Is any advantage of AMIC in isolated chondral injuries of femoral condyles?

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Epidemiology of cartilage damage

- Curl et al. described 53,569 hyaline cartilage lesions in 19,827 patients undergoing knee arthroscopy\(^1\)

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

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

Two major problems

The **first** is to fill the defect void with a tissue that has the same mechanical properties as articular cartilage.

The **second** is to promote successful integration between the repair tissue and the native articular cartilage.
Treatment options

1. Arthroscopic lavage & debridement
2. Bone marrow stimulation
3. Cell-based therapy
4. Osteochondral autograft transfer
5. Scaffolds
6. Allografts
7. Osteotomy
We do not have evidence based methods for the treatment of cartilage defects in the knee

Jan P. Benthien · Manuela Schwäninger · Peter Behrens

modified Coleman methodological score
Bone marrow stimulation

Symptomatic, focal high-grade chondral lesions of the weightbearing femoral condyles, trochlea, and patella in active patients

Incidental cartilage lesions

A defect size of \(< 4 \text{ cm}^2\)

A short preoperative duration of symptoms (optimally, less than 12 months)

Optimal patient age should be \(< 45 \text{ years-old}\)

Surgical technique

Debridement, with use of an arthroscopic shaver, of any loose cartilage flaps to create a stable peripheral cartilage margin
Surgical technique

débridement of the calcified cartilage layer with use of a curet to provide manual feedback control
Surgical technique

the adequate depth of subchondral bone penetration and width of osseous bridges between the individual microfracture holes
Surgical technique

the adequate depth of subchondral bone penetration and width of osseous bridges between the individual microfracture holes
Surgical technique

adequacy of the microfractures by noting the release of fat droplets and blood from the individual holes
Rehabilitation

Femoral condyle

<table>
<thead>
<tr>
<th>PHASE I 0 - 8 weeks</th>
<th>WEIGHT BEARING</th>
<th>BRACE</th>
<th>ROM</th>
<th>THERAPEUTIC EXERCISE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Touchdown weight bearing (20-30%)</td>
<td>None</td>
<td>Use of a CPM for 6-8 hours/day - set at a rate of 1 cycle/minute, advancing 10° daily - begin at a level of flexion that is comfortable for the patient - advance to full flexion as tolerated</td>
<td>Passive stretching/exercise for the first 6 - 8 weeks, quad/hamstring isometrics</td>
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<table>
<thead>
<tr>
<th>PHASE II 8 - 12 weeks</th>
<th>WEIGHT BEARING</th>
<th>BRACE</th>
<th>ROM</th>
<th>THERAPEUTIC EXERCISE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gradual return to full weight</td>
<td>None</td>
<td>Gain full and pain-free</td>
<td>Progressive active strengthening</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PHASE III 12 weeks and beyond</th>
<th>WEIGHT BEARING</th>
<th>BRACE</th>
<th>ROM</th>
<th>THERAPEUTIC EXERCISE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Full</td>
<td>None</td>
<td>Full and pain-free</td>
<td>Return to full activities, including cutting, turning, and jumping</td>
</tr>
</tbody>
</table>
Clinical studies

The overall clinical results of the microfracture arthroplasty have shown improved knee function in 70% to 95% of patients

Over the 7- to 17-year follow-up period (average, 11.3 years), patients < 45 years who underwent MF for full-thickness chondral defects, without associated meniscus or ligament pathology, showed statistically significant improvement in function.
Clinical studies

32 athletes with single articular cartilage lesions of the knee

66% reported good or excellent results and 44% were able to regularly participate in high-impact pivoting sports, 57% of these at the preoperative level.

Return to high-impact sports was significantly higher in athletes with age <40 years, lesion size <200 mm2, preoperative symptoms <12 months, and no prior surgical intervention.
15 Level I or II evidence studies

The use of MF for the treatment of small lesions in patients with **low postoperative demands** was observed to result in good clinical outcomes at short-term follow-up.

Beyond **5 years** postoperatively, treatment **failure** after MF could be expected regardless of lesion size.

Younger patients showed better clinical outcomes
Average age at the time of MF was 61.3 years.

50% of the patients were doing well without pain or TKA until 12 years after surgery.

Survival rate was 88.8%, 78.4%, 67.9%, and 45.6% at 5, 7, 10, & 12 years.

Of 134 knees, 51 (38.1%) proceeded to TKA a mean of 6.8 years after MF.
2.1 defects per knee were treated with an average defect size of 4.9 cm$^2$ and a total treated surface area of 10.4 cm$^2$ per knee joint.

Our data demonstrate that ACI results in clinically relevant reductions in pain and improvement in function, while apparently delaying the need for knee arthroplasty for over 5 years in 92% of patients.
A = Autologous  M = Matrix  I= Induced  C = Chondrogenesis
The treatment of chondral and osteochondral defects of the knee with autologous matrix-induced chondrogenesis (AMIC): method description and recent developments

Jan Philipp Benthien · Peter Behrens
Why AMIC?

- Single stage procedure
- Provides a matrix to form fibrocartilage
- Protects and stabilizes the blood clot
- Promotes migration and adhesion of progenitor cells
- Prevents bleeding into the joint
- No donor site morbidity, No cell culture
- Costs are moderate
Healing of Canine Articular Cartilage Defects Treated with Microfracture, a Type-II Collagen Matrix, or Cultured Autologous Chondrocytes

*†Howard A. Breinan, *Scott D. Martin, *Hu-Ping Hsu, and *††Myron Spector
15 Wks Post-op., n=8, Mean ± SEM

Total fill

µfx µfx/II

µfx µfx/II
Microfracture alone

Microfracture /collagen II
19 y old female, OCD MFC, symptomatic, Lyschom score 58
Stem cells
AMIC technique for cartilage regeneration

44 year old male, Large Osteochondral Defect on MFC

Jacobi M, Jakob R.P
Fribourg, Switzerland
First step: Unloading Osteotomy
4 weeks later

Abrasion and microfracturing
Preparation of Chondro-Gide Matrix
Spongiosa + Hydroxyapatite + Serum + Fibringlue
Filling of the defect and membrane suture
3 months later
All-arthroscopic AMIC procedure for repair of cartilage defects of the knee

Tomasz Piontek · Kinga Ciemniewska-Gorzela · Andrzej Szulc · Jakub Naczk · Michał Słomczykowski
Autologous matrix-induced chondrogenesis combined with platelet-rich plasma gel: technical description and a five pilot patients report

A. A. M. Dholander · F. De Neve · K. F. Almqvist · R. Verdonk · S. Lambrecht · D. Elewaat · G. Verbruggen · P. C. M. Verdonk
A Novel Technique for Treating Cartilage Defects in the Hip: A Fully Arthroscopic Approach to Using Autologous Matrix-Induced Chondrogenesis

Andrea Fontana, M.D.

Arthroscopy Techniques, Vol 1, No 1 (September), 2012: pp e63-e68
26 patients

Ligament repair 17/26 cases.

Corrective calcaneal osteotomy 16/26

Minimum fup 24 months

AOFAS ankle score improved from a mean of 60 points preoperatively to 89 points
Significant improvement of the mean Lysholm score was observed as early as 1 year after AMIC and further increased values were noted up to 2 years postoperatively.
Improvements in ICRS score were seen at 1- and 2-years post-operation, irrespective of the technique used. MRI assessment revealed a satisfactory and homogenous defect filling in the majority of patients.
Both techniques (microfracture and AMIC®) present an effective and safe method of treating full thickness chondral defects of the knee.

While results after microfractures deteriorate with time, clinical outcome after AMIC® seems to be more enduring.