

# Comparison Study of Nipple-Areolar Sensation After Reduction Mammoplasty

**Jeffrey E. Schreiber, MD; John A. Girotto, MD; Mehrdad M. Mofid, MD;  
Navin Singh, MD; and Maurice Y. Nahabedian, MD**

From the Division of Plastic and Reconstructive Surgery, Department of Surgery, The Johns Hopkins University School of Medicine, Baltimore, MD.

**Background:** Although many techniques of reduction mammoplasty are currently in use, a prospective study quantitating the sensation of the nipple-areolar complex (NAC) after the performance of specific techniques has not been performed.

**Objective:** The purpose of this study was to quantitate the postoperative sensation of the NAC after reduction mammoplasty and to compare the results on the basis of the orientation of the vascularized pedicle.

**Methods:** We tested 42 patients divided into 4 groups: medial pedicle (9 patients), inferior pedicle (8 patients), free nipple transfer (8 patients), and a control group (17 patients). The specific mammoplasty technique chosen was based on the preoperative assessment and the estimated volume of resection. A Wise pattern approach was used in all cases. NAC sensation was quantified with the use of the Pressure Specified Sensory Device (Sensory Management Services LLC, Baltimore, MD).

**Results:** We detected no significant difference in the volume of reduction between the free nipple group and the medial pedicle group ( $P = .14$ ). NAC sensation in the free nipple transfer group was significantly lower than either of the pedicle techniques and control group in all areas of testing ( $P < 0.001$ ), whereas the medial and inferior pedicle groups had no significant sensory differences in NAC sensation ( $P < 0.001$ ).

**Conclusions:** The medial pedicle technique is safe and reliable and can be used for large-volume reduction mammoplasty to optimize sensation of the NAC. (Aesthetic Surg J 2004;24:320-323)

Current methods of reduction mammoplasty for most women are based on transposition of the nipple-areolar complex (NAC) on a pedicle of tissue. The principle advantages of the various pedicle techniques are preservation of the vascularity of and innervation to the NAC. Reduction mammoplasty for mild to moderate hypertrophy (<1200 g/breast) involving NAC transposition is usually uncomplicated, with a high percentage of women retaining viability and sensation. However, large-volume reduction mammoplasty (>1200 g/breast) can result in morbidity related to the viability and sensation of the NAC. In these cases, the technique of using a free nipple graft is often preferred to preserve the viability of the NAC; however, nipple sensation is always diminished.

Reduction mammoplasty with NAC transposition based on a medial pedicle was initially designed as an alternative to amputation and free nipple grafting. Initial studies demonstrated that the viability and sensation of the NAC was retained in 98% of women with

severe mammary hypertrophy.<sup>1</sup> This is because the perforating vessels from the internal mammary artery and vein are the dominant source of blood to the breast in most women and because the anterior division of the intercostal nerves also innervate the NAC. Although many techniques of reduction mammoplasty are capable of maintaining the viability and sensation of the NAC, a prospective study quantitating the sensation of the NAC after various techniques has not been performed.

The purpose of this study was to quantitate the postoperative sensation of the NAC after reduction mammoplasty and to compare the results on the basis of the orientation of the vascularized pedicle. The results of pedicle techniques, including both the medial and inferior approaches were compared with those in standardized controls and women who had undergone amputation and free nipple grafting. The Pressure Specified Sensory Device (PSSD: Sensory Management Services, LLC, Baltimore, MD) was used to quantitate the sensation.

## Methods

Forty-two women who underwent large-volume reduction mammoplasty by the principal surgeon (M. Y. N.) were retrospectively identified. Large volume reduction was defined as removal of more than 1000 g of tissue per breast. Demographic and operative data, including age, body-mass index (BMI), sternal notch-to-nipple distance (SN-N), volume of reduction, date, and technical specifics of the procedure were obtained from the medical records. The 42 patients tested were divided into 4 groups on the basis of the procedure performed: medial pedicle (9 patients), inferior pedicle (8 patients), free nipple transfer (8 patients), and a control group (17 patients). Studies validating these techniques have been previously reported.<sup>2-4</sup> The control group was divided into subgroups based on bra-cup size (group 1, A-C; group 2, D-EE).

The specific mammoplasty technique chosen was based on the preoperative assessment and the estimated volume of resection. In general, when the length of the inferior pedicle exceeded that of the medial pedicle, the medial pedicle was chosen. The amputation-and-nipple graft technique was chosen for certain patients requiring resections that exceeded 1500 g per breast or when there was insufficient bleeding from the distal edge of the elevated dermoparenchymal pedicle. A Wise pattern approach was used in all cases. Postoperative follow-up for all women ranged from 6 to 36 months (mean 18 months). Institutional review board approval was granted for this study.

Sensation of the NAC was quantified in all women with the use of the PSSD. Clinical experience with this device and the technical details of its use have been previously reported.<sup>1</sup> Simply stated, the PSSD is a handheld device with 2 pressure-calibrated, computer-linked sensors. The device is applied to the cutaneous surface at variable pressures until the patient is able to discriminate the sensation. The pressure is recorded in grams per square millimeter. Sensation of the NAC was quantified with the use of the PSSD on the 4 quadrants of the areola (upper medial, upper lateral, lower medial, lower lateral) and the nipple. Five independent readings, assessed at each site, included 1 point static and 1 point moving sensation. All sensory studies were performed at least 6 months after reduction mammoplasty. We conducted statistical analysis using analysis of variance (ANOVA) and the Student *t* test.

## Results

The mean age of the patients was 30 years (range 19–50 years), the mean BMI was 42 kg/m<sup>2</sup> (BMI >30 defined as obese), and the mean SN-N distance was 46 cm.

The mean volume of reduction in the inferior pedicle group was significantly less than that in the free nipple transfer and medial pedicle groups (1.1, 2.0, and 1.7 kg, respectively;  $P < 0.05$ , ANOVA). We detected no significant difference in the volume of reduction between the free nipple group (2.0 kg) and the medial pedicle group (1.7 kg;  $P = 0.14$ , Student *t* test). Average movement of the nipple in the medial pedicle, inferior pedicle, and free nipple graft groups was 16.9, 7.3, and 16.8 cm, respectively. The change in nipple position in the medial pedicle group was significantly larger than that in the inferior pedicle group ( $P < 0.05$ , Student *t* test) but almost equal to that in the free nipple graft group ( $P = 0.929$ , Student *t* test).

Analysis of sensation demonstrated that within the control groups, sensitivity of the NAC was 10 times greater for group 1 (bra size 34A–36C) than in group 2 (36DD–46EE;  $P < 0.002$ , 2-tailed paired Student *t* test). Within the free nipple transfer group, sensation of the NAC was significantly lower than in either of the pedicle groups in all areas of testing ( $P < 0.001$ , ANOVA). We detected no significant difference in NAC sensation between the medial and inferior pedicle groups ( $P < 0.001$ , Student *t* test; Table).

## Discussion

The history of breast reduction dates back to the 6th century AD, when Paulus Aegineta recorded his experience performing a reduction mammoplasty for the treatment of gynecomastia.<sup>5</sup> Over the years, many different techniques have been developed in which the primary goals were to achieve an aesthetically pleasing breast while maintaining the neurovascular integrity of the NAC. These techniques were based on an idea championed by Biesenberger,<sup>6</sup> who in 1931 described his technique of keeping the nipple attached to a parenchymal pedicle as a means of preserving conical contouring of the breast. Since then, multiple pedicle techniques have been developed, including the dermal bipedicle,<sup>7</sup> superior pedicle,<sup>8</sup> lateral pedicle,<sup>9</sup> vertical bipedicle,<sup>10,11</sup> inferior pedicle,<sup>3,12</sup> and medial pedicle<sup>2</sup>; central breast reduction by way of vertical mammoplasty with lipoplasty<sup>13</sup>; and the “B” technique.<sup>14,15</sup> Free nipple transfer has been advocated for those patients requiring very large reductions (1500–2000 g/breast), for elderly women with comorbidities (to limit anesthesia time), and for women who have undergone previous breast operations in whom blood supply to the NAC is uncertain.<sup>16</sup>

We designed this study to assess the sensation of the NAC after the use of various methods of reduction

**Table. Mean cutaneous measurements: Medial pedicle versus inferior pedicle, free nipple graft, and control group 2**

Site and type of examination	Reduction mammoplasty technique				P
	Medial pedicle (n = 9)	Inferior pedicle (n = 9)	Free nipple graft (n = 8)	Group 2 36DD-46EE. (n = 8)	
Nipple: 1-point moving	5.36 (2.09)*	1.47 (1.72)	20.28 (10.06)	4.54 (2.72)	.005
Nipple: 1-point static	13.34 (5.0)	4.47 (2.00)	20.2 (5.53)	10.2 (4.31)	<.0001
Areola: 1-point moving	8.29 (2.49)	4.87 (2.37)	33.84 (14.97)	8.15 (3.43)	.003
Areola: 1-point static	22.99 (5.71)	14.79 (4.15)	44.48 (12.73)	21.37 (7.29)	.002

\*Numbers in parentheses represent standard deviation.

mammoplasty. The traditional method advocated for large-volume reduction mammoplasty (>1200 g resected per breast or elevation of the NAC of >16 cm) has been to perform a free nipple graft to minimize the risk of NAC ischemia or even total loss.<sup>17,18</sup> Although this technique can preserve the viability of the NAC, its disadvantages include altered sensation or absence of sensation, inability to lactate, and hypopigmentation. The results of this study have demonstrated that all patients who underwent reduction mammoplasty by means of the free nipple transfer technique had some return of NAC sensation after surgery, albeit significantly less than that in either of the 2 pedicle technique groups.

The inferior and medial pedicle techniques preserved normal to near-normal sensation in most breasts. However, comparison of the volume of resection and the distance of NAC transposition between the 2 methods demonstrated that the reductions involving a medial pedicle were significantly larger. We found no significant difference in the volume of resection or distance of NAC transposition when comparing the medial pedicle technique with the amputation and nipple graft techniques. This comparison demonstrated superior sensation in the NAC after following medial pedicle reduction mammoplasty. We therefore believe that reduction mammoplasty based on a medial pedicle can be safely performed in women with severe mammary hypertrophy who would otherwise be candidates for amputation and free nipple grafting. The benefits include retained viability, improved sensation, and normal pigmentation of the NAC.

Despite the apparent advantages of reduction mammoplasty based on a medial pedicle suggested by our results, the methodology of this study includes several possible sources of error. The sample sizes for each

group of women are relatively small; larger numbers would reinforce the results. Technical factors that are surgeon-dependent can also influence outcome. These include placement of the NAC at the proper location on the breast, design of the medial pedicle with an appropriate length-to-width ratio, maintenance of an adequate dermoparenchymal attachment to the chest wall to augment the vascularity of the NAC, and tension-free closure. Another possible source of error involves the interval between reduction mammoplasty and sensory testing. The 6-month interval we chose may not have provided sufficient time for nerve regeneration in some women. However, it is unlikely that the free nipple transfer group would undergo sufficient nerve regeneration to surpass the medial pedicle group in postoperative NAC sensation.

### Conclusion

The medial pedicle technique is a safe and reliable technique that can be applied to large-volume reduction mammoplasty. The ability to preserve NAC sensation with the use of a medial pedicle has been demonstrated, and it is significantly greater than the sensation preserved by amputation and free nipple graft. We detected no significant difference in NAC sensation after medial versus inferior pedicle reduction mammoplasty. This finding may be related to the volume of resection, which was significantly greater for the medial pedicle group. ■

### References

1. Nahabedian M, Mofid M. Viability and sensation of the nipple-areolar complex after reduction mammoplasty. *Ann Plast Surg* 2002;49:24-31.
2. Nahabedian M, McGibbon B, Manson P. Medial pedicle reduction mammoplasty for severe mammary hypertrophy. *Plast Reconstr Surg* 2000;105:896-904.

3. Courtiss E, Goldwyn R. Reduction mammoplasty by the inferior pedicle technique. *Plast Reconstr Surg* 1977;59:500.
4. Farina R, Villano J. Reduction mammoplasty with free grafting of the nipple and areola. *Br J Plast Surg* 1972;25:393-398.
5. Letterman G, Schurter M. History of reduction mammoplasty. In: Owsley JQ, Peterson RA Peterson, eds. *Symposium on Aesthetic Surgery of the Breast*. St. Louis: C. V. Mosby; 1978:243-249.
6. Biesenberger H. Deformaten und kosmetische operationene der weiblichen Brust. Vienna, Austria: W. Maudrich; 1931.
7. Strombeck J. Mammoplasty: report of a new technique based on the two pedicle procedure. *Br J Plast Surg* 1960;13:79.
8. Weiner D, Aiache A, Silver L, et al. A single dermal pedicle for nipple transposition in subcutaneous mastectomy, reduction mammoplasty, or mastopexy. *Plast Reconstr Surg* 1973;51:115.
9. Skoog T. A technique of breast reduction: transposition of the nipple on a cutaneous vascular pedicle. *Acta Chir Scand* 1963;126:453.
10. McKissock PK. Reduction mammoplasty with a vertical dermal flap. *Plast Reconstr Surg* 1972;49:245.
11. McKissock PK. Reduction mammoplasty by the vertical bipedicle flap technique. Rationale and results. *Clin Plast Surg* 1976;3:309.
12. Georgiade N, Serafin D, Morris R, et al. Reduction mammoplasty utilizing an inferior pedicle nipple-areolar flap. *Ann Plast Surg* 1979;3:211.
13. Lejour M. Vertical mammoplasty and liposuction of the breast. *Plast Reconstr Surg* 1994;94:100-114.
14. Regnault P. Reduction mammoplasty by the "B" technique. *Plast Reconstr Surg* 1974;53:19.
15. Regnault P. Breast reduction and mastopexy, an old love story: B technique update. *Aesthetic Plast Surg* 1990;14:101.
16. Oneal R, Goldstein J, Rohrich R, et al. Reduction mammoplasty with free-nipple transplantation: indications and technical refinements. *Ann Plast Surg* 1991;26:117.
17. Gradinger GP. Reduction mammoplasty utilizing nipple-areola transplantation. *Clin Plast Surg* 1988;15:641-654.
18. Little J, Spear S, Romm S. Reduction mammoplasty and mastopexy. In: Smith J, Aston S, eds. *Grabb and Smith's Plastic Surgery*. 4th ed. Boston, MA: Little, Brown, and Co.; 1991:1157-1202.

Accepted for publication March 16, 2004.

Presented at the Plastic Surgery Research Council Meeting, April 23-26, 2003, Las Vegas, NV.

Reprint requests: Maurice Y. Nahabedian, MD, FACS, Division of Plastic and Reconstructive Surgery, The Johns Hopkins Hospital, 601 N. Caroline Street 8152C, Baltimore, MD 21287; e-mail: [mnahabed@jhmi.edu](mailto:mnahabed@jhmi.edu).

Copyright © 2004 by The American Society for Aesthetic Plastic Surgery, Inc. 1090-820X/\$30

doi:10.1016/j.asj.2004.04.004