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Poly-ε-Caprolactone Nanofibers with Synthetic Growth Factor Enriched Liposomes as Controlled Drug Delivery System

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Abstract : PCL (poly-ε-caprolactone) nanofibrous scaffolds with adhered liposomes were prepared and tested as a possible drug delivery system for various synthetic growth factors. TGFβ, bFGF, and IGF-I have been shown to increase hMSC (human mesenchymal stem cells) proliferation and to induce hMSC differentiation. Functionalized PCL nanofibers were prepared with synthetic growth factors encapsulated in liposomes adhered to them in three different concentrations. Other samples contained PCL nanofibers with adhered, free synthetic growth factors. The synthetic growth factors free medium served as a control. The interaction of liposomes with the PCL nanofibers was visualized by SEM, and the release kinetics were determined by ELISA testing. The potential of liposomes, immobilized on the biodegradable scaffolds, as a delivery system for synthetic growth factors, and as a suitable system for MSCs adhesion, proliferation and differentiation in vitro was evaluated by MTS assay, dsDNA amount determination, confocal microscopy, flow cytometry and real-time PCR. The results showed that the growth factors adhered to the PCL nanofibers stimulated cell proliferation mainly up to day 11 and that subsequently their effect was lower. By contrast, the release of the lowest concentration of growth factors from liposomes resulted in gradual proliferation of MSCs throughout the experiment. Moreover, liposomes, as well as free growth factors, stimulated type II collagen production, which was confirmed by immunohistochemical staining using monoclonal antibody against type II collagen. The results of this study indicate that growth factors enriched liposomes adhered to surface of PCL nanofibers could be useful as a drug delivery instrument for application in short timescales, be combined with nanofiber scaffolds to promote local and persistent delivery while mimicking the local microenvironment. This work was supported by project LO1508 from the Ministry of Education, Youth and Sports of the Czech Republic

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