

Articular cartilage has limited healing capacity, due in part to poor vascularity and innervation. We originally developed a scaffold-free tissue-engineered construct (TEC) derived from autologous synovial membrane mesenchymal stem cells (MSCs) and demonstrated their safety and efficacy following implantation for cartilage repair at 2 years postoperatively in our earlier study. The present study aimed to further investigate clinical outcomes and MRI findings at 5 years post-implantation. An observational first-in-human study limited to 5 cases was approved by the Ministry of Health, Labor, and Welfare of Japan. Five patients (age 28 - 46 years old) with symptomatic knee chondral lesions (1.5 - 3.0 cm²) on the medial femoral condyle, lateral femoral condyle, or femoral groove were enrolled in this study. Synovial MSCs were isolated from arthroscopic biopsy specimens and cultured to develop a TEC that matched the lesion size. The TECs were then implanted into chondral defects without fixation and assessed up to 5 years postoperatively. The patients were clinically evaluated using a visual analog scale (VAS), Lysholm, Tegner, and Knee injury and Osteoarthritis Outcome Score (KOOS) scores. An MRI evaluation was also performed for morphologic and compositional quality of the repair tissue at 5 years of follow-up. All clinical scores were significantly improved from the preoperative evaluation to the 2- and 5-year follow-ups and the results were stable over time. The MRI evaluation showed cartilage defects filled with newly generated tissues with good tissue integration to adjacent host cartilage over time. The cartilage thickness and surface smoothness of the repair cartilage were maintained out to 5 years postoperatively. The MOCART 2.0 Knee Scores were maintained high at 5 years, although the total points decreased slightly. The present results highlighted the efficacy and feasibility of this procedure, showing good clinical outcomes and MRI findings with stable results at midterm follow-up. Thus, an autologous scaffold-free TEC derived from synovial MSCs could be used for regenerative cartilage repair via a sutureless and simple implantation procedure. On the other hand, further follow-up will be needed to assess the quality change in repair tissue.

Category: Knee - Cartilage

The Safety and Efficiency of the Osteo-Core Plasty Technique for Treating Painful Bone Marrow Lesions in the Knee Joints

Abstract ID# 21922

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Summary:

The Osteo-Core Plasty technique provides efficient and safe treatment for subchondral bone lesions of knee joint at two years follow-up

Data:

Background: The subchondral bone is a critical joint element and is considered an integral part of the osteochondral unit. In fact, it provides nutrients to the avascular cartilage, therefore participating in the healing process while also providing firm support and shock absorption to the cartilage. Subchondral bone pathology is seen as a bone marrow lesion (BML) on MRI and is visible in different pathologies, including knee osteoarthritis (OA). BML if not treated, accelerate osteoarthritic changes in the joint. Treatment options for subchondral bone lesions are still limited and no gold standard has been established. Osteo-Core Plasty is a minimally invasive treatment for subchondral pathologies to prevent the progression of OA. It consists of 2 parts: decompression of bone marrow to decrease intraosseous pressure, and the administration of bone marrow aspirate concentrate to enhance healing potential and bone autograft to provide supportive tissue. Purpose: To report the clinical outcomes and safety of Osteo-core Plasty for treating symptomatic BMLs in the knee at 2 years follow-up. Methods: 24 patients (mean age 53 ± 17 years) with symptomatic BML of the knee treated with the Osteo-core Plasty technique were included and followed prospectively for an average of 2.5 years. Patients were recruited from 2017 to 2021. Each patient was evaluated before the surgery and at 2 years using the Knee Injury and Osteoarthritis Outcome Score (KOOS): symptoms, pain, activity of daily living (ADL), sport, and quality of life. Results: All patients showed a significant improvement at final follow-up, compare to the initial state, with KOOS scores all significantly improved: symptoms (p = 0.0005), pain (p = 0.0003), ADL (p = 0.0053), sport (p = 0.0014), and quality of life (p < 0.0001). Median [IQR] KOOS symptoms improved from 48.00 [36.25 – 68.00] to 85.50 [61.75 – 100.0], KOOS pain 51.50 [39.25 – 67.75] to 90.50 [69.25 – 100.0], KOOS ADL from 51.50 [40.00 – 79.50] to 90.00 [62.00 – 100.0], KOOS sport

from 27.50 [15.00 – 48.75] to 75.00 [26.25 – 100.0], KOOS quality of life from 30.00 [25.00 – 43.00] to 72.00 [44.00 – 100.0]. No serious adverse event was observed during the study. Conclusions: This study provides evidence of the efficacy and safety of the Osteo-core Plasty technique in treating painful BMLs in the knee joints at a 2 years follow-up.

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Long Term Outcomes and Survivorship Of Autologous Chondrocyte Implantation for Femoral Condyle Articular Cartilage Defects In The Knee

Abstract ID# 22848

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Summary:

The results of this study demonstrates that ACI is a procedure that preserves the native knee with long-term graft survival of 74.4% and maintenance of functional improvements in 51.2% of patients at 20 years following treatment for isolated femoral condyle articular cartilage lesions

Data:

INTRODUCTION There has been an accumulation of high-level evidence demonstrating good clinical outcomes for the use of Autologous Chondrocyte Implantation (ACI) in articular cartilage repair in the knee over the short and mid-term. Long-term evidence, however, remains limited. The aim of this study is to report the long-term outcomes and identify predictors of success and failure following ACI for isolated femoral condyle articular cartilage defects in the knee. METHODS Study participants consisted of a cohort of patients treated with ACI for unipolar isolated defects of the femoral condyle. Patients were identified from the inhouse prospectively maintained ACI database. Each patient underwent a 2-stage procedure to reconstruct a chondral lesion using expanded chondrocytes (Oscell, Oswestry, UK). Kaplan-Meier survival analysis was performed, and clinical outcome was determined using the modified Lysholm score. Mixed multilevel modelling was used to identify predictive factors. RESULTS The study population consisted of 29 males and 12 females with a mean age of 36.6 years (SD 8.95, range 18-52). All patients had a single chondral defect of the distal femur with 30 lesions on the medial femoral condyle (MFC) and 11 on the lateral femoral condyle (LFC). The median defect area was 4.38cm² (IQR], 2.3-6.0) with the largest defect measuring 13.5cm². The mean number of cells implanted was 3.01 x 10⁶ cells/cm². The average follow-up time was 11 years (SD 5.03) with a maximum follow-up of 20 years post-ACI. The mean pre-operative Lysholm score was 42.9 (SD 17.3, 11-74). Improvement in clinical outcome scores were found to peak at year 7 with a mean score of 61.0 (SE 3.31). The biggest increase in Lysholm score was achieved in the first year with a mean increase of 16.7 (SE 4.10, p<0.05). Mean Lysholm scores at 15 and 20 years post-ACI were 59.7 and 57.1 respectively. Functional improvement was maintained in 65.7% (95% CI, 52%-83%) at 10 years and 51.2% (95% CI, 35%-75%) at 20 years. Mixed multilevel modelling identified an inverse relationship between total number of cells implanted and Lysholm score. For every extra 1 million cells implanted, the Lysholm score at 12 months decreased by 3.9 (95% CI, 0.7-7.1). Eight patients (19.5%) were considered to have failed with a conversion to total knee arthroplasty at a mean time of 8.1 years (SD 3.15) following ACI. Survival at 20 years was 74.4% (95% CO, 60%-91%) with maintenance of the native knee for which treatment was initially sought. CONCLUSIONS ACI is a procedure that preserves the native knee with long-term graft survival of 74.4% and maintenance of functional improvements in 51.2% of patients at 20 years. In addition, the total number of cells implanted rather than cell seeding density influenced the clinical outcome of patients in this study, with increasing cell number having a negative effect on clinical outcome.

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Evidence-Based Machine Learning Algorithm to Predict Failure Following Cartilage Preservation Procedures in the Knee

Abstract ID# 22922

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