1 SUMMARY

Tissue morphology and function are determined with features of extracellular matrix produced by resident cells. Extracellular matrix is composed of a complex of proteins maintaining tissue specific structure and composition. Cells and extracellular matrix are in reciprocal interaction leading to dynamic complex, contributing to homeostasis and providing specific microenvironment for stem cells. These reasons determine an extracellular matrix as a desirable structure for scaffolds utilized in tissue engineering. Extracellular matrix can be prepared by decellularization of tissues or organs by removal of all cellular components. Efficient decellularization produces three-dimensional structure with preserved architecture without harsh effect to the extracellular matrix. The combination of decellularized tissue, a scaffold, with stem cells provides a promising tool for production of new biological constructs in tissue engineering.

Above mentioned aspects were main aims of this thesis with major focus on establishment of suitable decellularization protocol adequately effective for cell removal from skeletal muscle tissue. This protocol is based on combination of physical, chemical and biological methods resulting in decellularized skeletal muscle. Produced scaffolds were analysed with myriad methods evaluating tissue architecture preservation with absence of skeletal muscle sarcoplasm. Maintenance of principal ECM proteins was confirmed with several histological techniques which proved conservation of basic muscle architecture in native state. Biochemical methods were used to determine quantity of collagen and DNA and confirmed successful preservation of high amount of collagen; on the other hand DNA in the scaffold was reduced to level which did not initiate immune response after implantation into the host organism. Cytocompatibility of the scaffold was determined with cultivation of the scaffold with several cell lineages (C2C12 myoblasts, muscle-derived stem cells and myogenic progenitor cells), resulted in cell adhesion to the surface of the scaffold and some cells were able to migrated into the scaffold. Further confirmation of cytocompatibility was assessed during *in vivo* experiments with implanted scaffolds into the mice which proved promotion of regenerative processes in damaged tissue and the ability to bridge defect in the skeletal muscle. Scaffold was also richly recellularized with autologous host cells. These data strongly indicated that skeletal muscle decellularization could be considered as a promising approach in construction of bioscaffolds suitable in treatment of volumetric muscle loss.