



Assessing Cellular Integration Into Double Layer Acellular Dermal Matrix Constructs: Impact Of Orientation And Native Perforations

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Background

Acellular Dermal Matrix

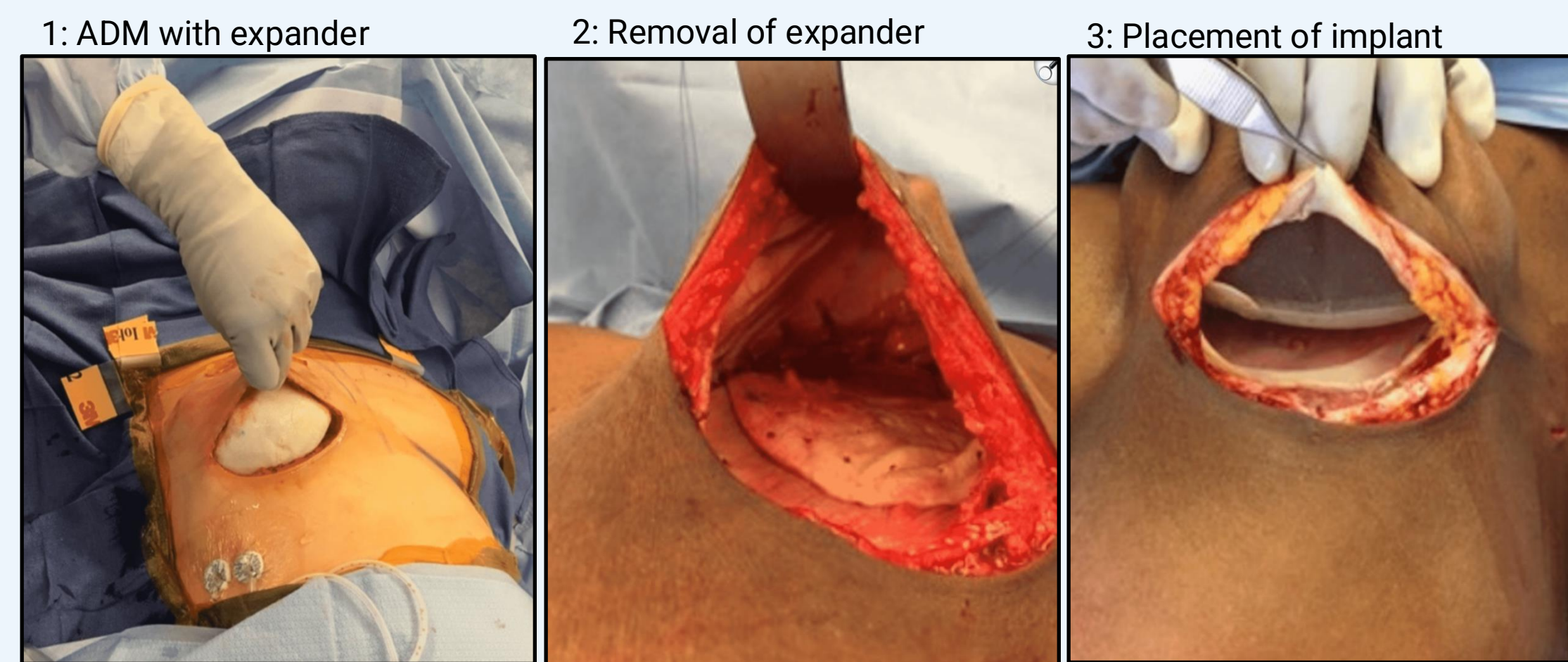
An **acellular dermal matrix (ADM)** is a biologic scaffold derived from cadaveric human skin that has been processed to remove cells while preserving the structural proteins. It provides soft tissue support, promotes vascular ingrowth, and integrates with host tissue.



ADM is widely used in breast reconstruction to reinforce the implant pocket, provide soft tissue coverage, and improve cosmetic outcomes by reducing implant visibility, palpability, and complications like rippling or malposition.

Current ADM Use

ADM in Two-Stage Breast Reconstruction

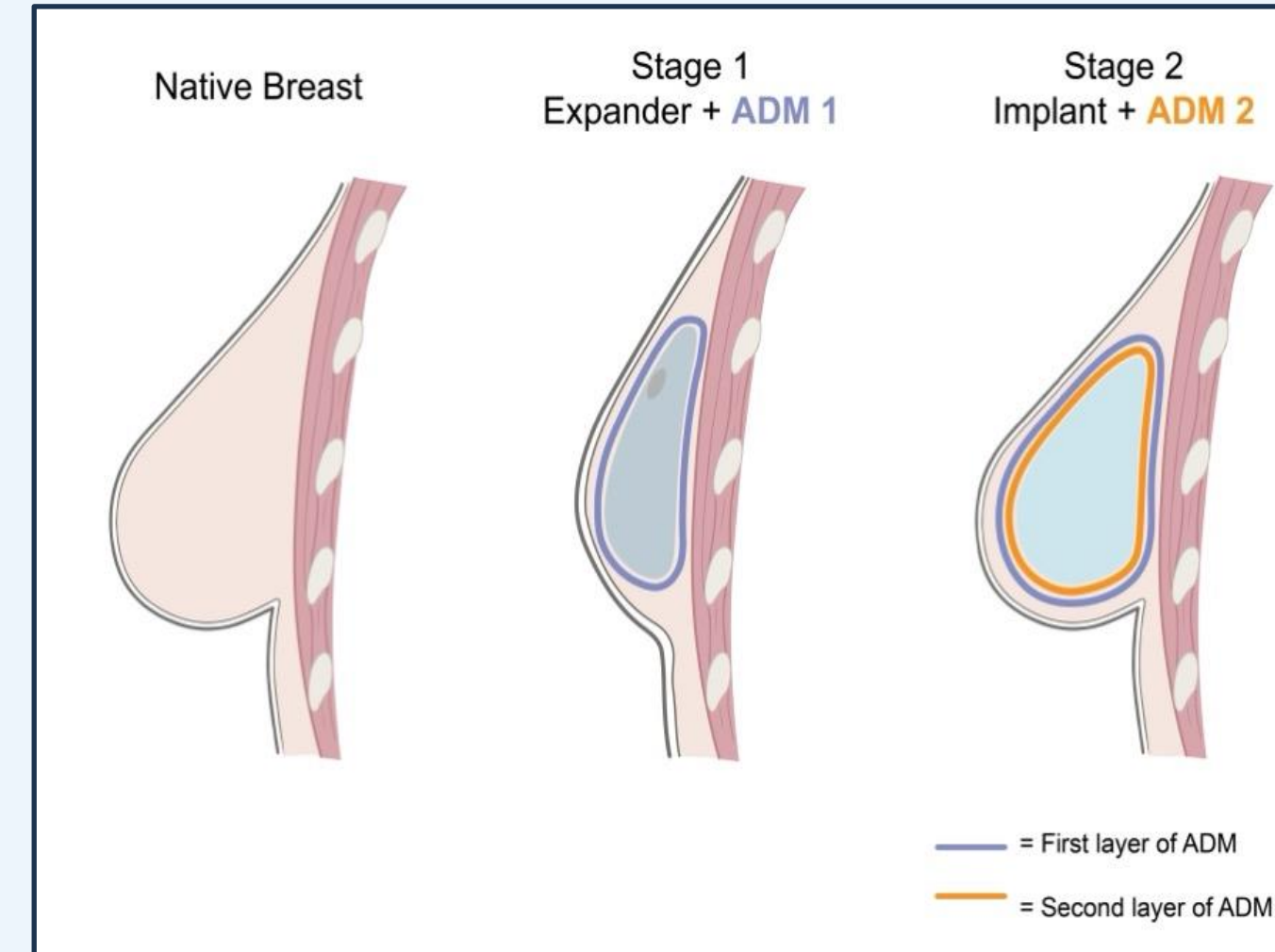


Novel Technique Stacked ADM

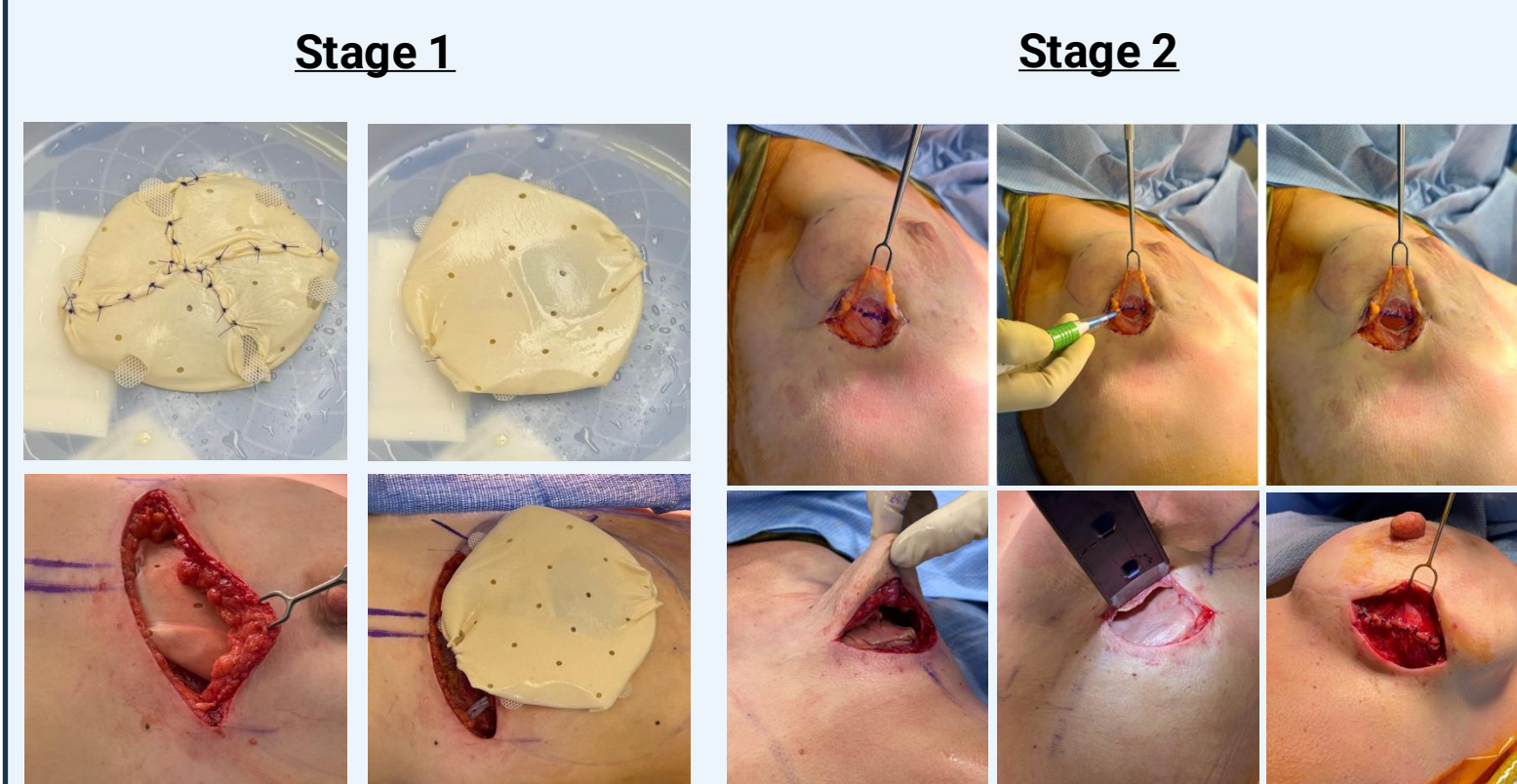
Stage 1: Tissue expander wrapped with ADM and placed in breast pocket

Stage 2: Final implant also wrapped with ADM, creating a stacked construct

- Benefits:**
- Greater soft tissue support and camouflage
 - Reduced implant visibility/rippling
 - Ability to use smaller implants



Novel Technique in Action



Prior Study: Clinical Data

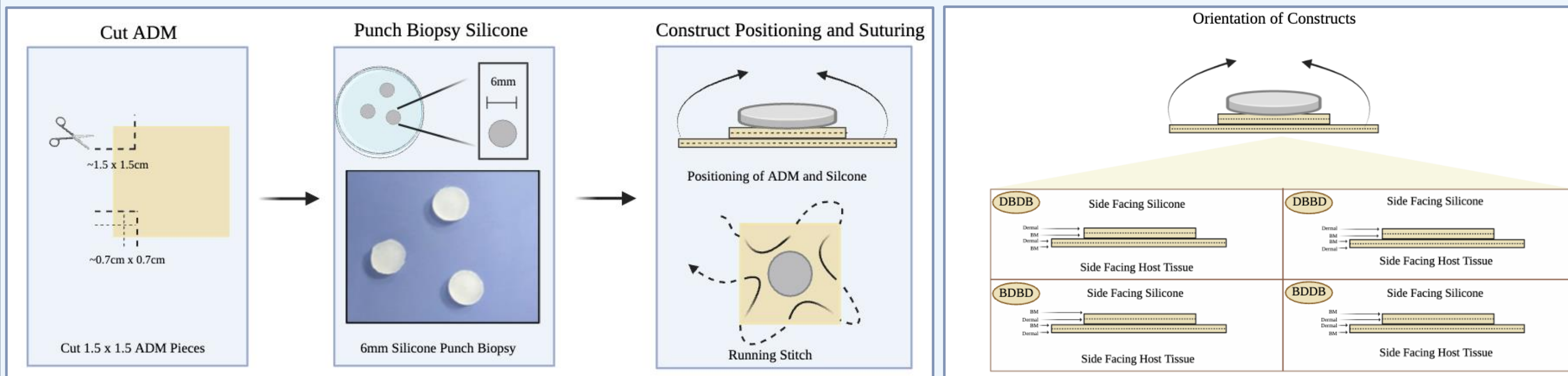
- **Patient Cohort:** (n=19, July 2020–May 2024)
- **Mean age:** 46 years
- **Mean BMI:** 21.6 kg/m²
- **Implant position:** Pre-pectoral 17, Subpectoral 2
- **Avg. interval between stages:** 180 days
- **Avg. follow-up:** 10.8 months
- **Complications:** No reoperations, readmissions, or major intra/post-op complications

Objective

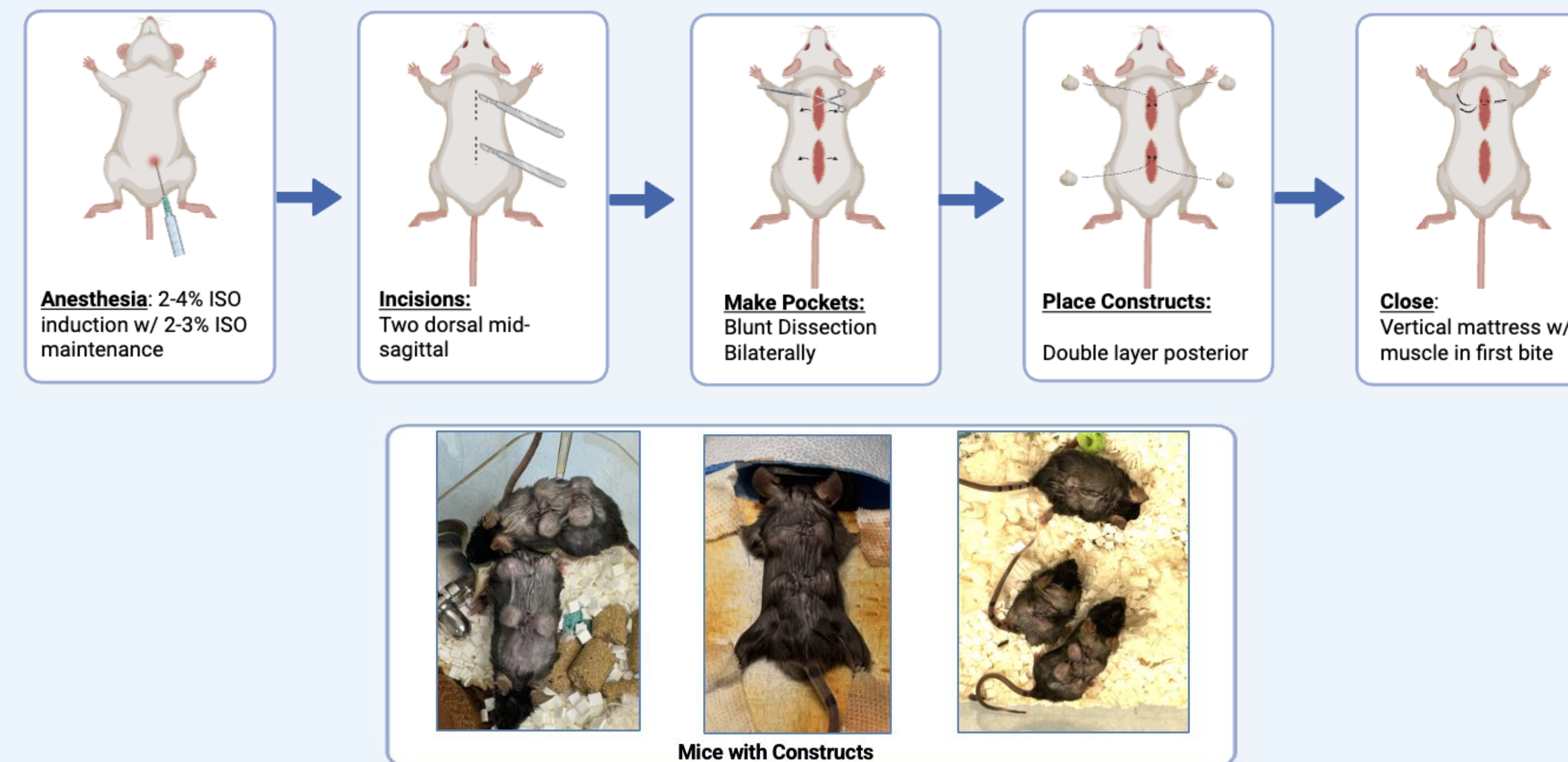
Evaluate the incorporation and vascular ingrowth of a second acellular dermal matrix (ADM) layer in a subcutaneous murine model through histological analysis, with the goal of characterizing cellular infiltration, neovascularization, and integration patterns over time.

Methods

Construct Creation



Surgery



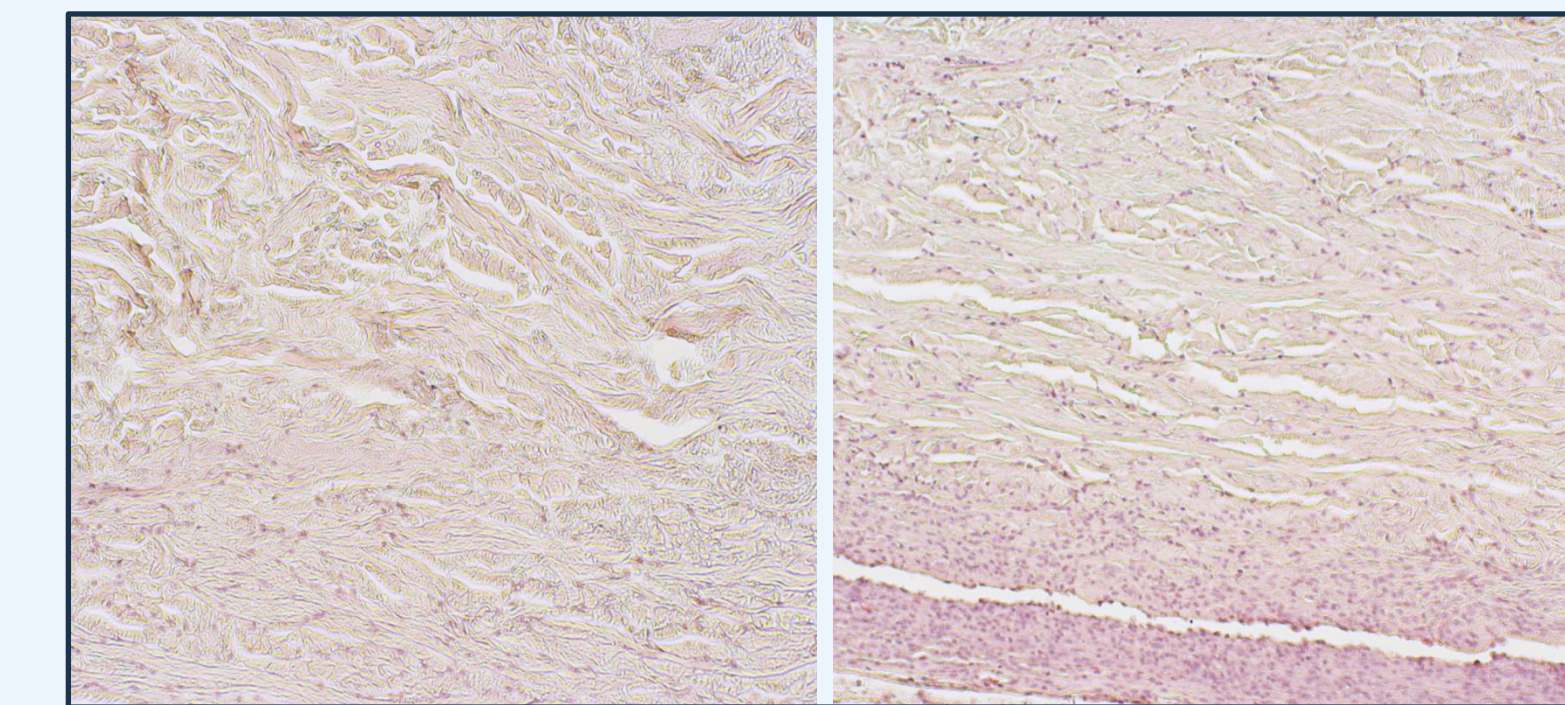
Staining



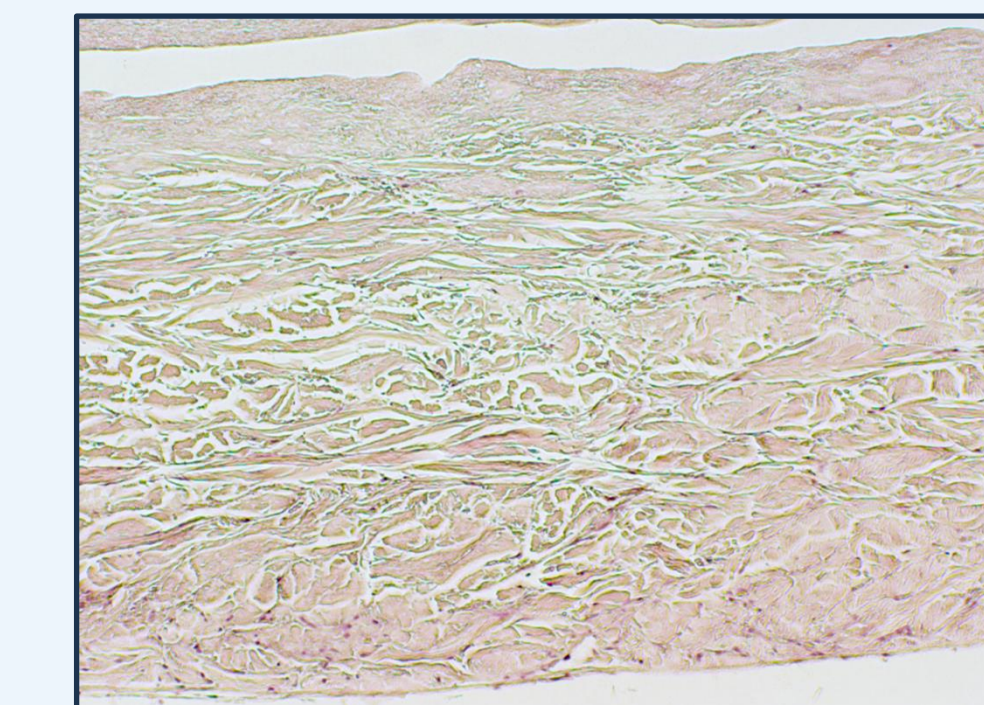
Results

The Effect of ADM Orientation Cellular Infiltration in Double Layer ADM Constructs

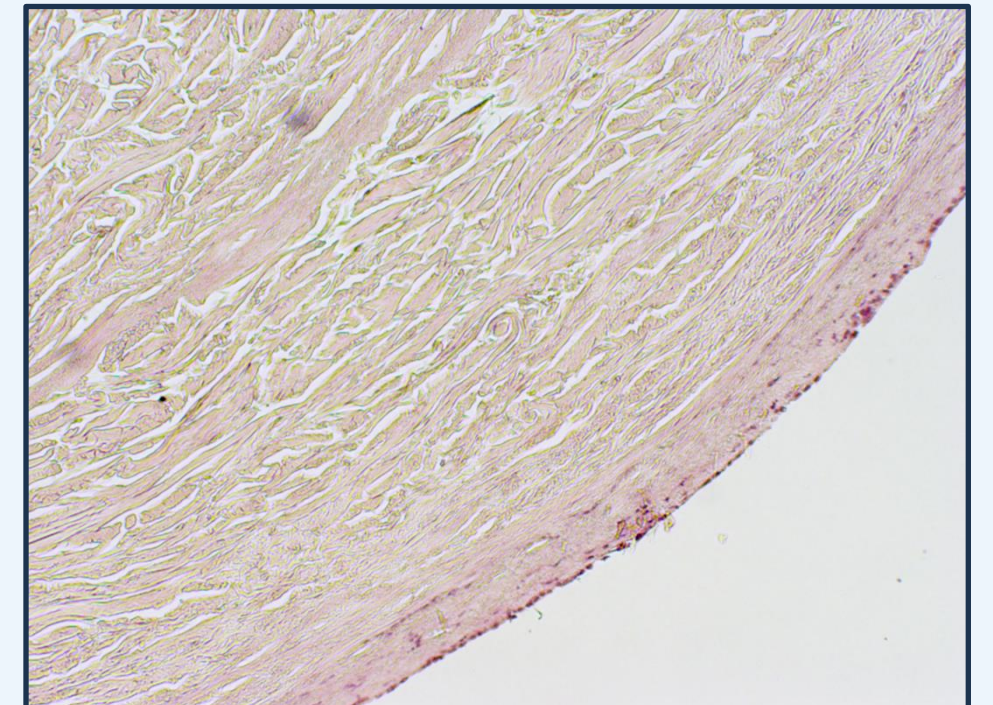
Double Layer
Orientation: BM → D → D → BM



Double Layer
Orientation: D → BM → BM → D



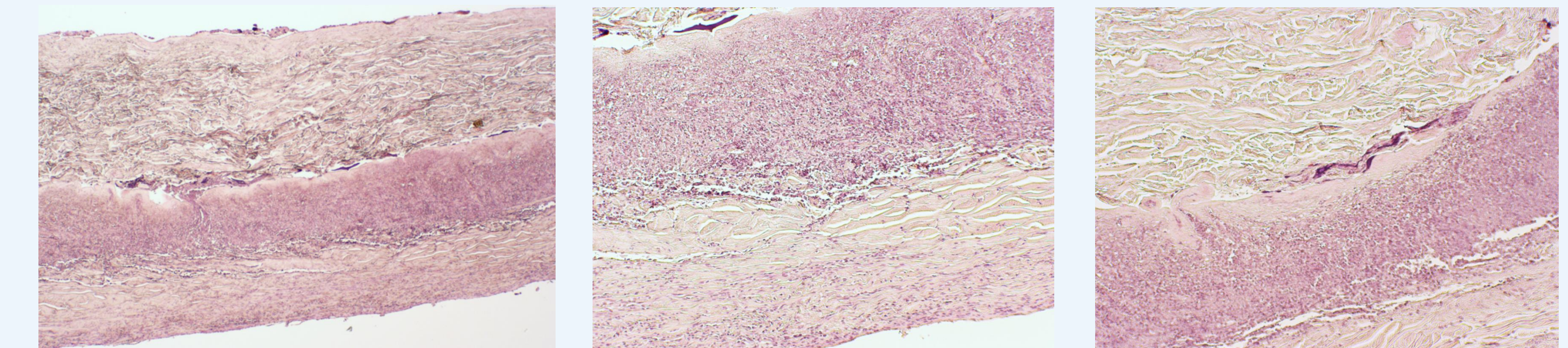
Double Layer
Orientation: D → BM → D → BM



The Effect of Perforations on Cellular Infiltration in Double-Layer ADM Constructs

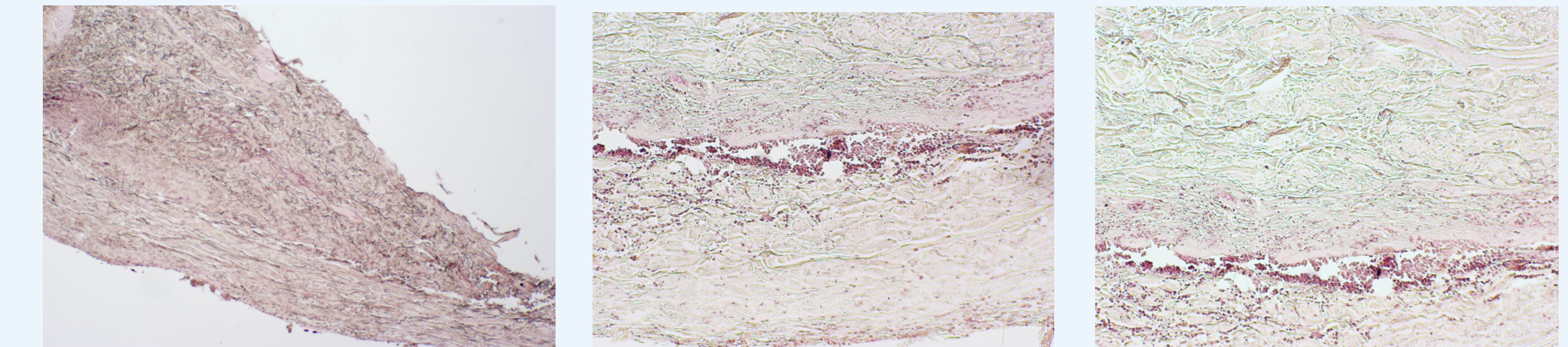
Double Layer Construct

Orientation: Basement membrane → Dermal → Basement membrane → Dermal (no hole)



Double Layer Construct

Orientation: Basement membrane → Dermal → Basement membrane → Dermal (With hole)



Conclusion and Future Direction

Conclusion:

Stacked ADM permits cellular integration into a second layer, demonstrating that infiltration is not limited to a single interface. Infiltration was strongly orientation-dependent, with greatest cell penetration occurring when cells were able to traverse the initial basement membrane (e.g., BM → D → D → BM, BM → D → BM → D).

Perforations in the outer layer significantly enhanced cellular migration into deeper layers. These findings highlight the importance of ADM orientation and construct design, and suggest a potential role for stacked ADM in improving integration in breast reconstruction

Future Direction

1) Perform Immunohistochemistry

- iNOS: M1 Macrophage
- CD163: M2 Macrophage
- FSP-1 : Fibroblast
- CD31 (PECAM): Endothelial cells
- α-SMA : myofibroblasts

2) Quantify Cellular infiltration on HE and IHC