3 percent of the TRAM flap patients. Expander/implant patients were significantly more satisfied than latissimus flap patients. Complication rates were 21.7 percent for expander/implant patients, 67.9 percent for latissimus flap patients, and 26.9 percent for TRAM flap patients. Reoperation rates were 11.3 percent for expander/implant patients, 10.7 percent for latissimus flap patients, and 5.8 percent for TRAM flap patients. Aesthetic scores were significantly higher for TRAM flap patients compared with expander/implant and latissimus flap patients.

Conclusion: High satisfaction rates were seen across all three reconstructive groups, with the highest satisfaction levels seen in the expander/implant group, despite higher reoperation rates and lower aesthetic scores for this group. (*Plast. Reconstr. Surg.* 122: 340, 2008.)

The subject of outcomes continues to gather momentum across the spectrum of health care. Although in some specialties mortality figures can be used to readily provide some objective measurement, in plastic surgery, outcomes assessment must often be more subjective. Plastic surgery outcomes are often assessed by either complication rates, patient satisfaction and quality-of-life questionnaires, or independent blinded ob-

server grading. These three different approaches are commonly used to evaluate plastic surgery results but usually not in the same study. Of those studies that have looked at breast reconstruction outcomes from more than one perspective, there is some evidence that there is good correlation between different methods of assessment.¹ In particular, poor cosmetic results or complications have correlated with patient dissatisfaction.^{2,3}

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Prior studies of breast reconstruction methods have produced somewhat conflicting results in terms of outcomes. Some studies have shown higher satisfaction rates for autologous tissue reconstruction compared with implant reconstruction.^{4,5} Others have shown no difference in satisfaction rates across different methods of reconstruction.^{2,5,7} Outcome studies specifically evaluating aesthetic results favor transverse rectus abdominis musculocutaneous (TRAM) flap reconstruction over implant reconstruction.⁸ In contrast, quality-of-life studies appear to favor implant reconstruction⁹ over TRAM flap reconstruction.¹⁰ In an attempt to resolve some of these conflicting satisfaction data, we decided to review the breast reconstruction experience at our institution in terms of patient satisfaction surveys, complication rates, and aesthetic results.

MATERIALS AND METHODS

A retrospective review of the senior author's (S.L.S.) practice was carried out for patients undergoing immediate breast reconstruction over the 5-year period from January of 2001 through December of 2005. Questionnaires adopted with permission from the Division of Plastic Surgery at Northwestern University⁵ were mailed to all patients who had undergone immediate breast reconstruction using tissue expanders, latissimus flaps, or TRAM flaps. The questionnaire asked patients to rank their satisfaction with their breast reconstruction on a scale with the categories of very disappointed, disappointed, satisfied, moderately satisfied, very satisfied, and highly satisfied. Patients were asked whether they would select the same reconstructive procedure again and whether they would recommend their reconstructive procedure to a friend. Additional data collected from the questionnaire included preoperative height, weight, and bra size; smoking history; radiation history; length of stay; recovery time; and complications. Only survey results from patients who had completed their reconstruction were included. For statistical analysis, satisfaction rates were compared using the *t* test and independent variables were evaluated using multiple regression analysis.

All patients who underwent reconstruction during the study period (including those patients who did not return surveys) had their charts reviewed for complications. These included infection, hematoma, capsular contracture, implant malposition, mastectomy skin necrosis, partial flap necrosis, donor-site skin necrosis, donor-site seroma, and reoperation. Data regarding radiation history were also collected during chart review.

Complication data were recorded and analyzed per patient rather than per procedure for bilateral reconstructions. Fisher's exact test was used to statistically compare complication rates for survey responders versus nonresponders.

Aesthetic analysis was performed using professional patient photographs with frontal and bilateral oblique views for each patient. Four blinded plastic surgery residents reviewed the photographs and scored results on a four-point scale as described previously.¹¹ A poor result was scored as 1, a fair result as 2, a good result as 3, and an excellent result as 4. The *t* test was used to analyze these data.

The senior author performs tissue expander reconstruction in a partly submuscular pocket, more recently with the assistance of acellular dermal matrix for implant coverage inferiorly. Expanders are filled intraoperatively until the skin envelope is full, typically to a volume of 200 to 400 ml. In-office expansion usually requires only one to three visits. Second-stage reconstruction includes exchange for an implant, pocket revision if necessary, and nipple reconstruction.

Latissimus and TRAM flap reconstruction is performed with or without an expander deep to the flap, depending on the patient's volume requirements. If an expander is used, it is exchanged at the second stage along with pocket revision if necessary and nipple reconstruction. TRAM flap reconstruction is performed as either a muscle-splitting pedicled flap or a free TRAM flap. Abdominal closure and rectus diastasis are typically reinforced with mesh.

RESULTS

One hundred eighty-six patients were identified who underwent immediate breast reconstruction by the senior author from 2001 to 2005. All charts were reviewed and all patients were sent surveys; no patients were excluded. Patients were divided into three groups: the expander/implant group, the latissimus flap group, and the TRAM flap group. Of the 186 patients, 106 (57 percent) were in the expander/implant group (47 simultaneous bilateral expander/implant reconstructions, four bilateral expander/implant reconstructions performed at separate times, 54 unilateral expander/implant reconstructions, and one bilateral implant reconstruction without expanders).

Twenty-eight patients (15 percent) were in the latissimus group (17 unilateral latissimus with expander reconstructions, six bilateral latissimus with expander reconstructions, three unilateral latissimus with expander reconstructions with simul-

taneous contralateral expander reconstructions, one unilateral latissimus with implant reconstruction, and one unilateral latissimus reconstruction without an expander or implant). Fifty-two patients (28 percent) were in the TRAM flap group (26 single-pedicled unilateral reconstructions, one double-pedicled unilateral reconstruction, seven pedicled bilateral reconstructions, 10 free unilateral reconstructions, six free bilateral reconstructions, and two unilateral single-pedicled reconstructions with an expander).

Eight patients in the expander/implant group later proceeded with flap reconstruction (four elected to convert to flaps and four others required flaps because of a complication). Only two patients who elected to proceed with latissimus flaps completed surveys. Satisfaction scores for those two patients were kept in the expander/implant group. However, the aesthetic scores for all eight patients were excluded to avoid confusion between reconstruction groups.

Survey Results

Seventy-nine (42 percent) of the 186 surveys were returned: 48 of 106 (45 percent) expander/implant patients, 13 of 28 (46 percent) latissimus flap patients, and 18 of 52 (35 percent) TRAM flap patients. The interval from the time of the initial reconstruction surgery until the return of the survey questionnaires ranged from 12 to 67 months, with a mean of 37 months. Survey results are summarized in Table 1.

Preoperative bra cup sizes for patients in the three types of reconstruction groups were compared by converting cup size to a numerical scale (A = 1, B = 2, C = 3, D = 4, and DD = 5). Body mass index and weight were compared between

reconstructive groups. A trend toward lower body mass index and weight for expander/implant patients was appreciated. Inpatient length-of-stay results were consistent with previous data.¹² Postoperative pain scores were generally lowest for expander/implant patients and highest for TRAM flap patients. Recovery time fell into an expected range (Table 1). These independent variables were all assessed using multiple regression analysis, with satisfaction as the dependent variable, but no statistically significant independent variables were identified.

Aesthetic Results

Mean aesthetic scores were 3.02 for the expander/implant group, 3.11 for the latissimus flap group, and 3.38 for the TRAM flap group. Statistical analysis revealed that the TRAM flap group had significantly higher aesthetic scores than both the expander/implant group ($p < 0.001$) and the latissimus flap group ($p = 0.009$). The latissimus and expander/implant group aesthetic scores were not significantly different from each other ($p = 0.317$). The highest and lowest scoring breast reconstructions for each group are presented in Figures 1 through 6.

Because of the potential effects that radiation may have had on aesthetic results, patients with a history of undergoing irradiation were removed and average aesthetic scores for each group were recalculated. Average scores increased for all three reconstructive groups. Average scores were 3.08 for the expander/implant group, 3.23 for the latissimus flap group, and 3.46 for the TRAM flap group. The TRAM flap group scores remained significantly higher than the expander/implant

Table 1. Breast Reconstruction Survey Patient Data

	Expander/Implant	Latissimus Flap	TRAM Flap	Total	Mean
Completed surveys	48	13	18	79	
Patients moderately to highly satisfied	45 (94%)	10 (77%)	15 (83%)	70	89%
Patients that would repeat same reconstruction	46 (96%)	12 (92%)	14 (78%)	72	92%
Recommend to friends	47 (96%)	12 (92%)	14 (78%)	73	92%
Patients with history of tobacco use	3	2	0	5	
Patients with radiation history	8	4	3	15	
Mean follow-up (mo)	35	40	37		36
Mean satisfaction score (1–6, with 6 being highest)	5.20	4.54	4.94		4.89
Body mass index	21.98	25.17	24.94		23.13
Average body weight (lb)	130	156	146		138
Average bra size	2.49	2.67	2.35		2.49
Length of stay (days)	1.76	2.67	4.67		3.03
Pain scale on POD1	6.02	6.75	7.13		6.63
Pain scale on POD7	3.45	4.25	6.06		4.58
Days to resume necessary activities	4.17	4.64	7.87		5.00
Days to return to normal activity	15.09	16.50	33.27		19.19

POD, postoperative day.



Fig. 1. Photograph of a patient from the expander/implant group with the lowest aesthetic score (1.25). Expander/implant reconstruction of the left breast was performed using a Wise pattern to reduce the skin envelope followed by irradiation. The patient also underwent a right reduction at the same time as her initial reconstruction.



Fig. 3. Photograph of a patient from the latissimus flap group with the lowest aesthetic score (1.5). This patient initially underwent bilateral lumpectomy with irradiation followed by left mastectomy and reconstruction with a pedicled TRAM flap and implant. This was all performed before the study period. During the study period, this patient underwent right mastectomy and reconstruction with a latissimus flap and expander followed by exchange to implant.



Fig. 2. Photograph of a patient from the expander/implant group with the highest aesthetic score (4). Bilateral breast reconstruction with expanders/implants was performed.



Fig. 4. Photograph of a patient from the latissimus group with the highest aesthetic score (4). Left breast reconstruction with a latissimus flap and expander and a right breast augmentation for symmetry. She had a composite nipple reconstruction.

scores ($p < 0.001$). Comparison of the other groups revealed no statistical significance.

Complications

Complication data were obtained from chart review of all 186 patients in the study. Reconstructive groups (expander/implant, latissimus, and TRAM flaps) were compared with each other. In addition, complication data for each reconstructive group were separated into survey responders

and nonresponders to assess for bias that may have affected the survey results. Follow-up time from the time of initial surgery to chart review was an average of 45 months, with a range of 20 to 74 months. Complications data are summarized in Table 2.

Information regarding irradiation history was collected during chart review (Table 2). The chart



Fig. 5. Photograph of a patient from the TRAM flap group with the lowest aesthetic score (1.75). Free TRAM flap reconstruction was performed, which was complicated by a hematoma and partial flap necrosis treated with debridement and wound care. She also underwent right mastopexy for symmetry.



Fig. 6. Photograph of a patient from the TRAM flap group with the highest aesthetic score (4). Right nipple-sparing mastectomy with a single pedicled TRAM flap breast reconstruction was performed.

notes did not explicitly state whether irradiation was before, during, or after reconstruction in every chart; therefore, no distinctions were made in reporting these data.

Overall, there were 56 patients with complications of the 186 patients, for a total complication rate of 30.1 percent. Of these 56 patients, 23 were in the expander/implant group, 19 were in the latissimus flap group, and 14 were in the TRAM flap group, resulting in complication rates of 21.7, 67.9, and 26.9 percent, respectively. The majority of these complications did not require reopera-

Table 2. Complications Data*

	Infection (%)	Hematoma (%)	Capsular Contracture (%)	Implant Malposition (%)	Mastectomy Skin Necrosis (%)	Partial Flap Necrosis (%)	Donor-Site Skin Necrosis (%)	Donor-Site Seroma (%)	Total Complications (%)	Complications Requiring Reoperation (%)	Total Patients	History of Irradiation
Expander/implant responders	1 (2.1)	0	0	1 (2.1)	7 (14.6)	N/A	N/A	N/A	9 (18.8)	3 (6.3)	48	8
Expander/implant nonresponders	5 (8.6)	3 (5.2)	3 (5.2)	1 (1.7)	2 (3.4)	N/A	N/A	N/A	14 (24.1)	9 (15.5)	58	10
Expander/implant total	6 (5.7)	3 (2.8)	3 (2.8)	2 (1.9)	9 (8.5)	N/A	N/A	N/A	23 (21.7)	12 (11.3)	106	18
Latissimus flap responders	0	0	0	0	0	0	0	7 (53.8)	7 (53.8)	1 (7.7)	13	4
Latissimus flap nonresponders	0	0	1 (6.7)	1 (6.7)	1 (6.7)	1 (6.7)	0	8 (53.3)	12 (80.0)	2 (13.3)	15	2
Latissimus flap total	0	0	1 (3.6)	1 (3.6)	1 (3.6)	1 (3.6)	0	15 (53.6)	19 (67.9)	3 (10.7)	28	6
TRAM flap responders	0	0	0	0	1 (5.6)	0	1 (5.6)	2 (11.1)	4 (22.2)	0	18	3
TRAM flap nonresponders	0	1 (1.9)	0	0	1 (2.9)	3 (8.8)	1 (2.9)	4 (11.8)	10 (29.4)	3 (8.8)	34	4
TRAM flap total	0	1 (1.9)	0	0	2 (3.8)	3 (5.8)	2 (3.8)	6 (11.5)	14 (26.9)	3 (5.8)	52	7
All patients	6 (3.2)	4 (2.2)	4 (2.2)	3 (1.6)	12 (6.5)	4 (2.2)	2 (1.1)	21 (11.3)	56 (30.1)	18 (9.7)	186	31

*Data are reported per patient (not per procedure).

tion. Nonoperative complications included seromas of the donor site treated with serial aspiration (21 patients), mastectomy skin necrosis treated with wound care (10 patients), donor-site skin necrosis treated with wound care (two patients), flap skin necrosis treated with wound care (three patients), and one patient with infection treated with oral antibiotics. One patient with capsular contracture refused reoperation.

The remaining 18 patients had complications that required additional unanticipated surgery. The total reoperation rate was 9.7 percent. By reconstructive procedure, the reoperation rates were 11.3 percent for the expander/implant group, 10.7 percent for the latissimus flap group, and 5.8 percent for the TRAM flap group.

Of the 106 expander/implant patients, 12 (11.3 percent) required additional surgery. Two hematomas required surgical drainage. One of these patients later required a latissimus flap. Two patients developed necrosis of the mastectomy skin flaps requiring surgical excision and closure. Four patients developed infection of the expander. One had the expander replaced. One had the expander removed. Two infected patients were treated with intravenous antibiotics with salvage of the implants. However, both of these patients had a history of irradiation and eventually required latissimus flaps. The remaining four reoperation patients in this group had a variety of complications (one rotated implant, one capsular contracture after irradiation, one malpositioned implant requiring capsulorrhaphy, and one patient that opted for bilateral latissimus flaps with expanders at her second stage with subsequent infection of one expander requiring removal).

Of the 28 latissimus patients, three (10.7 percent) required additional surgery. One developed implant malposition requiring capsulorrhaphy. One had a malpositioned nipple-areola complex requiring a transposition flap. One had a mastopexy.

Of the 52 TRAM flap patients, three (5.8 percent) required additional surgery. One developed a hematoma. One had a bilateral mastopexy. One had partial flap necrosis requiring debridement. There were some additional patients with small areas of fat necrosis, but these patients were treated with excision of the areas of fat necrosis during the second-stage nipple reconstruction procedure.

Complication rates and reoperation rates were lower for the survey responder groups compared with the nonresponder groups for all three recon-

structive procedure groups (Table 2). However, these differences were not statistically significant.

DISCUSSION

The technique and results of immediate breast reconstruction continue to change. The results are also necessarily institution- and even surgeon-specific. Our hypothesis in pursuing this review was that comparable results in terms of patient satisfaction, complications, and aesthetic results existed across all methods of reconstruction in our practice.

Review of other studies for breast reconstruction reveals a fairly wide spectrum of satisfaction and aesthetic results. Most studies have consistently high satisfaction and aesthetic results for TRAM flap reconstructions. However, these studies appear to differ from each other in outcomes for device reconstructions. Alderman et al.⁴ prospectively studied 212 patients as part of the Michigan Breast Reconstruction Outcomes Study. They reported that 78 percent of TRAM flap patients were generally satisfied compared with 61 percent of expander/implant patients. They also reported that “aesthetic satisfaction” was 75 percent for TRAM flap patients compared with 40 percent for device patients. Saulis et al.⁵ retrospectively surveyed 172 patients in Chicago, Illinois. They reported that TRAM flap patients were significantly more satisfied than expander/implant patients. Kroll and Baldwin⁸ retrospectively studied 325 patients in Houston, Texas. Aesthetic scores were significantly higher for TRAM flap patients compared with expander/implant patients.

In contrast, other studies suggested that patients are equally satisfied with device reconstruction compared with TRAM flap reconstruction. Tzafetta et al.⁶ retrospectively studied 67 patients from the United Kingdom. They reported an overall satisfaction rate of 89.6 percent across all reconstructive groups, and no significant differences were noted. In addition, the patients in this study self-reported aesthetic scores, and no significant differences were found between reconstructive groups. Andrade et al.² retrospectively surveyed 206 patients in Toronto, Canada. Satisfaction rates were 89 percent for autologous tissue reconstruction patients compared with 87 percent for expander/implant patients. Fogarty et al.⁷ surveyed 57 patients in Ireland. On a scale of 1 to 10, the mean satisfaction score was 6.7 for the TRAM flap group compared with 7.3 for the expander/implant group.

This wide range of satisfaction with device reconstruction highlights the concept that out-

comes are center-specific and perhaps even surgeon-specific. Therefore, good or bad outcomes seen at one center or by one surgeon should not be automatically generalized across multiple other centers and surgeons. Of note, the studies conducted in the United States^{4,5} demonstrated much lower satisfaction rates with device reconstruction compared with studies conducted in other countries.^{2,6,7} This may be partly related to the wider variety of devices available in other countries compared with the United States.

Our satisfaction rate for device reconstruction was 93.8 percent, higher than any of the studies mentioned above. We believe that it is generally more difficult to get quality aesthetic results with devices compared with autologous tissue. Presumably, our device reconstruction patients remained satisfied because of their rapid recovery and low pain scores, despite needing more reoperations. Certain technical details likely contribute to the high satisfaction, good aesthetic results, rapid recovery, and low pain scores seen in these patients. Specifically, we avoid elevation of the serratus muscle, we use acellular dermal matrix to define the inframammary fold, and we add a significant volume to the expander intraoperatively. We also make use of a wide variety of breast implants, including both round and anatomical, depending on the requirements of the situation.

Our complication data compare favorably with other studies. The Michigan Breast Reconstruction Outcomes Study reported a total complication rate for immediate expander/implant reconstructions of 52 percent, with a major complication rate in this group of 46 percent.¹ Their total complication rate for immediate TRAM flap reconstructions was 56 percent, with a major complication rate of 36 percent. In comparison, our total complication rate for expander/implant reconstructions was 21.7 percent, with a reoperation rate in this group of 11.3 percent. For TRAM flap reconstructions, our total complication rate was 26.9 percent, with a reoperation rate of 5.8 percent. Of note, the Michigan study reported data per procedure, which is in contrast to our study, which reported data per patient. Had we converted our data to per procedure, our complication rates would have been even lower.

It has been our perception that patient selection plays an important role in achieving fewer complications, better aesthetic results, and improved patient satisfaction. In particular, we believe that thin patients are better candidates for expander/implant reconstruction and heavier patients are better suited for latissimus or TRAM flap

reconstruction. This bias is represented in our survey data (Table 1).

Studies of outcomes in patients undergoing expander/implant reconstruction with radiation therapy have generally shown that these patients experience higher complication rates with lower satisfaction rates and poor aesthetic results.¹⁴⁻¹⁶ This did not appear to be the case in our patient population. Eighteen patients in the expander/implant group had a history of irradiation. However, only four of these patients required reoperation. All four patients received a latissimus flap to treat postirradiation capsular contracture or skin necrosis. None of these patients developed an infected or exposed implant. This suggests that expander/implant reconstruction in the setting of irradiation can be safe in carefully selected patients.

Surprisingly, smoking did not have a major effect on outcomes. Of the five active smokers that returned surveys, only one had a complication (mastectomy skin flap necrosis in the expander/implant group requiring excision and closure in the office).

The complication data for this study were separated into survey responders and nonresponders. The assumption is that nonresponders probably had more complications with their reconstruction and were potentially less satisfied. This appeared to be true. For each reconstructive group, the total complication rates and reoperation rates were higher for the nonresponders (Table 2), but these differences in complication rates between responders and nonresponders were not statistically significant. This certainly suggests some selection bias in the survey results. This bias is true for all surveys that have less than a 100 percent response rate. However, our response rate is particularly low, which may have left out patients who were less satisfied, leading to higher satisfaction survey results in each of the reconstructive groups in this study.

CONCLUSIONS

High satisfaction, low reoperation rates, and good aesthetic results are achievable with all three breast reconstruction techniques evaluated in this study. Our data and other reports, particularly from Western Europe, demonstrate that it is common to achieve consistently excellent aesthetic results, satisfied patients, low unanticipated reoperation rates, and a low frequency of complications in expander/implant breast reconstructions despite the fact that, on average, TRAM flap patients can achieve better cosmetic results. We be-

lieve that there are three critical factors at play here. First, the surgeon needs to match the procedure to the patient. Women who are younger, busy, smaller breasted, lighter, and undergoing bilateral reconstruction are more likely better candidates for prosthetic reconstruction compared with women that are older, less busy, larger breasted, heavier, and undergoing unilateral reconstruction. Second, the patient needs to be as well informed as possible about the options including the pluses and minuses of each. Third, surgeons must be skilled at each of the options they provide. Although this may be obvious in the case of microsurgical and other flap reconstruction techniques, it is even truer in the case of prosthetic reconstructions, which can be far more difficult than they appear.

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