ACI for knee cartilage injuries: Moderate functional outcome and performance in patients with high impact activities

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5% to 10% of patients with hemarthrosis have a focal chondral injury


5%-19% of young individuals have a grade IV cartilage lesion

Curl WW et al. Arthroscopy, 1997

these lesions can be a precursor to osteoarthritis

Buckwalter JA. CORR, 2002
Epidemiology

53,569 hyaline cartilage lesions in 19,827 patients undergoing knee arthroscopy\(^1\)

993 consecutive knee arthroscopies demonstrated evidence of articular cartilage abnormality in 66\%\(^2\)

Articular cartilage defects of the femoral condyles in up to 50\% of athletes undergoing ACL reconstruction\(^3\)

Treatment options

Debridement
Abrasion arthroplasty
Drilling
Microfracture, AMIC
Osteochondral transplantation
  Mosaicpasty
  Massive allograft
Autologous chondrocyte implantation
MACI
New, one-step biological treatments
Other

Dervin GF, et al JBJS Am, 2003
Knutsen G, et al. JBJS Am, 2004
Peterson L, et al JBJS Am. 2003
Microfracture and chondroplasty 98% of cases.

There was no significant change in the incidence of cartilage procedures noted from 2004 (1.27 cases per 10,000 patients) to 2009 (1.53 cases per 10,000 patients) (p = 0.06).
Autologous chondrocyte implantation

“Classic” ACI

Success rate up to 90% after 10 years follow-up
Long term durability
Gold-standard if previous treatment failed

Smith GD et al. JBJS Br, 2005

Matrix-assisted ACI

Mini arthroscopy
Shorter operative time?
Less graft-related complications?

Bartlett W, et al. JBJS Br, 2005
Haddo O, et al. Knee, 2004
At a mean of $12 \pm 2$ years follow up, 53 of 210 patients (25%) had at least one failed ACI graft age younger than 45 years, defect sizes less than 15 cm$^2$, no prior microfracture, concomitant HTO
ACI in high demand patients?

72% good to excellent overall results in 45 professional and recreational soccer players.


96% excellent results in 20 adolescents athletes

96% of them returned to high-impact sports

Improved outcomes (especially after ACI)

Defect size < 2 cm²,
preoperative duration of symptoms < 18 months,
no prior surgical treatment,
younger patient age,
and higher preinjury and postsurgical level of sports
Autologous Chondrocyte Implantation for Knee Cartilage Injuries: Moderate Functional Outcome and Performance in Patients With High-impact Activities

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abstract

Full article available online at ORTHOSuperSite.com. Search: 20111122-07

Few studies have assessed the results of autologous chondrocyte implantation in patients with high-impact activities. The purpose of this study was to evaluate the early functional outcome and activity level after 2-stage autologous chondrocyte implantation in professional soldiers and athletes. Nineteen patients with an average age of 32.2 years were treated with autologous chondrocyte implantation and followed up for a minimum of 2 years. All patients except 2 had received previous arthroscopic treatment with debridement and/or microfracture. The mean size of the postdebridement defect was 6.54 cm². Using Novocart technology (B. Braun-Tetec, Reutlingen, Germany), periosteal patch and matrix-assisted autologous chondrocyte implantation was sequentially performed with a 6-month interval. The mean KOOS and Lysholm scores improved from 50.8 to 83.1 and 69.3 to 82.8, respectively.
Material (19 patients)

12 professional soldiers
5 professional athletes,
2 recreational athletes
male: 15 – female: 4
average age 31 years
22 defects (ICRS grade-IV)
Material (19 patients)

Mean duration of symptoms **43.8** months
Average defect size was **6.03 cm²** (4.5-15 cm²)
73% at least 1 previous arthroscopy
(5 failed micro#, 1 failed OCD fixation)
4 patients bone graft (depth > 7mm)
minimum follow up **36** months
Secondary lesions = Grade I & II

Patella 3
Plateau 1  \[\text{debridement}\]

Complex injuries
ACL 3 (previous stage reconstruction)
Menisci 5 (same stage reconstruction)
Preoperative Evaluation
Surgical technique


**N=11**


**N=8**
Surgical technique
Clinical evaluation

Cartilage Injury Evaluation Package - ICRS

ICRS injury questionnaire
IKDC subjective knee evaluation form-2000

Lyshom score

Tegner activity scale

<table>
<thead>
<tr>
<th>No.</th>
<th>IKDC Score</th>
<th>Functional Status</th>
<th>Tegner Scale</th>
<th>Lyshom Score</th>
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Abbreviations: FU, follow-up; IKDC, International Knee Documentation Committee; Preop, preoperatively; PRI, preinjury.
Results

**IKDC**

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<tr>
<th>Preop</th>
<th>3 months</th>
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<th>12 months</th>
<th>36 months</th>
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**Lyshom score**

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<th>3 months</th>
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<th>12 months</th>
<th>36 months</th>
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<td>prop</td>
<td>42.42</td>
<td>post</td>
<td>69.4</td>
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</table>
Results

Median Tegner activity score was 8.8 before injury, 3.8 preoperatively, and 6.15 at latest follow-up.
Results

Change in IKDC & Lysholm score, pre-op to 36 months, in the two groups

IKDC

Lyshom
1 prof. footballer    same level
1 semi-prof. rugby player

3 significant lower level of performance

1 soldier only P2 level (fit for full service)
8 were classified as P3 (able for light duties only)
2 as P7 (still under medical care)
1 left the army untimely (P8, medically discharged).

PULHHAEEEMS, UK Army: fitness performance test

Only 6/19 patients (31%) return to pre-injury level of performance
2 patients arthrofibrosis

11/19 pt (57.8%) 2\textsuperscript{nd} look arthroscopy
  - persistent pain
  - decreased range of motion
  - mechanical symptoms

1 patient complete delamination of the central area (2.0 x 2.0 cm\textsuperscript{2}) of the graft

overgrowth of the graft (5 cases)
patch detachment (1 patient)
unstable periosteal edges (2 patients)
softened spots (2 patients)
Conclusions

In high-demand patients who have long standing disability, large defects and failed previous cartilage techniques the results of ACI might not be as good as it is usually is reported or expected.

An overall improvement in knee function can always be achieved but from this point of view, ACI can be only be defined as a salvage solution than a fundamental and life style procedure.
The quality of cartilage restoration studies is poor, and heterogeneity exists regarding the techniques followed, the included populations, and the reported outcomes.

The results of randomized and well-designed prospective studies may give more specific answers in the future. Until then, ACI implantation must prove its superiority, especially in the high-demand population.
Conclusions

**Ideal candidate** for ACI is a young and fit patient with high preoperative functional scores, and no previous operations, who is less than 12 months symptomatic, and has an isolated and moderate-sized cartilage defect.