Abstract: P577

A versatile electrospinning technique to manufacture scaffolds with adjustable fiber networks

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Purpose: The necessity for surgical revascularization therapies in small diameter applications is continually growing. Autologous vessels are gold standard but not always available. Vascular grafts which are comparable with those are essential. Electrospinning offers fabrication of fibrous scaffolds imitating the extracellular matrix. During conventional electrospinning fibers are deposited in a chaotic fashion due to various instabilities. Increased control of fiber deposition is essential to manufacture grafts which can mimic the complex layered structure and the biomechanical behavior of the host vessel.

Methods: Fibrous tubular vascular grafts were electrospun from Pellethane 2363 80A on metal mandrels with a diameter of 2mm. Orientation and fiber alignment was controlled by auxiliary plate-like electrodes using electrodynamic deflection of the electrospinning jet. Scaffolds with random, circumferential, longitudinal and 30° fiber direction were fabricated. Grafts were characterized by measuring the wall thickness and gravimetric porosity. Effects of fiber orientation were analyzed in the scanning electron microscope and by measuring the compliance in the physiologic blood pressure range.

Results: The electrospun vascular grafts had a mean wall thickness of 71 ± 6µm. Lowest porosity of 63% was seen in circumferentially electrospun grafts whereas grafts spun with fiber directions in ± 30° showed the highest porosity of 79%. Fiber alignment in the main direction of each selected orientation angle was observed. The prostheses with longitudinal fiber orientation showed a compliance of 18.6 ± 2.8 %/100mmHg, whereas the prostheses with circumferential orientation exhibited the lowest compliance of 7.1 ± 2.6 %/100mmHg.

Conclusion: The developed electrodynamic control method allows to electrospin scaffolds with pre-defined fiber orientations.