Healthcare Innovations
How practice has changed

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# Biofabrication of Small Diameter Tissue-Engineered Vascular Grafts (TEVGs)

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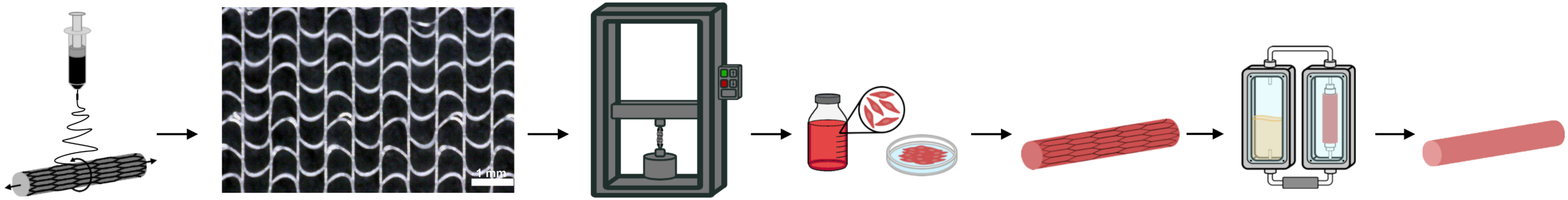
**Purpose:** Current strategies for revascularisation of small diameter (<6 mm) blood vessels frequently fail due to various clinical complications, and with cardiovascular disease (CVD) the leading cause of patient mortality globally (WHO, 2020), there is an urgent need for improved treatment options. The rapid advancement of tissue engineering, enabling the biofabrication of vascular grafts which remodel *in vivo*, promises a paradigm shift in CVD management. This project aims to develop biomimetic TEVGs using melt-electrowriting (MEW), a specialised additive manufacturing technology, to produce highly porous scaffolds for tissue culture. **Here, we present a project overview, focusing on scaffold production and mechanical testing.**

**Methods:** Melt-electrowriting (MEW) has been employed to fabricate sinusoidal scaffold geometries with ~200 µm pore sizing and 10 µm fibre diameters, from biocompatible, biodegradable PCL. Mechanical testing is underway to compare scaffold performance with existing grafts, focusing on radial compliance, which is critical to long term patency. Current synthetic grafts exhibit poor compliance, however preliminary mechanical testing of the scaffolds produced thus far, which are designed to compliantly expand, indicate promising results. Subsequently, we aim to seed and culture vascular cells onto scaffolds under physiological conditions in pulsative bioreactors, to produce TEVGs suitable for implantation.




**Melt Electrowriting** (Fabrication of polymeric scaffold)

**Geometric Analysis** (Imaging & analysis of scaffold geometry)

**Mechanical Testing** (Testing of scaffold mechanical properties)

**Cell Expansion** (Patient-derived cells or cell lines)

**Scaffold Seeding** (Cell seeding via various techniques)

**Tissue Culture** (Pulsative dynamic tissue culture)

**Engineered Vessel** (Suitable for implantation or further treatments)

**Conclusions:** While we continue to perform experimental work to assess the mechanical performance of the scaffolds produced via MEW, preliminary findings are promising, with cell studies to provide further indication of the suitability of the scaffolds produced. This application of MEW technology has potential to greatly improve small diameter vascular bypass surgery, through the fabrication of clinically relevant, vascular tissue engineered constructs with mechanical characteristics which mimic native tissue for improved patency *in vivo*.