

## **Compression enhances cell distribution and scaffold stability of osteochondral matrix constructs**

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### **INTRODUCTION**

Homogenous cell distribution and sufficient initial scaffold stability remain key issues for successful tissue engineered osteochondral constructs. The purpose of this study was to investigate the application of initial compression forces of cell culture followed by different stress patterns.

### **METHODS**

Bone marrow stromal cells were harvested from the iliac crest during routine trauma surgery. The cells were expanded in a 2-dimensional culture and then seeded into the biologic hybrid scaffold with a concentration of  $1 \times 10^6$  cells per ml. Pressure and vacuum forces were applied in a specially developed glass kit. The constructs were exposed to two different protocols of compression combined as osteochondral matrices of CaReS (rat collagen I, Ars Arthro, Esslingen, Germany) and Tutobone (bovine acellular spongiosa, Tutogen Medical GmbH, Neunkirchen a. Br., Germany). Controls were resected osteochondral fragments from patients with articular fractures and uncompressed constructs. These effects

were evaluated using microscopy to identify matrix penetration and vitality. Biomechanical tests were conducted, too using a modified biomechanical testing machine. The 'constrained compression', maximum load to failure, modulus, and strain energy density were determined.

### **RESULTS**

Histology: Penetration and cell distribution was demonstrated homogenous and vital, respectively. Mechanical tests showed a significant enhancement of primary matrix stability. The following stress patterns did not enhance significantly stability over seven days.

### **DISCUSSION**

The application of mechanical stimulation in the tissue engineering process leads to a progress in the structural and biomechanical properties of these tissues and offers new possibilities in the management of bone injuries and degenerative diseases. The influence on mesenchymal stem cell differentiation and in vivo cell viability have to be investigated in the future.