

Use of AlloDerm in Primary Nipple Reconstruction to Improve Long-Term Nipple Projection

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Background: The objective of this study was to demonstrate the use of the authors' technique to improve long-term maintenance of nipple projection by using AlloDerm (LifeCell Corp., Branchburg, N.J.) as a central core in nipple reconstruction.

Methods: The nipple reconstruction technique involved the use of a modified star dermal flap pattern measuring 5 cm in length and 1.0 to 1.5 cm in width, depending on the amount of desired projection to match the opposite nipple. Then, a 1.5 × 4.5-cm piece of AlloDerm was placed into the core of the newly reconstructed nipple and sutured closed. After the incisions were closed, an ocular eye bubble protector was used to prevent compressive forces on the newly reconstructed nipple, and strict postoperative use of this protector was maintained for 6 weeks.

Results: A total of 30 nipple reconstructions were performed [14 transverse rectus abdominis musculocutaneous (TRAM) flaps and 16 tissue-expanded breast mounds]. Caliper measurements of nipple projection were recorded at the time of surgery and at 3, 6, and 12 months postoperatively. Twelve-month average maintenance of nipple projection was 56 percent for the TRAM flap group and 47 percent for the tissue-expanded group. There were no infections or associated complications.

Conclusions: The authors' results demonstrate that the use of a modified star dermal flap pattern with the placement of an AlloDerm graft core is a safe, easily performed, and reproducible technique for improving the long-term maintenance of projection in reconstructed nipples. (*Plast. Reconstr. Surg.* 119: 1663, 2007.)

Long-term maintenance of nipple projection in nipple reconstruction has been a major challenge for plastic surgeons. Although several methods of nipple reconstruction have been described, they all share a common design fault, the use of random skin flaps and their inevitable loss of projection with contracture. Once a skin flap is raised, the process of contraction begins; and as the reconstructed nipple remodels over the next several months, its projection is lost. The reported average 50 percent loss of nipple projection for a variety of techniques has been discussed in the literature.¹ We feel this number may be misleading, and the actual loss

seen in practice may be greater. In our own series of patients using several techniques (e.g., C-V flap, skate flap, star flap), the maintenance of long-term nipple projection has demonstrated a disappointing 60 to 70 percent loss of projection from the time of surgery to 12 months postoperatively (Fig. 1). These techniques were performed on both autologous tissue [transverse rectus abdominis musculocutaneous (TRAM) flaps] and implant reconstructed patients, and were technically approached as described in the literature. These poor results have led us to seek a more reliable technique and protocol with which to maintain long-term nipple projection. The technique should be easy to perform, with reproducible results, and be able to closely match the contralateral nipple long term.

Nipple reconstruction is usually the final stage of reconstruction for many breast cancer patients. It transforms an amorphous mound into an aesthetically identifiable and pleasantly appealing breast.

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Fig. 1. (Above, left) A profile view of a nipple reconstructed with a skate flap. Note the poor nipple projection of 0.3 cm. (Above, right) The modified star flap is marked with a length of 5 cm and a width of 1.0 to 1.5 cm. (Center) Incisions are made for flap elevation, making sure not to violate the pedicle base of this random flap (viewed from the top of the operating table). (Below, left) The dermal flaps are wrapped around each other, forming a barrel shape and sutured together using nylon (viewed from the top of the operating table). (Below, right) A piece of AlloDerm is cut to the dimensions of 1.5 × 4.5 cm.

The psychological benefit for the patient from seeing their new breast in its complete form is immeasurable, and patient satisfaction is an important factor in this reconstructive process.¹

Acellular human cadaver dermis (AlloDerm; LifeCell Corp., Branchburg, N.J.) has been used with increasing frequency for many types of reconstructive procedures and has only recently

begun to be used in breast reconstruction.^{2,3} Recent reports have demonstrated the successful use of AlloDerm as a soft-tissue contouring medium and as a supportive tissue bridge in breast reconstruction.^{4,5} We believe the use of AlloDerm in nipple reconstruction is a reasonable next step in the advancement of breast reconstructive techniques. With this study, we were able to assess a newer technique for primary nipple reconstruction and determine whether the long-term results would justify its usage.

PATIENTS AND METHODS

We hypothesized that long-term nipple projection could be maintained by using a modified star dermal flap pattern with the placement of an AlloDerm graft core to act as a central strut. In our prospective study, 30 nipple reconstructions were performed for 14 TRAM flap and 16 tissue-expanded breast mounds. There were no matched control groups, and the patient selection was based on 30 consecutive nipple reconstructions. In the 14 TRAM flap breast mounds, the flaps were elevated as full-thickness dermal flaps with a central fatty pedicle. In the 16 tissue-expanded breast mounds, the flaps were elevated as full-thickness dermal flaps, and because of the thinness of the dermis overlying the breast implant capsule, a central fatty pedicle could not always be created.

In all of our nipple reconstructions (Figs. 1 and 2), the dimensions of the flap length measured 5 cm. The dimensions of the flap width varied from 1.0 to 1.5 cm and were based on the opposite nipple projection measurements and by overcorrecting the amount of projection in the reconstructed nipple by approximately 50 percent to account for the postoperative loss of projection. After the dermal flaps were elevated with a scalpel, the “wings” were wrapped around each other, forming a barrel, and sutured with 6-0 nylon, leaving the top of the nipple open. The lateral wing donor sites were closed with 5-0 Vicryl (Ethicon, Inc., Somerville, N.J.) and 6-0 nylon. At this time, using a 4 × 12-cm piece of thick AlloDerm (0.79 to 1.78 mm), a 1.5 × 4.5-cm piece is cut and rolled lengthwise into a barrel shape and sutured to maintain its form with 3-0 Vicryl. The AlloDerm was oriented with the dermal side out to optimize vascular ingrowth into the acellular dermis. This was placed through the opening in the top of the nipple into the core of the new nipple, acting as a dermal graft or central strut. More or less AlloDerm could be used, provided that the bulk of the AlloDerm was enough to fill the space of the core of the nipple. Once the AlloDerm was in place, the

top of the nipple was then closed with 6-0 nylon. Benzoin and Steri-Strips (3M Health Care, St. Paul, Minn.) were applied to the lateral incisions. A piece of Tegaderm dressing (3M Health Care) with a center hole cut out was then placed over the site and bacitracin ointment was applied to the nipple. Finally, an ocular eye bubble protector (Aaron Medical, St. Petersburg, Fla.) was perforated with a 16-gauge needle and then placed over the new nipple as a protective dressing. The patients were required to wear the eye bubble protector for a minimum of 6 weeks, after which it was discontinued. Nipple-areola tattooing was offered and performed at 12 weeks postoperatively. Nipple projection was measured with calipers at the time of surgery and at 3, 6, and 12 months postoperatively.

RESULTS

A total of 30 nipple reconstructions were performed, using the above technique, on 14 TRAM flaps and 16 tissue-expanded breast mounds. For the TRAM flap group, nipple projection measurements ranged initially from 1.0 to 1.5 cm (median, 1.2 cm) at the time of surgery, to 0.5 to 0.8 cm (median, 0.7 cm) at 12 months postoperatively. For the tissue-expanded group, nipple projection measurements ranged initially from 0.9 to 1.5 cm (median, 1.15 cm) at the time of surgery, to 0.4 to 0.7 cm (median, 0.5 cm) at 12 months postoperatively. Projection loss was calculated as the percentage decrease from the initial procedure projection measurement. For the TRAM flap group, the nipple projection loss was an average of 18 percent at 3 months, 39 percent at 6 months, and 44 percent at 12 months. For the tissue-expanded group, the nipple projection loss was an average of 22 percent at 3 months, 43 percent at 6 months, and 53 percent at 12 months. Thus, 12-month average maintenance of nipple projection was 56 percent for the TRAM flap group and 47 percent for the tissue-expanded group.

There were no infections, wound dehiscences, or any other associated complications. The overall patient satisfaction with symmetry to the opposite nipple was good.

DISCUSSION

The use of AlloDerm as a central core in primary nipple reconstruction has demonstrated, in our study, an improvement in long-term maintenance of nipple projection. The improved maintenance of projection seen in our TRAM flap patients is most likely related to the increased dermal thickness of the flaps and the ability to use a cen-



Fig. 2. (Above, left) The AlloDerm is rolled lengthwise, with the dermal side out, into a barrel shape and secured to itself using Vicryl suture. (Above, right) The AlloDerm is then placed into the core of the new nipple (viewed from the top of the operating table). (Center, left) Benzoin and Steri-Strips are applied, and a Tegaderm dressing, with a center hole cut out, is placed over the site. (Center, right) Placement of a perforated eye bubble protector over the nipple. (Below, left) The eye bubble protector provides adequate protection to the new nipple and is easily applied. (Below, right) Twelve-month postoperative photograph of a TRAM flap patient with a nipple reconstructed with AlloDerm. Note good projection of 0.8 cm after original intraoperative height measurement of 1.5 cm.

tral fatty pedicle during its elevation. In tissue-expanded patients, the breast mound dermis can have dramatic thinning, thus preventing the elevation of thicker dermal flaps, which may lead to long-term increased contraction, as seen with flaps with a poor blood supply. By using AlloDerm as a central core or strut, the maintenance of nipple projection may be improved in this patient population. Long-term follow-up of greater than 12 months is still needed to evaluate the maintenance of projection and is currently in process. Also, a biopsy with pathologic evaluation of the reconstructed nipple at 12 months would allow us to evaluate the central core of the nipple and describe the replaced host tissue where the AlloDerm was originally placed.

Several techniques have been described in the literature to improve the projection of the reconstructed nipple long term. Nahabedian⁶ was the first to describe the use of AlloDerm augmentation in secondary and tertiary nipple reconstruction using an elongated C flap and a C-V flap. This study involved eight patients with both implant and autologous tissue reconstructed breast mounds. The study was able to present only one patient with a 12-month follow-up of nipple projection, although their remaining 6-month data still correlated closely with our own. Also in this study, no primary nipple reconstructions using AlloDerm were described. The use of autologous fat grafts in nipple reconstruction was described by Bernard and Beran.⁷ In their study, they described transferring autologous fat grafts to the proposed nipple site in one or two stages. After several weeks, the nipple was created with the elevation of the flaps. This is a creative technique but requires one if not two separate fat grafting sessions to be performed before the actual nipple creation. Other techniques have been described by incorporating auricular cartilage into the dermal flaps to improve nipple projection.^{8,9} Guerra et al.¹⁰ described a more complex procedure of obtaining rib cartilage to serve as a nipple graft for maintenance of projection. This described technique has a disadvantage of the possible morbidity associated with the rib cartilage harvest and can only be used in a breast reconstruction using well-vascularized tissues, such as myocutaneous flaps. Finally, Cao et al.¹¹ described a technique of harvesting ear chondrocytes and injecting the mixture within a purse-string-controlled area to create a nipple in a porcine model.

Most of the above-mentioned techniques are excellent ideas but require multiple steps, including harvesting separate composite tissues for graft-

ing and therefore adding a layer of complexity. With our technique, there is no separate harvest of autologous tissues, which eliminates the potential associated morbidity of graft-site harvest. AlloDerm is readily available in a package format and can be easily reconstituted in a sterile saline bath during the elevation of the dermal flaps for nipple reconstruction. Our technique is simple and quick to perform, and can be easily used with both the TRAM flap and tissue-expanded patient population. With strict adherence to postoperative protection of the reconstructed nipple by use of the eye bubble protector, maintenance of the projection can be maximized. The only disadvantage of our procedure would be the associated cost of the AlloDerm graft.

CONCLUSIONS

The use of a modified star dermal flap pattern with the placement of an AlloDerm graft core to act as a central strut is a safe, easily performed, and reproducible technique for improving the long-term projection of the reconstructed nipple. Our study has demonstrated a 12-month maintenance of nipple projection of 56 percent and 47 percent for TRAM flap and tissue-expanded group populations, respectively. Data beyond 12 months are currently under study to evaluate the possible resorption of AlloDerm in nipple reconstruction. Further follow-up of these patients beyond the 12-month observation period is needed to assess maintenance of nipple projection 2, 5, and 10 years postoperatively. These results are encouraging and may open a new door in the area of tissue engineering and breast reconstruction.

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DISCLOSURE

Neither of the authors has a financial interest in any of the drugs, devices, or products mentioned in this article.

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