A Comparative Study Between Patellofemoral Joint and Femoral Condyles Cartilage Lesions after Mesenchymal Stem Cells Implantation

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We have no financial conflicts to disclose
Background

• Patellofemoral joint is a difficult site for cartilage procedure, because of the bony morphology and the patella’s mobility

Hypothesis- Purpose

• It is hypothesized that there will be differences in the healing process of patellofemoral joint focal chondral lesions compared with lesions in the femoral condyles

• The purpose of this prospective case series study was to compare the clinical results after matrix-induced autologous adipose-derived mesenchymal stem cells (AD-MSCs) implantation between patients with patellofemoral joint cartilage lesions and patients with femoral condyles lesions in 3-years FU
Material and Method

- In a single center between 2012 and 2015
- 30 patients (17 male and 13 female/ mean age 28.07 years ) treated for symptomatic focal knee cartilage defect
- 32 ICRS grade 3 and 4 cartilage lesions identified (mean size 4.6cm²/ range 1.8 – 6.1cm²)
- **Group A**: Patellofemoral chondral lesions No Patients=9 (4 patients recurrent PF dislocation + additional procedures)
- **Control Group**: Femoral condyles chondral lesions No Patients=21
Material and Method (contd.)

- subcutaneous adipose tissue piece from hypogastrium (~1 gr)
- MSCs isolated and grown under standard cell culture conditions (30-40 days) \(10-20 \times 10^6\) cell / 1 ml

Identification of the MSCs was established according to the criteria of the International Society for Cellular Therapy

- Certification after culture, flow cytometry, cell number measurement and microscopic examination for cell shape/type

- The characterization of AD-MSCs was indicated by microscopic morphological check and specific surface antigen expression such as CD90, CD29, CD73 and CD105 markers and expression lack of CD3, CD14, CD19, CD31, CD34, HLA DR, CD62 and CD45 markers

Tables 1.2. Patients and lesions characteristics: (no differences)
Material and Method (contd.)

- A single-staged procedure involved filling of each defect with autologous culture-expanded MSCs embedded in a trimmed-to-fit biodegradable matrix

- Biomaterial absorbable membrane  (*Esterified benzolic polymer of hyaluronic acid/ HyalofastTM-Hyaff®*)

Inject the cells into the membrane before putting it on the defect (only mini-open arthrotomy for patella and mini-open arthrotomy or arthroscopically for femoral condyles)
Results

• The patients were followed at 6th, 12th, 24th and 36th p.o. month
• outcome analysis was based on:
  • Knee injury and Osteoarthritis Outcome Score (KOOS), International Knee Documentation Committee (IKDC) forms, Tegner activity scale
  • The Repeated – Measures ANOVA results indicated significant change over time for the IKDC scale and all KOOS subscales (p < 0.001) in both Groups in general
  • No complications and/or adverse events or reoperation had been reported

Table 3. Descriptive Statistics 1 (IKDC)

Table 4. Descriptive Statistics 2 (KOOS subscales)
Figure 1. *Post hoc testing* confirmed significant changes in the *IKDC scale* between all time points of measurements (p<0.001 to p=0.001). **Nearly significant difference** (p=0.055) was found between group A (M=50.9, SD=10.8) and control group (M=60.1, SD=13.8). The interaction between time and group was not significant.

Figure 2. *Post hoc testing* confirmed significant changes in the *PAIN subscale* between all time points of measurements (p<0.001). **Significant difference** (p=0.007) was found between group A (M=71.6, SD=9.3) and control group (81.2, SD=10.4). The interaction between time and group was significant (p=0.045). The PAIN subscale did not change significantly for Group A until year 1 (p=0.075). There was a significant change between year 1 and year 2 (p=0.001)
• **Figure 3.** *Post hoc testing* confirmed significant changes in the **SYMPTOM subscale** between all time points of measurements (*p*<0.001). **Significant difference** (*p*=0.032) was found between group A (*M*=72.8, *SD*=6.5) and control group (*M*=79.7, *SD*=10.5). The interaction between time and group was not significant.

**Figure 4.** *Post hoc testing* confirmed significant changes in the **ADL subscale** between all time points of measurements (*p*<0.001 to *p*=0.001). **Significant difference** (*p*=0.035) was found between group A (*M*=70.4, *SD*=10.1) and control group (*M*=80.1, *SD*=13.7). The interaction between time and group was not significant.
Results (contd.)

**Figure 5.** Post hoc testing confirmed significant changes in the **SPORT_REC subscale** between all time points of measurements \((p<0.001\text{ to } p=0.003)\). Significant difference was not found between group A and control group. The interaction between time and group was not significant.

**Figure 6.** Post hoc testing confirmed significant changes in the **QOL subscale** between all time points of measurements \((p<0.001)\). Significant difference was not found between group A and control group. The interaction between time and group was not significant.

**Figure 7.** Not returning in the same pre-injury activity level (Activity level mean value slightly lower for group A)
Discussion

The most important finding of this study was that:

culture-expanded adipose derived MSCs embedded in a trimmed-to-fit biodegradable matrix is an effective and safe procedure to manage full-thickness focal chondral lesions both in femoral condyles and patellofemoral joint

There are differences in the improvement of some clinical scores between patellofemoral and femoral condyles lesions in favor of the femoral condyles

Limitations of the study

• Case series study without randomization (subject to selection bias)
• 3-years results are presented
• Cohorts size (9 vs 21 patients)
• Clinical evaluation
Conclusions

- The hypothesis that there will be differences in the healing process of patellofemoral joint focal chondral lesions compared with lesions in the femoral condyles was partially confirmed.

- This study has shown significant improvement for both patellofemoral joint and femoral condyles lesions over time, however the patellofemoral joint lesions showed slower improvement rhythm and lower level of clinical scores values.
References


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