Enhanced Auricular Reconstruction: Translating Bioprinted Auricles Into Clinical Practice Using Smartphone-Driven Scanning Applications

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External auricular reconstruction due to congenital malformations, tumors or accidents involving the auricular cartilage tissue remains a substantial problem in the field of reconstructive surgery. An improved therapeutic method for reconstruction of auricles would have great benefit for clinical application, as current options have high complication rates and are very time-consuming. A promising alternative are bio-fabricated auricles. For the purpose of translating those bio-printed auricles into clinical practice, a three dimensional model was conducted by a simple scan of the remaining ear using a scanning application on a smartphone. Numerous applications were evaluated according to different comparison criteria. Scann3D was used for the creation of the auricular model which was first printed with a conventional 3D printer for better visualization, before using a bioprinter. The bioink production included the preparation of a Methylcellulose Hydrogel. Subsequently, to achieve a high shape fidelity and cell viability, the influence of the printing parameters during the extrusion of the bioink was examined in several series of experiments before the bio-fabrication. By observing the sample scaffolds under a microscope with live/dead staining, the cell viability was calculated and a significant effect of the parameters could be shown. Finally, the auricle was printed, applying the determined parameters from the test series (nozzle diameter: 610µm, pressure: 60kPa, speed: 15mm/s). Size and proportions of the printed scaffold were very close to the original auricle. Metabolic activity inside the 3D scaffold was proven using the dye MTT to observe a color reaction through cellular respiration.

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