Impact of Stem Cell Seeding on Acute Mesh Response - Application of a Novel Method to Female Pelvic Surgery

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Objective

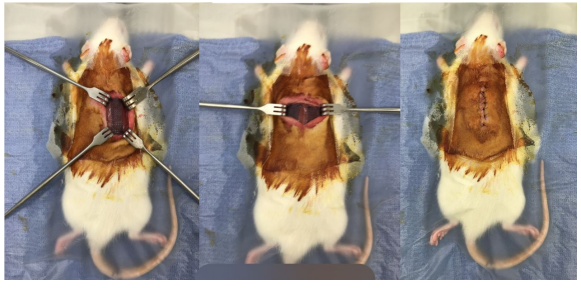
Studies on explanted mesh demonstrated that adverse outcomes may be associated with an acute inflammatory response that impacts mesh integration.[1-3]

Recent literature shows that **seeding mesh with stem cells may benefit local tissue healing and decrease acute inflammatory response**.[4-5] There are no prior studies applying this to the mesh used in female pelvic surgery.

We hypothesized that stem cell seeding of mesh would **enhance biocompatibility and result in decreased contracture and stiffness** at the point of explant.

Methods

- Polypropylene mesh swatches were dip coated with porcine gelatin.
- 24 swatches were seeded with rat adipose stem cells at a density of 5 x 10^5 cells/cm^2, and 24 were left unseeded.
- After 20 hours of culture swatches were implanted into the dorsal subcutaneous tissue of 24 Sprague Dawley rats.



- Each animal received either two stem cell seeded or two unseeded meshes.
- Two additional rats received sham operations.
- Rats received standard postoperative care and were sacrificed at one week.
- Explanted mesh was measured with calipers and mesh contraction calculated, in addition to rat weight gain.
- Biomechanical testing of mesh explants was performed using an Instron.
- Outcomes were compared between stem cell seeded mesh and unseeded mesh using an unpaired student's t-test.

Results

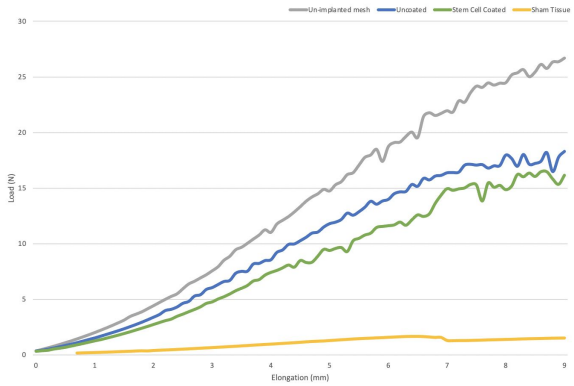
Rats in both conditions recovered well and had normal postoperative weight gain (Stem cell 14.7g, Unseeded 12.4g, p= 0.58).

Mesh stiffness at explant was significantly decreased in the stem cell seeded condition (Stem cell 1.53 N/mm, Unseeded 1.26 N/mm, p=0.036).

Explant stiffness is indicated by the slope of the curves shown in Figure 1. Explants from the stem cell coated condition demonstrate significantly less mechanical stiffness, and this curve can be seen to have a lower slope.

Mesh contracture at explant had a **trend towards less contracture in the stem cell seeded condition** (Stem cell 3.83%, Unseeded 4.27%, p=0.60).

Figure 1. Biomechanical Properties of Explanted Mesh Types and Controls at Week 1



Conclusion

Our study is the first to demonstrate in vivo testing of the impact of stem cell seeding of the polypropylene mesh used in female pelvic surgery. In the acute phase of healing, **stem cell seeding of polypropylene mesh is associated with a significant decrease in mechanical stiffness of mesh**, and there is a trend towards decreased contracture of mesh. This suggests **stem cell seeding of polypropylene mesh may enhance biocompatibility.**

We are currently investigating the impact of stem cell coating of mesh on acute inflammation in a rat model, by evaluating how stem cells impact macrophage response.

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