The Creation of a Chitosan Scaffold for Bovine Chondrocyte Culturing

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Due to an increase in wounded veterans and an aging population, it is important to develop technologies for the treatment of damaged epithelial, connective, muscle, and nervous tissues. Until recently, connective tissue could only be repaired with surgical removal or artificial replacement. However, it is now possible to culture a patient's own cartilage producing cells, chondrocytes, to create individualized biological implants. This study determined optimal conditions for developing composite scaffolds for growing cartilage tissue. A 3D-printed prototype for growing and molding such tissue to meet patient needs was designed as well. 1 cm3 natural sponge cuttings were placed in each well of six 6-well plates. Nine wells were supplemented with either a 0%, 2%, 4%, or 8% solution of a chitosan-containing crab shell extract and freeze dried for adherence to the sponge. Three replicates of each treatment were prepared in growth media containing either distilled water, minimal essential media, or phosphate buffer saline. Daily pH measurements of the solutions in which the composite scaffolds were bathed were taken for one week. Final mean pH values of 6.4, 7.9, 7.7, and 9.6, for the 0%, 2%, 4%, and 8% treatments, respectively, show significant differences (ANOVA, $F=36.01$, $p<0.002$), and separation of dried extract from the sponge was observed in the 8% solution. Compared to a neutral bodily pH, the 4% chitosan containing crab shell extract and sponge scaffold solution is optimal for future testing with the addition of bovine chondrocytes. Subsequent studies are required to assess culturing conditions for human cartilage tissue.

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