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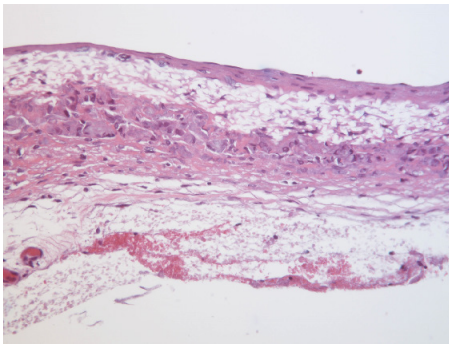
Segmented linear thermoplastic urethane elastomers with novel building blocks for electrospinning of vascular grafts

Surgical replacement of small diameter vessels is highly dependent on the availability of autologous host vessel grafts. Currently used synthetic materials have high failure rates. Thermoplastic polyurethane elastomers (TPU) can be used for the fabrication of small diameter vascular grafts through electrospinning. TPU grafts show great potential as small diameter replacement because of their biocompatibility and degradation properties.

BACKGROUND

Cardiovascular diseases are the principal cause of morbidity and mortality in all western countries. Therefore the number of cardiac and peripheral revascularization procedures is continuously increasing. Autologous grafts are limited available. Current synthetic approaches for small diameter vascular replacement are insufficient to ensure long-term graft patency due to biomechanical mismatch and thrombogeneicity.
TPUs have great potential as graft materials because of their tunable degradation and mechanical properties.



Representative histology of a 6 months implant (H&E staining)

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Thermoplastic polyurethane elastomers have a segmented configuration, consisting of a macrodiol (e.g. poly(ether diols)), as flexible soft block, and a combination of diisocyante and chain extender as a rigid hard block. Suitable mechanics and biocompatibility can be adjusted by choosing appropriate building blocks. Biodegradability can be achieved by the use of cleavable chain extenders.

ADVANTAGES

- Variation and tuning of material properties and degradation rate through the used building blocks
- Good biocompatibility with degradation rates correlating with the remodeling of native tissue
- Elastic properties matching the mechanics of native blood vessels
- Large scale synthesis is possible
- Suitable for electrospinning as fabrication technique

REFERENCE:
M040/2013

APPLICATIONS:
The structure of the electrospun scaffold is very similar to the native extracellular matrix of blood vessels. The graft material can be used as a vascular graft especial for small diameter applications. TPU scaffolds with various structure could be also applied for other tissue engineering purposes such as hernia repair, nerve conduits and wound healing.

KEYWORDS:
- Thermoplastic polyurethane elastomers
- tissue engineering
- electrospinning
- vascular grafts

DEVELOPMENT STATUS:
Chemical and biomechanical characteristics of the material have been intensively investigated.
The biocompatibility of the grafts has been evaluated in-vitro and in-vivo in long-term applications.

IPR:
Patent application in progress

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