Treatment of Articular Cartilage Injuries:

Osteochondral autograft
Osteochondral allograft

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DISCLOSURES

Industry:
- Vericel: Consultant
- Ceterix: Consultant
- Cartiheal: Consultant
- Icartilage: Consultant
- Smith&Nephew: Institutional Support
- Cocoon: CL stock options

Current Grant Support:

Editorial Board Memberships:
- Cartilage
- Journal of Sports Rehabilitation
- Orthopaedic Journal of Sports Medicine

Reviewer for Journals:
- AJSM, COBR, JRS, O&C, Orthopaedics, Tissue Engineering

Patents:
- 09/561,524 ; PCT/EP98/06849

All payments to Institution

CONSIDERATIONS:

- Initial Arthroscopy is important:
  - Verify lesion size and location
  - Verify technical barriers
  - Assess compartment (UKA needed?)

- Patient discussion:
  - Allograft:
    - Current risk of disease transmission:
      - e.g. Hepatitis C ~ 1/1750.000
      - HIV ~ 1/1,5 million (data: AATB)
    - bacterial infection (non confirmed through CDC to date)
    - Donor tissue is fresh tissue
  - Autograft:
    - Robbing Peter to pay Paul (up to 30% incidence of PF pain after trochlear harvest)
OSTEOCHONDRAL ALLOGRAFT
LOCATION / APPROACH

- **Mini-Arthrotomy:**
  - Advantage:
    - Low morbidity
    - 2.5-4 inch incisions
    - Excellent access with Z-retractor
  - Disadvantage:
    - LFC (far medial) or MFC (far lateral) lesions are difficult to visualize
    - May require 1-2 mm patella edge resection
    - Access to posterior condyle

- **Extensive Approach (TKA):**
  - Advantage:
    - Excellent visualization
    - Patella out of way
  - Disadvantage:
    - Morbidity
    - Access to posterior condyle

OSTEOCHONDRAL ALLOGRAFT
LOCATION / APPROACH

- **Collateral ligament or meniscus take down:**
  - Advantage:
    - Excellent visualization of posterior condyle
    - Useful for shell allografts
    - Access to tibia
  - Disadvantage:
    - Ligament take down, meniscus take down
**TECHNIQUE OCA:**

- **Single-OAT Press-fit Technique:**
  - **Advantage:**
    - Quick
    - 2-5 inch incisions
    - Lack of hardware
  - **Disadvantage:**
    - Goes from easy to very difficult if lesion oblong or larger than 30mm
    - One attempt to insert the graft

- **“Snow man-Technique”**
  - **Advantage:**
    - Can cover large oblong defects
    - Possible press fit
    - More precise than free hand
  - **Disadvantage:**
    - Technically challenging
    - Danger of destroying graft

**INSTRUMENTATION OCA:**

1. Assess location of defect on bone
2. Mark defect area on graft
3. Orient graft in lunar module
4. Hollow drill graft (irrigate)
5. Cut subchondral bone as thin as possible
6. Irrigate with:
   - Saline for articular cartilage
   - Bacitracin for subchondral bone

Available Instrumentation:
- Lunar module (Arthrex)
- “Allograft Chondral Transplant” (MTF)
- Arthrex “BioUni”

Courtesy: William Bugbee
**APPROACH / TECHNIQUE AUTOGRAFT:**

- **Arthroscopic:**
  - Small portal
  - Portal should be made where needed (perpendicular to lesion)
  - Still needs mini-open harvest from lateral or medial trochlea (arthroscopic in notch)
  - Limited to anterior and central lesions

- **Technique Autograft:**
  - Harvest from trochlea or notch
  - MOSAIC-plasty:
    - Many small 3-4 mm plugs
    - 10mm deep
    - Cobble stone construct
  - OATS (Osteoarticular transfer system)
    - 6-10mm plugs
    - 10mm deep
    - Often use 2 or 3 only

**TIPS AND TRICKS OCA:**

**General tips:**
- Measure your defect size carefully:
  - if at all under-measure by 1mm
  - Pay attention to orientation
- Protect the graft!!
  - Irrigate
  - use extra blue basins
  - drop barriers
- Do not pound the graft in!
  - Thumb pressure
  - very gentle taps with the oversized tap at most
- Cut subchondral bone as thin as possible

**Kang RW, AJSM 2010**
TIPS AND TRICKS OCA:

Tricks:
- Drill deep enough to get to healthy bone
- Fill cyst and deep bony lesions with autograft
- How to get the graft back out?
  - Get dental picks
  - Try to make a small hole on the lateral or medial condyle and tamp out.
  - Do not try to pry it out using an osteotome
- Smaller lesions in smaller condyles can accommodate grafts that are oversized better than larger condyles or larger lesions
- Never discard any of the Allograft before the defect is successfully filled!

TIPS AND TRICKS AUTOGRRAFT:

General tips:
- Measure your defect size carefully:
  - If over 3 cm² this may be too large for you to fix with an autograft
- Harvest the graft mini-open
  - Need to get perpendicular to harvest site
  - Watch the curvature of the defect and the graft
  - Assess the PF joint. In a patient with lateral tracking patella lateral trochlear harvest is dangerous
- Gentle graft handling:
  - Very gentle taps with oversized tap
  - Be patient and do not "wiggle" the graft
- Assess the subchondral bone carefully:
  - If no bleeding bone after 10 mm:
    - Either do not do it
    - Drill deeper
- Stabilize plugs if drilling a "mastercard"
- Two larger plugs may be better than 4 smaller ones

CLINICAL OUTCOMES OCA:

<table>
<thead>
<tr>
<th>Study</th>
<th>Characteristics</th>
<th>Pertinent Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brogden RC, J Bone Joint Surg 1984</td>
<td>n=17, 20 years Fx</td>
<td>91% graft survival at 3 years</td>
</tr>
<tr>
<td>Flynn JM, CORR 1994</td>
<td>n=17; 4.2 years f/u</td>
<td>12/17 “survived”</td>
</tr>
<tr>
<td>Ghazavi MT, JBJS 1997</td>
<td>n=126; 7.5 years f/u</td>
<td>85% success rate (HSS score)</td>
</tr>
<tr>
<td>Chu et al, CORR 1999</td>
<td>n=55; 75 mos fu</td>
<td>84% unipolar g/e, 50% bipolar g/e</td>
</tr>
<tr>
<td>Emmerson BC, AJSM 2007</td>
<td>n=66; 7.7 years f/u</td>
<td>72% g/e, subjective fx: 3.4/10 =&gt; 8.4/10</td>
</tr>
<tr>
<td>Williams RJ, JBJS 2007</td>
<td>n=19; 46 mos Fx</td>
<td>72% g/e, subjective: 50 =&gt; 70</td>
</tr>
<tr>
<td>McCullough PC, AJSM 2007</td>
<td>n=25; 35 mos f/u</td>
<td>Lysholm 39 =&gt; 67; IKDC 29 =&gt; 58</td>
</tr>
<tr>
<td>Levy YD, CORR 2013</td>
<td>n=122; 13 years f/u</td>
<td>82% Survival at 10 years, 74% at 15 years, 66% at 20 years</td>
</tr>
<tr>
<td>Laprade RF, JBJS 2009</td>
<td>n=23; 3 year f/u</td>
<td>IKDC 52 =&gt; 68.5, 22/23 radiographically incorporated</td>
</tr>
<tr>
<td>Goertz S, CORR 2010</td>
<td>n=28; 25 mos f/u</td>
<td>AVN lesions 89% survival, IKDC fx 60 =&gt; 87</td>
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- Overall good to excellent short and long-term results
- Those results can be achieved for various diagnoses and severities of defects
CLINICAL OUTCOMES

• Allografts Femoral Condyle:
  – 60-80% g/e (lower in bipolar cases)
  – Clinically meaningful improvements of subjective outcomes (Chahal J, Arthroscopy 2013)
  – Survival:
    • Success in:
      – AVN
      – OCD
      – OA
      – Tibial plateau fractures

CLINICAL OUTCOMES AUTOGRAPH:

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</tr>
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<tr>
<td>Horas et al, JBJS 2003</td>
<td>N=20; 2 years Fu</td>
<td>Lysholm at 2 years 74</td>
</tr>
<tr>
<td>Bentley et al. JBJS 2003</td>
<td>N=48; 1 year Fu</td>
<td>69% Cincinati score &gt;55, 7/48 poor results</td>
</tr>
<tr>
<td>Gudas et al. Arthroscopy 2005</td>
<td>N=30; 3 years Fu</td>
<td>HSS and ICRS scores &gt;89</td>
</tr>
<tr>
<td>Ulstein et al. CORR 2012</td>
<td>N=13; 9.8 years Fu</td>
<td>Lysholm 62.6 16% failure in patients with KL ≥2</td>
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</table>

• Lesion size >2cm² has worse outcomes and patella lesions have a high failure rate
• Smaller lesions size associated with earlier return to sport, (6 months)
• Re-operation rates between 4% and 36%
• Better results in patients under age 30

Lynch TS et al, Arthroscopy 2015

INDICATION:

Osteochondral allograft:
- any defect size
- primary or secondary procedure
- revision or bailout
- Osteochondritic defects
- OCD lesions
- AVN lesions
- PF joint: salvage only (few reported cases)

Osteochondral autograft:
- Up to defects sized < 2-3cm²
- Chondral defects and very shallow osteochondral defects
- PF joint: salvage (few reported cases)
SUMMARY OF CLINICAL OUTCOMES PF JOINT

- Lower success rate overall in the “best hands”
- 60% of patients require additional surgery
- Overall 29% failure rate
- Need to consider PF alignment
- Overstuffing etc.
  “Should be considered a salvage procedure in special cases”

SUMMARY

- For small lesions Osteochondral Autograft Transplantation is a good, established and economic technique
  • I would recommend not to use more than 1 or 2 plugs
  • Do not “mastercard” the plugs
  • Assess the patellofemoral joint if you harvest from the trochlea
- Athletes show equally good results with both techniques in the short run when it may be needed.
- For larger lesions the advantage shifts to OC allografts
- Salvage situations are better addressed with an allograft
- Patellofemoral defects are an experimental domaine for both procedures

REMEMBER!