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Tissue Engineering Based Therapy for Articular Cartilage Defects - A New Approach

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Background:

Articular cartilage, the load-bearing tissue in diarthrodial joints, when damaged due to trauma could lead to osteoarthritis. At present Autologous Cartilage Implantation is an established method in which patients own chondrocytes are isolated and then implanted after in vitro expansion over the affected area with bovine or porcine collagen matrix. This procedure results in more of Collagen Type I during in vitro expansion, which eventually becomes fibrocartilage. Also it requires growth factors. We have in this study tried growing human Chondrocytes without growth factors using synthetic scaffolds to grow more Collagen Type II

Materials and Methods:

Human cartilage specimens were harvested through arthroscopy from the non-weight bearing area of the knee joint from 13 patients who underwent surgical procedures of the knee joint after getting their informed consent. The tissues were transported in saline taking 1 hour to laboratory and subjected to digestion

with Collagenase type II for 16~18 Hrs. The chondrocyte cells obtained after dissociation were divided into two groups for culture. Gr. I were embedded in a Thermogelation polymer (TGP) and Gr. II in basal culture media (DMEM + Ascorbic Acid) without using any growth factors. The Group II cells were viable only for 4 weeks and then started degenerating. The TGP-Chondrocytes scaffolds were grown for 16 weeks and the specimens were harvested at 4, 8, 12 and 16-week intervals and their morphology and molecular characteristics were studied by H&E staining, S-100 protein analysis and RT-PCR.

Results:

Human chondrocytes could be cultured in both TGP (group I) and Basal culture media (group II). The Gr. I cells were viable upto the 16th week while the Group II chondrocytes started degenerating after the 4 week. Both the groups were proven positive for S-100 protein, a Chondrocyte specific marker protein; Gr. II specimens after 4 weeks, and Gr. I specimens after 4, 8, 12 and 16 weeks. RT-PCR study of

the cells of group I were positive for TGF beta 3 (Proliferation, differentiation, and other functions), GR beta, GR alpha (Development, metabolism and immune Response) (glucocorticoid receptor alpha), AGGF (Apoptosis), VDR (Vitamin D3 Receptor), Col II (Type II Collagen).

Conclusion:

We have established a methodology by which Human chondrocytes could be cultured in vitro without any growth factors for a period of 16 weeks in a polymer-hydrogel scaffold. Upon further confirmation of their characteristics, the TGP grown chondrocytes can be used for autologous implantation to repair damaged cartilage area as the Collagen Type II which grows better without growth factors in the scaffold, eventually will become Hyaline cartilage is expected to give a longer disease free duration than the present method of ACI.

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