Original Article

Nipple Reconstruction Using the "Arrow Flap" Technique: Outcomes and Patients Satisfaction

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Abstract

The lack of NAC, after skin sparing mastectomy, determines that the reconstructed breast remains anatomically incomplete. The aim of the study was to investigate and evaluate the impact of nipple reconstruction on the patients' perception and intimate life. A pre- and postoperative quality-of-life and psychological questionnaires Breast-Q questionnaire were given to all the patients. We noticed that the prevalence of patients reported to be very satisfied in regard to shape, appearance, naturalness, projection, position and symmetry. Also, the study shows an overall improvement in all the psychological items analyzed: "patient's satisfaction," "self-confidence," and "appearance of the breast." So, the NAC reconstruction has useful functional and aesthetic results particularly appreciated by patients who feel demoralized after breast demolition surgery.

Introduction: Skin-sparing mastectomy (SSM) entails complete removal of the breast tissue and the nipple and areola complex (NAC) with preservation of as much of the overlying skin as possible. The preservation of the natural skin envelope during SSM improves the aesthetic outcome of immediate breast reconstruction, but the lack of NAC determines that the reconstructed breast remains anatomically incomplete with not always satisfactory final results. For this purpose, the aim of the present study was to investigate and evaluate the impact of nipple reconstruction after skin sparing and skin reducing mastectomy on the patients' perception and intimate life. **Materials and Method:** This was a comparative single-center prospective study that involved 42 patients underwent NAC reconstruction after SSM. A pre- and postoperative quality-of-life and psychological questionnaires Breast-Q questionnaire (Breast Conserving therapy module) were given to all the patients before the surgery and 6 months after. The statistical analysis with chi-square test was performed. **Results:** After 6 months a prevalence of patients reported to be very satisfied in regard to shape, appearance, naturalness, projection, position and symmetry. The study shows an overall improvement in all the psychological items analyzed with statistically significant difference regarding: "patient's satisfaction," "self-confidence," "appearance of the breast." **Conclusion:** The authors believe that the NAC reconstruction has useful functional and aesthetic results particularly appreciated by patients who feel demoralized after breast demolition surgery.

Clinical Breast Cancer, Vol. 24, No. 4, e226–e231
Keywords: Cac, Local flap, Mastectomy, Patients reported outcome, Breast-Q questionnaire

Introduction

Breast cancer is the most commonly diagnosed cancer among U.S.A. women, about 30% of all newly diagnosed cancers in women each year are breast cancer[1]

Breast cancer accounts for 12.5% of all new annual cancer cases worldwide. About 13% (about 1 in 8) of U.S.A. women are going to develop invasive breast cancer in the course of their life. In 2023, an estimated 297,790 new cases of invasive breast cancer are expected to be diagnosed in American women, along with 55,720 new cases of DCIS. There are currently more than 4 million women with a history of breast cancer in the United States[1] Early diagnosis is the only real weapon that women have to defeat breast cancer and also to get conservative treatment to obtain a better aesthetic breast shape. The possible curative treatment range is from minimally invasive surgery (lumpectomy) to total mastectomy.

Skin-sparing mastectomy (SSM) entails complete removal of the breast tissue and the nipple and areola complex (NAC) with preservation of as much of the overlying skin as possible to prepare the patient for an immediate breast reconstruction, thus avoiding the potentially unsightly island of skin. The preservation of the

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Submitted: Dec 7, 2023; Accepted: Jan 18, 2024; Epub: 24 January 2024

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https://doi.org/10.1016/j.clbc.2024.01.011

natural skin envelope during SSM improves the aesthetic outcome of immediate breast reconstruction, but they need the reconstruction of the NAC that marks the concluding step for breast reconstruction. A reconstructed breast devoid of the nipple and areola remains anatomically incomplete.[2]

From a technical perspective, NAC reconstruction represents a relatively simple and straightforward surgical procedure. However, from an aesthetic perspective, it is viewed as one of the most important aspects by many women as the defining element of the female breast.

Numerous techniques for nipple reconstruction have been described, such as the C-V flap, arrow flap, skate flap, star flap and nipple share[3]

The definitive goals are a realistic and aesthetically pleasing nipple-areolar complex (NAC) and high patient satisfaction. Nipple projection, satisfactory texture, and color with the use of medical tattooing are highlighted as characteristics of a successful surgery.

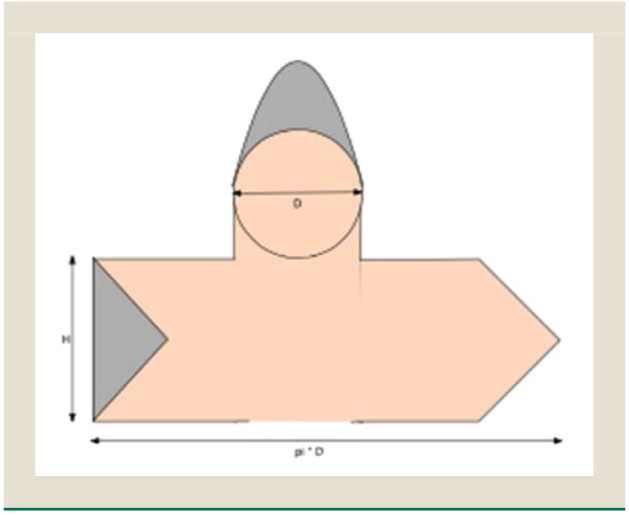
Nipple-areolar reconstruction is typically carried out in 2 stages, with the tattooing process conducted in an outpatient setting, after nipple reconstruction and completed wound healing.[4,5] The aim of the present study was to investigate and evaluate the impact of nipple reconstruction after skin sparing and skin reducing mastectomy on the patients' perception and intimate life.

Materials and Methods

This comparative single-center prospective study was conducted at the Plastic Surgery unit of Trieste Hospital (ASUGI Azienda Sanitaria Universitaria Giuliano-Isontina), Italy. The study was done in full accordance with the Helsinki declaration, and an informed consent for additional procedure was obtained from each patient enrolled in the study. The study involved a total of 42 patients who underwent NAC reconstruction after 6 months of prosthetic or autologous breast reconstruction between 2020 and June 2021, all the patients were identified from the ward breast database and enrolled in the study. Under local anesthetic, modified arrow flap was performed by the same operator. No antibiotics were administered, and the procedure was performed in an outpatient setting under local anesthetic. All the patients with previous radiotherapy and/or previous NAC tattoo were excluded from the study. Case notes were retrieved and demographic information including age, date of surgery, past medical history, smoking history, type of breast reconstruction, symmetrizing procedure, pre- or postoperative radiotherapy, and complications were documented. Subjective assessments were made using a quality-of-life questionnaire focusing primarily on patient satisfaction, analyzing 6 aspects: shape of the nipple, appearance, naturalness, projection, position, and symmetry. The questionnaire was somministrated just before and 6 months after the nipple reconstruction. In addition, a specific psychological questionnaire was administered to all the patients before and 6 months after the nipple surgery.[6] For all patients, we evaluated the psychological effect of nipple reconstruction with a disease-specific questionnaire that took in consideration 7 parameters: satisfaction, partner relationship, body image, self-confidence, nipple importance, sexuality, and breast appearance. These assessments were performed in 2 different times: before surgery and at 6 months after the date of surgery. A grading system has been created for the evaluation of each item, this was structured as: 4 = very satisfied, 3 = satisfied, 2 = somehow satisfied, 1 = not satisfied.

The statistical analysis was performed with CHI square test using the SPSS statistics 28 software (IBM Corp., New York, NY). A value of P of less than 0.05 was considered statistically significant.

Figure 1 Arrow flap preoperative planning.



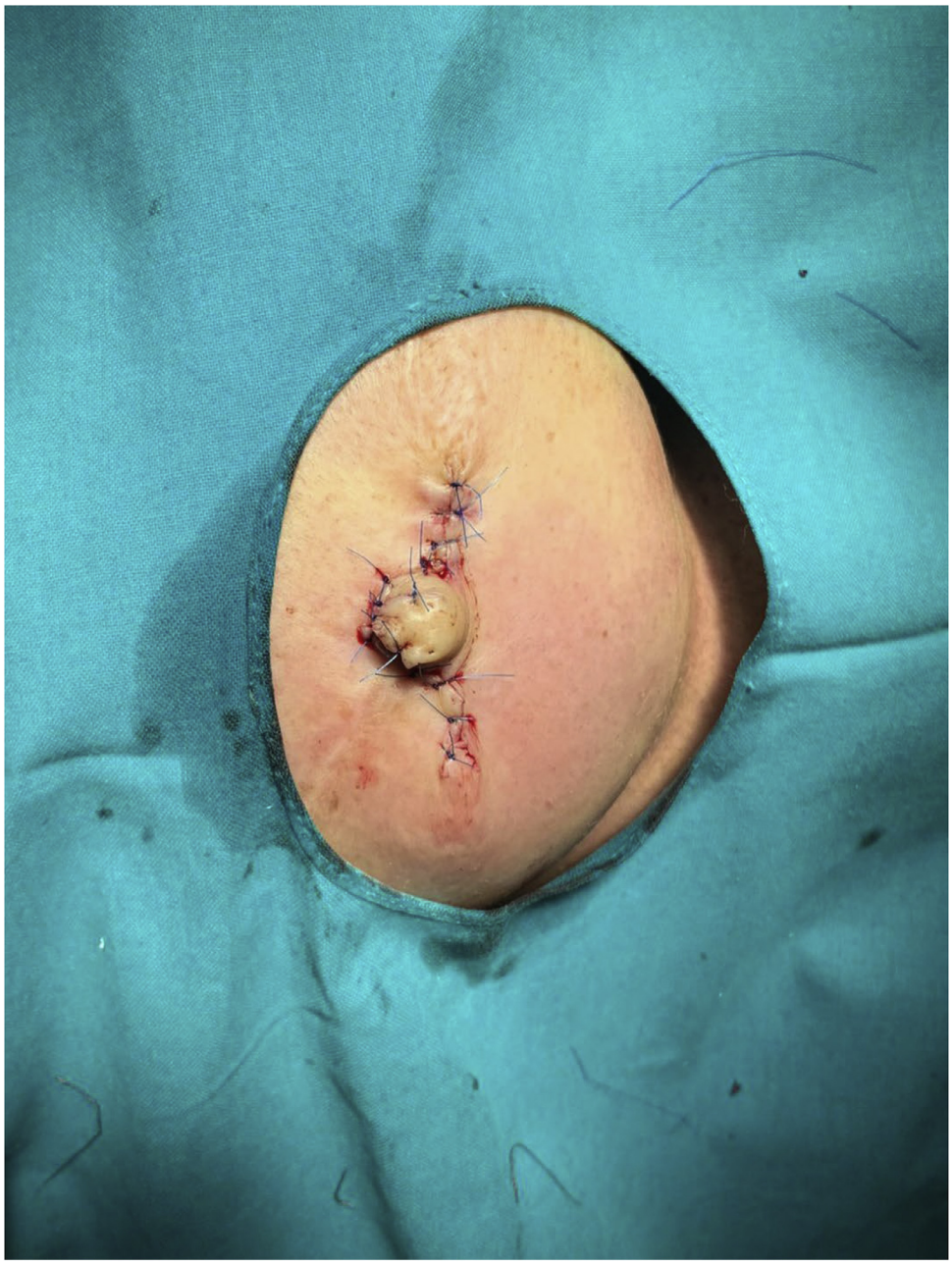
Surgical Technique

We use the modified arrow flap technique.[7] All patients were marked sitting upright. The position of the arrow flap (Fig. 1) was marked in relation to the nipple position in the native breast and whether a symmetrizing procedure was planned on the contralateral side. The flap was marked to ensure that the blood supply was away from any old scar. The flap was designed one and a half to twice the size of the contralateral nipple to allow for 50% shrinkage or reduction in projection occurring over time due to absorption of the central fat core to optimize the long-term cosmesis. The procedure was carried out under local anesthesia. The pattern of an unfolded cylinder is drawn at the desired position of the nipple-areola complex as described by Thomas et al.[8] The diameter of the circle represents the cylinder's top surface and is planned to correlate with the opposite nipple. The height of the rectangle is planned to be about 120% of the final nipple height. The reconstruction itself is performed by harvesting the lateral extensions and the top circle at the superficial subcutaneous level. Additional fat is preserved close to the pedicle to secure a healthy blood supply as well as bulk to the center of the cylinder. Further, the lateral extensions are closed to the side walls, thereby forming a cylinder, and the circle is flapped down to form the top of the nipple. At the end the donor site was closed by parallel approximation of its longitudinal wound margins, thereby suturing the base of the created cylinder in the excision area that was previously formed by resection of the cylinder's top circle (Figs. 2 and 3).[9–11]

Results

Between January 2020 and June 2021, 42 patients underwent nipple reconstruction with an arrow flap. We initially identified

Figure 2 Postoperative detail after NAC reconstruction.



from the ward breast database 51 patients but we enrolled just 42 patients that perfectly fit in the inclusion criteria. Four of them were reconstructed with autologous tissue, the other 38 with implant-based breast reconstruction.

Only one flap suffered from a partial necrosis and was treated conservatively. No other complications were recorded.

The patients' satisfaction questionnaire administered after 6 months of the nipple reconstruction showed a prevalence of patients who reported to be very satisfied in regard to shape, appearance, naturalness, projection, position and symmetry (Table 1).

The questionnaire used to value psychological aspects was administered before the nipple reconstruction and 6 months after surgery. The answers showed an overall improvement in all the items analyzed with statistically significant difference regarding: patient's satisfaction at 6 months after surgery, post-operative value was greater than pre-operative one, with statistical significance

Figure 3 Postoperative detail after NAC reconstruction.

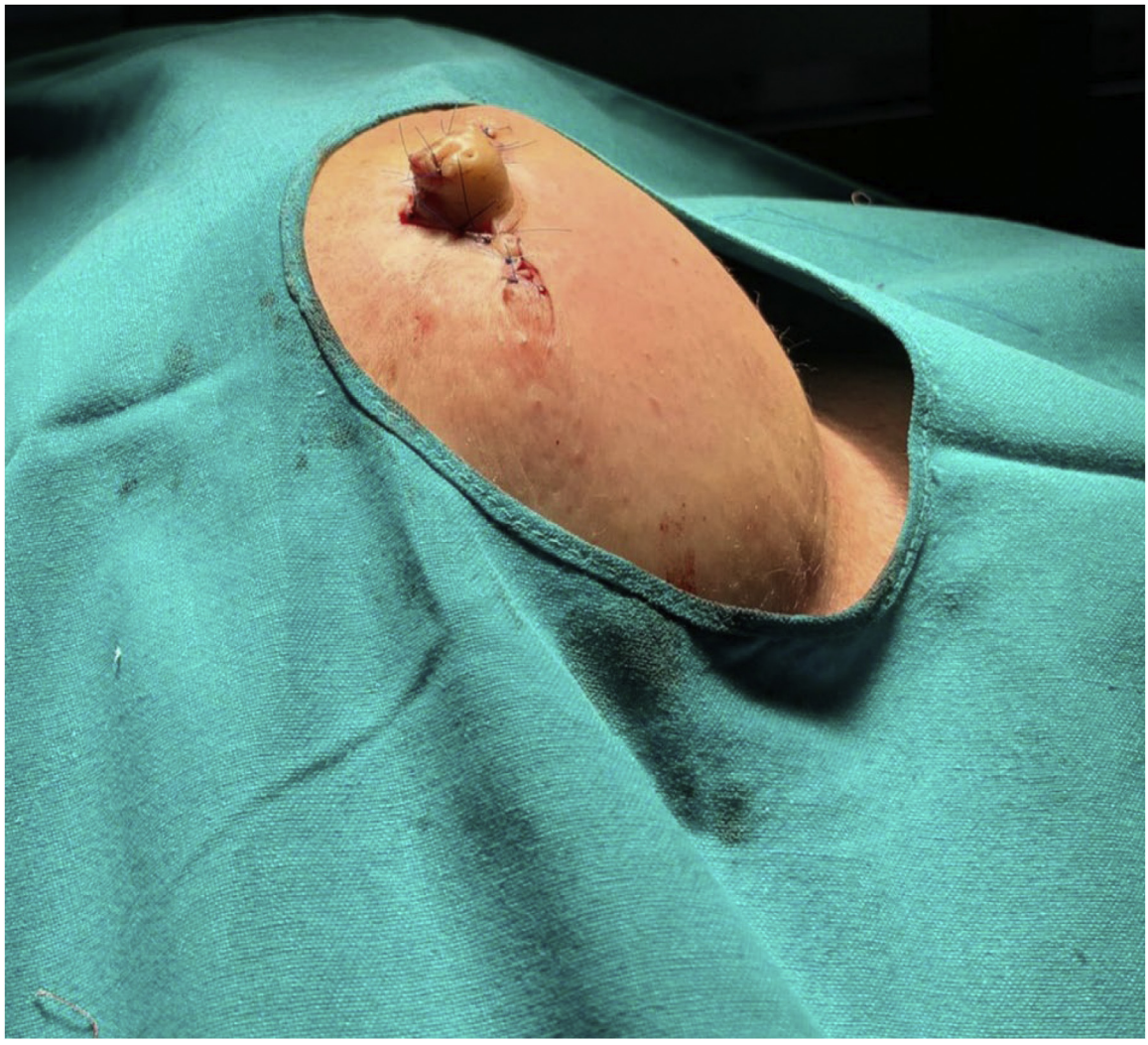


Table 1 Quality-of-Life Questionnaire Results

	Satisfaction (%)			
	Not	Quite a Bit	Much	Very Much
Shape	12.5	6.25	6.25	75
Appearance	12.5	0	12.5	75
Naturalness	12.5	0	25	62.5
Projection	18.75	12.5	12.5	56.25
Position	18.75	6.25	6.25	68.75
Symmetry	12.5	0	12.5	75

(1.29 vs. 3.52; $p = 0{,}041$); the self-confidence, 6 months-postoperative value was greater than preoperative one, with statistical significance (1.29 vs. 3.62; $p = 0.04$) and appearance of the breast, 6 months-postoperative value was greater than preoperative one, with statistical significance (2.29 vs. 3.29; $p = 0.04$) .

An increase of a few items, even though with no statistically significant difference, was recorded in regard to "partner relationship" (1.52 vs. 3.52; $p = 0.168$), "body image" (2.33 vs. 3,48; $p = 0.960$), "CAC importance" (3.10 vs. 3.24; $p = 1.000$) and "sexuality" (2.14 vs. 2,38; $p = 0.916$) (Table 2)

Discussion

NAC reconstruction is the final and vital step in the series of breast reconstruction procedures. Without a NAC, the reconstructed breast mound is likely to lack visual completion. Moreover, it is of significant importance in terms of the patient's psychological satisfaction. Although a number of nipple reconstruction procedures are described in the literature, few clinical trials have been conducted to reach a consensus on a favored method in terms of long-term

Table 2 Psychological Questionnaire Results

Psychological Items	Average Value		
	Before Surgery	6-mo After Surgery	*p*-Value
Satisfaction	1.29	3.52	**0.041**
Partner relationship	1.52	3.52	0.168
Body image	2.33	3.48	0.960
Self confidence	1.29	3.62	**0.039**
CAC importance	3.10	3.24	1.000
Sexuality	2.14	2.38	0.916
Breast appearance	2.29	3.29	**0.041**

cosmesis and ease of the technique.[12–14] In practice, the chosen method is usually dependent on the experience of the individual surgeon and patient choice. Nipple reconstruction with or without areola tattooing is the finishing touch and the defining feature of the female breast.[15,16] Some studies have shown that timely reconstruction leads to improved psychological wellbeing in the patient and improved patient and partner satisfaction[17] Regardless of the technique employed, certain rules are followed to achieve a successful local flap reconstruction including leaving a wide enough pedicle to ensure adequate blood supply while detaching it from surrounding tissue to allow flap shaping. Most reconstructed nipples retract over time due to scarring and scar contraction, particularly when there has been previous radiotherapy, infection, or poor flap design that compromises the circulation and delays healing.[18]

Since its introduction in 1996 as presented by Thomas et al, the arrow flap has been shown to be a successful method. The most common dissatisfaction with nipple reconstruction is flattening and loss of projection over time followed by color mismatch, shape, size, and malposition[19] In our study we report a high satisfaction rate with shape, appearance, naturalness, projection, position, and symmetry. In terms of safety, the techniques used in this study should be considered safe, as there were no significant postoperative complications that needed to be addressed via secondary surgical procedures. Fortunately, in 41/42 patients, no significant postoperative complications were reported.[20] The study is subject to several limitations such as the sample size that is not sufficient enough and the short follow-up time. In future studies, to draw a more generalized conclusion, more objective data from a larger population should be collected. However, a global problem is linked to the reconstruction time of the nipple-areola complex which should be done within 6 months from the surgery in order to finish the reconstructive process undertaken, but unfortunately in most centers it is done at least after 1 year.

Conclusion

In conclusion, our data suggests to propose and perform nipple reconstruction even in those patients who feel demoralized after breast demolition surgery. In fact the majority of our patients report high satisfaction rates and most of them said they accepted the reconstructed breast better after the reconstruction of the NAC.

Clinical Practice Points

- The study investigates and evaluates the impact of nipple reconstruction, with modified arrow flap technique, after skin sparing and skin reducing mastectomy on the patients' perception and intimate life.
- Our results show that the NAC reconstruction has useful functional and aesthetic results particularly appreciated by patients who feel demoralized after breast demolition surgery.

Disclosures

The authors have no commercial associations with or financial interests in any of the drugs, products, devices, or instruments used in this study.

CRediT authorship contribution statement

Vito Cazzato: Conceptualization, Formal analysis. **Chiara Stocco:** Methodology, Project administration. **Alessandro Scian:** Data curation, Formal analysis, Writing – original draft, Writing – review & editing. **Luigi Bonat Guarini:** Data curation, Formal analysis, Supervision, Writing – original draft, Writing – review & editing. **Giulia Benedetta Sidoti:** Funding acquisition, Methodology. **Nadia Renzi:** Conceptualization, Data curation, Funding acquisition, Methodology, Project administration. **Vittorio Ramella:** Project administration, Resources, Supervision, Validation. **Giovanni Papa:** Investigation, Methodology, Project administration, Supervision.

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