Abstract Submitted
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Investigation of endothelial cell adhesion in a biomimetic 3D printed blood vessel scaffold[1] KARTIK V. BULUSU, TIMOTHY ESWORTHY, SAMANTHA RACAN, LIJIE G. ZHANG, MICHAEL W. PLESNIAK, George Washington University — Human umbilical vein endothelial cell (HUVEC) responses in a biomimetic 3D bioprinted blood vessel model were investigated in vitro under complex (physiological and pathological) flows with the goal of characterizing the conditions driving mechanotransduction. Cylindrical vessel scaffolds (12.7mm ID, 76.2mm L) were fabricated using polylactic acid (PLA) material. The vessel inner walls were cultured with HUVEC (1.25 X 106 cells mL-1) in a bioreactor system using endothelial cell growth medium (ECM, Cell Applications Inc). A flow loop facility capable of generating steady and physiological, pulsatile flows was decontaminated prior to vessel installation. The ECM was circulated in the flow loop for 2 hours, subjecting the HUVECs to wall shear stresses from the flow forcing. Real-time flow conditions were monitored using catheterized pressure sensors and an ultrasonic flow rate sensor. Post-facto analysis performed on dissected vessels using confocal microscopy indicated the successful adhesion of HUVECs to the vessel walls. These results pave the way for HUVEC proliferation studies in realistic blood vessel constructs and physiological flows by the synergistic coupling of high-fidelity in vitro measurements with post-facto monitoring of cell biochemical response mechanisms.

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