Abstract

“Tissue Engineering Applications of an Amnion-based Barrier Membrane”

Cleft lips and/or palates are the most common oral and craniomaxillofacial birth defects. Properly restoring the severe cleft palates remains a major challenge insufficient autologous soft tissues to close the open wounds. Furthermore, since the ideal time for renovating cleft palate is shortly after birth, surgeries should cause minimal disruption of the skeleton to allow tissue growth in children. This study aims to create a barrier for cleft palate repair through incorporating poly (1,8-octamethylene-citrate) (POC) onto the decellularized amnion membrane (DAM) in order to improve both biological and mechanical properties of the native amnion tissue. The success of POC incorporation onto the DAM was confirmed by laser induced breakdown spectroscopy (LIBS) and fluorescence detecting. The DAM-POC scaffold preserved the basic structural and biomechanical integrity and showed a prolonged degradation period as compared to the natural amnion material. The DAM-POC scaffold is cell compatible when seeded with human mesenchymal stem cells (hMSCs), as evidenced by high cell viability, and promotes osteogenic differentiation and matrix mineralization. When applied for repairing the cleft palate in a young rat model, the DAM-POC scaffold showed good biocompatibility and improved tissue integration, angiogenesis, and bone regeneration. Importantly, the DAM-POC scaffold could further facilitate the ongoing tissue regeneration and reduce the associated complications and healing time after surgery. In conclusion, modification of the natural DAM scaffold with POC may contribute to the overall beneficial effect in retaining the matrix structure, mechanical property, and stability for developing a proper, cell-free DAM-based barrier with structural, mechanical, and biological properties suitable for repairing cleft palate in oral cavity.