Abstract

Connective tissues are characterized by significant volume of extracellular matrix. Their main role is to provide a mechanical support and protection to other body organs. This thesis is focused on regeneration of bone, cartilage and osteochondral defect. In the experimental part we observed viability and differentiation of human mesenchymal stem cells. *In vitro* we evaluated the potential of PCL scaffold with addition of growth factors, bone xenograft with biomimetic peptides, collagen I composite with bioceramics and a titanium alloy with nanostructured surface. During following *in vivo* study, we implanted a cell-free scaffold made of PCL, calcium phosphate and IGF-1, bFGF, TGFβ1 and BMP-2 to osteochondral defect. Unfortunately, addition of growth factors resulted in pathological inflammatory process despite clear beneficial effect *in vitro*. Likewise, the biomimetic peptide sequences promoted osteogenic differentiation of human mesenchymal stem cells. Addition of certain bioceramics influenced the scaffold morphology in the manner of pore size. However, we did not observe any effect of the surface characteristics on cell behavior. The cells were influenced rather by certain material. On the other hand, surface modification of titanium scaffold by anodic oxidation revealed that the most suitable for both viability and differentiation were nanotubes with diameter around 36 nm.

Keywords

bone graft, PCL, collagen scaffold, titanium scaffold, growth factors, osteogenesis, chondrogenesis, mesenchymal stem cells, regeneration, tissue engineering