



Strattice reconstructive tissue matrix to maintain nipple projection—what do patients think?

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Abstract

Background One of the main challenges in nipple reconstruction is achieving and maintaining nipple projection. We describe a novel use of banked Strattice to provide an internal scaffold and improve long-term projection following nipple reconstruction. We assess patient and partner satisfaction with the technique compared with routine reconstruction.

Methods All patients who underwent nipple reconstruction in our unit by a single surgeon between 1/1/11 and 29/4/16 were identified retrospectively and asked to complete a satisfaction questionnaire relating specifically to their reconstruction. Those who underwent reconstruction with Strattice were compared with those that had local flaps alone.

Results Sixty-four patients and 73 nipples were reconstructed during the study period. Eighteen nipples were reconstructed on 14 patients using Strattice. Fifty-seven patients responded to the questionnaire (90.5%). One patient developed an infection requiring removal of the banked matrix. Patients had a statistically significant increased degree of satisfaction when Strattice was used to augment their reconstruction (Mean \pm SEM score 8.06 ± 0.20 versus 5.83 ± 0.16 for no Strattice; $p < 0.0001$). This was also the case when undressed (7.59 ± 0.15 vs 5.69 ± 0.16) but did not reach statistical significance when the patient was dressed (6.85 ± 0.19 vs 6.44 ± 0.11 ; $p = 0.08$). Patients' partners also rated the reconstruction more highly when Strattice was used (7.71 ± 0.14 versus 6.33 ± 0.19 for no Strattice).

Conclusions Our study demonstrates that the use of Strattice in nipple reconstruction can lead to significantly increased rates of satisfaction among women undergoing the final stage of breast reconstruction.

Level of Evidence: III Therapeutic study.

Keywords Nipple reconstruction · Nipple projection · Patient satisfaction · Strattice · Dermal matrix

Introduction

The creation of the nipple-areola complex represents the final stage in the surgical treatment of breast cancer patients. It transforms an amorphous mound into an identifiable and aesthetically appealing breast. Numerous techniques, using a variety of geometric designs, have been reported in the literature [1, 2]. The aim is to achieve a natural shape with maintenance of projection over time with minimal donor site morbidity. The most signifi-

cant challenge, however, is in achieving and maintaining nipple projection.

Once a skin flap is raised, the process of contraction begins and over the next few months, remodelling occurs leading to a reduction in the projection of the reconstructed nipple. A study comparing three common reconstructive techniques reported a loss of nipple projection of between 40 and 74% over time [3]. To counter this effect, nipple reconstruction using local adipocutaneous flaps requires a degree of overcorrection in anticipation of eventual loss of projection due to a lack of an intrinsic 'scaffold'. However, this involves raising larger flaps which has a tendency to flatten the donor site and, therefore, the point of maximal projection of the breast, reducing the overall aesthetic result.

Several autologous and synthetic materials have been described to support local flaps with a view to maintaining nipple projection in the long term. In recent years, StratticeTM Reconstructive Tissue Matrix (LifeCell Corp., Branchburg, N.J.) has been used with increasing frequency in breast

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reconstructive procedures. Strattice is a surgical mesh that is derived from porcine skin and is processed and preserved in a patented phosphate buffered aqueous solution containing matrix stabilisers. The mesh provides an implant which is biocompatible and will incorporate into the recipient tissue with associated cell and microvascular ingrowth. We describe a novel use of Strattice to provide an internal scaffold and possibly improve long-term projection. We aimed to determine whether patient and partner satisfaction was greater in those patients who had nipple reconstruction using this dermal matrix.

Methods

All patients who underwent nipple reconstruction in our unit by a single surgeon between 1/1/11 and 3/3/16 were identified retrospectively from theatre records. Each was asked to complete a telephone outcome questionnaire, using Likert scoring scales (scale of 0–10), relating specifically to their nipple reconstruction. Patients graded satisfaction with their appearance in and out of clothing, satisfaction with specific features of their nipple and also partner satisfaction. In bilateral reconstructions, patients were asked to consider each nipple separately. Patients having undergone reconstruction with Strattice were compared with those who had purely adipocutaneous flaps. This data was collected and statistical analysis was performed using Microsoft Excel (Microsoft Corporation, USA) and an unpaired *t* test with significance set at $p < 0.05$.

Surgical technique

When using Strattice in breast reconstructive procedures, there are inevitably off-cuts that are not used once the matrix has been cut to fit an individual breast. Instead of discarding this excess, an appropriately sized piece of matrix (2×5 cm—later trimmed to size at second stage) is rolled tightly to form a compact cylinder and is ‘banked’ intraoperatively into a subcutaneous pocket in the groin and sutured to the fascia with a 4/0 vicryl stitch to avoid migration. At the time of delayed nipple reconstruction, this banked Strattice is harvested and used to augment projection by placing it under the adipocutaneous flap (Figs. 1 and 2). The banked Strattice was trimmed and the new nipple designed to be approximately 40% larger in height and diameter than the contralateral nipple to allow for loss of size. The donor site is then closed primarily. All nipples were reconstructed using a fishtail or modified fishtail flap. The authors do not have any experience of using other materials to augment nipple reconstructions.

Results

Sixty-four patients and 73 nipples were reconstructed during the study period. The average patient age was 56.3 years (36–74).



Fig. 1 Rolled strattice acting as a scaffold under flap

Eighteen nipples were reconstructed on 14 patients using Strattice. In all of these patients, the matrix had been banked in the groin. The banked Strattice had to be removed in one patient following a local infection. There were no recorded complications in any of the other patients in which Strattice was used at either the banked site or following its use in nipple reconstruction. Fifty patients (55 nipples) were reconstructed using just adipocutaneous flaps.

Of the 64 patients in the cohort, 57 responded to the questionnaire (90.5%). All 14 patients in the Strattice group responded to the questionnaire. General patient satisfaction is summarised in Fig. 3. Overall, patients had a statistically significant increased degree of satisfaction when Strattice was used to augment their reconstruction (Mean \pm SEM score 8.06 ± 0.20 versus 5.83 ± 0.16 for no Strattice; $p < 0.0001$). This was also the case when undressed (7.59 ± 0.15 vs 5.69 ± 0.16) but did not reach statistical significance when the patient was in clothing (6.85 ± 0.19 vs 6.44 ± 0.11 ; $p = 0.08$). Patients’ partners also rated the reconstruction more highly when Strattice was used (7.71 ± 0.14 versus 6.33 ± 0.19 for no Strattice).

With respect to the characteristics of the reconstructed nipple, there was again a statistically significant improvement in patient satisfaction when Strattice had been used in the reconstruction.



Fig. 2 Completed nipple reconstruction with Strattice scaffold

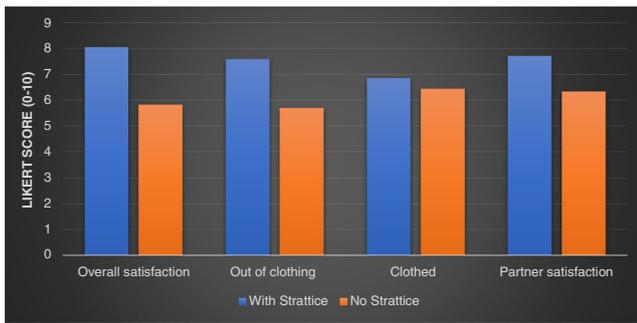


Fig. 3 Patient and partner satisfaction with nipple reconstruction. Graph shows score on Likert scale for satisfaction (mean). Overall satisfaction ($p < 0.0001$); out of clothing ($p < 0.0001$); clothed ($p = 0.08$); partner satisfaction ($p < 0.0001$)

The new nipple more closely approximated to patients’ perceptions of ideal when the matrix was used (Fig. 4). The precise dimensions of the nipples in terms of height and diameter were not objectively measured in this study.

Discussion

The maintenance of nipple projection can be as low as 30% following nipple reconstruction [3]. Although the most significant loss of projection occurs over the first 3 months, this stabilises by 1 year after reconstruction [4, 5]. Schwager et al. [6] reported in a histological study that normal human nipples contained a dense connective tissue layer surrounding the lactiferous ducts. This layer was found to be twice as thick in normal subjects when compared with patients with inverted nipples. They believed this rigid connective tissue played a major role in maintaining projection. Replacement of this rigid tissue with an equally rigid substitute could therefore lead to lasting projection in the reconstructed nipples. Chia et al. [7] also postulated that the inclusion of a column of tissue to act as an internal strut obliterates any dead space that may extend beyond the level of the skin and into the subcutaneous tissue that may contribute to loss of nipple height.

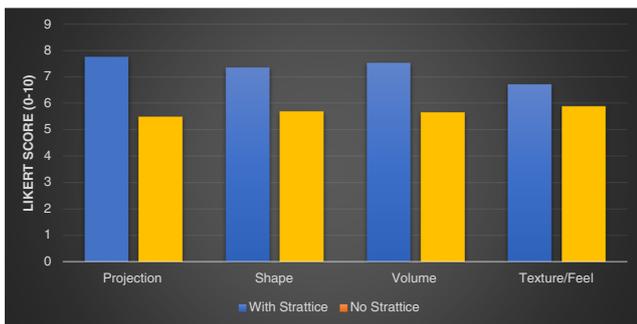


Fig. 4 Patient assessment of nipple characteristics. Graph shows score on Likert scale for satisfaction (mean). Projection ($p < 0.0001$); shape ($p < 0.0001$); volume ($p < 0.0001$); texture/feel ($p = 0.001$)

Strattice™ Reconstructive Tissue Matrix is an acellular matrix designed to support tissue regeneration. It is derived from porcine dermis, which has undergone proprietary processing to remove cells to significantly reduce the xenogenic rejection response. It has gained increasing popularity in implant-based breast reconstruction to provide greater lower pole support and an improved aesthetic outcome.

A number of autologous tissues have been described in the literature to act as an internal scaffold for the reconstructed nipple. These include dermal grafts [7], auricular cartilage [8], and toe pulp [9]. The disadvantage of these and our technique is the need for an extra donor site. However, only one of the patients in our series experienced any type of complication in the form of infection requiring removal of the banked Strattice. In addition, none of our patients were concerned with the small secondary scar in the groin. Cut offs of the banked strattice not used for the reconstruction were sent for histological analysis. This has shown that the matrix does not undergo any structural changes when inside the body (Fig. 5).

Guerra et al. [10] described the use of rib cartilage which was harvested and banked when the internal mammary vessels were used as donor vessels in breast reconstruction. Although this technique has the advantage of not creating an extra donor site, some patients complained about the excessive rigidity of the reconstructed nipple. This was also an issue for some of the patients in our series. Although women who had reconstructions with Strattice were more satisfied with their appearance in clothing and the feel of their nipple than those that did not have Strattice, this difference was to lesser degree. This was due to the fact that some women who had Strattice reconstructions felt their nipples were too firm and that this led to a degree of visible prominence in light clothing.

Synthetic materials used to augment nipple projection include polytetrafluoroethylene implants [11], artificial bone [12], and semipermanent injectable fillers, such as calcium hydroxylapatite

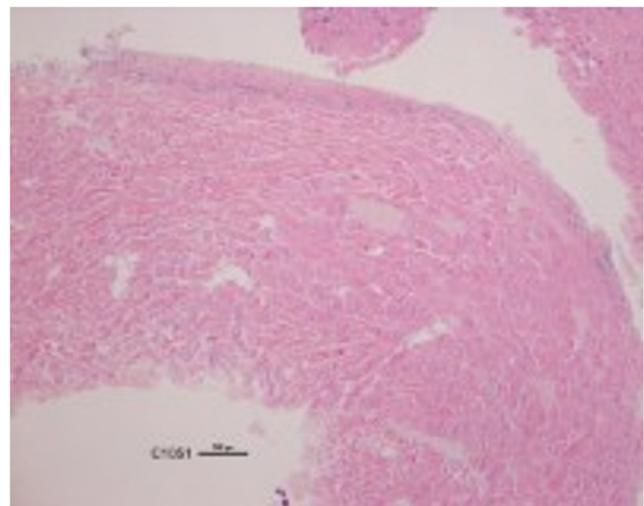


Fig. 5 Histological analysis of banked Strattice

[13]. Alloplastic materials are readily available and do not require a donor site. However, these options have an increased risk of extrusion and may predispose the patient to infections and wound-healing complications. Alloderm (LifeCell, Bridgewater, NJ, USA), an acellular human dermal substitute, has been used as an internal strut with favourable results [14–16].

Our study demonstrates that the use of Strattice Reconstructive Tissue Matrix in nipple reconstruction can lead to significantly increased rates of satisfaction among women undergoing the final stage of breast reconstruction. However, our study focuses purely on patient reported outcomes. Therefore, conclusions regarding the degree of maintenance of nipple projection with the different techniques are made following speaking with patients and theoretical conjecture. Any definite statements with regard to the effect of Strattice on maintenance of projection would require objective measurements of nipple height over time and would be an avenue for further study. However, despite our patient cohort being relatively small, we had a high patient response rate (90.5%) enabling the results to be strong enough to achieve statistical significance in a number of parameters. We suggest that Strattice may provide a novel technique to augment nipple projection and increase patient satisfaction rates with minimal risk of complications although further study would be appropriate.

Compliance with ethical standards

Conflict of interest Arvind Mohan, Honey Ghaffari, and Mark Ho-Asjoe declare that they have no conflict of interest.

Formal consent For this type of study formal consent was not required. However, informed consent was obtained for photographic publication and prior to operative procedures.

Ethical approval No ethical approval was required in the production of this study.

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