Electrical stimulation of muscle progenitor cells

Citation for published version (APA):

Document status and date:
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 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

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.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the “Taverne” license above, please follow below link for the End User Agreement:
www.tue.nl/taverne

Take down policy
If you believe that this document breaches copyright please contact us at:
openaccess@tue.nl
providing details and we will investigate your claim.
Introduction

External stimuli are required to induce determination and differentiation of muscle progenitor cells into skeletal muscle cells in vitro. Possible stimuli are:

- Biochemical → Differentiation medium

The effects of electrical stimulation (ES) were systematically investigated on 2D cultures of C2C12 murine skeletal myoblasts. The influence of ES on cells growing on flexible substrates (Flexcell Int.) was compared to standard tissue culture substrates. Furthermore, a 3D scaffold system was investigated for alignment of myotubes, since this is a prerequisite for muscle maturation. The main questions within this research were:

- Does ES of muscle cells growing on a flexible substrate influence maturation, compared to standard tissue culture substrates?
- Do muscle cells align to polymer fibers in a scaffold?

Material and methods

(2D) C2C12 myoblasts were cultured in standard growth medium and biochemically differentiated using 2% HS containing medium. Bipolar electrical field stimulation was realized by the C-Pace set-up (figure 1).

Cells were cultured in collagen type I coated standard 6-well and Flexwell dishes. The ES protocol (figure 2) was introduced after 48h of culturing in differentiation medium. (3D) PGA scaffolds were seeded with C2C12 myoblast within a fibrin gel, and grown in differentiation medium for 7 days.

Results

After ES, myotubes were contracting and showed different morphologies on standard 6-well dishes compared to Flexwell dishes. Myotubes on Flexwell dishes developed premature cross-striations (arrow figure 3).

Cytoskeletal staining (phalloidin) of tissue engineered skeletal muscle constructs with PGA, revealed that myotubes aligned and attached parallel to the polymer fibers within 7 days of culturing. The developed 3D model system can be combined with the ES set-up for future experiments.

Conclusion

We have strong indications that myotubes are more mature after 48h of ES on Flexwell substrates, compared to standard tissue culture substrates. Since myotubes aligned parallel to PGA fibers in a scaffold, possibilities for aligned electrospun scaffolds are generated to stimulate skeletal muscle maturation.

References