Meshed Acellular Dermal Matrix in Immediate Prepectoral Implant-based Breast Reconstruction

Michael Scheflan, MD*
Tanir M. Allweis, MD*†‡
Dafna Ben Yehuda, BSc‡
Adi Maisel Lotan, MD*§‡

Background: Prepectoral implant placement has many potential advantages in immediate breast reconstruction. Acellular dermal matrices (ADMs) are commonly used in these surgeries. ADM meshing may enhance integration, decrease seroma and infection rates, and reduce surgical costs.

Methods: This was a retrospective, single-center study of 49 women (71 breasts) undergoing immediate, prepectoral, implant-based breast reconstruction with 2:1 meshed, bovine-derived ADM (SurgiMend). Outcomes were compared against those of 77 patients (105 breasts) undergoing a similar procedure but with partial subpectoral implant placement.

Results: In the prepectoral group, the mean age was 49.1 years and mean body mass index was 24.7 kg/m². There were no significant differences in baseline characteristics versus the partial subpectoral control group. Mean follow-up was 18.6 months (prepectoral) and 21.3 months (partial subpectoral). Mean time to drain removal was reduced in the prepectoral group (6.5 versus 8.5 days; P < 0.001). Rates of minor and major complications with prepectoral implant placement were 15.5% and 11.3%, respectively—similar to partial subpectoral placement (15.2% and 14.3%) (overall P = 0.690). Capsular contracture and explantation were associated with radiation therapy, and rates were similar between groups.

Conclusions: Prepectoral implant placement with meshed ADM is a safe and reproducible alternative to partial muscle coverage with meshed ADM. Recovery may be easier and animation deformity avoided. It could therefore become the standard of care for implant-based breast reconstruction. (Plast Reconstr Surg Glob Open 2020;8:e3265; doi: 10.1097/GOX.0000000000003265; Published online 25 November 2020.)

INTRODUCTION

Immediate breast reconstruction with either a definitive implant or a tissue expander placed partially under the muscle—including use of an acellular dermal matrix (ADM) to bridge the gap in the lower pole—has been the standard of care over the last decade. This partial subpectoral, implant/ADM-based breast reconstruction, with the muscle covering 25%–40% of the implant, may improve upper-pole padding and hasten the recovery of skin-flap vascularity. Furthermore, many studies have established the safety and aesthetic outcomes of this form of reconstruction. However, disadvantages of this approach include pain, discomfort, muscle weakness, and animation deformities. Placing the implant over the muscle, and covering and securing it with an ADM, obviates the need to cut and elevate the muscle, and may therefore reduce unwanted early or late chronic symptoms.

In addition, meshing of the ADM at a 2:1 ratio has several known benefits, including stabilization of the implant pocket, facilitation of tissue ingrowth, acceleration of adhesion/engraftment of the overlying envelope, decreased length of hospital stay and drain time, and reduced seroma and infection rates. Hence, there may be a rationale for combining prepectoral implant placement with meshing of the ADM.

Disclosure: Dr. Michael Scheflan is an investigator and speaker for Integra LifeSciences (Plainsboro, N.J.). Integra LifeSciences is the manufacturer of SurgiMend 1.0 used in this study. All other authors have no financial interest to disclose.

Related Digital Media are available in the full-text version of the article on www.PRSGlobalOpen.com.
The purpose of this study was to assess outcomes in a group of women undergoing immediate breast reconstruction with prepectoral implant positioning, including use of 2:1 meshed, bovine-derived ADM, and to compare results with those of a control group of women undergoing a similar procedure but with partial subpectoral positioning (also using meshed ADM). To the best of our knowledge, this is the first study to describe the use of meshed ADM in prepectoral breast reconstruction.

PATIENTS AND METHODS

Study Design

This was a retrospective, institutional review board-approved, observational study of 49 consecutive patients undergoing immediate, implant-based, prepectoral breast reconstruction (Fig. 1) after mastectomy for breast cancer or risk reduction. Reconstructive procedures were based on prepectoral implant placement and used meshed bovine-derived ADM (SurgiMend 1.0, Integra LifeSciences, Plainsboro, N.J.). All patients were operated on by a single plastic surgeon (the senior author—MS) at a single medical center between February 2018 and October 2019, and all provided written informed consent before surgery.

Outcomes in this group were compared against previously published data from a control group of 77 patients (105 breasts) who underwent mastectomy and immediate breast reconstruction with a tissue expander/permanent implant and the same meshed, bovine-derived ADM (SurgiMend).2 However, in this group, implants were placed in a partial subpectoral plane. All these reconstructions were performed by the same plastic surgeon at the same medical center between January 2015 and September 2017.

Subjects

In both patient groups, study subjects were women aged ≥ 18 years undergoing immediate 1-stage (direct to implant) or 2-stage (insertion of a tissue expander with later exchange to a permanent implant) breast reconstruction, including use of ADM. In most cases, the decision on whether to use a 1- or 2-stage procedure was made preoperatively based on risk factors, breast size, and subcutaneous fat thickness. However, if intraoperative clinical evaluation of the flaps in patients initially assigned to a 1-stage reconstruction suggested suboptimal perfusion, a 2-stage procedure was performed instead. All patients received a mastectomy either because they had a high genetic risk of developing breast cancer in their lifetime or because they had been diagnosed with breast cancer. All smokers were required to quit smoking for ≥2 weeks before and 2 months after surgery, and to have a negative urine test for nicotine 3 days before surgery. Patients were excluded from this study if they were oncologically and/or medically unfit or unwilling to undergo immediate breast reconstruction in general or an implant-based procedure in particular. Patients who had received previous radiation therapy and presented with clinical signs of radiation injury (ie, pigmentation, induration, telangiectasia, and atrophy) were also excluded, and were referred for autologous breast reconstruction. Morbidly obese individuals (ie, >100 lb over ideal weight, body mass index ≥ 40 kg/m², or body mass index ≥ 35 kg/m², and experiencing obesity-related health conditions) were excluded from undergoing a 1-stage procedure.

Only women with clinically good, non-traumatized skin flaps were considered for a prepectoral reconstruction. In this group, imaging technologies were not used to evaluate skin-flap thickness, regularity, and perfusion. They vary dramatically from 1 surgeon to another depending on patient specifics, surgeon experience, surgical technique, instruments, and flap handling and assistants. The senior author has been working regularly with 5 general surgeons trained in using plastic surgery techniques and instruments for mastectomy. Clinically, the methodology is a time-proven assessment of flap thickness (>5 mm), regularity, color, and the absence of bare dermis on the undersurface—particularly when you work for many years with the same group of surgeons that you have trained yourself, you are present in the operating room throughout the mastectomy, and you evaluate subcutaneous fat thickness preoperatively with digital mammograms. Patients with poorly vascularized or traumatized flaps on clinical assessment, or who had large or posterior tumors <1 cm from the pectoral muscle, or who had inflammatory/stage 4 cancer or gross axillary involvement underwent subpectoral reconstruction and were excluded from the study.

Surgical Techniques

Apart from the difference in implant placement (prepectoral versus partial subpectoral), the surgical techniques used were similar in both groups.

All patients were marked preoperatively, in the standing position, for either nipple-sparing, skin-sparing, or skin-reducing mastectomy. Breast volume was estimated preoperatively, using Vectra 3D photography (Canfield Scientific, Parsippany, N.J.) and volumetric plastic bowls (Plastikmott, Gothenburg, Sweden). All breast specimens were weighed after completion of mastectomy.

The preferred incisions used were inframammary for nipple-sparing mastectomy, radial oblique in the upper outer quadrant for skin-sparing mastectomy, and transverse ellipses for skin-reducing mastectomy.3 Patients with no history of penicillin allergy received 1–2 g of intravenous cefazolin 30 minutes before surgical incision. Breasts were infiltrated subcutaneously with a blunt cannula at least 10 minutes before mastectomy incision with 60–120 mL per breast of tumescent solution, made from 500 mL of lactated Ringer solution plus 0.5 mg of adrenaline and 40 mL of 1% lidocaine.

In all cases,atraumatic mastectomy and reconstructive techniques were employed. The skin and subcutaneous tissues were separated from the breast by dissection with blunt-tip scissors, and the breast was separated from the muscles by electrocautery. To avoid injury to the skin flaps and subdermal plexus, no sharp or crushing instruments were used, and no retractors, clamps or hooks were used to hold the skin envelope during either mastectomy or...
reconstruction. Skin-flap retraction was performed using fingers only, thereby minimizing the risk of crush injury to the subdermal plexus.

An approximately 1-mm-thick, bovine-derived meshed ADM (SurgiMend 1.0) was used in every breast. For prepectoral reconstructions, a rectangular 10 × 20 cm piece was used. Meshing at a 2:1 ratio expanded the matrix to 18 × 23 cm. Depending on implant volume, the mesh either covered most of (or all) the implant (a wrap-around technique; Figs. 2–4) or covered only the anterior surface of the implant. SurgiMend 1.0 was also employed for partial subpectoral reconstructions, meshed at a 2:1 ratio. For implants ≤ 400 g, a semi-oval 10 × 15 cm piece of ADM was utilized; for implants > 400 g, a rectangular 10 × 20 cm piece of ADM was used.

Before placement, ADMs were soaked for at least 10 minutes in 500 mL of normal saline containing 1 g of cefazolin, 80 mg of gentamicin, and 50 mL of povidone–iodine solution. Implant pockets were irrigated with the same solution. In addition, the skin surrounding the incision was painted with betadine, and gloves and drapes were changed before handling the implant.

In the wrap-around technique, ADMs were sutured around the implant using 2/0 Vicryl Plus sutures (Ethicon, Inc., Somerville, N.J.). This was performed on a sterile back-table in the operating room. The meshed ADM was then sutured—either directly or through tabs created during the wrap—to the pectoralis major fascia at the boundaries of the implant in the desired position within the pocket. In cases in which the meshed ADM was sufficiently large only to cover the anterior surface of the implant, the matrix was first secured to the pectoralis major muscle in the superior and medial margins of the pocket, and the implant/expander was then inserted underneath the matrix and the ADM tailored over it laterally and inferiorly.

Vicryl Plus sutures were used to close the subcutaneous layers. As the base diameter of the implant was always narrower than the base width of the breast, the lateral gutter of the breast (potential dead space) was obliterated with 2 layers of running 2/0 Vicryl sutures.

Depending on pocket and implant size, either one or two 10-mm Jackson-Pratt drains were inserted through a 5-cm subcutaneous tunnel, one in the lateral breast gutter (in the subcutaneous space) and the other in the inframammary fold (between the ADM and skin). When 2 drains were used, the first drain, which had the least drainage of the 2, was removed on post-operative day 2, before discharge of the patient from the hospital, and the second when drainage fell below 30 mL per 24 hours. A light dressing and a support bra concluded the procedure.

Assessments

Baseline data collected during the initial consultation included patient age, height, weight, body mass index (BMI), comorbidities (hypertension, diabetes, or ischemic heart disease), and the following risk factors for complications: smoking status, obesity (BMI ≥ 30 kg/m²), pre- and postoperative radiation therapy, and neoadjuvant and adjuvant chemotherapy. Mastectomy specimen weight was also recorded. Key procedural data included the time to drain removal and the duration of follow up.

Postoperative complications, including hematoma, seroma, infection, and necrosis, were assessed throughout the study. All were categorized as either minor or major based on their management: in-office versus in the operative room, respectively. Rates of capsular contracture and

![Fig. 1. Illustration of the front and side view of prepectoral reconstruction with an implant and meshed acellular dermal matrix.](image)
explantation (reconstructive failure) were also recorded, as well as any requirement for further fat grafting of the reconstructed breast and the number of rounds performed.

Statistical Analysis

All data were collected by a study coordinator. For continuous variables, mean, SD and range, or median and interquartile range were calculated as appropriate. For categorical variables, absolute frequencies and percentages were calculated.

To compare baseline characteristics and reconstructive procedures between the prepectoral and partial subpectoral groups, t-tests, Mann–Whitney tests, Fisher exact tests, or Chi-squared tests (with Yates, correction) were performed as appropriate. The criterion for negating the preliminary differences between groups was α = 0.05 (2-sided). Complication rates were compared using the Fisher exact test. The criterion for significance was α = 0.05 (2-sided). Statistical analyses were conducted using the SPSS statistical software (Version 22; IBM Inc., Chicago, Ill.).

RESULTS

Baseline Characteristics

A total of 49 women (71 breasts) were included in the prepectoral group (Fig. 5). (See figure, Supplemental Digital Content 1, which displays immediate prepectoral breast reconstruction with 2:1 meshed ADM. A 32-year-old woman who received right-side lumpectomy and radiation therapy. Eighteen months later, she underwent bilateral nipple-sparing mastectomy for recurrent cancer on the same side. The mastectomy weight was 132 g on the right side and 168 g on the left side. She received immediate reconstruction with prepectoral tissue expanders wrapped in 2:1 meshed SurgiMend, followed in the second stage by fat grafting and exchange to permanent implants (300 cc Motiva round devices; moderate projection). The images show the patient before surgery (A–C) and 18 months after completion of all procedures (D–F). ADM, acellular dermal matrix. http://links.lww.com/PRSGO/B516.)

The mean age was 49.1 ± 9.4 years (range: 34–73 years) and the mean BMI was 24.7 ± 4.2 kg/m² (range: 18–39 kg/m²) (Table 1). Among the 71 breasts operated upon, 45 (63.4%) underwent mastectomy for breast cancer and 26 (36.6%) for risk reduction. With regard to risk factors, 4 patients (8.2%) were smokers, 4 (8.2%) were obese (BMI > 30 kg/m²), and 9 (18.3%) had comorbidities (diabetes or hypertension). In total, 17 patients (35.4%) received neoadjuvant or adjuvant chemotherapy, and 20 breasts (29.0%) underwent pre- or postoperative radiotherapy.

The partial subpectoral group included 77 patients (105 breasts). There were no significant differences
between the prepectoral and partial subpectoral groups in mean age, BMI, or reason for mastectomy, or in the proportion of patients with specific risk factors, including smoking, comorbidities, obesity, chemotherapy, or radiotherapy (Table 1).

**Reconstructive Procedures**

In both groups, most breasts underwent a direct-to-implant reconstruction: prepectoral, n = 55 (77.5%); partial subpectoral, n = 87 (82.9%) (Table 2). Hence, 61 breasts (85.9%) in the prepectoral group and 97 breasts (Table 1)

### Table 1. Baseline Demographics and Concurrent Treatments

| Variable                        | Prepectoral | Control | P      |
|---------------------------------|-------------|---------|--------|
| Total patients, n               | 49          | 77      |        |
| Total breasts, n                | 71          | 105     |        |
| Age, years, mean (SD; range)    | 49.1 (9.4; 34–73) | 48.3 (9.6; 28–72) | 0.675  |
| Age, years, median (IQR)        | 48.8 (41.2–55.1) | 47.0 (42.0–53.0) | 0.734  |
| BMI, kg/m², mean (SD; range)    | 24.7 (4.2; 18–39) | 23.5 (3.1; 18–35) | 0.091  |
| BMI, kg/m², median (IQR)        | 24.7 (22.4–27.3) | 23.1 (21.2–25.0) | 0.086  |
| Smoking*, n (%)                 | 4 (8.2)     | 8 (11.6) | 0.765  |
| Diabetes†, n (%)                | 3 (6.1)     | 3 (4.0)  | 0.680  |
| Hypertension‡, n (%)            | 6 (12.2)    | 8 (10.7) | 1.000  |
| Obesity†, n (%)                 | 4 (8.2)     | 3 (4.0)  | 0.423  |
| Chemotherapy§, n (%)            | None received | 31 (64.6) | 42 (60.9) | 0.508 |
| Neoadjuvant                    | 10 (20.8)   | 16 (23.2) |        |
| Adjuvant                       | 7 (14.6)    | 11 (15.9) |        |
| Neoadjuvant and adjuvant       | 0 (0.0)     | 0 (0.0)  |        |
| Radiotherapy§, n (%)           | None received | 49 (71.0) | 60 (62.5) | 0.061 |
| Preoperative                   | 10 (14.5)   | 8 (8.3)  |        |
| Postoperative                  | 10 (14.5)   | 28 (29.2) |        |
| Pre- and postoperative         | 0 (0.0)     | 0 (0.0)  |        |
| Reason for mastectomy‡, n (%)  | Prophylactic | 26 (36.6) | 26 (24.8) | 0.128 |
| Breast cancer                  | 45 (63.4)   | 79 (75.2) |        |

**Notes:**
- Percentages are calculated per patient, unless otherwise stated.
- Data missing for 8 patients in the control group.
- Data missing for 2 patients in the control group; obesity was defined as BMI > 30 kg/m².
- Data are missing for 1 patient in the prepectoral group and 8 patients in the control group.
- Calculated per breast; data are missing for 2 breasts in the prepectoral group and 9 breasts in the control group.
- Calculated per breast.
- BMI, body mass index; IQR, interquartile range.
capsular contracture and explantation were in irradiated breasts, except for 1 case of capsular contracture and 1 explantation in the partial subpectoral group. When data were combined for both the prepectoral and partial subpectoral placement groups, radiation therapy was associated with an increased rate of capsular contracture \( (P < 0.001) \) and explantation \( (P = 0.002) \) (Table 5).

**DISCUSSION**

To the best of our knowledge, the present study is the first to assess the use of meshed ADM in prepectoral implant-based breast reconstruction. The results demonstrate the benefits of prepectoral placement allied to implant coverage with a meshed matrix. To the best of our knowledge, the present study is the first to assess the use of meshed ADM in prepectoral implant-based breast reconstruction. The results demonstrate the benefits of prepectoral placement allied to implant coverage with a meshed matrix.\(^7\)

ADM use facilitates pocket definition, enhances implant support, reduces capsular contracture, and reinforces flap thickness.\(^1,5,10-12\) Meshing of the ADM further enhances pliability and drapability, promotes adherence and incorporation, and may reduce drain time and rates of seroma and infection.\(^2,6-8\) In addition, it has been suggested that the length of hospital stay is reduced with meshed versus unmeshed ADM (1.29 versus 1.84 day; \( P < 0.05)\).\(^5\) Meshing can also reduce operative costs by allowing a smaller piece of ADM to be used. Prepectoral implant placement preserves chest wall anatomy and facilitates sparing of the muscle (and hence no animation deformity), decreased postoperative pain, reduced duration of hospital stay, and good aesthetic outcomes.\(^3-5,13,15\)

In the present study, ADM (SurgiMend) meshing and prepectoral implant placement were combined in 49 consecutive patients (71 breasts) undergoing immediate breast reconstruction after mastectomy. The overall complication rate was 26.8% after a mean follow up of 18.6 months, which was similar to that of the control group (29.5%; \( P = 0.690)\), in which 77 patients (105 breasts) received partial subpectoral implant placement.

### Table 2. Reconstructive Procedure

| Variable                              | Prepectoral (N = 71 breasts) | Control (N = 105 breasts) | \( P \)  |
|---------------------------------------|------------------------------|----------------------------|---------|
| Procedure, n (%)                      | 55 (77.5)                    | 87 (82.9)                  | 0.487   |
| 1 stage                               | 16 (22.5)                    | 18 (17.1)                  |         |
| Mastectomy weight, g, mean (SD; range)| 399 (201; 86–1000)           | 394 (229; 65–1200)         | 0.875   |
| Follow up, months, mean (SD)          | 18.6 (13.9)                  | 21.3 (10.2)                | 0.129   |
| TE reconstruction procedure*          |                              |                            |         |
| Expander size, cm\(^3\), mean (SD)   | 420.3 (106.5)                | 422.5 (109.7)              | 0.953   |
| Intraoperative fill, cm\(^2\), mean (SD)| 282.9 (57.9)              | 294.2 (94.9)              | 0.065   |
| Total expansion, cm\(^2\), mean (SD) | 424.6 (88.4)                 | 343.2 (158.4)              | 0.225   |
| Time to drain removal, days, mean (SD; range) | 6.5 (3.0; 2–14)      | 8.5 (3.9; 4–21)            | <0.001  |
| No. injections, mean (SD; range)     | 9 (12.7)                     | 25 (23.8)                 | 0.101   |

*In breasts undergoing a 2-stage procedure.

IQR, interquartile range; TE, tissue expander.
These data align with previous results with prepectoral breast reconstruction (1- or 2-stage), which have shown complication rates typically ranging from 6% to 30%. In a study of immediate, tissue-expander-based, prepectoral reconstruction of 84 breasts, the complication rate during the first stage was 17.9%, similar to that of a comparator group of 186 breasts receiving partial submuscular placement (18.8%; $P = 0.49$). In a large, non-comparative study of 353 prepectoral reconstructions with ADM, Sigalove and colleagues showed a 9% complication rate. Interestingly, although patients with prior radiation therapy had a higher complication rate, there was no statistically significant association. In the present study, radiation was associated with increased rates of capsular contracture ($P < 0.001$) and explantation ($P = 0.002$) across both patient groups, but had no effect on other complications.

Drain time was significantly reduced with prepectoral versus partial subpectoral placement ($P < 0.001$). Leaving the pectoralis muscle intact with less surgical dissection may contribute to reduced drainage. We mainly used 1 surgical drain in the prepectoral group compared with 2 drains in the partial subpectoral controls. In cases where there was a second drain, this was removed on postoperative day 1 or 2, before the patient is discharged from hospital.

Notably, there were no cases of major seroma in either group in the present study, in which all patients received meshed ADM. Seroma has been a key concern in previous studies based on unmeshed ADM. Meshing has been shown to help reduce drain time by hastening incorporation and reducing bioburden. Indeed, we demonstrated reduced drain time in a previous study comparing meshed versus fenestrated ADM in implant-based breast reconstruction. In the same study, rates of seroma and infection were reduced with meshed ADM, and rates of capsular contracture were similar to those with fenestrated ADM. Meshing also allows a smaller piece of ADM to be used, and hence can reduce operative costs. This may be particularly important in prepectoral reconstructions for which larger ADM sizes are needed.

The current study found similar rates of Baker grade III/IV capsular contracture in the prepectoral and partial subpectoral groups ($P = 0.500$).

### Table 3. Complications

| Variable                  | Prepectoral (N = 71 breasts) | Control (N = 105 breasts) | OR (95% CI) | P   |
|---------------------------|-------------------------------|---------------------------|-------------|-----|
| Total complications       | 19 (26.8)                    | 31 (29.5)                 | 0.87 (0.45–1.71) | 0.690 |
| Minor                     | 11 (15.5)                    | 16 (15.2)                 |             |     |
| Major                     | 8 (11.3)                     | 15 (14.3)                 |             |     |
| No complication           | 52 (73.2)                    | 74 (70.5)                 |             |     |
| Hematoma                  |                               |                           |             |     |
| Minor                     | 0 (0.0)                      | 0 (0.0)                   |             |     |
| Major                     | 1 (1.4)                      | 0 (0.0)                   |             |     |
| No complication           | 70 (98.6)                    | 105 (100.0)               |             |     |
| Seroma                    |                               |                           |             |     |
| Minor                     | 3 (4.2)                      | 6 (5.7)                   | 0.73 (0.18–3.01) | 0.660 |
| Major                     | 0 (0.0)                      | 0 (0.0)                   |             |     |
| No complication           | 68 (95.8)                    | 99 (94.3)                 |             |     |
| Infection                 | 9 (12.7)                     | 12 (11.4)                 | 1.13 (0.45–2.83) | 0.802 |
| Minor                     | 5 (7.0)                      | 6 (5.7)                   |             |     |
| Major                     | 4 (5.6)                      | 6 (5.7)                   |             |     |
| No complication           | 62 (87.3)                    | 95 (88.6)                 |             |     |
| Skin-flap necrosis        | 6 (8.5)                      | 13 (12.4)                 | 0.65 (0.24–1.81) | 0.410 |
| Minor                     | 3 (4.2)                      | 4 (3.5)                   |             |     |
| Major                     | 3 (4.2)                      | 9 (8.6)                   |             |     |
| No complication           | 65 (91.5)                    | 92 (87.6)                 |             |     |
| Capsular contracture      | 6 (8.5)                      | 5 (4.8)                   | 1.85 (0.54–6.30) | 0.500 |
| Explantation              | 2 (2.8)                      | 6 (5.7)                   | 0.48 (0.09–2.44) | 0.592 |

Data are represented as numbers (%). CI, confidence interval; OR, odds ratio.

### Table 4. Complications in Non-irradiated and Irradiated Breasts

| Variable                  | Prepectoral (N = 49 breasts) | Control (N = 60 breasts) | OR (95% CI) | P   |
|---------------------------|-------------------------------|---------------------------|-------------|-----|
| Total complications       | 10 (20.4)                    | 20 (33.3)                 | 0.51 (0.21–1.23) | 0.349 |
| Hematoma                  | 0 (0.0)                      | 0 (0.0)                   |             |     |
| Seroma                    | 3 (6.1)                      | 4 (6.7)                   | 0.91 (0.19–4.29) | 0.895 |
| Infection                 | 6 (12.2)                     | 8 (13.3)                  | 0.91 (0.29–2.82) | 0.885 |
| Skin-flap necrosis        | 1 (2.0)                      | 8 (13.3)                  | 0.14 (0.02–1.12) | 0.099 |
| Capsular contracture      | 0 (0.0)                      | 1 (1.7)                   |             |     |
| Explantation              | 0 (0.0)                      | 1 (1.7)                   |             |     |
| Irradiated                | N = 20 breasts               | N = 36 breasts            |             |     |
| Total complications       | 7 (35.0)                     | 9 (25.0)                  | 1.62 (0.49–5.30) | 0.349 |
| Hematoma                  | 1 (5.0)                      | 0 (0.0)                   |             |     |
| Seroma                    | 0 (0.0)                      | 1 (2.8)                   |             |     |
| Infection                 | 3 (15.0)                     | 3 (8.3)                   | 1.94 (0.35–10.67) | 0.559 |
| Skin-flap necrosis        | 3 (15.0)                     | 5 (13.9)                  | 1.09 (0.23–5.15) | 0.895 |
| Capsular contracture      | 6 (30.0)                     | 4 (11.1)                  | 3.43 (0.84–14.08) | 0.125 |
| Explantation              | 2 (10.0)                     | 5 (13.9)                  | 0.69 (0.12–3.92) | 0.690 |

Data are represented as numbers (%). CI, confidence interval; OR, odds ratio.

### Table 5. Association between Radiation and Complications

| Variable                  | Non-irradiated (N = 109 breasts) | Irradiated (pre or post) (N = 56 breasts) | P   |
|---------------------------|----------------------------------|-------------------------------------------|-----|
| Total complications       | 30 (27.3)                       | 16 (28.6)                                 | 1.000 |
| Hematoma                  | 0 (0.0)                         | 1 (1.8)                                   | 0.339 |
| Seroma                    | 7 (6.4)                         | 1 (1.8)                                   | 0.268 |
| Infection                 | 14 (12.8)                       | 6 (10.7)                                  | 0.885 |
| Skin-flap necrosis        | 9 (8.3)                         | 8 (14.3)                                  | 0.349 |
| Capsular contracture      | 1 (0.9)                         | 10 (17.9)                                 | <0.001 |
| Explantation              | 1 (0.9)                         | 7 (12.5)                                  | 0.002 |

Data are represented as numbers (%).
subpectoral groups. Other studies have shown low rates of capsular contracture in prepectoral reconstruction, possibly due to the use of ADM.

The present work did not show a significant difference between groups in the number of patients receiving fat injections. This suggests that ADM coverage of the implant may be sufficient, and that meshing does not reduce soft-tissue coverage thickness. With regard to aesthetic outcomes, prepectoral reconstruction may be associated with increased rippling. However, in our experience, reconstructions based on either placement method may benefit from fat grafting as an ancillary procedure to thicken soft-tissue implant coverage and mask rippling and other depts.

The patient characteristics of the 2 groups were well matched, and there was no significant difference in the proportion of patients receiving a prophylactic procedure. However, breast surgeons can often produce superior mastectomy flaps in risk-reducing operations, thus facilitating implant placement in a prepectoral pocket. Better flaps that allow for prepectoral implant placement may also have supported the trend toward a lower incidence of flap necrosis in non-irradiated prepectoral patients (although this did not reach statistical significance; Table 4).

There was a notable shift in implant texture selection between the 2 groups: almost 3 quarters (72.1%) of completed reconstructions in the prepectoral group used smooth implants compared with only 8.2% in partial subpectoral controls. This reflects a change in our practice away from shaped, textured implants, to reduce the potential risk of breast implant-associated anaplastic large cell lymphoma. We should acknowledge the limitations of the present work. In particular, it was a retrospective study of a relatively small patient cohort, comparing outcomes against historical controls at a single center. However, the surgeon, surgical procedures, and follow-up time were similar between groups, and hence the comparison appears to be legitimate. A prospective, multicenter, randomized trial with a larger patient cohort would be welcomed. A comparison of outcomes with meshed versus non-meshed ADM in prepectoral reconstruction would also be valuable.

**CONCLUSIONS**

Prepectoral implant placement with meshed ADM is a viable alternative to partial muscle coverage with meshed ADM. This technique is safe and reproducible with natural aesthetic outcomes. The lack of animation with prepectoral implant placement is a major aesthetic advantage. These effects, allied to potentially lower ADM costs from meshing, suggest that prepectoral implant placement with meshed ADM may become the “go-to” method for implant-based breast reconstruction in appropriately selected patients.

*Michael Scheflan, MD*

Raoul Wallenberg 18
Tel Aviv 69710
Israel

E-mail: michael@scheflan.co.il
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