

## CASE REPORT

## Abdominal Advancement Flap as Oncoplastic Breast Conservation: Report of Seven Cases and Their Cosmetic Results

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An abdominal advancement flap (AAF) is a flap that pulls the elevated abdominal skin up and creates the shape of the inferior portion of the breast by making a neo-inframammary fold. Seven patients underwent remodeling using an AAF or a method combining an AAF with other volume displacement techniques after partial mastectomy. The excision volume ranged from 15% to 35%. AAF with only mobilization of the gland flaps was performed in two cases, with lateral mammoplasty in one case, with the round block technique (RBT) in one case, with a modified

RBT in one case, and with medial mammoplasty in two cases. Although one patient treated with a RBT had a partial blood-flow insufficiency of the nipple-areola complex, it improved with conservative treatment. The cosmetic results were found to be excellent in three cases, good in three, and fair in one case.

**Key Words:** Mammoplasty, Operative surgical procedures, Segmental mastectomy

### INTRODUCTION

Breast-conserving surgery (BCS) is the standard procedure used to treat early breast cancer. Considering the postoperative cosmetic results is also important when performing such surgeries. However, when the excision volume exceeds 20% of the breast volume, it is difficult to achieve good cosmetic results [1]. Operations performed to achieve both oncological radicality and good cosmetic results are referred to as oncoplastic surgery. Although many oncoplastic techniques have been reported, therapeutic mammoplasty using reduction mammoplasty is the most popular oncoplastic technique [2-4]. Therapeutic mammoplasty is best suited for Western women who have fatty large-sized breasts. However, the breast size of most Japanese females is relatively small and dense; thus, therapeutic mammoplasty is unsuitable for many Japanese patients.

An abdominal advancement flap (AAF) is a flap that is pulled up using the skin and the subcutaneous tissue that was under

the original inframammary fold (IMF). It is a method that can be used to create the shape of the inferior portion of the breast by making a neo-IMF. This flap has been reported as an auxiliary method for breast reconstruction using a prosthesis or autologous tissue after mastectomy [5-9]. Recently, we began to use an AAF to fill the defect after BCS that included the lower part of the breast in the excision range. Although there is not much volume provided by the AAF, it is sufficient to help fill the defect left after BCS for small breasts. Moreover, it can also be used for filling a relatively large defect if it is combined with other volume displacement techniques. We report AAF for BCS and cosmetic results.

### CASE REPORTS

We analyzed seven patients who underwent breast remodeling using an AAF or a method combining an AAF with other volume displacement techniques after partial mastectomy from October 2010 to May 2012. A summary of the patient characteristics is shown in Table 1. The preoperative evaluation was performed by a breast surgery group. This procedure was indicated for cases whose excision volumes were 15% to 35% of the total breast volume, even if other volume displacement techniques were combined with AAF. Because it is difficult to fill up the defect in the upper portion of the breast by

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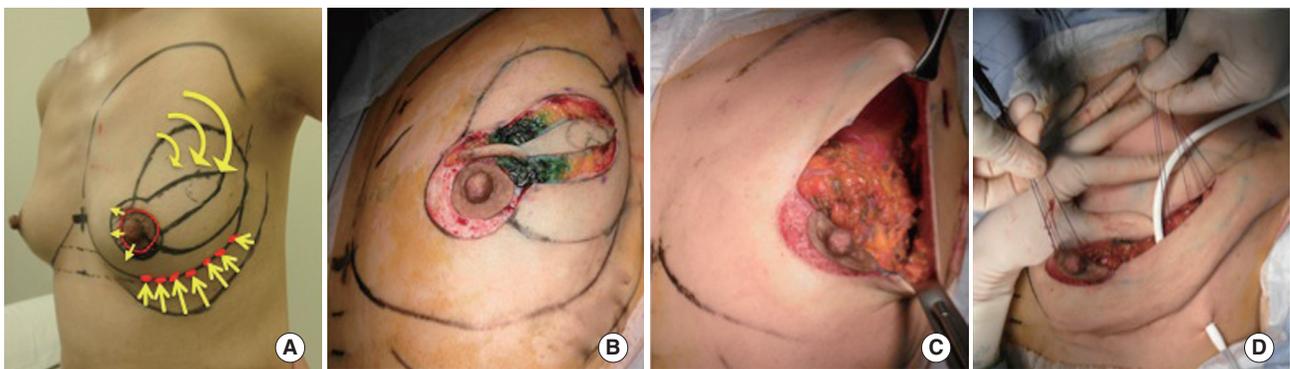
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**Table 1.** Summary of clinical manifestation and operation results

No.	Age (yr)	Location	Operation	Stage	Combining technique	Excision size (cm)	%*	Operation time (min)	Blood loss (g)	Postoperative complication	Cosmetic result
1	71	Central	Bp+SNB	TisNOM0	Only mobilization	6.5×7	25	64	12		Good
2	43	Outer	Bq+SNB	T1bNOM0	Only mobilization	9.5×7	25	96	21		Excellent
3	42	Outer	Bq+SNB	T1cNOM0	Lateral mammoplasty	8.5×8.5	35	118	18		Excellent
4	60	Lower	Bp+SNB	T2NOM0	Modified RBT	6.5×7	15	113	26		Excellent
5	58	Inner	Bq+SNB+Ax	T1cN1M0	RBT	7.5×8.5	25	100	16	Blood-flow insufficiency of NAC	Good
6	53	Inner	Bp+SNB	T2NOM0	Medial mammoplasty	7.5×7.5	20	101	0		Fair
7	52	Inner	Bq+SNB	T1micNOM0	Medial mammoplasty	7.5×8	30	110	10	Re-excision due to positive margin	Good

Bp=breast partial resection; SNB=sentinel node biopsy; Bq=breast quadrantectomy; Ax=axillary lymph node dissection; RBT=round block technique; NAC=nipple-areola complex.

\*The excision volume compared to the total breast volume was estimated by using the photograph of preoperative marking of a partial resection area.



**Figure 1.** The surgical procedures for using an abdominal advancement flap (AAF) combined with a lateral mammoplasty and the extended mobilization of the gland flaps (case 3). (A) Preoperative drawings. The lines mark the partial resection area, the area of the extended glandular flap, the original inframammary fold (IMF) and a neo-IMF. The skin incision line for the lateral mammoplasty was also marked. (B) After the skin incision was made and de-epithelialization was performed. (C) After remodeling the breast using an extended glandular flap. (D) Creating the neo-IMF by elevation of the AAF by applying traction on the sutures.

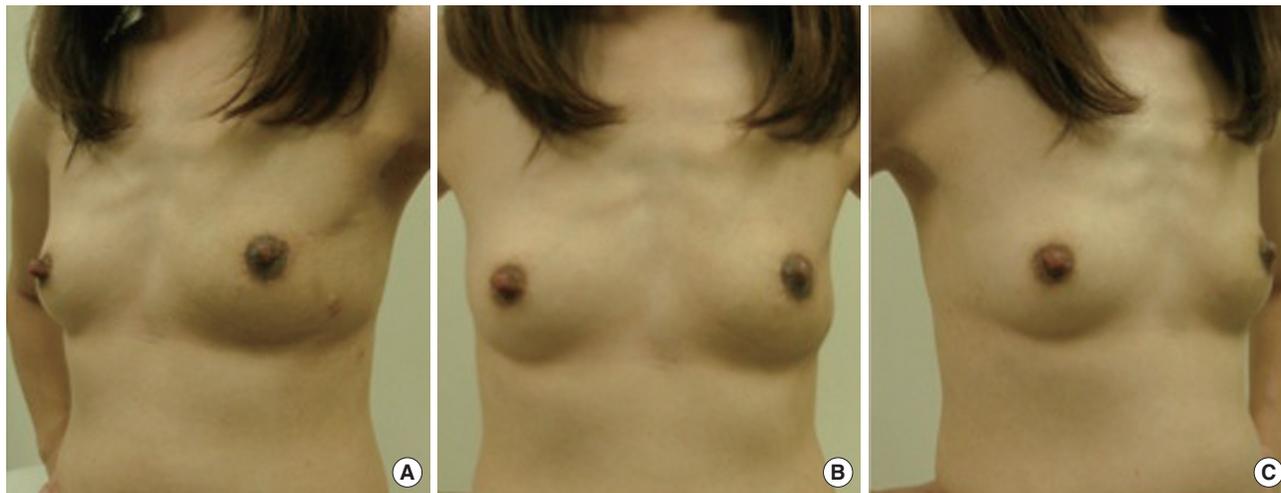
using AAF, patients with breast cancer in the upper portion of the breast were not included. Further, due to the fact that the cases needed a skin incision in the inframammary fold and/or had fatty large-sized ptotic breasts which were not considered to be indicated for remodeling using an AAF, these cases were also removed. The excision volume compared to the total breast volume was estimated by using a preoperative photograph of the markings made for the partial resection area by nine independent observers (eight breast surgeons and one plastic surgeon).

The average age of the patients was 54.1 years (range, 42-71 years). The location of the tumor was the central portion in one patient, the outer portion in two, the lower portion in one, and the inner portion in three patients. An AAF procedure with only mobilization of the gland flaps was performed in two cases, an AAF procedure with lateral mammoplasty and the extended mobilization of the gland flaps was performed in one case (Figures 1, 2), an AAF with a modified round block technique (RBT) was performed in one case (Figures 3, 4), an

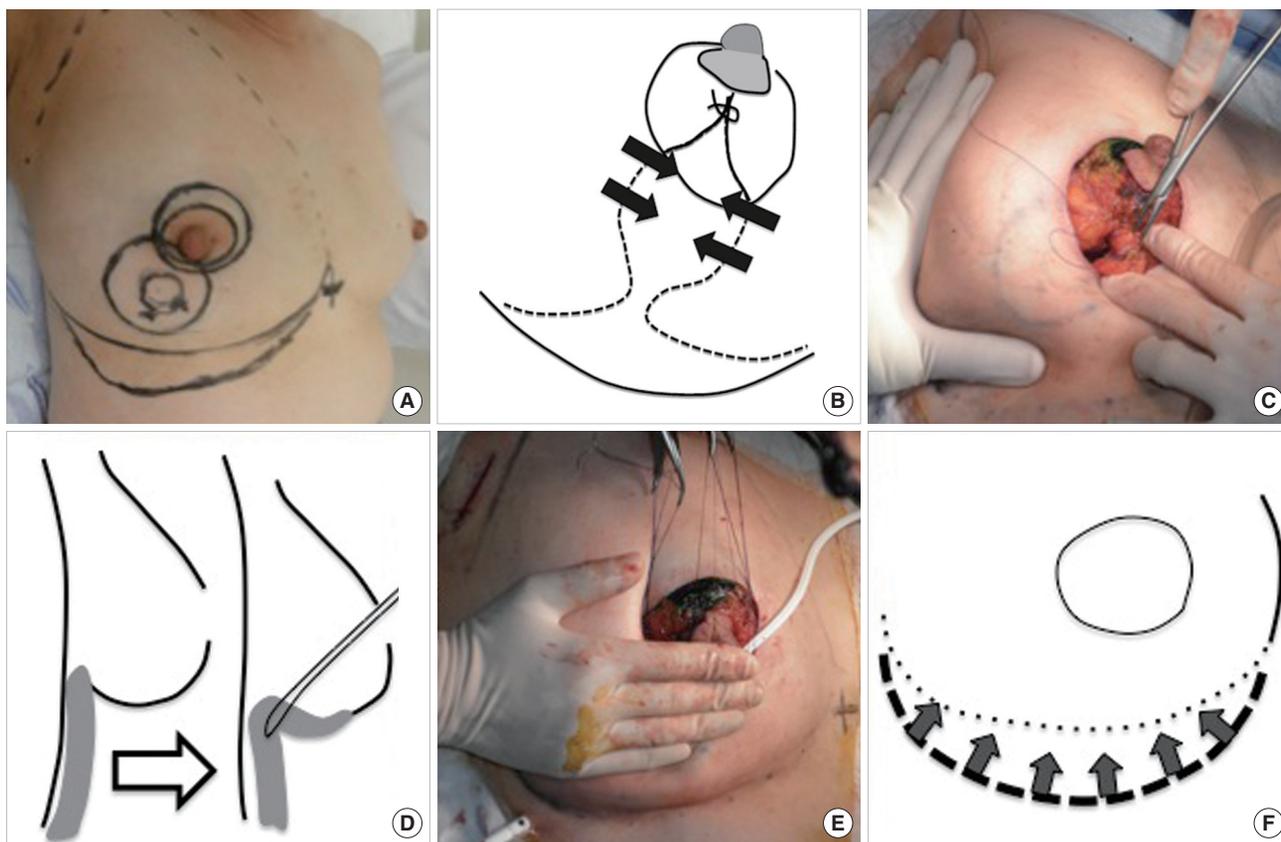
AAF with a RBT was performed in one case (Figures 5, 6) and an AAF procedure with medial mammoplasty was performed in two cases (Figures 7, 8).

After marking the partial resection area with the patient in the supine position, the original IMF and a neo-IMF were drawn. The position of the neo-IMF was about 3 cm below the IMF. When other volume displacement techniques were combined with the AAF, we also marked a skin incision line required for these techniques.

In the case shown in Figure 1 (case 3), an AAF was combined with a lateral mammoplasty and the extended mobilization of the gland flaps; thus, the skin resection line on the tumor and the line around the areola (an incision line like a racket) were marked. The incision line was adjusted in order to prevent the deviation of the nipple-areola complex (NAC). The slashed area was the only de-epithelialized portion (Figure 1A, B). After a partial resection of the breast is performed, the extended glandular flap is made by freeing the breast from both the skin and the pectoralis fascia up to the subclavicular



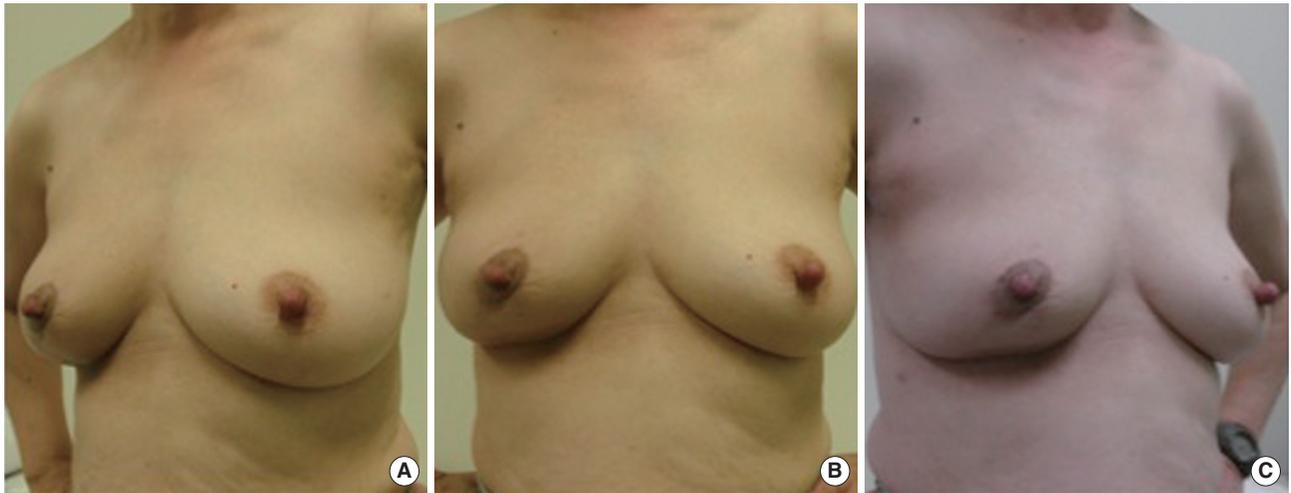
**Figure 2.** Photographs of case 3 taken 1 year after the operation. (A) A left oblique view with the patient in a standing position. (B) The frontal view with the patient in a standing position. (C) A right oblique view with the patient in a standing position.



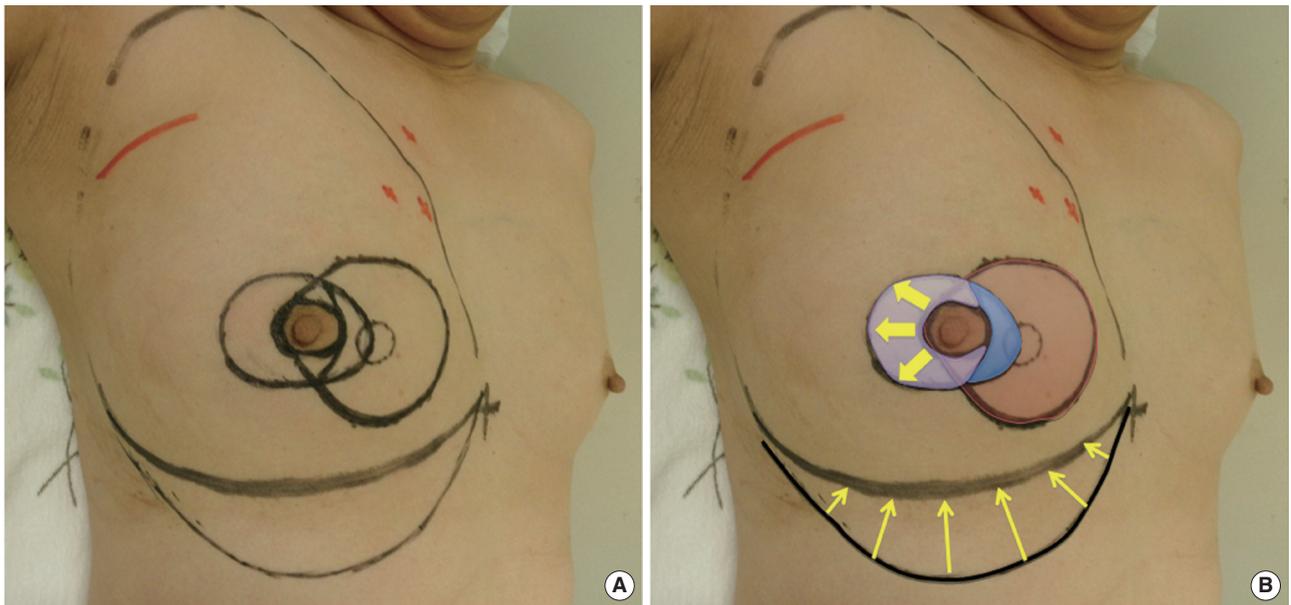
**Figure 3.** The surgical procedures using an abdominal advancement flap (AAF) combined with a modified round block technique (RBT) (case 4). (A) Preoperative drawings. The lines mark the partial resection area, the original inframammary fold (IMF) and a neo-IMF. The skin incision line for the modified RBT was also marked. (B) A schematic diagram of the process of closing the defect by mobilization of the gland flaps. (C) Suturing the gland flaps to each other. (D) A schema of creating the AAF. (E) Creating the neo-IMF by elevation of the AAF by applying traction on the sutures. (F) A schema of fixation to the chest wall.

area that was marked before surgery. While making the flap, it is important to undermine the skin of the subclavicular area

so that the subcutaneous fat might remain thick gradually toward the cranial side. It is important to keep the perforators of



**Figure 4.** Photographs of case 4 taken 10 months after the operation. (A) A left oblique view with the patient in a standing position. (B) The frontal view with the patient in a standing position. (C) A right oblique view with the patient in a standing position.

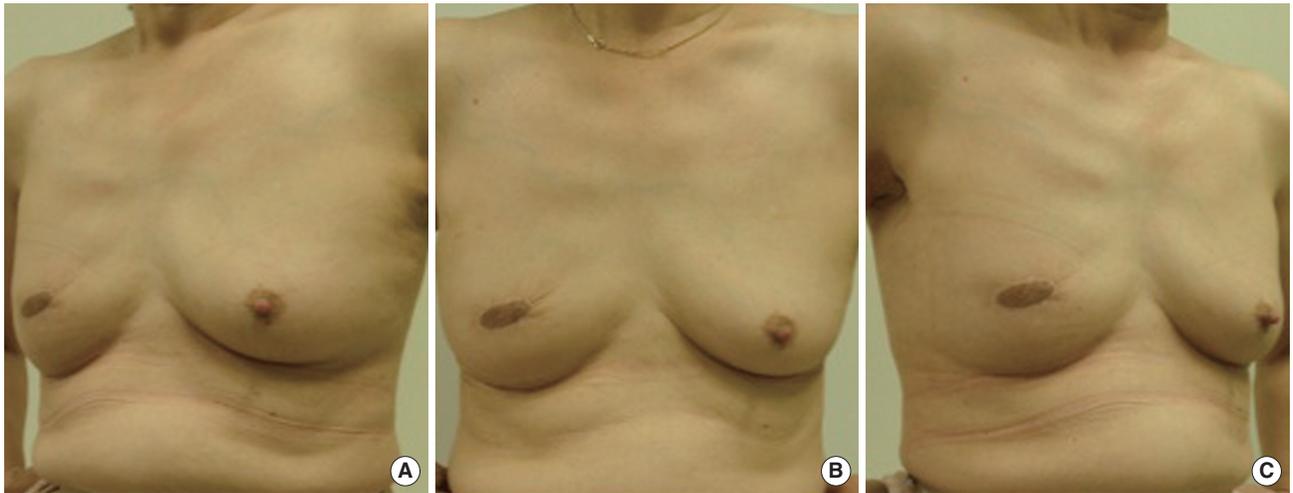


**Figure 5.** An abdominal advancement flap used in combination with a round block technique (RBT) (case 5). (A) Preoperative drawings. The lines mark the partial resection area, the original inframammary fold (IMF) and a neo-IMF. The skin incision line for the RBT was also marked. (B) The blue area is the area of skin that was resected. The purple area is the de-epithelialized area. The red area is the partial mastectomy area.

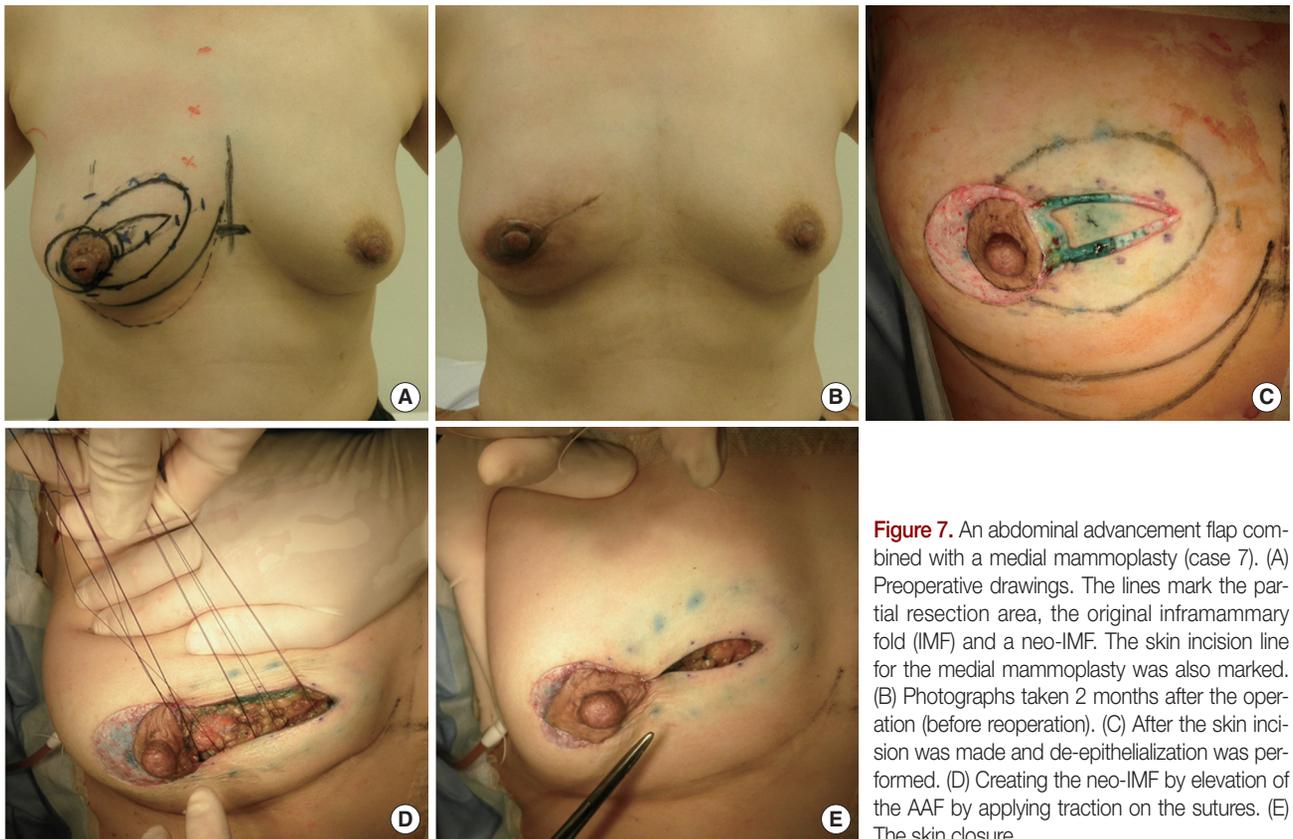
the internal mammary artery intact as well. This flap is moved to the breast area where the tumor has been removed. After the flap is inserted, it is then secured to the surrounding breast tissue with absorbable sutures (Figure 1C). However, because the surrounding tissue was not sufficient to fill the defect of the lower region of the breast, the volume of the inframammary region was created using an AAF. The procedure for the AAF is relatively simple. First, the elevated abdominal skin was pulled up onto the chest. A drain tube was then placed under the skin from below the neo-IMF. After that, absorbable inter-

rupted sutures were inserted into the subcutaneous tissue and the dermis layer of the neo-IMF from the inside. After creating the neo-IMF, it was checked by the elevation of the flap with traction on the sutures (Figure 1D) and the sutures were tied to fix the neo-IMF. Finally, the skin was sutured.

In the case shown in Figure 3 (case 4), an AAF was combined with a modified RBT; hence the outer and inner incision lines around the areola were marked. The distance between the inner and outer incision line was adjusted in order to prevent the deviation of the NAC. That is, on the excision



**Figure 6.** Photographs of case 5 taken 1 year and 5 months after the operation. (A) A left oblique view with the patient in a standing position. (B) The frontal view with the patient in a standing position. (C) A right oblique view with the patient in a standing position.

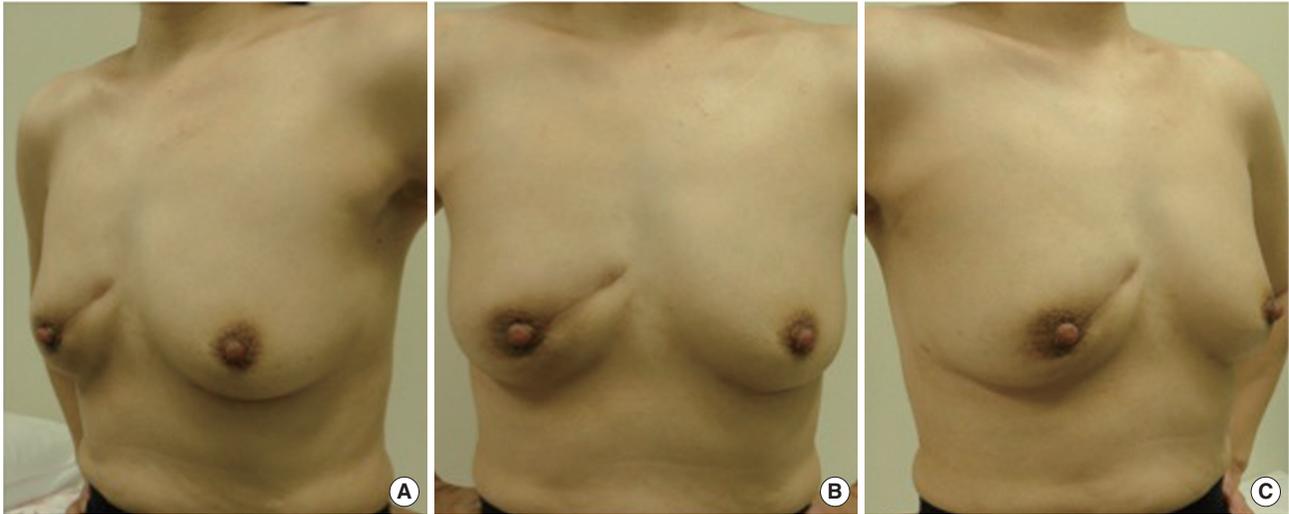


**Figure 7.** An abdominal advancement flap combined with a medial mammoplasty (case 7). (A) Preoperative drawings. The lines mark the partial resection area, the original inframammary fold (IMF) and a neo-IMF. The skin incision line for the medial mammoplasty was also marked. (B) Photographs taken 2 months after the operation (before reoperation). (C) After the skin incision was made and de-epithelialization was performed. (D) Creating the neo-IMF by elevation of the AAF by applying traction on the sutures. (E) The skin closure.

side, the distance between the inner and outer incision lines was as close as possible, and on the other side, the distance between the inner and outer incision line was larger (Figure 3A). After the skin incision was made, the skin was undermined with subcutaneous fat upon reaching the neo-IMF marked before surgery. Next, a partial resection of the breast was per-

formed. By mobilizing the gland flaps off the pectoralis muscle and suturing them to each other, the defect was closed (Figure 3B, C). Thereafter, the volume of the inframammary region was created using an AAF (Figure 3D-F).

In the case shown in Figure 5 (case 5), an AAF was combined with a RBT and therefore, the outer and inner incision



**Figure 8.** Photographs of case 7 taken 1 year and 3 months after the reoperation. (A) A left oblique view with the patient in a standing position. (B) The frontal view with the patient in a standing position. (C) A right oblique view with the patient in a standing position.

lines around the areola were marked. The distance between the inner and outer incision lines was adjusted in order to prevent the deviation of the NAC, the same as when the modified RBT was used. The skin was cut in a crescent-shape on the excision side (the blue area in Figure 5B); however, the area between the outer and inner incision lines was the only de-epithelialized portion on the other side of the excision side (the purple area in Figure 5B). After a partial resection of the breast was performed (the red area in Figure 5B), the defect was closed by the mobilization of the gland flaps off the pectoralis muscle and by suturing them to each other. Subsequently, the volume of the inframammary region was created using an AAF (yellow arrows in Figure 5B).

In the case shown in Figure 7 (case 7), an AAF was combined with a medial mammoplasty and thus, the skin resection line on the tumor and the line around the areola (mirror image of a lateral mammoplasty) were marked. In order to prevent the deviation of the NAC, the NAC was moved by de-epithelialization (Figure 7C). After a partial mastectomy and filling up the resection area by the surrounding glandular flaps, absorbable interrupted sutures were inserted into the subcutaneous tissue and the dermis layer of the neo-IMF from the inside and it was checked by the elevation of the flap by applying traction on the sutures (Figure 7D). After the sutures were tied to fix the neo-IMF, the skin was closed (Figure 7E).

All patients had undergone sentinel lymph node biopsy. Six patients had no metastasis in the sentinel lymph nodes, allowing them to avoid an axillary lymph node dissection. One patient with metastasis in the sentinel lymph nodes underwent an axillary lymph node dissection. The operation was performed by breast surgeons without the help of plastic surgeons.

The length of the operation and the total blood loss ranged from 64 to 118 minutes (average, 100.3 minutes) and from 0 to 26 g (average, 14.7 g), respectively. Although the patient who was treated with an AAF combined with RBT had a partial blood-flow insufficiency of the NAC, it was improved with conservative treatment. One patient had to undergo re-excision of the breast due to a positive margin (case 7). Two patients refused postoperative radiation therapy, whereas the other five patients received radiation therapy to the breast after wound healing, as usual.

The cosmetic outcome was evaluated based on photographs taken more than 10 months after the operation. Photographs of the patients' breasts were taken using a frontal view, left oblique and right oblique views, without any identifying features. The cosmetic results were evaluated by nine independent observers (eight breast surgeons and one plastic surgeon) as "excellent," "good," "fair," or "poor" using the Harvard Scale established by Harris et al. [10]. An excellent result was considered to have been achieved when the treated breast was almost identical to the untreated one. For a good result, the treated breast was slightly different from the untreated breast; for a fair result, there was an obvious difference between the two sides without a major distortion; a poor result was considered to be present when the treated breast was seriously distorted. The observers were blinded to the identity of the patients. The results were found to be excellent (Figures 3, 4) in three cases (42.9%), good (Figure 5) in three cases (42.9%) and fair in one case (14.2%). Poor results were not seen in any of the present cases. None of the patients wanted to receive contralateral breast surgery for symmetrization.

## DISCUSSION

Three elements affect the cosmetic results of BCS. These include the excision volume, tumor location, and glandular density [11]. A resection of the lower portion of the breast can easily cause a deformity, and studies have suggested that there is a clear risk of deformity if 20% of the breast volume is excised [1,11]. Therefore, when the excision volume exceeds 20% of the breast volume, especially in the lower portion of the breast, it is difficult to achieve good cosmetic results using only classical BCS techniques.

In European countries, oncoplastic techniques for breast-conserving reconstruction have been popular for more than 20 years ago, and many oncoplastic techniques have been reported [2-4]. However, many of these oncoplastic techniques involve reduction mammoplasty techniques are suitable for fatty large breasts of Western patients. In addition, the glandular density, which is one of the factors that affect the cosmetic results in BCS, is quite different in Western compared to Asian females. Many Japanese females have small dense breasts. Therefore, it is necessary to develop a new oncoplastic method suitable for small dense breasts.

We have previously reported an inframammary adipofascial flap [12,13] as a method for patients with a large defect in the lower portion of a small dense breast, who are not candidates for a reduction mammoplasty technique. For patients with a small defect in the lower portion of a small dense breast, the Crescent technique [14] is considered to be a good choice. In addition, as reported here, an AAF is very useful for filling the defect after BCS that includes the lower portion of the breast in the excision range. Although an AAF is a kind of volume replacement technique, there is little damage to the donor site because the abdominal skin, which is a little loose, is the only area pulled up.

For the defect in the lower portion, we used the above techniques for every case. Due to the fact that the skin is undermined with subcutaneous fat upon reaching the neo-IMF when using an AAF technique, it is difficult to use an AAF for fatty breasts, because there is a high risk of the patient developing fat necrosis when the undermining of the skin is performed on a wide scale. In addition, it is difficult to use the Crescent technique and an inframammary adipofascial flap for these fatty breasts, because patients with fatty breasts are usually obese and their inframammary adipose tissues are fatty, and fat necrosis can easily be caused by mobilization. Therefore, reduction mammoplasty has been the first choice of procedure for large fatty ptotic breasts. Both the Crescent technique and an AAF are suited for small dense breasts, and both techniques can only fill up defects of about 10% to 15% of the

breast. Therefore, we use a Crescent technique or AAF for relatively small defects of small dense breasts. In general, we use a Crescent technique in cases in which the resection area is close to the IMF and the skin is cut open on the IMF. We have been using an AAF in cases where the resection area is far from the IMF or the skin incision of the IMF is not suitable because of the need for a skin excision above the tumor. In addition, since an AAF only lifts up the skin, the risk of blood flow insufficiency is lower than that associated with the Crescent technique. We use an inframammary adipofascial flap for large defects in small dense breasts. However, a skin incision on the IMF is usually necessary to an inframammary adipofascial flap procedure. Therefore, an inframammary adipofascial flap is not indicated for patients who cannot receive an IMF incision because of the need for skin excision above the tumor. A method combining an AAF with other volume displacement techniques might be well suited for such a case.

With regard to complications, one case had partial blood-flow insufficiency of the NAC. However, we believe that the AAF was not the cause of the insufficiency, and this is considered to be a complication due to the RBT, which moved the position of the NAC. Of course, the blood-flow insufficiency of the NAC might have been caused by a strong traction of the skin, because the field of view while creating the AAF was poor when the skin incision of the RBT was made. Therefore, in order to ensure the field of view, we should have chosen a combination with medial mammoplasty instead of RBT in this case.

For the AAF, it is important to create a smooth neo-IMF. Therefore, it is important to check that the neo-IMF is smooth by elevating the flap by applying traction on the sutures after absorbable interrupted sutures are inserted into the subcutaneous tissue and the dermis layer of the neo-IMF from the inside. Fixation to the chest wall is performed after checking that a smooth neo-IMF has been created.

Although there is not much volume obtained by using an AAF and moreover the area which can be filled up by an AAF only includes the lower portion of the breast, it is sufficient to help fill a small defect of the lower portion of a small dense breast after BCS. Moreover, it can also be used to fill a relatively large defect by combining it with other volume displacement techniques, as we have done. In this report, there were no major complications, and good cosmetic results were obtained in most cases. Furthermore, although reduction mammoplasty techniques require a certain amount of training, the AAF procedure is very easy, and can be performed by breast surgeons without the help of plastic surgeons.

Based on the present study, we believe that using an AAF or combining an AAF with other volume displacement tech-

niques is a useful procedure for treating the volume defect resulting from BCS in the lower portion of a small dense breast, in which a reduction mammoplasty is not indicated.

### CONFLICT OF INTEREST

The authors declare that they have no competing interests.

### REFERENCES

1. Bulstrode NW, Shrotria S. Prediction of cosmetic outcome following conservative breast surgery using breast volume measurements. *Breast* 2001;10:124-6.
2. McCulley SJ, Macmillan RD. Planning and use of therapeutic mammoplasty: Nottingham approach. *Br J Plast Surg* 2005;58:889-901.
3. Kronowitz SJ, Hunt KK, Kuerer HM, Strom EA, Buchholz TA, Ensor JE, 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;120:1755-68.
4. Clough KB, Ihrai T, Oden S, Kaufman G, Massey E, Nos C. Oncoplastic surgery for breast cancer based on tumour location and a quadrant-per-quadrant atlas. *Br J Surg* 2012;99:1389-95.
5. Lewis JR Jr. Use of a sliding flap from the abdomen to provide cover in breast reconstructions. *Plast Reconstr Surg* 1979;64:491-7.
6. Ryan JJ. A lower thoracic advancement flap in breast reconstruction after mastectomy. *Plast Reconstr Surg* 1982;70:153-60.
7. Delay E, Jorquera F, Pasi P, Grataudour AC. Autologous latissimus breast reconstruction in association with the abdominal advancement flap: a new refinement in breast reconstruction. *Ann Plast Surg* 1999;42:67-75.
8. Leal PR, de Souza AF. Breast reconstruction by expansion and advancement of the upper abdominal flap. *Aesthetic Plast Surg* 1997;21:175-9.
9. Fitoussi A, Couturaud B, Salmon RJ. Abdominal advancement flap and the IMF. In: Fitoussi A, Berry MG, Couturaud B, Salmon RJ, editors. *Oncoplastic and Reconstructive Surgery for Breast Cancer: the Institut Curie Experience*. Berlin: Springer; 2009. p.48-52.
10. Harris JR, Levene MB, Svensson G, Hellman S. Analysis of cosmetic results following primary radiation therapy for stages I and II carcinoma of the breast. *Int J Radiat Oncol Biol Phys* 1979;5:257-61.
11. Clough KB, Kaufman GJ, Nos C, Buccimazza I, Sarfati IM. Improving breast cancer surgery: a classification and quadrant per quadrant atlas for oncoplastic surgery. *Ann Surg Oncol* 2010;17:1375-91.
12. Ogawa T, Hanamura N, Yamashita M, Ri Y, Kuriyama N, Isaji S. Usefulness of breast-volume replacement using an inframammary adipofascial flap after breast-conservation therapy. *Am J Surg* 2007;193:514-8.
13. Ogawa T, Hanamura N, Yamashita M, Kimura H, Kashikura Y. Long-term results of breast volume replacement using an inframammary adipofascial flap after breast-conserving surgery. *Breast Cancer*. Epub 2011 Jun 28. DOI: <http://dx.doi.org/10.1007/s12282-011-0285-2>.
14. Aljarrah A, Nos C, Nasr R, Clough KB, Bats AS, Lecuru F. Updated follow-up of patients treated with the oncoplastic "Crescent" technique for breast cancer. *Breast* 2012;21:475-9.