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Data Article

"Data characterizing microfabricated human blood vessels created via hydrodynamic focusing"

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ABSTRACT

This data article provides further detailed information related to our research article titled "Microfabricated Blood Vessels Undergo Neovascularization" (DiVito et al., 2017) [1], in which we report fabrication of human blood vessels using hydrodynamic focusing (HDF). Hydrodynamic focusing with advection inducing chevrons were used in concert to encase one fluid stream within another, shaping the inner core fluid into 'bullseye-like" cross-sections that were preserved through click photochemistry producing streams of cellularized hollow 3-dimensional assemblies, such as human blood vessels (Daniele et al., 2015a, 2015b, 2014, 2016; Roberts et al., 2016) [2–6]. Applications for fabricated blood vessels span general tissue engineering to organ-on-chip technologies, with specific utility in *in vitro* drug delivery and pharmacodynamics studies. Here, we report data regarding the construction of blood vessels including cellular composition and cell positioning within the engineered vascular construct as well as functional aspects of the tissues.
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Specifications Table

Subject area	*Bioengineering, microfluidics, materials science*
More specific subject area	*Synthetic human blood vessel fabrication*
Type of data	*Table, bar graph, immunofluorescence, videos*
How data was acquired	*Included data were acquired/generated using confocal microscopy (Nikon C1si) or computer-generated images, respectively.*
Data format	*Raw and analyzed*
Experimental factors	*None*
Experimental features	*We describe details of blood vessel construction, characterization and perfusion*
Data source location	*Washington, DC United States.*
Data accessibility	*All data described here is accessible within this article.*

Value of the data

- The potential for organ-on-chip technology to modernize *in vitro* experimentation is within reach. Yet, due to the lack of an integrated functional vasculature the technology is hampered by the inability to maintain truly representative tissue constructs long-term
- Our methodology generates synthetic human blood vessels capable of angiogenesis, anastomosis, and perfusion
- This work reports critical aspects concerning the fabrication of the blood vessels such as requirements for synthesis; cellular composition and downstream applications

1. Data

Using hydrodynamic focusing (HDF) in conjunction with photocrosslinkable polymers, human blood vessel mimics were constructed. Data presented here describes parameters for creating human endothelial microvessels (HEMV) and multi-cell microvessels (MCMV) and the requirements for integration and perfusion. Fig. 1 shows HEMV and MCMV maturation. Engineered vessels have an average outer diameter (O.D.) of 250 μm, an inner luminal diameter of 100–125 μm, and a wall thickness of 50–75 μm (Table 1). HEMVs were embedded into an extracellular matrix, endothelial outgrowths were observed (< 10 μm O.D.) (Table 1) [1]. Cellular growth was assessed in co-culture, variable media compositions were examined for three different cell types using their native media as diluents. The data showed endothelial cell proliferation was not affected until native growth media was diluted below 25% with vascular smooth muscle cell/pericyte growth medium (Fig. 2a and b). Smooth muscle cells were viable and displayed normal growth capacity (Fig. 2c and d). Pericytes displayed no changes in cell viability/proliferation (Fig. 2d and e). Distance limits growth-media diffusion [7,8] and engineered blood vessels were denuded from their walls. Fig. 3 shows collagenase-treated HEMV (liberated within 90 min); while the control HEMV remained intact. Immunofluorescence confirmed denuding did not affect structure. Similar results were obtained for mechanical disruption of the HEMV. Finally, HEMV were integrated into a perfusion device [1,5,6]. Videos 1 and 2 show microparticles entering and exiting the HEMV, respectively.

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