

PAPER

Body image dissatisfaction in patients undergoing breast reconstruction: Examining the roles of breast symmetry and appearance investment

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Abstract

Objective: Reconstruction as part of treatment for breast cancer is aimed at mitigating body image concerns after mastectomy. Although algorithms have been developed to objectively assess breast reconstruction outcomes, associations between objectively quantified breast aesthetic appearance and patient-reported body image outcomes have not been examined. Further, the role of appearance investment in explaining a patient's body image is not well understood. We investigated the extent to which objectively quantified breast symmetry and patient-reported appearance investment were associated with body image dissatisfaction in patients undergoing cancer-related breast reconstruction.

Methods: Breast cancer patients in different stages of reconstruction ($n = 190$) completed self-report measures of appearance investment and body image dissatisfaction. Vertical extent and horizontal extent symmetry values, which are indicators of breast symmetry, were calculated from clinical photographs. Associations among breast symmetry, appearance investment, body image dissatisfaction, and patient clinical factors were examined. Multi-variable regression was used to evaluate the extent to which symmetry and appearance investment were associated with body image dissatisfaction.

Results: Vertical extent symmetry, but not horizontal extent symmetry, was associated with body image dissatisfaction. Decreased vertical extent symmetry ($\beta = -.19, P < .05$) and increased appearance investment ($\beta = .45, P < .001$) were significantly associated with greater body image dissatisfaction while controlling for clinical factors.

Conclusions: Breast symmetry and patient appearance investment both significantly contribute to an understanding of patient-reported body image satisfaction during breast reconstruction treatment.

KEYWORDS

appearance investment, body image, breast cancer, breast symmetry, reconstruction

1 | BACKGROUND

Reconstruction as part of treatment for breast cancer is intended to restore the appearance of a woman's breast(s) to mitigate body image dissatisfaction and improve quality of life after mastectomy.¹⁻⁶ Recent years have seen an upward trend in the rates of women opting for

breast reconstruction as part of their cancer treatment,^{7,8} with one study⁸ reporting an increase from 46% to 63% of women with employment-based insurance in the United States choosing to do so between 1997 and 2007. This underscores the important role of breast reconstruction in restoring a woman's overall body image.^{9,10} However, factors that influence the body image satisfaction of patients who seek

reconstruction are not well understood.¹¹ It is assumed that a combination of factors influence body image outcomes, including the aesthetic outcomes of the reconstructive surgery, patients' own values, and clinical factors (eg, BMI, cancer treatment history, and surgical complications).¹⁰

Previous studies have revealed a lack of assessment criteria and reliable evaluation methods to assess aesthetic outcomes of breast reconstruction.¹² Methods for evaluating reconstruction outcomes can be organized into 3 broad groups: patient-reported outcomes, subjective observer ratings, and objective measurements. Patient-reported outcomes assess patient's perception of their reconstructed breasts and their satisfaction with the outcomes (eg, Breast Reconstruction Satisfaction Questionnaire and Breast Q).¹³⁻¹⁵ Subjective observer ratings are typically conducted by surgeons and other health care professionals to evaluate their impressions of a patient's outcome. Although subjective observer ratings are widely reported in the literature, they are known to have high interobserver discrepancies.^{16,17}

A systematic review that examined assessment of cosmesis after breast reconstruction surgery reported that majority of the 122 studies examined relied on clinical and photographic ratings, while only 13 studies were found to use objective geometric assessments of the reconstructed breast(s).¹⁸ Indeed, objective assessments of breast reconstruction are being increasingly developed to measure specific reconstruction outcomes such as breast symmetry (eg, Breast Retraction Index and Breast Symmetry Index).^{16,19,20} Objective measures offer distinct advantages for obtaining valid and reliable data on relevant outcomes for women undergoing breast reconstruction treatment. However, objective assessments of breast reconstruction outcomes must be considered in conjunction with patient-reported outcomes. A patient's assessment of her body image following breast reconstruction is critical to evaluate considering the ultimate goal is to recreate the appearance of a breast (or breasts) that is satisfying to the patient.

Research suggests patient characteristics can strongly influence patient-reported outcomes among breast cancer patients, for instance, patient personality traits^{21,22} and patient values regarding their appearance (ie, appearance investment).^{23,24} Appearance investment, which refers to the degree to which an individual values his or her appearance and believes their self-worth is contingent upon appearance, may be particularly relevant to consider in this patient population who experience significant changes in the way their bodies look, feel, and function as a result of treatment. Although reconstructive surgery is aimed at restoring the appearance of the breast, either by repairing the defects associated with segmental mastectomy or reconstructing the breast mound after a total mastectomy, it is possible that appearance investment influences the surgical expectations of patients that in turn have bearing on perceived reconstructive outcomes.

The purpose of this study was to conduct a novel investigation of associations between objectively quantified breast aesthetic appearance and patient-reported body image outcomes for women undergoing breast reconstruction as part of cancer treatment. We examined the extent to which breast symmetry and appearance investment were associated with body image dissatisfaction while controlling for clinical factors (ie, BMI, cancer treatment history, surgical complications, and characteristics of the breast reconstruction). We chose symmetry as

an objective parameter of interest as it is considered an important aesthetic outcome of breast reconstruction and can be easily measured by both patients and trained observers.^{25,26} We also sought to understand the role of appearance investment in predicting body image outcomes as that may be an important target of body image-focused interventions.

2 | METHODS

The study sample consisted of adult female breast cancer patients undergoing treatment at the Center for Reconstructive Surgery at The University of Texas MD Anderson Cancer Center between 2008 and 2011. The cross-sectional data in this study come from a larger prospective research project that enrolled patients at various stages of breast reconstruction. For the purpose of this analysis, we used data collected from a single study visit where a patient had 2 breast mounds. Patients enrolled in the parent study included women who underwent a total mastectomy (eg, skin-sparing or nipple-sparing mastectomy) of one or both breasts for cancer treatment and were about to initiate or were in the process of breast reconstruction. As such, not all women in the study had both nipples present. Exclusion criteria for the parent study included previous bilateral mastectomy without reconstruction, a diagnosis of serious mental illness or cognitive impairment, and inability to read and speak English. Participants provided written informed consent and received a \$25 gift card for their participation. The larger study was approved by our institutional review board (approval ID: 2004-0899).

2.1 | Measures

2.1.1 | Demographic and clinical factors

Information on patient age, ethnicity, race, marital status, height, and weight was obtained via self-report questionnaires. Treatment-related information was abstracted from each patient's medical record and included reconstruction type, reconstruction timing, reconstruction stage, prior chemotherapy, radiation therapy, and surgical complications. Reconstruction type consisted of 3 categories: (1) autologous only (ie, transverse rectus abdominis myocutaneous, deep inferior epigastric perforator, and superficial inferior epigastric artery flaps), (2) implant only (ie, tissue expander-implant), or (3) autologous plus implant (ie, latissimus dorsi reconstruction with tissue expander-implant). Reconstruction timing refers to whether the reconstruction commenced immediately after mastectomy during the same operating session (ie, immediate) or after the mastectomy during a different session (ie, delayed). Patients were also classified into 1 of 3 reconstruction groups based on their timetable for completing reconstruction: prereconstruction, intermediate reconstruction, or final stage of reconstruction. Prereconstruction refers to patients who had not yet undergone a breast reconstruction surgery. Intermediate reconstruction refers to patients who had recently undergone any of the following surgeries: placement of autologous flap, tissue expander, or implant; or exchange of a tissue expander for an autologous tissue or implant. Final stage of reconstruction refers to patients who had

completed reconstruction or were expected to undergo only minor surgical revision to improve aesthetic outcomes (eg, fat grafting and nipple reconstruction).

2.1.2 | Breast symmetry

Vertical extent (VE) and horizontal extent (HE) of the patients' breasts were calculated using 2-dimensional (2-D) clinical photographs of the patient's torso from the anterior-posterior view to measure symmetry across the vertical axis (midline). Refer to Figure 1. While some other measures of breast symmetry have been more widely used in the prior literature, the measurement formulas used in this study are more advantageous because they do not assume that the subject have nipples, which is the case of some patients undergoing breast reconstruction. Vertical extent represents the ratio of vertical distances of the lowest visible points (v) from the level of the sternal notch (s), where the subscripts R and L designate right and left laterality, respectively.

$$\begin{cases} f1\left(\frac{v_L-s}{v_R-s}\right) & \text{if } v_L-s > v_R-s \\ f1\left(\frac{v_R-s}{v_L-s}\right) & \text{if } v_R-s > v_L-s \end{cases}$$

Horizontal extent represents the ratio of horizontal distances of lateral extents (l) from the midline (m), where the subscripts R and L designate right and left laterality, respectively. Both these measures yield values that range continuously between 0.0 and 1.0. As the measure approaches 1.0, symmetry improves, with 1.0 indicating total symmetry.

$$\begin{cases} f1\left(\frac{l_L-m}{l_R-m}\right) & \text{if } l_L-m > l_R-m \\ f1\left(\frac{l_R-m}{l_L-m}\right) & \text{if } l_R-m > l_L-m \end{cases}$$

where $f1(x) = e^{-(x-1)}$.

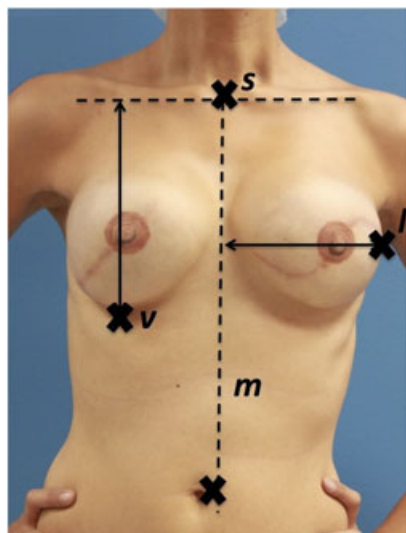


FIGURE 1 Vertical extent represents the ratio of distances of the lowest visible points of the breasts (v) from the level of the sternal notch (s), while horizontal extent represents the ratio of horizontal distances of the lateral extents (l) of the breasts from the midline (m)

2.1.3 | Body image investment

The Appearance Schemas Inventory-Revised,^{27,28} a 20-item self-report measure designed to assess body image investment in relation to beliefs or assumptions made about the importance, meaningfulness, and influence of appearance in one's life, was used as a measure of body image investment. Items were rated on a 5-point Likert scale (ranging from 1 = strongly disagree to 5 = strongly agree). The overall body image investment score is calculated by averaging the individual item scores. Possible scores range from 1 to 5, with a higher score indicating greater body image investment. The instrument and subscales have been reported to have high internal consistency ($\alpha = 0.82-0.91$) and good validity.²⁷

2.1.4 | Body image dissatisfaction

The Body Image Scale²⁹ is a 10-item measure of body image dissatisfaction that was developed for use with cancer patients who are undergoing appearance changes. Participants rated their dissatisfaction on a 4-point scale (0 = not at all to 3 = very much). The scale has been reported to have high internal consistency ($\alpha = 0.93$) and good clinical validity, discriminant validity, and consistency.²⁹

2.2 | Data analytic plan

Descriptive statistics were calculated for demographic, clinical-related factors, and psychosocial outcomes. As not all the data were normally distributed, nonparametric Spearman correlation, point biserial, and Kruskal-Wallis analyses (as appropriate) were conducted to examine the associations among patient clinical factors, symmetry, appearance investment, and body image dissatisfaction. Symmetry measures found to be significantly associated with body image ($P < .05$) in the univariate analyses were selected for regression analyses. Reciprocal transformation was conducted on the symmetry values to meet assumptions of normality as recommended by West et al prior to regression analyses.³⁰ Subsequently, regression analyses were conducted to examine the extent to which symmetry and appearance investment were statistically associated with body image dissatisfaction while controlling for clinical factors. Analyses were performed using IBM SPSS version 19.

3 | RESULTS

Of the 220 participants who were recruited for the parent study, 30 were excluded from the current study owing to missing clinical photographs or self-report questionnaires, leaving a final sample size of 190 participants. Table 1 presents the descriptive statistics of our sample.

Participants' mean age was 49 years ($SD = 9$ y). The majority of participants were Caucasian (89%) and married (70%). A proportion of the sample had undergone chemotherapy (44%) and radiation

TABLE 1 Demographic characteristics and treatment-related factors of study participants (N = 190)

Variable	n	Mean (SD)	Range
Age, y		48.86	25-73
BMI		27.73	17.7-42.1
Race			
Caucasian	169 (89%)		
African American	12 (6%)		
Asian	5 (3%)		
Other	4 (2%)		
Ethnicity			
Hispanic	25 (13%)		
Non-Hispanic	165 (87%)		
Marital status			
Married	134 (70%)		
Divorced	26 (14%)		
Widowed	3 (2%)		
Single	27 (14%)		
Prior treatments at the time of assessment			
Chemotherapy	83 (44%)		
Radiation therapy	43 (23%)		
Type of reconstructive surgery			
Autologous/flap	66 (35%)		
Implant	101 (53%)		
Mixed	23 (12%)		
Timing of reconstructive surgery			
Immediate	154 (81%)		
Delayed	36 (19%)		
Stage of reconstructive surgery			
Prereconstruction	43 (23%)		
Intermediate	116 (61%)		
Final	31 (16%)		
Major complications from reconstructive surgery ^a	55 (25%)		

^aMajor complications defined by any of the following: partial or total flap loss; exposure of tissue expander or implant; hematoma requiring drainage, seroma, fat, or flap necrosis that required surgery; abdominal hernia or bulge; infection requiring intravenous antibiotics; development of a thromboembolic event.

therapy (23%). With regard to reconstruction, majority (81%) of the sample underwent immediate reconstruction, 53% underwent implant-only reconstruction, and 61% were in the intermediate stage of reconstruction. History of a major surgical complication(s) was found in 25% of the sample.

Table 2 presents descriptive statistics related to our primary outcomes of interest: VE symmetry, HE symmetry, body image dissatisfaction, and appearance investment.

3.1 | Associations among clinical factors and breast symmetry

Greater BMI was significantly associated with VE and HE symmetry ($r = -0.22$, $P < .01$; $r = 0.19$, $P < .05$). Surgical complications were significantly associated with decreased VE symmetry ($r = -0.17$, $P < .05$) but

TABLE 2 Symmetry and body image outcomes

Variable	Mean (SD)	Range
Vertical extent symmetry	0.93 (0.08)	0.50-1.00
Horizontal extent symmetry	0.94 (0.05)	0.68-1.00
Body image dissatisfaction (BIS)	8.21 (7.15)	0-30
Appearance investment (ASI-R)	2.85 (0.74)	1.6-4.9

Abbreviations: BIS, Body Image Scale; ASI-R, Appearance Schemas Inventory.

not HE symmetry. Type of reconstruction (ie, autologous reconstruction) was associated with a significant decrease in HE symmetry ($r = -0.15$, $P < .05$) but not VE symmetry. Prior chemotherapy, prior radiation therapy, reconstruction timing, and stage of reconstruction were not significantly associated with symmetry.

3.2 | Associations among clinical factors, appearance investment, and body image dissatisfaction

The clinical factors assessed in this study were not significantly associated with appearance investment. Prior chemotherapy was significantly associated with higher body image dissatisfaction ($r = 0.19$, $P < .01$). Body mass index, prior radiation therapy, surgical complications, reconstruction timing, reconstruction type, and reconstruction stage were not significantly associated with body image dissatisfaction. Appearance investment was significantly associated with body image dissatisfaction ($r = 0.38$, $P < .001$).

3.3 | Associations between breast symmetry and body image dissatisfaction

We found VE symmetry to be significantly associated with body image dissatisfaction ($r = -0.16$, $P < .05$). Decreased VE symmetry was associated with higher body image dissatisfaction. Horizontal extent, which is the ratio of distances between the midline and lateral extent, was not significantly associated with body image dissatisfaction ($r = -0.07$, $P = .37$). As such, HE was not considered as a predictor of body image dissatisfaction in subsequent analyses.

3.4 | Breast symmetry and appearance investment and their associations with body image dissatisfaction controlling for clinical factors

In multi-variable regression analysis, body image dissatisfaction was significantly associated with both VE symmetry, $\beta = -.19$, $t(179) = -2.50$, $P < .05$, and appearance investment, $\beta = .45$, $t(179) = 6.25$, $P < .001$, controlling for BMI, prior chemotherapy, prior radiation therapy, history of surgical complications, and reconstruction characteristics (Table 3). Being in the final stage of reconstruction was associated with less body image dissatisfaction, $\beta = -0.17$, $t(179) = -1.98$, $P < .05$, and prior chemotherapy was marginally associated with greater body image dissatisfaction, $\beta = .15$, $t(179) = 1.78$, $P < .10$. A significant proportion of variance in body image dissatisfaction scores was explained by the model, $R^2 = 0.33$, $F_{10,179} = 6.12$, $P < .001$.

TABLE 3 Symmetry predicting body image dissatisfaction controlling for clinical factors

	Body Image Dissatisfaction
	β
Vertical extent symmetry	-.19*
Appearance investment (ASI-R)	.45***
Clinical factors controlled for	
BMI	-.02
Prior chemotherapy	.15 [†]
Prior radiation therapy	.07
Prior complications	.06
Reconstruction timing (reference: immediate)	
Delayed	-.00
Reconstruction type (reference: implant)	
Autologous	-.03
Mixed type	0.09
Reconstruction stage (reference: presurgery)	
Intermediate	-.07
Final	-.17*

Abbreviations: ASI-R, Appearance Schemas Inventory-Revised.

[†] $P < .10$.* $P < .05$.*** $P < .001$.

4 | CONCLUSIONS

In this study, we found that VE symmetry in conjunction with appearance investment significantly predicted body image dissatisfaction in our sample of breast cancer patients at various stages of reconstruction. Our findings suggest that there are diverse factors that influence body image outcomes for this patient population including objectively assessed aesthetic results of the reconstruction, patients' own values regarding appearance, and clinical-/treatment-related factors (in this case, being in the final stages of reconstruction and undergoing chemotherapy). These findings are consistent with theoretical models of body image, which point to the roles inherent individual characteristics, historical influences, cultural environment, and life experiences can have on body image development.^{10,31} Cancer and its treatment represent a proximal influence that can further shape a patient's body image, particularly when it results in visible changes to the body. In this study, greater breast asymmetry was a significant predictor of body image dissatisfaction; however, there were other factors that explained body image dissatisfaction as well.

4.1 | Clinical implications

Appearance investment was identified as an important predictor of body image dissatisfaction and relates to the degree to which an individual values one's appearance and tends to link one's self-worth with one's appearance. Higher appearance investment relates to greater body image dissatisfaction and represents an important potential target for psychotherapeutic intervention. Body image-focused

therapy is effective in challenging appearance assumptions that contribute to body image dissatisfaction³²⁻³⁴ and appears highly relevant and warranted for this patient population. Our results further indicated that the stage of reconstruction was significantly associated with body image. Not surprisingly, participants who were in the final stage of reconstruction reported lower levels of body image dissatisfaction compared with those preparing to undergo reconstruction. Although body image is expected to improve over time as patients undergo reconstruction, our findings also indicate that it is important to consider the potential lasting impact of chemotherapy upon a patient's body image. We found that having undergone chemotherapy prior to commencing reconstruction was marginally associated with increased body image dissatisfaction. These findings presumably relate to the physical and psychological effects from appearance changes due to chemotherapy, such as hair loss and weight change.

On the basis of our findings, VE symmetry appears to be more important than HE symmetry in capturing body image dissatisfaction. While some research exists as to how humans perceive symmetry across an axis (eg, symmetry is more salient closer to the axis), there is limited research about how humans perceive different types of symmetry across the same axis.³⁵ Given that the scores in our sample for HE symmetry are overall more variable compared with those of VE symmetry, our results are indeed interesting; nevertheless, further research is needed in this area to provide a more compelling explanation for this phenomenon. This finding has potential important implications for further guiding reconstructive surgeons performing the procedures and whose undoubted goal is to achieve the best aesthetic outcome (including symmetry); if data continue to support that VE symmetry is more important to a patient's body image satisfaction than HE symmetry, greater emphasis should be expended toward achieving VE symmetry. It will be important for future studies to investigate breast symmetry in conjunction with other aspects of appearance-related outcomes of breast reconstruction such as scarring, rippling, dimpling, and distortion of shape from capsular contracture to determine if there are certain characteristics that are more salient than others.

Our findings further suggest that the clinical 2-D photographs with anterior-posterior perspective and fiducial points that we used were adequate in capturing breast aesthetic outcomes that are associated with body image. This study used 2 fiducial points to calculate symmetry of the reconstructed breast based on clinical 2-D images. However, there are a number of other fiducial points that can be considered for symmetry calculations, including the nipple. We were not able to use the nipple as a landmark because a significant proportion of our sample was without a nipple-areola complex as they were in the process of undergoing reconstruction. There are recent innovations in objective measures, for instance, the use of 3-dimensional imaging to quantify additional properties such as breast volume and texture.^{17,20,36,37} There are also a number of other aspects of reconstruction outcomes including assessment of shape, discoloration, and position of the nipple-areola that can be considered in future studies.³⁸⁻⁴⁰

4.2 | Study limitations

Our study had a number of limitations. The sample we used reflects the current usage of breast reconstruction in the United States and

thus lacked racial and ethnic diversity, making the results difficult to generalize to non-Caucasian populations. The design of the study was cross-sectional, limiting the ability to draw causal relationships. In addition, our study only considered one aspect of aesthetic outcome (ie, symmetry). The study sample consisted of patients in various stages of reconstruction, including those who had yet to undergo reconstruction and those who were in the process of reconstruction. We did not limit the study to patients who had completed reconstruction, making it difficult to compare it with other studies where body image outcomes are evaluated only at the completion of reconstruction. This is because we found value in evaluating the relationship between symmetry and body image as patients undergo the lengthy process of breast reconstruction, which can take months or years to complete.

In summary, our findings suggest that it is important to consider objectively measured aesthetic reconstruction outcomes in conjunction with patient values in a clinical setting. Measurement of asymmetry in itself may not change patient outcomes; however, we have demonstrated that asymmetry is associated with body image outcomes. These findings must be considered within the context of both objective symmetry outcome and patient's subjective body image investment being relevant to patient's satisfaction with their surgical reconstruction. We believe our findings will spur future research to identify algorithms that are relatively easy to apply in the assessment of breast aesthetic appearance, which will help predict important patient outcomes. We also hope that our findings have clinical utility in aiding health care providers to deliver better-targeted treatment, may it be via reconstructive surgery procedures or through body image-focused interventions.

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CONFLICT OF INTEREST

All authors declare that they have no conflict of interest.

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