INTRODUCTION

Reconstruction of the nipple–areola complex (NAC) completes the final aesthetic step of breast reconstruction and restores the body image of breast cancer patients who have undergone mastectomy.1–6 An ideal reconstruction should provide good symmetry as regards color and projection compared with the contralateral nipple. The nipple can be reconstructed using a local flap, a local flap with synthetic/allogeneic/autologous graft inside or a skin graft. The areola is reconstructed by a split skin graft from hyperpigmented areas or from the contralateral areola or by tattooing. The above-mentioned techniques have some strengths and weaknesses, and no gold standard procedure exists at present. The local flap is the most frequently used technique for nipple reconstruction. It is generally performed 4–6 months after mastectomy, as an outpatient procedure, under local anesthesia. The first description of nipple reconstruction using a local skin flap dates to a 1946 study by Berson.7 To date, several local flap surgical techniques have been described to reconstruct the nipple such as the star flap, skate flap, S-flap, H-flap, C-V flap, arrow flap, cylindrical flap, and others.8–17 Although each local flap exhibits its own advantages, certain common limitations are ubiquitous. The most common shortcomings seen with local flap techniques are the loss of long-term projection and diameter. Objective measures assessing long-term nipple projection in the literature are sparse, but some studies have cited a long-term loss of projection of 40% or more. Moreover, necrosis of the flap is a non-negligible event.18–21 To overcome these problems, we developed an easy and effective nipple reconstruction technique that we have named the “Five-flap” Technique for Nipple–Areola Complex Reconstruction.
“five-flap technique,” which yields more stable and long-lasting results in terms of nipple projection and areola shape, with a significantly low rate of complications.

PATIENTS AND METHODS

From November 2018 to April 2021, a total of 21 female patients with unilaterally absent NAC due to post-oncological mastectomy and implant-based breast reconstruction were recruited. The age range was from 40 to 65 years (mean age: 50 years). All procedures were done by a single surgeon, and the operation consisted of a simultaneous procedure of nipple reconstruction using a local flap and areola reconstruction using a full-thickness skin graft from the inner thigh. Informed consent was provided by all patients undergoing NAC reconstruction, and the study was approved by University of Campania Luigi Vanvitelli Internal Ethical Committee.

Surgical Technique

The position and size of the nipple and areola are planned with the patient sitting upright with her arms relaxed along her body. Firstly, we measured the following parameters of the contralateral NAC: the areola diameter, the nipple diameter, the nipple projection, the nipple-jugular distance, the distance between the nipple and the mid-sternal line, the distance from the jugulum to the top of the areola, and the distance from the areola to the mid-sternal line. These parameters allow us to set the neo-NAC in a symmetrical position compared with the contralateral (Fig. 1A–C). The central point of the nipple is marked, and a 3.14 (π) cm line is drawn centered on this point and in a perpendicular orientation relative to the preexisting mastectomy scar to provide an optimal vascularization to the flap pedicles. With this line as a reference, we draw a figure five with these measurements: b1 = 1.64 cm; b2 = 1.5 cm; h1 = 1 cm; h2 = 2 cm. So, two facing skin flaps are created (Fig. 2). The dissection of the skin flaps includes about 1 cm of subcutaneous tissue. Then, the flaps are raised to an upright position and turned in toward each other in the middle of the figure five, suturing point x to x1 and point y to y1 with two absorbable monofilament 3/0 subcutaneous sutures (See Video [online], which displays how to face the two flaps). The two flaps are sutured to each other with an absorbable monofilament 4/0 running suture to create a dome about 2 cm high and close to 1.5 cm wide. The donor sites of the flaps are sutured with two intradermal absorbable sutures. The areola area is de-epithelialized around the neo-nipple to a size and shape corresponding to the opposite areola and engrafted with a full-thickness skin graft taken from the upper inner thigh, where the skin is more pigmented and gives an acceptable donor scar (Fig. 3A–C). The graft is pierced centrally, creating a hole with a diameter slightly smaller than the base of the nipple. A dressing is placed on the neo-NAC after the operation, consisting of a first layer of nonadhesive paraffine gauze with a central hole that accommodated the neo-nipple, and a second layer of normal gauzes. The dressing package is tied to the graft’s stitches. The tie-over dressing is then removed on the fifth day after surgery. The patients were all followed-up at 5, 10, and 15 days and at 1, 3, and 6 months after surgery (Fig. 4A–C). At each follow-up examination, the surgeons measured the areola diameter, nipple projection, and nipple diameter with a caliper to estimate any retraction that may have taken place. Overall satisfaction was evaluated at the end of the follow-up period by the patients themselves and by an external medical observer. The patients answered a questionnaire concerning symmetry of position, texture,
RESULTS

None of the 21 reconstructed nipples experienced total or partial necrosis. We only observed two minor complications. In one case, the de-epithelization of the flap surface that had completely healed in 2 weeks. In another case, the partial de-epithelization of the areola. Both cases were successfully treated as outpatients. The shape of the neo-nipple remained unaltered during the entire follow-up period for all patients. The average initial projection of the neo-nipple was 15.4 mm and the average projection 6 months after reconstruction was 13.5 mm (10 mm–19 mm), with an average loss of projection of 12%. The mean horizontal diameter of the nipple base was 15.8 mm (range 7–19 mm), and the vertical one was 15.3 mm (range 9–20 mm). The color of the nipples and areolas tend to lose some of their original tonality. However, in most of the cases, the cosmetic result was acceptable. The total average satisfaction score was 8.0 for patients and 9.0 for external observers.

DISCUSSION

The main complication in NAC reconstruction is represented by necrosis of the flap or skin graft, followed by retraction of the nipple projection due to scar retraction and change in the areola shape. According to some articles, the loss of nipple projection in nipple reconstruction varied from 45% to 75%. The complication rate was 46.9% after graft, 7.9% after local flap, and 5.3% in case of flaps with autologous graft/allograft/allograft augmentation, whereas complications in areola reconstruction were 10.1% after graft. Flaps seem to be more reliable than grafts in nipple reconstruction. The use of flaps with autologous graft/allograft/allograft augmentation (cartilage, fat, calcium hydroxyapatite, acellular dermal matrix, polymethylmethacrylate, biologic collagen) showed a minor loss of nipple projection but may lead to a major number of postoperative flap necroses. Although our study is limited in terms of number of cases (21) and follow-up period of 6 months, loss of projection usually occurs within the first 3–6 months after reconstruction and, in our study, nipple retraction after this period was negligible, with an average of 1.75 mm. Variation in areola shape was also minimal. Kroll suggested that flap width is the most important factor for obtaining long-term projection, as increasing the width augments the flap blood supply and reduces fat necrosis. The five-flap technique enables the nipple to be sufficiently wide, with a height/width ratio of about 1:1, allowing adequate blood flow. In C-V and skate flaps, which are made by collecting multiple flap lobules or tips in one place, blood supply is inevitably reduced at the tip area, potentially resulting in severe nipple retraction. The advantage of using a design with two opposing flaps sutured together with low tension and sufficiency of blood supply is that it ensures adequate nipple projection even with poor, thin, or tight skin. The five-flap technique also ensures a better aesthetic outcome regarding the shape of the nipple, which, in techniques like the S-flap, appears to be sharper compared with the contralateral nipple. Regarding areola reconstruction, we prefer grafting the areolar site rather than intraoperative tattooing like other authors perform. In our opinion, the main problem of that procedure is that it leaves a noticeable scar. In our technique, the scars resulting from the flap preparation at the donor site are covered by the graft, while the scar of the donor area is well hidden in a physiological skin fold. Tattooing certainly has some advantages over grafting, with a high rate of satisfaction. In our study,
grafts were preferred for many reasons. In patients with a history of prior radiotherapy or prosthetic-based breast reconstruction, areola grafting should be preferred compared with tattooing. Furthermore, tattooing is affected by fading in some cases with time, leading to asymmetry in the contralateral color match and usually requires at least two sessions, which could reduce patient compliance compared with a 1-step surgery like our NAC technique. However, we have no experience with the 3D nipple–areolar tattoo introduced by Hammond et al.23

Table 1. Questionnaire Used to Determine the General Patient Satisfaction

| Criteria                        | Statement                                                                 | Score |
|---------------------------------|---------------------------------------------------------------------------|-------|
| Symmetry of position            | Rate the degree of symmetry between the two NAC.                          | 0–10  |
| Texture                         | Do you believe that your neo-nipple–areola complex has a realistic texture? If you do, rate it. | 0–10  |
| Color                           | Rate the degree of chromatic similarity.                                  | 0–10  |
| Nipple (diameter and projection) | Are you satisfied with your neo-nipple dimensions? If you are, rate them. | 0–10  |
| Areola diameter                 | Are you satisfied with your neo-areola dimensions? If you are, rate them. | 0–10  |
| Scar retraction                 | The nipple and the areola may have a retraction. Rate the stationarity’s degree. | 0–10  |
| General satisfaction            | Are you satisfied with the results? If you are, rate them.                | 0–10  |

Fig. 4. Postoperative at T0 and at 6-month follow-up. A, Photograph of results on postoperative day 5. B, Lateral view of results at 6 months postoperative. C, Frontal view of 6-month postoperative results.
CONCLUSIONS

The five-flap technique for nipple reconstruction represents a simple, quick, and effective procedure to obtain an adequate nipple projection and an aesthetically satisfying shape, with a negligible rate of complications. It is particularly indicated for reconstructing moderate to very projected nipples.

Giuseppe Lanzano, MD
Plastic and Reconstructive Surgery Unit
Multidisciplinary Department of Medical-Surgical and Dental Specialties
University of Campania Luigi Vanvitelli
Piazza Luigi Miraglia, 2, 80138, Napoli
Naples, Italy
E-mail: dottgiuseppelanzano@gmail.com

ACKNOWLEDGMENTS

The study was approved by the institutional review board of University of Campania Luigi Vanvitelli and performed in accordance with the principles of the Declaration of Helsinki.

REFERENCES

1. Pa G. Psychological and social aspects of breast cancer. Oncology (Williston Park). 2008;22:642–653.
2. Jeevan R, Cromwell DA, Browne JP, et al. Findings of a national comparative audit of mastectomy and breast reconstruction surgery in England. J Plast Reconstr Aesthet Surg. 2014;67:1333–1344.
3. Cano SJ, Klassen A, Puic AL. The science behind quality-of-life measurement: a primer for plastic surgeons. Plast Reconstr Surg. 2009;123:98e–106e.
4. Alderman AK, Wilkins EG, Lowery JC, et al. Determinants of patient satisfaction in postmastectomy breast reconstruction. Plast Reconstr Surg. 2000;106:769–776.
5. Wilkins EG, Cederina PS, Lowery JC, et al. Prospective analysis of psychosocial outcomes in breast reconstruction: one-year postoperative results from the Michigan Breast Reconstruction Outcome Study. Plast Reconstr Surg. 2000;106:1014–1025.
6. Ricciardi C, Gubitosi A, Lanzano G, et al. The use of six sigma to assess two prostheses for immediate breast reconstruction. In: Jarm T, Cvetkoska A, Mahnič-Kalamiza S, Miklavčič D, eds. 8th European Medical and Biological Engineering Conference.

Proceedings of the EMBEC 2020. Vol. 80. Cham: Springer; 2021. https://doi.org/10.1007/978-3-030-64610-3_125.
7. Berson MI. Construction of pseudoareola. Surgery. 1946;20:808.
8. Gruber RP. Nipple-areola reconstruction: a review of techniques. Clin Plast Surg. 1979;6:71–83.
9. Millard DR Jr. Nipple and areola reconstruction by split-skin graft from the normal side. Plast Reconstr Surg. 1972;50:350–353.
10. Brent B, Bostwick J. Nipple-areola reconstruction with auricular tissues. Plast Reconstr Surg. 1977;60:353–361.
11. Broadbent TR, Woolf RM, Metz PS. Restoring the mammary areola by a skin graft from the upper inner thigh. Br J Plast Surg. 1977;30:220–222.
12. Klatsky SA, Manson PN. Toe pulp free grafts in nipple reconstruction. Plast Reconstr Surg. 1981;68:245–248.
13. Hallock GG, Altobelli JA. Cylindrical nipple reconstruction using an H flap. Ann Plast Surg. 1993;30:23–26.
14. Little JW III, Munasifi T, McCulloch DT. One-stage reconstruction of a projecting nipple: the quadrapod flap. Plast Reconstr Surg. 1983;71:126–133.
15. Rubino C, Dessy LA, Posadinu A. A modified technique for nipple reconstruction: the ‘arrow flap’. Br J Plast Surg. 2003;56:247–251.
16. Kroll SS. Integrated breast mound reduction and nipple reconstruction with the wraparound flap. Plast Reconstr Surg. 1999;104:687–693.
17. Cronin ED, Humphreys DH, Ruiz-Razura A. Nipple reconstruction: the S flap. Plast Reconstr Surg. 1988;81:783–787.
18. Bhatti MA, Berry RB. Nipple-areola reconstruction by tattooing and nipple sharing. Br J Plast Surg. 1997;50:351–354.
19. Few JW, Marcus JR, Casas LA, et al. Long-term predictable nipple projection following reconstruction. Plast Reconstr Surg. 1999;104:1321–1324.
20. Shestak KC, Gabriel A, Landecker A, et al. Assessment of long-term nipple projection: a comparison of three techniques. Plast Reconstr Surg. 2002;110:780–786.
21. Sisti A, Grimaldi I, Tassinari J, et al. Nipple-areola complex reconstruction techniques: a literature review. Eur J Surg Oncol. 2016;42:441–465.
22. Winoncour S, Saksena A, Oh C, et al. A systematic review of comparison of autologous, allogeneic, and synthetic augmentation grafts in nipple reconstruction. Plast Reconstr Surg. 2016;137:14e–23e.
23. Hammond JB, Teven CM, Bernard RW, et al. 3D nipple-areolar tattoo: it’s technique, outcomes, and utilization. Aesthetic Plast Surg. 2021;45:453–458.