

Development of Three-Dimensional Hybrid Scaffold Using Chondrocyte-Encapsulated Alginate Hydrogel

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Hydrogels are useful materials because of their chemical similarity to the extracellular matrix and their ability to rapidly diffuse hydrophilic nutrients and metabolites. Using rapid prototyping (RP) methods, we fabricated freeform three-dimensional (3-D) scaffolds with chondrocytes encapsulated in an alginate hydrogel. The 3-D hybrid scaffold was developed as a combination of two components, a trimethylene carbonate (TMC)/ trimethylolpropane (TMP) framework and an alginate hydrogel containing encapsulated chondrocytes. To develop 3-D hybrid scaffolds, we employed a microstereolithography (MSTL) system. A biocompatible, biodegradable, and photopolymerizable liquid prepolymer was prepared by the polymerization of TMC/TMP, and was subsequently end-capped with an acrylate group. The results of analyzing a cell culture indicate that because of the biomimetic nature of the encapsulated chondrocytes, scaffolds effectively retain the phenotypic function of the chondrocytes within their structure. The proposed 3-D hybrid scaffolds can be used for cartilage regeneration.

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