

Techniques in Nipple Areolar Reconstruction: A Retrospective Analysis of Surgical Interventions and Patient-reported Satisfaction Scores

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Background: Nipple areolar complex (NAC) reconstruction often signifies completion of the breast reconstruction process for some patients and has been shown to improve both psychosocial and sexual well-being. Several techniques have been described; however, there currently exists little evidence in the literature describing outcomes or patient satisfaction.

Methods: A retrospective analysis of NAC reconstructions over the last decade was queried for patient demographics, operative technique, and postoperative outcomes. A standardized, validated survey was also utilized to evaluate overall satisfaction, with a focus on aesthetic outcome, shape, color, and projection.

Results: Eighty-three patients were identified, with 49 (59.0%) completing the survey. The modalities used for reconstruction include the C-V flap (45.7%), the modified skate flap technique (42.2%), and free nipple grafting (FNG, 12.0%). No significant differences in age, BMI, or comorbidities were found among the three types. The most utilized donor site for skate flap reconstruction was the suprapubic area (37.1%). There were also no significant differences in complication rate (C-V 10.5%, FNG 10%, skate 5.7%, $P = 0.630$) or revision surgery (C-V 2.6%, FNG 0%, skate 5.7%, $P = 0.732$). The most common complication was nipple necrosis. Adjusting for time to follow-up using multivariate analysis, there was a significant difference in overall patient satisfaction when compared across all three techniques, with the modified skate flap having the highest mean overall satisfaction scores.

Conclusions: NAC reconstruction can be completed safely and effectively with a variety of techniques. The modified skate flap technique was associated with high levels of patient satisfaction and a low complication rate. (*Plast Reconstr Surg Glob Open* 2024; 12:e5667; doi: [10.1097/GOX.0000000000005667](https://doi.org/10.1097/GOX.0000000000005667); Published online 21 March 2024.)

INTRODUCTION

Loss of the nipple and areola can occur following mastectomy or other oncologic excision, complication of breast surgery, trauma, or congenital absence.^{1,2} The resulting appearance of the breast can cause significant psychological and sexual distress to patients.^{3,4} Several techniques for reconstruction of the nipple areolar complex (NAC) have been described in the literature, including free nipple grafts, local flaps, and flaps with

autologous graft augmentation, with the goal of creating bilaterally symmetric nipples and areolae with adequate size, contour, and projection.¹ The ideal method for nipple reconstruction can vary depending on the technique used for breast reconstruction.² For example, in the case of autologous breast reconstruction, ample local soft tissue taken from the flap itself makes NAC reconstruction possible by a variety of techniques.²⁻⁴ However, in the case of implant-based reconstruction performed in the setting of thin mastectomy skin flaps, there is often insufficient tissue to create adequate nipple contour and projection.^{4,5} Thus, it is crucial to consider the most effective approach for reconstructing the NAC to maximize psychosocial and sexual well-being in women after breast cancer treatment.

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There is a lack of evidence in the literature comparing techniques in NAC reconstruction and their long-term outcomes. In this report, we explore and compare the types of NAC reconstruction used at our institution, their clinical outcomes, complications, need for revision, and associated patient-reported satisfaction scores.

METHODS

Study Design

After obtaining institutional review board approval (IRB #00002699), the electronic medical records of 83 patients who underwent nipple reconstruction by the senior surgeons (G.W.C. and P.W.T.) over the last 10 years at Emory University Hospitals were retrospectively queried. Patient demographics, type of surgery, and surgical outcomes were considered. Inclusion criteria consisted of all patients who underwent nipple areolar reconstruction with either the modified skate flap technique, C-V flap,⁶ or free nipple graft⁷ by the two senior surgeons following either autologous or implant-based breast reconstruction. Patients who did not complete the phone survey were excluded from data analysis of patient-reported outcomes.

Surgical Techniques

NAC was reconstructed using one of the three methods. Some patients underwent reconstruction of the nipple using either C-V flap or a free nipple graft. The technique for the C-V flap has been previously described⁶: lateral “V” flaps are elevated in the subcutaneous plane with a central “C” flap elevated in the subdermal plane. The V flaps are connected in the midline to give the nipple columnar projection, whereas the C flap is folded over to serve as the top of the column.

In the free nipple grafting (FNG) technique, a full-thickness portion of the intact contralateral nipple is excised and grafted onto a de-epithelialized recipient NAC bed (nipple-sharing method); in some cases, an intact nipple and areola were harvested as a full-thickness graft at the time of the mastectomy and grafted back onto the mastectomy skin flap immediately.

In the modified skate flap technique, both the nipple and areola are reconstructed. The new areolar location is marked and incised. The upper portion of this circle is de-epithelialized, while the lower portion is elevated in the subdermal plane and folded on itself to create a projecting nipple. A full-thickness skin graft taken from one of several potential donor sites is defatted and sewn into position around the reconstructed nipple to reconstruct the areola.⁸

Patient-reported Outcomes

Patients in this retrospective cohort voluntarily completed the validated BREAST-Q nipple subscale rating overall satisfaction with their nipple reconstruction. This survey measures patient satisfaction with aesthetic outcome, shape, color, and projection of the nipple, rating each item using a Likert Scale of 1–5 where 1 is highly unsatisfied and 5 is highly satisfied.⁹ Patients were

Takeaways

Question: In terms of patient-reported outcomes, is the modified skate flap a preferred method of nipple reconstruction in comparison to other common techniques (C-V flap and free nipple graft)?

Findings: In our retrospective cohort study, the authors found that overall patient satisfaction was significantly higher among patients who underwent nipple reconstruction after either autologous or alloplastic breast reconstruction.

Meaning: In patients undergoing nipple reconstruction with local flaps, the modified skate flap may have better patient-reported outcomes than other traditional nipple reconstruction options.

administered the survey at a single time point between January 14, 2022, and February 6, 2022.

Statistical Analysis

Factors that may have influenced complications were analyzed by Fisher exact test (categorical variables) or analysis of variance (categorical and continuous) with significance set at a *P* value less than 0.05. Patient-reported outcome scores were analyzed with one-way analysis of variance. Multiple variable linear regression analysis was performed to evaluate if any of the patient-reported outcomes measures (overall, appearance, shape, color, projection) were independently associated with respect to follow-up time (days). (See figure, Supplemental Digital Content 1, which displays the results of multiple variable linear regression analysis for days follow-up and patient-reported outcomes, <http://links.lww.com/PRSGO/D102>.) All statistical analysis was conducted using the IBM SPSS Statistics 28.0 (IBM Corp., Armonk, N.Y.).

RESULTS

Patient Demographics and Type of Reconstruction

Eighty-three patients were identified who underwent NAC reconstruction. Of these procedures, the C-V flap was the most commonly performed (*n* = 38 patients, 46%), followed by the skate flap technique (*n* = 35 patients, 42%). FNG was performed in 10 (12%) patients. There were no significant differences in the age (*P* = 0.504) or the BMI of patients at the time of surgery (*P* = 0.286). In addition, there were no significant differences in other medical conditions, including hypertension (*P* = 0.481), diabetes mellitus (*P* = 0.959), or smoking (*P* = 0.722). A total of 32 patients underwent autologous reconstruction with either latissimus flap (*n* = 7 patients, 8%), transverse rectus abdominis flap (*n* = 13 patients, 16%), or deep inferior epigastric perforator flap (*n* = 12 patients, 14%), whereas 56 patients underwent implant-based breast reconstruction after tissue expansion (*n* = 39 patients, 47%) or immediate implant placement (*n* = 17 patients, 20%). Three patients received both autologous and implant-based breast reconstruction. C-V flaps were

Table 1. Demographic Differences between Patients Who Underwent NAC Reconstruction

	C-V [n = 38 (45.8%)]	FNG [n = 10 (12.0%)]	Skate [n = 35 (42.2%)]	P
BMI	29.4	25.3	27.9	0.286
Age	50.9	51	48.8	0.504
Hypertension	12 (31.6)	1 (10)	10 (28.6)	0.481
Diabetes mellitus	5 (13.2)	1 (10)	4 (11.4)	0.959
Smoker	1 (2.6)	0 (0)	2 (5.7)	0.722
Reconstruction type				
Latissimus	5 (13.2)	1 (10.0)	2 (5.7)	0.560
Transverse rectus abdominis	8 (21.0)	3 (3.0)	1 (2.8)	0.029
Deep inferior epigastric perforator	10 (26.3)	1 (10.0)	2 (5.7)	0.047
Tissue expander	13 (34.2)	3 (3.0)	19 (54.2)	0.157
Immediate implant	2 (5.2)	2 (2.0)	11 (31.4)	0.015

Table 2. Clinical Outcomes

	C-V [n = 38 (%)]	FNG [n = 10 (%)]	Skate [n = 35 (%)]	P
Complications	4 (10.5)	1 (10)	2 (5.7)	0.747
Nipple necrosis	3 (7.9)	1 (10)	1 (2.9)	
Delayed wound healing	1 (2.6)	0 (0)	0 (0)	
Partial areolar graft loss	0 (0)	0 (0)	1 (2.9)	
Infection	0 (0)	1 (10)	0 (0)	
Revision	1 (2.6)	0 (0)	2 (5.7)	0.621
Follow-up (mo)	95 ± 44	122 ± 47	58 ± 48	

performed more commonly following autologous reconstruction than implant reconstruction. Sixty-six percent of patients who had autologous reconstruction underwent nipple reconstruction with a C-V flap, whereas only 6% received a skate flap (Table 1).

Complications following NAC Reconstruction

Average length of follow-up at the time of our analysis for patients undergoing nipple reconstruction was 95 ± 44 months for the C-V group, 122 ± 47 months for the FNG group, and 58 ± 48 months for the skate flap group. Seven patients experienced a complication (Table 2). Of the patients who underwent a C-V flap, four (10.5%) experienced a complication, and one needed revision surgery (2.6%). The most common was nipple necrosis (7.9%) followed by delayed wound healing (2.6%). One patient who underwent FNG experienced a complication, which included both nipple necrosis and infection (10%). There were only two (5.7%) observed complications in the skate flap group, which included nipple necrosis (2.9%) and partial areolar graft loss (2.9%). Two (5.7%) patients in this group needed revision surgery, one to reduce the nipple length and another to improve nipple projection. One potential complication of nipple reconstruction in the setting of previous implant-based breast reconstruction is accidental entry into the implant capsule, with subsequent exposure of the implant and the possibility of

Table 3. Donor Site Selection in Skate Flap NAC Reconstruction

	No. of Patients [n (%)]
Suprapubic	13 (37.1)
Groin	7 (20.0)
Abdominal	7 (20.0)
Axillary	4 (11.4)
Other	3 (8.6)

implant infection or loss. In our series, there were no instances of implant infection or need for explantation following nipple reconstruction.

In each modified skate flap, a full-thickness skin graft was taken from a donor site with excess skin, an existing scar, or standing cone deformity (dog-ear). Of the 35 skate flaps performed, the most utilized skin graft donor site was the suprapubic area (13 of 35, 38.2%). The groin and abdomen were also commonly used (20.0%, Table 3). There were two complications related to the donor site, one involving a minor hematoma (treated with observation) and another involving incisional cellulitis (treated with a short course of oral antibiotics).

Patient-reported Satisfaction Scores

Forty-nine patients (59%) completed the follow-up survey. (See figure, Supplemental Digital Content 2, which displays the NAC reconstruction satisfaction survey, <http://links.lww.com/PRSGO/D103>.) Patients undergoing nipple reconstruction using the modified skate flap technique scored significantly higher in overall satisfaction (4.48), whereas patients who underwent FNG scored lowest (3.75, $P = 0.05$). Patients in the modified skate flap group reported better aesthetic outcomes, shape, color, and projection, although these differences did not achieve statistical significance (Table 4). After performing multiple variable linear regression analysis, length of follow-up was not significantly independently associated with any of the patient-reported outcome measures.

Modified Skate Flap Surgical Technique and Case Example

A 41-year-old woman with history of right breast cancer underwent bilateral mastectomies and implant-based breast reconstruction in July 2020. In May 2021, NAC reconstruction was performed using a modified skate flap technique. The underarm “bra roll” area was selected as the donor site for the areolar skin graft based on excess skin availability in this region, proximity to existing surgical scars, and patient’s desire for additional contouring of this area (Fig. 1).

Table 4. Patient-reported Outcomes

	C-V	FNG	Skate	P
Overall satisfaction	4.23	3.75	4.48	0.05
Aesthetic outcome	4.0	3.75	4.48	0.28
Shape	4.05	3.75	4.48	0.15
Color	3.95	3.5	4.26	0.49
Projection	3.55	3.5	4.04	0.61



Fig. 1. This patient is a 41-year-old woman with history of right breast cancer who previously had bilateral mastectomies and tissue expander with ADM reconstruction. She underwent staged nipple-areolar complex reconstruction using the skate flap technique. Full-thickness skin grafts were harvested from the underarm “bra roll” region. Pre- (A–C) and postoperative photographs at 6 months (D–F) and 1.5 years (G–I).

When using our modified skate flap technique, the proposed nipple position (Video 1) is marked at the intersection of the breast meridian and the most projected portion of the breast; the position is evaluated and confirmed by the patient before surgery. [See Video 1 (online), which displays the case presentation and marking.]

Donor sites for full-thickness skin grafts are selected based on proposed scar visibility and location of previous surgical incisions, and may include the axilla, the abdomen, the suprapubic region, groin, and/or the flanks. In many cases, full-thickness skin graft excision may be used to remove areas of skin and soft tissue excess, such as the prominent underarm “bra roll” area or standing cone deformity (dog-ear) at the lateral aspects of an abdominoplasty incision. A 38- or 42-mm areola sizer is used to mark the new areolar position. The same sizer is then used to mark the skin graft donor site. The circular graft marking may be extended into an ellipse and closed as a straight line, continuous with previous surgical scars.

The full-thickness skin graft is thoroughly defatted in the standard manner. The nipple is created using the skate flap technique and secured with a combination of 3-0 Monocryl (Ethicon, New Brunswick, N.J.) and 5-0 plain gut suture. [See Video 2 (online), which displays raising the skate flap and nipple reconstruction.]

A cruciate opening is made in the center of the skin graft and it is placed over the nipple, where it is secured circumferentially with 5-0 plain gut suture to create the neo-areola. [See Video 3 (online), which displays areolar reconstruction and postoperative results.] The nipple reconstruction and areolar skin grafts are secured with a dressing fashioned from the shortened barrel of a 20-mL syringe, Xeroform (Covidien, Dublin), bacitracin and 4×4 gauze. All fat grafting harvest and access sites are closed with 5-0 plain gut suture. Incisions are dressed with Steri-Strips.

Postoperative Management

Patients are instructed to keep dressings in place until seen in the clinic 1 week after the procedure. At that visit, dressings are removed, and patients are instructed

on daily dressing changes with antibiotic ointment or Xeroform gauze over the skin graft site until it is completely healed.

DISCUSSION

For many patients, NAC reconstruction is an important component of their final reconstructive result. The trompe-l’oeil effect achieved by adding a nipple can significantly improve the final aesthetic outcome of the reconstructed breast; in addition, NAC reconstruction has been shown to provide significant psychosocial benefits to patients undergoing breast reconstruction and often signifies completion of the breast reconstruction journey.^{10–12} Several techniques have been described to achieve adequate nipple contour and projection,^{2–5} with some of the most common including FNG,¹³ the C-V flap,³ and more recently, the modified skate flap technique.⁸ The challenges of NAC reconstruction include creation of a realistic and aesthetically pleasing nipple and areola that maintain color, shape, and projection over time. Particularly in thin patients, patients who have undergone radiation, and patients with thin mastectomy skin flaps, nipples created by rearrangement of local tissue can lack adequate bulk and projection, and can shrink over time.⁶ Relative long-term success rates of the various described techniques remains unclear, and which technique is “the best” is still a subject of debate and individual surgeon preference.

Previously, Pu et al described a modified skate flap technique in which a majority of patients reported high satisfaction with their surgery.⁶ Using this technique, the authors report excellent projection when compared to other methods of reconstruction at 1-year follow-up, with high patient satisfaction. Similarly, in our study, patients who underwent NAC reconstruction with the modified skate flap technique had higher levels of overall satisfaction compared with other techniques. Advantages of the modified skate flap include a highly realistic and reproducible result despite simplicity of the technique. When using the skate flap method, the local tissue donor site used to create the nipple is covered completely by the areolar skin graft. (Fig. 2). This differs from the C-V flap technique, where primary closure of the local donor

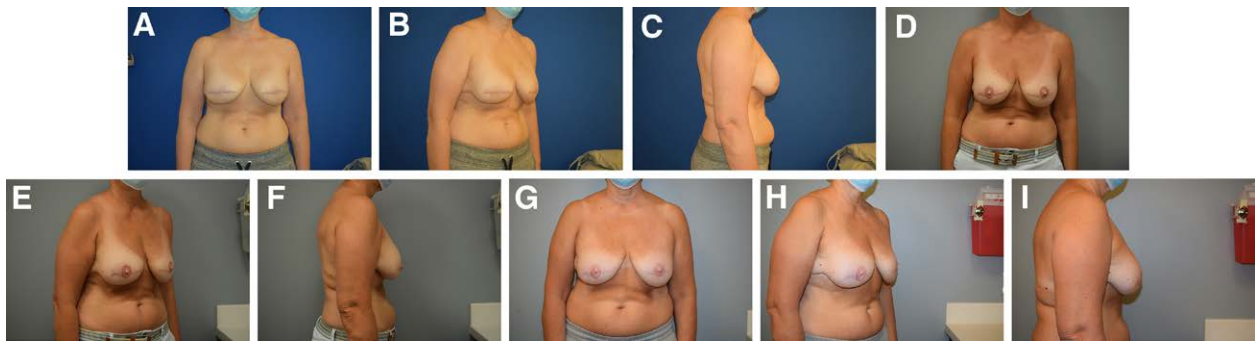


Fig. 2. This patient is a 54-year-old woman with history of BRCA-2 mutation who underwent bilateral prophylactic mastectomy and immediate reconstruction with prepectoral placement of implants. She underwent staged nipple-areolar complex reconstruction using the skate flap technique, with skin graft harvested from the bilateral groin crease. Pre- (A–C) and postoperative photographs at 6 months (D–F) and 1.5 years (G–I).

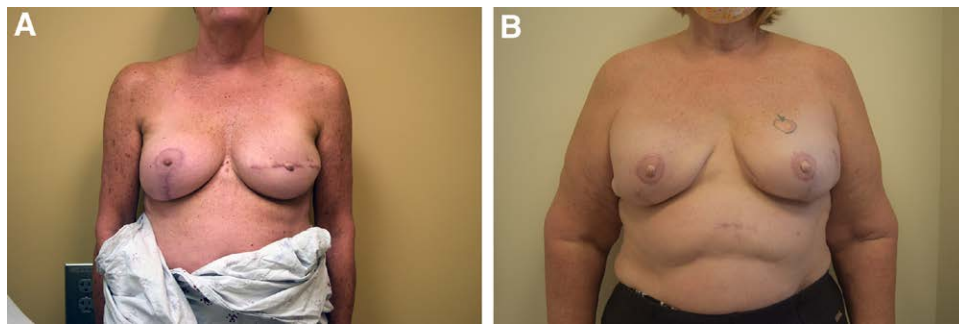


Fig. 3. Detail comparison of (A) C-V flap and (B) modified skate flap. The C-V flap is incorporated into previous mastectomy incisions and donor sites are closed primarily, in some cases resulting in additional widening and flattening of the breast. In the modified skate technique, the new nipple and areola can be positioned in the most ideal location on the reconstructed breast mound without concern for unsightly or nonanatomic scars; because the areolar skin graft resurfaces the donor site, there is less concern for change in the shape of the breast mound.

site can result in flattening of breast projection and visible, unsightly and nonanatomic scars around the nipple reconstruction (Fig. 3). The full-thickness skin graft used in the skate flap technique to reconstruct the areola may be harvested in a way that contours areas of the patient's body with skin or soft tissue excess. One additional advantage of the modified skate flap technique is that in our experience, because of darkening of the skin/hyperpigmentation of the neo-areola that usually occurs following secondary contraction of the full-thickness graft, few patients desire subsequent tattooing of the NAC. Future studies may consider how skin tone and color play a role in pigmentation of the nipple procedures, and whether tattooing or additional aesthetic procedures may affect the long-term outcome of this technique.

The value and efficacy of nipple areola reconstruction is well-established.⁷ Given the large psychosocial impact that nipple reconstruction can play in the role of breast reconstruction,^{14,15} patient satisfaction may be the single most important factor to assess the long-term success of nipple reconstruction. There are few studies that have compared patient-reported outcomes between nipple reconstruction techniques.¹³ Most commonly, studies have evaluated the efficacy of a single

nipple reconstruction technique in a cohort of alloplastic and autologous breast reconstruction patients, with the C-V flap often resulting in good overall patient satisfaction.^{3,4,16–19} Goh et al²⁰ was one of the few studies evaluating different NAC flap techniques and found equivocal levels of satisfaction between reconstruction techniques. Gullo et al²¹ provided evidence that the star flap achieves good overall patient satisfaction among patients undergoing breast reconstruction. Jabor et al²² evaluated numerous types of flaps (star, nipple sharing, keyhole, skate, S) and found equivocal satisfaction between techniques. Two studies by Chen et al and Cheng et al demonstrated between 80%–90% satisfaction with the modified S flap for nipple reconstruction in their respective cohorts.^{23,24} Chen et al²⁴ found 90% overall satisfaction with the badge flap used for nipple reconstruction.

Our study is one of the few studies to compare patient-reported outcomes between nipple reconstruction techniques and offers new insights into nipple reconstruction. We found that using the skate flap technique illustrated in this article, patients reported a statistically higher overall satisfaction with their reconstruction (Table 4). These findings present evidence that, despite the challenges of nipple reconstruction in

both alloplastic and autologous breast reconstruction, the skate flap is a promising option that may result in better overall satisfaction.

One limitation of this study is that it is retrospective in nature, and only contains patients from a single institution. However, as evidenced by the number of patients with minimal complications and minimal revision procedures, there is strong reason to believe that our results are generalizable to patients undergoing nipple reconstruction in a multitude of different practice settings. Another limitation relates to the timing of administration of our postoperative questionnaire; patients were given the survey at different time points in their recovery, which could potentially impact their reconstruction appearance and perception of their nipple reconstruction. We attempted to assess the effect of time on patient perceptions with our multivariate analysis; however, it is hoped that future studies will obtain patient-reported outcome data at set time points and compare to a preoperative baseline.

CONCLUSIONS

Patients may undergo nipple areola reconstruction safely by a variety of methods. In our institutional experience, complication rates and need for revision surgery were similar among the three most commonly used methods. The modified skate flap technique has several potential advantages over alternative methods, and in our study patient-reported satisfaction scores after this technique were higher compared with other methods.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

PATIENT CONSENT

Patients provided written consent for the use of their images.

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