The Use of Acellular Dermal Matrices in Implant-Based Breast Reconstruction

23

Glyn Jones

23.1 Introduction

Expander/implant reconstruction is one of the most widely used forms of breast reconstruction. Despite its popularity, it is fraught with the problems of capsular contracture, rippling of implants beneath the overlying thin skin envelope, and pseudoptosis of the device as the lower pole skin attenuates with time. Numerous solutions to these issues have been tried, often with little success. During the past 8 years, acellular dermal matrices have been increasingly incorporated into implant-based reconstructions and appear to offer a degree of resolution to many of these troublesome issues.

Although autologous techniques remain the gold standard of breast reconstruction for many surgeons, time constraints, resource allocation, availability of operating time, and decreasing reimbursement have all contributed to the ongoing popularity of prosthetic-device-based techniques despite their problems. Many patients are also concerned about the magnitude of some of the autologous approaches, including free tissue transfer, and see implant reconstruction as a quick and relatively easy answer to their reconstructive needs.

Surgeons familiar with all of these approaches are only too painfully aware of some of the major negatives associated with implant reconstructions. These include:

- Window shading of the pectoralis major muscle release
- Lack of control of the expander or implant pocket size and location
- Visible implant ripples
- Post-operative infection
- Problems achieving adequate lower pole expansion
- Significant capsular contracture rates in the long term
- The negative impact of radiation on implant-based reconstruction.

G. Jones (✉)
Department of Plastic Surgery, Proctor Hospital, Peoria, USA
e-mail: ghjones5@earthlink.net

At the time of surgery, coverage of the device with pectoralis major muscle provides upper pole cover, which can reduce long-term visible rippling of an underlying implant. Unfortunately inferomedial pectoralis major muscle release is complicated by window shade retraction of the muscle in a cephalad direction. Traditionally this has been countered by placing percutaneous sutures to anchor the muscle to the mastectomy skin envelope, an approach complicated by necrosis of marginally vascularized skin. The technique only provides cover to the upper pole, leaving the lower pole devoid of anything but thin skin coverage. Attempts at raising rectus muscle or fascia and the serratus fascia laterally can aid in resolving this dilemma but come at the expense of creating tight banding across the bottom of the reconstruction right where fullness and suppleness are most necessary. Having a biologic material to bridge the gap between the caudal edge of the pectoralis major muscle and the inframammary crease provides reliable, supple cover which can stretch with time or expansion.

In addition to the dilemma of providing cover, surgeons are faced intraoperatively with the difficulty of maintaining an expander or implant in its exact location within a larger mastectomy pocket than the device requires. Without the ability to control pocket size, particularly laterally, a device can shift or even rotate, creating major problems later. Having a biologic mesh to help shape and control pocket size is a desirable advantage in achieving excellent outcomes, particularly when one-stage direct-to-implant reconstructions are attempted.

With the acute intraoperative issues dealt with, we face the task of achieving successful expansion with subsequent expander/implant exchange. Isolating a prosthetic device from the mastectomy space could potentially reduce infection and device loss.

Once the implant has been exchanged for a permanent implant, we face the problem of visible rippling and wrinkling of the implant beneath the skin. Although cohesive gel implants have reduced this issue substantially, it remains a

C. Urban and M. Rietjens (eds.), *Oncoplastic and Reconstructive Breast Surgery*,
DOI: 10.1007/978-88-470-2652-0_23,

Table 23.1 Biologic materials available for breast reconstruction

Name	Company	Source tissue	Alpha-gal removed
DermaMatrix	MTF (Synthes)	Human dermis	NA
Flex HD	MTF (Ethicon)	Human dermis	NA
Neoform/AlloMax	Tutogen (Mentor)	Human dermis	NA
AlloDerm	LifeCell	Human dermis	NA
Strattice	LifeCell	Porcine dermis	Yes
SurgiMend	TEI Biosciences	Fetal bovine dermis	No
Veritas	Synovis	Bovine pericardium	No

cause for concern. Any biologic material that places more thickness between the skin and the implant can only serve to improve this troublesome problem and enhance esthetic outcomes.

Probably the most troubling complication of all remains that of capsular contracture.

With all of these complications in mind, acellular dermal matrices have become a useful and simple adjunct to our surgical armamentarium, providing significant improvement in clinical outcomes. The last 15 years has seen a dramatic increase in the number of patients receiving postoperative radiation therapy as the criteria for radiation therapy have expanded to include earlier forms of breast cancer. Radiation exerts a negative influence on implant reconstruction by tightening the overlying skin envelope and increasing the incidence of capsular contracture, resulting in deteriorating symmetry and increasing deformity with time. Acellular dermal matrices appear to be a valuable adjunct to improving the outcomes of implant-based reconstruction in the face of evolving data suggesting a reduction in significant capsular contracture following radiation of implant reconstructions.

In the past 15 years, numerous biologic materials have been introduced for use in reconstructive surgical procedures. Theoretically, biologically derived materials should allow a surgeon to achieve a better, more natural clinical outcome than by using synthetic materials. However, along with the many choices of biologic materials available to plastic surgeons, there are very few published data on most of these materials and considerable confusion as to the differences between them. Surgeons must be equipped with a fundamental understanding of these materials and how they work so they can make educated choices when developing a reconstructive strategy.

23.2 Currently Available Biologic Materials

Numerous allogeneic and xenogeneic tissue scaffolds have been introduced commercially. The nature and source of some of the most widely marketed materials are shown in Table 23.1.

The goal of using regenerative tissue matrices in reconstructive surgery is to establish an environment that enables the patient to "regenerate" tissue other than scar or foreign body capsule that mimics the autologous tissue and allows the surgeon to achieve an excellent outcome with durable esthetics and function.

23.3 Biologic Matrix Applications in Breast Reconstruction

Reconstructive options for using biologic matrices in breast reconstruction include the following:

- Implant reconstruction
- Expander reconstruction
- Augmentation of the reconstructed nipple
- Abdominal wall reinforcement
- Reducing capsular contracture after radiation therapy.

The aim of this chapter is to discuss the use of acellular dermal matrices in implant and expander reconstruction.

23.3.1 Implant Reconstruction

Patients undergoing skin-sparing mastectomy for breast cancer may be candidates for either immediate implant or expander insertion. Direct-to-implant insertion is becoming an increasingly attractive proposition as methods to assess skin viability become more available. Prerequisites for successful direct-to-implant insertion include a well-vascularized skin envelope and adequate skin surface area. The use of indocyanine green based fluorescence imaging has revolutionized our ability to assess skin vascularity at the time of mastectomy. If the skin envelope is viable, an implant of size similar to that of the original breast volume may be inserted without fear of postoperative necrosis. Unfortunately, such implant placement requires accuracy of implant positioning and maintenance of that position if the esthetic outcome is to be acceptable to both the patient and the surgeon. The mastectomy pocket is, by definition, larger than the space occupied by the implant. There is a tendency for the implant to fall laterally and inferiorly as well as to

slide out from beneath the pectoralis major muscle into a subcutaneous plane. To correct both of these issues, a sheet of acellular dermal matrix can be used to reduce both pectoralis major muscle window shading and control the implant pocket dimensions and location. The larger the implant and the greater the degree of ptosis required, the larger this sheet of matrix should be. My personal preference is for a sheet of 8 × 16 cm for most expander reconstructions, and an additional 6 × 16 cm sheet may be necessary for large (700–800 cm^3) implant reconstructions. In addition, the surgeon can use AlloDerm as a lower pole reinforcement to reduce both lower pole implant rippling and long-term capsular contracture.

23.3.1.1 Operative Technique

The perfusion and viability of the mastectomy skin envelope should be carefully assessed prior to committing to a direct-to-implant approach. It is the author's preference to use indocyanine green laser fluorescence for this assessment as it is quick, easy, and exceptionally accurate. The inferolateral border of pectoralis major muscle is grasped with an Alice tissue forceps (Fig. 23.1) and the subpectoral plane is entered (Fig. 23.2). Pectoralis major muscle is released from the 6 o'clock to 3 o'clock position on the right and from the 6 to 9 o'clock position on the left (Fig. 23.2a), producing a release that gives rise to the window shade effect of the muscle. A sheet of AlloDerm or Strattice (LifeCell, Branchburg, NJ, USA) is washed in saline for 2 min to rinse off preservatives (Fig. 23.3). The superomedial corner of the matrix is sutured to the inferomedial cut edge of the pectoralis major muscle with running 2-0 polydioxanone suture (Fig. 23.4). The suture is run along the medial breast border (Fig. 23.5), then across the curve of the inframammary crease and can be sutured to a raised

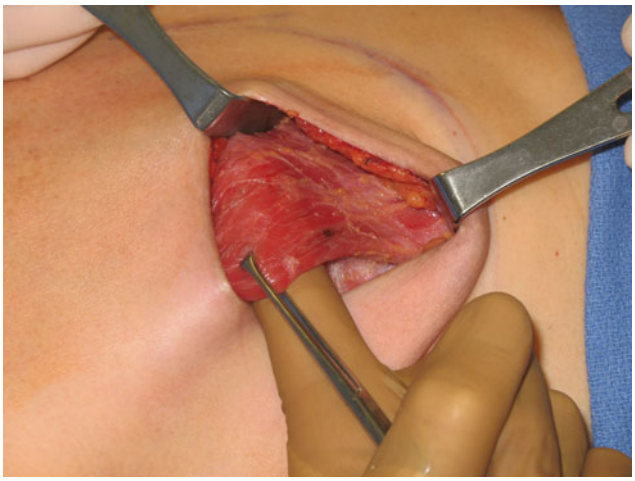

Fig. 23.2 The subpectoral plane is elevated

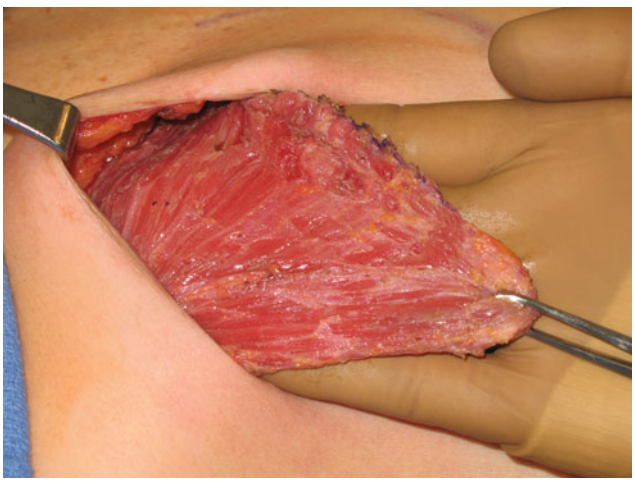

Fig. 23.3 The pectoralis major muscle is elevated after incising the origin inferomedially

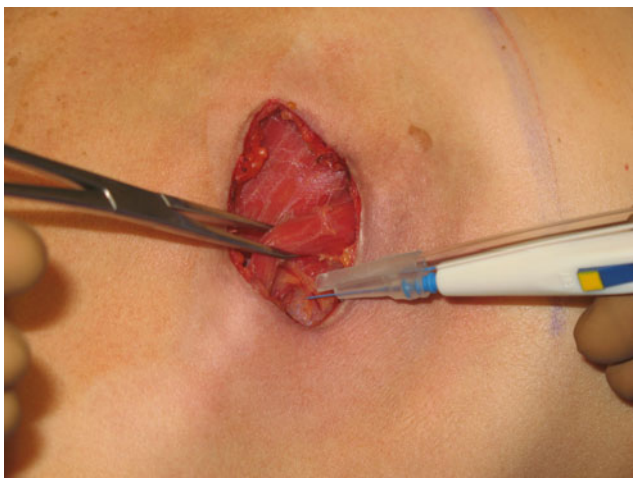

Fig. 23.1 The inferolateral border of pectoralis major is elevated with cautery

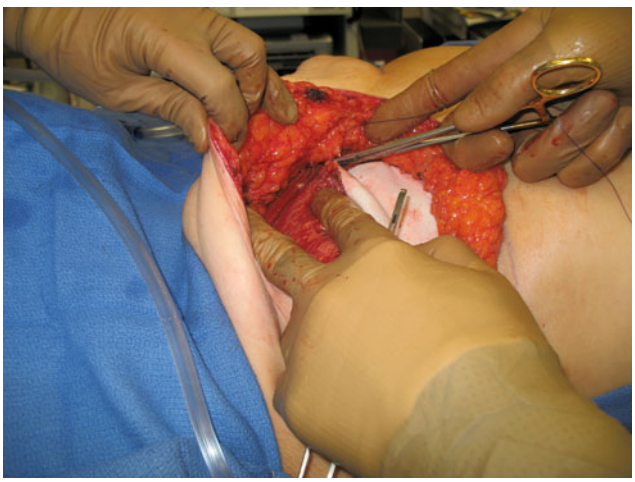

Fig. 23.4 The sheet of acellular dermal matrix is sutured t the cut origin of pectoralis major medially

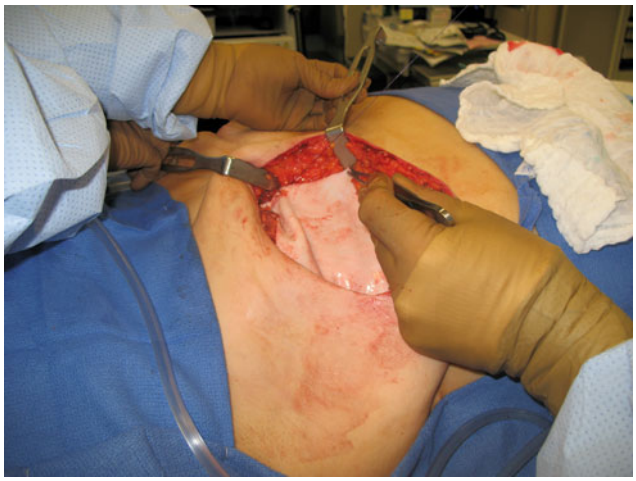

Fig. 23.5 Suturing is continued inferiorly along the inframammary crease and laterally to serratus anterior fascia to complete the creation of an inferior sling of acellular dermal matrix

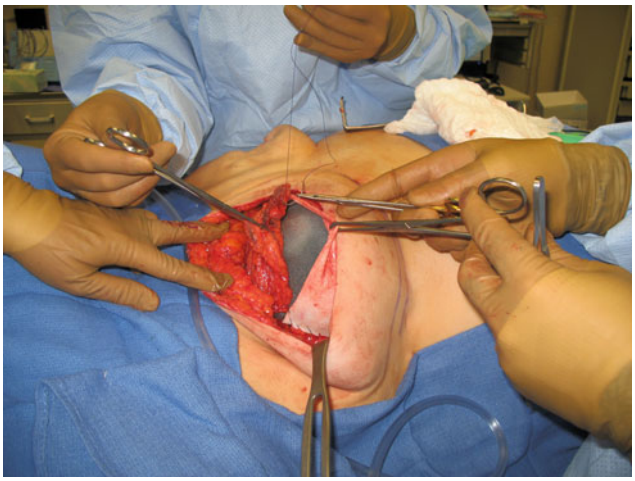

Fig. 23.7 The prosthetic device (expander or implant) is placed beneath the acellular dermal matrix inferiorly and the matrix is sutured to the caudal border of pectoralis major muscle superiorly

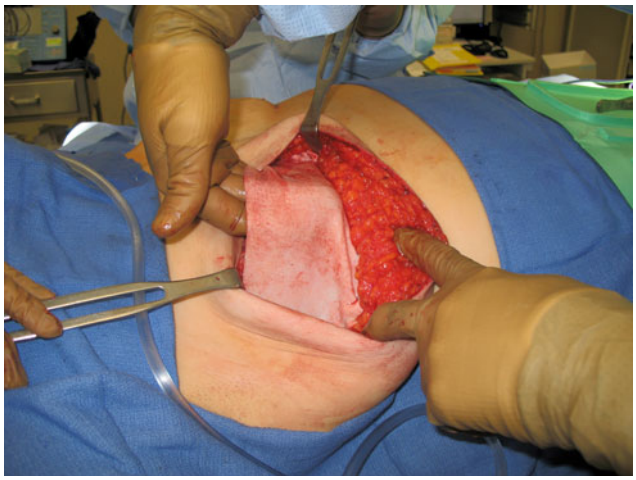

Fig. 23.6 The completed sling is shown

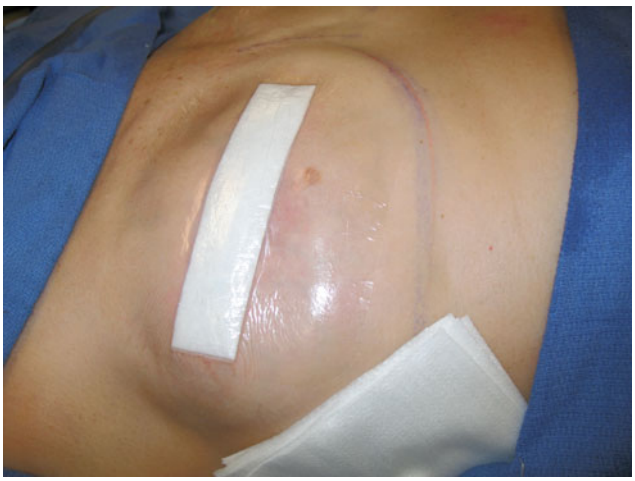

Fig. 23.8 The completed closure with dressings applied

cuff of serratus anterior fascia laterally which provides an additional domain for an implant if required. This creates an inferior sling of AlloDerm into which an implant or expander can be placed (Fig. 23.6). The device is placed beneath the AlloDerm inferiorly and the Strattice superiorly, following which the caudal edge of the pectoralis major muscle is sewn to the cephalad edge of the AlloDerm with running 2-0 polydioxanone suture (Fig. 23.7). This creates complete coverage of the implant with the mesh. It is essential that a drain be placed between the AlloDerm and the overlying skin in order to minimize seroma formation, which could inhibit contact between the mesh and the skin, thereby reducing vascular ingrowth and incorporation. The skin is then closed with absorbable subcutaneous and subcuticular sutures in a two-layer closure sealed with cyanoacrylate cement, SteriStrips, and an occlusive water-proof dressing such as Tegaderm (Fig. 23.8).

Direct-to-Implant Reconstruction

A 55-year-old woman (Fig. 23.9a) with cancer of the left breast and cancer phobia requested bilateral mastectomy with immediate implant reconstruction. She was a nonsmoker and had well-perfused skin flaps. AlloDerm was placed in the lower poles of both breasts, and high-profile 650-cm^3 gel implants were placed subpectorally. In Fig. 23.9b, she is shown 9 months after nipple reconstruction; the result is soft and stable, with good symmetry.

23.3.2 Expander Reconstruction

Tissue expander insertion after mastectomy (Fig. 23.10) is subject to the potential problems of poor lower pole coverage, expander migration, and capsular contracture. The use of acellular dermal matrix provides thicker lower pole

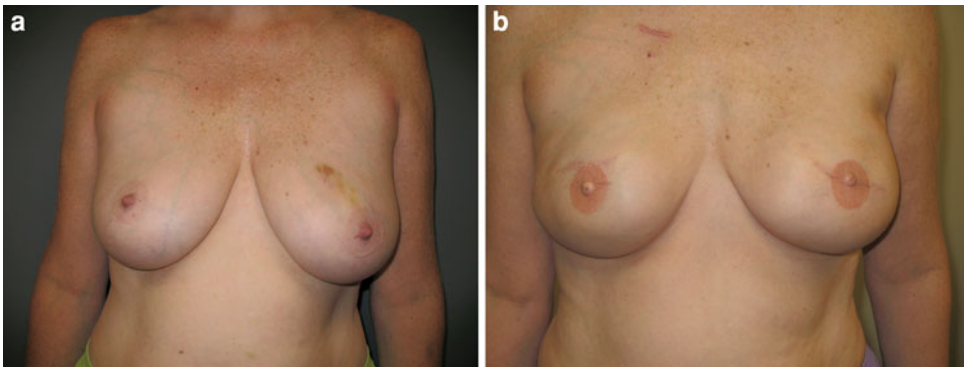

Fig. 23.9

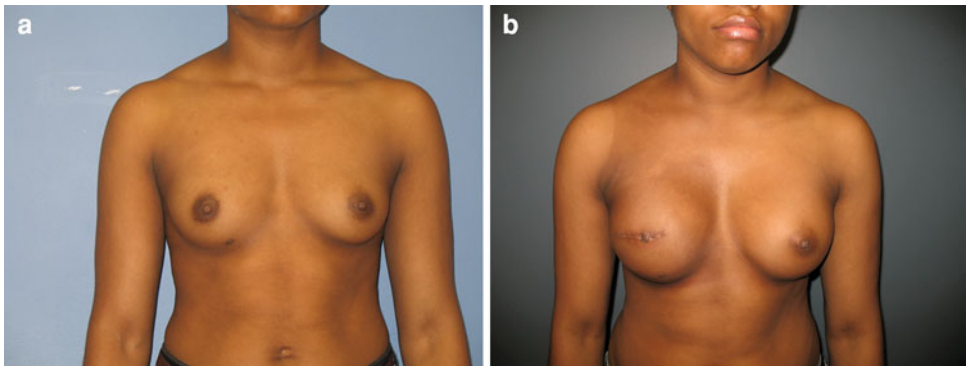

Fig. 23.10 This patient underwent expander insertion after right mastectomy for breast cancer. She had an implant exchange followed by radiation therapy and nipple reconstruction. No tattoo was performed. She is shown 1 year after treatment (**b**), with excellent shape and maintenance of symmetry despite radiation therapy. Her breast remains soft and supple

coverage and support and may reduce capsular contracture. In addition, the complete coverage of an expander by muscle and acellular dermal matrix compartmentalizes the device from a potentially more contaminated mastectomy pocket. This may reduce acute infection rates associated with expanders and could increase expander salvage in the presence of cellulitis of the mastectomy skin postoperatively. The technique of insertion is identical to that used with implant insertion. The expander should be inflated to the maximum intraoperative volume permissible that would allow adequate skin perfusion as it is preferable to have the matrix compressed up against the overlying mastectomy skin to encourage vascular ingrowth into the matrix as rapidly as possible. Drain insertion is mandatory to prevent seroma formation between the matrix and the skin.

23.3.3 Augmentation of the Reconstructed Nipple

Nipple reconstructions undergo a degree of atrophy over time. Nipples reconstructed from expanded mastectomy skin are most prone to this phenomenon because of the thin dermis present in breast skin and the lack of subcutaneous tissue following skin-sparing mastectomy. Several techniques have been used as possible solutions to this problem. These include staged autologous fat injection before elevation of the nipple-skin flaps, implantation of additional autologous dermal grafts, and the use of commercially available acellular dermal matrices. The latter technique obviates the need for a donor site.

Nahabedian and others have described the use of AlloDerm in secondary nipple reconstruction using C–V flaps, with satisfactory maintenance of projection over time. Although histologic evaluation of mature AlloDerm in the nipple has not been reported, Silverman conducted an animal study analyzing the cell repopulation and vascularization of AlloDerm sutured into a roll and implanted within a subcutaneous flap in rabbits. The results demonstrated revascularization of all layers of the matrix, with maintenance of projection.

23.3.3.1 Data Regarding Capsular Contracture in Nonirradiated Patients

Although numerous acellular dermal matrices exist on the market today, many of them are products formerly used

with differing degrees of success or failure in the hernia market and few have undergone rigorous premarket testing and clinical trials in breast surgery. Currently, the most widely tested and used products are AlloDerm and Strattice, both developed and marketed by LifeCell. This chapter is not intended to be an endorsement of any product or company but reflects the author's experience with this particular product series as well as the fact that the literature is replete with hundreds of articles on the successful use of AlloDerm and Strattice in breast reconstruction, whereas there are few if any articles attesting to the long-term success of most of the other products. These data may, however, be forthcoming in the future and comparisons will be interesting.

Experience with AlloDerm in breast reconstruction goes back approximately 8–10 years. Capsular contracture data are steadily emerging and more and more articles are attesting to the fact that AlloDerm incorporation in immediate or delayed breast reconstruction appears to be associated with significant decreases in capsular contracture. Breuing reported a zero contracture rate at 3 years in nonirradiated breast in a series of 97 immediate and four delayed reconstructions with either implants or expanders.

Although data to support this contention are still emerging, we are beginning to see an encouraging trend in this direction. Research in my own patient population has demonstrated capsular contracture occurring in 22 of 79 breasts treated without acellular dermal matrix, but in only 14 of 109 patients treated with acellular dermal matrix. Although these figures barely attain statistical significance, greater study numbers will probably indicate a significant difference in the long term. Infection rates between the two groups were similar, but expander salvage was significantly higher in the patients treated with acellular dermal matrix than in those without insertion of acellular dermal matrix. Jansen reviewed the recent literature and found a spread of capsular contracture rates of 0–8 % with AlloDerm use, all of which were well below reported averages for non-AlloDerm-based capsular contracture rates historically. Basu et al. demonstrated a highly statistically significant difference in capsular structure histologically between conventional fibrous capsules and the more elastic AlloDerm-based capsules seen with use of acellular dermal matrix resulting in suppler, soft clinical outcomes. In our own experience, we have seen a reduction in capsular contracture based on AlloDerm use when compared with our historical controls of non-AlloDerm patients (Table 23.2).

Table 23.2 Rates of capsular contracture

Capsular contracture grade	No AlloDerm used (%)	AlloDerm used (%)
I	72	87.1
II	21.5	1.6
III	6.3	0
IV	0	0

23.3.3.2 Data Regarding Reduction of Capsular Contracture After Radiation Therapy

Expander/implant reconstruction in the face of prior or subsequent radiation therapy has been associated with worse clinical outcomes than in the nonirradiated patient population. Spear et al. demonstrated dramatically increased complication rates, including capsular contracture, distortion, increased infection rates, and loss of the reconstruction. They reported an 84 % complication rate, with 39 % of patients requiring conversion to an autologous technique. The incorporation of acellular dermal matrices into expander/implant reconstruction appears to be helpful in reducing these complications according to 5-year observations in our practice.

The stimulus for their use was triggered by some of the earlier animal studies suggesting that subcutaneous AlloDerm insertion followed by radiation therapy did not appear to adversely affect vascularization, cell density, or graft thickness. In our own early data on patients undergoing adjuvant radiation therapy, only two of eight breasts (25 %) treated with acellular dermal matrices developed grade II capsular contracture, whereas six of seven breasts (85 %) without acellular dermal matrices developed grade II to III capsular contracture ($p < 0.05$). Of these non-AlloDerm irradiated patients, 14 % had grade II capsules and 71 % had grade III capsules, a highly significant difference between the two groups. This trend has been borne out over a 5-year period. We have been so impressed by these sustained outcomes that conversion to autologous reconstruction after irradiated implant reconstruction is now a relative rarity in our practice. Furthermore, the patients who have maintained an implant-based reconstruction in the face of radiation therapy have maintained at most a grade II capsule without progression to grade III or grade IV capsules as was so common in the past. The trend has reduced both patient morbidity and health care costs in this important patient subset.

23.3.3.3 Data on Cost Analysis

An additional cause of concern about the use of acellular dermal matrices in breast reconstruction has been the issue of cost. Jansen et al. reviewed cost outcome analyses of AlloDerm use based on the Canadian health care system and found that AlloDerm use reduced operative times and postoperative complications, resulting in fewer take backs, greater use of direct-to-implant reconstruction, and fewer reoperative events for capsular contracture. On the basis of

their estimates, direct-to-implant reconstruction with AlloDerm was particularly cost-effective.

23.3.3.4 Data on Infection Rates

Infection following expander and implant reconstruction is a major cause of postoperative morbidity. This is exacerbated by radiation therapy as evidenced by the data of Spear et al. Although user experience and familiarity with the product may affect infection rates, the use of acellular dermal matrices certainly does not seem to increase infection rates and may even decrease them owing to separation of the mastectomy pocket from the implant pocket by both the pectoralis major muscle and the acellular dermal matrix. Nahabedian found that in their series, the use of acellular dermal matrix neither increased nor decreased infection rates in expander/implant reconstruction, a conclusion which is similar to our own experience.

23.4 Conclusion

Acellular dermal matrices have assumed a pivotal role in the prevention of complications in implant-based and expander-based breast reconstruction. An increasing body of data from multiple centers confirms this trend. Although the materials are costly at the outset, the short-, medium-, and long-term benefits far outweigh the negatives associated with their use and it is likely that they will become a standard of care in the management of expander-based and implant-based breast reconstruction in the future.

References

1. Ashikari RH, Ashikari AY, Kelemen PR et al (2008) Subcutaneous mastectomy and immediate reconstruction for prevention of breast cancer for high-risk patients. Breast Cancer 15:185
2. Basu CB, Leong M (2010) Hicks MJ Acellular cadaveric dermis decreases the inflammatory response in capsule formation in reconstructive breast surgery. Plast Reconstr Surg 126(6):1842–1847
3. Baxter RA (2003) Intracapsular allogenic dermal grafts for breast implant-related problems. Plast Reconstr Surg 112:1692; discussion 1697
4. Becker S, Saint-Cyr M, Wong C et al (2009) AlloDerm versus DermaMatrix in immediate expander-based breast reconstruction: a preliminary comparison of complication profiles and material compliance. Plast Reconstr Surg 123:1; discussion 107
5. Bindingnavele V, Gaon M, Ota KS et al (2007) Use of acellular cadaveric dermis and tissue expansion in postmastectomy breast reconstruction. J Plast Reconstr Aesthet Surg 60:1214
6. Boehmler JH IV, Butler CE, Ensor J et al (2009) Outcomes of various techniques of abdominal fascia closure after TRAM flap breast reconstruction. Plast Reconstr Surg 123:773
7. Bökel C, Brown NH (2002) Integrins in development: moving on, responding to, and sticking to the extracellular matrix. Dev Cell 3:311
8. Breuing KH, Colwell AS (2007) Inferolateral AlloDerm hammock for implant coverage in breast reconstruction. Ann Plast Surg 59:250
9. Breuing KH, Warren SM (2005) Immediate bilateral breast reconstruction with implants and inferolateral AlloDerm slings. Ann Plast Surg 55:232
10. Brigido SA (2006) The use of an acellular dermal regenerative tissue matrix in the treatment of lower extremity wounds: a prospective 16-week pilot study. Int Wound J 3:181
11. Caplan AI (1991) Mesenchymal stem cells. J Orthop Res 9:641
12. Colwell AS, Breuing KH (2008) Improving shape and symmetry in mastopexy with autologous or cadaveric dermal slings. Ann Plast Surg 61:138
13. Costantino PD, Govindaraj S, Hiltzik DH et al (2001) Acellular dermis for facial soft tissue augmentation: preliminary report. Arch Facial Plast Surg 3:38
14. Cothren CC, Gallego K, Anderson ED et al (2004) Chest wall reconstruction with acellular dermal matrix (AlloDerm) and a latissimus muscle flap. Plast Reconstr Surg 114:1015
15. Disa JJ, Chiaramonte MF, Girotto JA et al (2001) Advantages of autologous fascia versus synthetic patch abdominal reconstruction in experimental animal defects. Plast Reconstr Surg 108:2086
16. Disa JJ, McCarthy CM, Mehrara BJ et al (2008) Histologic analysis of angiogenesis and lymphangiogenesis in acellular human dermis. Plast Reconstr Surg 121:159e
17. Dubin MG, Feldman M, Ibrahim HZ et al (2000) Allograft dermal implant (AlloDerm) in a previously irradiated field. Laryngoscope 110:934
18. Eppley BL (2001) Experimental assessment of the revascularization of acellular human dermis for soft-tissue augmentation. Plast Reconstr Surg 107:1
19. Gamboa-Bobadilla GM (2006) Implant breast reconstruction using acellular dermal matrix. Ann Plast Surg 56:22
20. Garramone CE, Lam B (2007) Use of AlloDerm in primary nipple reconstruction to improve long-term nipple projection. Plast Reconstr Surg 119:1663
21. Garramone CE, Lam B (2007) Use of AlloDerm in primary nipple reconstruction to improve long-term nipple projection. Plast Reconstr Surg 119:1663
22. Glasberg SB, D'Amico RA (2006) Use of regenerative human acellular tissue (AlloDerm) to reconstruct the abdominal wall following pedicle TRAM flap breast reconstruction surgery. Plast Reconstr Surg 118:8
23. Harper JR, McQuillan DJ (2007) A novel regenerative tissue matrix (RTM) technology for connective tissue reconstruction. Wounds 19:163
24. Holton LH, Haerian H, Silverman RP et al (2005) Improving long-term projection in nipple reconstruction using human acellular dermal matrix: an animal model. Ann Plast Surg 55:304–309
25. Holton LH III, Chung T, Silverman RP et al (2007) Comparison of acellular dermal matrix and synthetic mesh for lateral chest wall reconstruction in a rabbit model. Plast Reconstr Surg 119:1238
26. Ibrahim HZ, Kwiatkowski TJ, Montone KT et al (2000) Effects of external beam radiation on the allograft dermal implant. Otolaryngol Head Neck Surg 122:189
27. Jansen LA, Macadam SA (2011) The use of AlloDerm in postmastectomy alloplastic breast reconstruction: part I: a systematic review. Plast Reconstr Surg 127(6):2232–2244
28. Jansen LA, Macadam SA (2011) The use of AlloDerm in postmastectomy alloplastic breast reconstruction: part Il: a cost analysis. Plast Reconstr Surg 127(6):2245–2254
29. Jin J, Rosen MJ, Blatnik J et al (2007) Use of acellular dermal matrix for complicated ventral hernia repair: does technique affect outcomes? J Am Coll Surg 205:654

30. Jones GE, Harper A (2009) Technical advances in breast reconstruction. In: Jones G (ed) Bostwick's plastic and reconstructive breast surgery, 3rd edn. Quality Medical Publishing, St. Louis
31. Liao EC, Breuing KH (2007) Breast mound salvage using vacuum-assisted closure device as bridge to reconstruction with inferolateral AlloDerm hammock. Ann Plast Surg 59:218
32. Livesey S, Herndon D, Hollyoak M et al (1995) Transplanted acellular allograft dermal matrix. Transplantation 60:1
33. Margulies AG, Hochberg J, Kepple J et al (2005) Total skin-sparing mastectomy without preservation of the nipple-areola complex. Am J Surg 190:907
34. Mofid MM, Singh NK (2009) Pocket conversion made easy: a simple technique using AlloDerm to convert subglandular breast implants to the dual-plane position. Aesthet Surg J 29:12
35. Nahabedian MY (2007) Does AlloDerm stretch? Plast Reconstr Surg 120:1276
36. Nahabedian MY (2005) Secondary nipple reconstruction using local flaps and AlloDerm. Plast Reconstr Surg 115:2056
37. Nahabedian MY (2009) AlloDerm performance in the setting of prosthetic breast surgery, infection and irradiation. Plast Reconstr Surg 124(6):1743–1753
38. Otterburn D, Losken A (2009) The use of porcine acellular dermal material for TRAM flap donor-site closure. Plast Reconstr Surg 123:74e
39. Prantl L, Schreml S, Fichtner-Feigl S et al (2007) Clinical and morphological conditions in capsular contracture formed around silicone breast implants. Plast Reconstr Surg 120:275
40. Preminger BA, McCarthy CM, Hu QY, Mehrara BJ, Disa JJ (2008) The influence of AlloDerm on expander dynamics and complications in the setting of immediate tissue expander/implant reconstruction: a matched-cohort study. Ann Plast Surg 60:510
41. Preminger BA, McCarthy CM, Hu QY, Mehrara BJ, Disa JJ (2008) The influence of AlloDerm on expander dynamics and complications in the setting of immediate tissue expander/implant reconstruction: a matched-cohort study. Ann Plast Surg 60:510
42. Salzberg CA (2006) Nonexpansive immediate breast reconstruction using human acellular tissue matrix graft (AlloDerm). Ann Plast Surg 57:1
43. Silverman RP, Singh NK, Li EN et al (2004) Restoring abdominal wall integrity in contaminated tissue-deficient wounds using autologous fascia grafts. Plast Reconstr Surg 113:673
44. Spear SL, Bedford SM (2007) Discussion of Saulis AS, Mustoe TA, Fine NA. A retrospective analysis of patient satisfaction with immediate postmastectomy breast reconstruction: comparison of three common procedures. Plast Reconstr Surg 119:1677
45. Spear SL, Parikh PM, Reisin E et al (2008) Acellular dermis-assisted breast reconstruction. Aesthetic Plast Surg 32:418
46. Topol BM, Dalton EF, Ponn T et al (2008) Immediate single-stage breast reconstruction using implants and human acellular dermal tissue matrix with adjustment of the lower pole of the breast to reduce unwanted lift. Ann Plast Surg 61:494
47. Zienowicz RJ, Karacaoglu E (2007) Implant-based breast reconstruction with allograft. Plast Reconstr Surg 120:373