Biological Resurfacing Of Articular Joint In Osteoarthritis

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The management of osteoarthritis (OA) remains still challenging. Although several clinical options exist for the treatment of OA including osteotomies and joint replacements, regeneration of the damaged articular cartilage has been difficult due to the limited healing capacity. With the advancements in tissue engineering and cell-based technologies over the past decade, new therapeutic options for patients with osteochondral lesions potentially exist.

A successful tissue engineering approach for osteochondral repair involves the choice of cells and materials as well as the scaffold design. Regarding the scaffold design, it is important to facilitate zonal restoration of cartilage and subchondral bone, layer by layer, mimicking the natural articular structure. For satisfying the biological requirements, such an osteochondral implant should ideally have a rigid osseous layer to support the overlying cartilage and integrate with the native bone, and a chondral layer to enable the seeding and proliferation of chondrocytes or mesenchymal stem cells (MSCs) and subsequent deposition of cartilaginous matrix. Also, the materials with long term safety and durability should be chosen for future clinical application.

To meet these requirements, we have recently developed a novel hybrid implant comprising a MSC-based scaffold-free tissue-engineered construct (TEC) and a hydroxyapatite (HA)-based artificial bone for osteochondral repair and investigated its feasibility using a rabbit osteochondral defect model. Osteochondral defects treated with the hybrid implants exhibited more rapid subchondral bone repair coupled with the development of cartilaginous tissue with good tissue integration to the adjacent host cartilage. Biomechanically, the osteochondral repair tissue treated with the hybrid implants restored tissue stiffness, similar to normal osteochondral tissue. Therefore, our hybrid implant could be considered a promising MSC-based bio-implant with regard to safety and durability.