

A Head-to-Head Comparison of Quality of Life and Aesthetic Outcomes following Immediate, Staged-Immediate, and Delayed Oncoplastic Reduction Mammoplasty

Ketan M. Patel, M.D.
Catherine M. Hannan, M.D.
Margaret E. Gatti, M.P.H.
Maurice Y. Nahabedian,
M.D.
Washington, D.C.

Background: Oncoplastic reduction mammoplasty offers patients breast conservation with the added benefit of functional improvement in symptoms related to macromastia. The reduction can be performed in the immediate setting with the lumpectomy, in a staged-immediate fashion after final pathology has been confirmed or in a delayed fashion after completion of both lumpectomy and radiation. This study compared quality of life and aesthetic outcomes for these different cohorts.

Methods: A retrospective review was carried out on 16 consecutive patients who had oncoplastic reduction mammoplasty by the senior author (M.Y.N.) between 2003 and 2009. Demographics, oncologic treatment and timing, and reduction techniques were recorded. Patients were asked to complete a questionnaire to assess quality of life and satisfaction. Preoperative and postoperative photographs were evaluated by 15 reviewers.

Results: Over a 7-year period, five patients had immediate, six had staged-immediate, and five had delayed reduction mammoplasty. Mean patient age was 52.5 years, and mean body mass index was 31.5. The average timing of reduction was 0, 49, and 734 days for the three groups. Positive margins occurred in two patients, leading to completion mastectomy. In addition, one patient in the staged-immediate group had a recurrence that led to completion mastectomy. Complications occurred in seven (44 percent) of 16 patients. Questionnaire response was 75 percent (12 of 16), showing positive scores in all groups but no statistical significance. Objective aesthetic evaluation also revealed significant improvements within groups comparing various preoperative to postoperative parameters. Importantly, aesthetic scores for the delayed group were consistently lower across all aspects but did not reach significance.

Conclusion: Oncoplastic reduction mammoplasty can be safe and effective in carefully selected patients in the immediate, staged-immediate, and delayed settings. (*Plast. Reconstr. Surg.* 127: 2167, 2011.)

Breast conservation therapy has resulted in a paradigm shift in the traditional management of breast cancer. Studies have demonstrated that patient survival is unchanged when compared with traditional mastectomy.¹ Most women following breast conservation therapy will have acceptable aesthetic outcomes; however, up

to one-third of patients may have a significant cosmetic deformity and overall dissatisfaction with the outcome.²⁻⁴ These deformities are typically exacerbated following radiation therapy and may manifest with skin contraction, tightening, breast distortion, and tissue pigmentation changes.⁵

From the Department of Plastic Surgery, Georgetown University Hospital, and Georgetown University School of Medicine.

Received for publication July 28, 2010; accepted November 30, 2010.

Copyright ©2011 by the American Society of Plastic Surgeons

DOI: 10.1097/PRS.0b013e3182131c1c

Disclosure: Dr. Nahabedian is a member of the speakers bureau for Lifecell Corporation, Branchburg, N.J. All other authors have no conflicts of interest or financial disclosures. No funding was utilized for the preparation of this article.

The evolution of oncoplastic surgery has further modified the approach to breast conservation therapy. Partial mastectomy defects can now be tailored and contoured to create an acceptable cosmetic and functional result, which may lead to increased patient self-esteem and quality of life.^{6–8} The most commonly utilized oncoplastic approach is reduction mammoplasty. This technique is especially useful for women with mammary hypertrophy and breast cancer.^{9–11} Several studies have evaluated the various methods of reduction mammoplasty based on tumor location and pedicle design to provide an optimal algorithmic approach.^{12–16}

Recently, the timing of oncoplastic reduction mammoplasty relative to the radiation therapy has been analyzed in efforts to improve outcomes.^{17,18} Immediate oncoplastic reduction mammoplasty is performed in conjunction with lumpectomy. This approach has been advocated by many surgeons to avoid secondary operations and to minimize the psychological effect of breast distortions.¹⁹ A caveat with this approach includes an increased risk of a positive tumor margin that may compromise the efficacy of this immediate approach and possibly result in mastectomy. In the staged-immediate reconstruction, reduction mammoplasty is performed within the interval following lumpectomy and preceding radiation therapy. This method allows for confirmation of negative margins after lumpectomy and for the possibility of margin reexcision before performing the reduction mammoplasty. This option can result in breast conservation and may obviate the need for mastectomy in some situations. In the delayed setting, reduction mammoplasty is performed at some unspecified time interval following radiation therapy. Caveats with this approach include an increased incidence of complications that include wound dehiscence, seroma, infection, breast distortion, and poor cosmetic outcomes.^{18,20}

Oncoplastic reduction mammoplasty is advantageous in that it may improve functional outcomes in those patients who are plagued with symptoms of macromastia.^{13,21} In addition, it may reduce the number of operations that a woman with breast cancer and mammary hypertrophy might need. Previous studies have demonstrated benefits in terms of recurrence,^{12,22,23} complication profile,^{15,16} aesthetic outcomes,^{3,6,24} and patient satisfaction,^{3,24,25} but no studies have compared these outcomes among the various timing periods. The purpose of this study was to provide a head-to-head comparison among outcomes following oncoplastic reduction mammoplasty at various time intervals in relation to radiation therapy.

PATIENTS AND METHODS

A retrospective review was carried out on 16 consecutive patients who had oncoplastic reduction mammoplasty performed by the senior author (M.Y.N.) between 2003 and 2009. The study-specific protocol was approved by the institutional review board. Patient data were collected regarding demographics, oncologic treatment and timing, and reduction mammoplasty techniques. Three groups of patients were isolated: the immediate group having breast conservation and reduction mammoplasty before radiation (Fig. 1), the staged-immediate group having reduction mammoplasty within the time interval between lumpectomy and radiation therapy (Fig. 2), and the delayed group having reduction mammoplasty after both lumpectomy and radiation therapy (Fig. 3).

Oncoplastic Surgery

Each patient was evaluated by the senior author either before or after lumpectomy and/or radiation therapy for evaluation of oncoplastic reduction mammoplasty. Pedicle choice and markings were designed based on tumor location and breast volume to adequately provide a symmetric result with preservation of nipple-areola viability and position. Similar surgical techniques performed by the senior author were utilized to perform all operations in the immediate and staged-immediate groups. Within the delayed group, limited undermining and wide pedicle preservation techniques were used to minimize wound-healing complications in radiated tissue.

Questionnaire

An adapted questionnaire based on the BREAST-Q, developed by Pusic et al. as a validated instrument to assess quality of life and patient satisfaction following reduction mammoplasty, was used in our study to assess outcomes following oncoplastic reduction mammoplasty.²⁶ The adaptations to the BREAST-Q included (1) adding questions specifically addressing reduction mammoplasty as part of breast cancer treatment and (2) eliminating the satisfaction domain assessing the care process. Each patient was contacted via telephone and asked to consent and participate in answering the questionnaire regarding her experience with oncoplastic reduction mammoplasty. All patients who agreed to participate were sent questionnaires via mail. The questionnaire was composed of 56 questions and assessed (1) psy-



Fig. 1. Case 1. (Above, left) A 48-year-old woman initially underwent right-breast needle biopsy and was found to have invasive ductal carcinoma with scattered high-grade ductal carcinoma in situ involving multiple margins. Repeated excision with sentinel lymph node sampling was performed and timed with an immediate oncoplastic reduction mammoplasty. The first lumpectomy performed resulted in an incisional dehiscence. Mild asymmetry was present before immediate reconstruction. (Above, right) The patient is shown 3 months after reconstruction. (Center, left) The patient was found to have residual calcifications despite negative margins. A skin-sparing mastectomy with tissue expander reconstruction with AlloDerm was planned. (Center, right) Mastectomy skin flaps were elevated via the prior Wise pattern closure incisions. (Below) Two weeks after surgery, the nipple-areola complex and skin flaps remained viable with the 500-cc expander in place with a 250-cc initial fill volume.



Fig. 2. Case 2. (Left) A 63-year-old woman was found to have abnormal calcifications within the left breast. Needle biopsy was performed with pathology consistent with poorly differentiated invasive ductal carcinoma with negative margins. The patient subsequently finished 33 cycles of radiation therapy. At 10 months after radiation, the patient presented with significant asymmetry and distortion in the upper outer left breast. (Right) One year postoperatively, the patient retains satisfactory breast symmetry.

chosocial well-being, (2) physical well-being, (3) sexual well-being, (4) satisfaction with their breasts, and (5) satisfaction with the outcome.

Aesthetic Evaluation

Preoperative and postoperative photographs for 15 patients were obtained and arranged in a random fashion for evaluation. Five patients from each group were included in the evaluation. In the immediate and staged-immediate groups, preablative photographs and postradiation photographs were obtained for evaluation. In the delayed group, preradiation and postreduction photographs were used for evaluation. Fifteen reviewers composed of plastic surgery residents and fellows participated in evaluating each patient photograph. The evaluation consisted of seven questions evaluating both preoperative and postoperative aesthetic parameters, including breast symmetry, nipple position, and overall aesthetic grade. A five-point Likert scale was used to assess these parameters.

Statistical Analyses

Analyses were performed using SAS for Windows, version 9.2 (SAS Institute, Cary, N.C.). Categorical demographic variables were analyzed via Fisher's exact test due to the small sample size. Means and standard deviations were calculated for continuous variables (Table 1). Patient survey responses in the five domains were compared among the three oncoplastic reduction groups (i.e., immediate, staged-immediate, and delayed)

using the Kruskal-Wallis test. Preoperative and postoperative aesthetic evaluations were compared among the three groups, and a direct comparison between preoperative and postoperative changes among breast symmetry, nipple position, and the overall aesthetic grade was made using analysis of variance. Comparisons across the groups were made using repeated measures analysis of variance. To assess whether patients had higher perceived quality of life and satisfaction following surgery, patients were dichotomized based on their responses to the various survey domains. Higher perceived satisfaction was defined as scores equal to or greater than the group mean for a specific survey domain. Lower perceived satisfaction was defined as scores less than the group mean for a specific survey domain. An a priori p value of 0.05 was used for all statistical analyses.

RESULTS

Over a 7-year period, oncoplastic reduction mammoplasty was performed on 16 patients; five had reduction mammoplasty immediately following partial mastectomy, six had reduction surgery in the staged-immediate period, and five had delayed reduction mammoplasty. The mean patient age across all groups was 52.5 years, and the mean body mass index was 31.5. Three patients (two from the immediate group and one from the delayed group) reported a history of tobacco use.

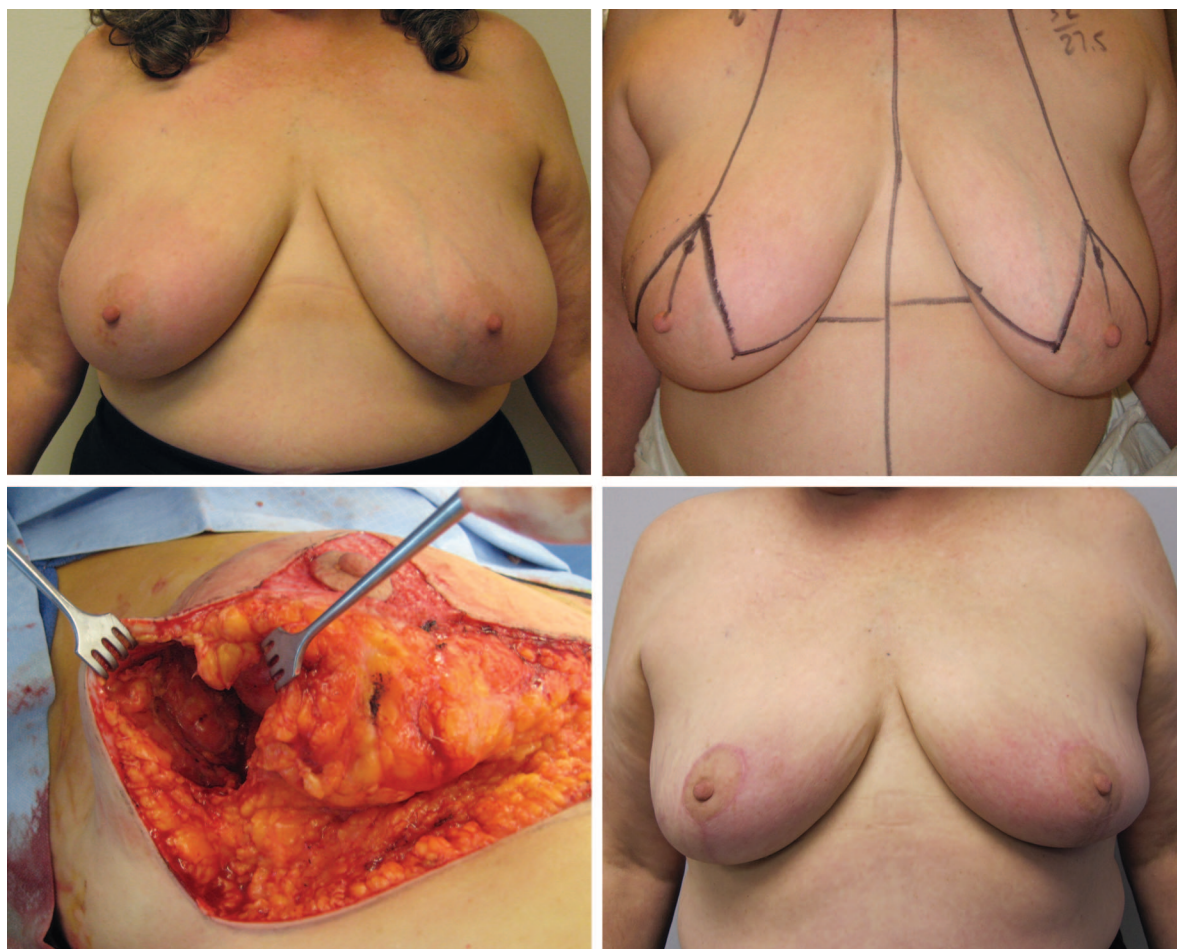


Fig. 3. Case 3. (Above, left) A 63-year-old woman with a right-breast lump was later biopsied and found to have moderately differentiated invasive ductal carcinoma. She subsequently underwent a lumpectomy with sentinel lymph biopsy. Results indicated that the tumor was in fact two larger, connecting masses. The margins were negative for malignancy. (Above, right) Two weeks later, the patient underwent a staged-immediate oncoplastic reduction mammoplasty. Markings are shown. (Below, left) A Wise pattern skin excision was used along with bilateral central mound pedicle design. The previous lumpectomy cavity is shown in the upper outer quadrant. (Below, right) The patient later underwent radiation therapy 6 months after surgery. The patient maintained satisfactory nipple position and breast symmetry.

The mean interval between ablative surgery and reduction mammoplasty is listed in Table 1. In the staged-immediate group, the mean interval between operations was 79 days. Excluding two patients for delays in scheduling in the staged-immediate group, the mean interval was 49 days. Positive margins occurred in two patients, leading to completion mastectomy with immediate expander reconstruction in both cases. In addition, recurrence of disease occurred in one patient in the staged-immediate group, leading to completion mastectomy with immediate reconstruction. Complications were seen in seven patients and included wound breakdown, scar contractures/distortion, cellulitis, and seroma.

Twelve patients responded and consented to participate in the questionnaire, for a response rate of 75 percent. The mean interval between the operation and participation in the questionnaire was 88.9 weeks. Overall scores for each group are shown in Table 2. Average scores for each group are shown for clarity. A high level of internal consistency was observed among the groups (Cronbach's $\alpha \geq 0.7$). No statistically significant difference was achieved across or between the groups. Overall, all groups had mean scores representing favorable or positive scores. Interestingly, though, the delayed group's means were consistently lower across all domains but did not reach statistical significance, likely due to small sample size.

Table 1. Patient Demographics and Perioperative Information

	Total	Immediate	Staged-Immediate	Delayed
Total no. of patients (%)	16	5 (31.3)	6 (37.5)	5 (31.2)
Mean age, yr (SD)	52.5 (10.5)	50.0 (6.6)	51.7 (11.2)	56 (13.7)
Mean body mass index (SD)	31.5 (2.3)	32.4 (2.9)	30.8 (1.8)	31.5 (2.5)
Smoker, <i>n</i> (%)	3	2 (40.0)	0 (0.0)	1 (20.0)
Diabetic, <i>n</i> (%)	4	1 (20.0)	2 (33.3)	1 (20.0)
CTX, <i>n</i> (%)	8	4 (80.0)	2 (33.3)	2 (40.0)
Mean interval between operations, days (SD)	259.3 (364.0)	0 (0.00)	79.7 (57.2)	734 (280.7)
Mean duration of follow-up, wk (SD)	136 (88.9)	95 (76.2)	102 (38.2)	219 (97.8)
Average cancer specimen weight, g	338.2	268.4	356	397.4
Pedicle(s) used	22 breasts	10 breasts	12 breasts	10 breasts
Inferior	9	8	0	1
Central	10	0	8	2
Medial	10	0	4	6
Superomedial	3	2	0	1
Complications after procedure, <i>n</i> (%)	7	2 (40.0)	2 (33.3)	3 (60.0)
Positive margins, <i>n</i> (%)	2	2 (40.0)	0 (0.0)	0 (0.0)
Eventual mastectomy, <i>n</i> (%)	3	2 (40.0)	1 (16.7)	0 (0.0)
Recurrence, <i>n</i> (%)	1	0 (0.0)	1 (16.7)	0 (0.0)

CTX, chemotherapy.

Table 2. Quality of Life Survey: Domains, Mean (SD)

	Oncoplastic Reduction Group				<i>p</i>
	Overall	Immediate	Staged-Immediate	Delayed	
Satisfaction with breasts*	3.67 (0.30)	3.83 (0.17)	3.72 (0.12)	3.49 (0.47)	0.26
Satisfaction with outcome†	2.67 (0.32)	2.83 (0.29)	2.68 (0.26)	2.52 (0.41)	0.55
Psychosocial well-being‡	4.23 (0.58)	4.41 (0.68)	4.29 (0.36)	4.03 (0.82)	0.73
Sexual well-being‡	3.58 (0.79)	3.67 (1.22)	3.60 (0.24)	3.50 (1.09)	0.67
Physical well-being‡	4.29 (0.68)	4.31 (1.07)	4.50 (0.36)	4.04 (0.77)	0.42

*Survey answers were based on a four-point Likert scale, with 1 = very dissatisfied, 2 = somewhat dissatisfied, 3 = somewhat satisfied, and 4 = very satisfied.

†Survey answers were based on a three-point Likert scale, with 1 = disagree, 2 = somewhat agree, and 3 = definitely agree.

‡Survey answers were based on a five-point Likert scale, with 1 = none of the time, 2 = a little of the time, 3 = some of the time, 4 = most of the time, and 5 = all of the time.

Mean scores of the aesthetic assessment are displayed in Table 3. A high degree of internal consistency (Cronbach’s alpha ≥0.7) was observed among the physicians who performed the aesthetic assessment. Significant improvements

occurred within groups comparing various preoperative to postoperative aesthetic parameters (Table 3). In addition, aesthetic assessments for the delayed group were consistently lower across all aspects but did not reach significance when com-

Table 3. Assessment of Preoperative and Postoperative Aesthetic Results, Mean (SD)*

	Oncoplastic Reduction Groups				Degree of Change (<i>p</i>)
	Overall	Immediate	Staged-Immediate	Delayed	
Breast symmetry					0.55
Preoperative	2.26 (0.73)	2.87 (0.50)	2.44 (0.71)	1.57 (0.25)	
Postoperative	2.75 (0.81)	3.04 (0.47)	3.25 (0.37)	1.90 (0.77)	
<i>p</i>	0.05	0.66	0.14	0.30	
Nipple position					0.10
Preoperative	1.91 (0.48)	1.78 (0.28)	2.20 (0.51)	1.63 (0.44)	
Postoperative	2.93 (0.73)	3.33 (0.18)	3.21 (0.73)	2.28 (0.62)	
<i>p</i>	0.001†	0.004†	0.04†	0.02†	
Overall aesthetic grade					0.31
Preoperative	1.87 (0.51)	1.78 (0.38)	2.20 (0.54)	1.52 (0.34)	
Postoperative	2.73 (0.73)	3.16 (0.54)	3.08 (0.58)	1.98 (0.40)	
<i>p</i>	<0.001†	0.02†	0.06	0.09	

*Survey answers were based on a five-point Likert scale, with 1 = poor, 2 = below average, 3 = satisfactory, 4 = good, and 5 = excellent.

†Significant at *p* ≤ 0.05.

pared against the other groups. Also, the improvement obtained for each breast parameter compared across groups did not reach significance, although larger improvements in overall aesthetic grades were seen in the immediate and staged-immediate groups.

Interestingly, when all questionnaire responders were dichotomized into two groups based on their level of quality of life/satisfaction and were compared with their aesthetic evaluations, some importance differences were uncovered (Table 4). Patients who were subjectively more satisfied with their breasts had significantly better breast symmetry and approached significance in overall aesthetic grade. In addition, patients who had higher scores in the psychosocial domain had significantly better overall aesthetic grades and approached significance in breast symmetry and nipple position. Also, patients with significantly symmetrical breasts and approaching significance in overall aesthetic grade reported improved physical well-being. These conclusions suggest the psychological and physical gains obtained by patients who achieve good aesthetic results (Figs. 1 through 3).

DISCUSSION

The benefits of breast conservation therapy and oncoplastic surgery are now well accepted.

The vast majority of women who are eligible for these procedures will benefit from them without compromising oncologic outcomes. Breast aesthetics are maintained in 70 to 80 percent of women following breast conservation therapy and can be further improved following oncoplastic procedures.^{3,27} Fitoussi et al. analyzed 540 patients who underwent oncoplastic breast surgery and found that a majority of patients (90 percent) achieved good aesthetic results at 5 years postoperatively and had an overall revision rate of 7.8 percent.²⁵

When considering only oncoplastic reduction mammoplasty, studies have also demonstrated high patient satisfaction. Spear et al. demonstrated an overall rating of 2.9 out of 4 for a group of patients who underwent immediate oncoplastic reduction mammoplasty.²⁴ Kronowitz et al. found excellent/good aesthetic results in 57 percent of all patients evaluated following oncoplastic reduction mammoplasty.²⁸ Reduction mammoplasty has the added benefit of providing functional improvements in patients who seek this method of reconstruction. Previous quality-of-life and patient satisfaction evaluations highlight the improvements/satisfaction obtained by patients who had oncoplastic reduction mammoplasty. Spear et al. demonstrated that patient-rated levels of satisfaction were 3.3 out of 4 after immediate

Table 4. Median Dichotomized* Quality of Life/Patient Satisfaction Scores, Mean (SD)

	Higher Mean Scores	Lower Mean Scores	<i>p</i>
Breast satisfaction			
No. of patients	9	6	
Postoperative breast symmetry	3.26 (0.35)	2.24 (0.84)	0.02*
Postoperative nipple position	3.21 (0.67)	2.66 (0.76)	0.20
Overall postoperative aesthetic grade	3.11 (0.66)	2.36 (0.62)	0.07
Outcome satisfaction			
No. of patients	10	5	
Postoperative breast symmetry	3.19 (0.34)	2.44 (0.92)	0.12
Postoperative nipple position	3.12 (0.69)	2.80 (0.79)	0.48
Overall postoperative aesthetic grade	3.01 (0.69)	2.53 (0.74)	0.28
Psychosocial well-being			
No. of patients	8	7	
Postoperative breast symmetry	3.10 (0.53)	2.27 (0.94)	0.08
Postoperative nipple position	3.24 (0.55)	2.51 (0.80)	0.09
Overall postoperative aesthetic grade	3.12 (0.59)	2.19 (0.55)	0.02†
Sexual well-being			
No. of patients	9	6	
Postoperative breast symmetry	3.12 (0.36)	2.34 (0.95)	0.08
Postoperative nipple position	3.21 (0.66)	2.66 (0.76)	0.20
Overall postoperative aesthetic grade	3.04 (0.63)	2.42 (0.73)	0.15
Physical well-being			
No. of patients	7	8	
Postoperative breast symmetry	3.07 (0.50)	2.12 (1.01)	0.05†
Postoperative nipple position	3.08 (0.69)	2.65 (0.85)	0.37
Overall postoperative aesthetic grade	3.00 (0.63)	2.18 (0.63)	0.06

*Patient responses to the questionnaire were dichotomized by the overall group mean for each specific domain to reflect patients who had higher perceived quality of life (\geq mean) versus those who had lower perceived quality of life ($<$ mean).

†Significant at $p \leq 0.05$.

reduction.²⁴ Losken et al. demonstrated a 95 percent (4.2 out of 5) patient satisfaction rate at 6-month follow-up in a group of immediate and staged-immediate reconstructions.¹⁵

In this study, comparisons of preoperative and postoperative results based on photographic images were performed. The results demonstrated that the postoperative aesthetic scores were increased for all three groups, although there was a lesser increase in the delayed cohort when compared with the immediate and staged-immediate groups. When evaluating quality of life and patient satisfaction using an adapted BREAST-Q questionnaire, similar scores were reported for each domain between groups. Importantly, symptomatic relief was adequately achieved in all groups, adding value of this means of reconstruction in patients with symptomatic macromastia. When these factors were evaluated against aesthetic scores, though, patients tended to be physically and psychologically more satisfied when they had improved breast aesthetic scores.

It is clear that oncoplastic reduction mammoplasty is a valuable tool in the setting of breast conservation therapy; however, the question of timing relative to radiation therapy remains. Most surgeons agree that the occurrence of a positive margin following oncoplastic reduction mammoplasty is problematic. Fitoussi et al. found that incomplete excision occurred in 19 percent of cases, leading to completion mastectomy in one-half of these patients or about 10 percent of all patients.²⁵ Losken et al. demonstrated a reexcision rate of 15 percent in 20 women following oncoplastic reduction mammoplasty.¹⁵ Despite this incidence, complications following oncoplastic reduction were still fewer than those following traditional mastectomy with reconstruction (22 versus 43 percent).²¹ Kronowitz et al. demonstrated positive margin status in 7 percent of women following oncoplastic breast surgery.¹⁷ All of these patients went on to completion mastectomy. Thus, the possibility of positive margins should be always kept in mind when performing immediate oncoplastic surgery, as 5 to 20 percent of patients will have close or involved margins.^{25,29}

The staged-immediate approach to patients with diffuse or extensive disease can help to eliminate the occurrence of a positive margin.^{30,31} In an era of prioritizing patient safety and minimizing untoward outcomes, this approach has merit. Occasionally, the results of a frozen section analysis may be equivocal, or the ablative surgeon may

have concerns regarding tumor size or location. In these situations, a staged-immediate procedure is advocated. In this study, it was demonstrated that the staged-immediate approach resulted in lower rates of positive margins compared with the immediate group (0 versus 40 percent). As an aside, it is important to differentiate a positive margin from local recurrence. In one patient in our series who had a staged-immediate oncoplastic reduction mammoplasty, local recurrence led to completion mastectomy.

The topic of delayed reduction mammoplasty following radiation therapy is controversial. Some surgeons remain reluctant to perform a reduction mammoplasty following breast conservation therapy. Radiation changes that occur following breast conservation therapy are often warning signs for complications later in the postoperative period. Although this is generally true, the patient's desire for symptomatic relief and improved appearance are important. Kronowitz et al. found twice as many complications in the delayed setting compared with the immediate setting. The higher complication rates were due to seroma formation, infection, and wound dehiscence.¹⁷ Breast size and body mass index also need to be considered, as complications rates tend to rise concurrently with increases in these values.³²

In summary, this study has demonstrated the safety and efficacy of immediate, staged-immediate, and delayed oncoplastic reduction mammoplasty. It is acknowledged that this study is mildly limited by its small sample size. The results of this study, however, highlight the improvements in aesthetic outcome as well as functional satisfaction following oncoplastic reduction mammoplasty. Larger comparative analyses focusing on improving patient satisfaction as related to aesthetic results are needed in the future as surgeons continue to strive for evidence-based improvement in outcomes.

Maurice Y. Nahabedian, M.D.
Department of Plastic Surgery
Georgetown University
3800 Reservoir Road NW
Washington, D.C. 20007
drnahabedian@aol.com

REFERENCES

1. Fisher B, Anderson S, Redmond CK, et al. Reanalysis and results after 12 years of follow-up in a randomized clinical trial comparing total mastectomy with lumpectomy with or without irradiation in the treatment of breast cancer. *N Engl J Med.* 1995;333:1456-1461.
2. Clough KB, Cuminet J, Fitoussi A, et al. Cosmetic sequelae after conservative treatment for breast cancer: Classification

- and results of surgical correction. *Ann Plast Surg.* 1998;41:471–481.
3. D'Aniello C, Grimaldi L, Barbato A, et al. Cosmetic results in 242 patients treated by conservative surgery for breast cancer. *Scand J Plast Reconstr Surg Hand Surg.* 1999;33:419–422.
 4. Waljee JF, Hu ES, Ubel PA, et al. Effect of esthetic outcome after breast-conserving surgery on psychosocial functioning and quality of life. *J Clin Oncol.* 2008;26:3331–3337.
 5. Waljee JF, Hu ES, Newman LA, et al. Predictors of breast asymmetry after breast-conserving operation for breast cancer. *J Am Coll Surg.* 2008;206:274–280.
 6. Clough KB, Thomas SS, Fitoussi AD, et al. Reconstruction after conservative treatment for breast cancer: Cosmetic sequelae classification revisited. *Plast Reconstr Surg.* 2004;114:1743–1753.
 7. Cochrane RA, Valasiadou P, Wilson AR, et al. Cosmesis and satisfaction after breast-conserving surgery correlates with the percentage of breast volume excised. *Br J Surg.* 2003;90:1505–1509.
 8. Veiga DF, Veiga-Filho J, Ribeiro LM, et al. Quality-of-life and self-esteem outcomes after oncoplastic breast-conserving surgery. *Plast Reconstr Surg.* 2010;125:811–817.
 9. Sabino Neto M, Dematte MF, Freire M, et al. Self-esteem and functional capacity outcomes following reduction mammoplasty. *Aesthet Surg J.* 2008;28:417–420.
 10. Ducic I, Iorio ML, Al-Attar A. Chronic headaches/migraines: Extending indications for breast reduction. *Plast Reconstr Surg.* 2010;125:44–49.
 11. Spector JA, Karp NS. Reduction mammoplasty: A significant improvement at any size. *Plast Reconstr Surg.* 2007;120:845–850.
 12. Losken A, Hamdi M. Partial breast reconstruction: Current perspectives. *Plast Reconstr Surg.* 2009;124:722–736.
 13. Hernanz F, Regano S, Vega A, et al. Reduction mammoplasty: An advantageous option for breast conserving surgery in large-breasted patients. *Surg Oncol.* 2010; 19:e95–e102.
 14. Kronowitz SJ, Kuerer HM, Buchholz TA, et al. A management algorithm and practical oncoplastic surgical techniques for repairing partial mastectomy defects. *Plast Reconstr Surg.* 2008;122:1631–1647.
 15. Losken A, Styblo TM, Carlson GW, et al. Management algorithm and outcome evaluation of partial mastectomy defects treated using reduction or mastopexy techniques. *Ann Plast Surg.* 2007;59:235–242.
 16. Munhoz AM, Montag E, Arruda EG, et al. Critical analysis of reduction mammoplasty techniques in combination with conservative breast surgery for early breast cancer treatment. *Plast Reconstr Surg.* 117:1091–1103, 2006; discussion 1104–1107.
 17. Kronowitz SJ, Hunt KK, Kuerer HM, et al. Practical guidelines for repair of partial mastectomy defects using the breast reduction technique in patients undergoing breast conservation therapy. *Plast Reconstr Surg.* 2007;120:1755–1768.
 18. Kronowitz SJ, Feledy JA, Hunt KK, et al. Determining the optimal approach to breast reconstruction after partial mastectomy. *Plast Reconstr Surg.* 2006;117:1–11; discussion 12–14.
 19. Clough KB, Kroll SS, Audretsch W. An approach to the repair of partial mastectomy defects. *Plast Reconstr Surg.* 1999;104:409–420.
 20. Clough KB, Lewis JS, Couturaud B, et al. Oncoplastic techniques allow extensive resections for breast-conserving therapy of breast carcinomas. *Ann Surg.* 2003;237:26–34.
 21. Losken A, Pinell XA, Eskenazi B. The benefits of partial versus total breast reconstruction for women with macromastia. *Plast Reconstr Surg.* 2010;125:1051–1056.
 22. Caruso F, Catanuto G, De Meo L, et al. Outcomes of bilateral mammoplasty for early stage breast cancer. *Eur J Surg Oncol.* 2008;34:1143–1147.
 23. Losken A, Schaefer TG, Newell M, et al. The impact of partial breast reconstruction using reduction techniques on post-operative cancer surveillance. *Plast Reconstr Surg.* 2009;124:9–17.
 24. Spear SL, Pelletiere CV, Wolfe AJ, et al. Experience with reduction mammoplasty combined with breast conservation therapy in the treatment of breast cancer. *Plast Reconstr Surg.* 2003;111:1102–1109.
 25. Fitoussi AD, Berry MG, Fama F, et al. Oncoplastic breast surgery for cancer: Analysis of 540 consecutive cases [outcomes article]. *Plast Reconstr Surg.* 2010;125:454–462.
 26. Pusic AL, Klassen AF, Scott AM, et al. Development of a new patient-reported outcome measure for breast surgery: The BREAST-Q. *Plast Reconstr Surg.* 2009;124:345–353.
 27. Bajaj AK, Kon PS, Oberg KC, et al. Aesthetic outcomes in patients undergoing breast conservation therapy for the treatment of localized breast cancer. *Plast Reconstr Surg.* 2004; 114:1442–1449.
 28. Kronowitz S, Hunt K, Kuerer H, et al. Immediate versus delayed repair of partial mastectomy defects in breast conservation. *Breast Cancer Res.* 2009;11(Suppl 1):S8.
 29. Rietjens M, Urban CA, Rey PC, et al. Long-term oncological results of breast conservative treatment with oncoplastic surgery. *Breast* 2007;16:387–395.
 30. Song HM, Styblo TM, Carlson GW, et al. The use of oncoplastic reduction techniques to reconstruct partial mastectomy defects in women with ductal carcinoma in situ. *Breast J.* 2010; 16:141–146.
 31. Kronowitz SJ. Practical guidelines for repair of partial mastectomy defects using the breast reduction technique in patients undergoing breast conservation therapy: Reply. *Plast Reconstr Surg.* 2008;122:676–677.
 32. Gamboa-Bobadilla GM, Killingsworth C. Large-volume reduction mammoplasty: The effect of body mass index on postoperative complications. *Ann Plast Surg.* 2007;58:246–249.