Evaluation of a hybrid scaffold/cell construct in repair of high-load-bearing osteochondral defects in rabbits.

Authors: Shao XX, Hutmacher DW, Ho ST, Goh JC, Lee EH

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Abstract:

The objective of this study was to evaluate the feasibility and potential of a hybrid scaffold system in large- and high-load-bearing osteochondral defects repair. The implants were made of medical-grade PCL (mPCL) for the bone compartment whereas fibrin glue was used for the cartilage part. Both matrices were seeded with allogenic bone marrow-derived mesenchymal cells (BMSC) and implanted in the defect (4 mm diameter x 5 mm depth) on medial femoral condyle of adult New Zealand White rabbits. Empty scaffolds were used at the control side. Cell survival was tracked via fluorescent labeling. The regeneration process was evaluated by several techniques at 3 and 6 months post-implantation. Mature trabecular bone regularly formed in the mPCL scaffold at both 3 and 6 months post-operation. Micro-Computed Tomography showed progression of mineralization from the host-tissue interface towards the inner region of the grafts. At 3 months time point, the specimens showed good cartilage repair. In contrast, the majority of 6 months specimens revealed poor remodeling and fissured integration with host cartilage while other samples could maintain good cartilage appearance. In vivo viability of the transplanted cells was demonstrated for the duration of 5 weeks. The results demonstrated that mPCL scaffold is a potential matrix for osteochondral bone regeneration and that fibrin glue does not inherit the physical properties to allow for cartilage regeneration in a large and high-load-bearing defect site.