Assessing the Influence of Failed Implant Reconstruction on Patient Satisfaction and Decision Regret after Salvage Free-Flap Breast Reconstruction

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Abstract

Background Free-flap breast reconstruction after failed implant reconstruction is associated with improved patient outcomes. How the level of satisfaction achieved compares between patients with and without previously failed implant reconstruction remains unknown. The aim of this study was to assess the influence of prior failed implant-based reconstruction on long-term patient-reported outcomes after free-flap breast reconstruction.

Methods All patients undergoing free-flap breast reconstruction between 2015 and 2019 were identified. Patient satisfaction using the BREAST-Q and decisional regret using the Decision Regret Scale were compared between patients with and without a history of implant breast reconstruction.

Results Overall, 207 patients were contacted and 131 completed the BREAST-Q and Decision Regret Scale. A total of 23 patients had a history of failed implant-based reconstruction requiring free-flap-flap salvage, most commonly due to infection (39.1%), chronic pain (34.8%), capsular contracture (26%), and implant malposition (26.1%). Following definitive free-flap reconstruction, patients with prior failed implant reconstruction had significantly lower BREAST-Q scores for satisfaction with breast (61.2 ± 16.7 vs. 70.4 ± 18.7; $p = 0.04$) and sexual well-being (38.5 ± 18.2 vs. 52.8 ± 24.7; $p = 0.01$) and reported higher decision regret (19.1 ± 18.6 vs. 9.6 ± 15.6, respectively). There were no significant differences for psychosocial well-being ($p = 0.67$), physical well-being (chest; $p = 0.27$), and physical well-being (abdomen; $p = 0.91$).

Conclusion A history of failed implant-based reconstruction is associated with reduced satisfaction and increased decision regret with the final reconstructive outcome. This data underscores the importance of appropriate patient selection at the initial consultation, and informed preoperative counseling regarding long-term outcomes in patients presenting for free-flap reconstruction after a failed implant-based reconstruction.

Keywords
- breast reconstruction
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- breast cancer
- BREAST-Q

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Implant and free-flap breast reconstruction result in improved psychosocial, physical, and sexual well-being in women who have undergone mastectomy.[1] While implant-based reconstruction accounts for approximately 70% of breast reconstruction performed in the United States,[2,3] complications such as chronic pain, capsular contracture, malposition, and infection may result in up to 15 to 20% of patients undergoing a conversion of their implant-based reconstruction to a free-flap reconstructive option.[4–7] Advances in microsurgical reconstruction have allowed for the increased utilization of perforator flaps for free-flap breast reconstruction, resulting in low rates of donor site morbidity and complications, and sustained long-term satisfaction and well-being.[1] However, the influence of prior implant reconstruction on patient satisfaction and decisional regret after free-flap breast reconstruction has yet to be thoroughly explored.

Previous studies have shown that free-flap breast reconstruction after failed implant reconstruction leads to improved patient outcomes.[5–7] More specifically, Coriddi et al compared outcomes in patients who had BREAST-Q scores available for both the implant and autologous phase of reconstruction, demonstrating that patients who underwent autologous reconstruction after failed implant reconstruction experienced significant improvement in satisfaction with their breasts, psychosocial well-being, and physical well-being.[6] However, the degree of satisfaction achieved after failed implant-based reconstruction as compared with a patient with no prior implant reconstruction remains unknown.[8] The aim of this study was to assess how patient satisfaction and decision regret after free-flap breast reconstruction differ between patients with and without a history of prior failed implant reconstruction. We hypothesized that a history of failed implant reconstruction would be associated with reduced satisfaction and increased decision regret with the final reconstructive outcome.

Methods

Study Design

A retrospective review was performed on adult female patients who underwent mastectomy and free-flap breast reconstruction from 2015 to 2019 at Duke University Medical Center. Patients were categorized into two cohorts as follows: (1) patients with no history of breast reconstruction prior to their definitive free-flap reconstruction, and (2) patients who had a history of implant-based breast reconstruction prior to their definitive free-flap reconstruction. Exclusion criteria included patients who did not undergo free-flap breast reconstruction and those with missing information. Overall, 334 patients were eligible for inclusion, and a total of 207 patients were able to be contacted via telephone to participate. Those who consented to the study were e-mailed a link to complete the postoperative BREAST-Q[9] reconstruction survey and Decision Regret Scale[10] using the Research Electronic Data Capture software.[11] The BREAST-Q has separate preoperative and postoperative modules for each type of breast surgery, including breast reconstruction. In the postoperative version, BREAST-Q scales are provided which correspond to the following five satisfaction domains: (1) psychosocial well-being, (2) sexual well-being, (3) satisfaction with breast, (4) physical well-being (chest), and (5) physical well-being (abdomen).[12] This allows for the quantification of patient satisfaction on a numerical scale of 0 (the worst) to 100 (the best) following breast reconstruction. The Decision Regret Scale is a five-item questionnaire designed to measure regret after health care decisions. Respondent scores are converted to a scale of 0 (the least regret) to 100 (the most regret), allowing for a measurement of decisional regret following surgery.[13]

Definition of Variables

Independent variables analyzed in this study included age at mastectomy, follow-up time, race/ethnicity, body mass index (BMI), diabetes, tobacco use, education level, income level, employment status, insurance status, genetic mutation, tumor type, tumor stage, hormone receptor status, human epidermal growth factor receptor-2 (HER-2) status, chemotherapy timing, radiation timing, and type of mastectomy. Specific reconstructive variables included for analysis were free-flap type, timing of free-flap reconstruction (i.e., immediate and delayed), total number of surgeries, and number of revisions, excluding nipple–areolar reconstruction or tattooing. For patients who underwent reconstructive surgery prior to their definitive free-flap reconstruction, the number of surgeries prior to free-flap reconstruction, previous reconstruction type (i.e., implant or autologous), and reasons for undergoing free-flap reconstruction were collected. Failed reconstruction was defined as a previously completed implant-based reconstruction which required salvage due to reasons of infection, extrusion, capsular contracture, pain, or patient dissatisfaction with the physical or esthetic outcome of the reconstructed breast. Postoperative complications of interest included surgical site infections, wound healing complications, return to the operating room, and flap loss. Surgical site infections of the breast included any infection that required oral or intravenous antibiotics with or without surgical intervention. Complications were defined as major (requiring reoperation or hospital admission) and minor (managed as an outpatient). The primary outcome of interest was to assess the influence of prior failed implant reconstruction on patient satisfaction and decision regret following definitive free-flap breast reconstruction.

Statistical Analysis

Demographic and clinical characteristics were summarized with numbers and percentages for categorical variables and mean (standard deviation) for continuous variables stratified by history of reconstructive surgery (no history of implant reconstruction vs. history of implant reconstruction). For patient-reported outcomes using the BREAST-Q and Decision Regret Scale, scaled scores (0–100) were calculated and used for all comparisons. Differences based on reconstruction history were tested using the Chi-square test for

categorical variables, and the analysis of variance (ANOVA) or Kruskal–Wallis test for continuous variables, as appropriate. A p-value of <0.05 was considered significant, and no adjustments were made for multiple comparisons. Univariate and multivariable linear regressions were used to estimate the effect of total number of surgeries on BREAST-Q scores and decision regret scores, after adjustment for confounders. All data analysis was performed with JMP (Version 13, SAS Institute Inc., Cary, NC).

Results

Characteristics of the Study Population

A total of 207 patients were contacted via telephone and asked to complete the survey. Overall, 131 patients completed the BREAST-Q and Decision Regret Scale. Out of all respondents who underwent free-flap breast reconstruction, 23 (18%) had a history of prior implant reconstruction and 108 (82%) had no history of breast reconstruction prior to the definitive free-flap procedure. The baseline unadjusted patient characteristics categorized by the presence of a prior implant reconstruction are shown in ►**Table 1**. Overall, patients were of white race, nonobese, nonsmokers, have a college degree, an income level of >$100,000, be employed for full time, and have private insurance. The oncologic characteristics of the patient cohort are shown in ►**Supplementary Table S1** (available in the online version). Overall, the stage of breast cancer and receipt of adjuvant chemotherapy and radiation therapy varied significantly among the groups. Patients with a history of implant reconstruction had a higher overall stage ($p = 0.004$) as compared with those with no prior implant reconstruction and were more likely to have undergone adjuvant chemotherapy ($p < 0.001$) or radiation therapy ($p < 0.001$). There were no differences in tumor type, hormone receptor status, HER-2 status, or receipt of neoadjuvant chemotherapy. Considering surgical characteristics, most patients underwent a simple mastectomy ($n = 75$, 59.1%), received a deep inferior epigastric artery perforator (DIEP) flap for definitive reconstructive surgery ($n = 116$, 88.6%), underwent a unilateral reconstruction ($n = 66$, 50.4%), and a delayed form of free-flap reconstruction ($n = 53$, 40.5%; ►**Table 2**). Among those who had a history of implant breast reconstruction, patients underwent a mean (standard deviation [SD]) of 2.3 (± 1) surgeries prior to the definitive free-flap procedure. In addition, patients with a history of implant reconstruction underwent a higher number of total surgeries throughout their complete reconstructive course (prior implant reconstruction 5.0 ± 1.6 vs. no prior implant reconstruction 2.8 ± 1.0; $p < 0.001$). There were no differences in the number of revision procedures after the definitive free-flap reconstruction ($p = 0.11$). Among patients with a history of breast reconstruction, the most common reasons for converting to a free-flap reconstruction included infection (39.1%), chronic pain (34.8%), capsular contracture (26%), and malposition of the implant (26.1%; ►**Table 3**). The mean (SD) follow-up time for the study cohort was 37 (± 18) months.

BREAST-Q Scores Compared Across the Study Cohort

The BREAST-Q was used to compare patient satisfaction between those who did or did not have a history of implant reconstruction (►**Table 4** and ►**Fig. 1**). Patients who had a history of implant reconstruction displayed significantly lower scaled scores for the BREAST-Q domains of satisfaction with breast (prior implant reconstruction 61.2 ± 16.7 vs. no prior implant reconstruction 70.4 ± 18.7; $p = 0.04$) and sexual well-being (prior implant reconstruction 38.5 ± 18.2 vs. no prior implant reconstruction 52.8 ± 24.7; $p = 0.01$). There were no significant differences between the two groups with respect to BREAST-Q scores for psychosocial well-being ($p = 0.67$), physical well-being (chest; $= 0.27$), and physical well-being (abdomen; $p = 0.91$). Given the difference in total number of surgeries between those with and without a prior implant reconstruction, we then assessed how number of surgeries impacted BREAST-Q scores. On unadjusted univariate regression, a higher total number of surgeries was associated with worsened physical well-being (chest; Regression coefficient (RC) $= -2.2$, 95% confidence interval [CI]: -4.4, -0.8; $p = 0.04$; ►**Table 5**). In addition, increased age (RC $= 0.4$, 95% CI: 0.07, 0.8; $p = 0.02$) was associated with worsened psychosocial well-being. Not undergoing radiation therapy was associated with improved sexual well-being (RC $= 4.5$, 95% CI: 0.3, 8.7; $p = 0.04$) and physical well-being (chest; RC $= 3.5$, 95% CI: 0.4, 6.6; $p = 0.03$), respectively. Not having suffered from major complications was also associated with improved satisfaction with breasts (RC $= 4.5$, 95% CI: 0.3, 8.8; $p = 0.04$). When using multivariate regression models to adjust for effect modifiers and confounders, the association between a higher total number of surgeries and worsened physical well-being (chest) remained ($b = -2.8$, 95% CI: -5.1, -0.5; $p = 0.02$). In addition, increased age continued to be associated with worsened psychosocial well-being ($b = 0.4$, 95% CI: 0.04, 0.8; $p = 0.03$). Furthermore, the absence of radiation therapy and major complications continued to be associated with improved physical well-being (chest; $b = 3.9$, 95% CI: 0.6, 7.2; $p = 0.02$) and improved satisfaction with breasts ($b = 4.6$, 95% CI: 0.11, 9.2; $p = 0.04$), respectively (►**Table 6**).

Decision Regret Scale Scores Compared across the Study Cohort

The decision regret scale was used to assess how a history of prior implant reconstruction may influence decisional regret after free-flap breast reconstruction. Overall, patients experienced a relatively low degree of decision regret after breast reconstruction (mean $= 11.3 \pm 16.5$). However, patients who had a history of implant reconstruction displayed a significantly higher degree of decision regret after free-flap breast reconstruction as compared with those with no history of implant reconstruction (19.1 ± 18.6 vs. 9.6 ± 15.6, $p = 0.01$ respectively; ►**Table 4** and ►**Fig. 1**). Utilizing logistic regression models to assess which factors may be associated with postsurgical decision regret, unadjusted univariate regression revealed that decision regret was significantly higher in patients who underwent a higher number of total surgeries throughout their reconstructive course (RC $= 3.0$, 95% CI: 1.0, 5.0; $p = 0.003$). In addition, the absence of radiation therapy (RC $= -3.1$, 95% CI: -6, -0.3; $p = 0.03$) and the absence of

Table 1 Demographic characteristics of the cohort ($n = 131$)

	Total ($n = 131$)	Prior reconstruction ($n = 23$)	No prior reconstruction ($n = 108$)	*p*-Value
Age at mastectomy (y) Mean (SD)	54.0 (9.1)	57.6 (6.3)	53.2 (9.5)	0.04
Race/ethnicity *n* (%)				0.42
Caucasian	105 (80.8)	18 (78.3)	87 (81.3)	
African American	19 (14.6)	4 (17.4)	15 (14.0)	
Hispanic/Latino	2 (1.5)	1 (4.4)	1 (0.9)	
Other	4 (3.1)	0 (0)	4 (3.7)	
BMI (kg/m^2) Mean (SD)	29.0 (3.9)	29.1 (4.1)	29.0 (3.8)	0.93
Diabetes *n* (%)	6 (4.6)	2 (8.7)	4 (3.7)	0.35
Tobacco use *n* (%)	6 (4.6)	1 (4.4)	5 (4.6)	0.95
Education level *n* (%)				0.83
High school graduate	9 (6.9)	2 (9.1)	7 (6.5)	
Some of college	30 (23.1)	4 (18.2)	26 (24.1)	
College graduate	52 (40.0)	8 (36.4)	44 (40.7)	
Postcollegiate degree	39 (30.0)	8 (36.4)	31 (28.7)	
Income level ($) *n* (%)				0.51
$<$ 20,000	1 (0.8)	0 (0)	1 (1.0)	
20,000–39,999	11 (9.0)	1 (4.8)	10 (9.9)	
40,000–59,999	14 (11.5)	2 (9.5)	12 (11.9)	
60,000–79,999	16 (13.1)	2 (9.5)	14 (13.9)	
80,000–99,999	22 (18.0%)	2 (9.5)	20 (19.8)	
$>$ 100,000	58 (47.5)	14 (66.7)	44 (43.6)	
Employment status *n* (%)				0.34
Full time	73 (57.0)	9 (42.9)	64 (59.8)	
Part time	11 (8.6)	2 (9.5)	9 (8.4)	
Unemployed	44 (34.4)	10 (47.6)	34 (31.8)	
Insurance status *n* (%)				0.83
Private	106 (82.8)	17 (81.0)	89 (83.2)	
Medicare	18 (14.1)	3 (14.3)	15 (14.0)	
Medicaid	3 (2.3)	1 (4.8)	2 (1.9)	
Uninsured	1 (0.8)	0 (0)	1 (0.9)	

Abbreviations: BMI, body mass index; SD, standard deviation.

major complications (RC = − 5.1, 95% CI: −8.7, −1.4; $p = 0.006$) were associated with reduced decision regret. After controlling for potential confounders and covariates on multivariate analysis, total number of surgeries continued to be associated with higher decision regret ($b = 1.9$, 95% CI: 0.2, 4.0; $p = 0.04$). In addition, lack of a history of radiation therapy and the absence of major complications were associated with reduced decision regret ($b = -3.3$, 95% CI: −6.3, −0.3; $p = 0.03$) and ($b = -4.0$, 95% CI: −7.8, −0.2; $p = 0.04$), respectively (►**Table 6**).

Comparison of Complications across the Study Cohort

A higher incidence of major complications after free-flap breast reconstruction was observed among patients who had a history of implant reconstruction (34.8 vs. 14.8%; $p = 0.03$). In addition, a higher incidence of surgical site infection (26.1 vs. 8.3%; $p = 0.03$) and wound healing complications (30.4% vs. 7.4%; $p = 0.005$) were observed among patients who had a history of implant reconstruction. There was no significant difference between the two groups when assessing the

Table 2 Reconstruction characteristics and complications ($n = 131$)

	Total ($n = 131$)	Prior reconstruction ($n = 23$)	No prior reconstruction ($n = 108$)	*p*-Value
Free-flap type *n* (%)				0.19
DIEP	116 (88.6)	23 (100)	93 (86.1)	
MS-TRAM	6 (4.6)	0 (0)	6 (5.6)	
TRAM	6 (4.6)	0 (0)	6 (5.6)	
SIEA	2 (1.5)	0 (0)	2 (1.9)	
Free-flap timing *n* (%)				<0.001
Immediate	26 (19.9)	0 (0)	26 (24.1)	
Delayed	105 (80.1)	23 (100)	82 (75.9)	
Reconstruction laterality *n* (%)				0.79
Unilateral	66 (50.4)	11 (47.8)	55 (50.9)	
Bilateral[a]	65 (49.6)	12 (52.2)	53 (49.1)	
Total number of surgeries Mean (SD)	3.2 (1.4)	5.0 (1.6)	2.8 (1.0)	<0.001
Number of revisions Mean (SD)	1.4 (0.9)	1.7 (1.0)	1.4 (0.9)	0.11
Major complications *n* (%)	24 (18.3)	8 (34.8)	16 (14.8)	0.03
Minor complications *n* (%)	10 (7.6)	3 (13.0)	7 (6.5)	0.31
Surgical site infection *n* (%)	15 (11.5)	6 (26.1)	9 (8.3)	0.03
Wound complications *n* (%)	15 (11.5)	7 (30.4)	8 (7.4)	0.005
Unplanned return to the operating room *n* (%)	10 (7.6)	1 (4.4)	9 (8.3)	0.49
Follow-up time (mo) Mean (SD)	37 (18)	39 (18)	36 (18)	0.44

Abbreviations: DIEP, deep inferior epigastric artery perforator; SD, standard deviation; MS-TRAM, muscle sparing transverse rectus abdominis flap; TRAM, transverse rectus abdominis flap; SIEA, superficial inferior epigastric arery.
[a]Patients with failed bilateral implant reconstruction were converted to bilateral free-flaps.

incidence of minor complications or unplanned return to the operating room ($p > 0.05$).

Discussion

Long-term complications related to implant-based reconstruction have resulted in an increased number of women who request removal of their implants in favor of free-flap reconstruction.[14] In this study, patients who had a history of failed implant reconstruction were found to be older and to have more frequently undergone postmastectomy radiation therapy, chemotherapy, and to have a higher tumor stage, all of which are factors that have previously been associated with an increased incidence of complications following implant-based breast reconstruction.[14,15] This complication risk may be exacerbated by inappropriate patient selection, as patients with high BMIs or a history of radiation may undergo implant-based, instead free-flap, reconstruction due to geographic or insurance limitations. This may lead to eventual implant failure requiring salvage with a free-flap reconstruction.[4,16] As suggested by Albornoz et al and Roughton et al, factors, such as a greater distance to travel and government funded health care, are associated with a lower likelihood for free-flap reconstruction,[17,18] resulting in patients with medical and oncologic characteristics that best suited for a free-flap reconstruction to instead receive an implant-based option. Barriers to receiving appropriate reconstructive care may potentially be addressed with regional referral systems and training programs that emphasize regional access to microsurgical expertise. Such an emphasis would increase the likelihood that breast cancer patients have access to free-flap reconstruction when appropriate to mitigate the incidence of complications seen with implant reconstruction and preserve patient satisfaction following free-flap breast reconstruction.[17]

When counseling patients regarding treatment options for postmastectomy breast reconstruction, the benefits of reconstruction, including those achieved with salvage

Table 3 Characteristics of patients with failed implant reconstruction ($n = 23$)

	Total ($n = 23$)
Number of prior surgeries before definitive free-flap reconstruction Mean (SD)	2.3 (1.0)
Previous reconstruction type *n* (%)	
Implant-based	23 (100)
Autologous	0 (0)
Prior implant-based complications *n* (%)	
Capsular contracture	6 (26.0)
Infection	9 (39.1)
Rupture	1 (4.3)
Extrusion	4 (17.4)
Chronic pain	8 (34.8)
Malposition	6 (26.1)

Abbreviation: SD, standard deviation.

reconstruction, should be considered in the context of patient-reported outcomes. As demonstrated by Nelson at el, in the setting of free-flap breast reconstruction, patient satisfaction remains high and is preserved over an 8-year period as compared with implant reconstruction.[1] However, patient satisfaction and well-being may be partially compromised in those who experience surgical-related complications or those who undergo postmastectomy radiation therapy.[19] Regarding outcomes among the subset of patients who failed implant reconstruction and ultimately underwent free-flap reconstruction, Coriddi et al have shown that significant improvements in satisfaction and quality of life are seen as compared with levels obtained with the initial implant reconstruction.[6] However, no studies to date have assessed how a history of failed implant reconstruction may affect the level of satisfaction achieved with free-flap breast reconstruction when compared with patients without a history of reconstructive surgery. As demonstrated in our study, patients who failed implant reconstruction and required conversion to free-flap breast reconstruction experienced worse satisfaction with breasts and sexual well-being, in addition to increased decision regret with the final reconstructive outcome as compared with patients who initially underwent free-flap reconstruction. Furthermore, an increased number of total surgeries was found to be associated with a worsened physical well-being of the chest. Most patients in this study who initially underwent implant reconstruction were found to have medical and oncologic characteristics that better suited for a free-flap breast reconstruction at the index operation. Judicious patient selection, including the use of regional referral systems to facilitate access to microsurgical expertise in appropriate candidates,[17] is needed when considering the most suitable index reconstruction to preserve long-term patient satisfaction and physical well-being.

Table 4 BREAST-Q Scores stratified by occurrence of previous implant reconstruction ($n = 131$)

	Total ($n = 131$)	Prior reconstruction ($n = 23$)	No prior reconstruction ($n = 108$)	*p*-Value[a]
Satisfaction with breast				0.04
n	117	23	94	
Mean (SD)	68.6 (18.7)	61.2 (16.7)	70.4 (18.7)	
Sexual well-being				0.01
n	130	23	107	
Mean (SD)	50.4 (24.3)	38.5 (18.2)	52.8 (24.7)	
Psychosocial well-being				0.67
n	129	23	106	
Mean (SD)	69.3 (19.8)	67.6 (18.8)	69.6 (20.0)	
Physical well-being (chest)				0.27
n	129	23	106	
Mean (SD)	77.9 (18.2)	74.0 (19.9)	78.7 (17.8)	
Physical well-being (abdomen)				0.91
n	129	23	106	
Mean (SD)	72.2 (20.3)	72.6 (21.6)	72.2 (20.1)	
The Decision Regret Scale Score				0.01
n	129	23	106	
Mean (SD)	11.3 (16.5)	19.1 (18.6)	9.6 (15.6)	

Abbreviation: SD, standard deviation.
[a]Kruskal–Wallis p-value.

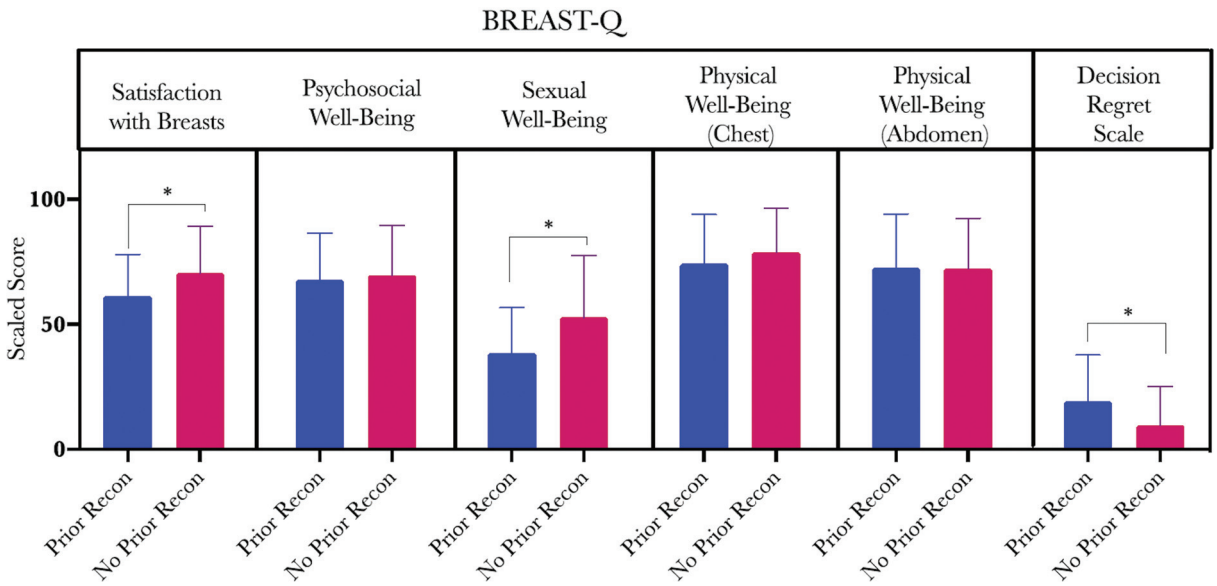

Fig. 1 A comparison between the BREAST-Q and Decision Regret Scale scores among patients with and without previous implant reconstruction following definitive free-flap salvage.

Patients who possess inadequate knowledge and lower levels of self-efficacy have been found to be at high risk for experiencing decision regret following breast reconstruction.[20–22] To prevent postsurgical regret, it is important to ensure that patients have appropriate knowledge and education about the advantages and disadvantages of each reconstructive option. As suggested by Flitcroft et al, factors most predominantly linked to increased decisional regret relate to limited access to a genuine choice, inadequate information regarding reconstructive options, and lack of tailored treatment strategies for individual patients.[23] Utilizing standardized education materials or decision aids can help ensure that patients are appropriately educated about reconstructive options, and the advantages and/or disadvantages of each reconstructive procedure, regardless of where they are receiving their oncologic care. As demonstrated in our study, patients with a history of failed implant-based reconstruction demonstrated high decisional regret with the final reconstructive outcome, despite salvage with a free-flap. Ensuring that patients who are predisposed to experiencing complications with an implant-based reconstruction possess sufficient knowledge to make a high-quality and independent treatment decision may help reduce postsurgical regret in the event of a failed reconstruction which requires salvage with a free-flap option.

Prior studies have reported that in the setting of salvage free-flap breast reconstruction, complication rates may range from 7 to 21%; however, few studies have examined how complications may compare with patients who have not had a prior implant-based reconstruction.[5,6,24] Our study finds that patients with a history of implant reconstruction experienced a higher rate of major complications following free-flap reconstruction as compared with patients with no reconstructive history. This is likely related to a patient's history of radiation therapy and multiple reconstructive surgeries prior to free-flap reconstruction. These factors may increase the risk for postoperative complications following free-flap breast reconstruction due to vascular compromise of the skin, fibrosis, inflammatory changes, and radiation skin toxicity that are often present in patients who present for salvage reconstruction following failed implant reconstruction.[25] While salvage free-flap reconstruction is a safe but challenging procedure, the higher rate of complications emphasizes the importance of appropriate patient selection for implant or free-flap breast reconstruction at the time of mastectomy to reduce the incidence of postsurgical complications, preserve patient satisfaction, and reduce decision regret following reconstructive surgery.

Limitations

This study has several limitations, many of which are inherent to its retrospective design. This study does not capture preoperative BREAST-Q scores and cannot assess how patient satisfaction changed over time or during the interval between implant and free-flap breast reconstruction. Thus, we cannot assess the baseline satisfaction and decisional regret of patients who initially had implant reconstruction and the degree to which they benefit from conversion to free-flap breast reconstruction. Furthermore, many of the patients with a failed implant-based reconstruction had their index implant-based reconstruction at an outside practice or institution and only presented to the study institution for consideration of revision or conversion. Thus, we lack information on the initial implant-based reconstruction, including details on the decision-making process to pursue an implant, as compared with a free-flap reconstruction. As noted by Velazquez et al, patient characteristics, such as an increased BMI, influence the likelihood of success with different forms of breast reconstruction and ultimately may influence patient satisfaction. Future

Table 5 Univariate linear regression model for the BREAST-Q and Decisional Regret scale scores

	Satisfaction with breast		Psychosocial well-being		Sexual well-being		Physical well-being (chest)		Physical well-being (abdomen)		Decisional regret	
	Estimate (95% CI)	*p*-Value	Estimate (95% CI)	*p*-Value	Estimate (95% CI)	*p*-Value	Estimate (95% CI)	*p*-Value	Estimate (95% CI)	*p*-Value	Estimate (95% CI)	*p*-Value
Total number of surgeries	−2.0 (−4.3, 0.3)	0.09	−2.0 (−4.4, 0.3)	0.09	−2.4 (−5.3, 0.5)	0.10	−1.5 (−4.0, 1.0)	0.23	−2.2 (−4.4, −0.8)	0.04	3.0 (1.0,5.0)	0.003
Age	0.1 (−0.2, 0.5)	0.50	0.4 (0.07, 0.8)	0.02	0.3 (−0.2, 0.74)	0.23	0.007 (−0.3, 0.4)	0.96	0.10 (−0.3, 0.5)	0.60	−0.006 (−0.3, 0.3)	0.97
BMI	−0.1 (−1.0, 0.8)	0.89	0.2 (−0.7, 1.1)	0.64	0.9 (−0.2, 2.0)	0.11	0.15 (−0.7, 1.0)	0.72	−0.7 (−1.6, 0.2)	0.12	0.4 (−0.3, 1.1)	0.28
Radiation												
Yes	Reference		Reference		Reference		Reference		Reference		Reference	
No	3.3 (−0.2, 6.8)	0.06	2.9 (−1.5, 5.4)	0.27	4.5 (0.3, 8.7)	0.04	3.5 (0.4, 6.6)	0.03	1.4 (−2.2, 5.0)	0.45	−3.1 (−6.0, −0.3)	0.03
Chemotherapy												
Yes												
No	2.7 (−0.7, 6.1)	0.11	−0.5 (−4.0, 3.0)	0.77	2.7 (−1.6, 7.0)	0.21	−0.7 (−3.9, 2.5)	0.66	−1.1 (−4.6, 2.4)	0.54	−0.8 (−3.7, 2.1)	0.60
Major complications												
Yes												
No	4.5 (0.3, 8.8)	0.04	3.6 (−0.9, 8.0)	0.11	5.1 (−0.2, 10.4)	0.06	0.8 (−3.3, 4.8)	0.71	2.1 (−2.5, 6.7)	0.36	−5.1 (−8.7, −1.4)	0.006
Minor complications												
Yes	Reference		Reference		Reference		Reference		Reference		Reference	
No	2.2 (−4.1, 8.6)	0.49	−0.4 (−7.2, 6.3)	0.90	−2.2 (−10.5, 6.0)	0.59	1.7 (−3.5, 8.8)	0.39	−1.5 (−8.1, 5.1)	0.65	0.4 (−5.2, 6.0)	0.89
Laterality												
Bilateral	Reference		Reference		Reference		Reference		Reference		Reference	
Unilateral	2.0 (−1.4, 5.4)	0.25	1.7 (−1.7, 5.2)	0.32	2.9 (−1.3, 7.1)	0.17	1.1 (−2.1, 4.2)	0.51	2.1 (−1.4, 5.6)	0.24	−0.7 (−3.5, 2.2)	0.65

Abbreviations: BMI, body mass index; CI, confidence interval.

Table 6 Multivariable linear regression model for the BREAST-Q and Decision Regret scores

Covariate	Satisfaction with breast			Psychosocial well-being			Sexual well-being			Physical well-being (chest)			Physical well-being (abdomen)			Decisional regret		
	b	95% CI	*p*-Value	*b*	95% CI	*p*-Value	*b*	95% CI	*p*-value	*b*	95% CI	*p*-Value	*b*	95% CI	*p*-Value	*b*	95% CI	*p*-Value
Number of total surgeries	−0.4	−3.0, 2.0	0.72	−1.3	−3.9, 1.3	0.32	−0.5	−3.7, 2.6	0.74	−2.9	−5.1, −0.6	0.02	−1.9	−4.6, 0.7	0.14	1.9	0.2, 4.0	0.04
Age (y)	0.2	−0.2, 0.6	0.28	0.4	0.04, 0.8	0.03	0.3	−1.9, 0.7	0.24	−0.02	−0.3, 0.3	0.90	0.07	−0.3, 0.4	0.71	0.02	−0.3, 0.3	0.88
Radiation																		
Yes	Reference			Reference			Reference			Reference			Reference			Reference		
No	3.0	−0.8, 6.7	0.11	2.5	−1.2, 6.2	0.19	4.2	−0.4, 8.8	0.07	3.9	0.6, 7.2	0.02	1.5	−2.3, 5.3	0.44	−3.3	−6.3, −0.3	0.03
Major complications																		
Yes	Reference			Reference			Reference			Reference			Reference			Reference		
No	4.6	0.11, 9.2	0.04	2.3	−2.4, 7.0	0.34	5.1	−0.6, 10.8	0.08	−0.9	−5.0, 3.2	0.66	1.0	−3.7, 5.8	0.68	−4.0	−7.8, −0.2	0.04

prospective studies examining the influence of these characteristics on patient-reported outcomes among those with previously failed implant reconstruction are needed.[26] Finally, the small sample size of patients who required conversion to a free-flap reconstruction limits the statistical power and described associations, as well as generalizability to other institutions.

Conclusion

A history of failed implant breast reconstruction is associated with increased complications, reduced satisfaction, and increased decision regret with the final reconstructive outcome as compared with patients who initially had a free-flap reconstruction. Preoperative counseling should ensure that women are able to make an independent, high-quality treatment decision prior to the index reconstructive surgery to reduce the likelihood of unmet expectations and the potential for postsurgical regret and reduced satisfaction. Overall, the findings of this study emphasize the importance of appropriate patient selection and shared decision-making when considering reconstructive options to preserve patent satisfaction and reduce decision regret after reconstructive surgery.

Conflict of Interest
None declared.

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