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Reconstruction of auricular cartilage and in vitro study of chondrogenesis

Mira Hammad, Alexis Veyssiere, Sylvain Leclerq, Catherine Bauge and Karim Boumédiene
Normandy University, France

Auricular malformations, resulting from congenital anomalies, trauma or cancer, which imposes a psychological and social burden, are treated using ear prosthesis, synthetic implants or autologous flaps derived from rib cartilage. These approaches were challenged by progressive resorption, lack of flexibility and donor-site morbidity. To address these problems, a major breakthrough in the field of reconstruction, by tissue engineering, has emerged (Otto et al., 2015). Tissue engineering aims to combine stem cells and biomaterials to create tissues and organs in vitro, to improve, replace or restore biological functions of damage tissues and organs in vivo (Gribova et al., 2016). Our project thus, aims at regenerating cartilage using biological scaffolds composed of allogeneic or xenogeneic extracellular matrices, previously decellularized and then recolonized with mesenchymal stem cells. These matrices will undergo biological treatment to completely remove cellular components. In fact, the optimal protocol for decellularization will be the one that achieves the best balance between the relative absence of nucleic acids and the preservation, both qualitative and quantitative, of the matrix content. No decellularization process, available in literature, has yet been able to avoid the alteration of tissue. Thus, we have developed a biological method for both porcine hyaline and elastic cartilage, compared to the chemical methods commonly reported in literature. Due to the difficulty of recolonizing cartilage matrices, we proceeded by powdering matrices, before adding cells and culturing using 3D hydrogels at different conditions. Cellular scaffolds had undergone qualitative and quantitative analyses to study the behavior and differentiation ability of cells into chondrocytes. Further experiments in vivo will investigate the host response to the implanted scaffolds in nude mice, as well as reconstruction of different cartilage defects created in animal models. Finally, our goal is to approach clinical trials in humans, paving the way for the extracellular matrix-based scaffolds for therapeutic applications in head and neck surgery.

Biography

Mira Hammad is pursuing her PhD at the University of Caen-Normandy, France. She holds a double Diploma Master's degree in Health Engineering from Grenoble-Alpes University, France and the Lebanese University, Lebanon. Her PhD project is about reconstruction of the cartilage, as a regenerative medicine for head and neck surgery.

mira.hammad-samir@unicaen.fr

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