

The aim of the thesis was development of an innovative treatment of bone defects. Human multipotent mesenchymal stromal cells (MSC) play a crucial role in bone healing. Clinical applications of MSC require large amount of cells, which could be obtained by autologous expansion of MSC harvested from bone marrow. As a first step, the standard protocol of MSC expansion based on  $\alpha$ MEM medium and fetal bovine serum (FBS) was used. Experiments replacing FBS by pooled human serum (HS) in the culture medium concluded in patenting of a new MSC cultivation protocol (EU 1999250, CR 301141). This one-step cultivation protocol and xenogeneic protein-free cultivation medium is based on CellGro® for Hematopoietic Cells' Medium, HS, human recombinant growth factors, dexamethasone, insulin and ascorbic acid. The preclinical in vitro and in vivo experiments with MSC from both expansion protocols were carried out. Fibrillar polylactic scaffolds were seeded with MSC, cultured, differentiated and implanted in immunodeficient mice (NOD/LtSz-Rag1-). Bone-like mineralized tissue containing vessels was observed. The MSC cultured according to patented method were classified as Advanced-therapy Medicinal Product and has to fulfil the European Medicines Agency regulations to enter the clinical trials. Nevertheless the use of MSC seems to be promising in cell therapy as well as in skeletal tissue engineering.