SOLVING THE PROBLEM LAYER BY LAYER: DESIGNING SCAFFOLDS FOR CARDIOVASCULAR TISSUES

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Introduction

In Europe, almost 50% of all mortality cases are related to cardiovascular diseases, with arteriosclerosis playing a major role [1]. A promising way to repair diseased vessels is to implant electrospun tubular scaffolds seeded with autologous cells. While mimicking the structure and the function of the native tissue, this method also avoids foreign body reactions induced by common synthetic grafts. Because of their intention to provide structural support for the cells, the mechanical properties of these scaffolds have to be in a physiological range. Furthermore, to achieve good seeding efficiency, the material used has to be highly biocompatible.

Methods

With our custom-made electrospinning setup, we fabricated multi-layered scaffolds (Fig. 2) with a specific inner and outer layer to improve cell compatibility and infiltration. These layers were spun out of a polymer blend consisting of polycaprolactone, polylactide and polyethylene glycol. The two layers were separated by a hydrophobic layer of polycaprolactone, which was intended to minimise the leakage in highly porous grafts.

Results

According to preliminary results, the multi-layered scaffolds had a wall thickness of 195 µm. Furthermore, no differences between inner and outer layers were observed for mean fibre diameter (2 µm, n=120) and the pore size (85 µm², n=50). Young’s modulus, determined for the circumferential direction, showed a mean value of 15 MPa (n=5). Hysteresis, based on stress and strain values of the loading and unloading phase, was calculated to be 49%.

Discussion

Regarding the preliminary results our electrospinning setup is suitable to fabricate standardised multi-layered tubular scaffold with desired mechanical properties. Further experiments with electrospun scaffolds (Peel Test, longitudinal testing) and comparative studies with native tissue should prove the potential of the multi-layered grafts. Moreover studies on in vitro degradation of the electrospun grafts are in planning.

References