A tissue culture system of the intervertebral disc

van Dijk, B.G.M.; Potier, E.; Ito, K.

Published: 01/01/2008

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.
A Tissue Culture System of the Intervertebral Disc
Bart van Dijk, Esther Potier and Keita Ito

Background
Low back pain is a common problem imposing a substantial burden on society, due to commonly accompanying long-term disability. Intervertebral disc degeneration, either induced by herniation (Figure 1) or accumulated over a lifetime, is a major cause of chronic low back pain.

Current treatments like conservative therapy, spinal fusion and disc prosthesis (Figure 2) are not functional and fail to address the cause of disc degeneration.

Treatments aimed at aiding the disc in restoring its original functionality, i.e. regenerative therapies, are proposed to be more successful.

Project description
For these regenerative therapies, regenerative stimuli, compounds that counter the degeneration of the disc, are needed. In the final phase of pre-clinical testing, the efficacy of these stimuli should be tested in near in vivo conditions. However, all current animal models have known dissimilarities with the human disease making them of limited use. Hence the aim of this project is to develop an in-vitro human degenerated intervertebral disc tissue culture system and to use it for testing various regenerative strategies developed by partners in the BioMedical Material consortium.

Approach
As a first approach, bovine tail tissue is used, which can be used as a model of the human disc [2].

The key challenge of this project will be to maintain the disc tissue in its unique physiological environment. In situ, the tissue is hyperosmolar with its swelling tendency balanced by tension in adjacent structures. Furthermore the tissue is naturally in hypoxic and low nutrient conditions. Finally, it has been demonstrated that the tissue is highly mechanobiologically responsive in both anabolic and catabolic behaviour to its loading conditions, which will be simulated in a bioreactor.

Ongoing work
The characteristic properties at harvesting, like cell-viability (Figure 3), biochemical content, gene expression, etc are being determined to establish a baseline of the tissue.

Besides that, intelligent solutions to keep the tissue in its unique environment are devised. To balance the osmolarity of the tissue, semi-permeable membranes in combination with a hyperosmolar solution are investigated. Furthermore, a setup is under development to measure the oxygen pressure and the osmolarity in the tissue.

References