

Patient-Surgeon Satisfaction Discrepancy following Breast Reduction Surgery: A 10-year Analysis of Aesthetic Outcomes and Quality of Life

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Background: Breast reduction surgery has been recognized for its potential to improve quality of life in patients with macromastia or after unilateral oncological treatment. However, comparative analysis of different surgical techniques remains sparse. Patient-reported outcome measures have emerged as indispensable tools in assessing patient satisfaction and postoperative outcomes. Driven by the hypothesis of substantial differences between self-reported patient outcomes and professional assessments, this study aimed to compare different technical approaches, integrating both the patients' and plastic surgeons' perspectives.

Methods: A 10-year retrospective single-center cohort study was conducted to compare patient- and surgeon-reported outcomes using pre- and postoperative BREAST-Q questionnaires and aesthetic self-assessments. Outcomes and postoperative complication rates of different technical approaches were analyzed using photographic documentation.

Results: A total of 170 patients met the inclusion criteria, of which 92 agreed to further photographic documentation for aesthetic evaluation. The median follow-up duration was 4.9 years. BREAST-Q scores significantly improved across all surgical techniques, with comparable scores in both oncoplastic and nononcoplastic patients. Notably, patients reported greater satisfaction with the postoperative aesthetic outcomes than surgeons. Multivariable analysis confirmed body mass index as a significant risk factor for postoperative complications.

Conclusions: Breast reduction surgery improves both aesthetic outcomes and long-term quality of life, regardless of surgical technique or the use of oncoplastic methods. The discrepancy between patient and surgeon satisfaction highlights the need for a patient-centered approach, such as incorporating patient-reported outcome measures to evaluate postoperative results. (*Plast Reconstr Surg Glob Open* 2025;13:e6709; doi: [10.1097/GOX.00000000000006709](https://doi.org/10.1097/GOX.00000000000006709); Published online 18 April 2025.)

INTRODUCTION

Macromastia, a condition characterized by excessively large breasts, presents a multitude of symptoms, including chronic shoulder, back, and neck pain/headache, sensory aberrations, polycystic mastitis, and cutaneous striae.^{1,2}

Conservative treatment strategies such as physiotherapy are the initial standard of care, though they offer only temporary relief for most patients.² Persistent symptoms frequently necessitate definitive surgical intervention, including resection of excess breast tissue.²

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The data used and/or analyzed during this study is available from the corresponding author upon reasonable request.

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In response to these needs, various breast reduction surgery techniques have been developed, significantly improving patients' quality of life (QoL) by addressing functional impairments and improving psychosocial well-being.¹⁻⁴ Predominantly used methods include the Hall-Findlay, Lejour, and inferior pedicle and Wise pattern skin incision techniques, with many variations adapted to patient-specific presentations.⁵⁻⁷ Despite the prevalence of these procedures, there is a notable lack of comparative research on their respective patient-reported outcomes and aesthetic assessments. Additionally, the comparative outcomes between oncoplastic and non-oncoplastic patients undergoing breast reductive surgery remain underexplored in the current literature.^{8,9} Consequently, understanding how cancer treatment influences perceived QoL is essential for optimizing patient outcomes.

Numerous studies have shown long-lasting postinterventional improvements in QoL after breast reduction surgery.¹⁰⁻¹⁵ Patient-reported outcome measures (PROMs), such as the BREAST-Q questionnaire, which encompass psychosocial, sexual, and physical well-being, alongside satisfaction with breast aesthetics, have been crucial in understanding the multidimensional impact of breast reduction surgery.^{3,10,11} However, there is a notable lack of comparison between surgeon-reported and patient-reported outcomes after reduction mammoplasty.

This study aimed to evaluate long-term satisfaction across various surgical techniques and to identify potential predictors of postoperative complications. Moreover, it directly compared the patient self-assessments with the aesthetic evaluations of independent plastic surgeons to explore any potential discrepancies in patient versus surgeon satisfaction. Finally, this study analyzed whether QoL differs between oncoplastic and nononcoplastic patients undergoing breast reduction surgery.

METHODS

Study Design

Characteristics of all patients undergoing breast reduction surgery at a tertiary referral center were entered into an encrypted database. The following inclusion criteria were then applied: female patients 18 years of age or younger with written informed consent and who underwent breast reduction surgery of any technique between January 1, 2012, and December 31, 2022, and a minimum follow-up of 3 months. All women who were pregnant or lactating, unable to complete the BREAST-Q questionnaire, and/or without informed consent were excluded from the study.

Timeline

Patients who met inclusion criteria were invited for an outpatient clinical examination with photographic documentation. They were asked to simultaneously complete the pre- and postoperative BREAST-Q and self-assessments of their postoperative aesthetic results. These self-assessments were conducted in accordance with the criteria established by Eriksen et al,¹⁶ encompassing

Takeaways

Question: Is there 1 ideal breast reduction surgery technique in terms of long-term patient satisfaction? Are patients and surgeons equally satisfied with aesthetic results?

Findings: Breast reduction surgery significantly enhances quality of life, regardless of technique, with comparable scores in both oncoplastic and nononcoplastic patients. Interestingly, patients generally reported greater satisfaction with aesthetic results than surgeons.

Meaning: The observed patient-surgeon satisfaction gap underscores the importance of integrating patient-reported outcomes in clinical practice.

evaluations of shape, size, scars, nipple-areola complex, symmetry, and the overall aesthetic result. The grading scale ranged from 1 (very bad) to 6 (very good) points per subgroup, resulting in an overall minimum score of 6 and maximum score of 36. All collected photographic documentation was subsequently evaluated by 3 independent plastic surgeons from three different breast centers to avoid bias, who used the identical aesthetic assessment scale to rate the postoperative results. Additionally, a comprehensive chart review including patient characteristics and clinical parameters, such as body mass index and postoperative complications, was performed for every patient. Finally, all complications were classified according to Clavien-Dindo.¹⁷

Statistical Analysis

Statistical analysis was conducted using R software (version 4.2.2) with a *P* value less than or equal to 0.05 indicating significance. Descriptive data analyses were performed to summarize the characteristics of the data. Qualitative data were reported with the number of observations and percentages, whereas median and interquartile range (IQR) was used for quantitative data.

BREAST-Q and Aesthetic Evaluations

The Wilcoxon signed-rank sum test allowed for comparison between pre- and postoperative BREAST-Q scores in the domains of psychosocial well-being, sexual well-being, physical well-being, and satisfaction with breasts. Linear regression analysis was independently used to examine differences in BREAST-Q scores between various breast reduction techniques. To manage the potential for false positives arising from multiple testing, the Holm-Bonferroni method was applied to control the family-wise error rate. Kendall's W and Krippendorff's

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alpha were used to determine the interrater reliability among aesthetic breast assessments between surgeons and between surgeons and the patients. Ordinal regression analysis allowed for comparison of aesthetic breast evaluations between oncoplastic and nononcoplastic patients.

Complications

Logistic regression analyses were performed to assess complications related to different surgical methods and potential risk factors. Pairwise comparisons between breast reduction methods were executed utilizing the Tukey method to adjust for multiple testing. Uni- and multivariable logistic regression models were applied to identify additional risk factors for complications. Results were reported as odds ratios (ORs) with corresponding 95% confidence intervals (CIs) and adjusted *P* values. The level of significance was set at $\alpha = 0.05$.

RESULTS

A total of 188 patients undergoing breast reduction surgery were identified, of whom 170 female patients with a median (IQR) age of 50 (35.0–60.0) years were included in this study (Table 1). Among these, 125 (73.5%) patients underwent surgery for breast hypertrophy alone, whereas 45 (26.5%) underwent oncoplastic breast reduction. Bilateral breast reduction was performed in 139 (81.8%) patients, whereas 31 (18.2%) underwent unilateral reductive surgery. In total, 88 (51.8%) patients were operated on with the Hall-Findlay technique, 45 (26.5%) with the Lejour vertical method, 24 (14.1%) with the inferior pedicle with Wise pattern skin incision, and the remaining 13 (7.6%) with other techniques. Of the 170 patients included in this study, 92 (54.1%) agreed to the photographic documentation with subsequent assessment by 3 independent plastic surgeons, among whom 31 (33.7%) were oncoplastic patients. A subgroup of 48 (28.2%) patients fully completed both BREAST-Q questionnaires and self-assessments of their perceived aesthetic outcomes, of which 19 (39.5%) were oncoplastic. The follow-up analysis was performed after a median (IQR) of 4.9 (2.5–6.9) years after surgery (Table 1).

BREAST-Q

Analysis of the BREAST-Q questionnaires revealed substantial improvements in patient-reported outcomes across all used surgical techniques, with no significant differences between techniques (Fig. 1). Interestingly, direct comparison of BREAST-Q outcomes between oncoplastic and nononcoplastic patients revealed no substantial differences, as suggested by nonsignificant *P* values in all subgroups: psychosocial well-being ($P = 0.78$), sexual well-being ($P = 0.56$), physical well-being ($P = 0.12$), and overall satisfaction with the breasts ($P = 0.15$). When compared with the aesthetic self-assessments, the BREAST-Q subcategory “overall satisfaction” demonstrated a strong association with the patients’ assessment of the nipple–areola complex ($P = 0.01$), breast symmetry ($P = 0.001$), and overall aesthetic result ($P = 0.005$). Similarly, the “sexual well-being” subgroup was significantly associated with perceived overall aesthetic results ($P = 0.05$). On the other hand, the “psychosocial well-being” and “physical well-being” subgroups did not show any significant association with the evaluated aesthetic parameters (Table 2).

Aesthetic Evaluation

In this study, more than half of all patients who completed the aesthetic self-assessments positively rated shape, size, symmetry, scarring, nipple–areola complex, and overall aesthetic result of their postoperative breasts, categorizing them as either good or very good. Notably, scarring demonstrated the lowest satisfaction rates in comparison to all other evaluated parameters (Fig. 2). Interestingly, each surgeon displayed a consistent and systematic approach to scoring, with some surgeons uniformly applying a stricter scoring style, whereas others adopted a more liberal approach. Despite differences in the absolute scores assigned by individual surgeons (Krippendorff’s alpha), substantial agreement was observed in the relative ranking of patient outcomes (Kendall’s W). Importantly, both excellent and poor results were consistently identified across evaluators, underscoring the robustness and reliability of the relative assessment of trained surgeons. However, when compared with the patient’s own assessment, only moderate agreement in relative scoring could be observed

Table 1. Patient Characteristics by Breast Reduction Method

Surgical Technique	All Patients (n = 170)	Hall-Findlay (n = 88)	Lejour (n = 45)	IPWPSI (n = 24)	Other (n = 13)	<i>P</i>
Age	50.0 (35.0–60.0)	52.5 (42.0–64.3)	43.0 (23.0–55.0)	50.5 (44.8–59.0)	47.0 (30.0–58.0)	0.03
BMI	26.4 (23.4–30.4)	27.2 (23.5–31.0)	25.0 (22.5–29.1)	28.1 (26.3–30.5)	25.5 (23.5–28.2)	0.09
Surgery duration (min)	167 (135–197)	167 (135–197)	175 (150–197)	150 (130–180)	165 (148–178)	0.71
Follow-up time (y)	4.9 (2.5–6.9)	3.1 (1.8–6.1)	8.0 (6.9–9.1)	3.9 (3.0–6.3)	6.5 (6.0–7.0)	0.003
Smoker						0.06
Yes	32 (18.8)	15 (17.0)	12 (26.7)	1 (4.2)	4 (30.8)	
No	116 (68.2)	58 (66.0)	30 (66.7)	21 (87.5)	7 (53.8)	
Missing	22 (13.0)	15 (17.0)	3 (6.6)	2 (8.3)	2 (15.4)	
Surgical site						0.43
Bilateral	139 (81.8)	68 (77.3)	38 (84.4)	22 (91.7)	11 (84.6)	
Unilateral	31 (18.2)	20 (22.7)	7 (15.6)	2 (8.3)	2 (15.4)	

Values are depicted as median (IQR) and number of observations (%). Values in italic demonstrate statistical significance ($P < 0.05$). IPWPSI, inferior pedicle and Wise-pattern skin incision.

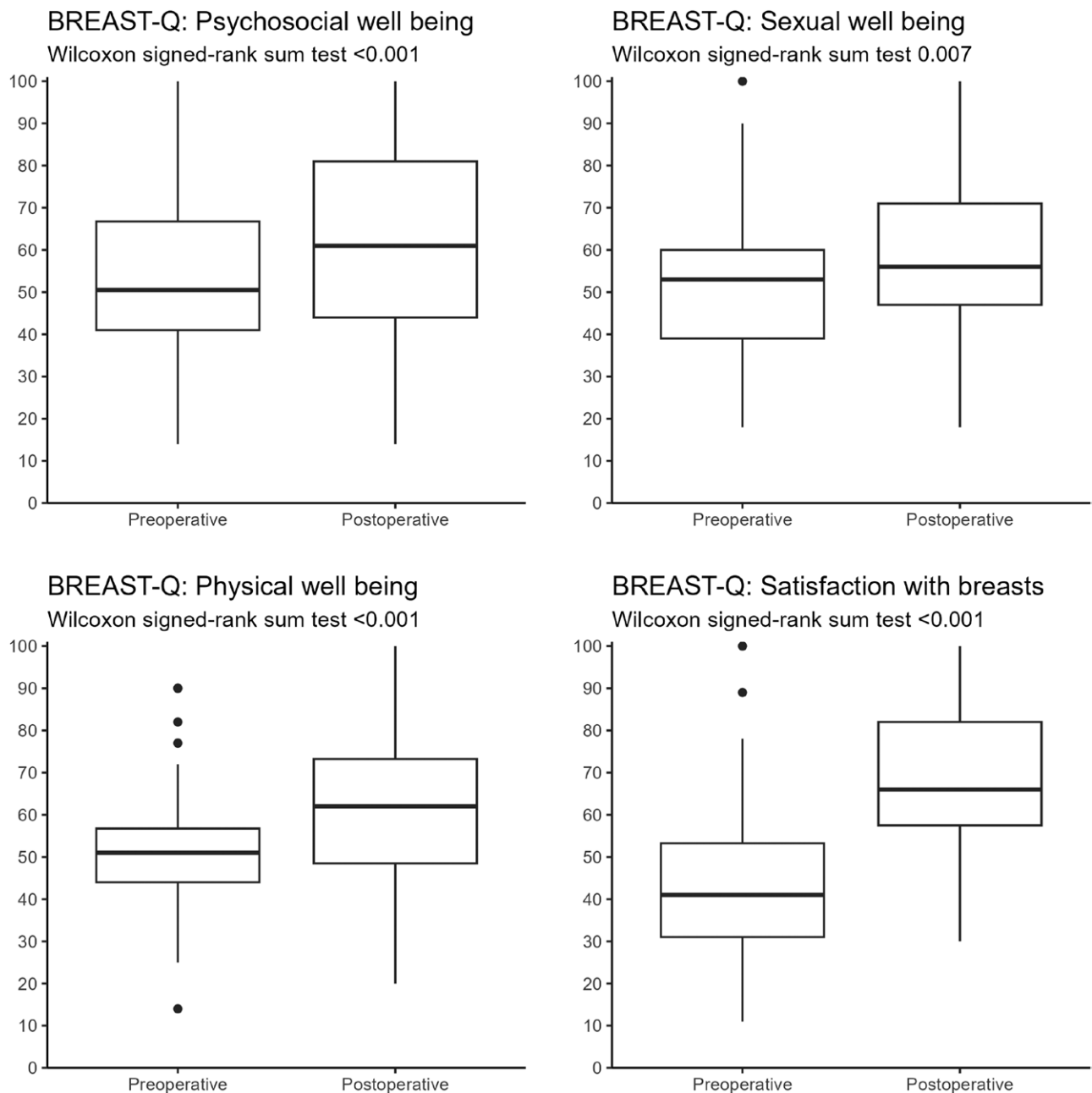


Fig. 1. Pre- and postoperative results of the BREAST-Q scores (n = 48).

(Kendall's W), indicating a substantial gap between patients' and plastic surgeons' assessments. Patients generally reported greater outcomes than the independent plastic surgeons, with the patients' postoperative satisfaction mostly being influenced by the nipple–areola complex, breast symmetry, and overall aesthetic result. (Fig. 2; Table 3).

Oncoplastic patients reported comparable aesthetic outcomes to nononcoplastic patients, with no significant differences in any of the aesthetic self-assessment subcategories (Table 4). (See figure, Supplemental Digital Content 1, which describes comparison of aesthetic evaluations in oncoplastic versus nononcoplastic

patients, <http://links.lww.com/PRSGO/D978>.) These findings were reflected by the assessments of the blinded plastic surgeons, who did not perceive significant differences in the aesthetic outcomes between both groups, with the “shape of the breasts,” “size of the breasts,” “nipple–areola complex,” “symmetry of the breasts,” and “overall aesthetic result” only achieving nonsignificant differences between both groups. Contrary to expectations, however, the oncoplastic group was noted to achieve substantially better outcomes in the “scarring of the breast” subcategory (OR 4.18, $P = 0.10$) than nononcoplastic patients, when rated by the plastic surgeons.

Table 2. Association Between Postoperative BREAST-Q Subgroups and Different Aspects of Aesthetic Self-assessments in Patients Who Completed Both Evaluations

Evaluation	<i>P</i>	Adjusted <i>P</i> *
Overall satisfaction		
Shape of the breasts	0.172	0.172
Size of the breasts	0.022	0.067
Scars of the breasts	0.03	0.067
Nipple–areola complex	0.004	0.014
Symmetry of the breasts	<0.001	0.001
Overall aesthetic result	0.001	0.005
Sexual well-being		
Shape of the breasts	0.57	1.000
Size of the breasts	0.249	1.000
Scars of the breasts	0.888	1.000
Nipple–areola complex	0.842	1.000
Symmetry of the breasts	0.498	1.000
Overall aesthetic result	0.008	0.045
Psychosocial well-being		
Shape of the breasts	0.16	0.639
Size of the breasts	0.041	0.203
Scars of the breasts	0.399	1.000
Nipple–areola complex	0.455	1.000
Symmetry of the breasts	0.549	1.000
Overall aesthetic result	0.021	0.129
Physical well-being		
Shape of the breasts	0.702	1.000
Size of the breasts	0.207	1.000
Scars of the breasts	0.443	1.000
Nipple–areola complex	0.991	1.000
Symmetry of the breasts	0.103	0.615
Overall aesthetic result	0.856	1.000

Values in italic demonstrate statistical significance ($P < 0.05$).

*Holm–Bonferroni adjustment.

Complications

In total, 49 (28.8%) patients experienced postoperative complications (Table 5). The majority (92.8%) of complications were minor and classified as Clavien-Dindo II or lower. The most frequent complications were painful or hypertrophic scarring ($n = 16$, 9.4%), hematomas ($n = 11$, 6.5%) and delayed wound healing ($n = 10$, 5.9%). No significant difference in the rate of complications could be observed between the surgical techniques. However, BMI emerged as a significant prognostic factor for the occurrence of complications in the multivariable analysis, regardless of the surgical technique ($P = 0.006$). Although resection weight and oncoplastic surgery were identified as variables of interest in the univariable model, both failed to reach statistical significance in the multivariable analysis ($P = 0.53$ and $P = 0.10$, respectively) (Table 6).

DISCUSSION

Improved Patient Outcomes

Analysis of the BREAST-Q questionnaires revealed significant improvements in patient-reported outcomes across all surgical techniques (Fig. 1), reaffirming the beneficial impact of breast reduction surgery on the QoL, regardless of the surgical approach used.

Aesthetic Assessment: Surgeons Versus Patients

Historically, the success of breast reduction surgery has solely been evaluated by surgeons and scientists, lacking the integration of PROMs, thus completely neglecting crucial aspects in the understanding of patients' postoperative QoL. Although certain surgeons were more stringent with their rating scores than others, this study identified a high degree of relative agreement among plastic surgeons in their evaluation of aesthetic outcomes. This consistency underscores the reliability and objectivity of their professional evaluations, despite inherent variability in individual scoring threshold. However, when comparing surgeons' aesthetic assessments to those reported by patients, notable discrepancies could be observed across all aesthetic evaluation subgroups. Consistent with previous studies, patients generally expressed greater satisfaction with postoperative aesthetic outcomes than surgeons (Fig. 2), regardless if oncoplastic or nononcoplastic.^{18,19} These differences in perception and priorities between patients and surgeons demonstrate that, although surgeon evaluations provide valuable technical insights, they fail to fully capture the patient-centered outcomes that define the success of breast reduction surgery. The findings of this study highlight the essential role of PROMs in providing a more complete evaluation of surgical outcomes, emphasizing the critical need for their further implementation in both scientific research and clinical practice.

Oncoplastic Versus Nononcoplastic Outcomes

Subsequent comparative analysis between oncoplastic and nononcoplastic patients revealed that those undergoing oncoplastic breast reduction reported similar satisfaction with their aesthetic outcomes compared with the nononcoplastic group (Table 4). This trend was also reflected in the plastic surgeons' evaluations, with no significant differences in aesthetic ratings between the 2 groups, highlighting the feasibility of achieving high aesthetic standards even in a reconstructive context. (See figure, Supplemental Digital Content 1, which displays comparison of aesthetic evaluations in oncoplastic versus nononcoplastic patients, <http://links.lww.com/PRSGO/D978>.)

Prior research has demonstrated clear associations with radiotherapy due to oncoplastic management and decreased QoL.^{20,21} Interestingly, and contrary to expectations, oncoplastic patients substantially outperformed the nononcoplastic group in terms of "scarring of the breast" in the objective evaluations by surgeons. This unexpected finding may possibly be attributed to the adjuvant radiotherapy associated with breast cancer treatment in oncoplastic patients, which has been shown to reduce the recurrence of keloids and minimize hypertrophic scarring.^{22–24} This positive effect is particularly noteworthy, given that the patient cohort included individuals several years after breast cancer treatment, highlighting the potential long-term benefits of radiotherapy in scar management. However, although scarring played a notable role in the objective evaluations by surgeons, it appeared to have less impact on patient-reported outcomes compared with breast form and symmetry (Table 2).

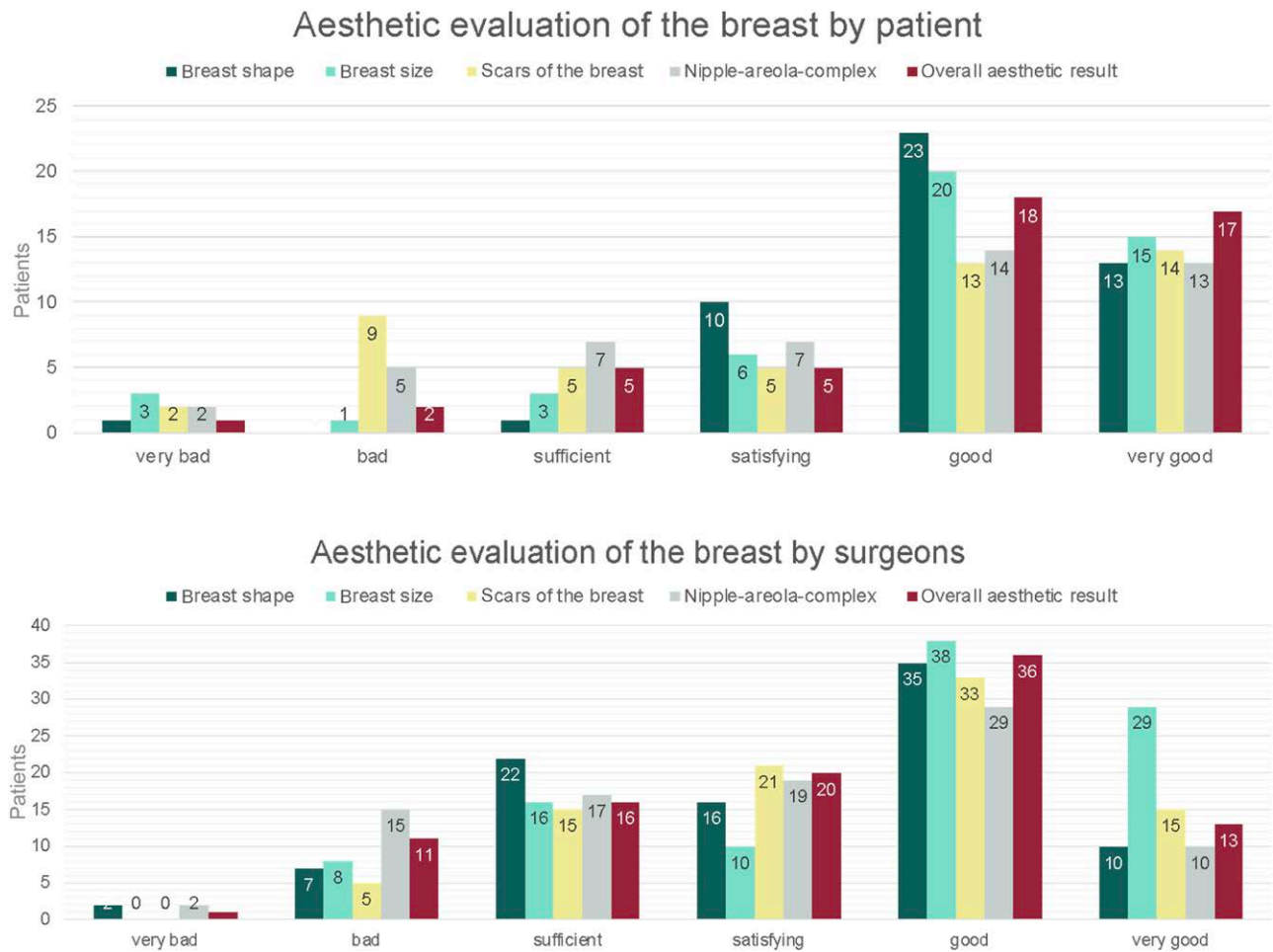


Fig. 2. Comparison of aesthetic evaluations by patients (n = 48) vs surgeons (n = 92).

Table 3. Interrater Reliability for Aesthetic Evaluations After Breast Surgery

Characteristic	n	Three Surgeons		n	Three Surgeons + Patients	
		Kendall's W	Krippendorff's Alpha		Kendall's W	Krippendorff's Alpha
Shape of the breast	92	0.62	0.02	46	0.49	0.06
Size of the breast	92	0.68	-0.03	46	0.44	-0.01
Scar of the breast	89	0.73	0.21	46	0.46	0.09
Nipple-areola complex	92	0.62	0.10	46	0.46	0.09
Symmetry of the breast	90	0.79	0.26	44	0.66	0.36
Overall aesthetics	92	0.70	0.07	46	0.49	0.05

Similarly, direct comparison of the BREAST-Q subgroups revealed no significant discrepancies in QoL between the oncoplastic and nononcoplastic groups, indicating that both groups achieved comparable improvements in QoL after breast reduction surgery. Interestingly, current literature suggests that breast cancer patients undergoing breast reductive surgery may have greater tolerance for suboptimal aesthetic outcomes, prioritizing breast preservation and oncological safety over aesthetic results, possibly due to emotionally biased preoperative expectations, which inherently shapes their satisfaction.²⁵ However, this study's results do not support this assumption, as oncoplastic patients

reported comparable levels of both aesthetic outcomes and QoL to nononcoplastic patients. Even though postoperative satisfaction and QoL may be influenced by various different factors, the results of this study clearly demonstrate that for oncoplastic patients, the aesthetic outcome also correlates with the long-term postoperative satisfaction (Table 2).

Postoperative Complications

In total, 49 (28.8%) patients experienced postoperative complications (Table 5), which is slightly higher than other, similar studies.^{26–29} Increased BMI has been identified as an important risk factor in prior

TABLE 4. Comparison of Aesthetic Outcomes Between Oncoplastic and Nononcoplastic Patients

Patient Evaluations				
Evaluation (n = 46)	OR	95% CI	P	Adjusted P
Shape of the breasts	0.32	0.11–0.96	<i>0.04</i>	0.21
Size of the breasts	0.44	0.19–1.05	0.06	0.21
Scars of the breasts	0.96	0.44–2.12	0.92	1.00
Nipple-areola complex	1.07	0.49–2.32	0.86	1.00
Symmetry of the breasts	0.20	0.05–0.74	<i>0.02</i>	0.09
Shape of the breasts	0.41	0.16–1.01	<i>0.05</i>	0.21
Surgeon Evaluations				
Evaluation (n = 92)	OR	95% CI	P	Adjusted P
Shape of the breasts	0.71	0.26–1.95	0.51	1.00
Size of the breasts	0.42	0.41–0.42	0.13	0.57
Scars of the breasts	4.18	1.32–13.25	<i>0.02</i>	0.10
Nipple-areola complex	1.61	0.71–3.68	0.26	0.78
Symmetry of the breasts	0.31	0.07–1.33	0.11	0.57
Shape of the breasts	0.94	0.28–3.11	0.91	1.00

Values in italic demonstrate statistical significance ($P < 0.05$).

CI, confidence interval; OR, odds ratio.

Table 5. Postoperative Complications According to Clavien-Dindo

Clavien-Dindo	Complication	Therapeutic Management	n (%)
I	Painful or hypertrophic scarring	—	16 (9.4)
I	Hematoma	Needle aspiration/evacuation	11 (6.5)
I	Delayed wound healing	Dressing change	10 (5.9)
II	Wound infection	Antibiotics	7 (4.1)
II	Seroma	Needle aspiration	1 (0.6)
IIIb	Partial nipple necrosis	Surgical revision	2 (1.2)
IIIb	Skin flap necrosis	Surgical revision	1 (0.6)
IIIb	Full nipple necrosis	Surgical revision	1 (0.6)

Table 6. Risk Factors for Postoperative Complications Using Uni- and Multivariable Logistic Regression

Variable	Univariate Analysis			Multivariate Analysis		
	OR	95% CI	P	OR	95% CI	P
Age	1.002	0.982–1.022	0.869	1.002	0.976–1.030	0.861
Resection weight	1.001	1.000–1.002	<i>0.012</i>	1.000	0.999–1.002	0.535
Surgery duration	0.998	0.991–1.005	0.572	0.998	0.988–1.008	0.753
Smoking	0.809	0.317–1.930	0.642	0.912	0.299–2.588	0.865
Oncoplastic	0.414	0.164–0.944	<i>0.045</i>	0.346	0.088–1.155	0.101
BMI	1.096	1.023–1.179	<i>0.011</i>	1.164	1.048–1.304	<i>0.006</i>

Values in italic demonstrate statistical significance ($P < 0.05$).

CI, confidence interval; OR, odds ratio.

literature.^{26,27,29} Similarly, this multivariable analysis suggested BMI to be the strongest predictor of postoperative complications. Notably, there were no statistically significant differences in either complication rates between surgical techniques or between oncoplastic and hypertrophic procedures (Table 6). These results reflect the findings of Gulcelik et al,³⁰ who found no significant difference in complication rates between the patients with and without breast cancer undergoing reduction mammoplasty.

Strengths and Limitations

This study's strength lies in its capacity to evaluate multiple outcomes, including patient-reported outcomes such as the BREAST-Q. However, the relatively

small sample size of subgroups and comparably low response rates to the questionnaires may limit the generalizability of this study's findings. The inclusion of oncoplastic breast reduction patients might have contributed to the discrepancy between surgeons and patients. The retrospective assessment of pre- and postoperative BREAST-Q may introduce cognitive recall biases potentially influencing the patients' memory and self-judgment and, thus, the interpretability of the responses, as the follow-up periods between the surgery and the clinical follow-up examination extended up to years. Nevertheless, this is the first study to directly compare perceived aesthetic outcomes from patients undergoing oncoplastic breast reduction surgery to those undergoing surgery for breast hypertrophy alone. Furthermore,

this is one of the first studies to compare objective and subjective assessments in breast reduction surgery and thus offers valuable insight into the patient-surgeon satisfaction discrepancy.

CONCLUSIONS

Breast reduction surgery consistently enhances long-term QoL, regardless of surgical technique, with similar BREAST-Q score improvements for oncological and non-oncological cases. Complication rates were comparable across all techniques. The significant gap in satisfaction between surgeons and patients underscores the importance of further implementing PROMs into routine clinical practice.

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DISCLOSURES

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PATIENT CONSENT

All participants gave their written informed consent before inclusion in this study.

ETHICAL APPROVAL

This retrospective cohort study was carried out in accordance with the principles of the Declaration of Helsinki. Ethics approval was granted by the ethics committee "Ethikkommission Nordwest und Zentralschweiz EKNZ," Switzerland.

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