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Reduction of Nipple Areola Complex Grafts with top Surgery among Transmasculine Patients: Description of Technique and Outcome

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Abstract

Free nipple grafts are commonly used in conjunction with double incision technique for gender-affirming chest surgery. However, there is a lack of data in the recovery of cutaneous sensation after free nipple grafting. In addition, some patients request for reduction of the size of the nipple areolar complex (NAC) to better fit their flatter chests. There is limited data in the literature on the feasibility of reducing or re-contouring the NAC as a graft. In this study, we described three surgical techniques to reduce the nipple size on a nipple graft. We identified 123 patients who underwent double incision with free nipple graft technique for gender-affirming chest surgery between 1st Oct, 2017 to 31st Dec, 2018. We performed reduction and re-contouring of nipple grafts on 62 patients, utilizing 1 of 3 techniques based on a simple algorithm. Postoperatively, we evaluated objectively the recovery of sensation using the Semmes-Weinstein monofilament testing. There was no nipple necrosis. There were 117 patients who developed sensation to their free nipple grafts postoperatively. Most patients started regaining NAC sensation between 3 to 6 months. Preoperatively, 5 patients did not have any sensation in the NACs, and four of these patients developed postoperative sensation of their new nipple grafts. We demonstrated that reducing or re-contouring the NAC as a graft can be done safely and that most patients may regain some sensation to their NAC postoperatively.

Keywords: Nipple grafts; Gender affirming chest surgery

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Introduction

Free nipple grafts are commonly used in conjunction with double incision technique for gender-affirming chest surgery. Patients may ask about the likelihood of preserving nipple sensation after having nipple grafts. Even in patients who are not interested in preserving nipple sensation, a loss of cutaneous sensation could compromise in protection of the nipples. However, a lack of data in the recovery of cutaneous sensation after free nipple grafting makes it difficult for providers to counsel patients. Semmes-Weinstein monofilament testing is an objective test for assessing light touch. This method has been shown to be reproducible in clinical situations [1-3]. In addition, some patients request for reduction of the size of the nipple areolar complex (NAC) to better fit their flatter chests. There is limited data in the literature on the feasibility of reducing or re-contouring the NAC as a graft.

In this study, we described three surgical techniques to reduce the nipple size on a nipple graft. We also evaluated objectively the recovery of sensation after performing free nipple grafts using the Semmes-Weinstein monofilament testing.

Materials and Methods

We identified patients who underwent double incision with free nipple graft technique for gender-affirming chest surgery between 01 Oct, 2017 to 31 Dec, 2018. Each patient obtained one clearance letter from a mental health provider prior to surgery. Preoperatively, the sensitivity of the NAC was tested using Semmes-Weinstein monofilaments according to the manufacturer's instructions. Patients were asked to close their

eyes throughout the testing, and respond orally when they felt a stimulus. Patients will be tested on their fingers with each Semmes-Weinstein monofilament prior to testing their NACs, so that they would know how it would feel. The NAC was tested at the 12, 3, 6, and 9 o'clock positions, as well as centrally. The monofilaments were applied at a right angle to the skin, and force was applied until the monofilaments were slightly bent by 1 to 2 mm. The monofilaments were applied in descending order of magnitude to assess the threshold at which sensation disappeared. The lightest pressure threshold detected by the patient in aforementioned regions of NAC was recorded as grams per square millimeters. If the largest (300 grams) monofilament was applied without being sensed by the patient, the area was touched with a finger. If the touch of the fingertip was not felt by the patient, the area was considered insensate. The device used for two-point discrimination in the nipple areolar area exceeded the dimension of the areola itself and the two-point discrimination evaluation was aborted early on in our clinical examination. All surgeries utilizing double incisions with free nipple graft technique were performed under general anesthesia. With the patient in supine position, skin incisions were made according to preoperative markings. Mastectomy flaps were raised. The NACs were harvested, thinned and contoured by reducing the nipple and areola. The NAC grafts were then placed in low and lateral position on the flattened chests. A bolster dressing was secured over the NAC graft. The dressing was removed at 7 days postoperatively and local wound care to NAC was performed by the patient. Postoperatively, the NACs were evaluated at 4 weeks, 3 months, 6 months and 12 months respectively with Semmes-Weinstein monofilament by the same person.

Techniques for reduction of nipple

If the nipple was wide and the height did not require adjustment, we would perform a wedge excision in the form of a V-shape extending from the nipple's center. The edges would then be re-approximated with absorbable sutures. This would reduce the circumference of the nipple without changing the height too much **(Technique 1, Figure 1).** If the nipple was wide and tall, we would excise a wedge from the nipple and then excise tissue from the remaining base of the nipple to flatten the nipple out more. We would then advance the cut edges of the nipple inferiorly. This would decrease the height and circumference of the nipple **(Technique 2, Figure 2).** If the nipple was wide and relatively short in height, we would excise a small wedge from the nipple, and then create limbs from the edges of the nipple. By re-approximating the limbs together, this would maintain the height of the nipple **(Technique 3, Figure 3).** For patients who consented to have nipple reduction, we will utilize 1 of 3 techniques based on a simple algorithm **(Figure 4).**

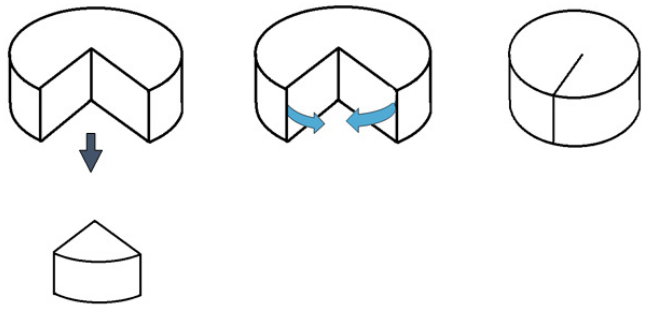

Figure 1 Technique 1: Wedge excision and close. Left: Excise the wedge. Center: Re-approximate the cut edges. Right: Smaller nipple, height maintained.

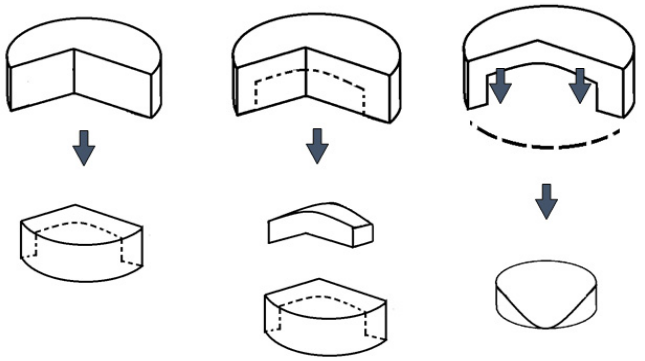

Figure 2 Technique 2: Wedge excision, then excise tissue from center, and close. Left: Excise the wedge. Center: Excise tissue from the center to flatten the nipple. Re-approximate the cut edges. Right: Advance the cut edges inferiorly, resulting in a smaller and shorter nipple.

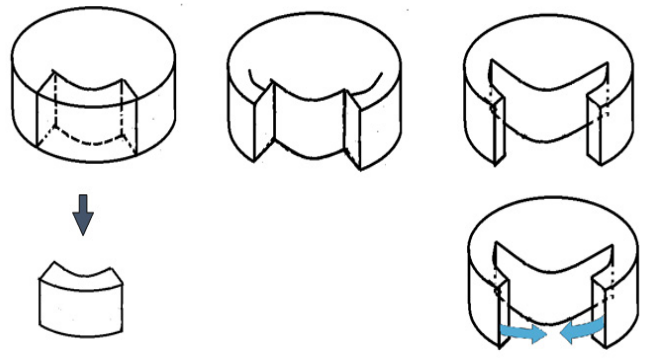

Figure 3 Technique 3: Wedge excision, then create limbs, and close. Left: Excise the wedge. Center: Create limbs. Right: Re-approximate limbs, smaller nipple, height maintained.

Results

There were a total of 123 patients with 246 NACs evaluated, among whom 50% had nipple reduction. Technique 1, 2, & 3 were utilized at 50%, 30%, 20% of the cases for nipple reduction respectively. Mean age was 26.8 +/- 8.9 years. Mean ASA score was 1.4 +/- 0.5. No one had diabetes. No one was reported actively smoking during peri operative period. Mean operative time was 160.2 +/- 61.5 minutes. Mean weight of chest tissue removed was 407.3 +/- 292.03 grams. There were 90% of patients who had at least 3 months of follow-up. There was no nipple necrosis. There were 117 patients who developed sensation to their free nipple

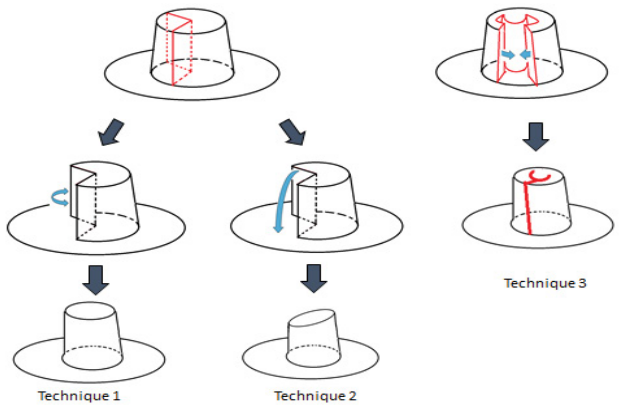

Figure 4 Algorithm for reducing and re-contouring nipples those were too wide. Left: [Technique 1] for nipples that were wide but did not require adjustment of height. Center: [Technique 2] for nipples that were wide and tall. Right: [Technique 3] for nipples that were wide and short.

grafts postoperatively. Of the 6 patients who could not detect even light touch by a finger postoperatively, 2 were examined at least 9 months after surgery. There were 23 patients who could detect only 300 g or less, of whom 18 patients were seen at least 30 days postoperatively. Most [90%] patients started regaining NAC sensation between 3 to 6 months. Preoperatively, 5 patients did not have any sensation in the NACs, and four of these patients developed postoperative sensation of their new nipple grafts.

Discussion

Physiology of re-enervation

In our study, patients regained some sensation in their nipple grafts after surgery. There was limited data on nipple graft outcome in the literature. We extrapolated data from studies that used semi-quantitative and quantitative methods to evaluate sensation after skin graft operation, and found an improved, albeit not fully normal, sensation after patients have healed. For example, split skin grafts were used to cover wounds following excision of malignant melanoma in 39 patients. The authors evaluated sensation to touch, heat/cold, and pain) and divided the patients into two groups. They placed skin grafts over muscle fascia in 17 patients and placed skin grafts directly onto the muscle in 22 patients. Both groups demonstrated good reinnervation of the transplanted skin at 7months to 14 years postoperatively, although patients with skin grafted onto intact muscle fascia had better reinnervation than their counterparts [4]. Another study performed full thickness grafting from ulnar border of the palm to cover volar surface of the hand in 22 patients and showed that sensation covering the finger-tip areas had mean static 2 point discrimination of 5.5 mm, i.e., adequate for function, in 4 cases [5]. A study on who followed 11 patients who underwent reduction mammoplasty with free nipple grafts for up to one year postoperatively showed that there was negligible change postoperatively relative to baseline measurement of the NAC sensation. Patients did not end up having insensate in their NAC despite receiving free nipple grafts [6]. Another study on 15 male burn survivors who had deep partial or full thickness burn injury covered by skin graft. The patients were evaluated using Semmes-Weinstein monofilaments and the Medoc TSA 2001 therma stimulator. The authors found that touch, cold and warmth thresholds did not return to normal levels after skin grafting. The authors also performed skin biopsies form both the grafted and normal skin and stained with antibodies for protein gene product 9.5 and neurofilament 200 kDa. They found that a reduction of sensory was associated with a decrease in the density of nerve terminals. The reduction of sweat glands and innervated blood vessels were indicative of diminished sensation on grafted skin [7]. Similarly, other studies reported almost normal return of sensitivity of skin grafts, thus suggesting skin grafts had a potential to regain sensation to almost full extent [8-10]. In contrast, other studies demonstrated poor recovery after skin graft operation. For example, a study evaluated skin grafting to donor site after radial forearm flap was harvested in 19 patients, and demonstrated that 17 patients complained of areas of reduced sensibility over the grafted skin area [11]. In a study on severely burned face, the authors found that sensory recovery was poor with moving two point discrimination and monofilament light touch. The authors suggested that recovery of sensation depended on the depth of the original burn, anatomic locations and thickness of skin grafts [12]. All these studies were different in terms of skin graft thickness, age of patients, and location of donor and recipient sites, thus making it hard to perform direct comparison between the studies, because these factors could account for the variability in reinnervation of the skin graft. Also, the NAC tissue is also unique in its anatomy, hence we need studies specific on NAC grafts to further delineate the sensory outcome of this procedure.

Nearly normal reinnervation in individual patients with a skin graft in cannot be fully explained. Preoperatively, the lateral branch pierces the fascia of the serratus anterior muscle and runs towards the lateral margin of the pectoralis major, turning in at a right ankle to penetrate NAC [13,14]. Branches from the second to the sixth intercostal nerves and branches of the cervical plexus form a microscopic sub-dermal plexus below the nipple areolar complex and contribute to the ability of the nipple areolar complex to perceive stimuli [15,16]. Preserving the fourth lateral intercostal nerve would not be possible with this technique, although that would benefit postoperative nipple areolar complex sensitivity. There were histologic findings to support the clinical manifestation of regaining sensation after skin grafts. Studies have demonstrated invasion of the skin grafts by regional nerves that seemed to enter the base and sides of the grafts [17]. Cutaneous nerves were demonstrated to regenerate into skin grafts if the skin grafts were placed on a sufficiently innervated graft bed. The more sophisticated finer sensation such as two-point discrimination were transmitted by heavily myelinated fibers and specialized sensory receptors which was not found histologically in studies. The authors suggested that the regeneration of nerves into the skin graft could only result in gross sensation [18]. This regeneration process could explain why four of our patients who did not have sensation before surgery and ended having sensation in their nipples after surgery.

Our study showed that patients continued to have improve sensation to their nipples over time. Other studies similarly demonstrated sensory improvement with time after skin graft reconstruction for wound coverage. For example, a study utilized Semmes Weinstein monofilament testing to evaluate sensation of a defatted full-thickness skin graft used to cover degloving injury of the foot. The authors demonstrated the development of protective sensation, with positive response to the 4.56 monofilament, starting at 3 months postoperatively in some children and at 6 months in adults. They demonstrated that all patients have protective sensation, sensing monofilament of less than 5.07, at the time of final follow-up (24 to 60 months, mean 32.8 months). No more noticeable sensory improvement was shown after 15 months postoperatively [19]. Another study evaluated 13 patients who underwent Mohs surgery followed by repair with a skin graft. Sensation was objectively assessed via light touch (monofilament testing), temperature testing, and pinprick testing. No patients were able to perceive light touch when evaluated less than 24 months after surgery. However, 2 patients could perceive light touch at more than 24 months after surgery. No patients evaluated at less than 24 months after surgery could distinguish between sharp and dull, but 3 patients could differentiate sharp from dull when evaluated after 24 months postoperatively [20]. Studies to evaluate when nipple grafts start to regain sensation and the time after which there would be low likelihood of regaining sensation may be useful to help us counsel patients appropriately.

We described three different techniques to reduce the circumference of the nipple while decreasing or maintaining the height of the nipple. We demonstrated that a nipple graft can be reduced and recontoured to modify its shape and size without resulting in a loss of the graft. Our initial concern of losing the entire nipple graft from manipulation was not substantiated. This study, however, did not evaluate the aesthetic outcome of the nipple, i.e., whether the nipple remained projected with time. Flattening of the nipple was a known problem with any nipple reconstruction technique. It would be interesting to determine the percentage nipple grafts that would remain projected after a prolonged period of follow- up. Another study demonstrated the use of a modified skate flap using local chest tissue for nipple reconstruction, while using the free areola graft for areola reconstruction in 50 patients. The authors demonstrated that 10% of patient underwent revision to adjust NAC size, projection or asymmetry [21]. It may be interesting to compare that technique to those described in this paper.

Several limitations should be noted. The biases inherent in a retrospective study design are present. Patients were followed up to a year postoperatively only, thus limiting the information on longer follow-up. The authors were aware of the limitations of the Simes-Weinstein monofilament testing, and tried to enhance the reproducibility of the results by performing the testing under similar conditions by the same examiner. The sample size decreased as time progressed, due to the failure of postsurgical patients to keep their appointments despite multiple attempts by the clinic to reach out to the patients, thus posing a bias of the results. The degree to which sensory dysfunction in the nipple grafts affect quality of life and patient satisfaction merit further study. There is conflicting data on the importance of sensation of an organ in relation to patient's satisfaction. Studies have demonstrated an association between sexual dysfunction and low NAC sensitivity to temperature, vibration, touch, pressure after reduction mammoplasty in cis-women [14]. In contrast, another study followed 125 patients after reduction mammaplasty at a 6-month questionnaire showed that there was no association between nipple sensation and patient's evaluation of cosmetic outcome, although almost 40% experienced a decrease in sensation [22]. In addition, Sigurjónsson et al. evaluated neo-clitoral sensitivity testing in transfeminine patients and showed no significant correlation between objective measurement of sensitivity and patient satisfaction on sexual function [23].

Conclusion

Our algorithm provides guidance in the selection of an appropriate technique for nipple reduction in association with the free nipple graft. The technique chosen is dependent on the height and width of the preoperative nipple in relation to the final goal. The goal of nipple reduction is to obtain an appropriately sized nipple with a low complication rate. Patient who will have free nipple grafts with or without reduction can be counseled that nipple sensation could be partially regained and may improve with time.

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