

Scaffold-free chondrocyte transplantation as alternative to matrix associated chondrocyte transplantation

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INTRODUCTION: Tissue engineering (TE) is a modern discipline to repair destructed joint cartilage. One of the most favorized methods of TE is the MACT (matrix associated chondrocyte transplantation). This method combines the use of different types of artificial scaffolds to support a tri-dimensional structure of in monolayer proliferated autologous chondrocytes. Contrary to common used procedures a new technique of scaffold free chondrocyte transplantation (SFCT) was developed by the fzmb. As a model of neo cartilage production joint cartilage from horse was used.

METHODS: Chondrocytes were isolated from joint cartilage by enzymatic hydrolysis and propagated using autologous serum. After cultivation and proliferation in monolayer cultures cells were transferred into a three-dimensional structure without any artificial matrix or biocompatible material. An undifferentiated mechanical pressure (manual) was used for producing a scaffold free product and with development of extracellular matrix. These scaffold-free constructs were compared with native cartilage of the same animals. Cartilage development was documented by biochemical, histological and immunohistological analysis.

RESULTS: Within three weeks of cultivation applying a mechanical stimulation (ten minutes a day) chondrogenesis was induced without additional growth factors. With mechanical stimulation the SFCT can reach a 20 mm diameter and a height of 2-3 mm (Fig.1). Data obtained clearly demonstrate that three-dimensional scaffold-free cartilage constructs derived by mechanical stimulation have a high proteoglycan (35%) and collagen (40%) content in comparison to native cartilage (Tab.1). Histological results revealed a distinct proteoglycan and collagen staining. Immunohistological staining showed collagen type II.

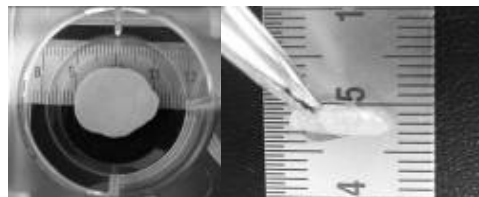


Fig. 1: Size of "de novo" cartilage derived from joints chondrocytes

Table 1. Proteoglycan and hydroxyprolin content in cartilage and neo cartilage (DDT-dried and defatted tissue)

	Proteoglycan	Hydroxyprolin
Cartilage	90-120 µg/mg DDT	90-110 mg/mg DDT
Neo cartilage	30-40 µg/mg DDT	30-45 mg/mg DDT

DISCUSSION & CONCLUSIONS:

Mechanical stimulation can be used as a stimulation factor for cartilage development. In comparison with native cartilage the collagen content of the SFCT was about 40% and the proteoglycan content was about 35%. These scaffold free chondrocyte transplantats can be used for repair of defect horse joint cartilage.

REFERENCES: ¹N.Blumenkrantz, G. Asboe-Hansen (1978) *Hydroxyproline to hydroxylysine molar ratio indicates collagen type*. *Acta Dermatovener (Stockholm)* 58:111-115, ²R.W. Frandale et al. (1986) *Bichimica et Biophysica Acta* 883:173-177

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