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Project Title:	MimiCart
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Mission Statement

In Germany, about 5 million people suffer from arthrosis. Arthrosis is a degenerative joint disease characterized by changes in cartilage and underlying bone structure. The gold standard treatment of arthrosis consists of pain therapy. If the course of the disease is very advanced, the joint must be replaced by a total endoprosthesis. However, especially in active younger patients, this often results in highly invasive revision operations, which are associated with long rehabilitation periods. Alternative therapy approaches from the field of cartilage tissue engineering, such as matrix-associated autologous chondrocyte transplantation, are already being used clinically. However, the attainable strength of these implants is lower than that of native cartilage tissue. The aim of the research project is a biomimetic cartilage implant that enables the formation of native cartilage tissue.

Research Approach

Hydrogels are of particular interest in tissue engineering. Due to their high water content, their ECM-like structure and the presence of cell adhesion motifs, they offer a good environment for three-dimensional cell culture. However, hydrogels lack mechanical strength and dimensional stability. These two properties are crucial for tissue engineering applications, especially for

supporting load bearing tissues such as bone or cartilage. To improve the mechanical properties of hydrogels, they can be reinforced with textile structures. Spacer fabrics are particularly suitable as reinforcement structure due to their easily adjustable porosity, pore size and mechanical properties. Moreover, they can easily be filled with cell-laden hydrogels.

The load bearing ability of cartilage results from its composition and architecture. Proteoglycans bind water within the tissue and thus lead to swelling of the tissue. Arcade-like collagen fibers limit the swelling of the tissue. In this biomimetic tissue engineering approach, the swelling of a hydrogel is limited by a spacer fabric. Spacer fabrics made of polycaprolactone (PCL) are developed for this purpose. The spacer fabrics are filled with cell-laden swelling hydrogels. To anchor the cartilage implant in the bone, a cylindrical bone plug made of PCL is woven. This anchorage is connected to the cartilage implant and inserted into the bone. PCL degrades over a period of several months to years without the release of acidic degradation products in the body. Thus, the cells introduced with the hydrogel can form new native cartilage tissue, while the implant gradually degrades.

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REGMEDXB

REGENERATIVE MEDICINE CROSSING BORDERS

RegMed XB is a virtual institute that uses regenerative medicine strategies to cure common chronic diseases. It comprises an intensive Flemish-Dutch public-private partnership between governments, health foundations, doctors, scientists and specialized companies. For more information please visit www.regmedxb.com."

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