

Experimental Study

Knee Surgery, Sports Traumatology, Arthroscopy

May 2015, Volume 23, *Issue 5*, pp 1368-1377

First online: 22 October 2013

PVA-chitosan composite hydrogel versus alginate beads as a potential mesenchymal stem cell carrier for the treatment of focal cartilage defects

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Abstract

Purpose

To investigate whether mesenchymal stem cells (MSCs) seeded in novel polyvinyl alcohol (PVA)-chitosan composite hydrogel can provide comparable or even further improve cartilage repair outcomes as compared to previously established alginate-transplanted models.

Methods

Medial femoral condyle defect was created in both knees of twenty-four mature New Zealand white rabbits, and the animals were divided into four groups containing six animals each. After 3 weeks, the right knees were transplanted with PVA-chitosan-MSC, PVA-chitosan scaffold alone, alginate-MSC construct or alginate alone. The left knee was kept as untreated control. Animals were killed at the end of 6 months after transplantation, and the cartilage repair was assessed

through Brittberg morphological score, histological grading by O'Driscoll score and quantitative glycosaminoglycan analysis.

Results

Morphological and histological analyses showed significant ($p < 0.05$) tissue repair when treated with PVA-chitosan-MSC or alginate MSC as compared to the scaffold only and untreated control. In addition, safranin O staining and the glycosaminoglycan (GAG) content were significantly higher ($p < 0.05$) in MSC treatment groups than in scaffold-only or untreated control group. No significant difference was observed between the PVA-chitosan-MSC- and alginate-MSC-treated groups.

Conclusion

PVA-chitosan hydrogel seeded with mesenchymal stem cells provides comparable treatment outcomes to that of previously established alginate-MSC construct implantation. This study supports the potential use of PVA-chitosan hydrogel seeded with MSCs for clinical use in cartilage repair such as traumatic injuries.

Keywords

PVA-chitosan Mesenchymal stem cell Tissue engineering Cartilage repair Biomaterials

Concepts found in this article

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MSC Treatment Group

Cartilage Tissue Engineering

Mesenchymal Stem Cell

Composite Hydrogel

Medial Femoral Condyle

Alginate Bead

Articular Cartilage Repair

Scaffold Treatment

MSC Transplantation

Allogeneic MSCs

Gag Content

Collagen Type

Control Knee

Full-thickness Cartilage Defect

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cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=23274630)

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Title

PVA-chitosan composite hydrogel versus alginate beads as a potential mesenchymal stem cell carrier for the treatment of focal cartilage defects

Journal

Knee Surgery, Sports Traumatology, Arthroscopy

Volume 23, Issue 5, pp 1368-1377

Cover Date

2015-05

DOI

10.1007/s00167-013-2723-5

Print ISSN

0942-2056

Online ISSN

1433-7347

Publisher

Springer Berlin Heidelberg

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