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Chondrogenesis of synovium-derived mesenchymal stem cells in heparin-conjugated fibrin hydrogel containing TGF-β and BMP4

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In the present work we describe heparin-conjugated fibrin (HCF) hydrogel fabricated for the presentation and sustained release of transforming growth factor β1 (TGF-β1) and bone morphogenic protein 4 (BMP-4), and examine their effects on the chondrogenesis of human synovium-derived mesenchymal stem cells (SDMSCs).

In this study SDMSCs were isolated from human synovium membrane and expanded *in vitro*. HCF was prepared by conjugating heparin to fibrinogen and subsequently mixing with thrombin and then used as an injectable hydrogel for delivery of SDMSCs, BMP-4 and TGF-β1. The kinetics of BMP-4 and TGF-β1 release from HCF hydrogel was determined with sandwich ELISA. SDMSCs encapsulated in HCF hydrogel containing TGF-β1 (200 ng/ml) and BMP-4 (200 ng/ml) were cultured in complete growth medium within 21 days and examined by histology and immuhistochemical assays.

Results of our study showed that HCF hydrogel are biocompatible for SDMSCs and can maintain a sustained release of BMP-4 and TGF-β1 for the induction of SDMSC chondrogenic differentiation. Moreover, HCF hydrogel containing BMP-4 and TGF-β1 provided a suitable niche for the formation via the differentiation of transplanted SDMSCs, which produced cartilage-specific ECM proteins such as collagen type II, and aggrecans. Histological and immunohistochemical analyses showed that significant expression of these ECM proteins occurred only when SDMSCs were mixed with BMP-4 and TGF-β1.

Thus, our data suggest that SDMSC-encapsulated HCF hydrogel containing BMP-4 and TGF-β1 can be good tissue engineering strategy for regeneration of damaged articular cartilage.

Biography

Madina Sarsenova is a master student at Eurasian National University, School of Natural Sciences. Currently she works at National Center for Biotechnology as a research assistant. Her scientific fields of interests are stem cell research and tissue engineering.

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