

Secondary Nipple Reconstruction Using Local Flaps and AlloDerm

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Over the years, a variety of techniques to reconstruct the nipple following mastectomy and reconstruction have been described. The most commonly used techniques involve the use of local flaps that include the star, bell, skate, double-opposing tab, and C-V.¹⁻³ All of these methods require a series of incisions on the breast mound, creation of local flaps with random blood supply, and rearrangement of these flaps to reconstruct the nipple. Although the initial projection is excellent, all will flatten to some degree over time. Shestak et al. have compared the skate, star, and bell flaps and demonstrated flattening by 30 to 75 percent within 2 years.¹ Losken et al. have analyzed long-term nipple projection using the C-V flap and demonstrated an average projection of 3.77 mm with a patient satisfaction of 42 percent at an average follow-up of 5.3 years.² Kroll et al. have compared the double-opposing tab and star flaps and found that the mean 2-year projection was 2.42 mm and 1.97 mm, respectively.³ In a survey assessing patient satisfaction following nipple reconstruction, Jabor et al. have demonstrated that excessive flattening of the nipple was the principal area of dissatisfaction in over 50 percent of the women questioned.⁴

To overcome the tendency of reconstructed nipples to flatten, a variety of materials have been used to augment nipple projection that includes subcutaneous fat, bone, cartilage, and silicone.⁵⁻⁸ These materials have been used for primary and secondary nipple reconstruction and sometimes result in improved long-term projection; however, a disadvantage of these methods is that they rely on foreign material or

autologous material harvested from remote areas of the body. This can occasionally result in donor-site morbidity such as scars, pain, and distortion.

AlloDerm (LifeCell Corporation, Branchburg, N.J.) is an acellular dermal graft that has been demonstrated to revascularize and become incorporated into recipient tissues with minimal morbidity.^{9,10} It has been successfully used in a variety of clinical and experimental settings^{9,11,12}; however, its use to increase projection of the nipple following reconstruction has not been previously described. The purpose of this study was to review my initial experience and outcome with AlloDerm for secondary and tertiary nipple reconstruction.

PATIENTS AND METHODS

Over a 6-year period, the author has performed 383 primary nipple reconstructions. Of these, 35 nipples (9.1 percent) required secondary reconstruction because of excessive flattening. AlloDerm was used in eight of these nipples (four women) to increase projection. The secondary nipple reconstruction was bilateral in three women, unilateral in one woman, and repeated in one breast, totaling eight nipples. This cohort of patients was not compared with a control group. The type of breast reconstruction was an implant in four breasts and autologous tissue in three breasts. Nipple projection was assessed and measured in the operating room and the clinic. The mean age of these four women was 40.5 years (range, 25 to 54 years). Minimum follow-up was 6 months after the final nipple reconstruction.

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Technique of Nipple Reconstruction Using AlloDerm

The use of AlloDerm for nipple reconstruction is possible using a variety of local flaps. The method described reflects the author's preferred technique for nipple reconstruction. The local flaps used for this study include the elongated C flap and the C-V flap (Fig. 1, *above* and *center*). The elongated C flap was usually used for primary nipple reconstruction and the C-V flap was usually used for secondary nipple reconstruction. The dimensions of the elongated C flap are 3 to 4 cm in width and 1 to 1.5 cm in length. The base of the flap is usually 1 to 1.5 cm in length to allow for adequate blood supply. Projection of the nipple is usually 9 to 10 mm at completion. Advantages of the elongated C flap include orientation along a scar, orientation in any direction, and ease of elevation. The reason for use of the C-V flap for secondary nipple reconstruction was that the V segment included the residual nipple and scar from the prior reconstruction.

The technical aspects of the secondary nipple reconstruction using AlloDerm are described. The operation is usually performed under local anesthesia using lidocaine without epinephrine. The C-V flap is outlined, incised, and elevated in the subcutaneous plane, incorporating some fat (Fig. 1, *below*). The donor site created by the right and left wings of the C flap is reapproximated using an absorbable suture. A trifurcation suture is then used to suture the right and left dermal apices of the C flap to the dermal midline of the donor site created by elevation of the V flap. A 1 × 2-cm precut portion of AlloDerm was obtained and prepared according to the manufacturer's instructions (Fig. 2, *above*). A small portion of the AlloDerm measuring between 4 and 6 mm in each direction was folded in half and sutured using an absorbable suture. The dimension of the AlloDerm to be inserted was usually 2 × 6 mm and based on the dimensions of the C-V flap (Fig. 2, *below*). The AlloDerm was inserted into the pocket created by the approximated lateral apices of the C flap and oriented vertically to serve as a strut to maintain projection (Fig. 3, *above*). The V flap was then draped over the AlloDerm and the skin incisions were closed using a permanent monofilament suture (Fig. 3, *center*). Using this technique, nipple



FIG. 1. (*Above*) A secondary nipple reconstruction using a C-V flap is outlined on a breast following excessive flattening of the nipple. (*Center*) A primary nipple reconstruction using the elongated C flap is outlined. (*Below*) The elevated C-V flap is depicted. Note the bleeding from the distal margins, demonstrating good blood supply.

projection on immediate completion ranged from 7 to 8 mm (Fig. 3, *below*). Figure 4 demonstrates a secondary nipple reconstruction using AlloDerm at 1-year follow-up.



FIG. 2. (Above) A 1 × 2-cm prepackaged portion of AlloDerm. (Below) The AlloDerm is cut, folded, and sutured based on the dimensions of the local flaps.

RESULTS

The pre-AlloDerm and post-AlloDerm projection of the nipple and the time for final projection height of the nipple are provided in Table I. In no breast was preoperative or postoperative radiation therapy necessary. In all nipples, the wound healing was uneventful without skin flap necrosis or local infection. In the breast that required a secondary and tertiary nipple reconstruction using AlloDerm, a transverse rectus abdominis musculocutaneous flap had been performed.

In all seven breasts in which secondary nipple reconstruction using AlloDerm was performed, the preoperative nipple projection ranged from 0 to 2 mm. Secondary nipple reconstruction was completed in all breasts of which AlloDerm was used in five and not in two (Table I). Of the five nipples in which AlloDerm was used, four (80 percent) demonstrated acceptable projection (4 to 5 mm) and one did not. In this breast, a tertiary nipple reconstruction using AlloDerm for a second

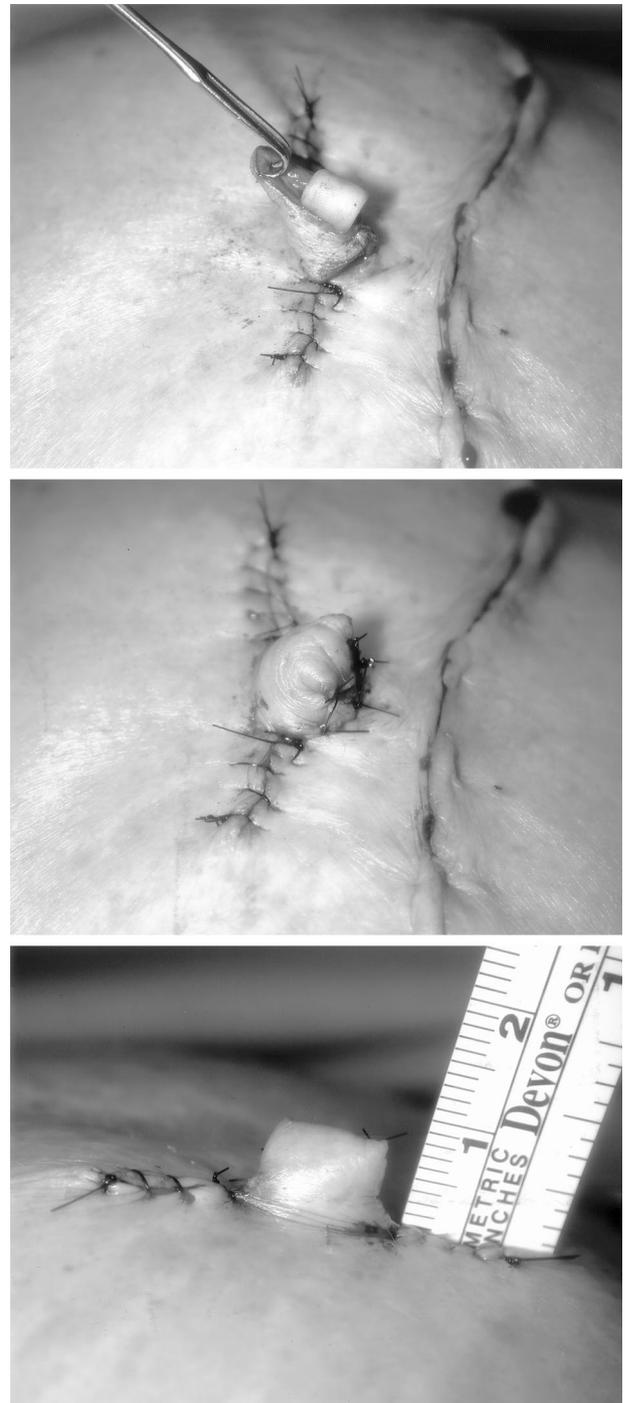


FIG. 3. (Above) The AlloDerm is inserted vertically between the local flaps. (Center) The AlloDerm is completely covered by the C and V flaps. (Below) The immediate projection of the nipple is demonstrated.

time resulted in acceptable projection (4 mm). Operative findings at the time of this tertiary nipple reconstruction demonstrated some residual scar tissue that may have been from the AlloDerm. No histologic analysis was performed. Of the two secondary nipple recon-



FIG. 4. A lateral view of a breast demonstrating good nipple projection at 1-year follow-up. AlloDerm was used during the secondary reconstruction.

structions in which AlloDerm was not used, excessive flattening was observed (2 mm). Tertiary nipple reconstruction using AlloDerm resulted in a final projection of 4 and 5 mm, respectively. The success of AlloDerm did not appear to be related to the type of breast reconstruction (autologous tissue or implant).

DISCUSSION

One of the principal goals of breast reconstruction is to create a three-dimensional nipple from a two-dimensional surface. To accomplish this goal, it is important to realize that there is a natural tendency for the reconstructed nipple to flatten and for the skin surface to return to its normal contour. The cause of nipple flattening is multifactorial and includes inadequate subcutaneous fat, internal pressure, external pressure, poor flap design, delayed healing, and tissue memory. The natural elements required for a nipple reconstructed with local flaps include epidermis, dermis, and subcutaneous fat. The ratio of these elements is variable and dependent on the quality of skin, type of breast reconstruction, and surgical technique. In some women that have had breast reconstruction with implants, the skin is very thin and contains minimal subcutaneous fat. In addition, there is internal pressure that is applied to the surface of the breast that tends to stretch and flatten the surface over time. This may predispose to pre-

TABLE I
Results of Primary, Secondary, and Tertiary Nipple Reconstruction

Patient	Age (yr)	Procedure	Primary Nipple Reconstruction			Secondary Nipple Reconstruction			Tertiary Nipple Reconstruction		
			Initial Projection (mm)	Final Projection (mm)	Time	Initial Projection (mm)	Final Projection (mm)	Time	Initial Projection (mm)	Final Projection (mm)	Time
1	54	Right TRAM	10	1	4 mo	8	2	6 mo	8	4 (AlloDerm)	6 mo
		Left TRAM	10	1	4 mo	8	2	6 mo	8	5 (AlloDerm)	6 mo
2	25	Left implant	10	1	3 mo	9	4 (AlloDerm)	1 yr	NA	NA	NA
		Right implant	10	1	4 mo	8	1 (AlloDerm)	9 mo	8	4 (AlloDerm)	8 mo
3	44	Left TRAM	10	2	4 mo	9	4 (AlloDerm)	9 mo	NA	NA	NA
		Right implant	10	1	5 yr	8	5 (AlloDerm)	6 mo	NA	NA	NA
4	39	Left implant	10	1	5 yr	8	4 (AlloDerm)	6 mo	NA	NA	NA

NA, not applicable; TRAM, transverse rectus myocutaneous.

mature or excessive flattening of the reconstructed nipple. Wearing a bra may result in external pressure on the surface of the breast and may predispose to nipple flattening. Other factors such as local infection, previous radiation, and poor flap design can compromise the circulation within the local flaps, resulting in delayed healing and eventual flattening. Thus, the principal challenge with nipple reconstruction is to reconstruct a nipple that will be able to overcome these local obstacles and natural tendencies.

Methods to improve nipple projection and minimize flattening include secondary nipple reconstruction and/or use of remote material. Secondary nipple reconstruction without the use of remote material has included the use of a purse-string suture, local flaps, and skin grafts.^{13,14} Remote materials that have been used to augment nipple projection include autologous homografts such as cartilage^{6,8} and fat,⁵ biological heterografts such as artificial bone⁷ and tissue-engineered cartilage,¹⁵ and synthetic materials such as polyurethane coated silicone.¹⁶ These techniques have all been used with variable success and some have been limited by donor-site morbidity, availability, tissue reactivity, and cost.

AlloDerm was used in this series of women for secondary nipple reconstruction primarily based on our current understanding of its physiology and that it was readily available. It has been used in a variety of clinical settings that have included abdominal wall reconstruction,^{11,12} urogynecologic procedures^{17,18} and, most recently, breast reconstruction.^{19,20} This limited experience has demonstrated that AlloDerm can be successfully used to augment nipple projection in the secondary and tertiary settings. Although histologic analysis was not performed in this study, it appears that the AlloDerm was well tolerated and incorporated into the normal host tissue, resulting in improved nipple projection. Although shrinkage of the nipple did occur, ranging from 38 to 50 percent, the final projection observed at 6 months was greater than that of the historical controls (4 to 5 mm versus 1.97 to 3.77 mm). These results can be partially attributed to the fact that there was some residual tissue (scar and skin) from the primary nipple reconstruction that was incorporated into the secondary nipple reconstruction. However, it is the author's

belief that the AlloDerm did contribute to the stability and longevity of the secondary nipple reconstructions. Further prospective studies using AlloDerm for primary and secondary nipple reconstruction are warranted.

SUMMARY

Secondary nipple reconstruction using AlloDerm results in improved nipple projection. This was demonstrated in seven of eight nipple reconstructions (88 percent). In the only nipple that flattened, a tertiary reconstruction again using AlloDerm resulted in good projection. This limited experience has demonstrated that AlloDerm is simple to use, well tolerated, and has the potential for improved long-term nipple projection. Further studies are warranted.

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