Cartilage can regenerate only in a limited extend. The aim of the study was to enhance hyaline cartilage regeneration using peroral supplementation of glycosaminoglycans (GAGs) and antioxidants, or using artificial scaffolds seeded with autologous cells. Scaffolds seeded with chondrocytes or mesenchymal stem cells (MSCs) have a potential for treatment of cartilage defects. For the complex characterization of biomechanical properties of scaffold, we developed the novel shock dynamic method. Subsequently, the composite hyaluronate-type I collagen-fibrin scaffold with the viscoelastic properties and dynamic loading response similar to the native cartilage was developed. The composite scaffold was then used for osteochondral regeneration and physeal cartilage regeneration.

The effect of peroral supplementation of GAGs and antioxidants (vitamin E/selenium) on the regeneration of osteochondral defects was investigated in rabbits. After introduction of defined osteochondral defects in the knee joint, groups of ten animals were given a GAG/vitamin E/selenium mixture or a placebo (milk sugar) for 6 weeks. The amount of sulfated GAGs in the osteochondral regenerates was significantly higher in the GAG group. In both groups, the GAG amount in the cartilage of the operated knee was significantly higher than in the non-involved knee. Moreover, the viscosity of the synovial fluid was significantly enhanced in the GAG group.

Osteochondral regeneration using autologous chondrocyte-seeded composite scaffold was tested in miniature pigs. After six months, chondrocyte-seeded composite hyaluronate-type I collagen-fibrin scaffold was able to regenerate the defect with the formation of the hyaline cartilage, and partially fibrocartilage while the scaffold alone supported the fibrocartilage formation.

The ability of cultured MSCs to repair damaged physis was evaluated in rabbits. Prophylactic implantation of autologous mesenchymal stem cell-seeded scaffold to iatrogenically ...