

The Ray Method: Aesthetic and Simple Technique for Prosthesis Coverage in Prepectoral Breast Reconstruction

Min-Gi Seo, MD
Kyu-Jin Chung, MD, PhD
Jun-Ho Lee, MD, PhD

Summary: In prepectoral breast reconstruction, the acellular dermal matrix (ADM) is commonly used to envelop breast implants. Various wrapping methods have been proposed. We present a simple but aesthetic method (ie, the ray method) for wrapping in prepectoral breast reconstruction. Without any complicated design, we folded the four corners of one large ADM and sewed them together to completely envelop the implant. Then, the 6 o'clock corner of the ADM envelope was folded up and sutured to make a pentagonal shape. The other corners of the ADM envelope were quilted to determine the position and movement of the internal implant. Additional sutures were placed on the ADM envelope to separate the implant from the host tissue. The folded 6 o'clock corner was cut to a convex contour and had a diagonal gap to prevent the collection of fluid in the ADM envelope. Finally, the wrapped implant was inserted in the postmastectomy space, and the ADM envelope was spread widely to support soft tissue effectively. This simple design is straightforward for inexperienced surgeons and reduces operation time. The position and movement of the breast implant in the ADM envelope can be easily controlled by using quilted sutures. Subclavian depression and step-off deformities can be minimized by this wide-stretched ADM. By total coverage with a large ADM, the breast implant is separated from the surrounding tissue, and foreign body reactions are reduced. This method is reliable for maximizing the aesthetic advantages of prepectoral direct-to-implant breast reconstruction. (*Plast Reconstr Surg Glob Open* 2024; 12:e5835; doi: [10.1097/GOX.0000000000005835](https://doi.org/10.1097/GOX.0000000000005835); Published online 1 July 2024.)

INTRODUCTION

Implant-based breast reconstruction is the most commonly performed reconstructive surgery after mastectomy. Historically, subpectoral implant placement was predominant, using the surrounding soft tissue to envelop the implant.¹ However, because of the risk of animation deformity during subpectoral implant placement, a new technique to place breast implants with acellular dermal matrix (ADM) in the original anatomical location within the prepectoral space has emerged.² The implant wrapped with the ADM is placed above the pectoralis major in the anatomic space previously occupied by the

breast parenchyma.³ Over time, surgeons have developed various methods to wrap the implant with ADM, each with its unique benefits.^{4,5} We also devised an easy ADM wrapping method without the complicated design process used in previously presented methods. This method can maximize aesthetic advantages by covering the postmastectomy space, which may not be covered in the other methods.

SURGICAL TECHNIQUE

We conduct implant wrapping with one large, thick ADM. We mainly use a single square-shaped ADM without a slit incision. It depends on the volume of the resected breast parenchyma, but most sheets are 16 × 16 cm² or larger and 2- to 3-mm thick. Before use, we wash the ADM with normal saline and a 0.5% diluted povidone-iodine solution carefully to remove the residues and preservatives. Minimal slit incisions are made, and the cleaned

From the Department of Plastic and Reconstructive Surgery, College of Medicine, Yeungnam University, Daegu Republic of Korea.

Received for publication January 8, 2024; accepted April 4, 2024.

Presented at Aesthetic Plastic Surgery (APS) 2022, Seoul, Korea.

Copyright © 2024 The Authors. Published by Wolters Kluwer Health, Inc. on behalf of The American Society of Plastic Surgeons. This is an open-access article distributed under the terms of the [Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 \(CCBY-NC-ND\)](https://creativecommons.org/licenses/by-nc-nd/4.0/), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

DOI: [10.1097/GOX.0000000000005835](https://doi.org/10.1097/GOX.0000000000005835)

Disclosure statements are at the end of this article, following the correspondence information.

Related Digital Media are available in the full-text version of the article on www.PRSGlobalOpen.com.

ADM is placed with its epidermal layer of ADM facing the implant. We fold the four corners of the ADM and sew them together to completely envelop the implant. Then, the 6 o'clock corner of the ADM envelope is folded and sutured to make a pentagonal shape 3-0 Monocryl (Ethicon, Inc., Somerville, N.J.). The other 3 o'clock, 9 o'clock, and 12 o'clock corners of the ADM envelope are quilted to determine the position and movement of the internal implant. Additional sutures are placed on the ADM envelope to enclose the implant. The folded 6 o'clock corner is cut to a convex contour and has two diagonal gaps. When the ADM envelope is naturally lowered by gravity, the overall shape of the ADM envelope becomes a pentagon with an elongated 12 o'clock corner, resembling a ray with a long tail. Therefore, we name this ADM wrapping technique the ray method. This pentagonal ADM envelope can reproduce the natural ptotic breast shape by gravity. In addition, the convex 6 o'clock corner of the ADM envelope can create a natural round inframammary fold.

Finally, the wrapped implant is inserted in the postmastectomy space, and the ADM envelope is spread widely. This wide-stretched ADM envelope fills the space previously occupied by the breast parenchyma and provides an additional volume. It has the advantage of being able to sufficiently reinforce soft-tissue defects after mastectomy. The additional ADM envelopes surrounding the breast implant can serve as a suturing point on the chest wall with 1-0 polyglactin 910 (Vicryl; Ethicon, Somerville, N.J.). (See figure, **Supplemental Digital Content 1**, which shows how the acellular dermal matrix envelope is spread out to fill the postmastectomy space effectively and provides an additional volume previously occupied by the breast parenchyma, and the additional acellular dermal matrix envelopes surrounding the breast implant can serve as a suturing point on the chest wall. <http://links.lww.com/PRSGO/D217>.) Surgeons can easily determine the position of the breast to be reconstructed by fixing the ADM envelope to the upper, medial, or lateral chest wall. [See **Video 1 (online)**, which demonstrates each stage of the ray method.]

DISCUSSION

Using the ray method, the creation of the ex vivo ADM envelope is performed quickly without complicated designs or many sutures, thereby avoiding delays in surgery. In addition, simultaneously, the assistant doctor can perform hemostasis, irrigation, skin assessment, and drainage tube insertion inside the postmastectomy space.⁶

The wide-stretched ADM envelope supports a cavity that is difficult to fill with the implant alone. By suturing this extra ADM envelope to the chest wall, the operator can easily position the ADM envelope where more soft-tissue support is needed and prevent unexpected migration of the breast implant. In prepectoral direct-to-implant breast reconstruction, a step-off deformity and depression of the subclavian regions may occur.⁷ Our wide-stretched ADM envelope has a gentle slope that effectively covers the edges of the implant, minimizing the risk of step-off deformity. Moreover, the elongated 12 o'clock corner of

Takeaways

Question: How can a simple yet aesthetic breast be achieved in prepectoral breast reconstruction?

Findings: The study highlighted the ray method, a simple, aesthetic technique in which a large acellular dermal matrix is folded at its corners and sewn to completely cover the implant, creating a pentagonal shape. This method allows for precise control over the implant's position and is effective in replicating a natural breast appearance.

Meaning: The ray method offers a straightforward, effective strategy for enhancing aesthetic outcomes in prepectoral breast reconstruction by wrapping implants in acellular dermal matrix, simplifying the procedure for surgeons and reducing operation time.

the ADM envelope provides sufficient support for the depression of the upper pole of the breast or the subclavian area (Fig. 1). The 2- to 3-mm thick ADM envelope also serves to prevent the direct exposure of the implant just beneath the skin, which can reduce the risk of implant rippling. Inside a separated cavity created by the ADM envelope, the implant can float and move freely. This mimics the natural movement of the breast. The range of motion and the position of the implant inserted into the body can be easily adjusted by quilted sutures. These advantages of the ray method may reproduce the aesthetically pleasing shape and movement of the reconstructed breast with high postoperative patient satisfaction (Fig. 2).

In our method, a single large ADM completely encases the implant, thereby eliminating direct contact between the implant and the surrounding host tissue. This can potentially lower the probability of foreign body reactions and capsular contracture.⁸ Based on the author's experience, implants up to a maximum size of 350cm³ could be completely covered using a single piece of ADM. However, the total coverage of the implant by nonfenestrated ADM may cause overlapped folds and bunching, increasing the risk of postoperative fluid accumulation.⁹ To address this concern,

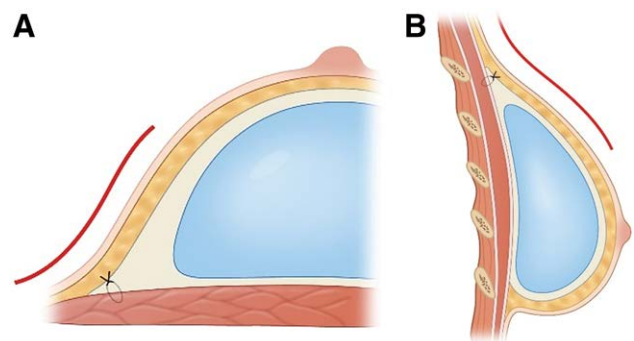


Fig. 1. Coronal and sagittal views. A, Coronal view: the wide-stretched ADM envelope has a gentle slope that covers the blunt edges of the implant and minimizes step-off deformity. B, Sagittal view: the elongated 12 o'clock corner of the ADM envelope can sufficiently support the depression of the upper pole of the breast or the subclavian area.

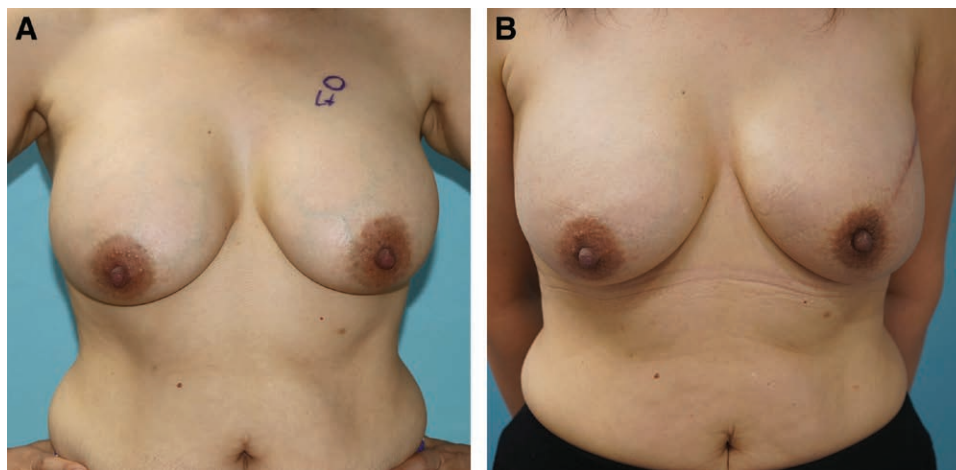


Fig. 2. A 50-year-old patient underwent left breast reconstruction with the breast implant wrapped in ADM using the ray method. A, Preoperative clinical photograph. B, Postoperative clinical photograph at 7 months. The reconstructed breast reproduces the natural ptotic breast shape symmetrically with the contralateral side. The upper pole of the left breast has sufficient fullness, like the opposite nonoperated breast.

several slit incisions were performed in the ADM envelope, and two drainage tubes were inserted during the surgery. One was placed through diagonal gaps into the inner ADM envelope, whereas the other was positioned in the postmastectomy space outside the ADM envelope. Between January 2020 and December 2022, seroma occurred in 13 (7.6%) out of a total of 171 patients. Additional long-term follow-up and research are necessary to discuss other complications and the long-term safety of this method.

Jun-Ho Lee, MD, PhD

170, Hyeonchung-ro
Nam-gu, Daegu 42415
Republic of Korea

E-mail: junojunho@gmail.com

DISCLOSURES

The authors have no financial interest to declare in relation to the content of this article. This study was supported by research grants from Yeungnam University.

ETHICAL APPROVAL

This study was conducted in accordance with the Declaration of Helsinki and approved by the institutional review board of Yeungnam University Hospital (No. 2022-03-034: the registration number of the ethics board).

REFERENCES

1. Janhofer DE, Economides JM, Song DH. The suture tab technique: securing implant position in prepectoral breast reconstruction. *Plast Reconstr Surg Glob Open.* 2018;6:e2005.
2. Lee JS, Kim JS, Lee JH, et al. Prepectoral breast reconstruction with complete implant coverage using double-crossed acellular dermal matrix. *Gland Surg.* 2019;8:748–757.
3. Sbitany H. Important considerations for performing Prepectoral breast reconstruction. *Plast Reconstr Surg.* 2017;140(6S Prepectoral Breast Reconstruction):7S–13S.
4. Hill EJR, Buck DW, II. The “butterfly” wrap: a simplified technique for consistent prosthesis coverage in prepectoral breast reconstruction. *Plast Reconstr Surg Glob Open.* 2018;e2007.
5. Liliav B, Patel P, Jacobson AK. Prepectoral breast reconstruction: a technical algorithm. *Plast Reconstr Surg Glob Open.* 2019;7:e2107.
6. Sigalove S. Options in acellular dermal matrix-device assembly. *Plast Reconstr Surg.* 2017;140:39S–42S.
7. Maxwell GP, Gabriel A. Bioengineered breast: concept, technique, and preliminary results. *Plast Reconstr Surg.* 2016;137:415–421.
8. Leong M, Basu CB, Hicks MJ. Further evidence that human acellular dermal matrix decreases inflammatory markers of capsule formation in implant-based breast reconstruction. *Aesthet Surg J.* 2015;35:40–47.
9. Palaia DA, Arthur KS, Cahan AC, et al. Incidence of seromas and infections using fenestrated versus nonfenestrated acellular dermal matrix in breast reconstructions. *Plast Reconstr Surg Glob Open.* 2015;3:e569.