

Best Practices in Knee Treatment

Chairperson: Dr. Xinning Li

Tuesday, March 26th, 2019

8:00 – 8:45 am

*Work Related Injuries Workshop
March 25th & 26th, 2019*

Intra-articular Knee Injection Therapy: When, Where, Why & How Many?

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Work Related Injuries Workshop
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Disclosures

- **Scientific and Product Advisory Board**

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- American Journal of Sports Medicine
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 - CME Questions Board
- Orthopedic Reviews
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- Rotator Cuff Management

- Research Funding

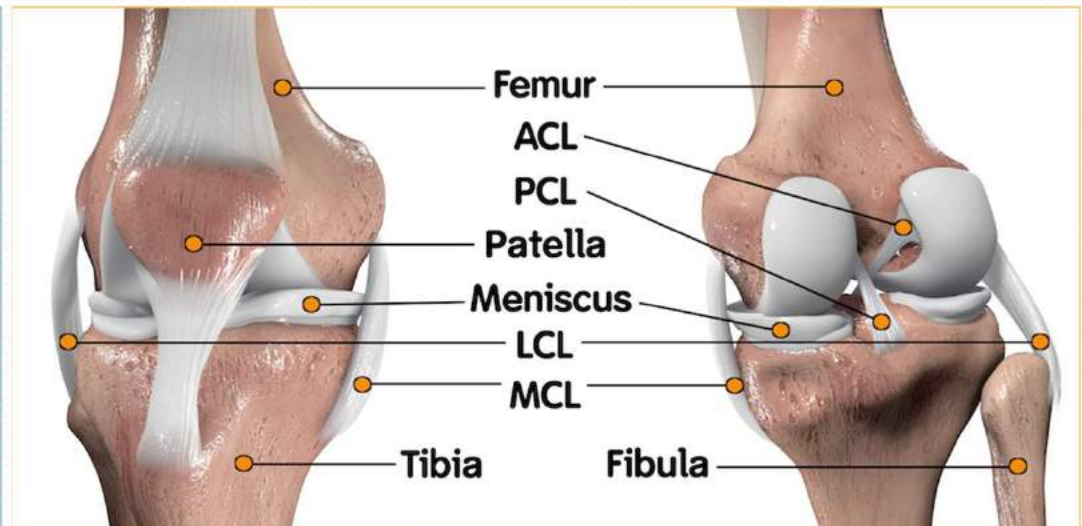
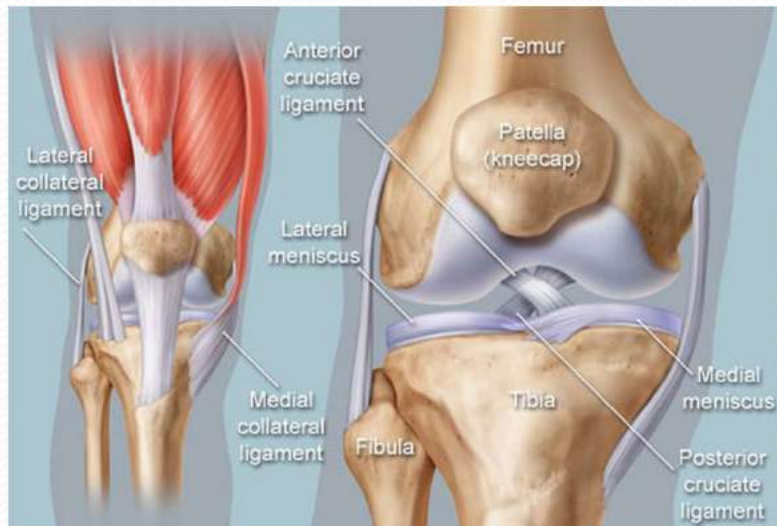
- OREF



Outline

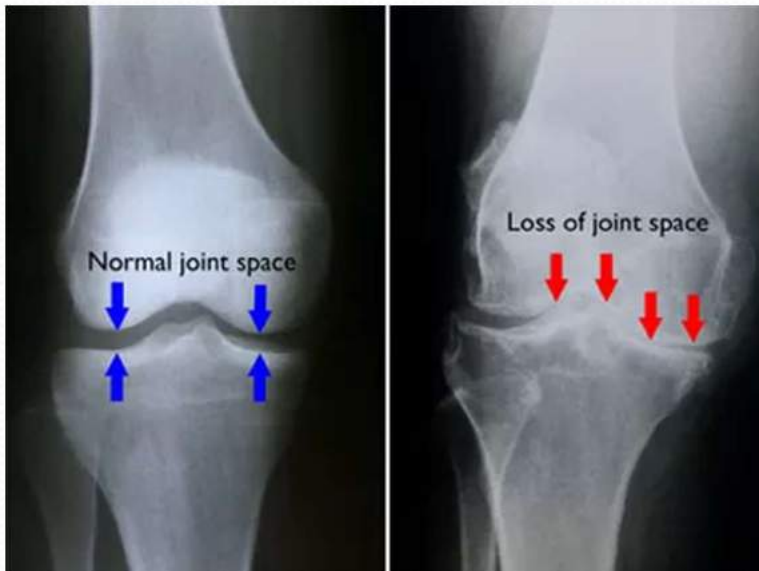
- Anatomy
- Injection Technique
- What Can you Inject into the Knee?
- Indications
- What's the Evidence?

Anatomy



Common Indications

- **Knee Arthritis**
 - Arthritis, inflammatory arthritis (RA), Gout, etc.
- Degenerative Meniscus Tears (older patients)
- Bursa or Infrapatellar fat pad
- Diagnostic Injection



Contraindications

**Table 2. Contraindications
to Intra-Articular Injection**

Broken skin at injection site
Known hypersensitivity to intra-articular agent
Osteochondral/intra-articular fracture
Prosthetic joint*
Severe joint destruction
Skin infection overlying injection site
Unstable coagulopathy

*—*Relative contraindication.*

Aspiration / Injection Technique



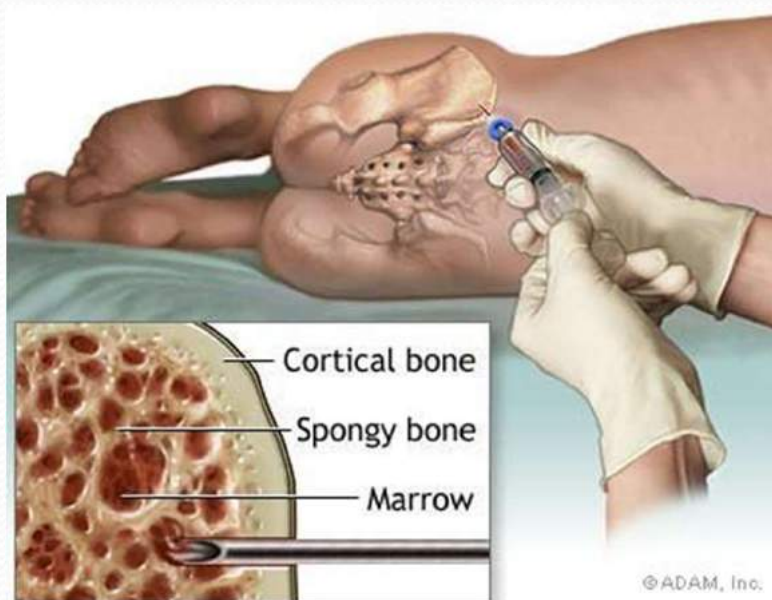
Knee Injection



What Can You Inject??



Bone Marrow



Fat and Bone Marrow Stem Cells used to Treat Severe Knee Arthritis



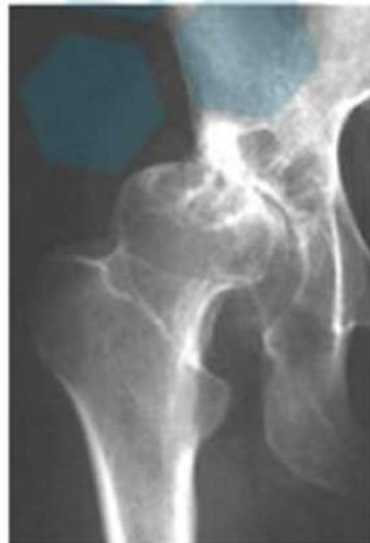
the last five years. I'm not sure. ...I will try to get another treatment when I can work it into my schedule."

SUBSCRIBE

Placental

Tissue Bank

BEFORE REGEN CENTER



AFTER REGEN CENTER



umbilical
cord

HOW IT WORKS

1. Tissue is taken from umbilical cord and frozen
2. The cord is full of the most potent stem cells, known as the body's 'master cells'

future, new tissue or
could be grown and
at illnesses like heart
disease & dementia

 Regenexx®

Dextrose or Prolotherapy



\$\$\$



What's the Evidence?



Cochrane
Library

Cochrane Database of Systematic Reviews

Intra-articular corticosteroid for knee osteoarthritis (Review)

Jüni P, Hari R, Rutjes AWS, Fischer R, Sillelta MG, Reichenbach S, da Costa BR

RESULTS

- 27 Randomized Control Trials with 1767 patients

Pain

- People who reported extreme pain
- People who reported pain after 1 month.

Steroid: PAIN Improved ~3/10 (1 month)

(extreme pain) to 10

Placebo: PAIN Improved ~2/10 (1 month)

(in) after 1

- People who reported disability
- People who reported extreme disability after 1 month.

Steroid: FUNCTION Improved ~3/10 (1 month)

(if 0 (no

Placebo: FUNCTION Improved ~2/10 (1 month)

extreme

Side effects

- 13 people out of 100 with side effects
- 15 people out of 100 with side effects
- 2 more people experienced side effects with placebo than with intra-articular corticosteroids (difference of 2%).

Steroid: SIDE EFFECTS ~13%

(13%).

Placebo: SIDE EFFECTS ~15%

Conclusion

Based on function, effect, in physical many side
Intra-articular Steroid Injection: Moderate Improvement in Pain and Small Improvement in Function at short term F/U.

Quality of evidence

We wa This
Low Quality of Evidence and not much different vs Placebo!

In this update of the system that compared intra-articular corticosteroid injection with placebo, the results were hampered by low methodological quality. The effects decreased over time, and overall, the effect of a corticosteroid injection was not statistically significant.



Most of the identified trials had a low risk of bias, but the intervention control small and the confidence intervals were wide. The results suggested that effects were not statistically significant, and the effect remains six months after the intervention.

Viscosupplementation for Osteoarthritis of the Knee

A Systematic Review and Meta-analysis

Anne W.S. Rutjes, PhD; Peter Jüni, MD; Bruno R. da Costa, MSc; Sven Trelle, MD; Eveline Nüesch, PhD; and Stephan Reichenbach, MD, MSc

- 89 Studies with 12,677 Patients
 - Sham/control vs HA

We conclude that the benefit of viscosupplementation on pain and function in patients with symptomatic osteoarthritis of the knee is minimal or nonexistent. Because of increased risks for serious adverse events and local adverse events, the administration of these preparations should be discouraged.



Hyaluronic Acid Versus Platelet-Rich Plasma

A Prospective, Double-Blind Randomized Controlled Trial Comparing Clinical Outcomes and Effects on Intra-articular Biology for the Treatment of Knee Osteoarthritis

Brian J. Cole,^{*†‡§||¶} MD, MBA, Vasili Karas,[#] MD, MS, Kristen Hussey,[†] MS, David B. Merkow,[†] BA, Kyle Pilz,^{†¶} MMS, PA-C, and Lisa A. Fortier,^{**} DVM, PhD, DACVS
Investigation performed at the Rush University Medical Center, Chicago, Illinois, USA

Conclusion: We found no difference between HA and PRP at any time point in the primary outcome measure: the patient-reported WOMAC pain score. Significant improvements were seen in other patient-reported outcome measures, with results favoring PRP over HA. Preceding a significant difference in subjective outcomes favoring PRP, there was a trend toward a decrease in 2 proinflammatory cytokines, which suggest that the anti-inflammatory properties of PRP may contribute to an improvement of symptoms.

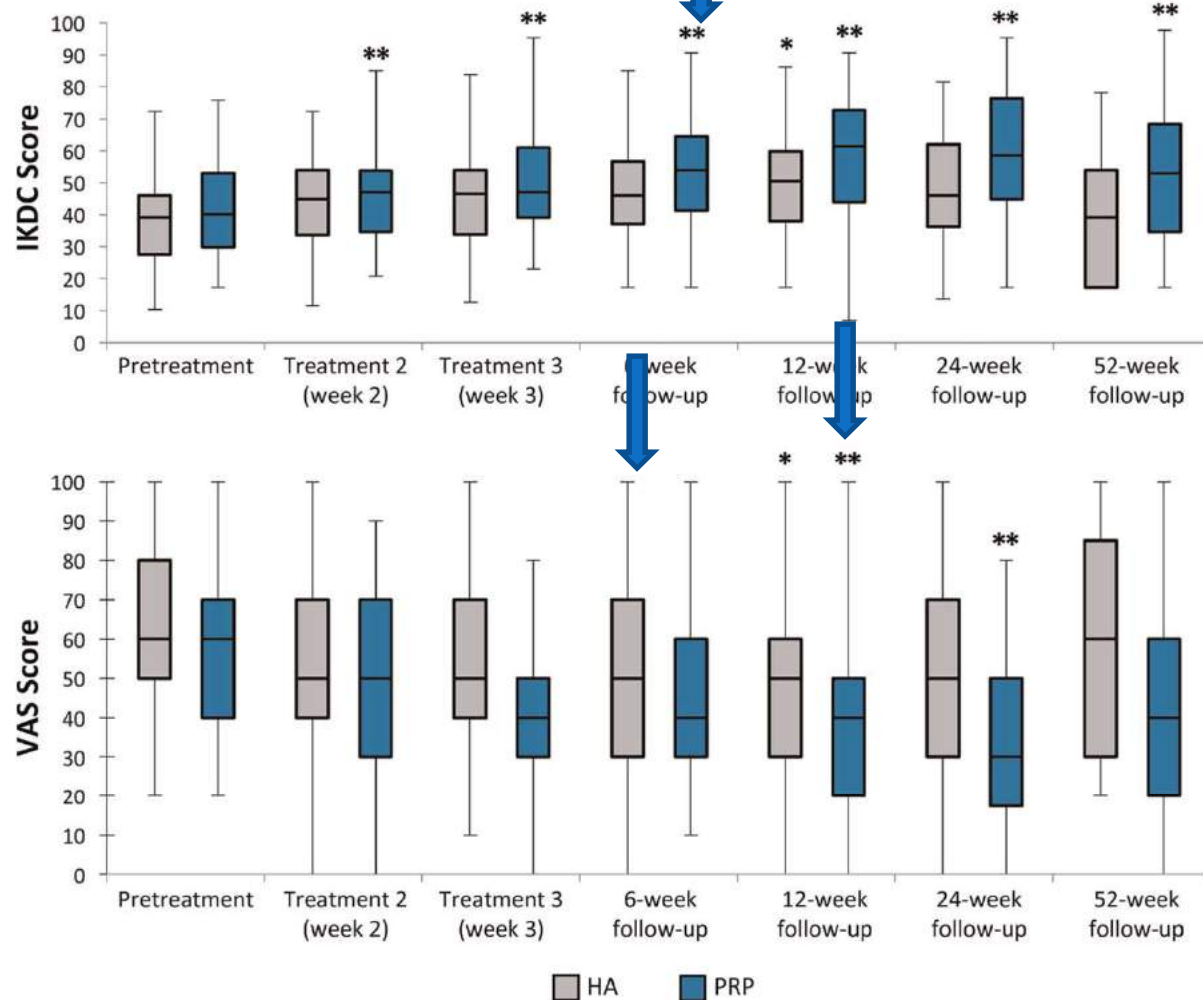


Figure 2. Box-and-whisker plot showing the treatment effect of hyaluronic acid (HA) and platelet-rich plasma (PRP) over time. There was a significant improvement in the International Knee Documentation Committee (IKDC) and visual analog scale (VAS) scores from before treatment to after treatment. Statistically significant difference between pre- and posttreatment score at a given time point for *HA and **PRP. The solid line delineates the median value.

Platelet-Rich Plasma Intra-articular Knee Injections Show No Superiority Versus Viscosupplementation

A Randomized Controlled Trial

Giuseppe Filardo,^{*} MD, PhD, Berardo Di Matteo,^{*†} MD, Alessandro Di Martino,^{*} MD, Maria Letizia Merli,^{*} MD, Annarita Cenacchi,[‡] MD, PierMaria Fornasari,[‡] MD, Maurilio Marcacci,^{*} MD, Prof., and Elizaveta Kon,[§] MD

Investigation performed at Rizzoli Orthopaedic Institute, Bologna, Italy

[Knee Surgery, Sports Traumatology, Arthroscopy](#)

March 2017, Volume 25, [Issue 3](#), pp 958–965 | [Cite as](#)

Multiple PRP injections are more effective than single injections and hyaluronic acid in knees with early osteoarthritis: a randomized, double-blind, placebo-controlled trial



The temporal effect of platelet-rich plasma on pain and physical function in the treatment of knee osteoarthritis: systematic review and meta-analysis of randomized controlled trials

Longxiang Shen^{1†}, Ting Yuan^{1†}, Shengbao Chen², Xuetao Xie^{1*} and Changqing Zhang¹

Results: Fourteen RCTs comprising 1423 participants were included. The control included saline placebo, HA, ozone, and corticosteroids. The follow-up ranged from 12 weeks to 12 months. Risk of bias assessment showed that 4 studies were considered as moderate risk of bias and 10 as high risk of bias. Compared with control, PRP injections significantly reduced WOMAC score at 6-12 months (MD -3.98, 95% CI -7.11 to -0.85, $p=0.001$); PRP significantly improved knee function at 6-12 months (MD 1.31, 95% CI 0.22 to 2.41, $p=0.001$); PRP significantly improved knee pain at 6-12 months (MD -1.48, 95% CI -2.63 to -0.33, $p=0.001$). Intra-articular PRP **PROBABLY** is more efficacious vs other injections for knee OA.

Conclusions: Intra-articular PRP injections probably are more efficacious in the treatment of knee OA in terms of pain relief and self-reported function improvement at 3, 6 and 12 months follow-up, compared with other injections, including saline placebo, HA, ozone, and corticosteroids.

Jeremy Magalon, Pharm.D., Olivier Bausset, Pharm.D., Nicolas Serratrice, Laurent Giraudo, Houssein Aboudou, Julie Veran, Guy Magalon, M.D., Françoise Dignat-Georges, Pharm.D., and Florence Sabatier, Pharm.D.

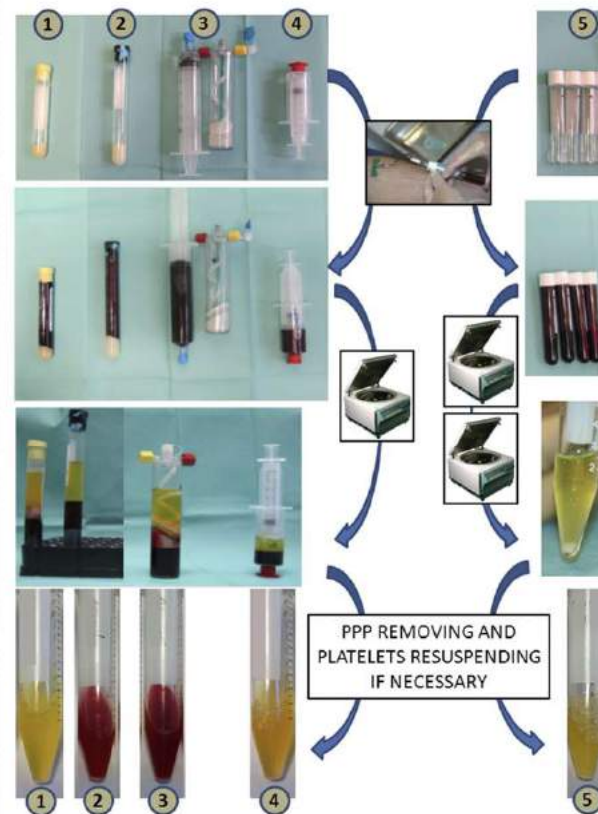


Table 3. Mean PRP Characteristics Obtained From Different Preparation and ANOVA Comparison Among Different Systems

	PRP Preparation System					P Value (ANOVA)
	Selphyl System	RegenPRP	Mini GPS III System	Arthrex ACP	Laboratory Preparation	
Volume of PRP obtained (mL)	4.10 ± 0.43	3.10 ± 0.61	3.21 ± 0.15	4.03 ± 0.35	3.41 ± 0.92	.0002
Platelet capture efficiency (%)	59.89 ± 15.73	55.28 ± 18.43	46.45 ± 12.66	48.23 ± 7.41	29.63 ± 9.10	<.0001
Relative composition in platelets (%)	73.86 ± 19.72	45.97 ± 24.70	51.84 ± 18.48	80.96 ± 3.10	80.72 ± 3.79	<.0001
Relative composition in WBC (%)	0.18 ± 0.11	1.04 ± 0.47	1.37 ± 0.36	0.08 ± 0.06	0.27 ± 0.24	<.0001
Relative composition in RBC (%)	25.97 ± 19.65	52.99 ± 24.93	46.79 ± 18.51	18.96 ± 3.05	19.01 ± 3.72	<.0001
Relative composition in neutrophils (%)	13.99 ± 11.56	38.40 ± 22.57	33.60 ± 18.88	25.26 ± 17.70	9.63 ± 16.66	.0031
Platelet concentration ($\times 10^9/L$)	330.60 ± 95.64	453.67 ± 262.37	1,135.20 ± 422.15	372.90 ± 77.67	756.20 ± 195.00	<.0001
Factor increase in platelet concentration	1.16 ± 0.27	1.37 ± 0.14	3.77 ± 1.07	1.14 ± 0.15	2.31 ± 0.55	
WBC concentration ($\times 10^9/L$)	1.29 ± 2.02	10.61 ± 3.64	30.36 ± 9.81	0.39 ± 0.33	2.27 ± 2.01	<.0001
Factor increase in WBC concentration	0.18 ± 0.27	1.52 ± 0.46	4.13 ± 0.80	0.06 ± 0.04	0.35 ± 0.31	—
% of activated platelets	6.46 ± 2.45	6.10 ± 4.07	5.03 ± 2.95	4.27 ± 3.06	11.08 ± 9.85	.0801
Platelet dose in PRP ($\times 10^9$)	1.36 ± 0.42	1.25 ± 0.49	3.61 ± 0.13	1.49 ± 0.29	2.62 ± 0.12	<.0001



Conclusions

In a single-donor model, significant biological variations in PRP obtained from different preparation systems were highlighted. The observed differences suggest different results for treated tissue and could explain the large variability in the clinical benefit of PRP reported in the literature. Our findings will help clinicians to choose a system that meets their specific needs for a given indication.

Review

Stem cell injections in knee osteoarthritis: a systematic review of the literature

Haiko IMFL Pas^{1,2,3}, Marinus Winters⁴, Hidde J Haisma⁵, Martinus JJ Koenis⁶, Johannes L Tol^{1,3,7}, Maarten H Moen^{1,8,9}

Author affiliations +



Key messages

What are the new findings?

- The available evidence supporting the use of (mesenchymal) stem cells in knee osteoarthritis is at high risk of bias.
- The long-term risks of stem cell use needs further investigation.
- Methodologically sound research is needed to explore the efficacy of stem cell therapy in knee osteoarthritis.

How might it impact on clinical practice in the near future?

- Presently, clinicians should refrain from using (mesenchymal stem cells) in patients with knee osteoarthritis.
- If patients are treated with (mesenchymal) stem cells, they should be extensively monitored.
- International guidelines for quality control should be used and followed when working with (mesenchymal) stem cells.

My approach with Knee Injections

- Knee Arthritis and degenerative meniscus tears
- Diagnostic injection (Lidocaine)
- Depo Medrol (Methylprednisolone) 40mg with 4 cc of Bupivacaine
 - 2 to 3 Injections spaced out 3 to 4 months
 - No Injections 3 months prior to Knee Replacement
- HA, STEM CELLS, PLACENTA, DEXTROSE, BMA, etc.
 - Evidence is limited
 - Cost
- PRP for mild or moderate knee OA
 - ?Role for short term benefit

THANKS



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Knee Cartilage Injuries

Brett D. Owens, MD

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Brown University Alpert Medical School
Providence, RI

Work Related Injuries Workshop
March 25th & 26th, 2019



Disclosures

- Associate Editor, *American Journal of Sports Medicine*
- Committees: AOSSM, ASES, NFL
- Consultant: Mitek, Musculoskeletal Transplant Foundation, Conmed, Vericel
- Invention Royalties: Conmed
- Research Support: Arthrex, Mitek, MTF, NATA, OREF, CDMRP, NIAMS, DoD, NIGMS
- Publishing Royalties :Springer, Slack, Elsevier

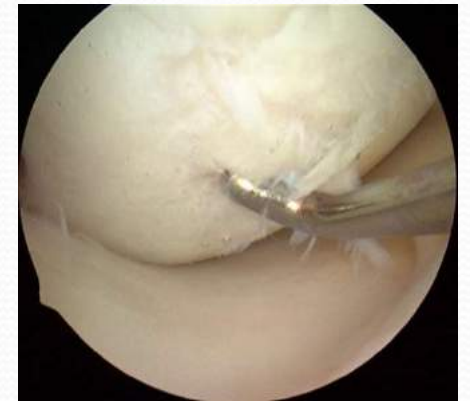


Cartilage Lesions

- Documented in 63% of patients undergoing knee arthroscopy (Curl Arthroscopy 1997)
- May be partial or full thickness
- Has no sensory nerves – not the direct cause of pain
- Need to consider the entire joint (organ)

Cartilage Lesions

- Spectrum of disease
- Extremely common in older patients
- Exact epidemiology unknown
- Often seen at arthroscopy
- Usually not treated without symptoms



Young Patients

- Arthroplasty not an option
- Desire for active lifestyle
- Candidate for biologic solution?



Mechanism

- Acute traumatic event – bodes well for repair/outcome
- Chronic attritional wear – poor outcome unless you fix underlying cause
- No specific mechanism for MFC lesion which is most common
- ACL injury
- Patellofemoral instability

Presentation

- Symptoms
 - asymptomatic vs. localized knee pain
 - may complain of effusion, motion deficits, mechanical symptoms (e.g., catching, instability)





Exam

- Physical exam
 - inspection
 - look for background factors that predispose to the formation of articular defects
 - joint laxity
 - malalignment
 - compartment overload
 - motion
 - assess range of motion, ligamentous stability, gait

Classification

Outerbridge Arthroscopic Grading System

Grade 0	Normal cartilage
Grade I	Softening and swelling
Grade II	Superficial fissures
Grade III	Deep fissures, without exposed bone
Grade IV	Exposed subchondral bone

ICRS (International Cartilage Repair Society) Grading System

Grade 0	Normal cartilage
Grade 1	Nearly normal (superficial lesions)
Grade 2	Abnormal (lesions extend < 50% of cartilage depth)
Grade 3	Severely abnormal (>50% of cartilage depth)
Grade 4	Severely abnormal (through the subchondral bone)



Imaging

- Plain xrays
 - AP, lat, Merchant/sunrise
 - Rosenberg
 - ALIGNMENT films are key
- CT – rarely helpful
- MRI – critical to assess lesion size, location, meniscus/ligament status, and bone signal***



Nonop Treatment

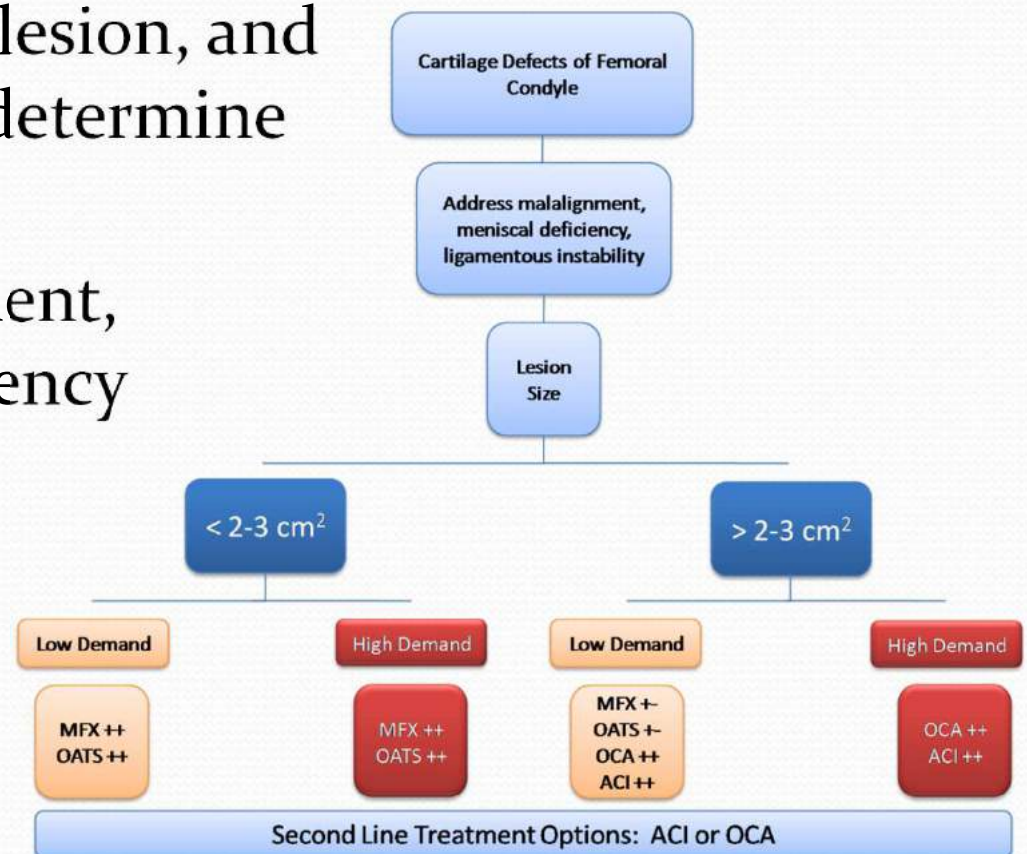
- Weight loss, NSAIDs, activity modification, therapy
- Bracing – unloader brace
- Injections – HA, steroid, PRP?

Surgical Options

- Palliative
 - Debridement
- Repair
 - Primary repair
 - Marrow stimulation (microfracture)
- Restoration
 - OATS (auto plug transfer)
 - Auto cell-based (ACI, MACI, Neocart)
 - Allograft (fresh OC allograft, denovo, cartimax)

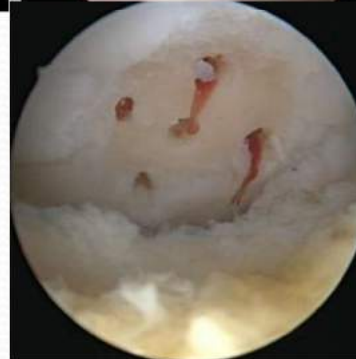
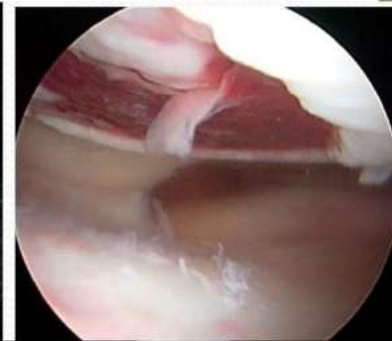
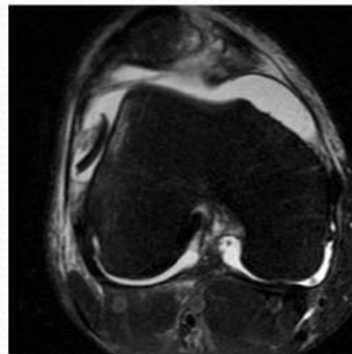
Treatment Algorithm

- Adapted from Cole
- Size of lesion, location of lesion, and patient age/activity level determine treatment options
- MUST address malalignment, meniscus/ligament deficiency



Cartilage Repair

- Many treatment options
- Primary repair
- Marrow stimulation (microfracture)
- Osteochondral plug (autograft or allograft)
- Cartilage particles (Biocartilage, DeNovo)
- Cell based repair (ACI, Neocart)



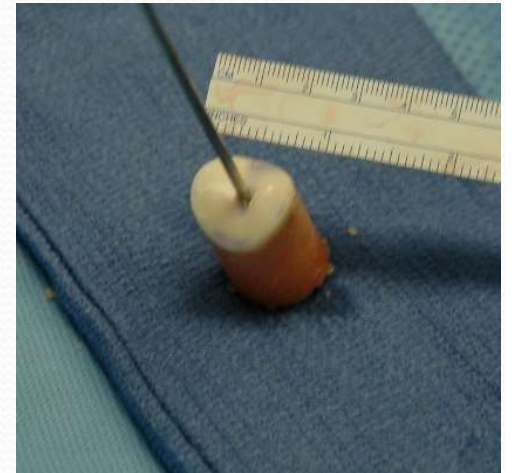
Osteochondral Grafts

- Autografts can be performed arthroscopically
- Limited by size –max 10mm
- Large lesions best treated by fresh allograft



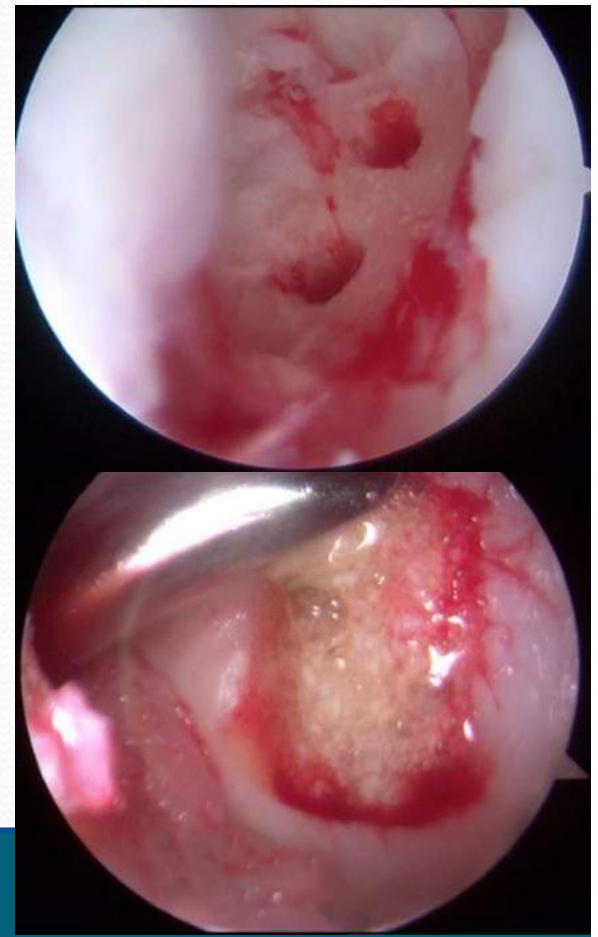
Osteochondral Allografts

- No size limit
- Need to be ordered and implanted during small time window to ensure viability
- Current research into optimal storage medium to prolong shelf life



Cartilage Allograft Matrix

- Biocartilage (Arthrex) – minced cartilage - involves microfracture as well
- CAM (MTF) micronized particles



Autologous Chondrocyte Implantation

- Requires 2 surgeries (one for biopsy)
- Expensive
- Prolonged rehab protocol
- MACI, Neocart, others?



Osteotomies

- Key to make the leg straight
- This is not the Coventry osteotomy for osteoarthritis treatment
- Aim is to correct malalignment
 - Do NOT overcorrect
 - Windswept knees



Valgus

- If in valgus – DFO – distal femoral osteotomy
- Medial closing wedge is described
- Most surgeons prefer lateral opening wedge



Varus

- If in varus – HTO – high tibial osteotomy
- Lateral closing wedge is performed
 - Concerns about peroneal nerve injury
 - Faster bone healing
- Opening wedge medial is preferred by most surgeons
 - Vascular injury reported



Tibial Tubercle Osteotomy

- Used for many patellofemoral chondral lesions
- Also for patellofemoral instability



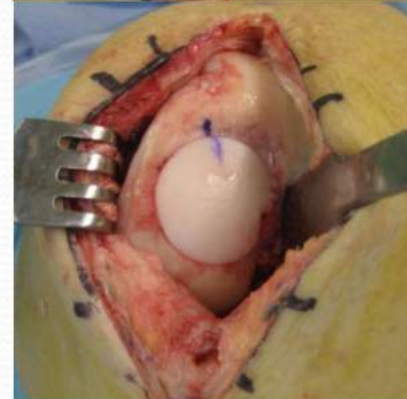
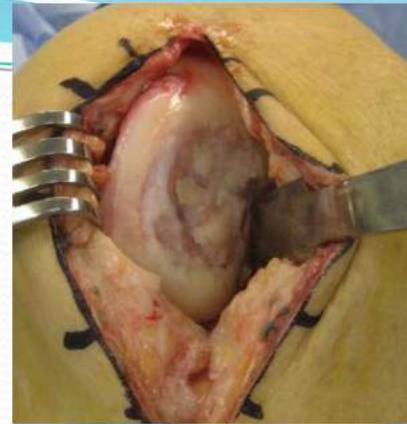
Case PC

- 42 yo male, active runner
- Failed OATS plugs
- Varus malalignment



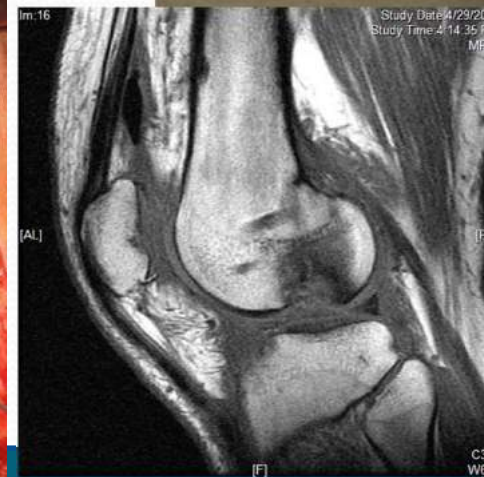
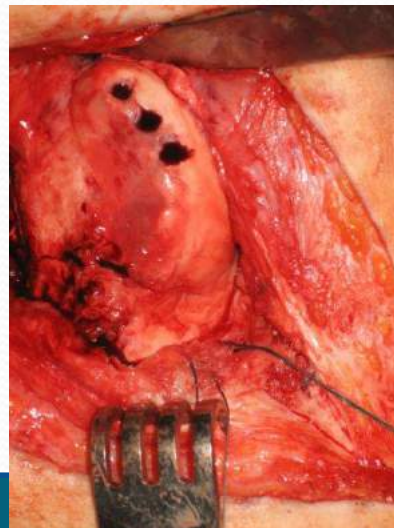
se PC

- #1 HTO, staging scope, order fresh OC graft
- #2 fresh OC allograft, 30mm graft



Case JL

- 21 yo male injured in MVA
- Distal femoral Hoffa fracture ORIF
- LFC defect with bone loss
- Lateral meniscus deficiency
- Valgus malalignment



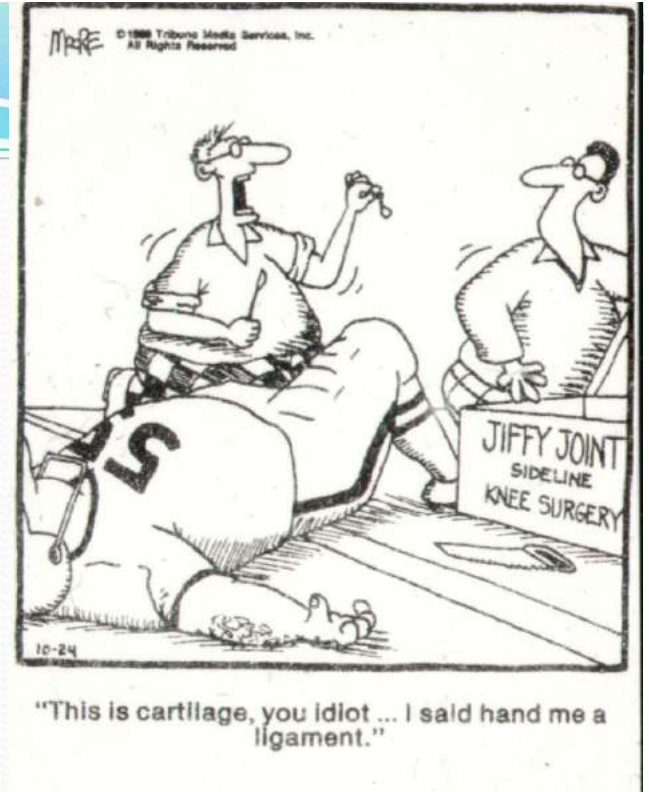
Case JL

- Single stage DFO
- fresh OC graft LFC
- lat MAT



Summary

- Biologic reconstruction is possible, but must correct malalignment and ligament deficiency
- Aggressive treatment is warranted in young active population
- Many options for cartilage repair/restoration
- Don't overlook role of osteotomy



Thank you!

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Work Comp Knee Injury: Case Presentation

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Case

- 40 year old male s/p work related injury to left knee.
 - Twisted his knee and felt pain and swelling (2014)
 - PT (>6 months), 1 Injection Cortisone, braced, NSAIDs.
 - 2015 referred to me with MRI of knee
- Pain 9/10 with squatting, bending, twisting motions
 - Up and down stairs is painful
 - Clicking inner knee.
 - Swelling
 - No buckling or instability
- PMH and PSH: None
- SH: No Tob, etoh and still working with pain
 - Laborer



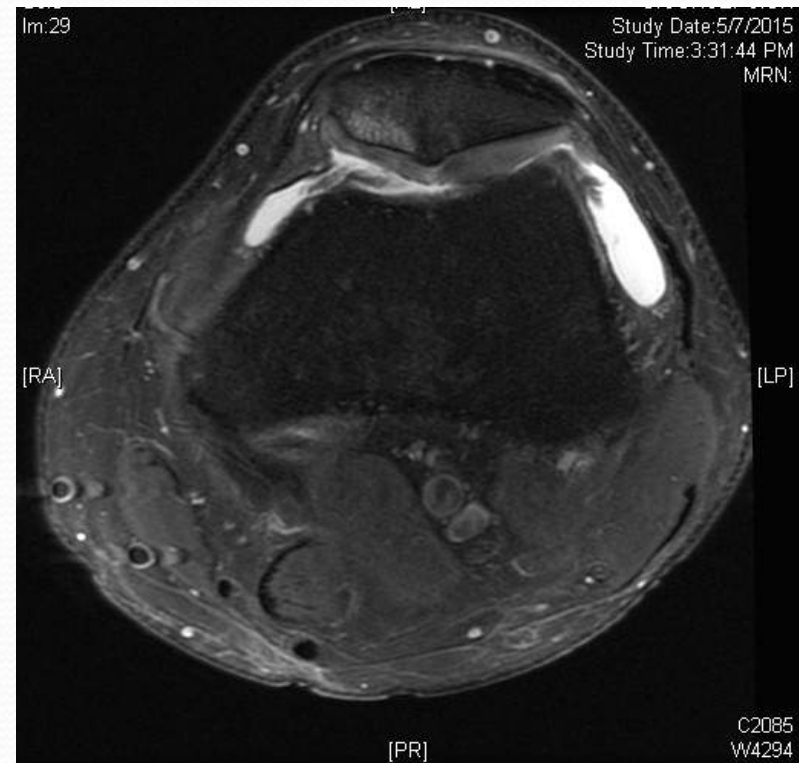
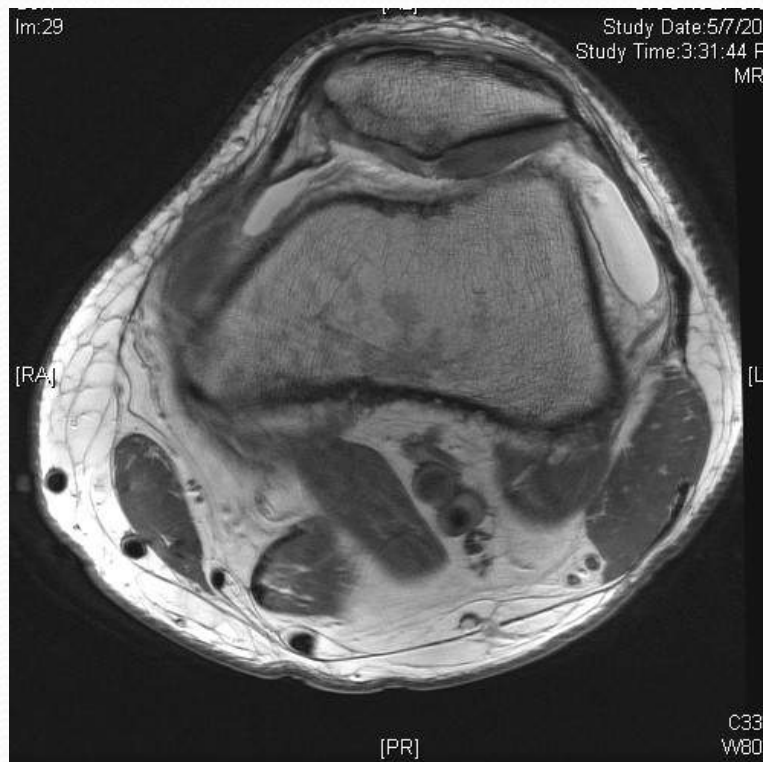
Exam:

- ROM 0 to 130 degrees
- Medial joint line tenderness to palpation
- McMurry slightly positive
- Lachman is 1A and negative pivot shift
- Varus and Valgus at 0 and 30 symmetrical to the other side.
- Pain with patellofemoral grind

Radiographs



MRI Images



MRI Results

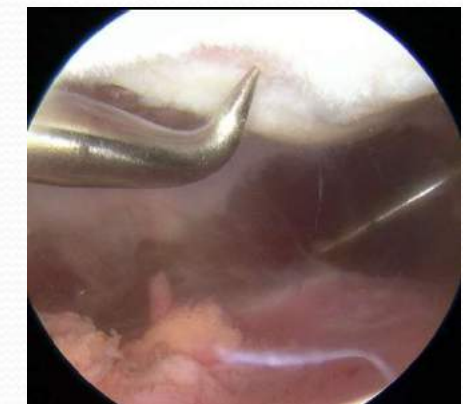
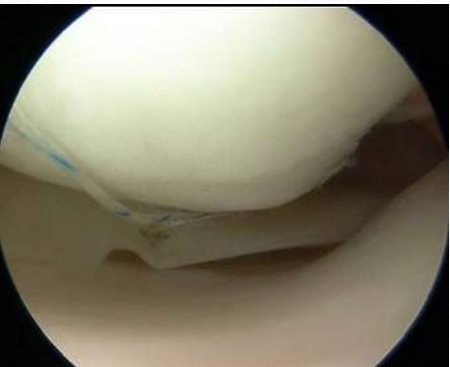
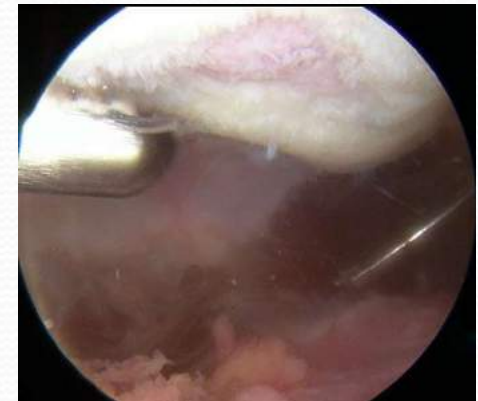
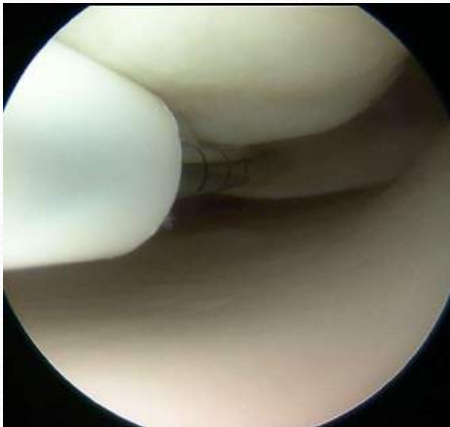
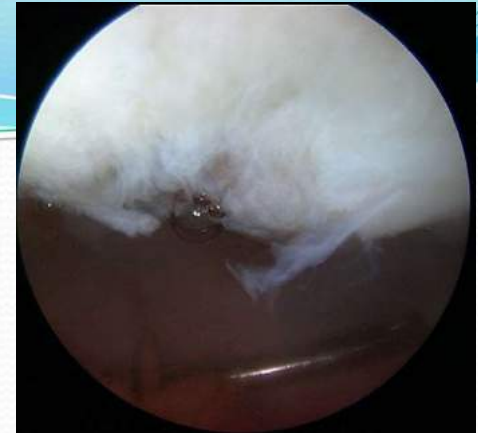
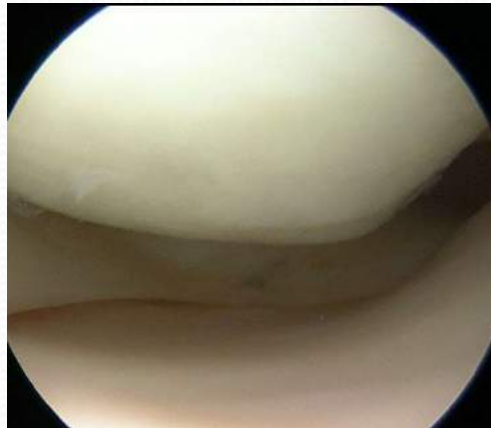
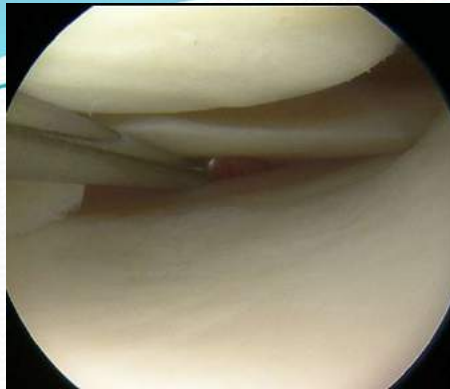
- Partial ACL tear
- Low grade sprain of MCL
- Posterior horn medial meniscus tear / capsular
- Moderate grade patella medial facet thinning
 - Subchondral bone edema
 - Fissuring of the patellar apex cartilage and small delamination adjacent to fissuring.



Options?

- 2016 Arthroscopic surgery
 - Arthroscopic medial meniscus repair
 - Arthroscopic chondroplasty of patella and microfracture
 - Arthroscopic debridement

Surgery

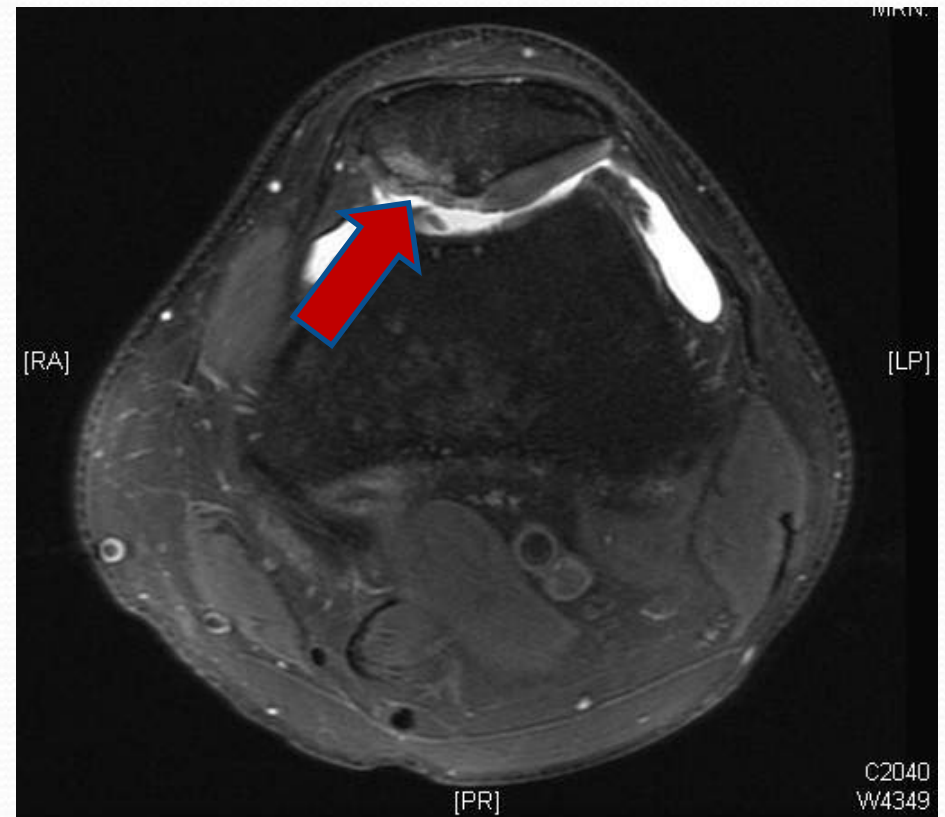


1 Year f/u

- Went back to work
- Still have pain with up and down stairs
 - Swelling
- No more medial joint line pain or mechanical symptoms

MRI

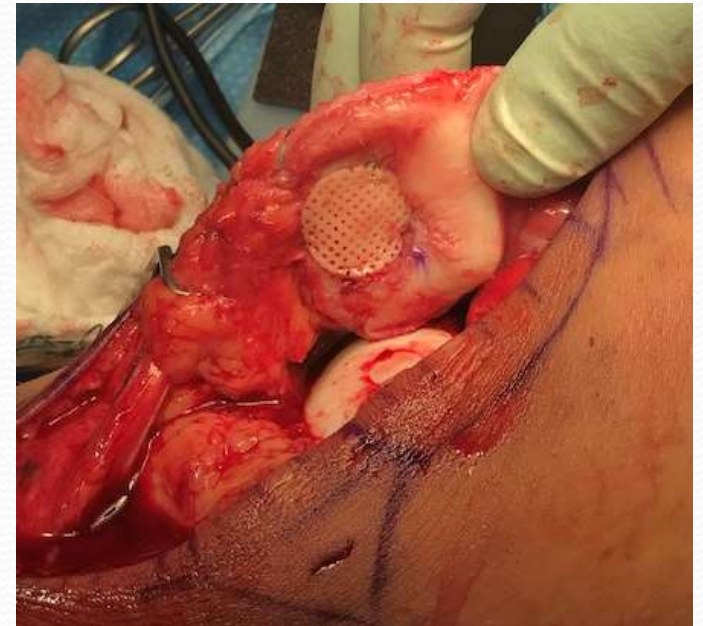
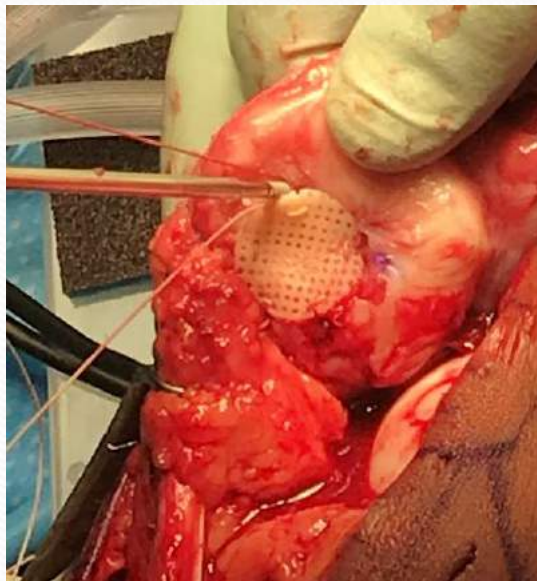
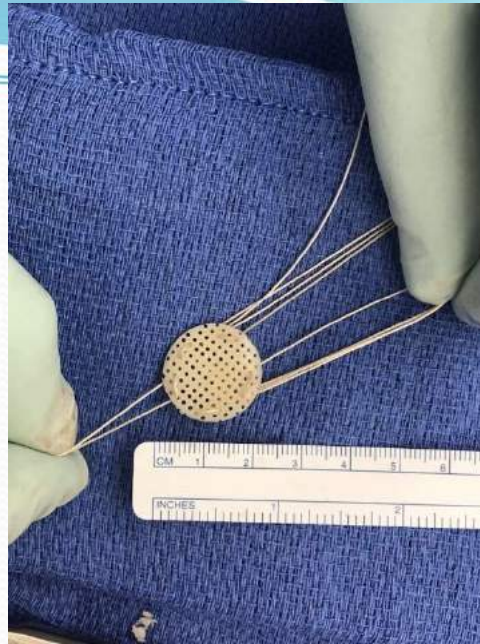
- Medial Meniscus healed
- Moderate to high grade chondral loss (patella)
- Effusion and synovitis



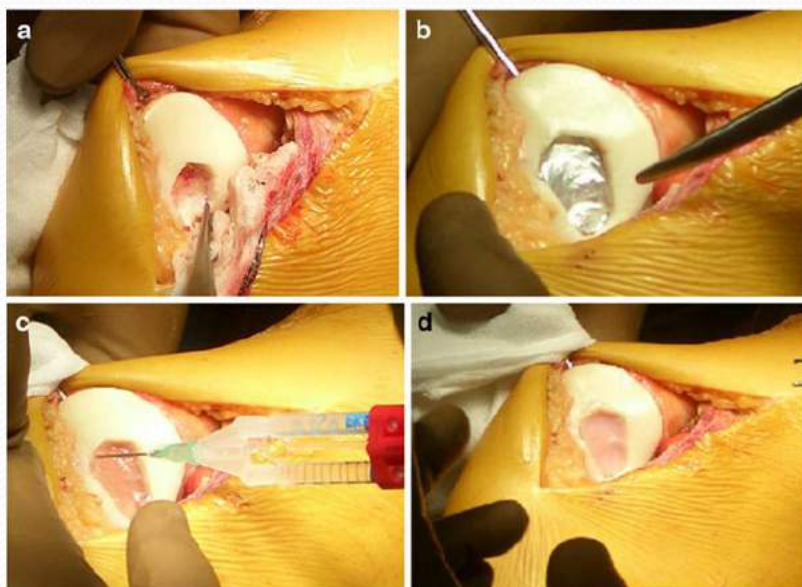


Options?

- Cartilage Restoration Procedure
- Patella femoral replacement
 - Activity level post surgery...



Other Options



Surgery Request

- What's the Process?
- Utilization Review -> IME
- IME Denied Surgery – Now What??
- Appeal the decision

Peer to Peer Review

- Denied the Cartilage Procedure to Patella
 - Causation?
 - Approved the Arthroscopic Debridement Code
 - ** Semi Retired Spine Surgeon**
- Now What?
- Can NOT bill the Cartilage Procedure on his own health insurance.
- On my OR schedule next month
 - Do the Cartilage restoration for free.
 - How do we pay for the graft? And other cost?

THANKS



*Work Related Injuries Workshop
March 25th & 26th, 2019*