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Guided tissue engineering for articular cartilage regeneration

Christoph Brochhausen
University Medical Centre Mainz, Germany

The purposes of tissue engineering strategies to treat cartilage defects are the expansion of cells, their maturation, their integration into the defect and their preservation. The rationale for the use of growth factors in tissue engineering applications is given by their ability to stimulate the controlled proliferation and differentiation of seeded cells in the scaffolds. They should also enhance the migration, proliferation, and differentiation of cells from the edges of the defect. Since regeneration recapitulates in parts embryological development, we used the growth plate of the long bones, which consists of chondrocytes in different proliferation and maturation stages, as a model to target growth factors and signalling molecules for cartilage tissue engineering. Growth factors act in a dose-dependent manner and via receptors on the target cells. Therefore, the kinetics of growth factor release from delivering devices should be adapted to the situation of the microenvironment. The amount of growth factor must reach an optimum for its biological action. Based on our analyses on the growth plate we identify prostaglandin E2 (PGE2) as a promising candidate molecule and integrated it in a release system which guaranteed prolonged release of functional PGE2. In a next step the release system was integrated in a three dimensional collagen-based scaffold. We clearly demonstrated that within that scaffold under the presence of PGE2 cultured chondrocytes showed a rapid re-differentiation and relevant synthesis of collagen II, the typical collagen for articular cartilage. This combined scaffold-release construct opens innovative perspectives for the future of guided tissue engineering strategies.

Biography

Christoph Brochhausen is Chief Consultant Pathologist and Head of Electron Microscopy at the Institute of Pathology at the University Medical Centre Mainz as well as Group Leader of the Cartilage Tissue Engineering Group at the REPAIR-lap. His research-work was awarded by national and international awards. He has published more than 80 papers in reputed journals and serving as an editorial board member of some reputed journals.

brochhausen@pathologie.klinik.uni-mainz.de