All Arthroscopic Matrix Encapsulated Autologous Chondrocyte Implantation For The Treatment Of Focal Articular Cartilage Lesions In The Knee. Quantitative T2-Mapping Evaluation at 24-months of Follow-up.

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Introduction: Cartilage injuries are common in young people causing physical impairment and pain. Several studies report ICRS grade III or IV cartilage lesions in 60 to 63% of knee arthroscopic procedures. There is a wide number of surgical techniques for cartilage repair. The most common in clinical practice with good results are microfractures, osteochondral autologous transplantation (OATs), autologous chondrocyte implantation (ACI), and matrix-induced autologous chondrocyte implantation (MACI). The recent development of surgical procedures that hold the promise of forming repair tissue, either fibrocartilage or hyalinelike cartilage has increased the need for accurate, noninvasive assessment of both native articular cartilage and postoperative repair tissue. T2-Mapping MRI represents a useful tool to make a quantitative non-invasive assessment of the evolution (maturation or deterioration) of the repaired tissue through the time.

The purpose of this study is to prospectively evaluate by MRI T2 mapping the repair tissue after cartilage repair by either microfractures or arthroscopic matrix encapsulated autologous chondrocyte implantation (MECI) up to 24 months.

Methods: A total of 52 patients with symptomatic articular cartilage lesions in the knee, 1-4cm size, and grade III-IV (ICRS) were included in this study. Patients were randomized between MECI and Microfracture. In the MECI group two-to-three osteochondral biopsies were obtained during the first surgical procedure. Isolated chondrocytes were expanded in monolayer culture. After 3 weeks a construct was formed with a collagen III scaffold enveloped in a chondrocyte monolayer, and incubated in DMEM-F12 plus autologous human serum during 4 days. Debridement of the lesion was performed and the construct was implanted arthroscopically (Fig.1). Clinical evaluation and T2-mapping were performed pre-op, and at 3, 6, 12, 18, and 24 months. Second-look arthroscopy was performed at 12 months.

Results: Twenty-six patients underwent MECI and 24 received microfractures. Average age was 35 (4.2±SD) years. There was no statistically significant difference in the clinical evaluation with Lysholm (83.31 ± 22.44, 79.95 ± 16.54: p=0.245), KOOSs (84.31 ± 14.28, 84.23 ± 15.13: p=0.626), Tegner (3.94 ± 1.91, 3.85 ± 1.87: p=0.857), IKDC (72.97 ± 18.10, 63 ± 25.39: p=0.272) scores between MECI and Microfractures, respectively. Six regions of interest were analyzed by T2-mapping (Fig.2). T2-Mapping results showed significant difference between MECI and Microfractures in ROI-6 (basal repaired tissue) at 12-months (37.63 ± 4.25, 48.13 ± 13.36: p=0.040), and 24-months (39.63 ± 3.51, 47.56 ± 8.75: p=0.004) after surgery, respectively. Second-look arthroscopic scores were significantly higher in the MECI (11 ± .78) compared to microfractures (9.09 ± .52, p<0.001. There were 2 failures in microfractures group, compared to none in MECI group.

Discussion: Although clinical evaluations were similar in both groups, T2-mapping assessment showed statistical significant difference in signal intensity through the time between MECI and Microfracture group. Those results are comparable with the literature studies. Reports of the histological analysis of the repaired tissue after ACI technique shown hyaline-like cartilage tissue. However, the best repair tissue is not morphologically or histochemically identical to hyaline cartilage. MR and second look arthroscopy are complementary examinations for follow-up of autologous chondrocyte implants in the knee. Arthroscopy is better used for assessing the cartilage surface, and MRI is better used for assessing lesions deep within the cartilage and the underlying bone. Although we had two failures in the MECI group compared with the Microfracture group, MECI procedure showed to be safety and reproducible.

Significance: The sensitivity of magnetic resonance imaging to biochemical and biophysical changes in the extracellular matrix of articular cartilage give it the potential to noninvasively detect the changes through the time and the long-term durability of the repaired tissue.

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References: 1. S. E. Domayer MD. T2-Mapping in the Knee.

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Figura 3. T2-Mapping MRI of a patient after MECI with a 24-months follow-up. Images through the time show an improvement in the signal intensity, these values permit an assessment of the quality the repaired tissue observing that those characteristics are very closed to healthy control cartilage.