In vitro Characterization of Mesenchymal Stem Cells
Minna Chen¹, Lee A. Meier², Zeeshan Syedain², and Robert T. Tranquillo¹,²
Departments of Chemical Engineering and Materials Science¹ and Biomedical Engineering²
University of Minnesota- Twin Cities, Undergraduate Research Opportunities Program

Motivation

→ Over 300,000 coronary artery bypass graft surgeries are performed each year

http://www.nhlbi.nih.gov

→ Tissue engineered vascular grafts (TEVG) are a viable alternative to native blood vessels

http://www.nlm.nih.gov/medlineplus

Artery anatomy

→ An intact layer of endothelial cells reduces clotting on the luminal surface

To reduce possibility of an immune response

→ Remove cellular material (decellularize)

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Graft Fabrication

Cell Seeding

i. Decellularized TEVGs

ii. Cut longitudinally, open to expose lumen

iii. Embed tissue in insert using agarose

→ Coat tissue with fibronectin for 4 hours at 37°C

→ Ovine mesenchymal stem cells seeded at 2.5 million cells/mL (0.5 mL per embedded sample)

Applied Fluid Shear Stress

F = \frac{6\mu Q}{h^2 W}

→ Ramped to physiological shear stress (12 dyn/cm² or 29 mL/min)

→ Applied for 48 hours

Results

oMSC coverage - Static vs Flow

Static

oMSC

Post-flow

0%

10%

20%

30%

40%

50%

60%

70%

80%

90%

100%

110%

120%

130%

140%

150%

160%

Static

Platelets

Pos Ctrl

Neg Ctrl

Static

Post-flow

Platelets

Pos Ctrl

Neg Ctrl

Static

Post-flow

Sigmoid difference (p=0.002) in platelet adhesion between static and flow samples

Conclusion

→ oMSCs are retained after 48 hours of constant applied fluid shear stress

→ Platelet adhesion of oMSCs seeded on decellularized tissue decreases after samples are exposed to fluid shear stress

Future Work

→ Continue to verify functional endothelial phenotype

→ Compare immunogenicity of mesenchymal stem cells and endothelial cells

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