

## Optimizing Arthroscopic Treatment of Osteoarthritis

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## Disclosures

	Consultant	Research Funding	Fellowship Funding
DePuy/Mitek	✓		
Linvatec	✓		✓
Ossur	✓	✓	✓
Smith & Nephew			✓
Zimmer Biomet	✓	✓	
Maximed	✓		
Harvest Technologies	✓	✓	
Flexion Therapeutics	✓		
Breg			✓

	Consultant	Research Funding	Fellowship Funding
Arthrex	✓		
MTF		✓	
DonJoy	✓		
RTI Surgical	✓	✓	
Bioventus	✓		
KCRN Research	✓		
Sideline Sports Doc, LLC	✓		
JRF Ortho	✓		


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  - Partnership for Clean Competition

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## Randomized Controlled Studies



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## Audience Response

- Do you agree with the evidence that meniscectomy in patients with OA is minimally effective?
  - Yes
  - No
  - Some patients may benefit

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## 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?

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## Treatments included

### A CONTROLLED TRIAL OF ARTHROSCOPIC SURGERY 2002 FOR OSTEOARTHRITIS OF THE KNEE

J. Bruce Morrison, M.D., Kimberly O'Malley, Ph.D., Nancy J. Petros, Ph.D., Tom J. Minas, Ph.D., Bruce A. Brown, Ph.D., David R. Kaminetsky, Ph.D., Jane R. Hutchinson, D.M.P.H., Carl M. Abrecht, M.D., M.P.H., and Neil F. Wilson, M.D., M.P.H.

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

### A Randomized Trial of Arthroscopic Surgery 2008 for Osteoarthritis of the Knee


Alexander Kellgren, M.D.,\* Simon R. Barrington, Ph.D., Robert E. Litchfield, M.D.,† Robert Griffin, M.D., Kevin R. Wilton, M.D., Craig J. Wang, M.D., John C. Hooper, M.D., Alan Clarke, Ph.D.,† Stephen G. Colby, C.S.L., Linda M. Fitzpatrick, B.Sc.,† James E. Pope, M.D., and Peter J. Fowler, M.D.

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

### Surgery versus Physical Therapy for a Meniscal Tear and Osteoarthritis 2013

Julian N. Katz, M.D., Robert H. Shroyer, M.D., Christian J. Chalmers, M.P.H., Jagjit deChamere, Ph.D., D.C., Brent Cook, M.D., M.P.H., Steven C. Coon, M.D., Laurel A. Dandelino, M.P.H., Margaret M.D., Ph.D., Alexander F. Han, M.D., Margaret Jones, M.D., M.P.H., Bruce A. Lee, M.D., Clark Hand, M.D., M.P.H., Scott M. Murray, M.D., Richard M. Ryan, M.D., Jeffrey Wilmore, M.D., Stephen Wang, M.D., Joseph F. Sullivan, M.D., Ph.D., Joseph P. Saltz, Ph.D., Jeffrey A. Katz, M.D., D.C., D.O., Benjamin A. Boman, B.A., Charles J. Saltonstall, Ph.D., Ph.D., D.C., Daniel J. Damann, M.D., A.B., Daniel R. Johnson, M.D., M.P.H., Matthew V. Coyle, M.D., Scott Standish, M.D., Richard J. Stone, M.D., John Wright, M.D., Rick W. Wright, M.D., and Sara Luchini, Ph.D.


- Chondroplasty
- Loose body removal
- Meniscectomy



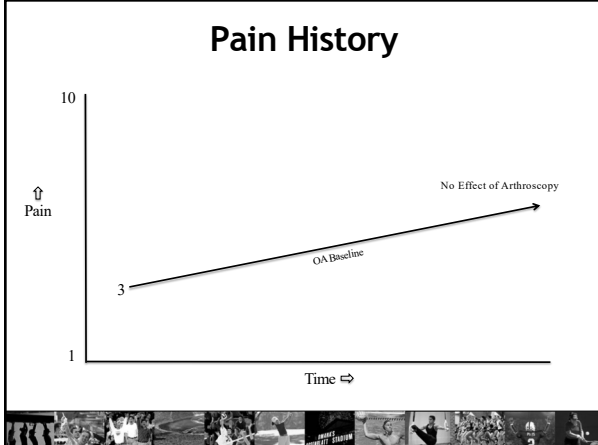
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## How to get good results?

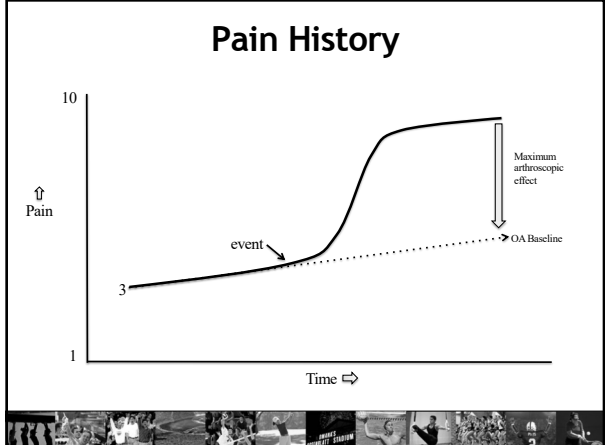
- What are we missing?
- *How can we pick the patients who will respond?*
- *Are there other pain generators on OA?*



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## Pain History



dial meniscus (Fig. 1). Patients with an obvious traumatic onset of symptoms or with knee osteoarthritis as defined with the use of clinical criteria (American College of Rheumatology)<sup>10</sup> or radiographic criteria (Kellgren–Lawrence grade >1)<sup>11</sup> were excluded. On the Kellgren–Lawrence scale,


“Arthroscopy for baseline pain of OA, with out traumatic incident, tends not to be effective....”



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## Identify Pain Generators in OA

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

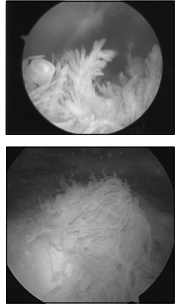


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## Synovitis

- Rheumatoid arthritis
- Hemophilic arthropathy
- OA

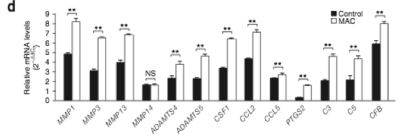
- ★ Osteoarthritis can have an inflammatory component



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**nature medicine** Identification of a central role for complement in osteoarthritis

Qian Wang<sup>1,2,16</sup>, Andrew L. Razzell<sup>1,2,16</sup>, Christin M. Lopez<sup>1,2</sup>, Carla R. Scanzello<sup>1</sup>, Jason J. Song<sup>1,2</sup>, D. Megan Larsen<sup>1,3</sup>, James F. Critch<sup>4</sup>, Gurkan Bebek<sup>4,5</sup>, Susan Y. Ritter<sup>6</sup>, Tamsin M. Lindstrom<sup>1,2</sup>, Inyong Hwang<sup>1,2</sup>, Heidi H. Wong<sup>1,2</sup>, Leonardo Punzi<sup>7</sup>, Angelo Encarnacion<sup>8</sup>, Mehrdad Shambou<sup>9</sup>, Stuart B. Goodman<sup>9</sup>, Tney Wyse-Coray<sup>10,11</sup>, Steven R. Goldring<sup>1</sup>, Nirmal K. Randa<sup>12,13</sup>, Joshua M. Thurman<sup>12,13</sup>, Reuben Gobezie<sup>14</sup>, Mary K. Crowe<sup>15</sup>, V. Michael Holzer<sup>12,13</sup>, David M. Lee<sup>16,17</sup> & William H. Robinson<sup>1,2</sup>

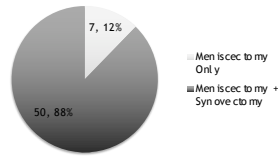


- ✓ Synovial fluid and membrane complement levels significantly expressed and activated in human OA joints
- ✓ Synovial membrane contributes to excessive complement activation
- ✓ Membrane attack complex (MAC)-mediated arm of complement crucial to OA development in 3 mice models

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## Our Results

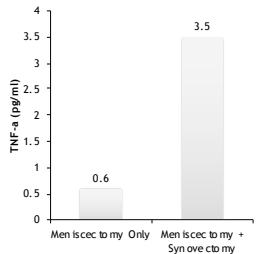
- Total of 57 patients evaluated in 2011-2012
- ✓ 7/57 (12.3%) meniscectomy only
- ✓ 50/57 (87.7%) meniscectomy + synovectomy



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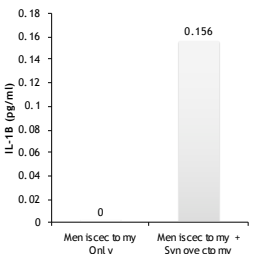
## Pre-op Cytokine Results

### TNF-α



Statistically significant, p=0.012

### IL-1β



Statistically significant, p=0.001

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## Inflammatory OA

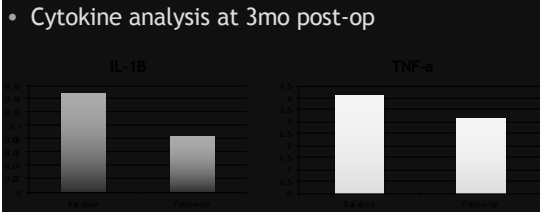
- May present with:
  - Effusion
  - Bogginess
  - Reactive knee after exercise/activity



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## Results of Synovectomy

- Cytokine analysis at 3mo post-op



May require additional treatment, incl medications, for max benefit

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## Impinging Synovitis

**Description**

- Idiopathic synovial impingement described by Pavioich 2002
- Impingement of local synovium that has hypertrophied in response to trauma or trophic factors

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## Impinging Synovitis

**Description**

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

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## Impinging Synovitis

**Diagnosis**

- MRI
  - Synovium between meniscus and condyle
  - "Double meniscus" sign
- Exam
  - + Hyperextension test
  - + Hoffa's test

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## Impinging Synovitis

- May occur:
  - Anteriorly
  - Posteriorly
- May mimic meniscal pain

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## Anterior Impinging Synovitis

**Treatment**

- Resection with radiofrequency probe
- Use caution
  - Articular cartilage is close

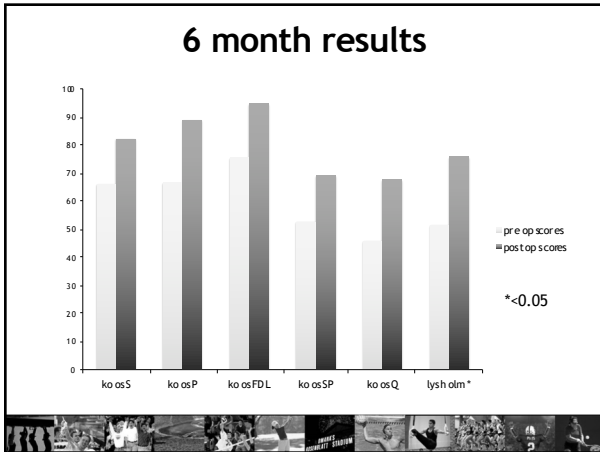
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## Posterior Impinging Synovitis

- Impingement may occur posteriorly

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### Denervation of Inferior Pole Patella

- Nociceptive fibers enter patella from fat pad
  - ↓ sensitivity of patella
- Can release scar tissue from proximal fat pad

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### Identify Pain Generators in OA

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

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### 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
  - Felson, Annals of Int Med, 2011
- 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

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### Worse Outcomes with Bone Lesions

- Worse outcomes associated with marrow edema/bone loss
  - Talus: Cuttica 2011
  - ACI knee: Niemeyer 2010

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### How should we treat bone marrow lesions?

Biologic	Structural
<ul style="list-style-type: none"> <li>K-wire drilling</li> <li>Core decompression</li> <li>Stem Cell injection</li> </ul>	<ul style="list-style-type: none"> <li>Calcium Phosphate cement</li> </ul>

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## 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



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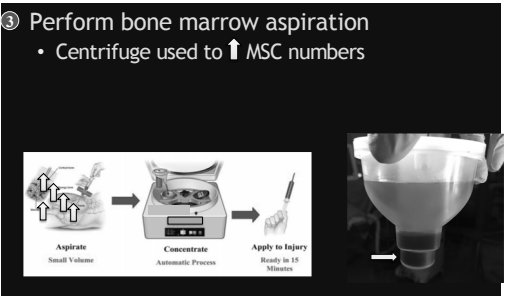
## Biologic Treatment of BML

- ① Fluoro-guided placement of k-wire
 
- ② Ream over wire (4mm)
  - ↑ blood flow
  - ↑ area for BMAC

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## Bone Marrow Aspirate Concentration

- ③ Perform bone marrow aspiration
  - Centrifuge used to ↑ MSC numbers



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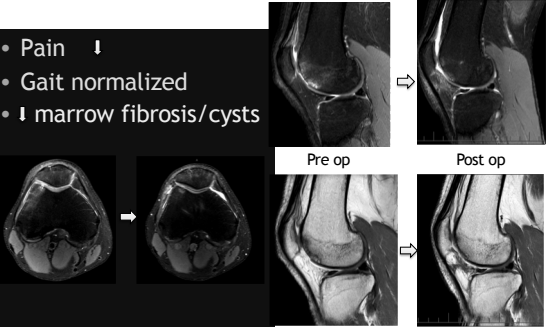
## Injection

- ④ Injection of BMAC w thrombin
  - Cellularity
  - VEGF/vascularity

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## 3 Month MRI

- Pain ↓
- Gait normalized
- ↓ marrow fibrosis/cysts



Pre op                      Post op


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## Identify Pain Generators in OA


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

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### 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

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### Clinical Relevance



Normal

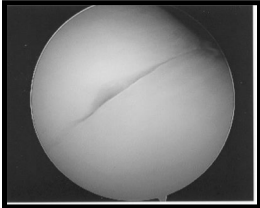


Loss of Volume Capacity

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### Clinical Relevance

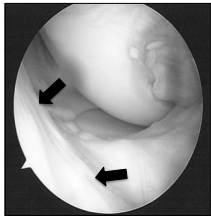
- 36 year old with chronic infrapatellar pain
- Longitudinal “grooving” trochlea



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### Loss of Articular Volume

- Loss of capsular compliance
- Scar tissue formation



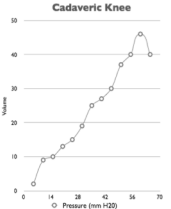
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### Restoration of Knee Volume Using Selected Arthroscopic Releases

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

- Average volume of knees: 86 ml (50-110)
- Volume of knees with complete supra-patellar plica = 50 ml


VOLUME (ML)	PRESSURE (MM H <sub>2</sub> O)
5	2
10	9
15	10
20	13
25	15
30	19
35	25
40	27
45	30
50	37
55	40
60	46
65	49




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### Identifying Volume Compromise

- Injection of 60 ml of saline can be used to identify volume compromise

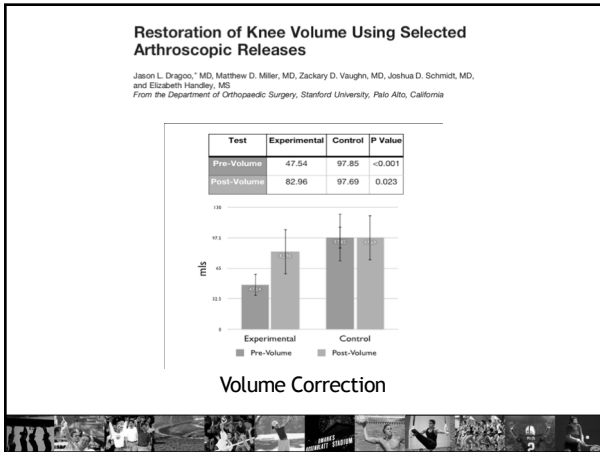


Loss of Volume

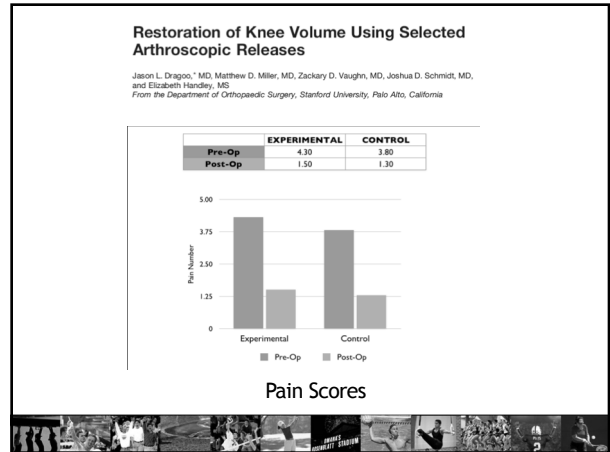


Normal

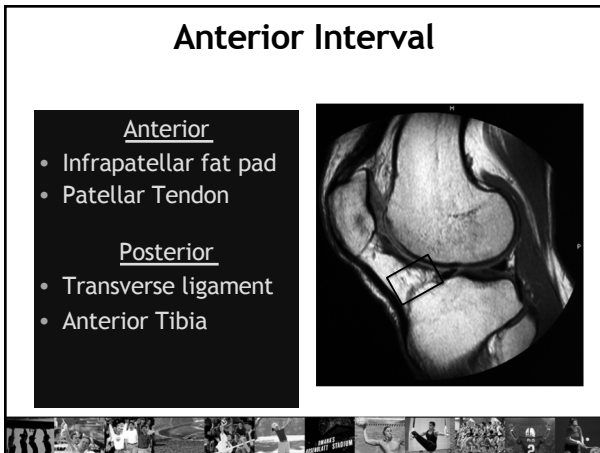
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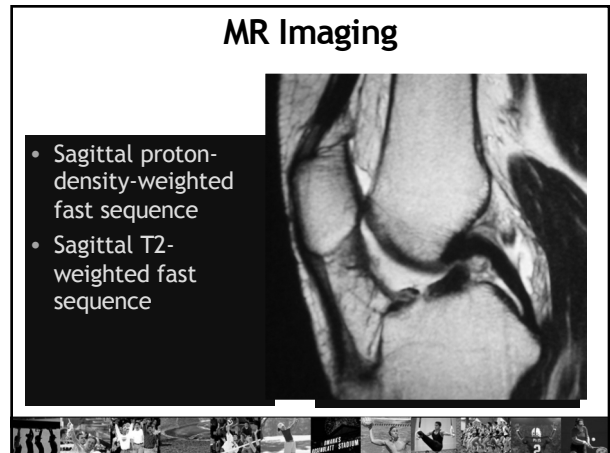
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### Arthroscopic Release for Symptomatic Scarring of the Anterior Interval of the Knee

J. Richard Steadman,<sup>1</sup> MD, Jason L. Drago,<sup>2</sup> MD, Sophie L. Hines,<sup>1</sup> and Karen K. Briggs,<sup>1</sup> MPH  
From the <sup>1</sup>Steadman Hawkins Research Foundation, Vail, Colorado, and the <sup>2</sup>Department of Orthopaedic Surgery, Stanford University, Stanford, California

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°

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### 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

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## 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



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## Arthroscopic Exam

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



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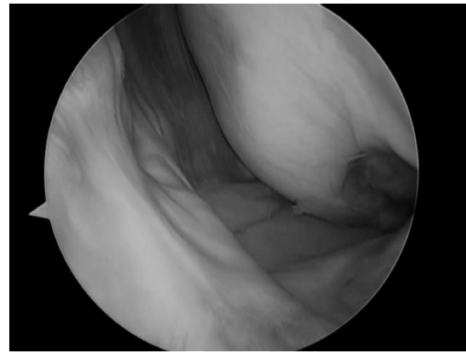
## Arthroscopic Exam

- Modified portals
  - Avoid injury to fat pad
  - Allow visualization of Anterior Interval



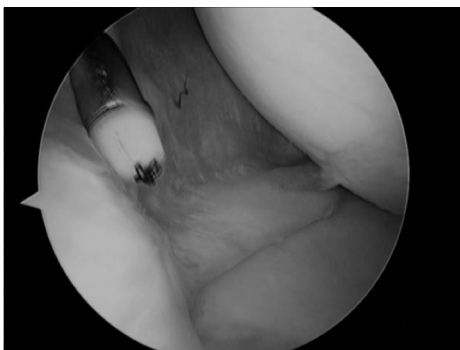
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## Arthroscopic Exam



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## Anterior Interval Release



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## Surgical Results at 4 yrs

	<u>Pre-op</u>	<u>Post-op</u>
Lysholm	59	81 (p< 0.001)
IKDC	49	70 (p< 0.001)

Average Tegner: 4.5  
Average patient satisfaction: 8/10

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### Restoration of Knee Volume Using Selected Arthroscopic Releases

Jason L. Drago, 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

- Anterior Interval release
  - ✓ ↑ volume by 33%

Test	Anterior Interval
Pre-Volume	53.60
Post-Volume	84.90
P-Value	P<0.001

**Anterior Interval Release**

ml

Pre-Volume Post-Volume

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### Suprapatellar Restriction

Fig. 1. Synovial (fat) plicae.

Plica/adhesions may: -Tether the PF mechanism  
-Be volume restricting

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### Identify Pain Generators in OA

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

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### Selective Removal of Osteophytes to Improve Extension

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### Arthroscopic Release for Symptomatic Scarring of the Anterior Interval of the Knee

J. Richard Steadman, MD, Jason L. Drago, MD, Sophie L. Hines, and Karen K. Briggs, MPH  
From the Steadman Hawkins Research Foundation, Vail, Colorado, and the Department of Orthopaedic Surgery, Stanford University, Stanford, California

**25 patients with 4 yr f/u**

- 76% AIR patients pre-op flexion contracture
  - 56% Flexion Contracture 1-4°
- All resolved with AIR

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### 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

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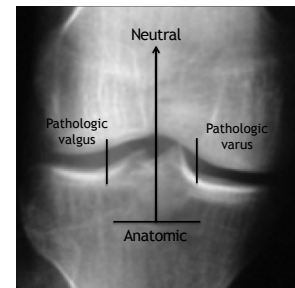
## Identify Pain Generators in OA

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



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## Lower Extremity Alignment



Avoid pathologic alignment



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## Treatment of Malalignment

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



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## 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*



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### An Arthroscopic Treatment Regimen for Osteoarthritis of the Knee

J. Richard Steadman, M.D., Arun J. Ramappa, M.D., R. Brian Maxwell, B.S., and Karen K. Briggs, M.P.H.

- 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%



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Thank you

 Sports Medicine  
University of Colorado



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