Implantation of ferumoxides labeled human mesenchymal stem cells in cartilage defects.

Abstract:

The field of tissue engineering integrates the principles of engineering, cell biology and medicine towards the regeneration of specific cells and functional tissue. Matrix associated stem cell implants (MASI) aim to regenerate cartilage defects due to arthritic or traumatic joint injuries. Adult mesenchymal stem cells (MSCs) have the ability to differentiate into cells of the chondrogenic lineage and have shown promising results for cell-based articular cartilage repair technologies. Autologous MSCs can be isolated from a variety of tissues, can be expanded in cell cultures without losing their differentiation potential, and have demonstrated chondrogenic differentiation in vitro and in vivo(1, 2). In order to provide local retention and viability of transplanted MSCs in cartilage defects, a scaffold is needed, which also supports subsequent differentiation and proliferation. The architecture of the scaffold guides tissue formation and permits the extracellular matrix, produced by the stem cells, to expand. Previous investigations have shown that a 2% agarose scaffold may support the development of stable hyaline cartilage and does not induce immune responses(3). Long term retention of transplanted stem cells in MASI is critical for cartilage regeneration. Labeling of MSCs with iron oxide nanoparticles allows for long-term in vivo tracking with non-invasive MR imaging techniques(4). This presentation will demonstrate
techniques for labeling MSCs with iron oxide nanoparticles, the generation of cell-agarose constructs and implantation of these constructs into cartilage defects. The labeled constructs can be tracked non-invasively with MR-Imaging.

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