Immediate Targeted Nipple–Areolar Complex Reinnervation: Improving Outcomes in Gender-affirming Mastectomy

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Background: Female-to-male mastectomy often renders the chest skin and nipple–areolar complex (NAC) insensate. We propose a new technique of preserving the intercostal nerves and using them to reinnervate the NAC after mastectomy.

Methods: We performed a prospective analysis of transmasculine patients who underwent female-to-male mastectomy. The technique involves dissecting out the lateral intercostal nerves to length and performing a neurorrhaphy to nerve stumps at the base of the NAC. Sensory outcomes, as assessed with Semmes-Weinstein monofilaments, were compared to a cohort of patients who underwent mastectomy without neurotization.

Results: Ten patients with a mean age of 17.5 years (range: 16–19 years) underwent mastectomy. The final follow-up was a mean of 15.4 ± 4.3 months for the treated group and 40.7 ± 12.9 months for the control group. Compared to control patients, treated patients had significant improvement in sensation at the nipple (P ≤ 0.0002), areola (P = 0.0001), and peripheral breast skin (P = 0.0001). For treated patients, there was no statistically significant difference in sensation between preoperative and postoperative sensation in all tested areas at final follow-up.

Conclusion: This proof of concept study suggests that immediate reinnervation of the NAC after mastectomy enhances recovery of NAC sensation in patients undergoing female-to-male mastectomy and may be further generalized to women undergoing postmastectomy breast reconstruction. (*Plast Reconstr Surg Glob Open 2020;8:e2719; doi: 10.1097/GOX.0000000000002719; Published online 24 March 2020.)

INTRODUCTION

Female-to-male mastectomy is the most common procedure among transmasculine patients and is often the first surgical step of the transition process. Skin excision for gender-affirming mastectomy may be performed via a variety of techniques—semicircular, transareolar, concentric circular, extended concentric circular, and breast amputation—which may be nipple sparing, or require excision and reattachment of the nipple–areolar complex (NAC) with free nipple grafts. The NAC is innervated by the anterior and lateral cutaneous branches of the fourth intercostal nerve, with variable contributions from cutaneous branches of the third and fifth intercostal nerves. The NAC is thus anatomically denervated as these fine nerve branches are inevitably sacrificed, as the breast tissue is separated from the overlying skin in the subcutaneous plane. In cases of free nipple grafts, the NAC is insensate by definition since it is a skin graft that is completely detached from all surrounding tissues and transplanted to a different location on the chest wall.

Though female-to-male mastectomy alone has demonstrated psychological benefits among patients with gender dysphoria, loss of NAC sensation can lead to a lack of sexual arousal, a negative impact on self-esteem, and physical harm such as burns and mechanical trauma due to the absence of sensory awareness. Though much attention has been paid to the esthetics of female-to-male chest contouring, sensory outcomes have often been...
overlooked. In this study, we propose a novel technique for targeted reinnervation of the NAC during female-to-male mastectomy.

METHODS

This prospective study assessed consecutive patients who underwent female-to-male mastectomy by the lead author from 2016 to 2019. Approval for this study was provided by the Stanford Institutional Review Board. All patients met the World Professional Association for Transgender Health Standards of Care for chest surgery. Mastectomies were performed as nipple-sparing mastectomy (NSM) with a periareolar incision, or via a 2-incision approach with free nipple grafts. The extent of dissection and degree of undermining was similar to that of mastectomy as it is typically performed in women for breast pathology. During the dissection of the lateral outer quadrant, the third, fourth, and/or fifth lateral intercostal nerves were identified coming off the lateral border of the pectoralis major muscle and dissected free from the breast parenchyma while tracing the nerves toward the NAC (Figs. 1, 2). Neurorrhaphy was performed to the base of the NAC with 2 simple interrupted 7-0 prolene sutures, anchoring the perineurium to the dermis and biopsy-proven nerve stump, when available (Figs. 3, 4). In the case of free nipple grafts, the graft was affixed to a deepithelialized oval segment of skin; neurorrhaphy was performed to the underlying dermal surface of the deepithelialized area. No allograft was used.

Patient demographics and sensory outcomes were recorded. The areola and breast skin were divided into 4 quadrants similar to prior methods of breast sensory assessment (See figure, Supplemental Digital Content 1, which displays a diagram of breast for sensory testing. Areola and the surrounding breast skin are divided into 4 quadrants. N, nipple; AS, areola superior; AM, areola medial; AI, areola inferior; AL, areola lateral; BS, breast superior; BM, breast medial; BI, breast inferior; BL, breast lateral. http://links.lww.com/PRSGO/B343). Sensation was assessed pre- and postoperatively for right (R) and left (L) sides using Semmes–Weinstein monofilaments (6.65, 4.56, 4.31, 3.61, and 2.83 g) at the nipple, and each quadrant of the areola and breast skin 2 cm from the areola. The temperature was assessed using a metal probe. Outcomes were compared to a cohort of patients who underwent prophylactic NSM without neurotization. Unpaired t tests were employed to compare the cohorts based on the mean lowest monofilament weight at which sensation was detected.

RESULTS

Ten female-to-male transgender patients underwent bilateral mastectomy with NAC reinnervation; 3 patients underwent bilateral NSM, and 7 underwent 2-incision mastectomy with free nipple grafts. The average number of grafted nerves per side was 1.7 (range: 1–3) with a mean length of 3.8 ± 0.8 cm. The diameter of the nerves was 1–3 mm. Average age was 17.5 years (range: 16–19 years) and the mean body mass index was 27.1 ± 9.7 kg/m². The control group consisted of 10 female BRCA1 or BRCA2 carriers with a mean age of 36.6 years (range: 18–59 years) and the mean body mass index of 24.2 ± 4.1 kg/m². Mean Regnault classification of ptosis was 1.6 for the reinnervated group and 1.0 for the control group (range: 0–3 for both). Compared to control patients, treated patients had significant improvement in sensation at the nipple (control: R, 5.58 ± 1.13, L, 4.95 ± 0.90; treated: R, 3.41 ± 0.53, L, 3.21 ± 0.57; P ≤ 0.0002), areola (control: R, 5.09 ± 0.60, L, 5.13 ± 0.57; treated: R, 3.34 ± 0.39, L, 3.41 ± 0.44; P = 0.0001), and peripheral breast skin (control: R, 4.70 ± 0.91, L, 4.47 ± 0.78; treated: R, 3.00 ± 0.35, L, 2.98 ± 0.35; P = 0.0001) at average final follow-up time of 15.4 ± 4.3 months for the treated group and 40.7 ± 12.9 months for controls (see figure, Supplemental Digital Content 2, which demonstrates that compared to control patients,
treated patients had significant improvement in sensation at the (A) nipple, (B) areola, and (C) peripheral breast skin. http://links.lww.com/PRSGO/B344).

For treated patients, there was no statistically significant difference in sensation between preoperative baseline and postoperative sensation at the nipple (before: R, 3.20 ± 0.61, L, 2.93 ± 0.28; after: R, 3.51 ± 0.58, L, 3.21 ± 0.57), areola (before: R, 3.02 ± 0.23, L, 3.00 ± 0.29; after: R, 3.34 ± 0.39, L, 3.41 ± 0.44), and peripheral breast skin (before: R, 2.95 ± 0.20, L, 2.93 ± 0.15; after: R, 3.00 ± 0.35, L, 2.98 ± 0.35) at a final follow-up (see figure, Supplemental Digital Content 3, which displays that for treated patients, there was no significant difference in sensation between preoperative baseline and postoperative sensation at the (A) nipple, (B) areola, and (C) peripheral breast skin at final follow up. http://links.lww.com/PRSGO/B345). For control patients, there was a statistically significant decrease in sensation between preoperative baseline (nipple: R, 2.83 ± 0, L, 2.83 ± 0; areola: R, 2.87 ± 0.12, L, 2.89 ± 0.18; peripheral breast skin: R, 2.83 ± 0, L, 2.85 ± 0.06) and postoperative sensation (nipple: R, 5.58 ± 1.13, L, 4.95 ± 0.90; areola: R, 5.09 ± 0.60, L, 5.12 ± 0.57; peripheral breast skin: R, 4.70 ± 0.91, L, 4.47 ± 0.78) in all areas (P < 0.001). Three treated patients in the treatment group additionally reported recovery of ticklish sensation with light touch. All treated patients had intact temperature sensation. No patients experienced adverse effects of reinnervation.

DISCUSSION

Among the transgender population, there are limited data surrounding the extent of NAC sensory loss and the rate of spontaneous return of sensation following female-to-male mastectomy. From studies in women undergoing mastectomy for oncologic indications, we know that sensation to the NAC can return spontaneously without neurotization13–16; however, the extent, quality, and timing of reinnervation are highly variable.17 In a survey of 68 transmasculine postsurgical youth, Olson-Kennedy et al18 found the main complaint to be an NAC sensory loss, with 59% sustaining temporary loss and 41% reporting permanent loss. Also based on the survey data, Knox et al19 reported that 43 out of 92 breasts (46.7%) managed with nipple-sparing techniques had full or partial sensation, whereas Wolter et al20 reported “very good” or “good” sensation in 80.3% of breasts (212 out of 264). For patients with free nipple grafts, Nelson et al20 showed that 7 out of 16 patients (43.8%) self-reported some postoperative NAC sensation, whereas Knox et al19 found that all 110 breasts treated with free nipple grafts lost sensation. Without the use of objective measures, it is difficult to determine the true postoperative pattern of NAC sensation. However, from the aforementioned studies, it is clear that sensory recovery is highly variable and loss of sensation is a major risk in female-to-male mastectomy.

We demonstrate a novel technique of targeted NAC reinnervation that enhances NAC sensation following female-to-male mastectomy. In contrast to prior studies, we employ monofilament testing and a control group to objectively quantify the extent of sensory restoration in the reinnervated group. All patients had sensory recovery at the nipple, in contrast to fractions of patients in prior studies. The return of ticklish sensation furthermore signifies recovery of meaningful sensation. We hypothesize that the success of our technique is related to the fact that we are essentially performing a direct peripheral nerve repair, avoiding a delay in sensory recovery inherent with the use of autograft or allograft.21 In addition, we posit that sensory recovery in the peripheral breast skin is due to spontaneous cutaneous connections that form with branches of the intercostal nerve that are preserved during the dissection.

The limitations of our study include the small study size. We focus on objective sensory outcomes based on monofilament and temperature testing, though subjective outcomes, such as sexual arousal and self-esteem, are also important clinical endpoints. In addition, the placebo effect is a potential bias, as knowledge of neurotization may have impacted the treated group’s perception of...
sensation. To avoid this potential bias, future studies could employ a prospective, single-blind randomized controlled study design comparing transmasculine patients undergoing mastectomy with and without neurotization to more definitively evaluate sensory outcomes. Alternatively, future studies could evaluate differential sensory recovery of the chest in patients receiving unilateral nipple neurotization. Comparison of sensory recovery in patients who undergo NSM versus free nipple grafts is also an interesting line of inquiry that can be addressed in future investigations.

Neurotization in chest reconstruction is not a novel concept, as authors have been reporting this technique for autologous breast reconstruction for over 20 years. Blondeel et al. demonstrated higher-quality sensory recovery following deep inferior epigastric perforator flap breast reconstruction among patients who underwent neurotomy of the sensory branch of nerves to the rectus abdominis muscle to the fourth intercostal nerve, compared to those who underwent nonreinnervated deep inferior epigastric perforator flaps. However, targeted NAC reinnervation has neither been demonstrated in autologous or implant-based breast reconstruction nor in the transgender population. Immediate targeted NAC reinnervation thus has the potential to herald the “next frontier” in breast reconstruction, while also improving outcomes in transmasculine patients undergoing gender-affirming mastectomy.

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