

## REVIEW ARTICLE

# Surgical Techniques for Personalized Oncoplastic Surgery in Breast Cancer Patients with Small- to Moderate-Sized Breasts (Part 1): Volume Displacement

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Despite the popularity of breast-conserving surgery (BCS), which constitutes 50-60% of all breast cancer surgeries, discussions regarding cosmetic results after BCS are not specifically conducted. The simple conservation of breast tissue is no longer adequate to qualify for BCS completion. The incorporation of oncological and plastic surgery techniques allows for the complete resection of local disease while achieving superior cosmetic outcome. Oncoplastic BCS can be performed in one of the following two ways: 1) volume displacement techniques and 2) volume replacement techniques. This study reports volume displacement surgical techniques, which allow the use of remaining breast tissue after BCS by glandular reshaping or reduction techniques for better cosmetic results. Thorough understanding of these procedures and careful consideration of the patient's breast size, tumor location, excised volume, and volume of the remaining breast tissue during the surgery in choosing appropri-

ate patient and surgical techniques will result in good cosmetic results. Surgery of the contralateral breast may be requested to improve symmetry and may take the form of a reduction mammoplasty or mastopexy. The timing of such surgery and the merits of synchronous versus delayed approaches should be discussed in full with the patients. Because Korean women have relatively small breast sizes compared to Western women, it is not very easy to apply the oncoplastic volume displacement technique to cover defects. However, we have performed various types of oncoplastic volume displacement techniques on Korean women, and based on our experience, we report a number of oncoplastic volume displacement techniques that are applicable to Korean women with small- to moderate-sized breasts.

**Key Words:** Breast neoplasms, Breast conserving surgery, Cosmetic surgery, Volume displacement

## INTRODUCTION

The field of oncoplastic surgery has greatly evolved over the past several years. The incorporation of oncological and plastic surgery techniques allows for the complete resection of local disease while achieving superior cosmetic outcome. As previously described, the choice of oncoplastic surgical technique resulting in better cosmetics depends on the patient's breast size, tumor location, the excised volume, and the volume of the remaining breast tissue after surgery [1]. Oncoplastic breast-conserving surgery (BCS) can be performed in one of the following two ways: First, volume replacement technique

combines resection with glandular reshaping or reduction mammoplasty. Second, volume replacement technique combines resection with immediate reconstruction using an autologous tissue flap [2].

Volume displacement techniques have some advantages over volume replacement techniques. The surgery is shorter in duration, it is less extensive, and there is no donor-site morbidity. However, in patients with small breast size or a higher tumor-to-breast-volume ratio, there is a limitation on satisfactory cosmetic results using this technique. In these cases, volume replacement techniques may be useful. Because Korean women have relatively small breast sizes compared to Western women, it is not very easy to apply the oncoplastic volume displacement technique to cover defects. However, we have performed various types of oncoplastic volume displacement techniques on Korean women, and based on our experience, we report a number of oncoplastic volume displacement techniques that are applicable to Korean women with small- to moderate-sized breasts.

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## GENERAL PRINCIPLES

Most patients receiving BCS are good candidates for oncoplastic surgery. In particular, larger areas need to be excised to achieve negative margins in those who have independent risk factors for positive margins (i.e., multifocal disease, large tumor size, diffuse microcalcification, the presence of extensive ductal component, younger age, estrogen receptor negativity, and lobular histology). Because these patients show particularly poor cosmetic results, oncoplastic surgery is necessary. Larger areas may be excised in locally advanced breast cancers with good response to neoadjuvant chemotherapy, and oncoplastic surgery may be performed to correct breast shape defects. The excision of greater than 20% of the breast or of tumors inferiorly, medially, or subareolarly located result in more noticeable defects, thus creating candidates for oncoplastic surgery.

If the excised tumor is located on the superior portion of the breast, the round block technique, the tennis racket method, the rotation flap, and the reduction mammoplasty technique using the inferior pedicle produce good results. Central tumors must be considered for multifocal or multiple disease processes, the direct invasion of the nipple-areolar complex (NAC), and poor aesthetic results in the case of NAC removal. For inferior tumors, caution must be used to prevent unfavorable distortion results, skin retraction, and inferior malpositioning of the NAC due to an inadequate amount of remaining tissue after excision.

Following wide excisions, the resultant scarring and radiotherapy changes tend to cause nipple deviation towards the scar. This can be avoided by undermining the skin and disconnecting the ducts behind the NAC. If significant NAC deviation is anticipated, then de-epithelialization of a crescent of the skin from the areolar edge that is opposite the scar and resiting the nipple to adjust for anticipated deviation is often helpful. Surgery of the contralateral breast may be requested to improve symmetry and may take the form of a reduction mammoplasty or mastopexy. Surgery of the contralateral breast to improve symmetry should be offered to all patients. The timing of such surgery and the merits of synchronous versus delayed approaches should be discussed in full with the patients.

## GLANDULAR RESHAPING

In glandular reshaping, the surgeons can minimize the depression around the defects and subsequently perform a simple primary closure. When additional defects caused by the breast cancer are less than moderate and the remaining breast tissue is sufficient, broad dissection of the breast parenchyma around the defects from the skin and chest wall can be per-

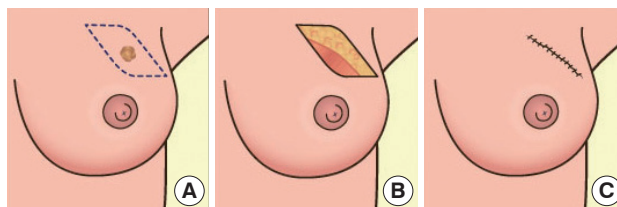
formed, and the defects are subsequently filled using a full-thickness segment of fibroglandular breast tissue advancement, rotation and transposition.

### Parallelogram mastopexy lumpectomy

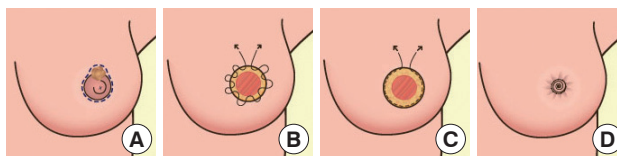
Parallelogram mastopexy lumpectomy is applicable when the tumor is located far from the NAC, and this allows for larger margins compared to standard lumpectomy. The skin incision is not elliptical but rather shaped like a parallelogram with the two margins of the same length that taper at the end to prevent dog-earing (Figure 1A). After lumpectomy (Figure 1B), breast tissues around the incision are separated and undergo glandular reshaping to maintain the breast shape without a divot (Figure 1C). The disadvantage of this technique is an increased scar length, and care must be taken against removing too much skin to broadly prevent shifting of the NAC, so this procedure can be used in small tumors [2,3].

### Purse-string suture

A purse-string suture is used when the tumor is located close to the NAC, and the NAC is excised along with the tumor (Figure 2A). Round defects after central quadrantectomy are brought together after undermining the nearby breast tissue, and the skin is closed by a continuous running stitch technique using purse-string sutures (Figure 2B, C, D). This technique should only be performed when the defect is small enough to be closed using nearby breast tissue. In the past, close proximity of the tumor to the NAC was an indication for total mastectomy. Using purse-string sutures can yield satisfactory cosmetic results by conserving the breast and reconstructing the NAC and tattoo after radiation therapy [4].



**Figure 1.** Parallelogram mastopexy lumpectomy. (A) Preoperative design with parallelogram form. (B) Lumpectomy. (C) Glandular reshaping.



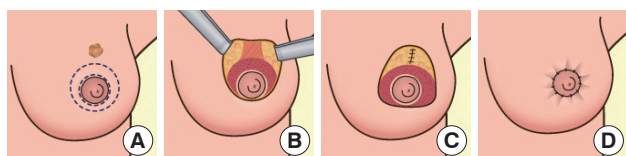
**Figure 2.** Purse-string suture. (A) Preoperative design including tumor and nipple-areolar complex. (B) Purse-string suture with nearby breast tissue. (C) Purse-string suture with skin. (D) Final result at closure.

**Round block technique**

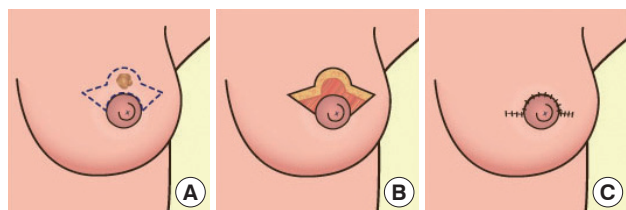
The round block technique can be used in patients with small- to moderate-sized breasts without ptosis and for tumors located near the NAC but without nipple invasion. While the patient is sitting, two circular skin markings are made (Figure 3A) on her breasts. The inner marking is made on the areolar border, and the external marking border varies based on the tumor size and location, nipple position, and the degree of ptosis. An external incision is made further away from the inner incision with increasing degrees of ptosis and tumor size. After the incisions are made, the tissue between the two incisions is de-epithelialized. Care must be taken to prevent injury to the dermis to preserve blood supply to the NAC (Figure 3B). After separation of the skin around the tumor, lumpectomy is performed including the tumor and normal breast tissue. The surrounding breast tissue undergoes undermining and approximation for glandular reshaping (Figure 3C), and the two periareolar skin incisions are closed using a running suture technique while checking for symmetry of the two breasts (Figure 3D). If necessary, as in severe ptosis, the opposite NAC may be repositioned using the same method to result in a symmetric and ideal position of and appearance of the NAC. After the surgery, the cosmetic results are satisfactory because there are only perimamillary scars without any additional scars, and in the case of a large NAC, a smaller neo-areola may be created [2,5].

**Batwing mastopexy**

Batwing mastopexy is a technique that uses a semi-circular line at the upper margin of the NAC and another semi-circular parallel line above with two angled incisions to connect



**Figure 3.** Round block technique. (A) Preoperative design with two circular skin marking. (B) Lumpectomy and de-epithelialization. (C) Undermining and approximation of nearby breast tissue. (D) Postoperative periareolar scar.

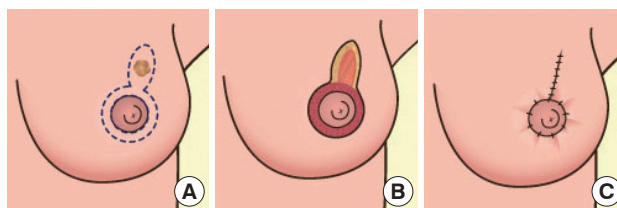


**Figure 4.** Batwing mastopexy. (A) Preoperative design with batwing form. (B) Lumpectomy. (C) Pulling up the inferior breast tissue.

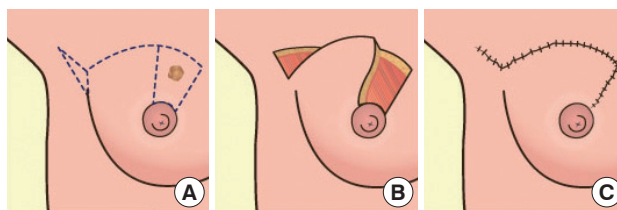
these two lines in a wing-like fashion to remove the lesion (Figure 4A, B). The defect is closed by pulling up the inferior breast tissue and suturing the layers together (Figure 4C). This technique is also known as inverted V or omega plasty due to the incision shape, which looks similar to an inverted V or an “omega” symbol [5]. It may be used for lesions in the upper central breast near the nipple. An advantage of this procedure is the inclusion of the NAC border in the incision line to hide the wound and the easy addition of central quadrantectomy if nipple invasion is found during the procedure [3]. However, if the diameter of NAC is small, the proportion of the NAC in the incision decreases, and the wound may appear relatively large. After the procedure, the location of the NAC deviates superiorly, and in some cases, additional surgery to correct the asymmetry on the other NAC may be necessary.

**Tennis racket method**

The tennis racket method uses the circular line of the NAC, a larger, more external circular line, and a wedge-shaped incision from the external circular line (Figure 5A). After removal of the breast tissue within the wedge-shaped incision and de-epithelialization between the two circular incision lines (Figure 5B), the surrounding breast tissues outside the wedge are brought together, the defects are filled with sutures, and the NAC is re-centralized. Then, the skin layers of the external circular incision are sutured along with the repositioned NAC (Figure 5C). Although this method is usually used for cancerous lesions located in the upper outer quadrants (UOQs) and lower outer quadrants (LOQ), an advantage of this technique is that it can be used for other quadrants as well.



**Figure 5.** Tennis racket method. (A) Preoperative design with racket form. (B) Lumpectomy and de-epithelialization. (C) Filling and nipple-areolar complex reposition.



**Figure 6.** Rotation flap. (A) Preoperative design. (B) Lumpectomy and flap elevation. (C) Flap rotation and closure.

### Rotation flap

Incisions of the rotation flap include a semi-circular line of the upper inner quadrant (UIQ) of the NAC and a parallel semicircular arc at the margin line of the breast UIQ (Figure 6A). Straight lines are drawn connecting these two arcs, the breast tissue within the area is removed (Figure 6B), and the UOQ of the breast is used as a skin and subcutaneous tissue flap and elevated and rotated to fill in the defect (Figure 6C). An axillary triangular incision window helps in the rotation of the flap and can be useful in axillary lymph node dissection (Figure 6A) [2]. This method is applicable to relatively large tumors located in the UIQ with some distance from the nipple, and it may be used in some tumors located in the upper central aspect of the breast. The disadvantage of this technique is its relatively large incision.

## REDUCTION MAMMOPLASTY

Of the oncoplastic techniques, oncoplastic reduction mammoplasty may be used if the patient has a large breast volume or if there is breast ptosis. Patient selection should be primarily limited to those who desire breast reduction and those who have at least moderately sized breasts with a defect that is suspected to be at least moderate in size (Table 1).

Oncoplastic reduction mammoplasty has many cosmetic, functional, and oncological advantages. Because the breast size decreases after the procedure, the balance of the two breasts against each other and against the entire body can be optimally maintained. Back pain and shoulder pain due to large breasts can be resolved, and a more balanced posture can be achieved. In addition, investigation of the excised parenchymal tissue from opposite breast allows for the detection of occult breast lesions [6], and additional excision of surrounding breast tissue after partial mastectomy increases the safety of the resection margin. By reducing the breast size, the use of postoperative radiation is made easier, and radiotherapy complications can be meaningfully decreased by using equal amounts of radiation in a well-balanced distribution [7].

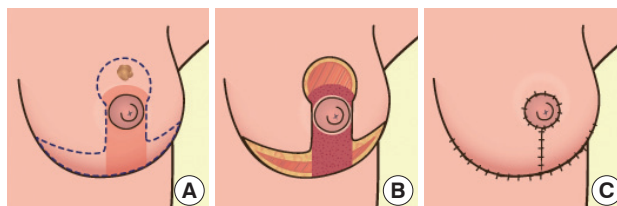
Complications include wound dehiscence, fat necrosis, flap necrosis, NAC necrosis, and, rarely, wound infection, hemato-

mas and seromas. Wound dehiscence can be managed using conservative treatment or wound revision, and breast deformation that is secondary to fat necrosis can be repaired by the removal of necrosed fat and the injection of fat harvested from the abdomen. Flap necrosis and NAC necrosis occur due to the vascular status and tension of the flap and can therefore be prevented by maximal preservation of the perforator vessel and beveling of the flap.

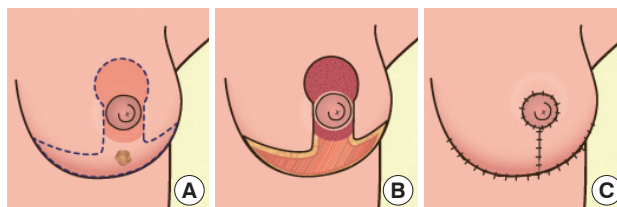
The location of the tumor is thought to be the most important factor in the choice of a pedicle. An inferiorly based pedicle is used if the tumor is located in the upper breast, and the superiorly based pedicle is used if it is located in the lower breast. Other than this important factor, the preferred techniques and tendencies of the surgeon and the preference of the patient can influence the decision [8]. After the pedicle choice is made, Wise (inverted T) or vertical pattern incisions can be chosen. In the case of moderate-sized breasts, a vertical pattern or Wise pattern (inverted T) can be chosen based on breast size, degree of ptosis, and size of the tumor to be excised. For larger breasts, the Wise pattern (inverted T) is primarily used.

### Wise pattern (Inverted T)

A midline from the suprasternal notch advancing inferiorly is first marked. The intersection of the line from the midclavicular point and the current nipple with an inframammary fold is selected as the location of the new nipple. The distance between the midline and new nipple should be approximately 9-11 cm, and the lines from the suprasternal notch and the new nipples on both sides should form a right triangle (18-22



**Figure 7.** Wise pattern (inverted T) reduction with inferiorly based pedicle. (A) Preoperative design. (B) Lumpectomy and deepithelized pedicle elevation. (C) Transposition of the pedicle into the new location.



**Figure 8.** Wise pattern (inverted T) reduction with superiorly based pedicle. (A) Preoperative design. (B) Lumpectomy and deepithelized pedicle elevation. (C) Transposition of the pedicle into the new location.

**Table 1.** Patient selection for oncoplastic reduction mammoplasty

Patient selection
1. Those who wish to undergo partial reconstruction
2. Those who don't want replacement techniques
3. Those who wish to reduce their breasts
4. Those in whom cancer is confirmed preoperatively
5. Breast size: moderate to large
6. Defect size: moderate to large



cm). After marking the tumor location, a Wise keyhole wire pattern is used to further design the excision area to include the area of breast to be removed. The key hole can be rotated towards the tumor, or the design can be enlarged, with a subsequent repositioning of the NAC. Based on the tumor location, an inferiorly based pedicle (Figure 7A) or superiorly based pedicle (Figure 8A) is chosen, and a pedicle with a width of approximately 8-10 cm is designed with a margin of 1.5 cm from the areola.

First, the tumor resection is performed at the previously marked tumor location. After infiltration with local anesthesia at the dermal pedicle and incision line, an incision is made along the design, and de-epithelization is performed to create the pedicle. The thickness of pedicle should be 4-10 cm at the base and 3-5 cm at the NAC. After flap elevation, parenchymal tissue is removed (Figures 7B, 8B). The transposition of the pedicle into the new location, and then the skin flaps on both sides are advanced and closed (Figures 7C, 8C). The reduction of the other breast is performed using the same method.

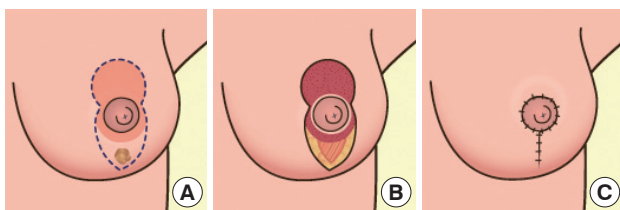
### Vertical pattern

After marking the location of the new nipple in the same fashion as in the Wise pattern, the location of the tumor and the extent of breast tissue removal is marked. When the breast is pushed medially and laterally against a vertical line, the medial and lateral incision line is determined as the area to be resected (Figure 9A). The inferior margin of the excision should be located approximately 4 cm superior to the inframammary fold. A pedicle 8-10 cm in width with a 1.5 cm margin around the areola is designed.

The operative procedure is similarly performed as mentioned above. After the tumor resection, the dermal pedicle deepithelized is elevated and the parenchymal tissue inside the incision line is removed (Figure 9B). The dermal pedicle is transposed towards the defect and skin flap on both sides are advanced and closed (Figure 9C).

### CONCLUSION

Despite the popularity of BCS, which constitutes 50-60% of



**Figure 9.** Vertical reduction. (A) Preoperative design. (B) Lumpectomy and deepithelized pedicle elevation. (C) New nipple positioning.

all breast cancer surgeries, discussions regarding cosmetic results after BCS are not specifically conducted. The simple conservation of breast tissue is no longer adequate to qualify for BCS completion. More research should be actively pursued to achieve symmetry with the contralateral breast after BCS and radiotherapy as well as patient satisfaction with breast cosmetics. This study reports volume displacement surgical techniques, which allow the use of remaining breast tissue after BCS by glandular reshaping or reduction techniques for better cosmetic results. Thorough understanding of these procedures and careful consideration of the patient's breast size, tumor location, excised volume, and volume of the remaining breast tissue during the surgery in choosing appropriate patient and surgical techniques will result in good cosmetic results. Not all patients receiving BCS require oncoplastic breast surgery, and immediate reconstruction is not always necessary even when using oncoplastic procedures. Based on surgical opinion, in cases of high risk for positive margins, delaying the procedure for a few weeks or after radiotherapy is also an option.

Collaboration between breast surgeons and plastic surgeons in considering oncologic and cosmetic perspectives and application of appropriate surgical techniques will result in a greater range of criteria for patient suitability for BCS and limit adverse aesthetic sequelae.

### CONFLICT OF INTEREST

The authors declare that they have no competing interests.

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