

# A High-biocompatibility Interface for the Breast Implant: First Report of a Novel Biological Matrix–assisted Technique in Aesthetic Revision Surgery

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**Summary:** Development of human-compatible tissues is an active field of research that is leading to the production of optimized biological scaffolds to support regenerative medicine. Xenogenic acellular matrices are known to have strongly influenced the field of breast surgery, playing an integral role in wound healing and in preventing the foreign body reaction to silicone implants. Here, we present our experience in using a biological matrix for aesthetic revision surgery with malposition and severe capsular contracture. Revisions were performed using the new MASQUE equine acellular-pericardium-matrix (APM) as an anterior cover for the synthetic prosthesis. Acting as an internal support, the thin APM layer provides a biological and biocompatible interface between the synthetic implant and living tissues, exerting a protective function against fibrotic responses and capsular contracture. The role of an APM in matrix-assisted mammoplasty has yet to be fully established. Our early experience of APM-assisted aesthetic revision surgery shows promising results, laying the foundations for equine biological matrices as a valid tool for the management of capsular contracture-susceptible patients. (*Plast Reconstr Surg Glob Open* 2024; 12:e5628; doi: [10.1097/GOX.0000000000005628](https://doi.org/10.1097/GOX.0000000000005628); Published online 26 February 2024.)

## INTRODUCTION

Over the last decades, breast plastic surgery has undergone a truly remarkable evolution, taking advantage of enhanced procedures and biomaterials.<sup>1</sup> Seeking to overcome the implant-related fibrotic reaction of susceptible patients, innovative revision surgery has been attempted using biological decellularized scaffolds, widely recognized to guide regenerative healing.<sup>1,2</sup> Decellularized materials faithfully reproduce extracellular matrix (ECM) structure and bioactive components of human tissues, providing an essential scaffold for the cellular elements required for tissue regeneration and homeostasis.<sup>2-4</sup> These ECM-biomimetic materials may therefore enhance soft-tissue healing, providing support and reducing implant-related complication such as malposition and fibrotic reactions.<sup>1,3,4</sup>

Surgery-indicated decellularized scaffolds can be obtained from a variety of sources, either allogenic or xenogeneic (such as porcine, equine, bovine).<sup>3,4</sup> For example, dermis-derived materials known as acellular

dermal matrices (ADMs) have been effectively used for the repair of a variety of tissues, with excellent results in the field of breast reconstruction, where they are proven to guide a highly coordinated regenerative healing.<sup>4</sup> The antiinflammatory nature and capsular contracture preventive properties of ADMs are also demonstrated, even in the long term.<sup>5,6</sup> Unfortunately, due to high production costs, these dermal materials struggle to enter routine use in aesthetic surgery, leaving a gap for tissue engineering advancements in this specific field.<sup>7</sup>

Here, we present a new breast implant revision surgery technique with the innovative equine acellular-pericardium-matrix (APM) MASQUE as a cost-effective option to handle implant malposition and treat patients who display fibrotic susceptibility issues after breast augmentation. As an acellular matrix, MASQUE retains all the ECM-scaffold bioactive properties, but given the widespread know-how in the production of pericardium devices, the resulting membranes can have a lower final cost. To the best of our knowledge, this is the first report on breast augmentation revision surgery with the use of an equine APM.

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## PATIENTS AND METHODS

Between May 2021 and March 2022, four patients who underwent previous breast augmentation surgery presented to our clinic with implant malposition and painful Baker IV capsular contracture. Except for one bilateral case [See Video (online), which displays pre- and postoperative photographs of a bilateral revision for severe capsular contracture (Baker IV) on the left breast and for implant rupture on the right breast], all the remaining were unilateral capsular contractures, for a total of five submuscular implants that were treated with capsulotomy or capsulectomy depending on the thickness and level of contracture of the fibrotic capsule. In line with the current scientific evidence, tranexamic acid was perioperatively administered to achieve reduced risk of hematoma and blood loss.<sup>8</sup> Three capsulotomies and two capsulectomies were performed to reposition a new implant on the same submuscular surgical plane. The revision was performed on the surgical access made at primary surgery in all cases at the inframammary fold level. Medium follow-up is 16 months.

## Takeaways

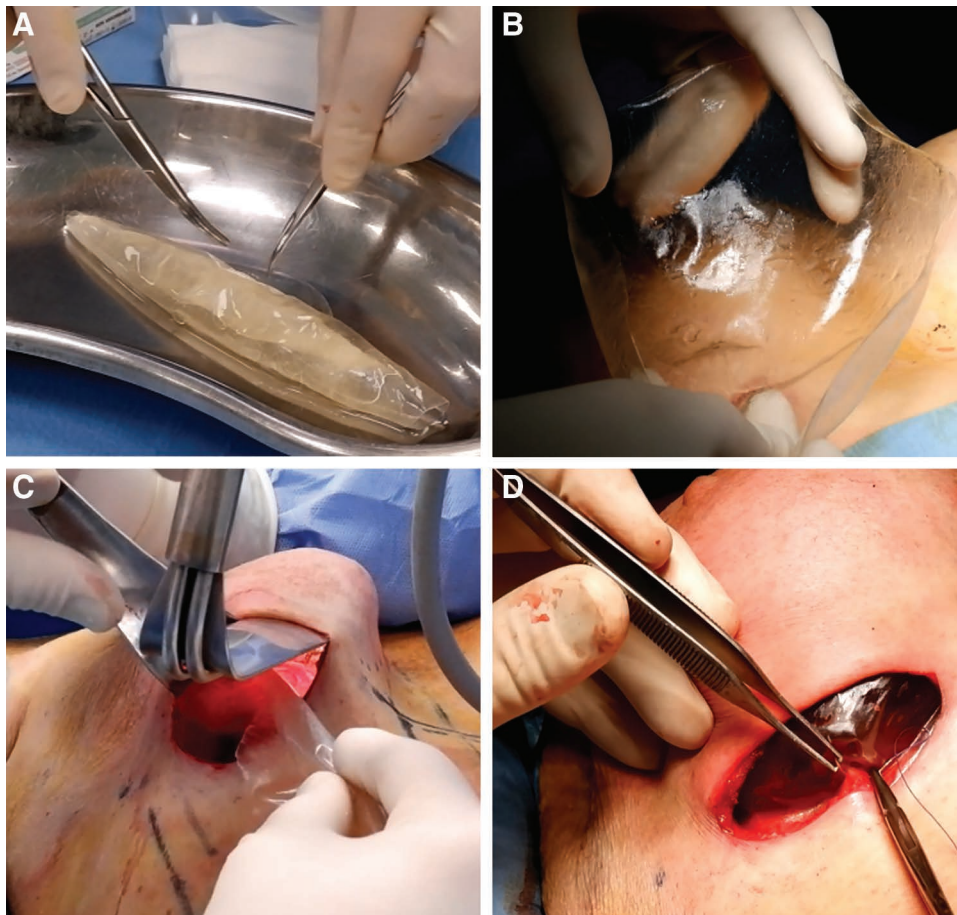
**Question:** How can we manage pocket revision in aesthetic breast surgery for women prone to fibrotic reactions?

**Findings:** A dome-shaped collagen acellular-pericardium-matrix is used here in a novel technique to treat five breasts with implant malposition and painful Baker IV capsular contracture. No complication was encountered, and aesthetic results were satisfactory.

**Meaning:** By covering the prosthesis, the acellular-pericardium-matrix acts as an internal support and provides a biological interface between the synthetic implant and impaired tissues, ameliorating the conditions of women prone to fibrosis.

## SURGICAL TECHNIQUE

All revision procedures were performed using MASQUE pericardium matrix. MASQUE is a deantigenated equine collagen device that presents itself as a membrane rolled up in the form of a cigar (Fig. 1A). In its unfolded conformation, MASQUE looks like a dome-shaped membrane



**Fig. 1.** Surgical steps of APM implantation. A, MASQUE hydration: visible preshaped cigar form. B, Unfolded and hydrated MASQUE: dome-shaped membrane. C, MASQUE easy pocket insertion in its cigar-shaped conformation. D, MASQUE correctly positioned to cover the prosthesis anteriorly without folds or redundancies.

designed to cover the anterior surface of the silicone prosthesis (Fig. 1B). The surgical technique has been optimized to allow for a rapid and effective use of the device, in accordance with the manufacturer instructions. Before positioning the silicone implant, the MASQUE membrane is hydrated in saline solution (Fig. 1A), inserted in its rolled-up conformation (Fig. 1C), and fixed medially to the pocket, with at least three detached sutures. Once fixed, the thin layer is then unrolled into the breast chamber. The membrane is thus uplifted using a retractor, to allow the insertion of the silicone prosthesis. Once inside the breast pocket, the prosthesis is covered anteriorly by the unfolded biological membrane. MASQUE is finally sutured with additional stitches at the inframammary fold level on the lateral pole, to create a complete coverage of the implant without folds or redundancies (Fig. 1D).

Sutures are essential to connect the ECM membrane to vital tissues, thus promoting the revascularization of the matrix and its regenerative effect. Furthermore, membrane fixation provides internal support, allowing for improving prosthesis stability and positioning, thus achieving greater pocket control against implant malposition. After skin closure, a light dressing and a supportive bra were always applied.

All procedures were successful. A video of the main steps of the surgical technique is also provided. [See Video (online)].

## DISCUSSION

The need to overcome implant-related fibrotic reaction in susceptible patients has led to the search for biological cost-effective biomaterials.<sup>2,4,8</sup> This is a particularly thorny challenge in the field of aesthetic plastic surgery, where biomaterials, despite their proven functionality, struggle to enter aesthetic surgical practice because of restrictive prices.<sup>7</sup> On these premises, the push for disposing of biological materials with lower production costs that still retain the regenerative properties of biological ECM-scaffolds, was strong and led to pericardium-based membranes production.<sup>3,4,7</sup> Pericardium-based membranes are an excellent option to fulfil this gap, given the simpler processing steps that justify lower prices.<sup>7</sup> As a matter of fact, we can confirm that for our center the price of the device used in this work is comparable to that of synthetic meshes.

Although bovine-derived APMs have already been explored primarily in breast reconstructive surgery,<sup>9</sup> equine-derived is of more recent surgical breast application.<sup>7</sup> According to a 2021 study, equine pericardium is considered thinner, easier to handle and remodel in proper shape than bovine pericardium.<sup>10</sup> In fact, Berna et al have discussed equine pericardium as attractive for breast surgery, given the superior strength of equine pericardial collagen fibers arranged in such a thin layer, excellent for obtaining regenerative implants with minimal thickness.<sup>7</sup> Compactness of APM collagen fibers guides a gradual remodeling process that makes bioactive physiological components available, modulating angiogenesis, cell proliferation and orientation in regenerative healing.<sup>4,7</sup> Such regenerative properties have been extensively documented for several collagen-based implantable materials.<sup>4,9</sup>

Yet, device-to-device differences may occur, and additional histologies will be useful to further characterize MASQUE performances. In our preliminary report, no significant complication emerged with the use of the MASQUE APM, and aesthetic results were satisfactory. Nevertheless, the duration of our follow-up is limiting for definitive considerations on capsular contracture, which may occur over several years. As far as our results show, with the development and optimization of our technique, MASQUE seems to be a valid ECM-based surgical device, with the potential to provide excellent internal support against malposition and protection against early capsular contracture. Further studies are needed to confirm long-term outcomes.

## CONCLUSIONS

Equine APM is here analyzed as a new tool in breast aesthetic revision surgery to treat malposition and fibrotic predispositions. No significant complications were encountered, and aesthetic results were satisfactory at a mean follow-up of 16 months. Longer follow-up and deeper investigations into the biological mechanisms of the new APM are required to confirm this early evidence.

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## DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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