

Patient-Reported Outcomes in Free-Flap Breast Reconstructive Surgery over Time (PRO-BREST)

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Keywords

Breast reconstruction · Breast cancer · Quality of life · Patient-reported outcome measure · Coping

Abstract

Introduction: Patient-reported outcomes (PROMs) are increasingly relevant to assess surgical quality and guide decisions in breast reconstruction (BR). Satisfaction with outcomes may change as time progresses. We assessed satisfaction in patients who underwent free-flap BR in the last 12 years. **Methods:** All patients who underwent free-flap BR from 2006 to 2018 were invited to complete the validated BREAST-Q for reconstruction. The BREAST-Q comprises 6 domains covering various aspects of satisfaction. Unadjusted linear regression assessed the relationship between different domains of the BREAST-Q and time since BR. Two-sample *t* tests assessed differences in satisfaction between patients who underwent BR ≥ 5 years versus < 5 years prior. **Results:** Forty-three women with primary or secondary free-flap BR between 2006 and 2018 were included in the study. Most patients ($n = 33$, 76.7%) underwent DIEP flap BR. Overall satisfaction with breasts and with outcomes improved as time since BR increased ($p = 0.031$ and $p = 0.017$, respectively). Overall satisfaction with outcomes scored higher in patients with BR ≥ 5 years prior (≥ 5 years vs. < 5 years: breast score 88.6 (SD 12.5) versus 66.9 (SD 21.8); $p = 0.005$). Satisfaction with breasts and psychosocial well-being also scored higher in these patients. There was no difference in results between

primary and secondary BR. Patients who underwent additional surgery (refinements) reported higher satisfaction with outcomes and abdominal well-being. **Conclusions:** PROMs concerning satisfaction with breast and with outcomes following BR improve as time since treatment progresses. This study demonstrates that time since diagnosis may be an important factor in satisfaction. It underlines the importance of long-term PROMs related to BR, to help provide patients and health care professionals in decision-making and in managing expectations related to BR.

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Introduction

Breast cancer is the most common invasive cancer among women affecting an increasing number of women worldwide. Breast cancer incidence has been estimated around 89.7 cases per 100,000 women in Western Europe, according to the World Health Organization [1]. Many women diagnosed with breast cancer undergo mastectomy, which can lead to a range of long-term psychosocial problems including distortion of body image, decreased femininity and attractiveness, and reduced sexual desire and pleasure [2]. A study by Beugels and colleagues [3] reported that 50% of all women who underwent mastec-

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tomy experienced negative changes in self-image and sexuality. Breast reconstruction (BR) can facilitate in restoring psychosocial problems associated with mastectomy [2, 4]. Previously, women reported many reasons for undergoing BR, including the desire to improve body image and restoring feelings of wholeness and integrity [2]. Following BR, women reported higher satisfaction with their reconstructed breast(s) in comparison to women who underwent mastectomy without reconstruction [5–7].

In the last years, breast cancer survival has increased significantly due to early detection and improved treatment and more emphasis is placed on improving psychological outcomes [3, 8–10]. Furthermore, common surgical outcome measures alone such as morbidity, postoperative complications, functional results, and objective measures of cosmetic outcomes do not suffice as outcomes for breast reconstructive surgery [11, 12]. Since the overall goal of BR is to improve the appearance of the patient's breast(s) in order to attain a higher quality of life (QoL), patient-reported outcome measures (PROMs) are important markers of successful reconstructive surgery [13, 14].

The BREAST-Q for BR is a validated and well-accepted questionnaire for patient-reported satisfaction and QoL assessment [15]. Previous studies investigating patients' long-term QoL and satisfaction have revealed that satisfaction is higher following BR than in mastectomy patients who do not undergo BR [7, 16]. Complications also play an important role in patient satisfaction following BR [9, 17, 18]. However, studies investigating changes in patient satisfaction over longer periods of time are still relatively lacking, and QoL and satisfaction with outcomes may change as time since reconstructive surgery passes [19]. In this study, we aimed to assess long-term QoL and satisfaction outcomes based on PROMs in post-mastectomy patients who underwent free-flap BR between 2006 and 2018.

Methods

Materials and Methods

We performed a single-center cross-sectional cohort study investigating the QoL in women after BR. Ethical approval for the study protocol by the Swiss Cantonal Ethics Committee was obtained (BASEC No. 2018-00867). All patients provided written informed consent. The study was designed in accordance with the EQUATOR Network's recommendations on reporting patient-reported outcomes in clinical trials [20]. All female patients (18 years or older) who underwent primary or secondary free-flap BR to one or both breasts for any stage breast cancer, benign breast tumors, or for breast cancer prevention at the University Hospital of Zurich between 2006 and 2018 were invited to participate. Patients with other diseases/conditions to the breast (i.e., burns, congenital malformations, or posttraumatic breast deformities), and patients who did not return the questionnaire, did not speak German, or had an invalid address were excluded from this study.

Patients and Data Collection

Patients were enrolled from the patient and surgical records of the University Hospital of Zurich. Patients who met the inclusion criteria were invited to complete the BREAST-Q questionnaire [12] for BR (postoperative) at home. Non-responders were contacted a second time per telephone. Routinely collected data on patient-, disease-, and treatment-specific characteristics, breast-specific surgical data, complications, and photo documentation was obtained through the hospital's patient records.

Questionnaires

QoL was measured using the validated BREAST-Q questionnaire for BR module (postoperative) version 2.0, November 2017 (German version) [12]. The questionnaire consists of three QoL domains: 1) psychosocial well-being, 2) sexual well-being, 3) physical well-being, and satisfaction domains: 1) satisfaction with breast, 2) satisfaction with overall outcome, 3) satisfaction with care. Raw data from the BREAST-Q was converted using the Q-score software [12]. For each scale, a summary score (0–100) was constructed using the individual answers from each patient. This score represents the QoL and satisfaction. The higher the score, the greater the satisfaction or the better the QoL.

Statistical Analysis

Based on standard BREAST-Q scoring procedures, all scales were linearly converted to a 0–100 scale. For the statistical analysis, the breast scores in relation to time since BR were compared through unadjusted linear regression. In addition, patients were grouped according to time since BR (<5 and ≥5 years prior to receiving the BREAST-Q). We excluded domains pertaining to satisfaction with care due to the risk of recall bias. Two-sample *t* tests were used to assess differences in QoL between the two groups of patients. The significance level was fixed at 5%. Statistical analyses were performed using IBM SPSS Statistics, version 25 (IBM, Armonk, NY, USA). Frequencies of baseline characteristics between groups were compared using Fisher's exact test in R-Studio (R-Studio version 1.3.959, 2009–2020). Unknown or missing data were excluded from the analyses.

Results

After screening, 114 female patients with postmastectomy, free-flap BR between 2006 and 2018 were invited to participate in this study. Overall response rate was 37.7% ($n = 43$). Table 1 presents baseline characteristics of patients included in the study. Mean age was 53.8 years (range 33–79 years). Most patients underwent primary BR (58.1%). The mean time since BR was 3.3 years (range 0.3–12.4 years). The number of responders who underwent BR <5 years ago was 33 (76.7%) versus 10 patients who were treated ≥5 years ago (23.3%). The majority of patients underwent DIEP flap BR ($n = 33$, 76.7%). Other flap types included TRAM, ms-TRAM, SIEA, SGAP, IGAP, and TMG/TUG flaps. Type of reconstruction, free-flap type, and disease site were similar between patients treated <5 years and those treated ≥5 years ago. Approximately half of all patients underwent adjuvant hormonal therapy (55.8%) and 60.5% ($n = 26$) underwent adjuvant chemotherapy. Seventeen patients (39.5%)

Table 1. Baseline characteristics of patients included in this study

Baseline characteristics	All patients	Time since breast reconstruction		<i>p</i> value
		≥5 years	<5 years	
Patients	43	12 (27.9)	31 (72.1)	
Age (mean, range)	53.8 (33–79)	56.3 (49–70)	53.1 (33–79)	
Time since BR (mean, range)	3.3 (0.3–12.4)	7.1 (5.0–12.4)	2.1 (0.3–4.9)	
Site of disease				
Left	23 (53.5)	8 (66.7)	15 (48.4)	0.39
Right	17 (39.5)	4 (33.3)	13 (41.9)	
Bilateral	3 (7.0)	0 (0.0)	3 (9.7)	
Type of reconstruction				
Primary	25 (58.1)	7 (70.0)	18 (54.5)	0.48
Secondary	18 (41.9)	3 (30.0)	15 (45.4)	
Flap type				
DIEP	33 (76.7)	9 (75.0)	24 (77.4)	0.87
Other	10 (23.3)	3 (25.0)	7 (22.6)	
NAC reconstruction				
Yes	16 (39.0)	6 (50.0)	10 (34.5)	0.35
No	25 (61.0)	6 (50.0)	19 (65.5)	
Chemotherapy				
Yes	26 (60.5)	5 (41.6)	21 (67.7)	0.25
No	14 (32.6)	5 (41.6)	9 (29.0)	
Unknown	3 (7.0)	2 (16.6)	1 (3.2)	
Radiotherapy				
Yes	17 (39.5)	4 (33.3)	13 (41.9)	0.79
No	22 (51.2)	6 (50.0)	16 (51.6)	
Unknown	2 (9.3)	2 (16.6)	2 (6.5)	
Hormonal therapy				
Yes	24 (55.8)	7 (58.3)	17 (54.8)	0.52
No	15 (34.9)	3 (0.25)	12 (38.7)	
Unknown	4 (9.3)	2 (16.6)	2 (6.5)	
Additional elective surgery				
0	21 (50.0)	7 (58.3)	14 (46.7)	0.79
1	14 (33.3)	3 (25.0)	11 (36.7)	
2	6 (14.3)	2 (16.7)	4 (13.3)	
≥3	1 (2.4)	0 (0.0)	1 (3.3)	

Data are presented as *n* (%) unless indicated otherwise. BR, breast reconstruction; NAC, nipple-areola complex.

Table 2. Unadjusted linear regression outcomes for satisfaction and well-being domains in relation to time since breast reconstruction

BREAST-Q domain	Coefficient	<i>R</i> ²	95% CI	<i>p</i> value
Satisfaction with breast	0.33	0.11	0.22–4.23	0.031
Satisfaction with outcome	0.37	0.14	0.59–5.61	0.017
Psychosocial well-being	0.22	0.05	−0.64–3.80	0.16
Sexual well-being	1.08	0.02	−1.75–3.90	0.45
Physical well-being: chest	2.03	0.08	−0.14–4.21	0.066
Physical well-being: abdomen	3.19	0.09	−0.22–6.59	0.066

CI, confidence interval.

had adjuvant radiotherapy. There were no statistically significant differences in baseline characteristics between responding and non-responding patients (data not shown).

Using unadjusted linear regression, scores for overall satisfaction with breasts and satisfaction with outcomes

improved in relation to time since BR (regression coefficient: 0.33 and 0.37; *R*² 0.11 and 0.14; *p* = 0.031 and *p* = 0.017, respectively) (Table 2; Fig. 1a, b). There was a trend towards improved physical well-being regarding both the chest and abdomen as time since BR progressed. Results for satisfaction with breasts and satisfaction with out-

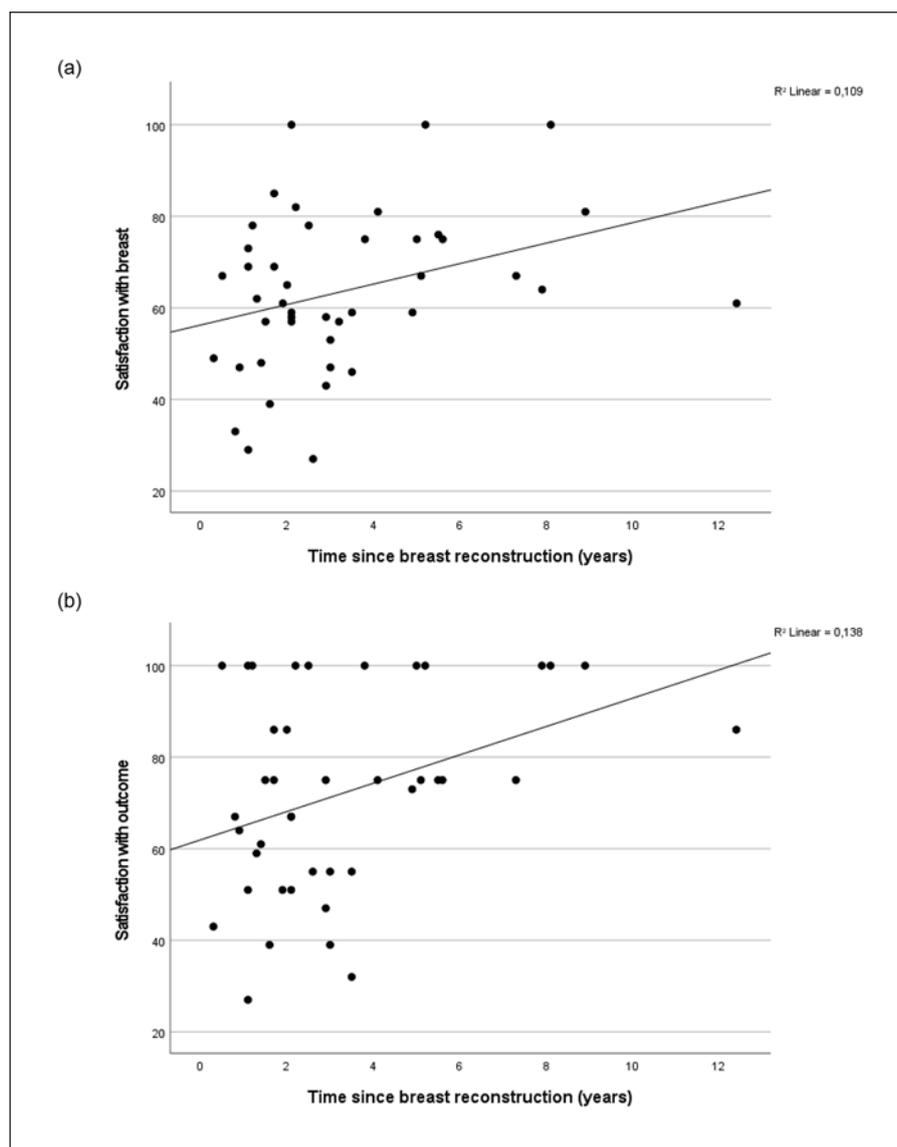


Fig. 1. Scatter plot of satisfaction with breast (a) and outcomes (b) by time since free-flap breast reconstruction.

come, as well as psychosocial well-being scored higher in patients who underwent breast reconstructive surgery ≥ 5 years ago (satisfaction with breasts: $p = 0.006$; satisfaction with outcome: $p = 0.005$; psychosocial well-being: $p = 0.016$) (Table 3; Fig. 2). Sexual well-being and physical well-being outcomes did not show differences between the two groups.

Lastly, we assessed for differences in type of reconstruction (primary vs. secondary) and for differences in outcomes based on the occurrence of complications requiring surgery. No differences in satisfaction were found between patients with primary versus secondary BR (data not shown). In addition, no statistically significant differences were found in patients who suffered complications (any type) requiring additional surgery (data not shown).

Discussion

PROMs are becoming increasingly relevant for the assessment of surgical quality in BR and to help guide clinical decision-making [12, 15]. The aim of this study was to evaluate QoL and satisfaction with outcomes over longer periods of time in postmastectomy patients who underwent free-flap BR. Overall, there is moderate evidence to support that patients who underwent BR longer ago have higher overall satisfaction with outcomes and with their breasts compared to patients who underwent surgery more recently [21]. In patients who were treated more than 5 years prior, psychosocial well-being was also found to be better when compared to patients treated more recently.

Although this study is limited by the low number of responders and by the fact that we did not adjust for multiple testing due to the explorative nature of the analyses,

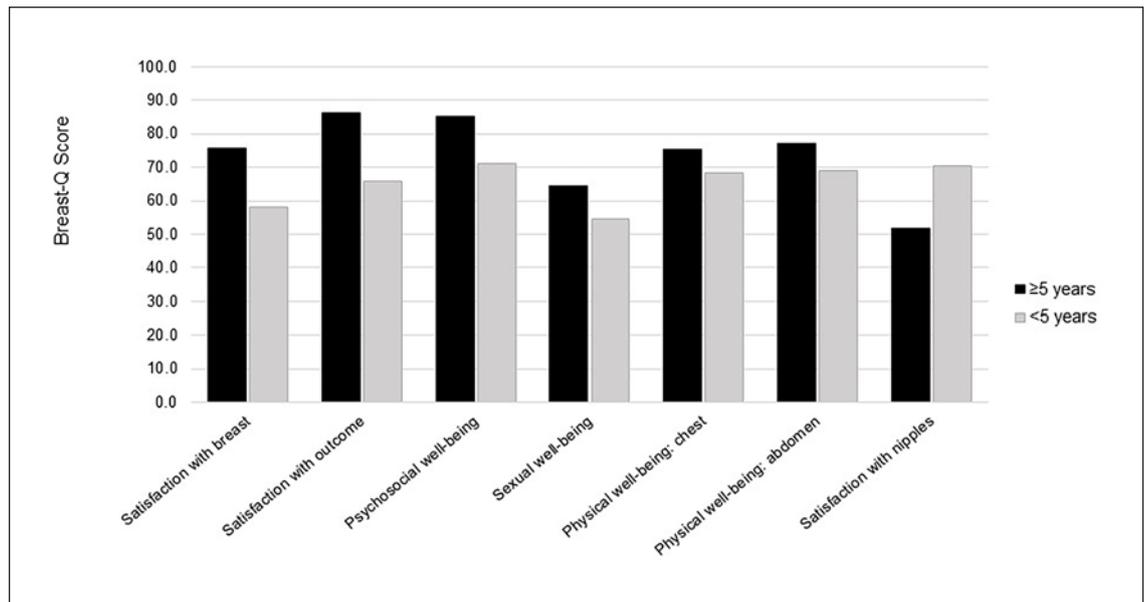


Fig. 2. BREAST-Q scores by time since free-flap breast reconstruction.

Table 3. BREAST-Q scores by time since free-flap breast reconstruction

BREAST-Q domains	Time since breast reconstruction		p value
	≥5 years	<5 years	
Satisfaction with breast	76.60 (13.77)	59.70 (16.61)	0.006
Satisfaction with outcome	88.60 (12.46)	66.94 (21.78)	0.005
Psychosocial well-being	87.80 (15.53)	72.03 (17.94)	0.016
Sexual well-being	68.10 (18.23)	54.87 (23.25)	0.11
Physical well-being: chest	77.10 (20.59)	68.42 (17.57)	0.20
Physical well-being: abdomen	76.56 (26.27)	69.77 (23.25)	0.46
Satisfaction with nipples	54.00 (33.26)	66.88 (29.14)	0.36

Data are presented as mean (standard deviation).

we observed improved satisfaction with outcomes and with breasts as time since BR progressed in both linear regression and grouped analyses. The higher satisfaction with breast scores reported by patients treated longer ago suggests that satisfaction and QoL have the potential to improve as time passes. Prior studies have also shown that QoL improves over time in cancer patients [22, 23] and also specifically after BR [24]. Our study parallels the findings by Nelson and colleagues [25] who also studied long-term satisfaction and QoL outcomes in patients who underwent autologous and implant-based BR at a single academic institution in the USA [25]. We found no differences in satisfaction outcomes between patients who underwent primary versus secondary BR. Although the majority of patients undergo primary BR due to better aesthetic results, secondary BR is sometimes preferred or required in selected patients. A previous study by Yoon and colleagues [26] investigated PROMs in immediate

and delayed BR and found no effect of timing of BR on QoL and satisfaction outcomes, even though preoperative PROMs differed significantly. These findings suggest that it is the BR itself which instigates an enhanced QoL and continues to improve over time. Long-term QoL in cancer survivors has even been reported to reach levels comparable to general population in multiple studies [23, 27, 28]. An explanation for Improved outcomes may also be associated with a response shift over time: as time passes, disease-free survivors have a more pragmatic view of the role of cancer in their everyday life [22]. The improved satisfaction with outcomes and breasts that we observed suggests that the surgery itself may not be the only relevant factor determining postoperative QoL and satisfaction. Psychological factors may also influence QoL and satisfaction, including the time that women need to adapt to the new body, as some women may feel disconnected to their breast(s) [4, 29].

Another important factor in patient well-being in the context of disease is coping. Healthy coping mechanisms such as self-regulation abilities and prevention of avoidance can improve QoL over time [29]. With time progressing after surgery, women may experience cognitive and emotional processing, which can lead to posttraumatic growth and therefore improved QoL in patients after breast reconstructive surgery [30]. The current study showed better psychosocial well-being, but not sexual well-being, in patients who underwent BR longer ago, which again is similar to the results demonstrated in the study by Nelson and colleagues [25]. Psychological interventions can have a positive impact on posttraumatic growth, thereby leading to better QoL [29]. It is well known that a breast cancer diagnosis can be a traumatic event and needs to be approached in a multidisciplinary manner [29]. In recent years, focus on psychological care for breast cancer patients has become increasingly evident and the effect of specific interventions has led to better psychological well-being in breast cancer patients [31].

In conclusion, time since BR resulted in improved PROMs such as QoL and satisfaction in patients. The current study underlines the importance of long-term PROMs related to breast cancer treatment and BR, to help provide patients and health care professionals with a realistic outlook and to facilitate managing expectations regarding BR.

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Statement of Ethics

The study protocol was approved by the Swiss Ethics Committees on research involving humans (BASEC No. 2018-00867). The study was designed in accordance with the EQUATOR Network's recommendations on reporting patient-reported outcomes in clinical trials. All patients have given their written informed consent.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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A.L.P. is a co-developer of the BREAST-Q and receives royalties when it is used in for-profit, industry-sponsored clinical trials.

Author Contributions

D.B.Y.F. contributed to the design, coordination, execution, data analysis, and publication of this study. M.O. contributed to the execution of this study and writing of the manuscript. D.B.Y.F. and M.O. contributed equally. L.H. contributed to the data analysis and editing of the manuscript. P.G. contributed to the editing and publication of the manuscript. A.L.P. contributed to the design of the questionnaires and editing of the manuscript. N.L. contributed to the treatment of patients, coordination of the study, and publication of the manuscript. All authors read and approved the final version of the manuscript.

Data Availability Statement

All data that support the findings of this study can be made available on request to the corresponding author.

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