A MULTIANGULAR APPROACH TOWARDS BIOFABRICATION OF AN AURICULAR CARTILAGE IMPLANT

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Key Words: auricular cartilage, progenitor cells, hybrid bioprinting, reinforcement

Cartilage tissue engineering opens new avenues for reconstruction of auricular deformities. Nevertheless, a number of challenges hinder the development of an auricular cartilage implant, including an appropriate cell source, nutrient limitation in large non-vascularized constructs, and maintenance of the complex auricular shape. This work uses a multiangular approach including biofabrication strategies to address these challenges. Firstly, we investigated the regenerative potential of novel auricular cartilage progenitor cells in 3D printable hydrogels. Furthermore, we proposed a modular construct to decrease the diffusion distance throughout the implant. In addition, the mechanical integrity of the developing construct is warranted by a polymer fiber-reinforced network integrated into a cell-laden hydrogel. Equine auricular cartilage progenitor cells (AuCPC) were encapsulated in 10% gelatin methacrylate (gelMA) hydrogel cylinders and chondrogenically differentiated up to 56 days *in vitro*. The neocartilage produced by AuCPC displayed GAG/DNA composition and mechanical integrity comparable to auricular chondrocytes (AuCH), and the production of cartilage-like extracellular matrix was confirmed by histology. Polycaprolactone (PCL) scaffolds for custom-designed modular parts of the auricle were fabricated using a Bioscaffolder and combined with gelMA to form hybrid constructs. Light microscopy confirmed homogenous distribution of the hydrogel through the reinforcing network, and the assembled modules displayed a convincing aesthetical appearance under a rubber skin. Bioprinted cell-laden constructs demonstrated homogenous cell distribution and good cell viability after printing up to 7 days of *in vitro* culture. These results indicate that a multi-faceted approach in creating large tissue constructs is a promising method that warrants further investigation.