Cartilage Injuries



Suzanne Miller, MD Boston Sports and Shoulder Center New England Baptist Hospital Boston, MA

Articular Cartilage

Simple in appearance

- Avascular
- Aneural
- Alymphatic
- One cell type

Functions

- Low friction
- Lubrication
- Shock absorption
- Load distribution



Articular Cartilage

- Highly structured and organized into four zones
 - Superficial, transitional, radial, and calcified
- H₂0
- Collagen (95% type II)
- Proteoglycans (aggrecans)
- Chondrocytes



Articular Cartilage

- Poor intrinsic ability to heal
- Untreated lesions can lead to debilitating OA
- To succeed on restoring joint surface need
 - Substantial durability
 - Reproduce biomechanical properties

How to assess cartilage injuries

Outerbridge Classification:



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Optimal Technique

- Surgical easy
- Reproducibility
- Low cost
- Cartilage like material
- Short recovery time
- Minimal patient morbidity

Chondral Injuries

- Microfracture
- Osteochondral transfer
 - Autograft
 - Allograft
- Autologous chondrocyte implantation
- Denovo



Microfracture

- Fast
- Cheap
- Technically straightforward
- Recruit mesenchymal stem cells into the lesion

Microfracture







Microfracture

- Cons: Not type II cartilage mostly Type I and III
- Mesenchymal cells deteriorate with age
- Need small stable borders (contained)
- Non-weight-bearing 6 wks
- Return at least 3-4 months
 - Often 6+ months
 - Need significant PT
 - Quadriceps key



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Microfracture Results

- Improvement in 75% of individuals
- Independent factors
 - Patient Age
 - Size of lesion

New adjuncts to microfracture

- Platelet –Rich Plasma
 - Theory concentrated platelets, platelet-derived growth factor may promote healing
 - PRP increases in vitro model mesenschymal cell proliferation (Mishra)
 - PRP increase proteoglycan and collagen production of porcine chondrocytes (Akeda)

Osteochondral Autografts "OATS"

- Wilson and Jacobs 1952
- Pap and Krompecher 1960
- Yamashita 1985
- Matsusue 1993
- Hangody 1994



• Used standardized instrumentation for harvesting plugs

Indications:

- 1 ≥2.0cm diameter cartilage lesions
 - 1-4 cm² total surface area
- Can be primary resurfacing or failed micro-fracture or debridement



- Outerbridge Grade 4
- Exposed bone
- Normal surrounding cart.



"OATS"

Benefits: Restore articular cartilage Cell viability Bone to bone healing Earlier return to work Good long term results Low Cost instruments \$600 Outpatient procedure





• Limitations:

- Limited graft donor sites
- Incomplete defect fill with multiple plugs
- Donor site morbidity
- Plug congruity difficult to obtain with larger lesions and OCD
- 1mm proud can increase 50% joint contact pressure



Medscape

.

Donor Plugs

- Plug sizes: 4mm 10mm
- Kits now disposable
- Multiple vendors -each slightly different





Donor Sites

- Medial and Lateral Trochlea
- Intra-condylar notch
- Supra-lateral and medial notch with lower contact pressure (medial not tested)





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Technique

- Open or arthroscopic
 - Prefer scope preparation and open harvest and insertion
- Identify lesion
- Size lesion
- Template lesion





Technique

- Prepare recipient site
- Obtain donor plug
 - Be perpendicular
 - Supramedial / lateral trochlea contours well to femoral condyle
- Gently Inset Plug









Results

Return to work: LD – minimum 2 months Manual labor – 4-6 months

Femoral condyle lesions 80-91% Patello-femoral : 60-74%



Allograft OATS

- Indicated for large lesions up to 30mm diameter
- OCD
- Failed microfracture or cell based resurfacing
- Difficult to obtain tissue / insurance
- Open procedure / complex

Allograft OATS



Allograft OAT





Allograft OAT

Allograft articular

cartilage

- Do not freeze
- Sterile harvest
- Cell survival after 28 days an issue

Chondrocyte Survival and Material Properties of Hypothermically Stored Cartilage



Allograft OAT

- Delayed wt. bearing
 - Min 8 weeks
 - Prolonged protection (1 year: no sports)
 - Graft incorporation takes months (2 yr f/u)



Williams R. J. et.al. J Bone Joint Surg 2007/089.el//th8+jJ/246 Workshop May 2 & 3, 2016

Allograft OATS Results

- Return to work: LD 2-3 months
- Full duty 6-12 months based on demands
- Gross: 95% at 5 yrs ; 85% at 10 and 73% at 15 yrs (best results out there)
- Others 80-90% 10 year survival
- Type II collagen restored
 - Viable long term



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Autologous Chondrocyte Implantation (ACI / Carticel)

- Indications are large lesions
- Better results if no microfracture previously
- Need at least two operations
- Advantage hyaline like cartilage not fibrocartilage (microfracture)
- Disadvantages: \$\$\$\$, complicated

Current Cell Therapy Paradigm: Complex Two-Stage Procedures



Autologous Chondrocyte Implantation



Issues with ACI

- 2 stage procedure
- >25% re-operation rate
 - Perosteal overgrowth
 - Incomplete fill or integration
 - Increased failure (25%) if prior microfx
- Tedious procedure
- Cost!!! \$27,000 for cells alone



ACI Results

- Return to work LD 3 months
 - Manual labor 9- 24 months
 - Many need second operation
 - Success: 80-90% femoral condyle lesions
 - 60-80 % patellofemoral need to address alignment issues with TTO or worse results.

Thank You