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Five years clinical results after matrix assisted autologous chondrocyte transplantation using a hyaluronan matrix

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Purpose: Various biomaterials have been used in matrix assisted chondrocyte transplantation to improve articular cartilage repair. Hyaluronan was introduced successfully to transplant cultured chondrocytes in cartilage defects. This study presents the first five-years clinical result using the Hyalograft technique.
Methods and Materials: Between December 2000 and November 2005 51 patients were treated with Hyalograft C in the knee joint. 29 were male, 22 female, 48 had single defects, 3 had multiple defects. Mean defect size was 4.4 cm^2. 39 cases showed defects on the medial femoral condyle (MFC), 6 cases on the lateral femoral condyle (LFC). 2 had patellar defects, 1 tibial, 1 MFC/LFC, 1 tibial/MFC and in one case multiple defects on the MFC were treated. Clinical follow up was performed at 1,3 and 5 years with three knee scoring systems: the Lysholm Score, a modified Cincinnati Knee Score and the IKDC Score.
Results: At 5-years follow-up the preoperative Lysholm Score increased from 56.9 (+/- 16.8) to 83.5 (+/-22.8), the modified Cincinnati Score from 2.7 (+/- 1.6,) to 7 (+/- 2.1) and the subjektive IKDC Knie Score fom 39.8 (+/-19.5) to 62.9 (+/- 18.4) in 8 patients. Overall in 44 patients the clincical outcome at 1 and 3 years improved significantly, however failures were 2 graft delamination and 8 patients with total knee replacement due to progressing osteoarthritis.
Conclusions: Hyalograft is a useful treatment option for cartilage defects with outcome comparable to autologous chondrocyte implantation. Simpler surgery and a miniarthrotomy-approach are advantages of the technique. In patients with osteoarthrosis critical indication should take place.

16.8

Osteochondral lesions of the talus: a new one-step arthroscopic procedure for the regeneration of hyaline articular cartilage

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Purpose: Different methods have been proposed to date to achieve the regeneration of hyaline cartilage in osteochondral lesions of the talus (OLT). The aim of this study was to present a new one-step arthroscopic procedure with the use of mesenchimal stem cells (MSC) supported on a collagen scaffold and Platelet Rich Fibrin (PRF).
Methods and Materials: 14 patients with a diagnosis of OLT underwent this procedure. The MSC were harvested from the posterior iliac crest and concentrated directly in the operating room. An ankle arthroscopy was performed with lesion detection and curettage. The cell concentrate was mixed with a collagen paste as scaffold and with PRF as a pool of growth factors in order to have a final composite to fill the lesion site. Partial weight bearing for 2 months and early ROM was advised postoperatively.
Results: According to the American Orthopaedic Foot and Ankle Score (AOFAS) system the patients had a preoperative score of 65.1 (range 35-79), a postoperative of 69.4 (range 61-97) at 6 months and of 83.6 (range 65-100) at 12 months follow up. MRI control at 6 and 12 months showed a progression of the reparative process in the osteochondral lesions. Histological and immunohystochemical analysis on a sample biopsed during a control arthroscopy at 12 months confirmed the hyaline quality of the regenerated cartilage.
Conclusions: This one-step technique demonstrated to be capable to regenerate hyaline cartilage, with the advantages of a reduced surgical time, lower costs and lower patient's morbidity.

17.3

Cartilage regeneration with chondrocytes in fibrinogen gel scaffold and polylactate porous scaffold. An in vivo study in goats

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Purpose: Recently porous scaffolds have been introduced for clinical cartilage tissue engineering. Numerous scaffold materials exist and the optimal scaffold needs to be identified. The present study aims to investigate the cartilage regenerative response of a polylactate (PLGA) porous scaffold and a fibrin scaffold combined with chondrocyte suspension in a goat femoral condyle full thickness cartilage defect model.
Methods and Materials: 20 adult goats were used for the study. 6 mm circular defect was created in bilateral medial femoral condyles. Cartilage tissue was harvested for chondrocyte culture. At secondary open surgery the defects were randomized to the following four treatment groups .1. Empty defect (control) 2. Microfracture (control) 3. Fibrin scaffold with chondrocytes and 4. Fibrin/chondrocyte solution in a PLGA porous scaffold. Animals were followed for 4 month. Analyses: ICRS macroscopic scoring. Mechanical stiffness test of regeneration tissue. Histological analyses was performed by O,Driscoll and Pinada scores and percentage tissue filling of the defects.
Results: The cartilage regeneration is PLGA/Cell group demonstrated high defect fill and a tissue characteristic close to hyaline cartilage whereas no regeneration tissue was seen in the empty defects. The fibrin/chondrocyte and microfracture group demonstrated limited repair tissue formation. Mechanical testing demonstrated no difference between treatment groups.
Conclusions: The PLGA/cell construct demonstrates an extensive cartilage regenerative response with good phenotypic characteristic. Fibrin scaffold with chondrocytes and microfracture stimulated only limited cartilage repair tissue. A porous PLGA scaffold in combination with cultures chondrocytes seems to be a good technique for cartilage tissue engineering in vivo.

17.4

Efficient in vivo gene delivery using chitosan/DNA nanoparticles for applications in cartilage repair

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Purpose: Chitosan is a cationic polymer that can condense plasmid DNA into nanosized gene vectors. We have recently published that specific chitosans (10kDa at 80%DDA and 92%DDA called 80-10 and 92-10 where DDA is degree of deacetylation) can efficiently deliver genes to cells in vitro. The purpose of this study was to examine in vivo gene delivery using these chitosan/DNA nanovectors.
Methods and Materials: Chitosan/DNA nanoparticles were injected subcutaneously in mice, 5 times over a 7 week period using a pVax-FGF2 plasmid. ELISA assays were used to quantify the expressed human proteins and anti-FGF2 antibodies in serum. Nanoparticles were used in a rabbit model where pVax-LacZ was injected subcutaneously while fluorescent nanoparticles were applied to a chondral defect of the trochlea.
Results: Using chitosan 92-10, FGF2 protein expression doubled compared to plasmid alone without detectable anti-FGF2 antibody. In contrast, anti-FGF2 antibodies were detected with chitosan 80-10 without detectable protein suggesting the immune response to be sensitive to chitosan type. Subcutaneous injection of these nanoparticles in rabbits produced positive β-Gal transfection in fibroblast-like cells, white blood cells and adipocytes. Fluorescently labeled chitosan/DNA nanoparticles were found to adhere and be resident in cartilage defects as revealed by confocal microscopy at sacrifice 24 hours post-surgery.
Conclusions: Chitosan/DNA nanoparticles are promising therapeutic systems for repair and regeneration of joint tissues. Choice of a formulation with high transfection efficiency and limited immune response combined with the ability of chitosan to adhere to cartilage defects indicates a high potential to improve repair of cartilage and other joint tissues.