The effect of shock waves on *in vitro* cartilage development in silk scaffolds

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Introduction: Osteoarthritis (OA) is a degenerative condition causing joint pain and stiffness and, thereby, severely impairs everyday life of patients. It is predicted that by the year 2030, a quarter of the US population alone will be diagnosed with OA.

Silk is a biocompatible and biodegradable biomaterial, which has been implicated in a wide range of applications in biomedical engineering. Silk can be processed into very different forms, from hydrogels to solid bulk material, making it one of the most versatile biomaterials available. Furthermore, its outstanding mechanical properties permit the creation of constructs capable of withstanding physiological loads.

It has been shown that low-energy shock wave treatment (SWT), applied in combination with microfractures, resulted in increased production of cartilage-like tissue, affecting both chondrocytes and the surrounding blood vessels. Moreover, in another study, SWT was proven to slightly improve the differentiation potential of equine adipose tissue-derived mesenchymal stem cells *in vitro*.

Methods: We therefore studied the effect of SWT on articular chondrocytes *in vitro*. This included their expansion *in vitro*, resulting in their dedifferentiation, and finally their redifferentiation into functional cartilage in a silk scaffold upon SWT. We analyzed the distribution of cells within the scaffold, gene expression of cartilage-specific markers, as well as the activation of intracellular signaling pathways *in vitro*.

Results: Silk-based hydrogels and sponges were shown to be suitable scaffolds for cartilage engineering, providing the cells with a robust environment that preserves its architecture during long culture periods. The scaffold alone was shown to promote chondrogenic marker expression in cultured cells. This effect was further increased when SWT was applied.

Discussion: The use of shock wave treatment on chondrocyte-loaded silk scaffolds would provide a novel tool for tissue engineering in cartilage regeneration.

Device and manufacturing company: Dermagold® 100 with OP155 applicator, MTS Europe GmbH

Setup: cells in suspension or in a 3D silk scaffold placed in a 15 ml polypropylene tube in a water bath

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