Endothelialization of tissue engineered vascular grafts

Pullens, R.A.A.; Stekelenburg, M.; Baaijens, F.P.T.; Post, M.J.

Published: 01/01/2007

Document Version
Publisher's PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:

• A submitted manuscript is the author's version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
• The final author version and the galley proof are versions of the publication after peer review.
• The final published version features the final layout of the paper including the volume, issue and page numbers.

Link to publication

Citation for published version (APA):

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

• Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
• You may not further distribute the material or use it for any profit-making activity or commercial gain
• You may freely distribute the URL identifying the publication in the public portal.

Take down policy
If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.
Endothelialization of tissue engineered vascular grafts

Rolf A.A. Pullens, Maria Stekelenburg, Frank P.T. Baaijens, Mark J. Post
Biomechanics and Tissue Engineering, Soft Tissue Biomechanics & Engineering

Introduction
In 2004, approximately 425,000 coronary bypass graft procedures were performed in the USA on patients suffering from cardiovascular disease.[1] Tissue engineering of small diameter (<5 mm) blood vessels is a promising approach to develop viable alternatives for autologous vascular grafts. Development of a functional, adherent, shear resisting endothelial cell (EC) layer (figure 1) is one of the major issues limiting the successful application of these tissue engineered grafts.[2] The goal of the present study was to seed and culture ECs in tissue engineered vascular grafts.

Material and methods
Tubular PGA/P4HB scaffolds were placed around a silicone tube and were seeded with human saphenous vein myofibroblasts (MFs) using fibrin as a cell carrier. After 4 weeks of culture, the silicone tube was removed and a human saphenous vein EC suspension was injected into the lumen of the graft. The bioreactor was rotated for 3 hours, (figure 2) to homogeneously seed the ECs.

After seeding, a flow was applied through the vessels (figure 2) using a rollerpump. After 1 and 7 days of culture, vessels were removed from the bioreactors and the seeded ECs were visualized with a CLSM using a EC specific FITC UEA-1 lectin staining.

Results
During the 4 week culture period, the MFs produce extracellular matrix and the vascular grafts developed. The grafts were open and not leaking, in this way enabling EC seeding and the application of flow. During the 7 day EC culture period, the grafts remained open (figure 3).

ECs were homogeneously distributed in the graft 1 day after seeding (figure 4). After one week of culture, ECs were present throughout the whole vessel. In some parts confluent monolayers were found, while in other parts the cells were round and not connected (figure 5).

Summary
A method was developed to seed ECs in tissue engineered vascular grafts. Although the seeding protocol worked, the ECs did not always grow into a confluent monolayer.

Future
- Create full confluent EC monolayer
- Investigate influence of shear on EC layer
- Investigate thrombogenicity of EC layer

References: