

## 유두-유륜 복합체 보존 유방절제술 및 즉시 유방 재건술 후 종양학적 미용학적 결과

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— Abstract —

### Oncological and Aesthetic Outcomes of Nipple-Areolar Complex(NAC) Sparing Mastectomy and Immediate Breast Reconstruction

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**Background:** Women receiving mastectomy usually prefer a single-stage surgical procedure without the need for additional surgery. Hence, nipple sparing mastectomy was introduced, and the follow-up data on the aesthetic outcome and recurrence of breast cancer were investigated in this study.

**Materials and Methods:** The study subjects comprised 22 patients who received nipple-sparing mastectomy and immediate breast reconstruction using the free transverse abdominal rectus abdominis myocutaneous flap between June of 2007 and June of 2012. The patients' aesthetic outcomes were measured with 2 methods for the objective result: Breast size measurements and breast volume calculation both at preoperative phase and postoperative 1 years phase. Also, the patients' satisfaction was evaluated at postoperative 1 year with the self-assessment questionnaire. Follow up check for assessing cancer recurrence was performed for an average period of postoperative 1063 days.

**Results:** First, in objective aesthetic outcome, there were no significant differences between the preoperative and postoperative results on both the breast size and the volume. Second, the patient satisfaction analysis scores were graded as very good in 15 patients (68.2%), and as good in 6 patient (27.3%). Most of the patients were very satisfied with our surgery method. Last, there was no local or distant recurrence in these 22 patients during the follow-up period.

**Conclusion:** In this study, the nipple-sparing mastectomy achieved satisfactory results for the breast scar and shape with a single-stage surgical procedure, and the cancer recurrence rate was not significantly different from that of the conventional mastectomy. Besides, the nipple-sparing mastectomy is more cost-effective than the conventional mastectomy since it reduces the need for additional procedures. However, we think that it is necessary to determine the long-term outcomes about the recurrence rate.

**Key Words:** Breast Neoplasms, Nipples, Mastectomy, Neoplasm Recurrence, Local

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## INTRODUCTION

As more advanced breast cancer screening programs, various neo-adjuvant and adjuvant treatments are being developed and the need for a paradigm shift in breast cancer surgery has been increased with the evolution of breast cancer surgery, and its progression to a more minimally invasive and cosmetically acceptable method<sup>1</sup>. As the proportion of women diagnosed with early breast cancer has increased due to the advanced screening methods, a less invasive surgery can be performed for the radical treatment of breast cancer<sup>2</sup>.

Moreover, women requiring mastectomy usually prefer a single-stage surgical procedure which does not require additional surgery for the nipple areola complex(NAC) reconstruction.

Therefore, the demand for a less invasive and cosmetically superior surgical procedure is rapidly increasing in Korea as well as worldwide<sup>1</sup>.

As the demand for a surgical procedure with improved aesthetic outcome is increasing, nipple sparing mastectomy(NSM) is gaining worldwide popularity due to the cosmetically satisfying outcome.

NSM provides the optimal aesthetic outcome in breast cancer treatment due to some advantages<sup>3,4</sup>: First, this surgical procedure allows for the preservation of the natural shape, size, sensation and symmetry of the nipple areola complex compared with the contra-lateral or normal breast without additional surgery. Second, breast secondary touch operation is usually performed 6 months after the final breast reconstruction, and tattooing is commenced 3 to 6 months after nipple reconstruction whereas in the NSM, there is no need for a secondary surgery, if an aesthetically satisfying result is achieved in a single-stage surgical procedure and it is also cost-efficient<sup>4</sup>. Third, a thicker flap and more breast tissue are preserved in NSM, and since there is more blood supply to the nipple and breast tissue, it will be associated with a

lower incidence of flap loss and necrosis<sup>5</sup>.

But, as the surgical procedure is becoming less invasive, the risk of ongoing recurrence and incomplete resection of the remnant tumor is increasing. This means that, the minimally invasive surgical procedure is likely to be an incomplete operation for local and distant recurrences<sup>6,7</sup>.

Therefore, when performing breast cancer surgery, it is necessary to consider both the aesthetic and oncological aspects in order to achieve the best aesthetic results, and to perform an oncologic safe surgical procedure. However, since mastectomy can cause breast disfigurement and deformity, the minimally invasive mastectomy alone cannot achieve optimal aesthetic result.

Therefore, by performing minimally invasive mastectomy concomitantly with breast reconstruction surgery, we can greatly reduce the physical and psychological trauma in the patients and produce an optimal aesthetic result without impairing the oncologic outcome.

Hence in this article, we report our experience of a less invasive and single-stage surgery, NSM and immediate breast reconstruction with muscle-sparing free transverse abdominal rectus abdominis muscle(TRAM) flap. In addition, we also report the follow-up data on the aesthetic and oncologic outcomes of this surgical procedure.

## MATERIALS AND METHODS

From January of 2007 to June of 2012, data of 34 patients who underwent NSM and immediate breast reconstruction with muscle-sparing free TRAM flap were analyzed retrospectively

Out of 34 patients, a total of 22 patients met the inclusion criteria and included in this study (Table 1-1) because other 12 patients had vascular-occlusive disease, rheumatic disease or history of irradiation and some of them were lost in the follow-up process or had less than 1 year follow-up period. A few of them had history of other

**Table 1-1.** Characteristics of 22 patients receiving nipple sparing mastectomy and immediate breast reconstruction with free TRAM flap and satisfying inclusion criteria

Case	Age(yr)	BMI	Follow-Up(days)	Previous breast operation history	Cancer Position	Other combined medical problems
1	38	27.5	599	No	Left	No
2	62	28	1355	No	Right	No
3	60	32.1	581	No	Right	No
4	41	30.5	1625	No	Left	No
5	42	28.4	722	No	Right	No
6	46	29.3	2045	No	Right	No
7	34	30	888	No	Left	No
8	43	26	812	No	Left	No
9	38	23.5	1236	No	Left	No
10	44	25.5	1525	No	Left	No
11	36	22.7	1162	No	Right	No
12	65	29.5	769	No	Bilateral	No
13	45	30.1	499	No	Left	No
14	51	27.4	1543	No	Left	No
15	37	29	680	No	Left	No
16	37	25.5	1312	No	Right	No
17	36	25.7	757	No	Right	No
18	45	23.5	662	No	Right	No
19	40	27	1444	No	Right	No
20	37	29.3	1402	No	Left	No
21	56	30.5	1367	No	Left	No
22	35	26	401	No	Right	No
Average	44	27.3	1063			

**Table 1-2.** Exclusion criteria

Complication
Vasculo-occlusive disease
Rheumatic disease
Hhistory of irradiation
Follow up loss
Less than 1 year follow up period
Abdominal wall disease
History of abdominal wall surgery

underlying abdominal wall diseases or had gone through surgeries such as cesarean section, abdominoplasty, etc before breast cancer surgery and they were also excluded (Table 1-2).

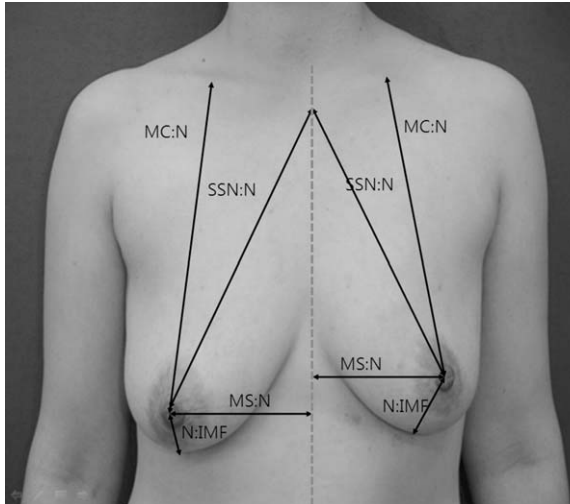
Mastectomies were performed by a senior general surgeon. The surgical indications were decided limited by the Department of General Surgery to the as follows.

1. Tumor had to be at least >3 cm away from the nipple-areolar complex.
2. There were no clinically positive lymph nodes.
3. There were negative intraoperative frozen sections of the tissue obtained from the nipple-areolar complex around the involved breast.

All breast reconstruction procedures were performed by a single plastic surgeon affiliated to the Department of Plastic Surgery using muscle-sparing free TRAM flap only. Except for the TRAM flap procedure, any additional procedures which could change the breast volume such as artificial breast prosthesis application, reduction mammoplasty were not performed.

The authors retrospectively evaluated the data of 22 patients who underwent NSM and immedi-

ate breast reconstruction with muscle-sparing free TRAM flap particularly in terms of aesthetic result, patient's aesthetic satisfaction, oncologic safety and complications



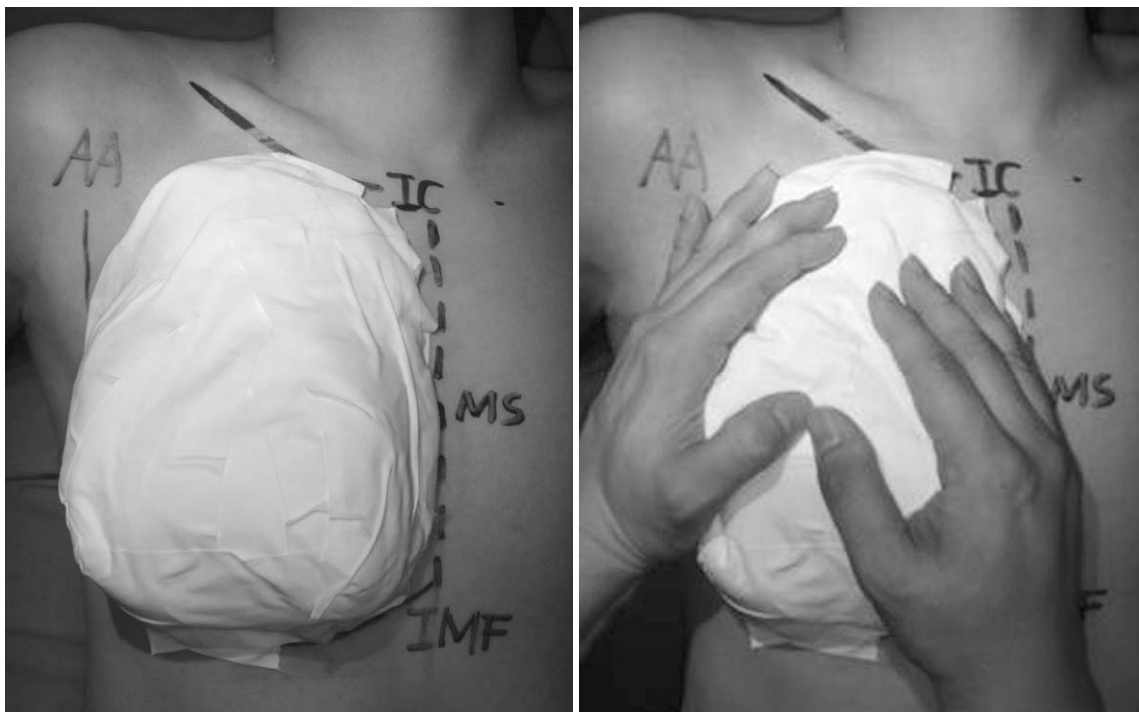
**Fig. 1.** For Objective comparative analysis about aesthetic outcome, we have measured 4 breast size parameters. : Mid-clavicle to nipple distance, suprasternal notch to nipple distance, nipple to inframammary fold(IMF) distance, mid-sternum to nipple distance preoperatively, postoperatively and follow up period.

First, aesthetic outcome was measured with 2 methods for the objective result: Breast size measurements by using 4 parameters and breast volume calculation (Fig.1).

Breast size was assessed with physical examination and clinical photographs by the plastic surgeon which compared the reconstructed breasts with the contra-lateral unaffected breasts at a minimum period of 12 months after the initial breast reconstruction surgery.

For the objective comparative breast size analysis, we have used 4 breast size parameters. : Mid-clavicle to nipple distance, supra-sternal notch to nipple distance, nipple to infra-mammary fold(IMF) distance and mid-sternum to nipple distance measured before the surgery and 1 year after the surgery each.

It is helpful to measure the preoperative breast volume because carving flaps similar to contra-lateral breast is critical procedure. So, other than breast size measurements, we also have calculated breast volume preoperatively and postoperatively. Breast volume measurement was performed by the plaster casting method and it



**Fig. 2.** Breast volume measurement was performed by the plaster casting method.

can be summarized as follows (Fig.2).

We applied the plaster to 4 anatomical points - infraclavicle, anterior axilla, inframammary fold, mid-sternum - the combination of which formed patients' breast-shaped mold. Then we poured water into the mold. After that, we could indirectly measure patients' breast volume through measured water volume (Fig.2).

Generally, as free TRAM flap has the muscle component, there are some volume reduction in reconstructed breast and anatomical landmarks' position change due to muscle atrophy in postoperative 1 year. Therefore, we have compared the result of preoperative parameter measurements with that of postoperative 1 year.

Second, the patients' satisfaction was evaluat-

ed at postoperative 1 year with the self-assessment questionnaire. It was designed by incorporating multiple subjective questions to evaluate the patients' aesthetic satisfaction. The overall score of the self satisfaction analysis was graded in 10 subjects. The investigated items included breast contour and volume, NAC position (malposition, degree of rotation), symmetry, color (degree of discoloration), size, shape (degree of distortion), projection, degree of scar formation (size, shape), and need for additional revision surgery.

The scores were classified into 6 grades as follows: 0, very bad; 1, bad; 2, fair; 3, good; 4, very good; 5, excellent. After summing up the scores of the 10 subjects, the cumulative score

**Table 2.** Preoperative absolute aesthetic outcome analysis

Case	MC to N d(Affected/ Contralateral)	Diff	SSN to N d(Affected/ Contralateral)	Diff	N to IMF d(Affected/ Contralateral)	Diff	MS to N d(Affected/ Contralateral)	Diff	Breast volume (Affected side)
1	20.0/20.4	-0.4	21.0/21.0	0	7.5/7.2	0.3	9.0/9.0	0	393
2	21.4/20.8	0.6	22.0/21.5	0.5	8.5/8.2	0.3	10.5/10.3	0.2	488
3	18.5/18.2	0.3	19.0/18.8	0.2	6.8/6.8	0	8.6/8.8	-0.2	194
4	22.0/22.0	0	21.5/21.8	-0.3	8.2/8.5	-0.3	10.7/10.5	0.2	486
5	20.5/20.2	0.3	20.8/20.4	0.4	7.2/6.7	0.5	9.3/9.0	0.3	453
6	21.0/21.0	0	21.0/21.0	0	7.0/7.0	0	9.6/10.0	-0.4	522
7	22.3/22.0	0.3	23.0/23.3	-0.3	7.8/8.0	-0.2	11.5/11.0	0.5	802
8	19.8/19.4	0.4	19.5/19.1	0.4	7.0/6.5	0.5	8.8/9.0	-0.2	398
9	20.3/20.7	-0.4	20.5/20.5	0	6.8/7.3	-0.5	9.5/9.5	0	433
10	19.0/19.5	-0.5	19.3/19.0	0.3	6.9/7.2	-0.3	9.0/8.5	0.5	396
11	20.0/20.0	0	20.4/20.0	0.4	7.3/7.3	0	9.2/9.5	-0.3	411
12	19.0/18.8	0.2	19.0/19.0	0	7.0/7.0	0	9.3/9.3	0	288
13	21.0/20.7	0.3	21.2/21.0	0.2	7.5/7.1	0.4	9.6/9.3	0.3	437
14	21.0/21.0	0	21.3/21.0	0.3	7.3/7.5	-0.2	8.5/8.5	0	443
15	20.0/20.0	0	20.5/20.5	0	7.0/7.0	0	9.3/9.0	0.3	429
16	20.0/19.5	0.5	20.3/20.0	0.3	7.1/6.9	0.2	10.2/10.0	0.2	464
17	19.0/19.0	0	19.7/19.5	0.2	6.8/6.8	0	9.0/9.0	0	398
18	21.0/20.5	0.5	21.3/21.0	0.3	7.3/7.1	0.2	10.1/10.1	0	534
19	20.0/20.0	0	20.5/20.0	0.5	7.4/7.7	-0.3	9.5/9.8	-0.3	529
20	19.0/19.5	-0.5	19.0/19.5	-0.5	6.8/6.5	0.3	9.1/9.0	0.1	418
21	21.0/20.7	0.3	21.4/21.0	0.4	7.2/7.2	0	10.6/10.5	0.1	534
22	21.6/22.0	-0.4	21.0/21.3	-0.3	8.0/8.3	-0.3	10.3/10.3	0	569
Average	20.3/20.3	0.07	20.6/20.5	0.14	7.3/7.3	0.03	9.6/9.5	0.06	455.4

\*MC(Midclevice), N(Nipple), IMF(Inframammary fold), SSN(Suprasternal notch), MS(Midsternum), d(Distance)

\*Diff: Difference between affected side data & contralateral side data

\*Breast volume measurement was performed by casting method.

was reassessed using the overall scores as follows: a score of 0 to 24 was regarded as aesthetically poor; a score of 25 to 34 as aesthetically bad; a score of 35 to 39 as aesthetically fair; a score of 40 to 44 as aesthetically good; a score of 45 to 49 as aesthetically very good; a score of 50 as aesthetically superior.

Third, the assessment of oncologic safety and complications was done through regular outpatient monitoring with radiologic imaging study and clinical examination about local and systemic recurrence and newly developed cancer.

### RESULTS

The age of the patients ranged from 34 to 65 years with the mean age of 44 years.

The median follow-up period was 1063 days

(range: 401-2045 days).

All 22 patients had unilateral breast cancer. Twelve of them had a left breast cancer and ten of them had a right breast cancer. All of them underwent unilateral breast reconstruction surgery concomitantly with nipple sparing mastectomy and none of them had positive lymph node and received postoperative radiation therapy.

The objective breast size measurement of the affected breasts before the surgery are as follows.

The mean length of mid-clavicle to nipple on affected breast was 20.3 cm (range: 18.5 to 22.3 cm). The mean length of supra-sternal notch to nipple on affected breast was 20.6cm (range: 19.0 to 23.0 cm). The mean length of nipple to inframammary fold(IMF) on affected breast was 7.3 cm (range: 6.8 to 8.5 cm). The mean length

**Table 3.** Comparative aesthetic outcome analysis of affected breast

Case	D of MC to N d	D of SSN to N d	D of N to IMF d	D of MS to N d	D of Breast volume(ml)
1	0.2	0.3	0.1	-0.2	34
2	0.2	0.2	0.1	-0.2	23
3	-0.2	-0.3	0	0	-23
4	0.5	0.5	0.3	0.2	46
5	0	0	0	0.2	21
6	0.2	0.3	0.2	-0.3	29
7	0.5	0.5	0.3	0	36
8	-0.5	-0.3	0.2	0.2	-26
9	0.3	0.5	0.3	0	26
10	-0.2	0.3	0.2	0	-18
11	0.3	0.2	0	0	29
12	-0.2	-0.2	-0.3	-0.1	-25
13	-0.5	-0.5	-0.5	-0.3	-48
14	0	0	0	0.2	-21
15	0	0.3	0.2	0	31
16	0.3	0.3	0.4	0.2	38
17	0.3	0.2	0.2	0	18
18	0.5	0.6	0.5	0.4	52
19	0	0.3	0.4	0.4	36
20	0.4	0.4	0.3	0.3	33
21	-0.2	0.4	0.3	0.3	16
22	0.2	0.5	0.3	-0.3	28
Average	0.1	0.2	0.16	0.05	15.23

\*D(Difference postoperative 1 year result - preoperative result), MC(Midclavicle), N(Nipple), IMF(Inframammary fold), SSN(Suprasternal notch), MS(Midsternum), d(Distance)

of mid-sternum to nipple on affected breast was 9.6 cm (range 8.5 to 11.5 cm). There were no significant differences of breast sizes between the affected breasts and the unaffected breasts (Table 2).

Comparative objective analysis of the affected breast size measurement before and after the surgery are as follows. The mean length of mid-clavicle to nipple on affected breast was 0.1 cm. The mean length of suprasternal notch to nipple on affected breast was 0.2 cm. The mean length of nipple to inframammary fold (IMF) on affected breast was 0.16 cm. The mean length of mid-sternum to nipple on affected breast was 0.05 cm. There were no significant differences of breast sizes between the preoperative and postoperative results (Table 3).

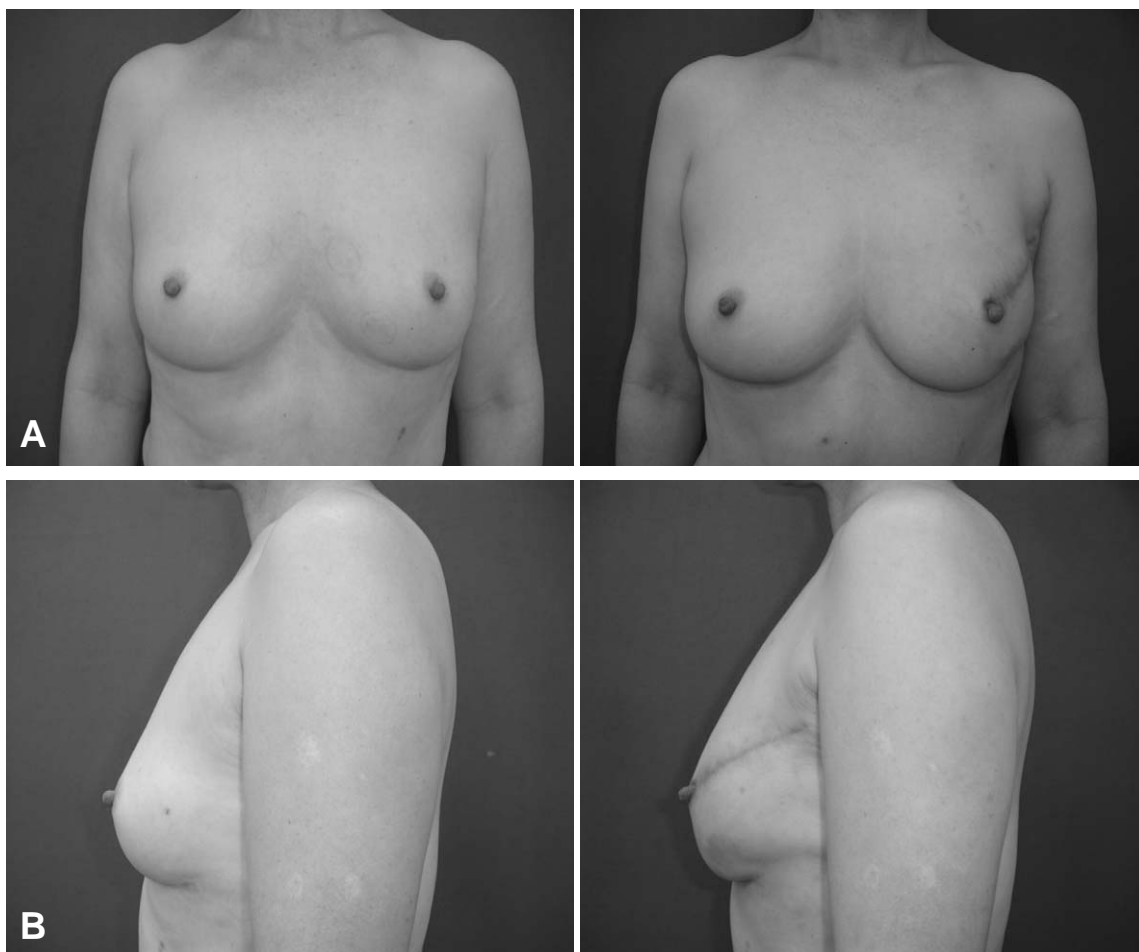
Preoperative mean breast volume was calculated to be 455.4 (194~802) ml by the plaster casting method. Comparative objective analysis of breast volume calculation before and after the surgery are 15.25 ml(range: -48 to 52). There were no significant differences of breast volume between the preoperative and postoperative results (Table 3).

Second, the overall score of the patient satisfaction analysis was graded as very good in 15 patients (68.2%), and as good in 6 patient (27.3%). This indicates that, most of the patients were very satisfied with our surgery method (Table 4). Regarding the nipple-areolar complex position, symmetry, color, size, and shape, almost all patients agreed that the projection of the nipple-areolar complex was well

**Table 4.** Patient satisfaction analysis

Case	Contour	Volume	NAC Position	NAC symmetry	NAC color	NAC size	NAC shape	NAC projection	Scar Formation	Need for Additional operation	Overall score
1	5	5	4	5	5	5	5	4	3	5	46 (Very good)
2	4	4	5	4	5	5	5	4	3	4	43 (Good)
3	5	5	5	5	5	5	5	4	3	4	46 (Very good)
4	5	4	4	5	5	5	5	3	3	5	44 (Very good)
5	5	5	4	5	5	5	5	4	4	4	46 (Very good)
6	4	5	4	4	4	5	5	5	5	5	46 (Very good)
7	4	4	4	4	5	4	4	4	2	2	37 (Fair)
8	5	5	5	5	4	5	5	4	4	4	46 (Very good)
9	4	5	5	4	5	5	5	4	4	4	45 (Very good)
10	4	5	5	5	5	5	5	5	3	4	46 (Very good)
11	5	4	5	5	4	4	4	4	4	4	43 (Good)
12	3	4	5	5	5	5	5	5	3	4	44 (Good)
13	5	5	4	5	5	5	5	4	4	5	47 (Very good)
14	4	4	4	4	5	4	4	5	3	5	42 (Good)
15	5	5	5	4	5	5	5	5	5	4	48 (Very good)
16	5	4	5	5	5	4	5	4	4	5	46 (Very good)
17	4	4	4	4	4	5	5	5	3	5	43 (Good)
18	4	5	4	5	4	4	4	4	4	5	43 (Good)
19	5	4	5	5	5	5	5	5	4	4	47 (Very good)
20	4	5	4	4	5	5	5	5	4	4	45 (Very good)
21	5	4	5	5	4	5	5	4	3	4	45 (Very good)
22	5	5	5	5	4	5	5	3	4	5	46 (Very good)
Average	4.5	4.55	4.55	4.64	4.68	4.77	4.82	4.27	3.59	4.32	

\*The score was classified into the 6 grades as follows: 0 is considered as very bad; 1, bad; 2, fair; 3, good; 4, very good; 5, excellent.  
 \*After summing up the scores of the 10 subjects, the cumulative score was reassessed using the overall scores as follows: a score of 0 to 24 was regarded as aesthetically poor; a score of 25 to 34 as aesthetically bad; a score of 35 to 39 as aesthetically fair; a score of 40 to 44 as aesthetically good; a score of 45 to 49 as aesthetically very good; a score of 50 as aesthetically superior.



**Fig. 3.** (A) 41-years-old woman had Nipple preserving mastectomy and immediate left breast reconstruction with free TRAM flap, Anterior view at postoperative 1 year. (B) After Nipple preserving mastectomy and immediate breast reconstruction with free TRAM flap, Lateral view at postoperative 1 year. Overall satisfaction score was 44.

maintained, the natural shape and color of the nipple-areolar complex were preserved, and the nipple-areolar complex was located in a suitable position (Fig. 3, 4). There was no patient on whom additional nipple and areola reconstruction surgery was performed for aesthetic reasons. There was no local or distant breast cancer recurrence in these 22 patients during the 1063 days mean follow-up period(range: 101 to 2045 days)

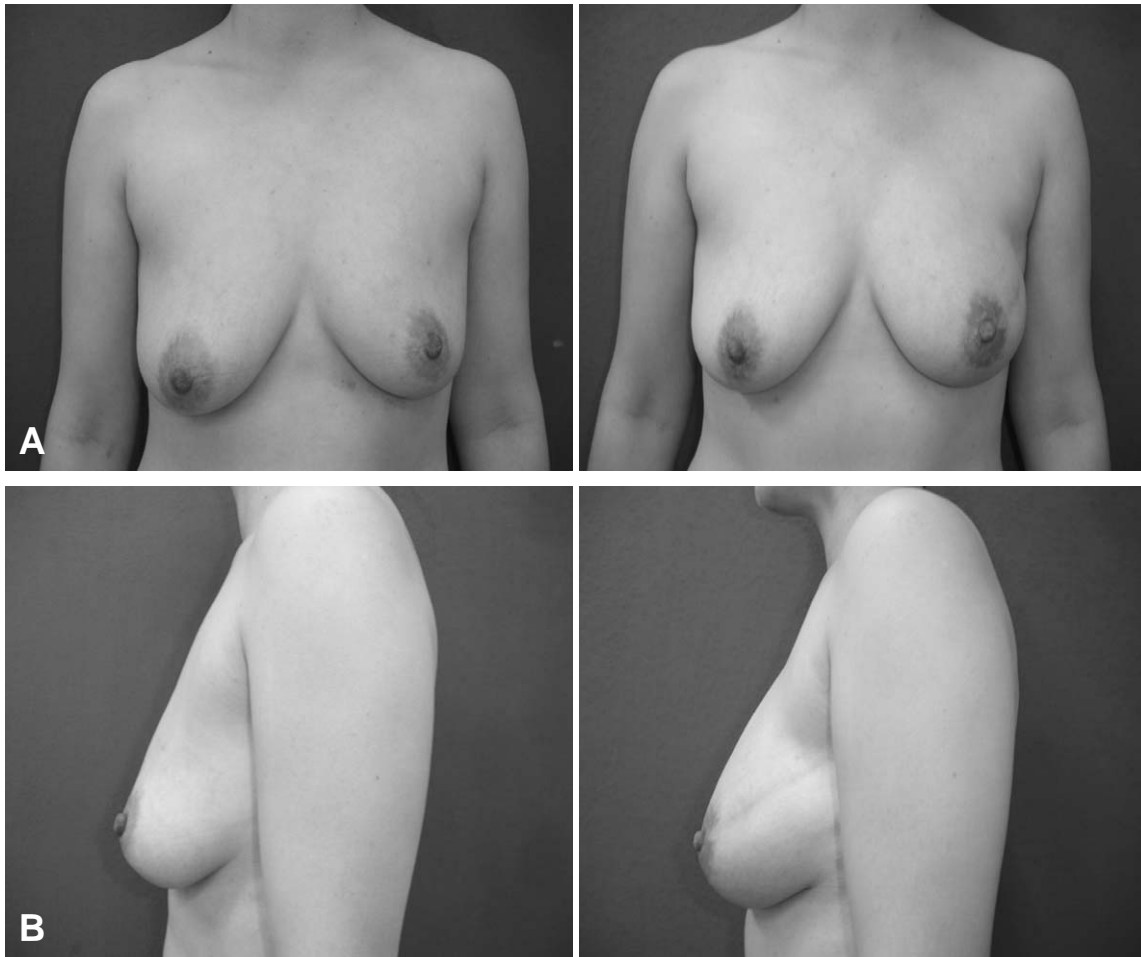
However, there were two patients (9.1%) who underwent an additional surgery for the resolution of fat necrosis and partial flap necrosis. The complication was resolved with wound revision without progression of inflammation (Table 5).

Also, three patients (13.65%) developed minor wound complications such as delayed healing at the flap site or donor site wound dehiscence but they were resolved with conservative treatment (Table 5).

## DISCUSSION

Compared with the other breast cancer surgeries, nipple sparing mastectomy has been demonstrated to successfully achieve an excellent aesthetic outcome. However, there are several questions such as “Minimal cancer resection can be the cause of higher recurrence rates of breast cancer?” which need to be addressed<sup>7</sup>. Several





**Fig. 4.** (A) 38 years old woman underwent Nipple preserving mastectomy and immediate breast reconstruction with free TRAM flap, Anterior view at postoperative 1 year. (B) 38 years old woman, Lateral view at postoperative 1 year. Overall satisfaction score was 46.

**Table 5.** Number of postoperative complications after immediate breast reconstruction with free TRAM flap

Complication	No. (%)
Major flap complications	2/22(9.1%)
Hematoma	0/22(0%)
Seroma	0/22(0%)
Fat necrosis	1/22(4.55%)
Partial flap necrosis	1/22(4.55%)
Total flap necrosis	0/22(0%)
Minor flap complications	3/22(13.65%)
Donor-site complications	0/22(0%)
<b>Total</b>	<b>5/22(22.75%)</b>

\*Minor flap complications were defined as complications which could be treated by conservative treatment.

\*Major flap complications were defined as complications which could be treated by surgical treatment.

\*Abdominal bulging, abdominal herniation, donor site fat necrosis, and delayed wound healind were defined in Donor site complications.

studies have demonstrated that local recurrence rate was not increased after nipple sparing mastectomy compared with skin-sparing mastectomy (SSM), modified radical mastectomy (MRM), and radical mastectomy (RM) in breast cancer<sup>8</sup>.

Gerber B. et al. also reported that nipple sparing mastectomy did not increase the recurrence risk, and was an oncologically safe technique compared to the other breast cancer surgeries<sup>9,10</sup>.

There are some additional procedures for reducing the recurrence rate after nipple sparing mastectomy more effectively. Since the distance between the tumor and the NAC could be related to occult tumor involvement in the NAC, it is important to calculate the distance between the tumor and the NAC, so as to further minimize the risk of tumor recurrence<sup>11,12</sup>. Since assessing

the tumor margins including the base of the NAC intraoperatively is important for predicting the presence of occult tumor involvement in the NAC, it could help predict whether tumor recurrence occurs and further minimize the recurrence risk<sup>3,12</sup>.

There are definite surgical indications for nipple sparing mastectomy. The tumor should be located at least 3 centimeters or more from the nipple-areolar complex. There should be no clinically positive lymph nodes in the axilla. The intraoperative frozen section of the tissue obtained from around the nipple-areolar complex should be negative. Since the blood supply near the nipple-areolar complex can be compromised when the incision is made near the NAC, incision and dissection should be performed at least 3 cm away from the NAC<sup>13</sup>.

In general, advanced breast cancer is treated with radical resection whereas early breast cancer is treated with minimal resection such as in nipple sparing mastectomy although there is no strict rule for the range of resection. Interestingly, nipple sparing mastectomy could be associated with a low recurrence rate using strict patient selection and tumor margin evaluation<sup>14</sup>.

Therefore, if nipple sparing mastectomy is performed in selected patients with great care, it could be considered as a relatively safe procedure with an excellent aesthetic outcome and can be successfully used in early-stage breast cancer.

The ideal breast reconstruction technique can be decided based on the requirements of natural contour of the reconstructed breast, its symmetry to the contra-lateral breast, and the patient's needs<sup>15</sup>. Also, it is important to select the most appropriate breast reconstruction technique in each condition.

There are a lot of breast reconstruction techniques after breast cancer surgery, including prosthetic procedures, techniques using autologous tissue, and combination techniques using the autologous tissue and the implant. After

considering several factors such as the size of the opposite breast, the plans for altering the opposite breast, the exact nature of the mastectomy defect, the pathologic stage of breast cancer, the history of irradiation, the general health of the patient, the availability of donor tissue, and the patient's expectations, the surgeons have to select the most suitable technique for breast reconstruction<sup>16</sup>.

Development of the material for tissue expander breast reconstruction surgery, the use of autologous tissue, and the advances in microscopic techniques have brought about a significant improvement in the functional and aesthetic results of breast reconstruction surgery<sup>17</sup>. Many studies have demonstrated that immediate breast reconstruction for women with early breast cancer was more effective in increasing the survival rate of patients and detection rate of recurrence<sup>18</sup>.

Generally, due to the infection resistance and aesthetically natural contour, techniques using autologous tissue are more preferred for breast reconstruction surgery than techniques using breast implant or tissue expander. Another complication related to the use of breast prosthesis is migration of the expander or implant through the axilla into the back.

Since there are various available surgical techniques using the autologous tissue, such as pedicled TRAM flap, LD flap, free TRAM flap and free DIEP flap, the problem of choosing the most suitable tissue for breast reconstruction surgery still remains unanswered<sup>19</sup>.

First, pedicled TRAM flap can be the most attractive option, since the use of TRAM flap can help surgeons to avoid the complications related to the use of prosthesis. However, there certainly are some patients who have suffered from major abdominal donor site complications.

Abdominal wall complications using TRAM flap including direct hernia, abdominal wall weakness and seroma are preventable complications if a careful fascial closure is performed<sup>19</sup>.

Second, in pedicled TRAM flap, flap complications include total or partial flap necrosis, or more commonly, fat necrosis. However, since the commonly used dominant pedicle has a higher perfusion pressure in free flap techniques, the frequency of flap necrosis or fat necrosis can be reduced dramatically, compared with that using pedicled TRAM flap<sup>20</sup>.

So, in cases in which a large amount of tissue is needed, like in breast cancer surgery, or in cases of some vascular problems, a bipedicled TRAM flap or free TRAM flap or LD flap or free DIEP flap should be considered to reduce the risk of flap loss and necrosis. Most cases of flap loss do not occur in split-thickness grafts. But there are some cases of partial flap loss in which debridement and additional reconstruction surgery are needed<sup>21,22</sup>.

Besides, the use of pedicled TRAM flap is associated with an aesthetic problem such as anterior chest wall bulging.

The latissimus dorsi flap can be another option, since the latissimus dorsi flap is a stable flap that has excellent and abundant blood circulation and is rarely associated with significant flap loss and necrosis<sup>22</sup>.

But, in LD flap reconstruction, there remains a possibility of donor site complications like limitation of shoulder mobility, shoulder weakness and winging of the scapula. Also, latissimus dorsi myocutaneous flap does not provide enough soft tissue for breast reconstruction. Therefore, tissue expander, breast implants are usually used to do breast reconstruction. Also, aesthetic problems in the donor site are found in breast reconstruction using LD flap such as malposition of the nipple-areolar complex, loss of natural breast contour<sup>22</sup>.

The deep inferior epigastric artery perforator (DIEP) flap provides an enhanced circulation but is difficult to harvest compared with free TRAM flap<sup>23</sup>.

Therefore, free flap technique such as free TRAM flap, free DIEP flap can be the possible

options for breast reconstruction since this procedure has some advantages such as the less use of muscle, and better blood supply.

In conclusion, free TRAM flap can be applied to the patients with a larger breast and the patients with a previous history of irradiation after receiving a free flap<sup>23</sup>.

Moreover, among the other available autologous tissue flap techniques, the natural contour and shape of the breast can be more easily achieved with the free TRAM flap and it produces aesthetically superior results. With suitable flap inseting and shaping, breast projection can be increased, the location of the inframammary fold can be adjusted to the ideal site and the desired shape can be obtained by additional flap trimming<sup>23</sup>.

As a result, free TRAM flap can provide many benefits in selected patients: it can provide an aesthetically superior breast reconstruction, both in terms of contour and projection; it can simultaneously provide the patients with the benefits of an abdominoplasty; and it demonstrates a superior flap survival rate. As per the experience of one of the surgeon's at our hospital regarding various breast reconstruction techniques, free TRAM flap showed a higher survival rate, lower complication rate, and better aesthetic result compared with the other reconstruction techniques.

But, in order to choose a free TRAM flap for breast reconstruction, a skillful microanastomosis technique and a positive frame of mind are required for free flap survival. Therefore, in this study, the authors selected a free TRAM flap for breast reconstruction. Nipple sparing mastectomy and immediate breast reconstruction with muscle-sparing free TRAM flap is not only aesthetically satisfying and but it is also oncologically safe, and therefore it should be considered as a surgical treatment option in women who need to undergo breast cancer surgery and reconstruction.

In summary, there are several advantages of

the above mentioned surgical procedure.

First, only a single-stage reconstructive surgery is needed to be performed. There is no need for additional surgery to reconstruct the nipple-areolar complex. Thus, this surgical procedure can reduce the hospital costs and the financial burden on patients, and it can be considered as an excellent cost-effective surgical procedure.

Second, due to minimized scar formation and better cosmesis, the need for secondary or revision surgery is less likely.

The other advantage of immediate breast reconstruction is the preservation of important landmarks, such as inframammary fold, nipple-areolar complex, and the native unaffected breast. Thus the preservation of important landmarks allows the reconstructed breast to assume a more natural and symmetrical shape once the breast volume is restored.

Even though a long-term follow-up in a large number of cases of early stage breast cancer was not conducted, we can report that nipple sparing mastectomy and immediate breast reconstruction with free TRAM flap can be the single-stage breast reconstructive surgery with a high level of patient satisfaction in terms of aesthetic and oncologic outcomes.

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