Non-Arthroplasty Treatment of Cartilage Defects in the Shoulder

Geoffrey S. Van Thiel, MD/MBA
OrthoIllinois
Assistant Professor – Rush University Medical Center
Team Physician – US National Soccer Team
Team Physician – Chicago Blackhawks Medical Network – Ice Hogs
www.VanThielMD.com, VanThielMD@OrthoIllinois.com

Disclosures

- Smith and Nephew – Consultant
- Zimmer/Biomet – Consultant and Royalties

Cartilage Loss in the Shoulder

- Cartilage defects in the glenohumeral joint pose unique challenges
- Contemporary techniques for other joints cannot be directly applied to the shoulder
- Less common OR less symptomatic
- Good results with arthroplasty
- No large studies of other techniques
Etiology

1. Post-traumatic
2. Post-surgical
3. Local degenerative
4. AVN
5. OCD

Decision Making

- Patient-Specific
  - Age
  - Symptoms
  - Prior treatment
  - Demand-Matching

- Defect-Specific
  - Location
  - Size/Depth
  - Containment
  - Geometry

Most Defects Don’t Require Treatment!!!!!!!
What Has Been Done?

- Interpositional Arthroplasty/Biologic Resurfacing
  - High failure rate
- Osteotomies
  - Humeral head rotation away from cartilage defect

The high failure rate of biologic resurfacing of the glenoid in young patients with glenohumeral arthritis

What Is Being Done?

- Arthroscopic Debridement
- Microfracture
- Autologous Chondrocyte Implantation
- Osteochondral Allograft
- Micronized Allograft

What Could Be Done?

- Autologous or Allogenic Stem Cells
- Growth Factors
- Scaffolds
- Mediums
- Ideal Solution
  - Off the shelf
  - Minimally Invasive
  - True Cartilage
What Is Being Done

The treatment of early degenerative joint disease in the shoulder is different than the knee or hip.

- The knee and hip are "weight bearing" joints, the shoulder is a "motion" joint.
- Pain can be related to decreased ROM due to capsular thickening.
- Debridement and capsular release can provide good pain relief if there are no large osteophytes and some joint space.

Autologous Chondrocyte Implantation

- 2-6 cm² Superficial, Contained, Young
- Failed Microfracture
- New Technique of MACI that would make technique more approachable

Osteochondral Allograft

- Humeral Head
- Glenoid
- Can be bipolar "Biologic Joint"

References:

- Giannini et al
- Coburn et al

Gobezie et al
Novel – Distal Tibia Allograft

- Good Availability
- Excellent Congruity
- Intra-articular
- Ease of Procedure

Concerns
- Minimal Data
- Allograft

Proencher MD, Van Thiel GS, Ghodadra N, LeClere L, Solomon DI, Ramos AA. Arthroscopy 2009

What Is Being Done

- Microfracture
- Can be done with or without a scaffold (AMIC)
- Miller et al – 19% failure rate, but remaining did well.
- Large and bipolar did not do well.

Clinical Outcomes After Microfracture of the Glenohumeral Joint

Rachel M. Frank, Geoffrey S. Van Thiel, MD, MSK, Mark A. Stilbaugh, MD, Maj USAF, Anthony A. Romeo, MD, Brian J. Cole, MD, MBA, and Nahin N. Verma, MD
From the Division of Sports Medicine, Department of Orthopaedic Surgery, Rush University Medical Center, Chicago, Illinois

What Is Being Done

- Micronized Allograft
- Can be done arthroscopically
What Could Be Done

- The Goal
  - Easy
  - Effective
  - Cell Targeting
  - Cell Differentiation

3 Different Concepts
1. Cartilage Environment
2. Cartilage Cell Introduction
3. Cartilage Cell Differentiation

“Stem cells are not given any clues on how to differentiate; they just become what they are programmed to be that is false”

Autologous Matrix Induced Chondrogenesis (AMIC)

- AMIC
  - Microfracture with a collagen scaffold
  - Provides structure
  - Non-controlled clinical studies in Europe have shown good results

Specific to our Study
- Microfracture supplemented by a porcine bilayer scaffold of collagen type I and III
AMIC and Microfracture

- Microfracture
  - 0.7 mm drill used to create 8-10 holes

- Autologous Matrix Induced Chondrogenesis (AMIC)
  - 0.7 mm drill used to create 8-10 holes
  - AMIC patch (Col I/III) sutured to glenoid

What Could Be Done

- What could be done in the future is to provide an appropriate scaffold for cells to become what we want them to be.
- This currently is in the form of de-cellular cartilage, manufactured membranes and gels.

What Could Be Done

- How do stem cells apply to the shoulder?
- What is the science behind it?
- Translation from other applications/research?
- What are the potential future applications for bone marrow derived stem cells in the shoulder?
- Fat, bone marrow, allogenic
How Do We Get Them To Work?

- Stem cells require external influences to differentiate into the appropriate lineage.
- Growth Factors
- Matrix
- MSCs can get clues on how to differentiate from their nanostructure environment
- Stem cells modulate T cell activity and probably work as an anti-inflammatory currently

What Could Be Done

- Cell differentiation
  - TGB1 and IGF 1
  - Wnt and MAPK signaling pathways
- This is the holy grail.
  - We have them, just don't know how to talk to them.
What Could Be Done

- Stem Cell Utilization
  
  Early
  
  Use/Introduction of stem cells or other disease modifying factors to slow the pathophysiology of cartilage loss

Later

- Introduction of stem cells into a cartilage defect with an appropriate scaffold and treated with factors that encourage differentiation

Thank You

Geoffrey S. Van Thiel, MD/MBA
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