

Lesion Specific Modified Rehabilitation: How Knee Articular Cartilage Injury can Inform Your Practice

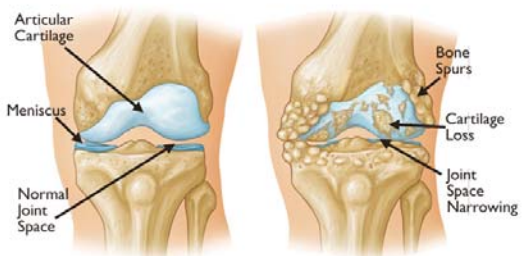
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Objectives

1. Review the incidence and prevalence of isolated articular cartilage injury in the presence of knee injury/pathology
2. Discuss the effect of articular cartilage injury on outcome in patients with concomitant knee pathology/injury
3. Review current evidence regarding treatment planning for patients with articular cartilage injury of the knee






AAOS:
<http://orthoinfo.aaos.org/topic.cfm?topic=a00212>






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Articular Cartilage Injury: Prevalence

- 60-70% of knee arthroscopies reported articular cartilage pathology
 - Aroen et al AJSM 2004
 - Curl et al Arthroscopy 1997
 - Hjelle et al Arthroscopy 2002
- 30% of articular cartilage lesions described as isolated articular cartilage lesion
 - Widuchowski et al Knee 2007
- 37% PF Joint, 35% Femoral Condyle, 25% Tibia



Articular Cartilage Injury: Link to Outcome

- ACL Reconstruction
 - Cox et al AJSM 2014
 - Cartilage injury related to IKDC/KOOS outcome
 - Grade 4 MFC lesion predicted Marx activity score
 - Rotterud et al AJSM 2013
 - Full thickness AC lesion – KOOS score at 2 year f/u
- Knee Dislocation
 - King et al KSSTA 2015
 - "...IKDC score were significantly lower for patients with cartilage damage...."
- Patellar Dislocation



Post-Operative Management

1. Chondroplasty
2. Microfracture/Marrow Stimulation
3. OATS (Osteochondral autograft)
4. Mosaicplasty
5. ACI (Autologous Chondrocyte Implantation)
6. Osteochondral allograft
7. Structural alignment procedure
8. Total knee arthroplasty



Basic Science of Articular Cartilage: Implications for Physical Therapy

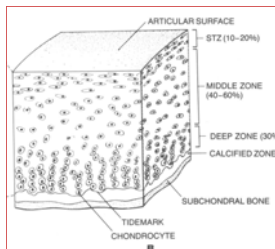
1. Functions to provide ease of movement at joint, while withstanding load and shear
2. Absence of vascularity = inability to respond to injury
3. Extracellular matrix: Needs balance of forces
4. Articular Cartilage "Zones"
5. Joint Homeostasis: "Balance"

Better understanding at the basic science level is critical to our success at a macroscopic level




Basic Science of Articular Cartilage: Implications for Physical Therapy

1. Articular Surface (Superficial)
2. Transitional Zone (Middle)
3. Radial (Deep)
4. Calcified Cartilage



Guiding Principles of Rehabilitation


1. Never overstress healing tissue
2. Allow progression of WB with goal of minimizing excessive compressive loads
3. Allow immediate ROM to facilitate healing
4. Progression of rehabilitation is dependent on size and location of lesion



Guiding Principles of Rehabilitation after Articular Cartilage Injury


FOCUS: "...to provide a mechanical environment for the local adaptation and remodeling of the repair tissue that will enable the patient to safely return to the optimal level of function."

Mithoefer et al JOSPT 2012



Guiding Principles of Rehabilitation

1. Location!: Tibiofemoral vs. Patellofemoral
 - TF: Compressive forces with WB/exercise
 - too much vs. not enough
 - PF: Compressive/shearing forces with quad contraction
2. Size of lesion
 - Outcome dependent on lesion size: modifications based on size



| TABLE 1 | | FACTORS TO CONSIDER DURING INDIVIDUALIZED CARTILAGE REPAIR REHABILITATION | |
|---------------------------------|--|--|--|
| Considerations/Specific Factors | | Implications | |
| Individual | | | |
| Athlete's age | | Slower cartilage repair with increased age | |
| Body mass index | | More gradual rehabilitation progression with body mass index greater than 30 kg/m ² | |
| Type of sport | | Higher demand on repair tissue in impact sports | |
| Competitive level | | Competitive athletes have better outcomes | |
| Psychological | | Less fear of reinjury and higher self-efficacy are associated with better outcomes | |
| Lesion/detect | | | |
| Defect size | | Smaller defects frequently improve faster with rehabilitation | |
| Repair technique | | More rapid rehabilitation progression with restorative techniques | |
| Defect location | | Immediate weight bearing for patellofemoral defect (knee brace locked in full extension) | |
| Duration of symptoms | | Longer recovery if symptoms persist longer than 12 months (deconditioning) | |
| Cartilage quality | | Slower rehabilitation progression with generalized joint chondropenia | |
| Concomitant injuries | | | |
| Concomitant procedures | | Modified protocols for anterior cruciate ligament reconstruction, meniscal repair, osteotomy, etc. | |
| Meniscus status | | Slower rehabilitation progression after meniscectomy (especially lateral meniscus) | |

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Mithoefer et al JOSPT 2012

CLINICAL GUIDELINES

DAVID S. LOGERSTEDT, PT, MA • LYNN SNYDER-MACKLER, PT, SCD • RICHARD C. BITTER, DPT • MICHAEL J. AXE, MD

Knee Pain and Mobility Impairments: Meniscal and Articular Cartilage Lesions

Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability, and Health from the Orthopaedic Section of the American Physical Therapy Association

J Orthop Sports Phys Ther. 2010;40(6):A1-A35. doi:10.2519/jospt.2010.0304

| | GRADES OF RECOMMENDATION BASED ON | | STRENGTH OF EVIDENCE |
|--|-----------------------------------|-----------------------------------|---|
| | Grade | Evidence | |
| Best Current Evidence: Management of Patients with Articular Cartilage Injury of the Knee | A | Strong evidence | A preponderance of level I and/or level II studies support the recommendation. This must include at least 1 level I study |
| | B | Moderate evidence | A single high-quality randomized controlled trial or a preponderance of level II studies support the recommendation |
| | C | Weak evidence | A single level III study or a preponderance of level III and IV studies including statements of consensus by content experts support the recommendation |
| | D | Conflicting evidence | Higher-quality studies conducted on this topic disagree with respect to their conclusions. The recommendation is based on these conflicting studies |
| | E | Theoretical/foundational evidence | A preponderance of evidence from animal or cadaver studies, from conceptual models/principles or from basic sciences/bench research support this conclusion |
| | F | Expert opinion | Best practice based on the clinical experience of the guidelines development team |

Interventions

- Weak/Conflicting Evidence
 - Progressive ROM
 - Progressive Weight Bearing
 - Progressive Return to Activity
- Foundational Evidence
 - Method to Assess Readiness to Return to Activity
 - Need for Supervised Rehabilitation (meniscus vs. AC)



Interventions

- Moderate Evidence
 - Use of therapeutic exercises
 - Use of NMES



Guiding Principles: ROCK Group

In the absence of evidence...


1. Dichotomized treatment based on cell based intervention vs. structural intervention
2. Dichotomized by location (tibio-femoral joint vs. patellofemoral joint)



Guiding Principles: ROCK Group

| | Tibiofemoral Joint | Patellofemoral Joint |
|---|--------------------|----------------------|
| Cell-Based Intervention (ACI, Microfracture) | | |
| Structural Intervention (OATS, Osteochondral allograft, Fragment fixation.) | | |


Mithoefer et al JOSPT 2012:
 Restorative Cartilage Repair = Structural Intervention
 Reparative Cartilage Repair = Cell-Based Intervention



Guiding Principles: ROCK Group


3. Focused on key variables:

- o WB guidelines
- o Bracing
- o CPM use
- o ROM limitations
- o Guidelines for strengthening
- o Return to Sport guidelines



Guiding Principles: ROCK Group

- Weight Bearing (ROCK):
 - TF Joint
 - Cell Based = 6 wk NWB, 2 wk PWB
 - Structural = 4 wk NWB, 2 wk PWB
 - PF Joint
 - NWB 2 wk (in brace), PWB 2 wk
- Weight Bearing (Mithoefer et al):
 - TF Joint
 - Reparative = TTWB x 2 weeks then increase 25%/wk
 - Restorative = TTWB x 2 weeks with full WB at 4-6 wks
 - PF Joint
 - WBAT with knee locked in brace at 0-10 deg



Guiding Principles: ROCK Group

- Bracing:
 - No bracing for TF lesion
 - Post-op bracing in PF group (both cell based and structural interventions) locked in extension for WB
- CPM use: Moderate importance with cell based treatments



Guiding Principles: ROCK Group

ROM guidelines:

- Cell based treatment:
 - ✓ No limits with TF joint lesion
 - ✓ PF joint: 0-90 x 2 weeks with 10 degree weekly progression after 2 weeks
- Structural guideline:
 - ✓ No limits with progression of ROM



Guiding Principles: ROCK Group

Return to Activity Guidelines:

- Structural Interventions: 3-6 months
- Cell based interventions:
 - ✓ TF: MF=4-6 months; ACI=9-18 months
 - ✓ PF: MF= 4-9 months; ACI=12-18 months



Guiding Principles of Rehabilitation

1. Concomitant Injuries/Pathology
 - Ligament instability
 - Meniscal pathology
 - Malalignment
2. Patient
 - Age
 - BMI
 - Return to activity goals



Articular Cartilage Rehabilitation: Phased Progression

- Acute
 - Sub-Acute
 - Neuromuscular Re-education
 - Return to Function
- VS.
- Protection and Joint Activation
 - Progressive loading and functional restoration
 - Activity restoration



Acute Phase/Joint Protection

1. Manage post op effusion/pain
2. ROM
 - Patellofemoral mobilization
 - PROM/AAROM
 - ROM Guidelines:
 - TF Joint: Unrestricted ROM
 - PF Joint: 0-90 x 2-4 weeks, then progress ROM



Acute to Sub-Acute Phase/ Joint Protection

1. Continuous Passive Motion
 - Mechanical CPM
 - AAROM/PROM

2. WB Restriction:
 - TF Joint
 - PF Joint



Acute to Sub-Acute Phase/ Joint Protection to Progressive Loading

Strengthening

1. Quad strengthening
 - Quad activation
 - NMES to quadriceps
 - OKC strengthening (TF joint lesion)
2. Hip and Core strengthening
 - Proximal stabilization in NWB positions
 - Influence on PF kinematics



Special Consideration: PF Joint

Patella Protection Program:

- Limited OKC knee extension
- Focus on limited range CKC activity
- Limit deep squatting
- Limit stair climbing
- Progress hip and core stabilization



Progression of Strength/Joint Loading Initiation

- Advance CKC strengthening per WB restriction
- Advance proprioception/balance training
- Initiate functional progression of activity specific to patient goals
- Limit impact until sufficient healing has occurred



Functional Progression/Activity Restoration

- Restoration of normal limb symmetry with strength and functional movements
- Return to activity progression
- Limit return to activity until after successful completion of RTS program
- Future Needs: Objective criteria to determine readiness to RTS.



[RESEARCH REPORT]

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Thomas M. Best, MD, PhD³ • David C. Flanagan, MD⁴

Functional Outcomes After Surgical Management of Articular Cartilage Lesions in the Knee: A Systematic Literature Review to Guide Postoperative Rehabilitation


JOURNAL OF ORTHOPAEDIC & SPORTS PHYSICAL THERAPY | VOLUME 44 | NUMBER 8 | AUGUST 2014 |

N=16 articles




Functional Outcome after Surgical Management of AC Injury

1. Quadriceps Strength (QF) strength (n=7): Deficits in QF strength at 2 years PO
2. Joint Loading and Gait (n=2): Altered gait and loading patterns after AC injury



Functional Outcome after Surgical Management of AC Injury


3. Performance Based Function (n=10): Deficits may persist up to 6 years post-op
 - 6 minute walk test
 - Single leg hop tests
 - Triple cross over hop for distance

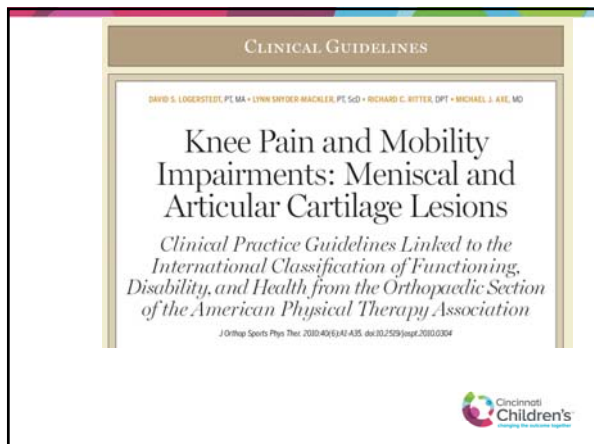


Gait Adaptations with AC Injury

Thoma et al Osteo and Cart 2017

- Altered joint loading during gait in patients with TF lesions and mixed TF/PF lesions
- No altered joint loading in patients with only PF lesions
- Reduced gait velocity in patients with TF and mixed TF/PF lesions





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| D Expert opinion | Best practice based on the clinical experience of the guidelines development team |

E INTERVENTIONS – PROGRESSIVE RETURN TO ACTIVITY – ARTICULAR CARTILAGE

Clinicians may need to delay return to activity depending on the type of articular cartilage surgery.

Recommendation is based on these conflicting studies

Articular Cartilage Injury to the Knee: Who goes back to sports?

- **Microfracture:** 59%-66% return to competition
- **OATS:** 91-93%
- **Osteochondral Allograft:** 84% RTS (60% pre-injury level)
- **ACI:** 33-96% RTS

Mithoefer et al JOSPT 2012

Conclusion

1. Rehabilitation after articular cartilage surgery is a "work in progress"
2. Presence of AC lesion necessitates an individualized approach to rehab
3. Current focus should be to protect healing tissues and appropriately progress exercise to address impairments
4. Prior to return to activity, patients should complete a graded functional progression and demonstrate adequate level of function