Optimizing Arthroscopic Treatment of Osteoarthritis

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## Disclosures

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<th>Consultant</th>
<th>Research Funding</th>
<th>Fellowship Funding</th>
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Randomized Controlled Studies

The New England Journal of Medicine

Volume 347
July 11, 2002

A Controlled Trial of Arthroscopic Surgery for Osteoarthritis of the Knee


ABSTRACT

Background: Many patients report symptom relief after undergoing arthroscopy of the knee for osteoarthritis, but it is unclear how the procedure achieves this result. We conducted a randomized, parallel-controlled trial to evaluate the efficacy of arthroscopy for osteoarthritis of the knee.

Methods: A total of 168 patients with osteoarthritis of the knee were randomly assigned to receive arthroscopic debridement, arthroscopic lavage, or placebo. Patients were randomly assigned to the intervention or control group using a computer-generated randomization scheme. The primary outcome was the change in knee scores from baseline to 12 months, measured with the Knee Society knee score and the Western Ontario and McMaster Universities Osteoarthritis index (WOMAC) physical function score.

Results: At 12 months, the respondents’ WOMAC physical function score improved by a mean of 3.6 (95% confidence interval [CI], 1.3-5.8) in the intervention group and by a mean of 0.6 (95% CI, 0.0-1.2) in the control group. The difference was statistically significant (P = 0.003).

Conclusions: Arthroscopic partial meniscectomy is a beneficial procedure for patients with osteoarthritis of the knee, but the results of this study do not support the routine use of arthroscopic debridement or arthroscopic lavage.
• Do you agree with the evidence that menisectomy in patients with OA is minimally effective?
  • Yes
  • No
  • Some patients may benefit
Do you agree with the evidence?

- I do.

- With exception of a locked knee:
  - All patients should have min 6 wks physical therapy

- But....
  - Some of these patients DO get better with surgery

Who will respond?
Treatments included

- Chondroplasty
- Loose body removal
- Meniscectomy
- Removal of osteophytes

A Controlled Trial of Arthroscopic Surgery for Osteoarthritis of the Knee

J. Bruce Moseley, M.D., Kimberly O’Malley, Ph.D., Nancy J. Petersen, Ph.D., Terri J. Menke, Ph.D., Baruch A. Brody, Ph.D., David H. Kuykendall, Ph.D., John C. Hollingerworth, Dr.P.H., Carol M. Ashton, M.D., M.P.H., and Nelda P. Wray, M.D., M.P.H.

A Randomized Trial of Arthroscopic Surgery for Osteoarthritis of the Knee


Surgery versus Physical Therapy for a Meniscal Tear and Osteoarthritis

How to get good results?

- What are we missing?
- How can we pick the patients who will respond?
- Are there other pain generators on OA?
Pain History

Pain History Graph:

- **Pain** axis (y-axis) ranges from 0 to 10.
- **Time** axis (x-axis) is not labeled with specific units.
- The graph shows a linear increase in pain over time.
- The point **3** represents the **OA Baseline**.
- The label **No Effect of Arthroscopy** is placed near the upper right corner of the graph.
Pain History

- Maximum arthroscopic effect
- OA Baseline
- Event
- Time
Pain History

Arthroscopy for baseline pain of OA, with out traumatic incident, tends not to be effective....
Identify Pain Generators in OA

- Synovitis
- Subchondral bone lesions
- Loss of Articular Volume
- Flexion Contracture
- Malalignment
Synovitis

- Rheumatoid arthritis
- Hemophilic arthropathy
- OA

★ Osteoarthritis can have an inflammatory component
Synovial fluid and membrane complement levels significantly expressed and activated in human OA joints

Synovial membrane contributes to excessive complement activation

Membrane attack complex (MAC)-mediated arm of complement crucial to OA development in 3 mice models
Our Results

- Total of 57 patients evaluated in 2011-2012
  - 7/57 (12.3%) meniscectomy only
  - 50/57 (87.7%) meniscectomy + synovectomy
Pre-op Cytokine Results

**TNF-α**
- Meniscectomy Only: 0.6 pg/ml
- Meniscectomy + Synovectomy: 3.5 pg/ml

Statistically significant, p=0.012

**IL-1β**
- Meniscectomy Only: 0.0 pg/ml
- Meniscectomy + Synovectomy: 0.156 pg/ml

Statistically significant, p<0.001
Inflammatory OA

- May present with:
  - Effusion
  - Bogginess
  - Reactive knee after exercise/activity
Results of Synovectomy

- Cytokine analysis at 3mo post-op

May require additional treatment, incl medications, for max benefit
Impinging Synovitis

Description

- *Idiopathic synovial impingement* described by Pavioovich 2002

- Impingement of local synovium that has hypertrophied in response to trauma or trophic factors
Impinging Synovitis

Description

- Synovial impingement in RA, PVNS, hemophilia or post-TKA.
  - Granowitz 1967
  - Avral 1997
  - Takahashi 2002
  - Verma 2007
Impinging Synovitis

**Diagnosis**

- **MRI**
  - Synovium between meniscus and condyle
  - “Double meniscus” sign

- **Exam**
  - + Hyperextension test
  - + Hoffa’s test
Impinging Synovitis

- May occur:
  - Anteriorly
  - Posteriorly

- May mimic meniscal pain
Anterior Impinging Synovitis

**Treatment**

- Resection with radiofrequency probe
- **Use caution**
  - Articular cartilage is close
Posterior Impinging Synovitis

- Impingement may occur posteriorly
6 month results

pre op scores
post op scores

*<0.05
Denervation of Inferior Pole Patella

- Nociceptive fibers enter patella from fat pad
  - ↓ sensitivity of patella

- Can release scar tissue from proximal fat pad
Identify Pain Generators in OA

- Synovitis
- Subchondral bone lesions
- Loss of Articular Volume
- Flexion Contracture
- Malalignment
Evidence that Bone Marrow Lesions cause pain

- Pain strongly related to large BMLs
  - Hunter, OA & Cartilage, 2011

- **BMLs are the strongest predictor of the presence of pain associated with knee OA**

- BMLs correlate with OA disease progression
  - Roemer, 2009

- Patients are ~9x more likely to progress rapidly to TKR
  - Scher, Skel Rad 2008

- BML increase patient’s risk of TKR by 57%
  - Tanamas et al, Rheum 2010
Worse Outcomes with Bone Lesions

- Worse outcomes associated with marrow edema/bone loss
  - Talus: Cuttica 2011
  - ACI knee: Niemeyer 2010
How should we treat bone marrow lesions?

**Biologic**
- K-wire drilling
- Core decompression
- Stem Cell injection

**Structural**
- Calcium Phosphate cement
Cartilage Defect Involving Subchondral Bone

- 34 yo knee pain x 5 yrs
  - ✔ Patellofemoral pain
  - ✔ Effusions
  - ✔ No injury HX
  - ✔ Mechanical ssx

- PMH: Asthma (steroids)

- TX:
  - ✔ PT-no improvement
  - ✔ NSAID-helped
Biologic Treatment of BML

1. Fluoro-guided placement of k-wire

2. Ream over wire (4mm)
   - ↑ blood flow
   - ↑ area for BMAC
Bone Marrow Aspirate Concentration

3 Perform bone marrow aspiration
   • Centrifuge used to \( \uparrow \) MSC numbers
Injection

Injection of BMAC with thrombin
• Cellularity
• VEGF/vasculature
3 Month MRI

- Pain ↓
- Gait normalized
- ↓ marrow fibrosis/cysts
Identify Pain Generators in OA

• Synovitis

• Subchondral bone lesions

• Loss of Articular Volume

• Flexion Contracture

• Malalignment
Which patient has pain?

31 year old
↓ ROM patella
+ Patellar tilt test
3° Flexion Contracture

72 year old
+ Pseudolaxity
- Patellar tilt Test
1° Flexion Contracture
Clinical Relevance

Normal

Loss of Volume Capacity
Clinical Relevance

• 36 year old with chronic infrapatellar pain

• Longitudinal “grooving” trochlea
Loss of Articular Volume

- Loss of capsular compliance
- Scar tissue formation
Average volume of knees: 86 ml (50-110)

Volume of knees with complete supra-patellar plica = 50 ml
Identifying Volume Compromise

- Injection of 60 ml of saline can be used to identify volume compromise
Restoration of Knee Volume Using Selected Arthroscopic Releases

Jason L. Dragoo,* MD, Matthew D. Miller, MD, Zackary D. Vaughn, MD, Joshua D. Schmidt, MD, and Elizabeth Handley, MS

From the Department of Orthopaedic Surgery, Stanford University, Palo Alto, California

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<th>Test</th>
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<th>Control</th>
<th>P Value</th>
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<td>Pre-Volume</td>
<td>47.54</td>
<td>97.85</td>
<td>&lt;0.001</td>
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<tr>
<td>Post-Volume</td>
<td>82.96</td>
<td>97.69</td>
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Volume Correction
Restoration of Knee Volume Using Selected Arthroscopic Releases

Jason L. Dragoo,* MD, Matthew D. Miller, MD, Zackary D. Vaughn, MD, Joshua D. Schmidt, MD, and Elizabeth Handley, MS
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<td>Pre-Op</td>
<td>4.30</td>
<td>3.80</td>
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<tr>
<td>Post-Op</td>
<td>1.50</td>
<td>1.30</td>
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Pain Scores
Anterior Interval

**Anterior**
- Infrapatellar fat pad
- Patellar Tendon

**Posterior**
- Transverse ligament
- Anterior Tibia
MR Imaging

- Sagittal proton-density-weighted fast sequence
- Sagittal T2-weighted fast sequence
25 patients with 4 yr f/u

- 76% AIR patients pre-op flexion contracture
  - 56% Flexion Contracture 1-4°
  - 12% Flexion Contracture 5-9°
  - 8% Flexion Contracture 10-14°
Physical Exam

- Decreased proximal ROM patella
  - 38% of AI Patients
  - Odds Ratio = 4.1

If patellar tightness, then 4x the chance of Anterior Interval Scarring

- May have ↓ROM patella in ALL planes
Physical Exam

• Hoffa’s test:
  • Place thumb at margin of IFP and PT with knee bent 30°
  • Apply pressure with thumb and fully extend knee
  • Increased pain in fat pad is + test
Arthroscopic Exam

- Standard Portals
  - Penetrate fat pad
  - Difficult to view
- Anterior Interval
Arthroscopic Exam

- Modified portals
  - Avoid injury to fat pad
  - Allow visualization of Anterior Interval
Arthroscopic Exam
Anterior Interval Release
## Surgical Results at 4 yrs

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<tr>
<td>Lysholm</td>
<td>59</td>
<td>81</td>
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<tr>
<td>(p&lt; 0.001)</td>
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<td>IKDC</td>
<td>49</td>
<td>70</td>
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<td>(p&lt; 0.001)</td>
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Average Tegner: **4.5**

Average patient satisfaction: **8/10**
Anterior Interval release

volume by 33%
Suprapatellar Restriction

Plica/adhesions may:
- Tether the PF mechanism
- Be volume restricting
Identify Pain Generators in OA

• Synovitis

• Subchondral bone lesions

• Loss of Articular Volume

• Flexion Contracture

• Malalignment
Selective Removal of Osteophytes to Improve Extension
25 patients with 4 yr f/u

- 76% AIR patients pre-op flexion contracture
  - 56% Flexion Contracture 1-4°
- All resolved with AIR
Arthroscopic Debridement for the Treatment of Osteoarthritis of the Knee: 2- and 5-Year Results

Jason Fond, M.D., Dennis Rodin, M.D., Sohail Ahmad, M.D., and Robert P. Nirschl, M.D.

Retrospective review of 36 patients

Procedures (1 or more):
✓ Meniscal debridement
✓ Chondral debridement
✓ Synovectomy
✓ Lateral retinacular release
✓ Osteophyte removal

Two and five-year f/u

✓ Poor outcomes associated with preoperative contractures > 10°

✓ 25/36 had satisfactory outcomes
  • Mean pre-op contracture = 7.3°
  • All achieved 0° extension @ 5yrs
Identify Pain Generators in OA

- Synovitis
- Subchondral bone lesions
- Loss of Articular Volume
- Flexion Contracture
- Malalignment
Lower Extremity Alignment

Avoid pathologic alignment
Treatment of Malalignment

- Osteotomy
  - HTO (Tibial)
  - DFO (Femoral)

- Offloading brace
Summary

- Results may be improved by:
  1. Taking a pain history
  2. Understanding additional pain generators in the joint
  3. **Use surgery to optimize the joint environment:**
     - Improve volume, capsular compliance, ROM
     - Decrease inflammatory burden
     - Treat subchondral bone lesions
     - Neutralize mal-alignment

- **Do not** only focus on meniscus and articular cartilage
• 69 knees with severe OA (TKR candidates)

• Mean Age: 57 years

• Follow-up: > 2 years

Results

✓ Lysholm: 49 to 74 (p<.001)

✓ Failure Rate 13%
Thank you