The Breast 19 (2010) 521–526

Contents lists available at ScienceDirect

The Breast

journal homepage: www.elsevier.com/brst

Original article

Patient-subjective cosmetic outcomes following the varying stages of tissue expander breast reconstruction: *The importance of completion*

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ARTICLE INFO

Article history:
Received 28 October 2009
Received in revised form
18 March 2010
Accepted 25 May 2010
Available online 17 June 2010

Keywords:
Acellular dermis
Breast reconstruction
Tissue expander
Cosmetic outcome
Patient satisfaction

ABSTRACT

Introduction: Tissue expander breast reconstruction consists of three major surgical steps: placement of the expander after mastectomy, exchange of the expander for an implant, and nipple-areola complex reconstruction. The evolution of patient satisfaction throughout this process has not been evaluated. Here we performed a stratified analysis of patient-subjective cosmetic outcomes during the stages of breast reconstruction.

Methods: Twenty-eight consecutive tissue expander-implant reconstructions were performed by the senior author using human acellular dermis. Cosmetic outcomes were assessed after each reconstructive stage using a validated Breast Evaluation Questionnaire consisting of questions related to breast size, shape and firmness in three separate contexts: intimate or sexual activities, leisure or social activities, and professional or job-related activities.

Results: Eighteen patients underwent unilateral reconstruction, while 10 underwent bilateral reconstruction. Satisfaction scores were statistically higher following Stage I and II procedures for bilateral reconstructions. For unilateral reconstructions, there was a statistically significant elevation in scores following Stage II. The addition of nipple-areola reconstruction resulted in the highest scores for both unilateral and bilateral reconstructions. These score elevations were significant ($p < 0.05$) in nearly every measured context for unilateral reconstructions and as such, the significant differences in scores between unilateral and bilateral cohorts after stages I and II were nearly eliminated after completion of the entire reconstructive process.

Conclusion: Satisfaction with tissue expander reconstruction is significantly affected by the patients' stage during the reconstructive process. Completion of all three stages, including nipple-areolar complex reconstruction, achieves maximal patient satisfaction. For unilateral reconstructions, completion of the entire reconstructive process, including contralateral symmetry procedures and nipple-areolar complex reconstruction, results in cosmesis scores that are similar to those in bilateral cases.

Introduction

Over 50,000 tissue expander-implant breast reconstructions were performed in 2008, representing the majority of post-mastectomy breast reconstructions.[1] Since 2005, there has been a steady increase in the percentage of surgeons electing to use acellular dermis to assist their expander-based reconstructions. Breuing was the first to report on the use of human acellular dermis in prosthetic breast reconstruction. Since then, several other reconstructive surgeons have demonstrated their respective reconstructive outcomes using this method.[2–7]

Proposed advantages of acellular dermis include: improved definition of the mammary folds; increased resistance to capsular contracture; less implant displacement; better control of implant position, facilitating greater lower pole projection and potentially greater ptosis; reduced risk of implant exposure, extrusion, visibility, palpability; and greater intra-operative tissue expander fill volumes by creating a large sub-pectoral pocket.[2–9] The process of tissue expander breast reconstruction encompasses three major surgical stages, the first of which involves placement of the tissue expander followed by serial expansion. The second stage entails removal of the expander in exchange for a permanent implant, as well as potential contralateral symmetry procedures in unilateral cases. And, the final stage includes the nipple-areola reconstruction.[2,3,7]

While prior studies describe in detail the reconstructive benefits of acellular dermis in tissue expander-implant breast reconstruction,

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doi:10.1016/j.breast.2010.05.017

less is known about the aesthetic outcomes. Additionally, the impact of these stages on patient-subjective cosmetic outcomes has not previously been investigated. In this study, we explore patient-subjective cosmesis scores using an ad-hoc, validated breast evaluation questionnaire to ascertain the impact of stage within the reconstructive process on overall patient satisfaction.

Methods

Patients and study design

The Northwestern University Institutional Review Board approved this retrospective medical record review of a prospectively maintained database. Twenty-eight consecutive patients undergoing tissue expander breast reconstruction (18 unilateral, 10 bilateral) received the validated Breast Evaluation Questionnaire[10] survey after each stage during the reconstructive process. All patients underwent unilateral or bilateral mastectomy by a breast surgeon. Each patient in this series either elected to have implant-based reconstruction, or were not candidates for autologous reconstruction based on expert clinical opinion. A single plastic surgeon (JYK) performed the procedures in all reconstructive stages. Patients scheduled to receive neo-adjuvant/adjuvant radiation therapy chemotherapy, as well as single stage nipple sparing procedures were excluded from the study.

Patient-subjective cosmetic outcomes were measured using the Breast Evaluation Questionnaire, a survey that was validated by Cogwell et al. in 2006, on a group of 1244 women seeking augmentation mammaplasty. The questionnaire uses a scale ranging from 1 (very dissatisfied) to 5 (very satisfied) with respect to breast size, shape and firmness in three separate clinical contexts: intimate or sexual activities, leisure or social activities, and professional or job-related activities. Implant firmness relates to how the implant feels to touch, with higher scores correlating to a more “natural feel” of the implant. It is important to recognize that a patient-subjective outcome questionnaire specifically directed toward breast reconstruction patients does not currently exist. The closest, validated correlate is the Breast Evaluation Questionnaire, described above, which was tailored toward the reconstructive population where possible.

Surgical technique

In the senior author’s (JYK) preferred expander reconstruction technique, the pectoralis muscle is disinserted and either pre-hydrated human acellular dermal matrix (PHADM) (Flex HD®, Musculoskeletal Transplant Foundation, Edison, New Jersey) or non-hydrated human acellular dermal matrix (NHADM) (AlloDerm®, Lifecell, Branchburg, New Jersey) is attached to the inframammary fold using 3-0 vicryl suture. Laterally, the ADM is secured directly to the serratus muscle fascia. Additionally, the lateral border of the pectoralis major muscle is secured to the serratus muscle fascia to create the lateral border of the expander pocket. A textured expander (McGhan-Inamed, Santa Barbara, CA) is inserted into the newly created sub-pectoral/dual-plane pocket, and the superior border of the ADM is sutured to the cut edge of the pectoralis major muscle. The expander is then inflated judiciously according to the degree of skin excess. Post-operatively, serial expansions of the tissue expander are initiated after incisions have healed. Stage II reconstruction with tissue expander to implant exchange is performed after the desired volume of expansion is obtained. For unilateral cases, where indicated, a simultaneous symmetry procedure (mastopexy alone, mastopexy with augmentation, or reduction mammaplasty) is performed on the contralateral breast for symmetry at the same time as expander-implant exchange. Stage III reconstruction of the nipple-areola complex (NAC) is performed after the stage II incisions have healed. The senior author’s (JYK) preferred method of NAC reconstruction is through a modified C–V flap, which relies on local tissue to create two “V” flaps which wrap around the central plane of the new nipple with a “C” flap as a hinged cap.[11]

Statistical analysis

All statistical analyses were performed using SPSS Statistical Analysis Software (SPSS, Version 17.0, Chicago, Illinois). A paired two-tailed Wilcoxon signed-rank test was utilized to compare scores after each stage. An independent Wilcoxon rank sum test was used to compare outcomes between unilateral and bilateral cohorts. Data is considered statistically significant with a p-value < 0.05 and is expressed as mean $\pm$ standard error of the mean.

Results

During the research period, the senior author completed 38 breast reconstructions (18 unilateral and 10 bilateral) in 28 patients. The mean age of the patients was 52.2 $\pm$ 2.6 years. Ten women (36%) in this study had a significant smoking history. Mean interval between Stage 1 and Stage 2 reconstruction was 136.2 $\pm$ 24.4 days with a total follow-up period of 153.7 $\pm$ 23.1 days. There were no reconstructive complications, including infection, mastectomy flap necrosis, hematoma, seroma, tissue expander migration, implant extrusion, or early capsular contracture, in the acute perioperative period or during short-term follow-up.

Cosmetic outcomes – stage I tissue expander placement

Patients completed the stage I questionnaire at the final expansion visit prior to expander/implant exchange. For unilateral reconstructions, overall mean cosmesis scores after Stage I were 2.36 $\pm$ .24, 2.40 $\pm$ .18, and 2.63 $\pm$ .23 for breast size, shape, and firmness, respectively. Individual scores for each of the contexts (intimate, social, and professional) can be found in Table 1. For bilateral reconstructions, scores were 3.7 $\pm$ .33, 3.5 $\pm$ .31, and 3.6 $\pm$ .35 for breast size, shape, and firmness, respectively. Stage 1 bilateral reconstruction scores were statistically higher than their unilateral counterparts across nearly all contexts in intimate, social, and professional settings (Table 1).

Stage II – tissue expander exchange

By the end of the research period, 13 women (72%) in the unilateral reconstruction group had completed Stage II procedures, while the remaining 5 women were scheduled to undergo stage II surgery at a future date. Mean overall scores following this procedure were 3.36 $\pm$ .29, 3.28 $\pm$ .28, and 3.33 $\pm$ .30 for breast size, shape, and firmness respectively. Within this cohort, there was a statistically significant improvement in cosmesis scores in all three contexts when compared to the previous stage (Table 2). The majority (69%) of women in the unilateral reconstruction cohort also underwent a contralateral symmetry procedure during stage II, including breast augmentation with mastopexy in 7 cases, mastopexy alone in 1 case, and reduction mammaplasty in 1 case.

At the end of the research period, 9 (90%) of the women in the bilateral reconstruction cohort had completed Stage II procedures, and 1 was awaiting surgery. Overall mean cosmesis scores were 4.23 $\pm$ .16, 4.16 $\pm$ .7, and 4.27 $\pm$ .20 for breast size, shape, and firmness, respectively. There was a statistically significant improvement in cosmesis scores in nearly all clinical contexts, especially with regard to shape and firmness, when compared to