

Acellular Dermal Matrices in Breast Surgery

A Comprehensive Review

Ahmed M.S. Ibrahim, MD, Olubimpe A. Ayeni, MD, MPH, FRCSC, Kenneth B. Hughes, MD, Bernard T. Lee, MD, Sumner A. Slavin, MD, and Samuel J. Lin, MD

Introduction: Acellular dermal matrices (ADMs) have become increasingly popular for use in plastic surgery. There has been an increase in the number of products that have paralleled their usage in various clinical settings and specifically breast surgery.

Methods: A direct comparison of the most common ADMs used in breast surgery was performed including physical characteristics, level of sterility, maximum load sustained (N), stiffness (N/mm), and tensile strength (N/cm). A comprehensive review of the literature was also performed, detailing known results and complications.

Results: The direct comparison of most common ADMs is detailed along with a review of 26 series of breast reconstruction manuscripts involving the usage of ADMs. Specifically, Strattice and Permacol had the highest values of maximum loads sustained, stiffness, and tensile strength.

Conclusions: ADMs have a role in breast surgery that continues to be defined. Future long-term follow-up remains crucial to the identification of the optimal biologic mesh.

Key Words: acellular dermal matrix, ADM, tissue expander/implant, breast reconstruction, AlloDerm, Strattice, DermaMatrix

(*Ann Plast Surg* 2013;70: 732–738)

Within plastic and reconstructive surgery, the increasing role of acellular dermal matrices (ADMs) is currently being defined for various settings. ADMs became available in the early to mid 1990s and have frequently been used in breast and abdominal wall reconstruction.^{1–6} Since their introduction, the list of indications for ADMs has grown to include burn reconstruction,^{7–10} eyelid reconstruction,^{11–13} hand surgery,^{14,15} lower extremity coverage,¹⁶ and nasal reconstruction.^{17,18} The various types of ADMs differ in their intraoperative preparation, method of storage, and cost.¹⁹

Increased interest in utilizing ADMs for breast surgery has paralleled the introduction of new products. This review quantitatively compares the physical characteristics of the most commonly used ADMs within breast surgery and a review of the literature.

COMMON TYPES OF ADMs

Table 1 outlines commonly used ADMs within breast surgery and their physical characteristics (eg, origin, method of proprietary processing, level of sterility). Figure 1 details the maximum loads (N) sustained by each product, with those of Strattice and Permacol being

the highest. Figure 2 outlines the stiffness (N/mm) of each product, with Strattice and Permacol having the highest stiffness values. Figure 3 outlines a comparison of tensile strengths (N/cm).

AlloDerm

AlloDerm Regenerative Tissue Matrix (LifeCell Corp., Branchburg, NJ) is produced by removing the epidermis and cells from human cadaveric skin; the resultant acellular matrix has reduced antigenicity.^{20,21} As AlloDerm undergoes cell repopulation and revascularization, it is described to incorporate into the host tissue in 4 stages: (1) damaged tissue is targeted by circulating stem cells, (2) stem cells are deposited, (3) stem cells differentiate, and (4) a new matrix is formed from the differentiated cells allowing for tissue regeneration.²² AlloDerm has been described to be partially integrated into the host tissue within 7 days of implantation and increases over a period from 2 weeks to months.²³ AlloDerm does not have terminal sterility.²⁴ Within breast surgery, AlloDerm has been described for postmastectomy breast reconstruction and aesthetic breast procedures.²⁵

Strattice

Strattice Reconstructive Tissue Matrix (LifeCell Corp., Branchburg, NJ) is a sheet of sterile tissue derived from porcine dermis denuded of antigenic cells.²⁶ This proprietary process causes a marked reduction in 1, 3 alpha galactose epitope, a major component of the xenogenic rejection response. This product behaves as a scaffold repopulated and revascularized by the host. Strattice supports tissue regeneration and is used in implant-based breast reconstruction.^{26,27} Strattice does not require rehydration and is ready for use as an onlay or underlay following a 2-minute soak.²⁸ During uniaxial testing of tensile strength in Yucatan minipigs, Strattice demonstrated 128.4 N/cm compared to an AlloDerm score of 84.3 N/cm; the maximum loads sustained were 385.1 N and 253.0 N for Strattice and AlloDerm, respectively (Fig. 1). The stiffness of Strattice was 58.3 N/mm whereas that of AlloDerm was 18.2 N/mm (Fig. 2).²⁹

Strattice is thicker and stronger than AlloDerm. Unlike AlloDerm, Strattice is a terminally sterile product that is available in larger pieces (up to 20–25 cm), potentially minimizing wound dehiscence.^{30,31}

DermaMatrix

DermaMatrix (MTF/Synthes CME, West Chester, PA) is human skin that undergoes removal of the epidermis and dermis in a process utilizing sodium chloride solution. The product is sterile while preserving the original dermal collagen matrix. Once DermaMatrix is transferred to the patient, the collagen matrix is infiltrated by host cells promoting neovascularization and fibroblast deposition. DermaMatrix has advantages of rapid rehydration and bacterial inactivation and does not need refrigeration for storage.^{32–34} Using biomechanical testing, authors found this product to resist an average maximum load of 63.2 N before yielding and to exhibit a tensile strength of 14.6 N/mm² (Fig. 3). The ability of DermaMatrix to oppose deformation was 8.8 MPa compared to other conventional dermal matrices at 5.8 MPa.³²

Received December 13, 2011, and accepted for publication, after revision, January 14, 2012.

From the Division of Plastic Surgery, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, MA.

Conflicts of interest and sources of funding: none declared.

Reprints: Samuel J. Lin, MD, 110 Francis Street Suite 5A, Boston, MA 02215. E-mail: sjlin@bidmc.harvard.edu.

Copyright © 2013 by Lippincott Williams & Wilkins

ISSN: 0148-7043/13/7006-0732

DOI: 10.1097/SAP.0b013e31824b3d30