Mid-Term Clinical Outcomes of Atelocollagen-associated Autologous Chondrocyte Implantation for the Repair of Chondral Defects of the Knee

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I have no financial conflicts to disclose.
Autologous chondrocyte implantation: ACI

- Atelocollagen-associated ACI is applied new tissue-engineering technology to create a cartilage-like tissue in a 3D culture using atelocollagen gel\(^1\)\(^2\)

- Short-term good clinical results of atelocollagen-associated ACI was reported in prospective multicenter clinical trial in our previous study\(^3\)

![Graph showing original knee function score and Lysholm score over time](image)
**Purpose**

- To evaluate mid-term clinical outcomes and complications in patients undergoing atelocollagen-associated ACI for the repair of chondral defects of the knee
## Methods

- 2004-2016
  - 12 cases (12 knees) underwent Atelocollagen-associated ACI (Table 1)
  - Clinical (Lysholm, KOOS score) and MRI evaluations (MOCART score) at latest follow up
  - Statistical analysis: The Student’s t-test

### Table 1

<table>
<thead>
<tr>
<th>Demographic characteristics</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at surgery, mean (range), y</td>
<td>35.7 (15-68)</td>
</tr>
<tr>
<td>Sex, male/female, n</td>
<td>7/5</td>
</tr>
<tr>
<td>Follow-up periods, mean (range), y</td>
<td>8 (2-13)</td>
</tr>
<tr>
<td>Cause of the osteochondral defect, n</td>
<td></td>
</tr>
<tr>
<td>Trauma</td>
<td>6</td>
</tr>
<tr>
<td>Osteochondritis dissecans</td>
<td>5</td>
</tr>
<tr>
<td>Spontaneous osteonecrosis</td>
<td>1</td>
</tr>
<tr>
<td>Defect size, mean, cm²</td>
<td>4.5 (4-6)</td>
</tr>
<tr>
<td>Defect location, n</td>
<td></td>
</tr>
<tr>
<td>Medial femoral condyle</td>
<td>7</td>
</tr>
<tr>
<td>Lateral femoral condyle</td>
<td>5</td>
</tr>
<tr>
<td>Combined surgery, n</td>
<td></td>
</tr>
<tr>
<td>ACL reconstruction</td>
<td>2</td>
</tr>
<tr>
<td>Iliac bone graft</td>
<td>1</td>
</tr>
<tr>
<td>OATS</td>
<td>1</td>
</tr>
<tr>
<td>Lateral meniscus reconstruction</td>
<td>1</td>
</tr>
</tbody>
</table>
**Methods: Atelocollagen-associated ACI procedure**

- 2-stage procedure\(^1\)\(^2\)\(^3\)
  1. Cartilage harvest from unloaded area of femoral condyle
  2. Implantation of autologous chondrocytes embedded in atelocollagen gel covered by a sutured periosteal flap

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[Image: Diagram showing the procedure steps]
Results

• Clinical outcomes
  ✓ Lysholm score improved from 65 to 90 points (p<0.001)
  ✓ Regarding KOOS, all five subscale scores improved (p<0.05)
Results

MRI evaluation (MOCART score 4)

- Graft integration to border zone and subchondral bone
- Thickening of the graft in 2 cases
- MOCART score improved from 10 to 83 points (p<0.001)
Results

Arthroscopic & histological evaluation

- Needle biopsy at the implantation site was performed in four cases
- Well bonded to subchondral bone
- Cartilage-like tissue with proteoglycan-rich matrix
- Just monolayer different from four layers in normal hyaline cartilage
Results

Complications

• Partial detachment of the graft; 1 case @ 8 Mths after implantation
  ✓ Previously treated with OATS for OCD
  ✓ Osteosclerosis of the subchondral bone for implantation

• Total knee arthroplasty was performed 8 years after surgery in case with spontaneous necrosis of the knee
Discussion

- Evaluation of outcomes of atelocollagen-associated ACI in 12 cases
  - Good to excellent mid-term clinical results
  - MOCART score improved significantly
  - Grafted tissue: well bonded to the subchondral bone

Cartilage-like tissue with a PG-rich matrix was observed in biopsy specimens

[Graph showing Lysholm score and KOOS scores]

[Biopsy specimen image]
Discussion

- Detachment of the graft
  - Increased failure rate of ACI after microfracture due to altered subchondral plate ⁵⁻⁶⁻
- Partial detachment of the graft after OATS in this study
  - Detached graft was histologically cartilage-like tissue
  - Osteosclerosis of the subchondral bone for implantation was thought to be the reason of detachment
Conclusion & References

Conclusion

- We evaluated the mid-term outcomes after atelocollagen-associated ACI
- Lysholm score and KOOS improved significantly @ 8 yrs after surgery
- Detachment of the graft was observed in 1 case

References

1) M Ochi, Y Uchio, K Kawasaki et al Atif Organs 2001
2) M Ochi, Y Uchio, J Iwasa et al. JBJS 2002
3) H Tohyama, K Yasuda, M Ochi et al. JOS 2009
5) T Minas, A Gonmoll, T Bryant et al. AJSM 2009
6) J Pestka, G Bode, P Niemeyer et al. AJSM 2012