Cartilage Injuries of the Knee

Jason Hurbanek MD
Hinsdale Orthopaedic Associates
WCLA Spring Medical Forum
April 12th, 2019

Hinsdale Orthopaedics

Disclosures

- I have nothing to disclose related to this presentation.

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Introduction

- Denison University (Columbus OH)
- Medical School: Ohio State University
- Residency: Henry Ford Hospital (Detroit, MI)
- Fellowship: Sports Medicine/Arthroscopy – Ohio State University

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Introduction

- Hinsdale Orthopaedic Associates (HOA)
  - 2009
- Office Locations
  - New Lenox
  - Joliet
- Hospital Affiliations
  - Silver Cross (Joliet, IL)
  - Presence/Amita St. Joes (Joliet, IL)
  - Salt Creek Surgery Center (Westmont, IL)
  - CMIS (Mokena, IL)
  - Munster Specialty Surgery Center (Munster, IN)

Introduction

- Affiliated Team Physician:
  - Joliet Junior College
  - Lincolnway Central High School
  - Joliet Slammers Baseball Club

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Purpose

- 1) To learn about different types of knee cartilage/injuries and defects
- 2) To determine which surgical technique(s) improve(s) outcomes in injured workers
- 3) To determine which factor(s) influence outcomes after cartilage repair or restoration
- 4) To Review Cases Involving these Cartilage Restoration Techniques

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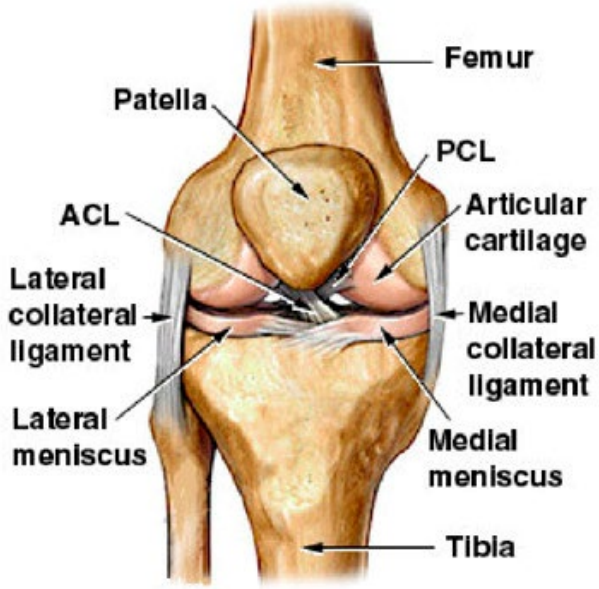
Two Types of Cartilage

- Meniscus Cartilage (Medial/Lateral)
- Articular Cartilage



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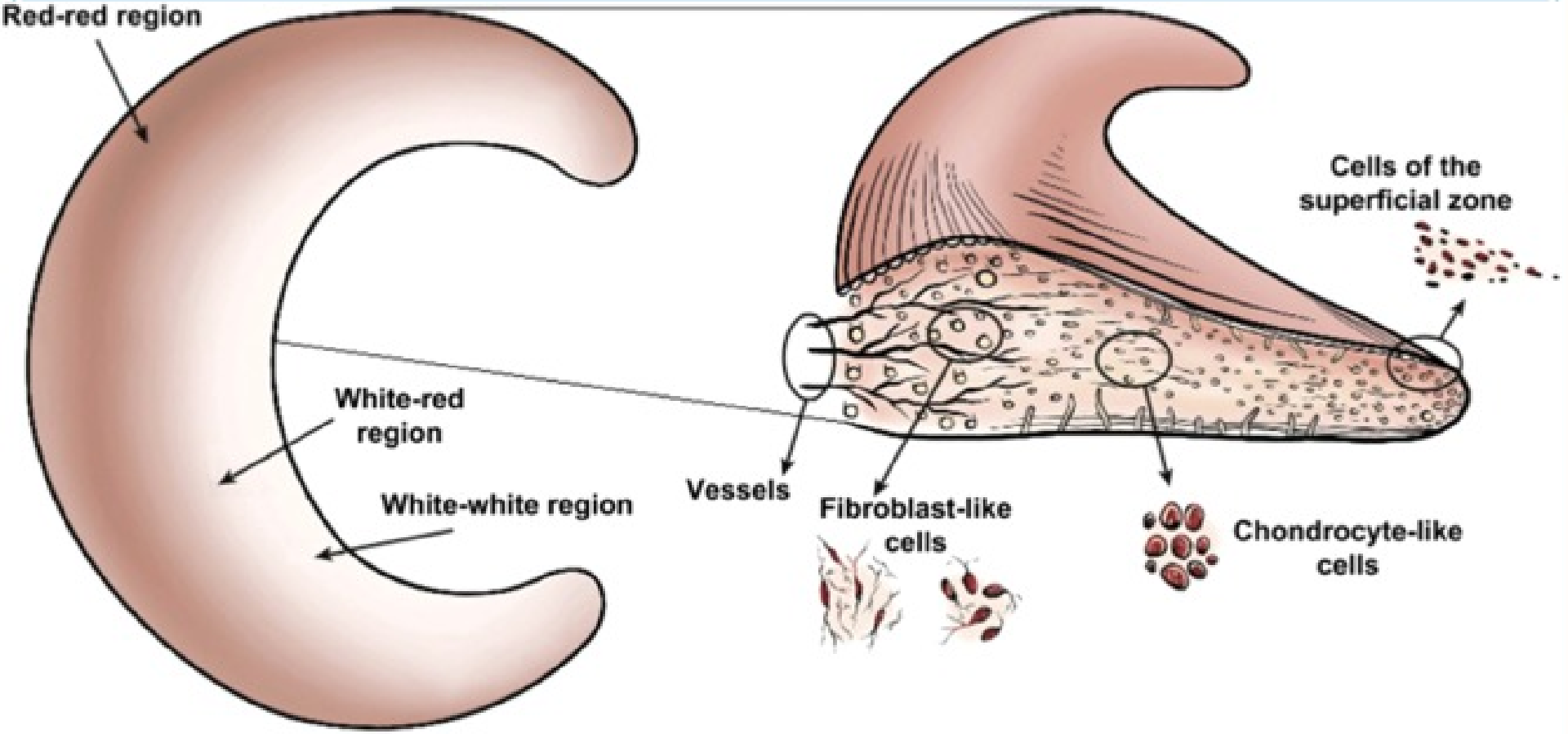
Meniscus Anatomy



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Meniscus Tear Options

- Non-operative
  - NSAIDS
  - PT
  - Brace
  - Injections (cortisone)
- Operative
  - Partial menisectomy (“Trim”)
  - Meniscus repair (“Stitch”)

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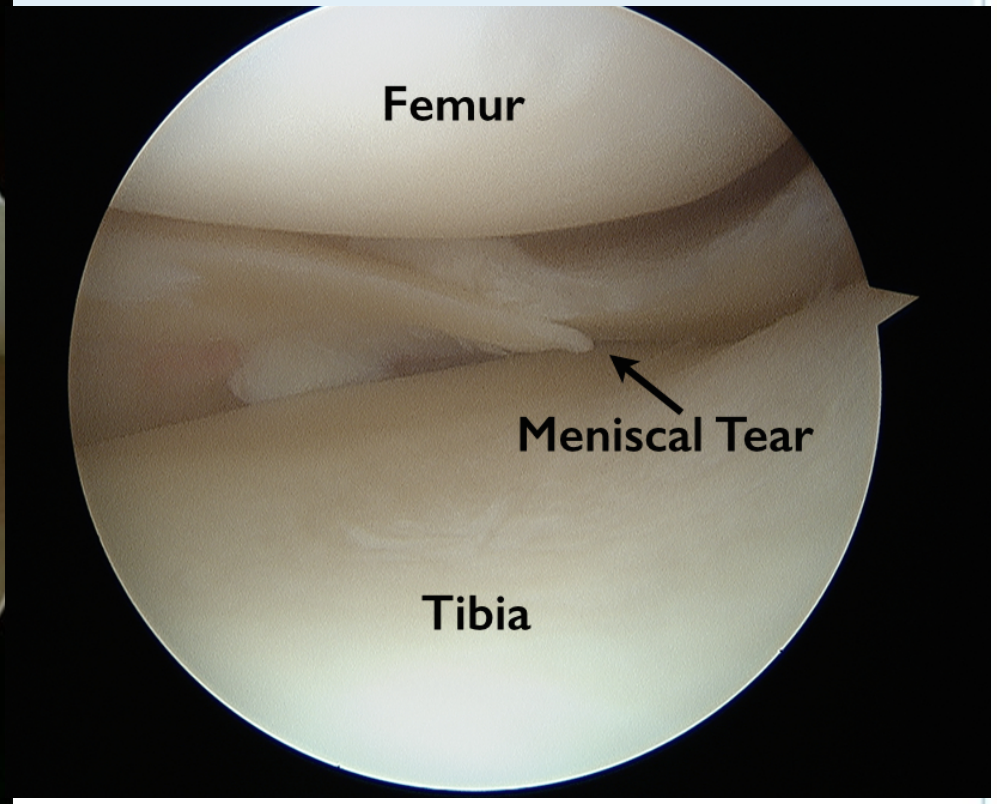
Meniscus Tear



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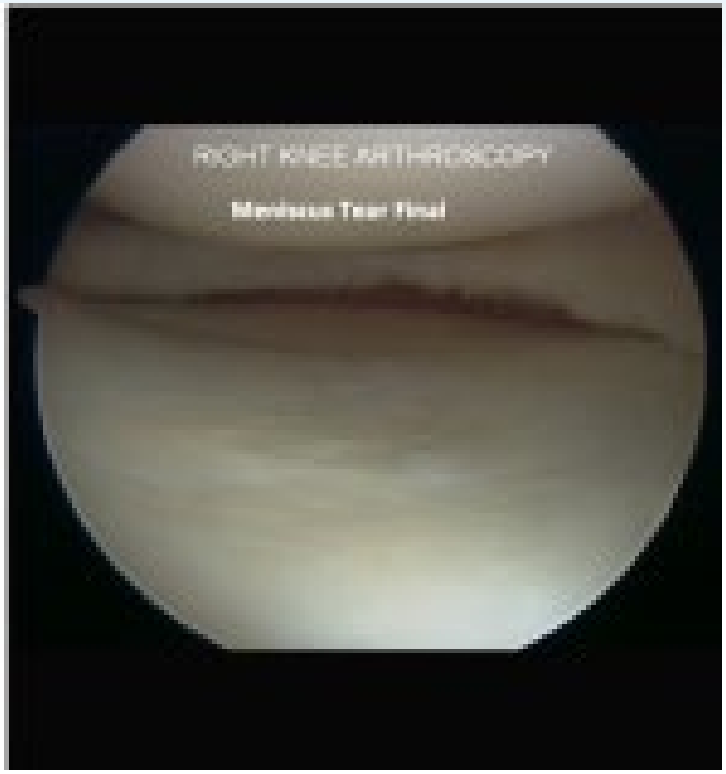
Trim



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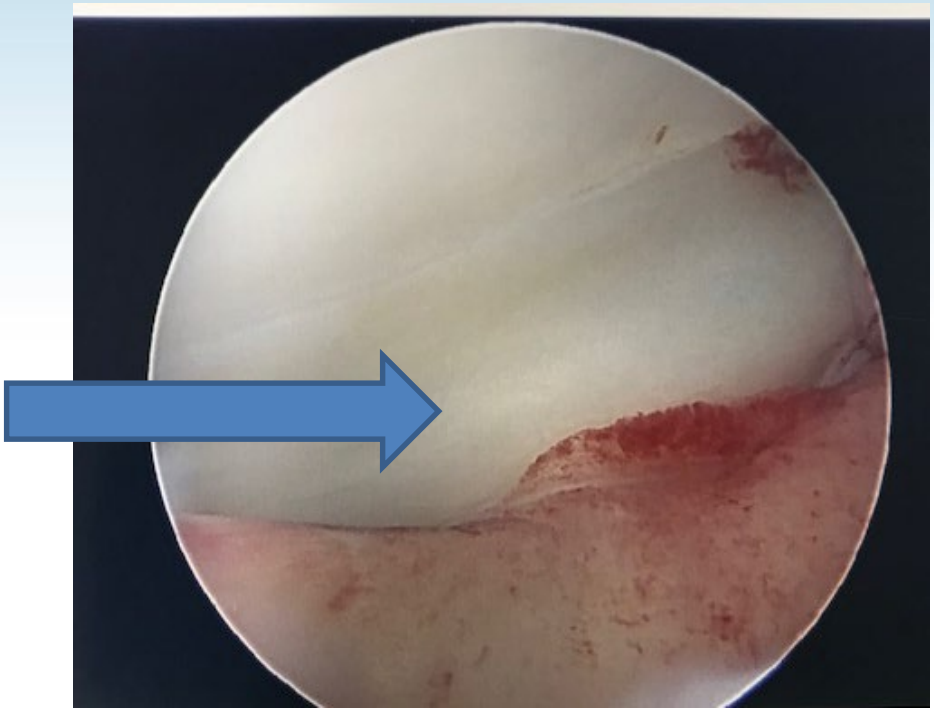
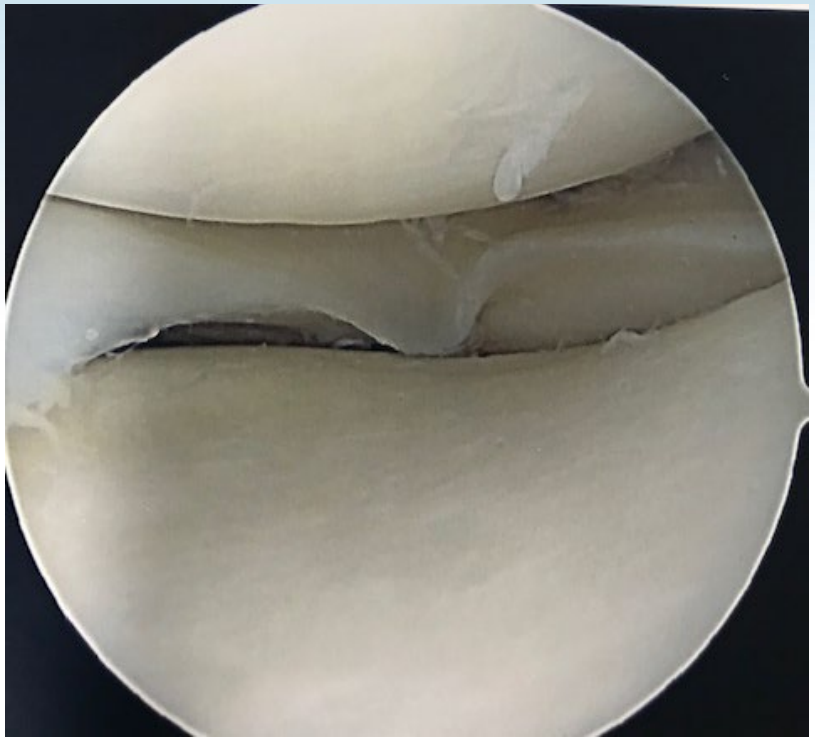
Meniscus Repair (Stitch)





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Post-operative Recovery

- Trim
  - WBAT
  - Crutches 1-2 days
  - Physical Therapy
  - Recovery 4-6 weeks
  - MMI: ~3-4 months depending on job demands
- Stitch (Repair)
  - NWB 4-6 weeks (Crutches)
  - Physical Therapy
  - Recovery 3-5 months
  - MMI: ~6-8 months depending on job demands

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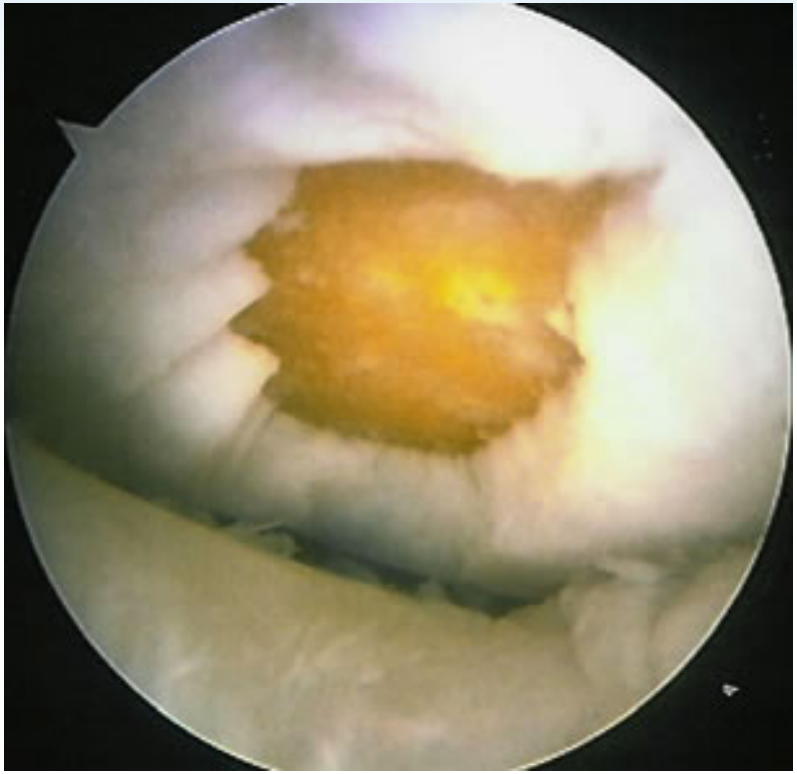
Articular Cartilage Injury

- Pot hole/Egg analogy



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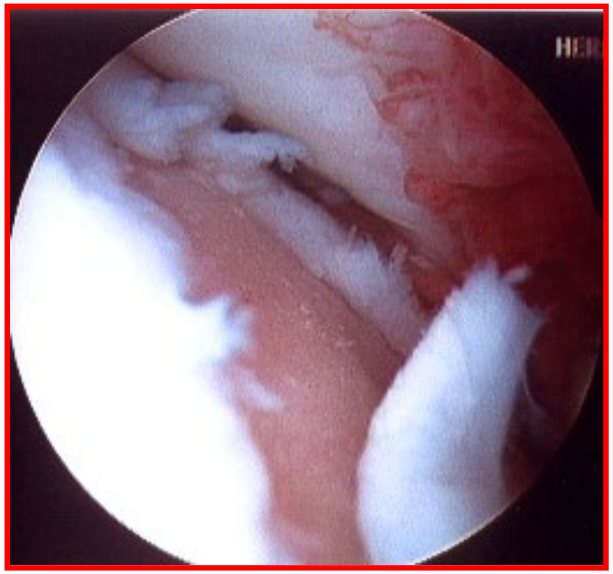
Articular Cartilage Injury

- Chondral defects in the knee lack intrinsic ability to spontaneously heal when damaged
  - Avascular / Alymphatic
  - Aneural
  - 1% cellularity



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Articular Cartilage Injury

- Management in injured worker requires consideration of more factors than in general population:
  - Occupation
  - Job Demands
  - Time off work
  - Restrictions

General population

-Age
-BMI
-Pre-operative activity level
-Duration of symptoms
-Prior surgeries
-Ligament stability
-Meniscus status
-Patellofemoral alignment
-Tibiofemoral alignment

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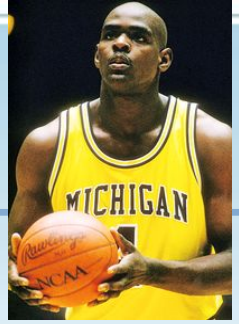

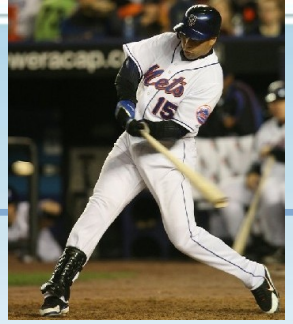

PROMINENT NBA MICROFRACTURE PATIENTS

Player	Date	Age	Return	Missed	DWin%
John Stockton	10/14/97	35	12/8/97	2 months	-1.4
Anfernee Hardaway	12/10/97	26	1/29/98	2 months	-19.5
Brian Grant	6/15/99	35	11/17/99	4.5 months	-15.3
Anfernee Hardaway	5/26/00	28	1/7/01	7 months	[illegible]
Kerry Kittles	6/15/00	26	10/30/01	16.5 months	1.6
Eduardo Najera	12/6/02	26	2/11/03	2 months	21.5
Chris Webber	6/10/03	32	3/2/04	9 months	-16.5
Allan Houston	6/10/03	32	10/29/03	4.5 months	-14.5
Adrian Griffin	9/10/03	29	2/4/04	5 months	-31.5
Jamal Mashburn	11/3/03	30	1/28/04	3 months	-26.4
Matt Harpring	1/16/04	27	11/3/04	10 months	-2.6
Pat Garrity	2/18/04	27	11/3/04	8.5 months	-14.4
Jason Kidd	7/1/04	31	12/6/04	5 months	-3.1
Zach Randolph	3/31/05	23	11/2/05	7 months	-12.1
Matt Harpring	4/22/05	28	11/2/05	6.5 months	3.8
Kenyon Martin	5/16/05	27	11/1/05	5.5 months	-10.5
Amar'e Stoudemire	10/11/05	22	3/23/06	5 months	-6.1
Rashad McCants	6/16/06	21	1/31/07	7.5 months	-19.1
Kenyon Martin	11/15/06	28	10/31/07	11.5 months	-7.6
Greg Oden	9/13/07	19	10/28/08	13.5 months	-
Sean May	10/9/07	23	10/30/08	13 months	-52.6

Notes: Return is player's first regular-season NBA game after micro fracture. DWin% is change in player's per-minute winning percentage.

***Economic impact of microfracture:**
Total one year salary of these 10 athletes:
$145 million

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Articular Cartilage Repair in Soccer Players With Autologous Chondrocyte Transplantation

Functional Outcome and Return to Competition

Kai Mithöfer,*† MD, Lars Peterson,‡ MD, PhD, Bert R. Mandelbaum,§ MD, and Tom Minas,† MD
From the †Harvard Combined Orthopedic Surgery Program, Boston, Massachusetts, the ‡Gothenburg Medical Center, Gothenburg, Sweden, and the §Santa Monica Orthopedic and Sports Medicine Foundation, Los Angeles, California

Articular Cartilage Repair in the Adolescent Athlete: Is Autologous Chondrocyte Implantation the Answer?

Lyle Micheli, MD,† Christine Curtis, BS,* and Nina Shervin, MD‡*

Functional Outcome of Knee Articular Cartilage Repair in Adolescent Athletes

Kai Mithöfer,*†‡ MD, Tom Minas,†‡§ MD, Lars Peterson,‖ MD, PhD, Howard Yeon,*†‡ MD, and Lyle J. Micheli,*‡ MD
*From the *Department of Orthopedic Surgery, Children's Hospital, Boston, Massachusetts, †Department of Orthopedic Surgery, Brigham and Women's Hospital, Boston, Massachusetts, ‡Harvard Medical School, Boston, Massachusetts, and ‖Gothenburg Medical Center, Gothenburg, Sweden*

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Clinical Experiences With Autologous Osteochondral Mosaicplasty in an Athletic Population

A 17-Year Prospective Multicenter Study

László Hangody,*† MD, PhD, DSc, Jozsef Dobos,‡ MD, Eszter Baló,† MD, Gergely Pánics,† MD, Laszlo Rudolf Hangody,§ MD, and Istvan Berkes,‡ MD, PhD
From the †Uzsoki Hospital, Department of Orthopaedics, Budapest, Hungary, ‡National Institute of Sportsmedicine, Budapest, Hungary, and §Sanitas Private Clinic, Budapest, Hungary

Knee Surg Sports Traumatol Arthrosc (2006) 14: 834–842

KNEE

DOI 10.1007/s00167-006-0067-0

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Eglė Monastyreckienė
Darius Pranys
Romas J. Kalesinskas

Osteochondral autologous transplantation versus microfracture for the treatment of articular cartilage defects in the knee joint in athletes

A Prospective Randomized Clinical Study of Mosaic Osteochondral Autologous Transplantation Versus Microfracture for the Treatment of Osteochondral Defects in the Knee Joint in Young Athletes

Rimtautas Gudas, M.D., Ph.D., Romas J. Kalesinskas, M.D., Vytautas Kimtys, M.D., Edgaras Stankevičius, M.D., Ph.D., Vytautas Toliušis, M.D., Giedrius Bernotavičius, M.D., and Alfredas Smailys, M.D., Ph.D.

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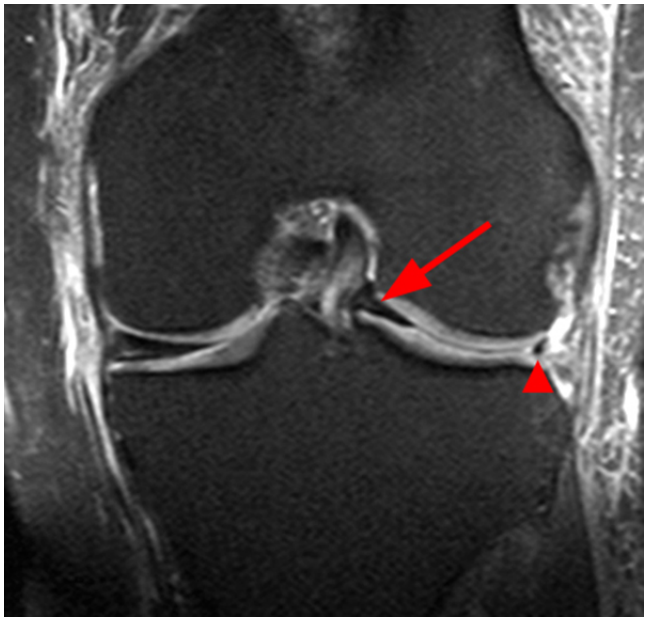
Work up

- Complete History
  - Mechanism of Injury
- Physical Exam
- X-Rays
- MRI
- Assessment/Plan



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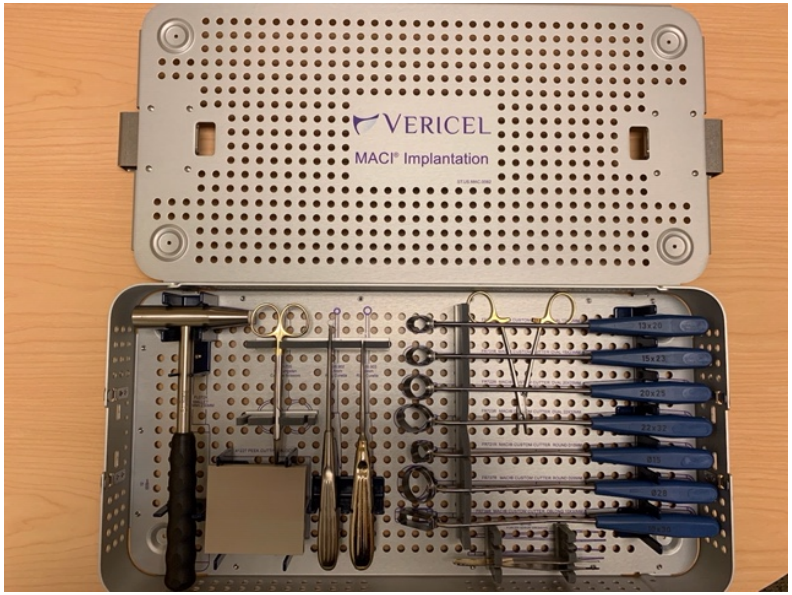
Options

- Non-Surgical
  - PT, cortisone, viscosupplementation, brace, NSAIDs
- Surgical
  - Debridement/Chondroplasty
  - Microfracture
  - Osteochondral allograft/autograft transfer (OATs)
  - MACI
  - +/-Osteotomy



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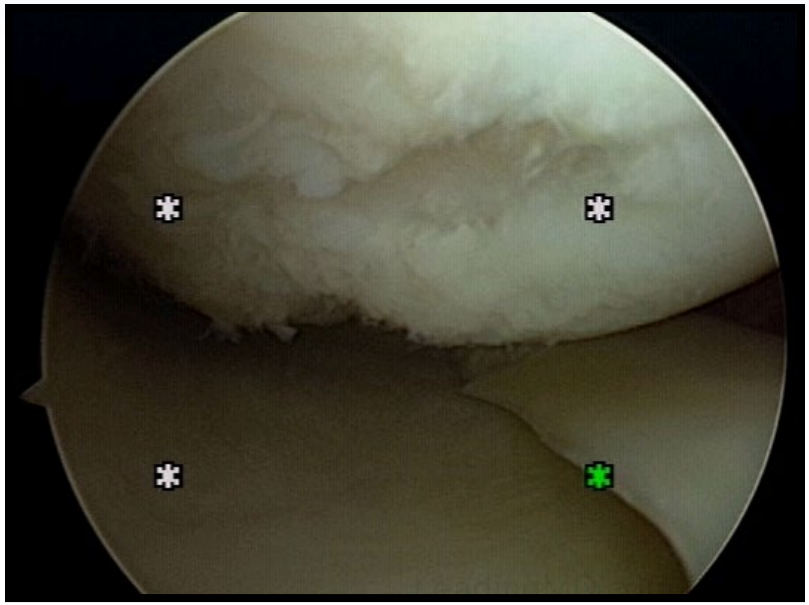
Debridement/Chondroplasty

- Small isolated lesions
- Good knee alignment
- Mechanical symptoms
- Low demand



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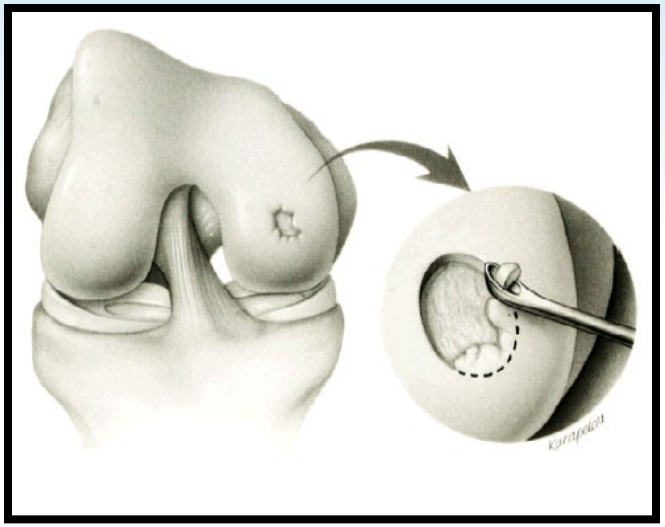
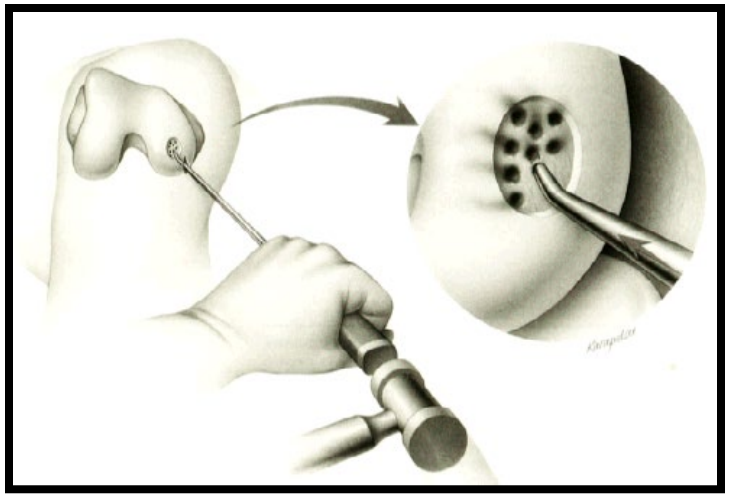
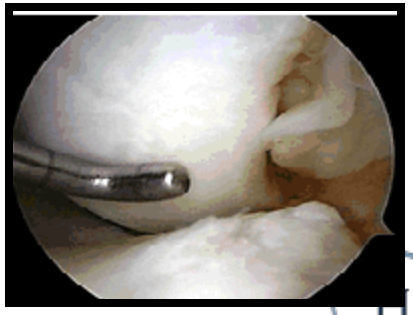
Microfracture







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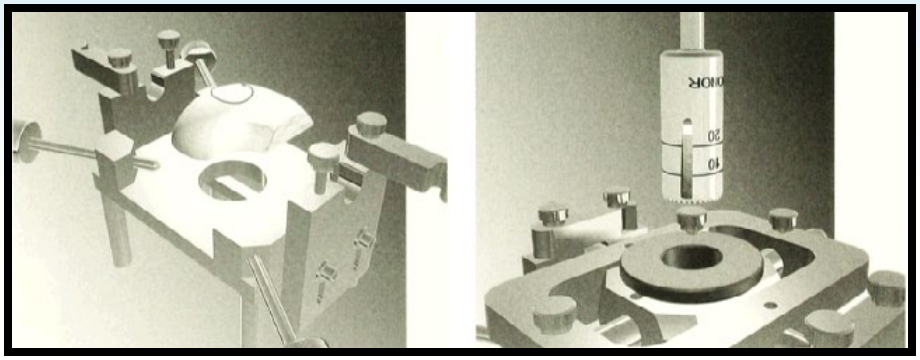
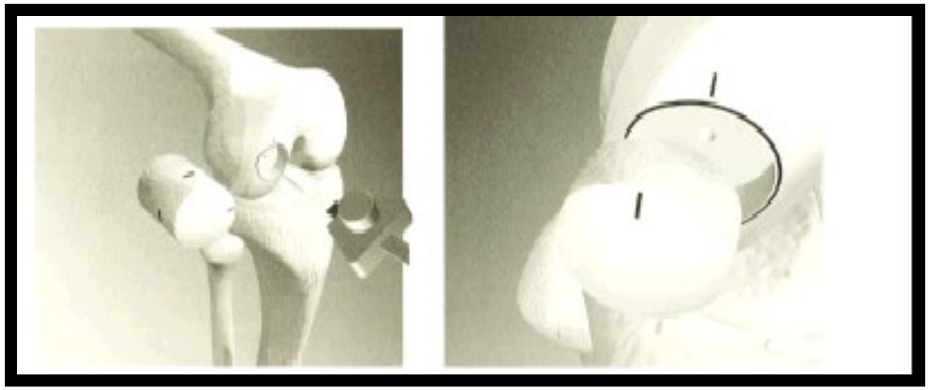
Osteochondral Allograft

- Large lesions ($2.5cm^2$)
- Significant bone loss
- Salvage situations
- Complex defects





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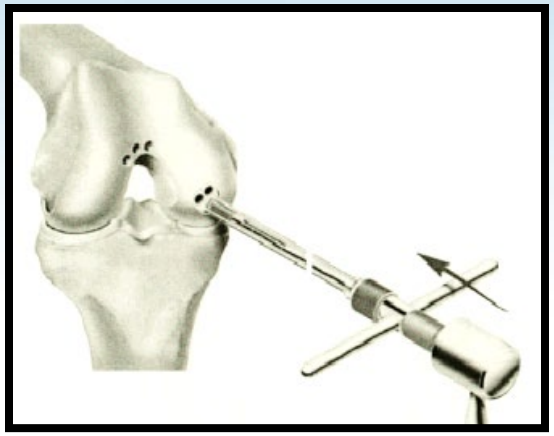
Osteochondral Autograft Transfer (OATs)

- **Autologous Osteochondral Grafting (OATS/Mosaicplasty)**
- **Bobic/Hangody developed 1996**
  - Transfer of hyaline cartilage with cylindrical bony plug from NWB portion to articular defect
  - Transplants retain hyaline character with intervening fibrocartilage
  - Restoration of convexity is important
  - Limited donor tissue precludes use for larger defects (<2-4cm2)



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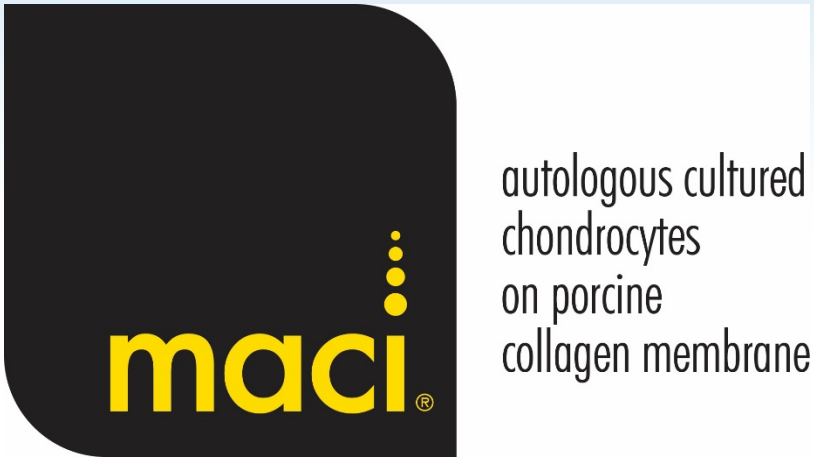
MACI (Previously ACI)

- **Matrix Autologous Chondrocyte Implantation (MACI)**
  - Autologous cultured chondrocytes on porcine collagen membrane
  - Previously ACI
    - Improved delivery/surgical technique



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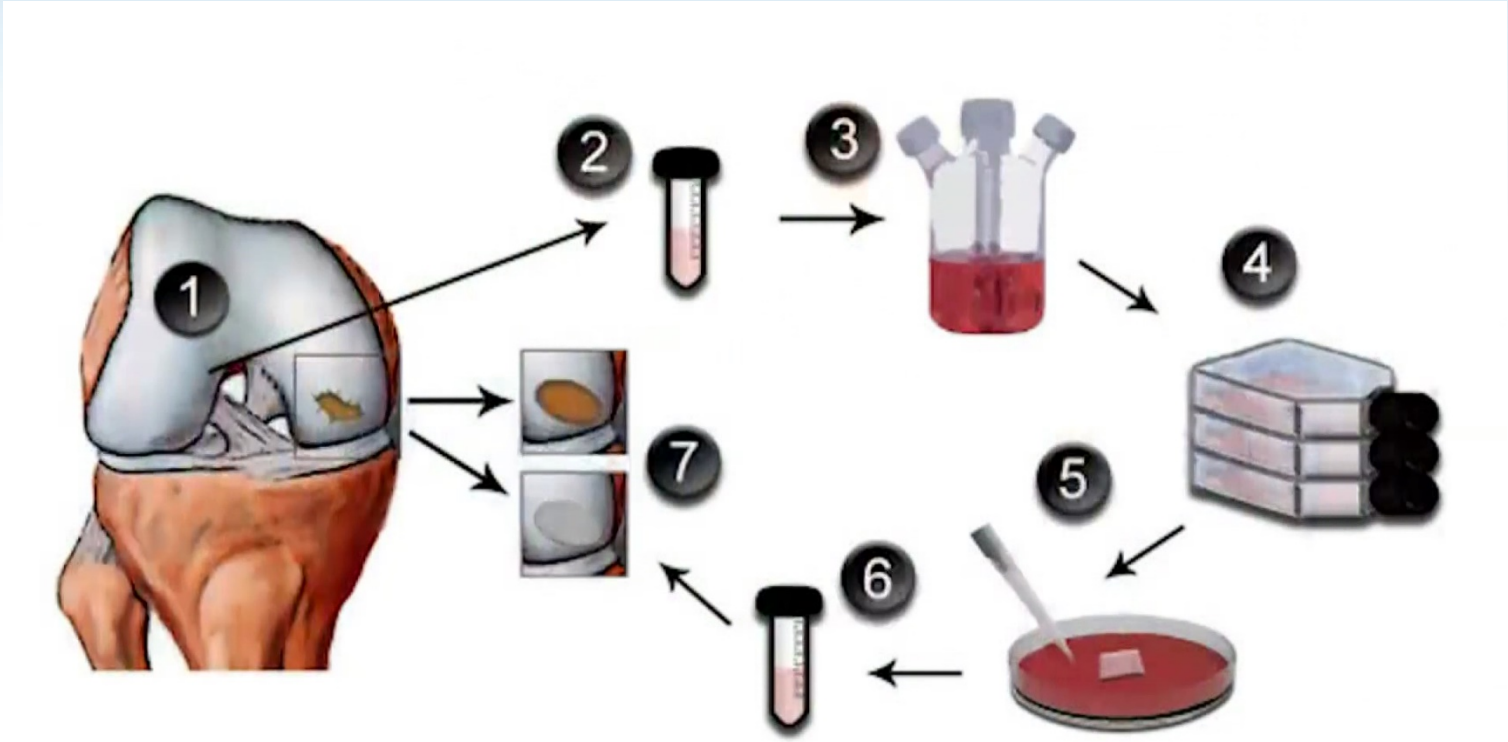
MACI – Surgical Technique



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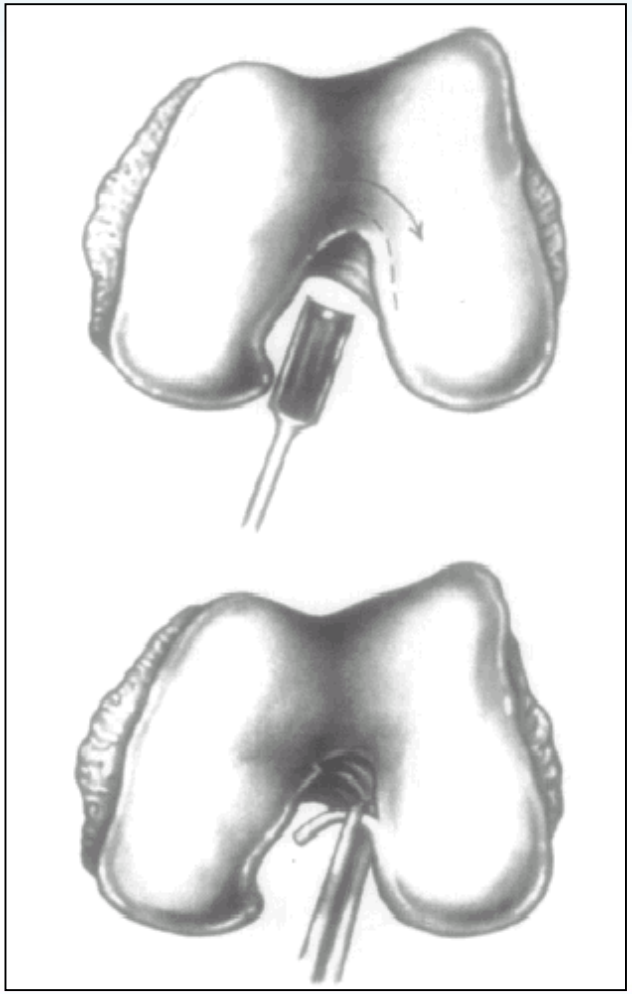
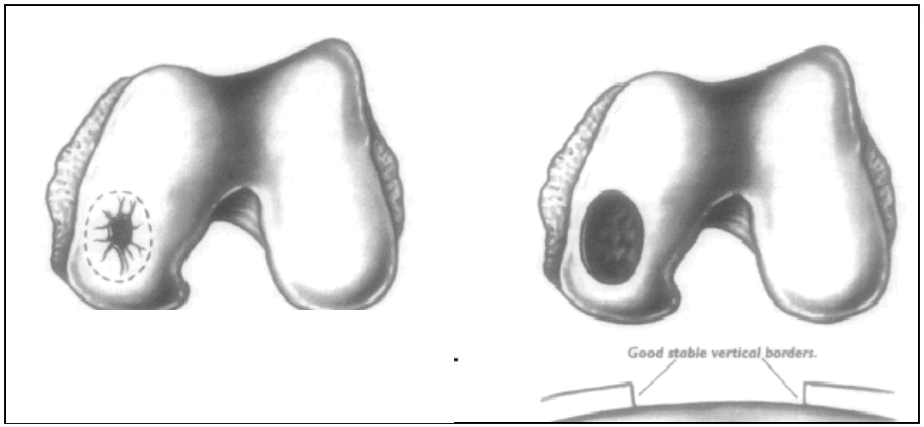
MACI - SURGICAL TECHNIQUE

- **Biopsy (1st Surgery)**



- **(2nd Surgery) Lesion preparation**



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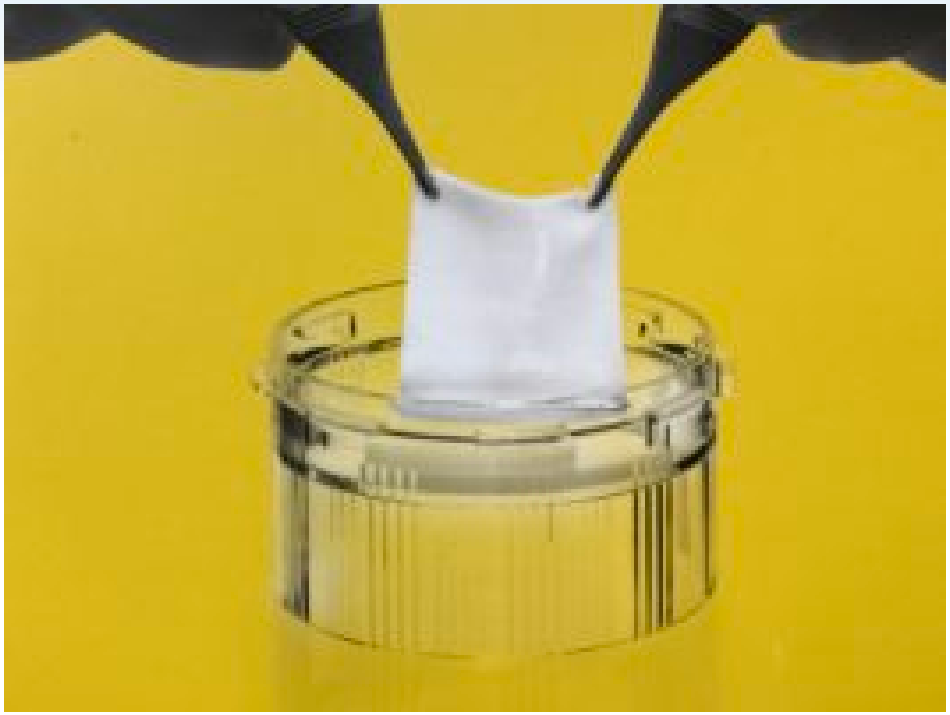
ACI - SURGICAL TECHNIQUE



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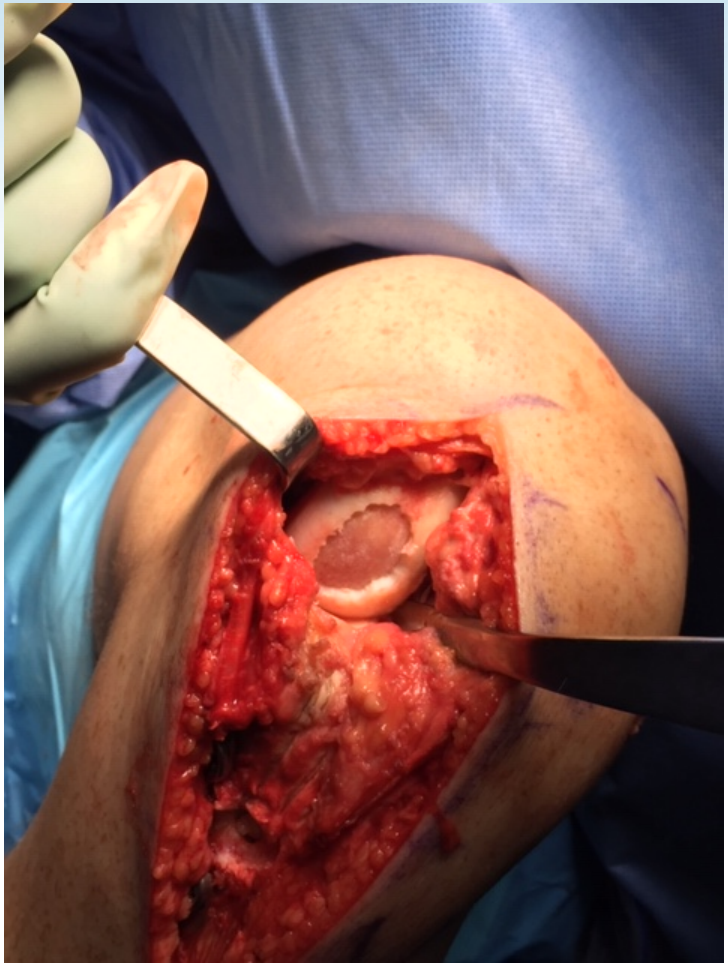

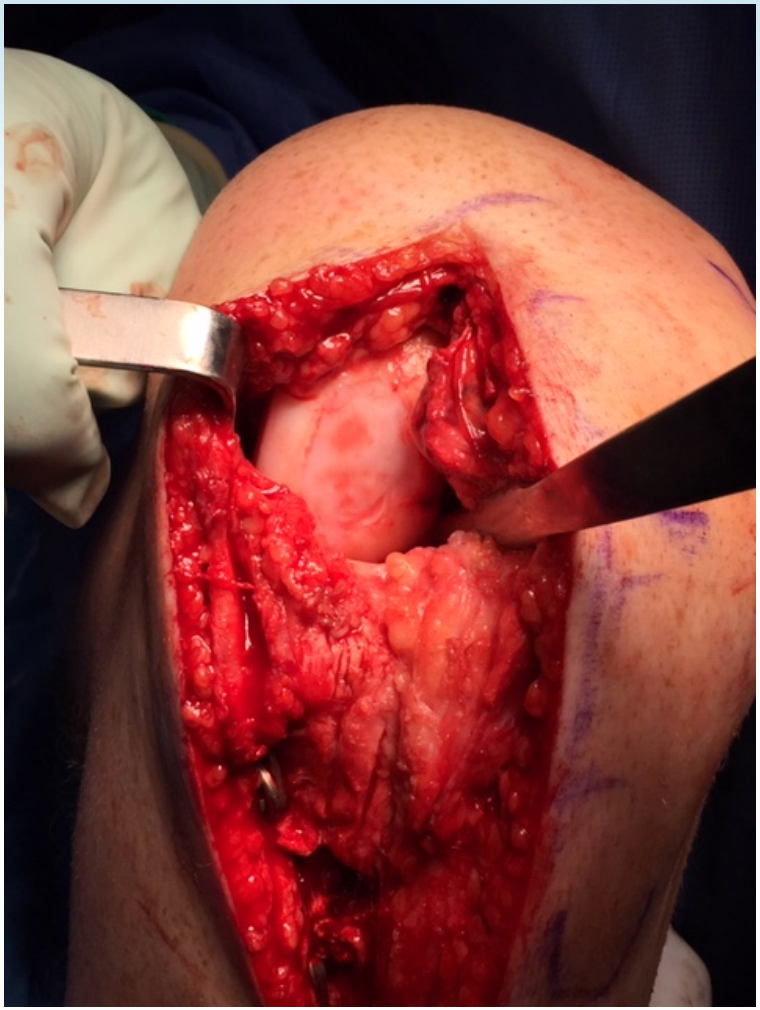

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Overall Results in Athletic Population

- 66% rate of RTS overall
- 74% rate of RTS for professional athletes (n = 145) at a mean of 7.8 months (6.3 – 10 months)
- RTS timing was quickest after OATS, slowest after ACI
- Factors to positively influence outcomes:
  - Defect size < 2 cm^2
  - Symptoms < 18 months
  - No prior surgeries
  - Younger age (30 years)
  - Higher pre-injury and post-surgery sport level

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Knee Articular Cartilage Injuries in the National Football League

Epidemiology and Treatment Approach by Team Physicians

Robert H. Brophy, MD
Scott A. Rodeo, MD
Ronnie P. Barnes, MA, ATC
John W. Powell, PhD
Russell F. Warren, MD

- Survey 31 NFL team physicians
- Most important factor in treatment choice: Size
- Most popular treatment choice:
  - Microfracture (43%)
  - Debridement (31%)
  - Nonoperative (13%)
  - Osteochondral autograft (6%) or allograft (3.5%)
  - ACI (2.6%)

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Conclusions

- It is important to differentiate between meniscus and articular cartilage pathology
- A complete history, physical exam, X-rays, and MRI are necessary after injury
- Articular cartilage injury may not be diagnosed until arthroscopy
- MRI can under-represent articular cartilage injury
- Surgical management is multifactorial and based on multiple patient-specific, and defect-specific (size/location)
- There are good results for patients undergoing cartilage procedures

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Surgical Concepts/Considerations

- Identify chondral lesion, size, location
- Consider patient activity level, occupation, etc.
- Determine best cartilage restoration procedure based on above factors
- Protect the environment – osteotomy
  - High Tibial Osteotomy (HTO)
  - Tibial Tubercle Osteotomy (TTO)
    - AMZ/Fulkerson

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Case JC

- 35 y/o laborer shipping/receiving
- Heavy pipe, knee bent, twist, pop
- Significant swelling
- 1st Surgery: Scope, fixation of osteochondral fragment, MPFL repair
- 3 months post-op – Manipulation/scope
- 9 months post-op – MMI

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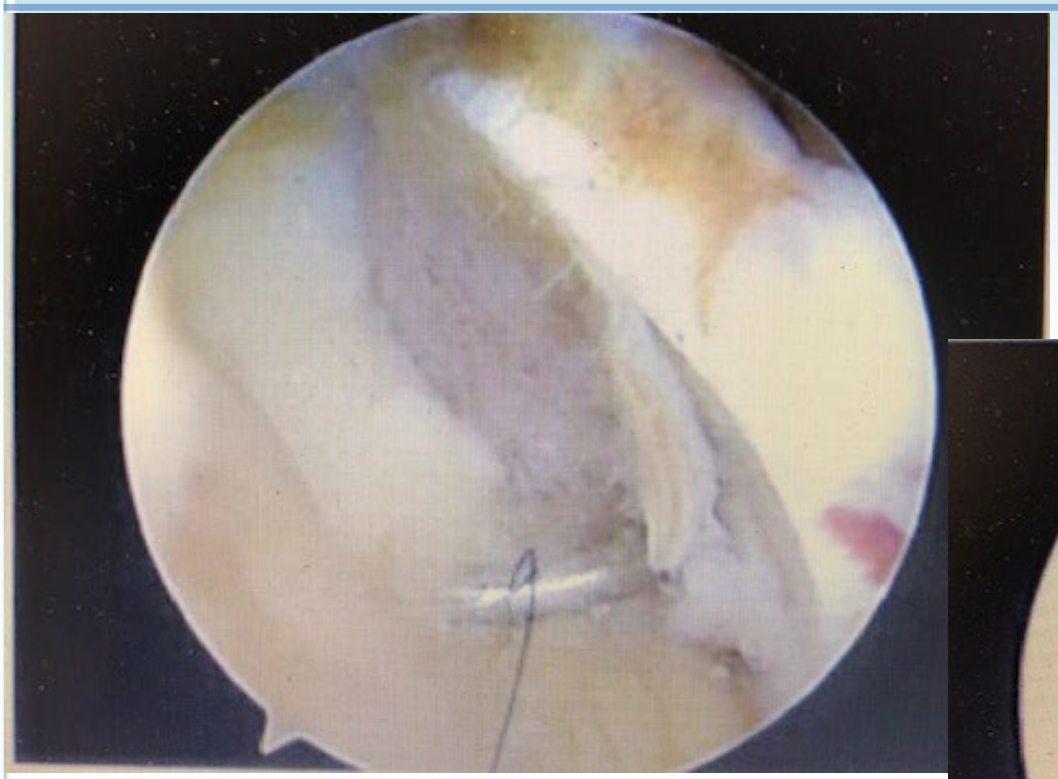
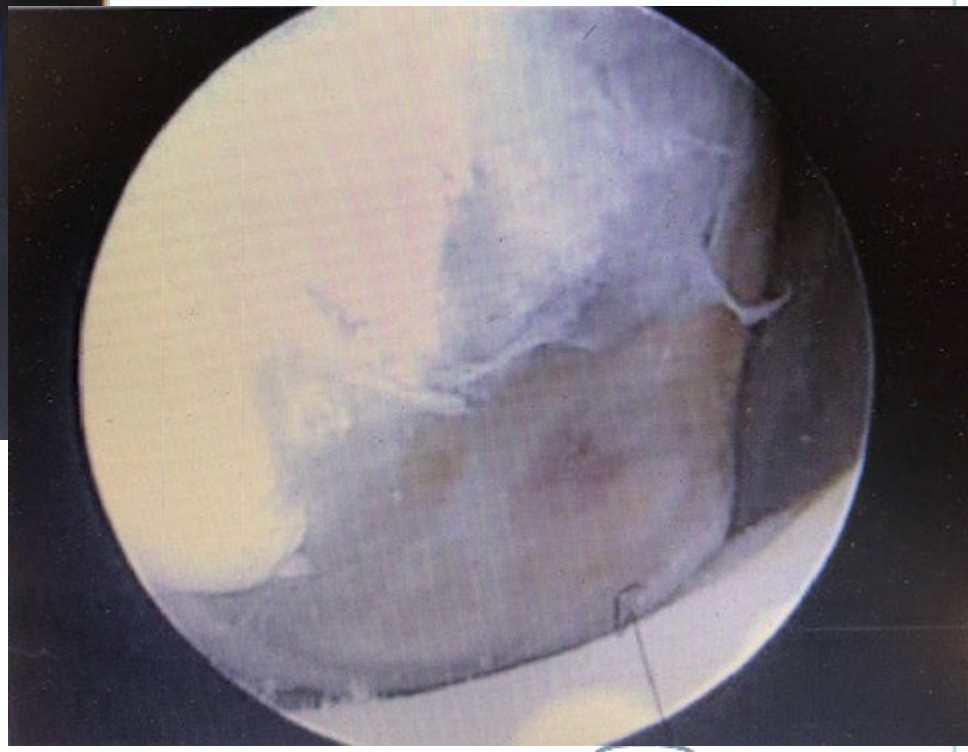
JC – 1st Scope Images





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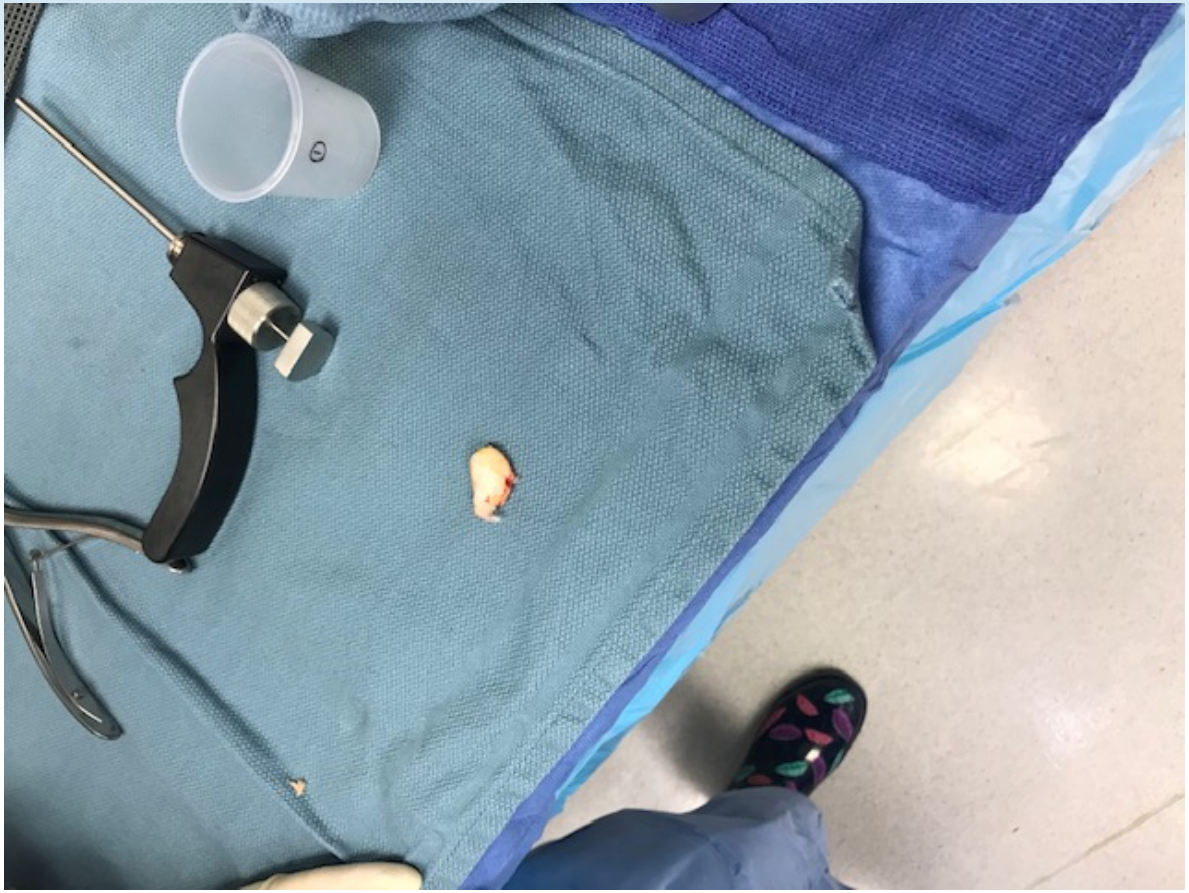
JC



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JC – 1st Surgery

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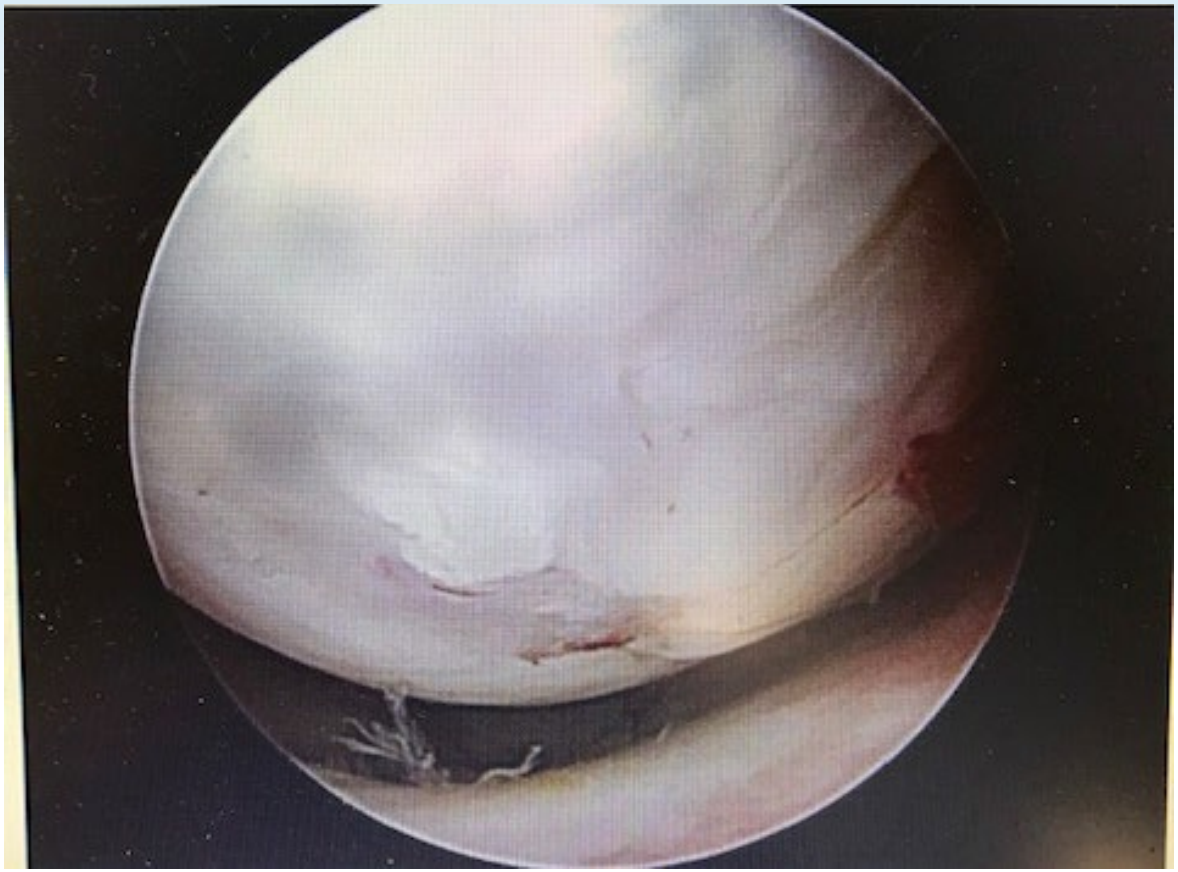
JC – 2nd Scope with MUA



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JC

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Case TD

- 53 y/o male
- Laborer
- Stepped awkwardly off of ladder
- Pain, Swelling
- Knee “Locked up”

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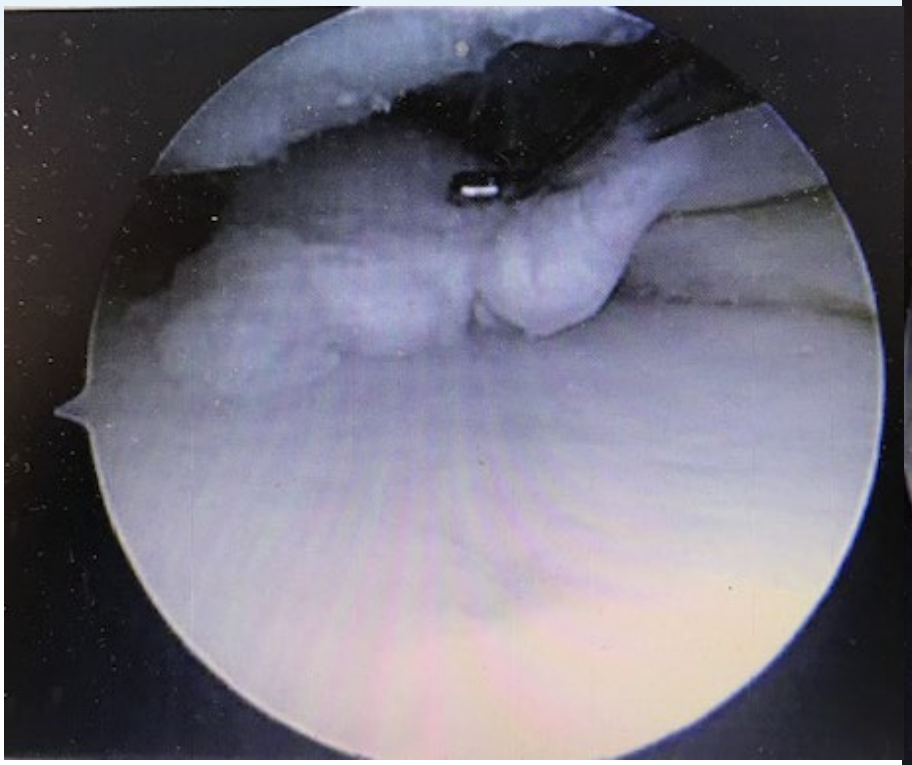
Case TD



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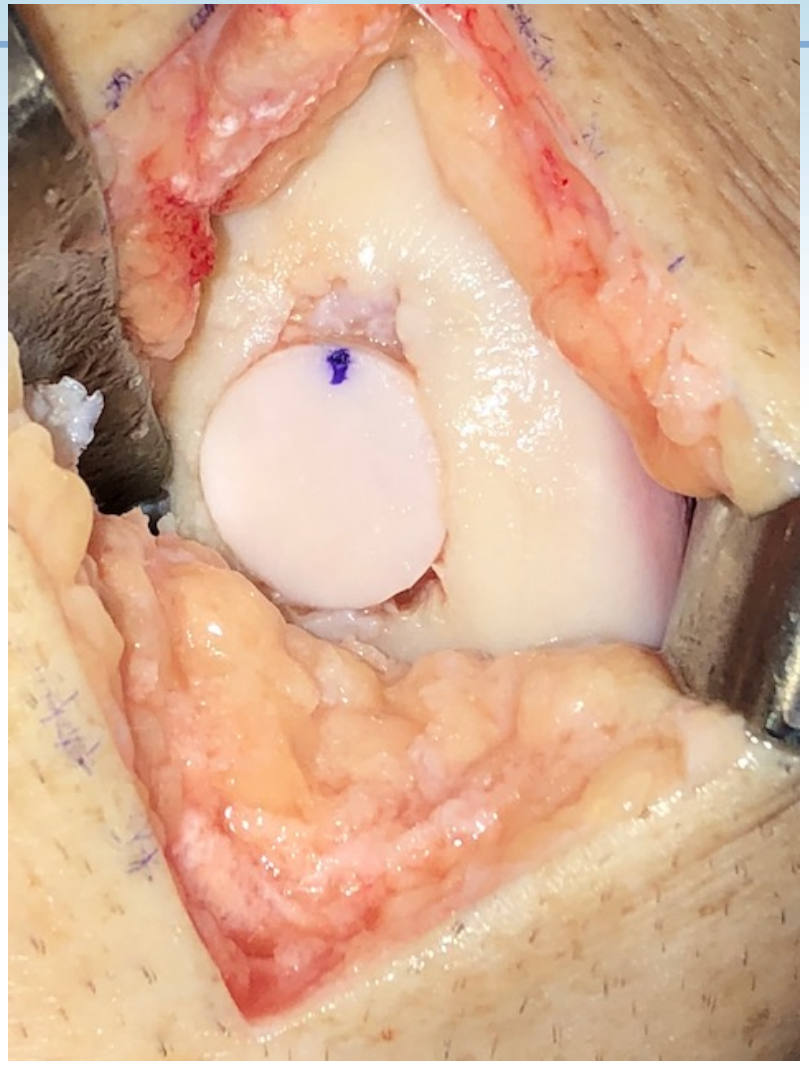
Case TD



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Case TD

- Protected WB for 2-4 weeks
- PT
- Return to full duty 3-4 months post surgery

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Case - DV

- 35 y/o with OCD lesion
- Failed microfracture
- Pain, swelling

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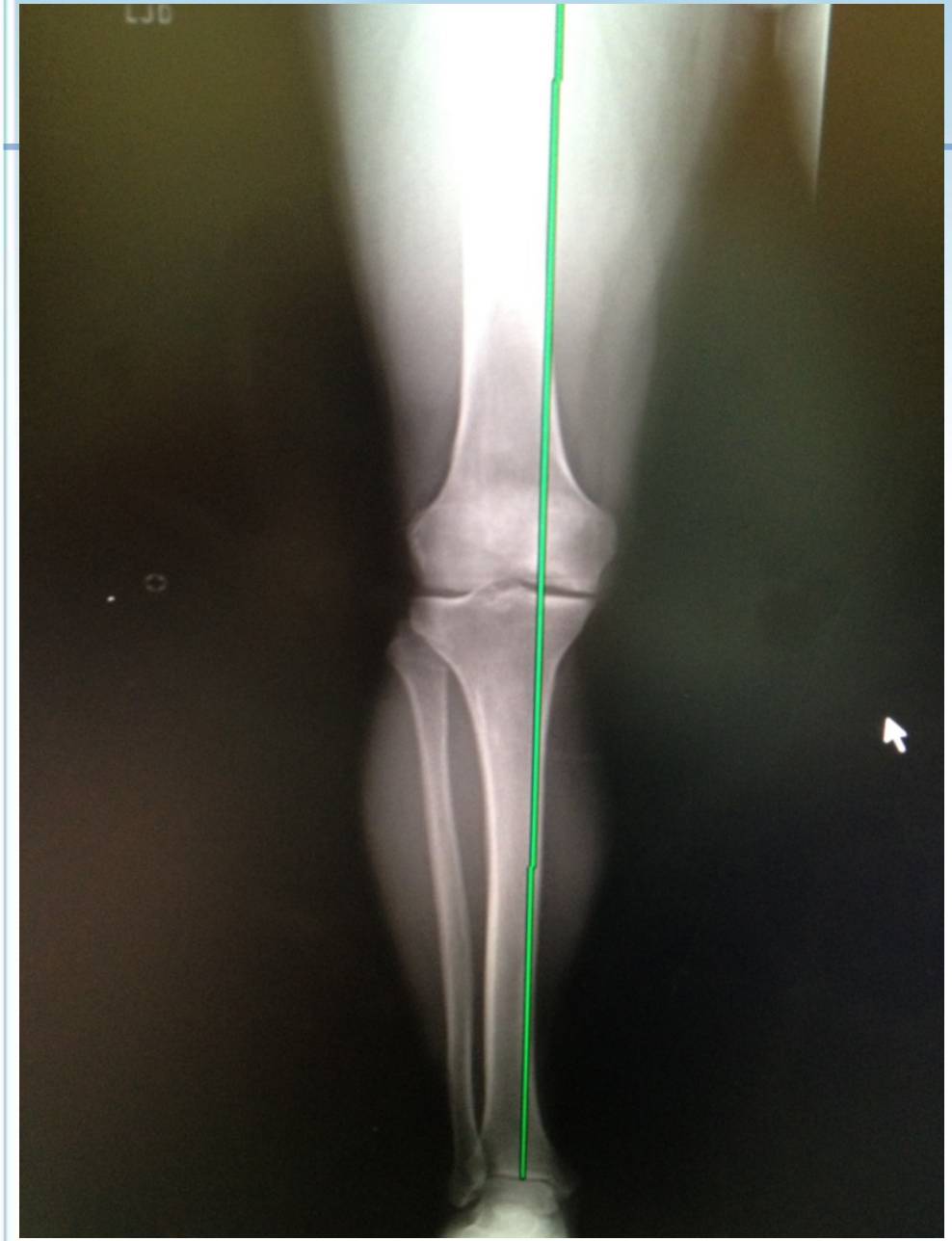

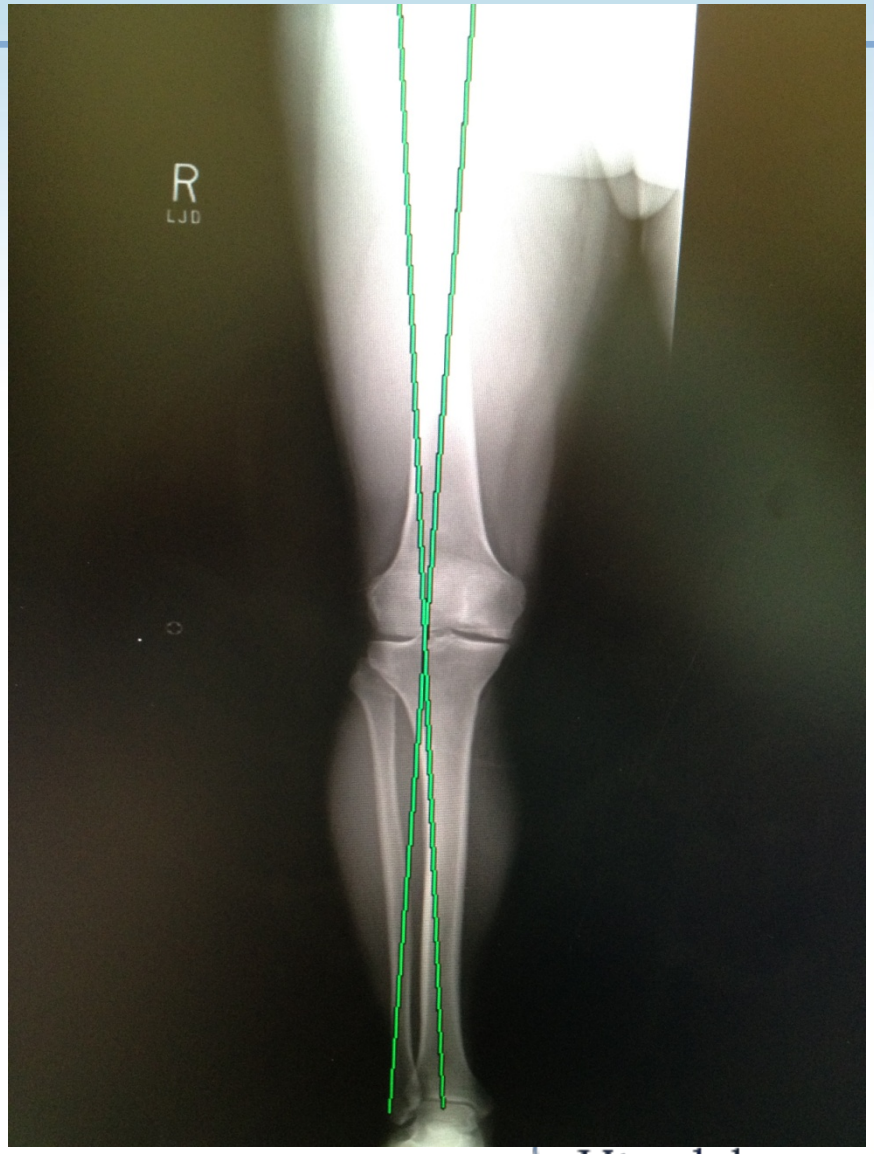

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My Plan

- Arthroscopy/Debridement
- High Tibial Osteotomy (HTO)
- Osteochondral Allograft Transfer

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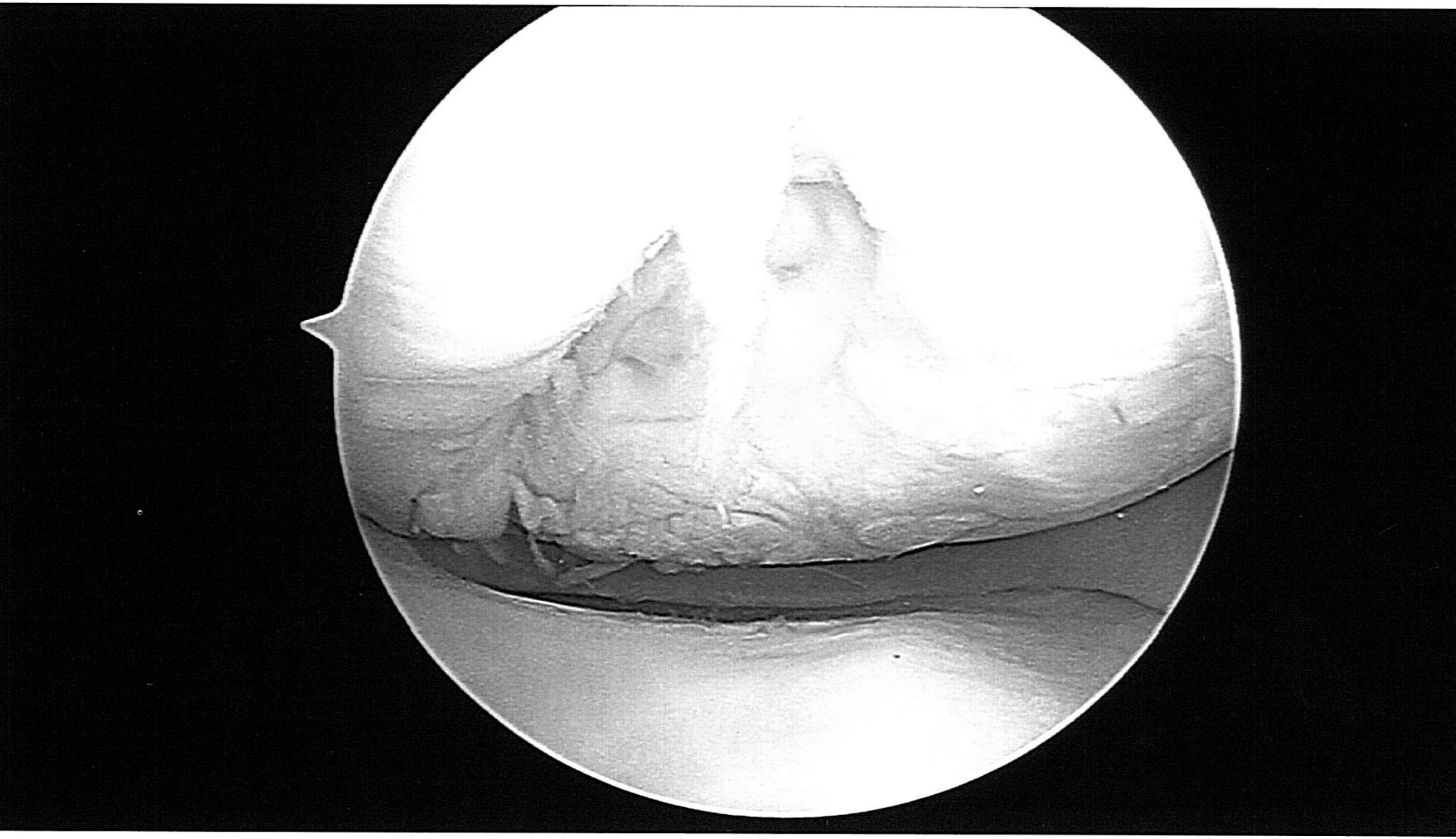
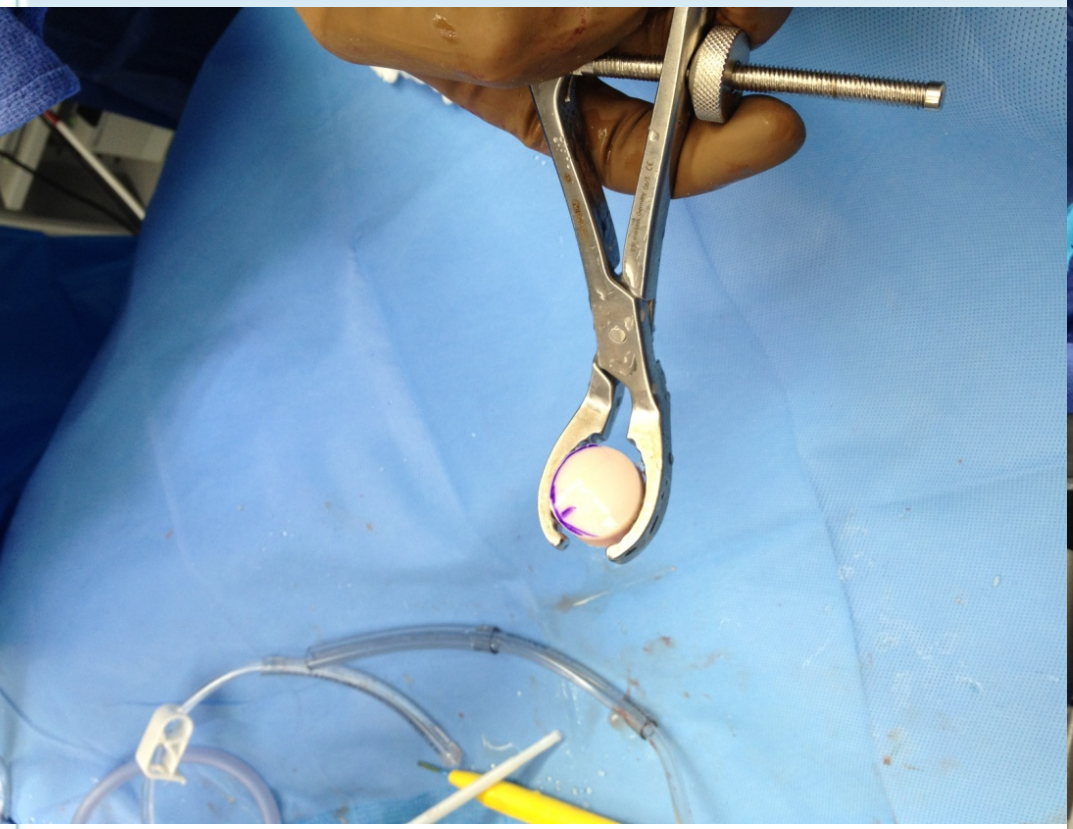
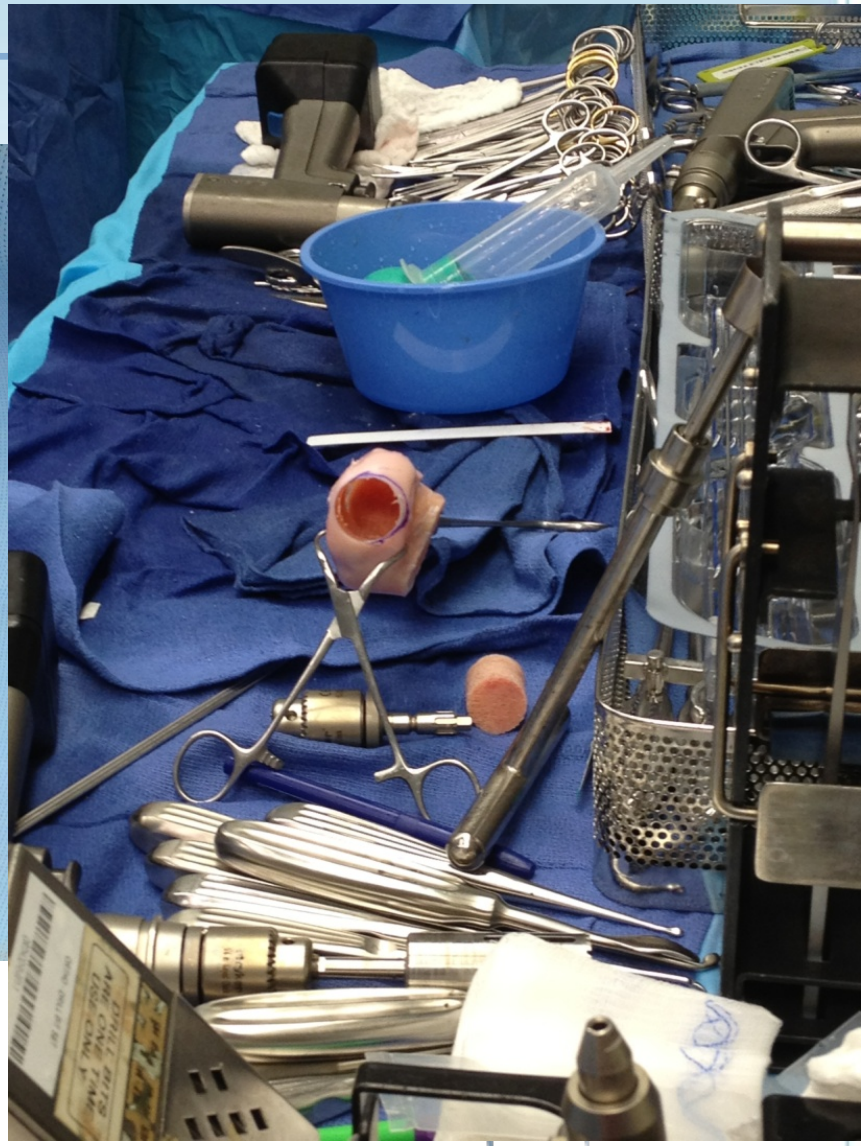
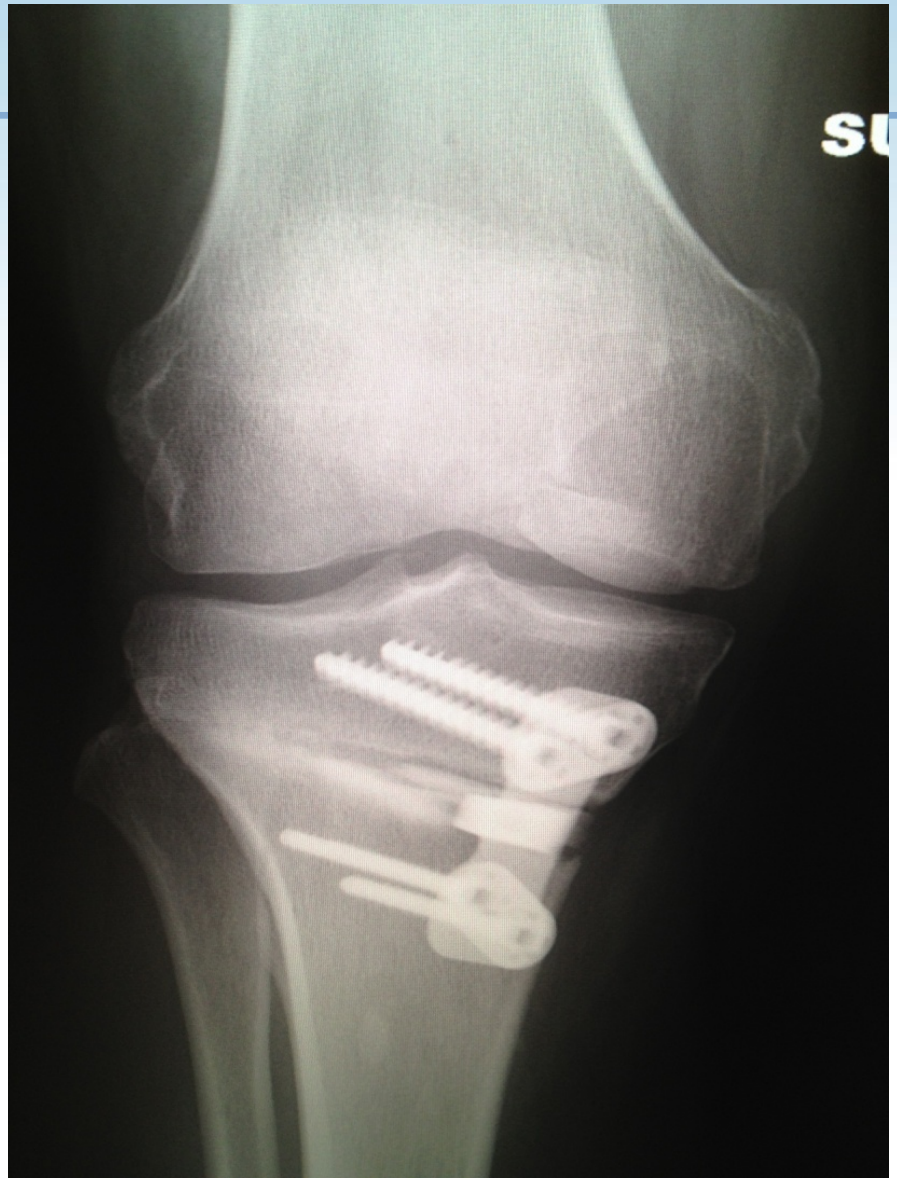






Hinsdale Orthopaedics

Hinsdale Orthopaedics



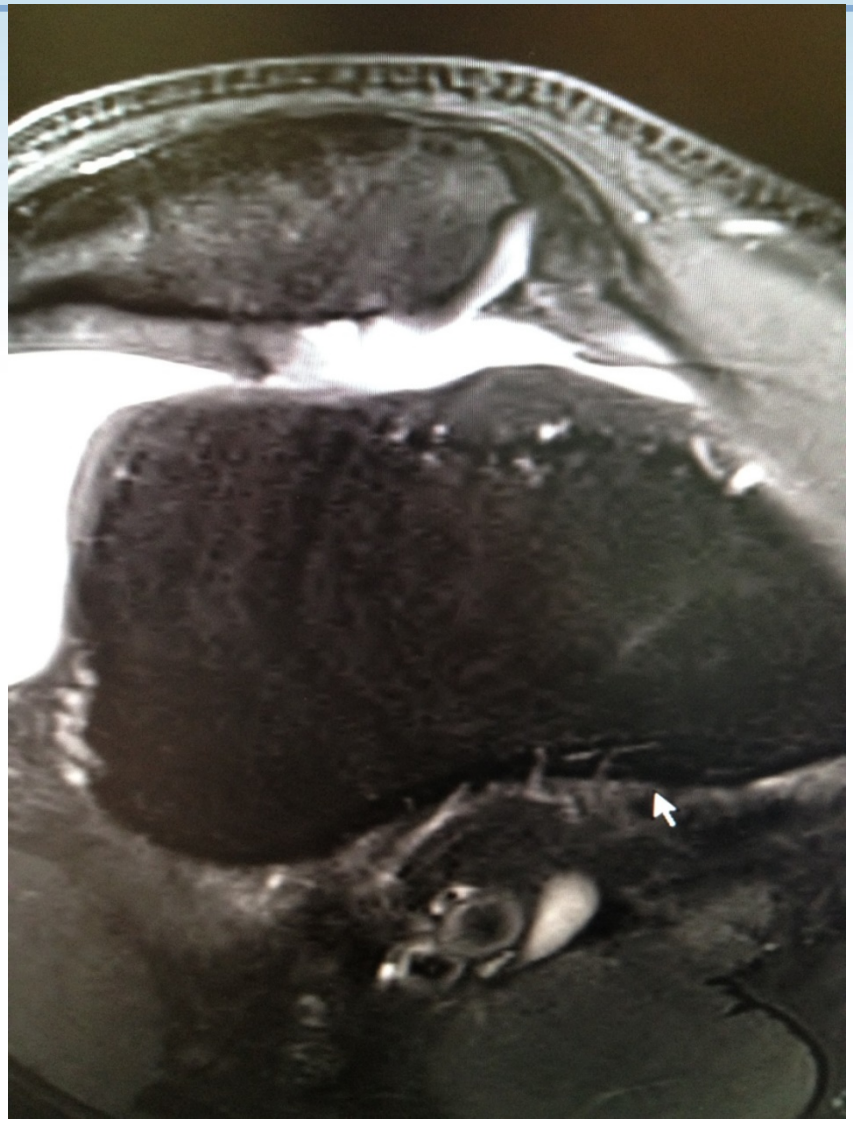
Hinsdale Orthopaedics

Case: JB

- 23 y/o male with recurrent patellar instability/dislocation
- Pain, swelling, inability to perform activities
- Firefighter

Hinsdale Orthopaedics

Hinsdale Orthopaedics

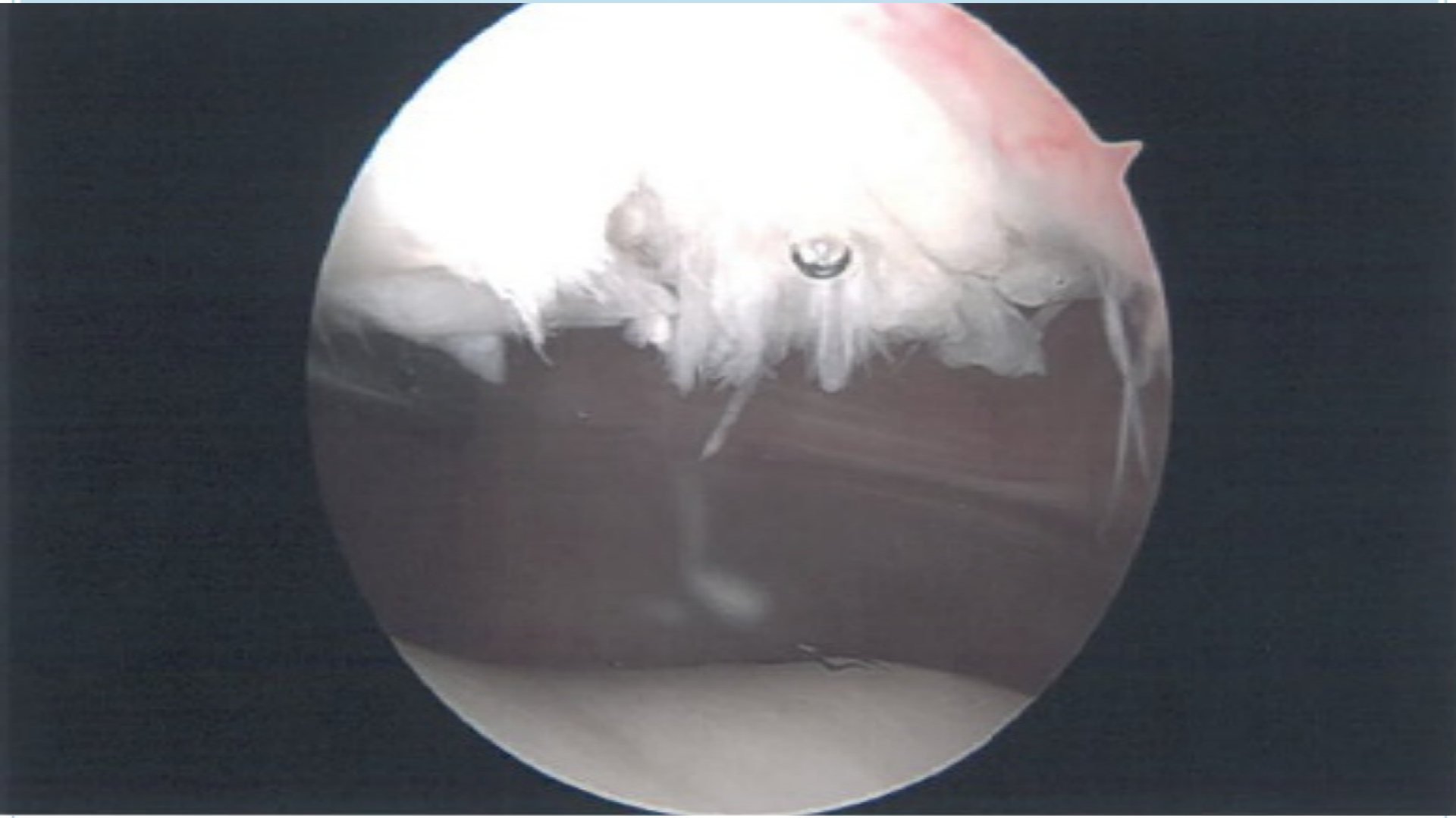


Hinsdale Orthopaedics

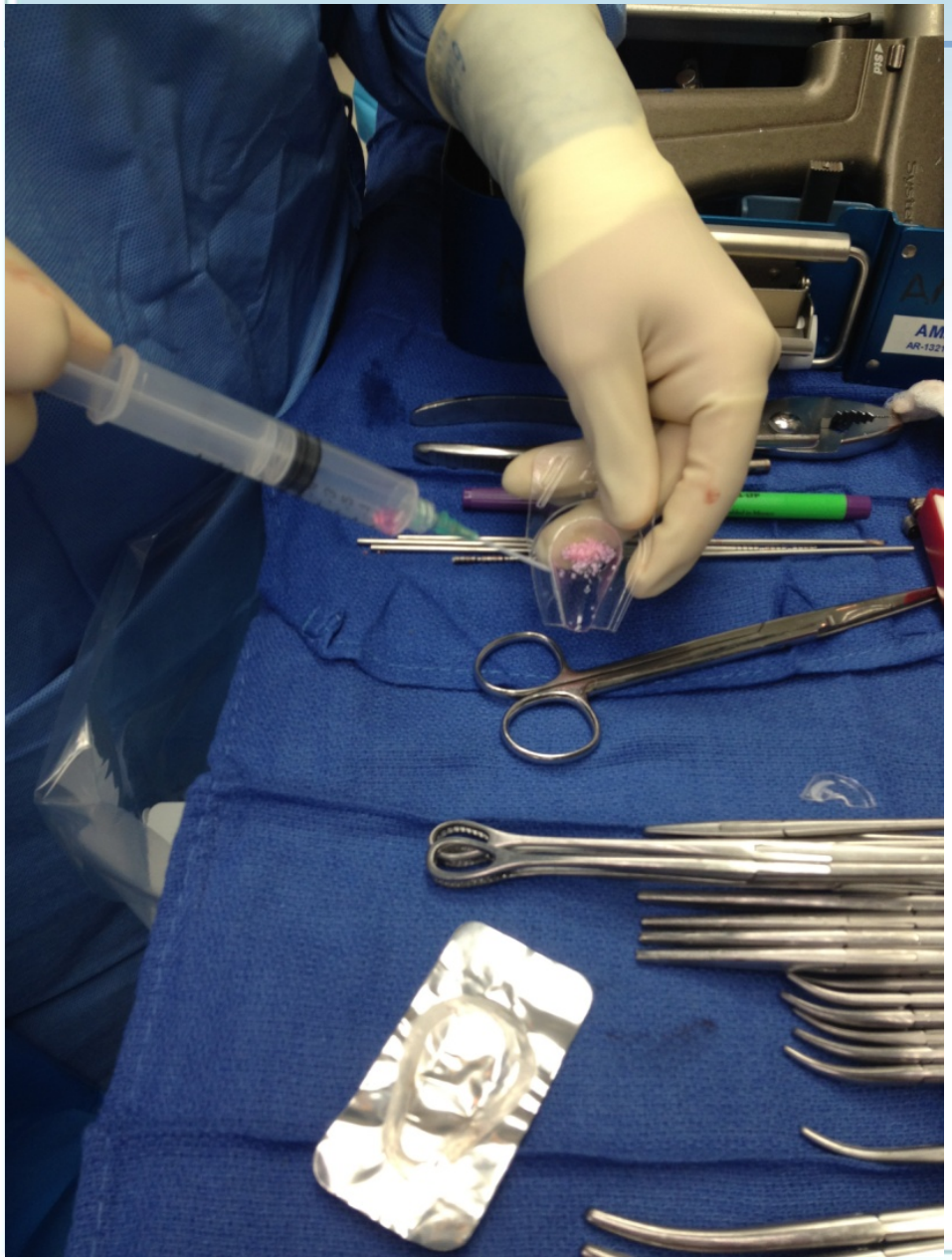
Plan

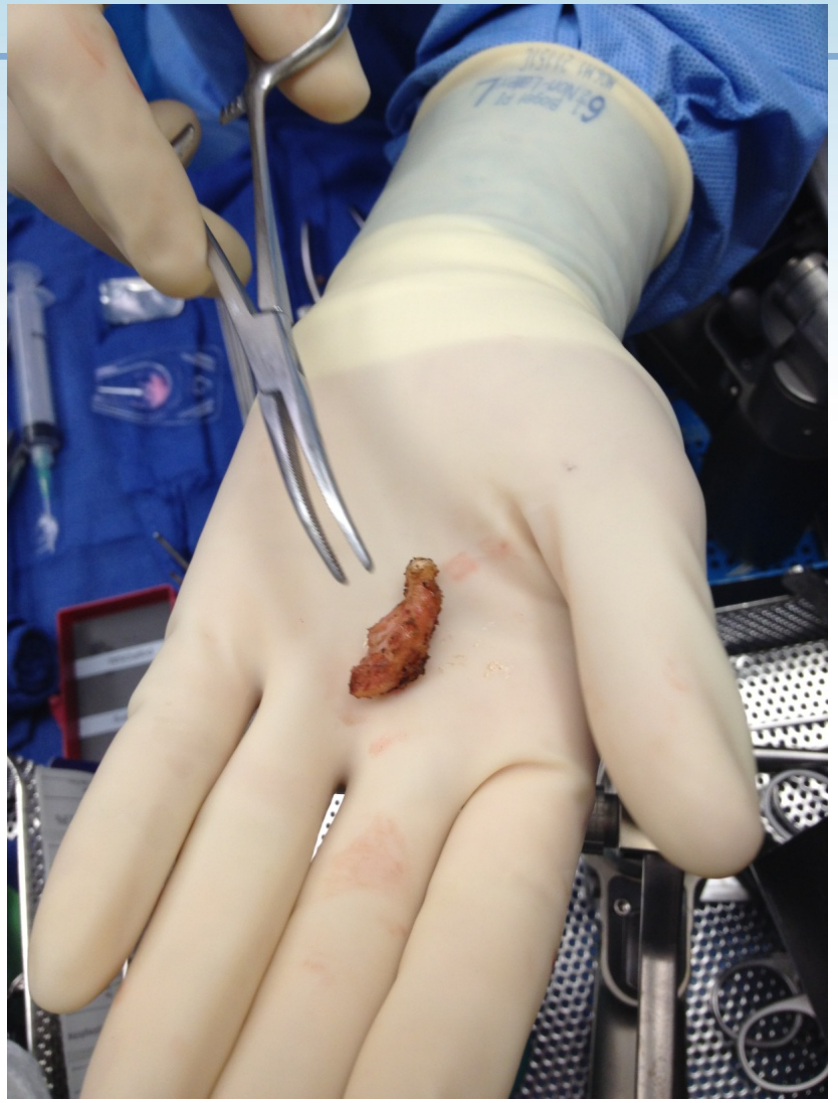
- Arthroscopy/Debridement
- Tibial Tubercle Osteotomy
  - Anteriorize/Medialize Tibial Tubercle
- DeNovo Chondrocyte Implantation
- Removal of Patellar Fragment
- Medial Retinacular Repair/Imbrication

Hinsdale Orthopaedics

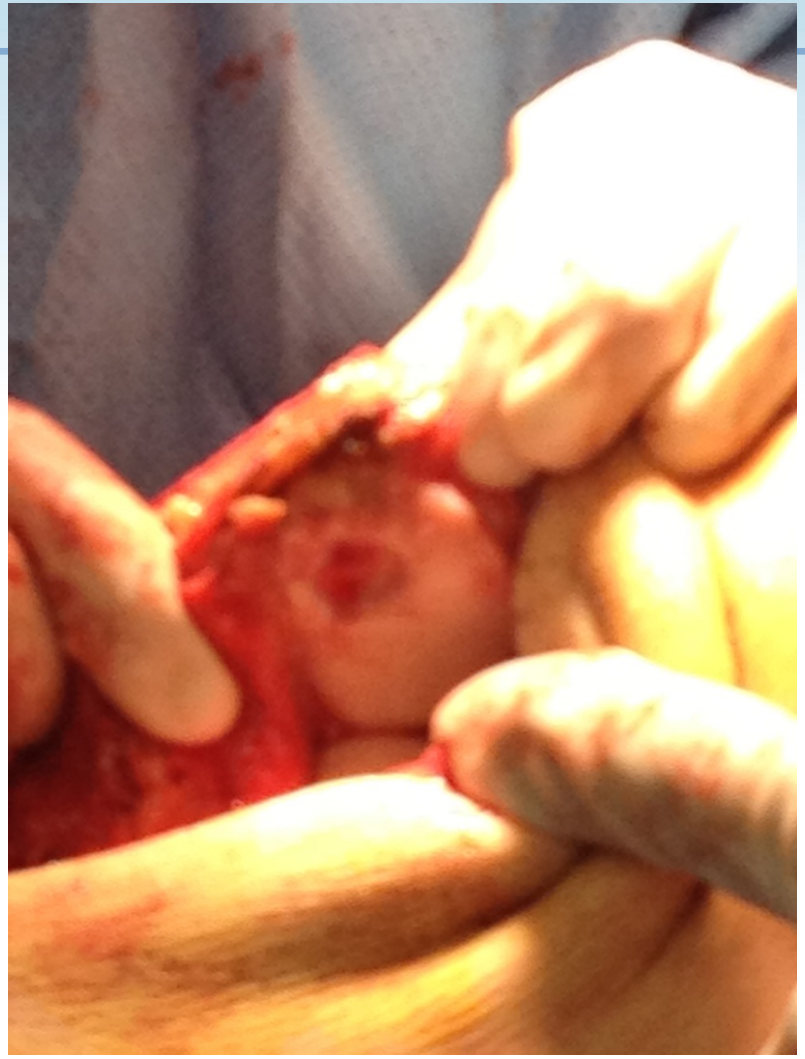


Hinsdale Orthopaedics

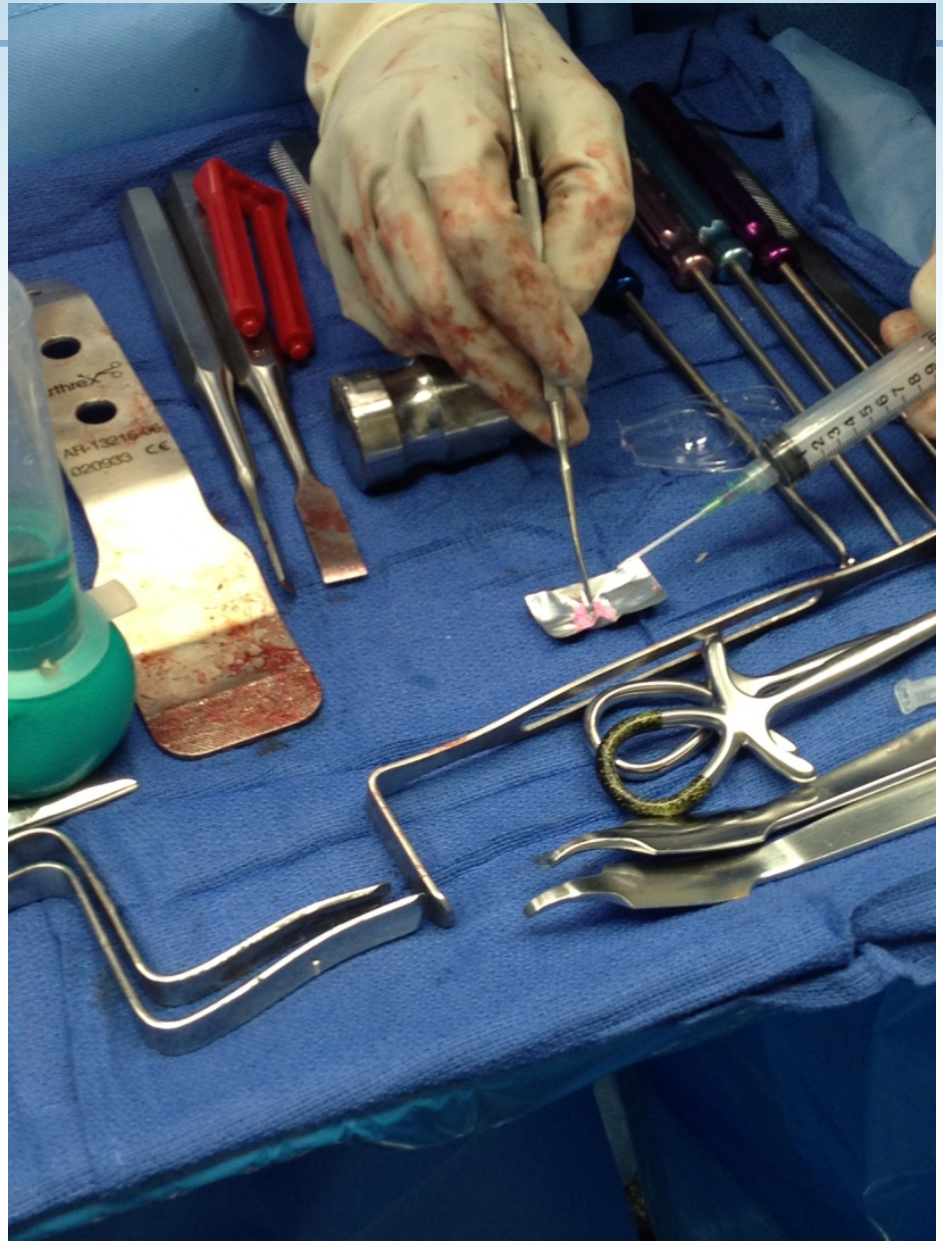




Hinsdale Orthopaedics

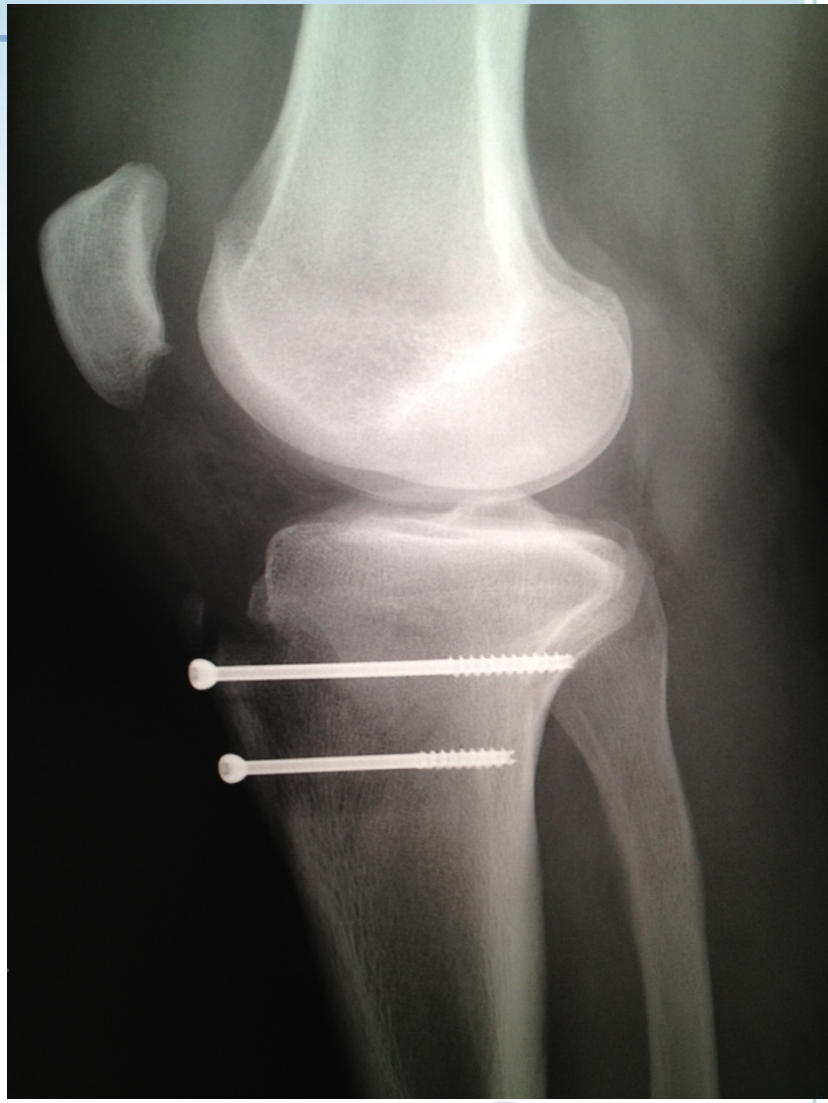


Hinsdale Orthopaedics



Hinsdale Orthopaedics

Hinsdale Orthopaedics

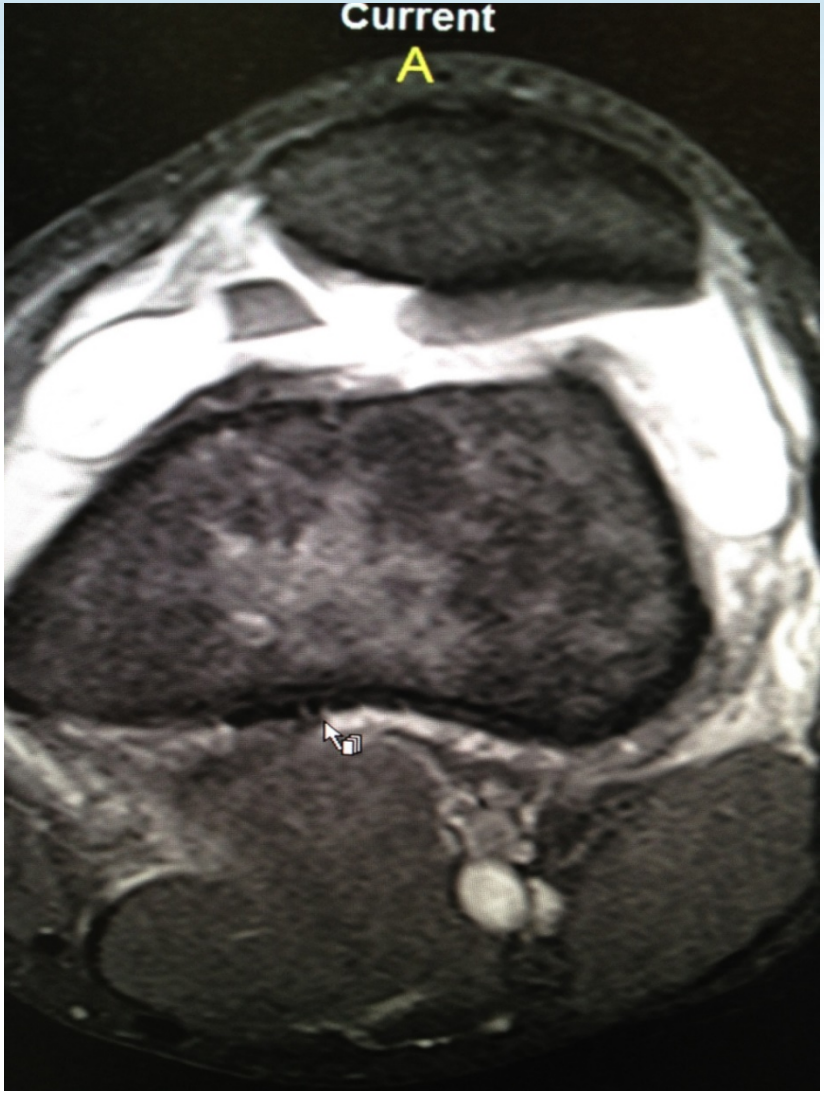


Hinsdale Orthopaedics

Case: JS

- 18 y/o football player
- First patellar dislocation prior to senior year (8/11)

Hinsdale Orthopaedics

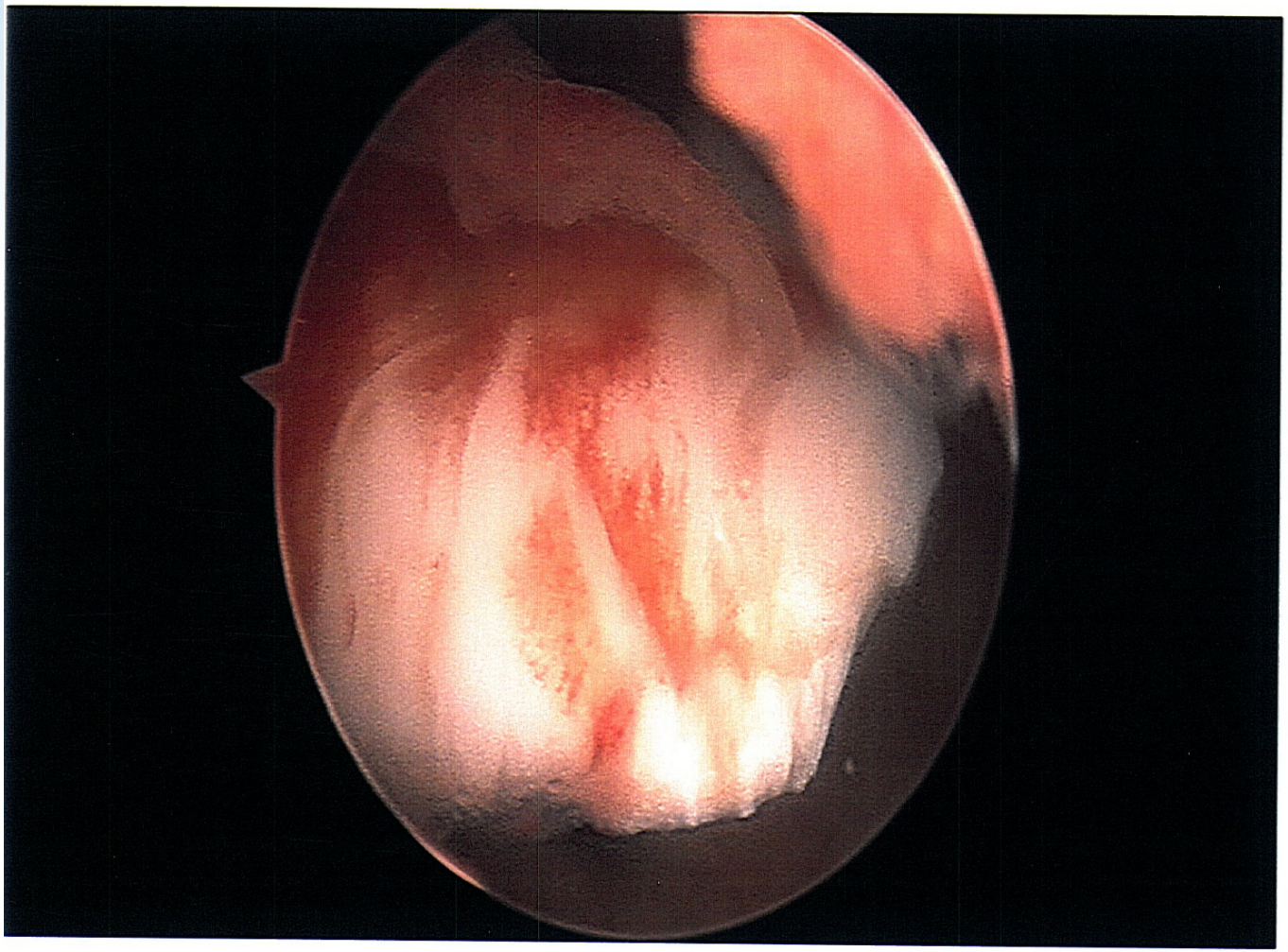


Hinsdale Orthopaedics

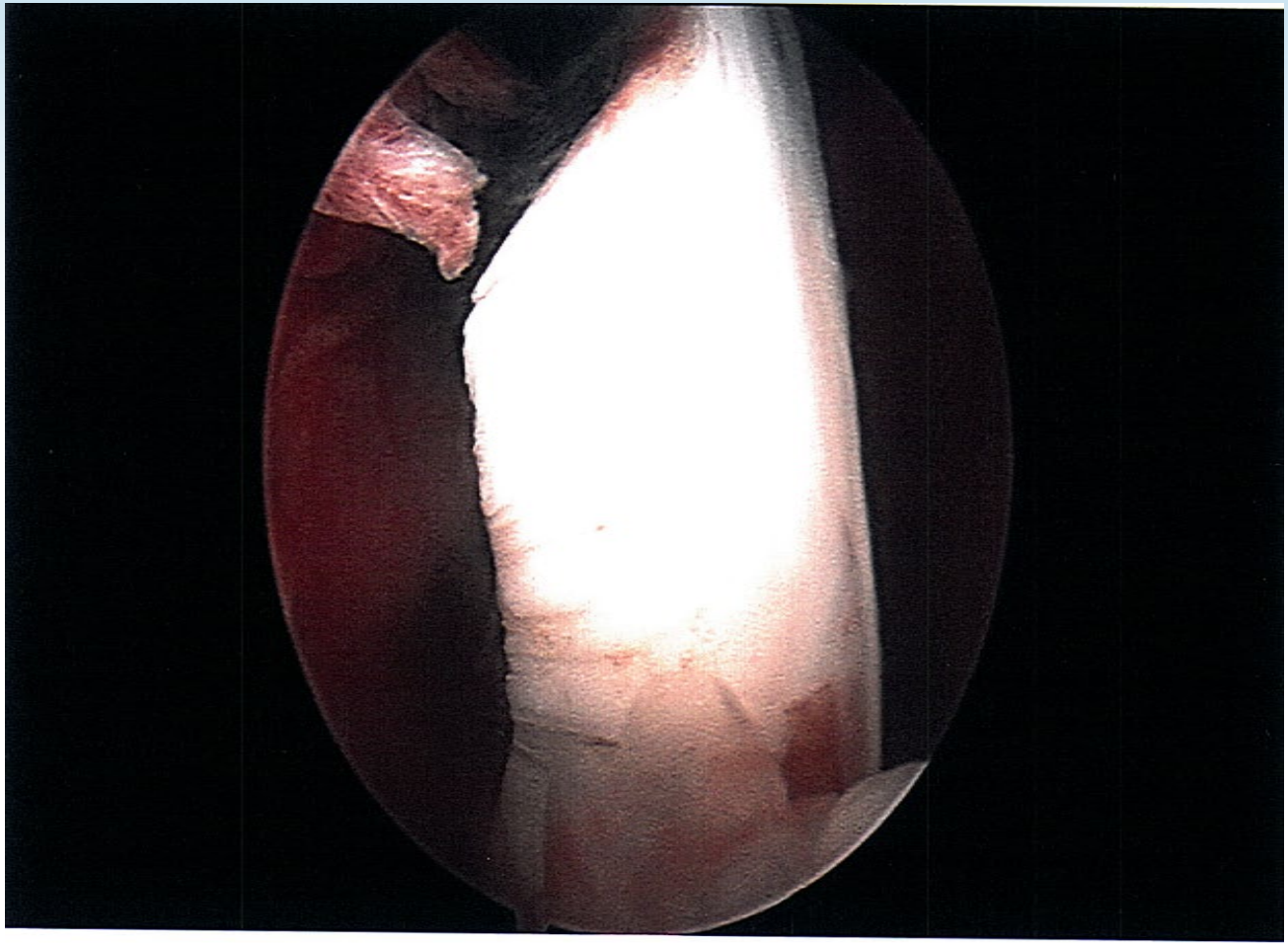
JS Continued

- Primary surgery –
  - Loose body removal
  - Microfracture patella
  - MPFL Repair
  - Chondral biopsy - Vericel

Hinsdale Orthopaedics



Hinsdale Orthopaedics



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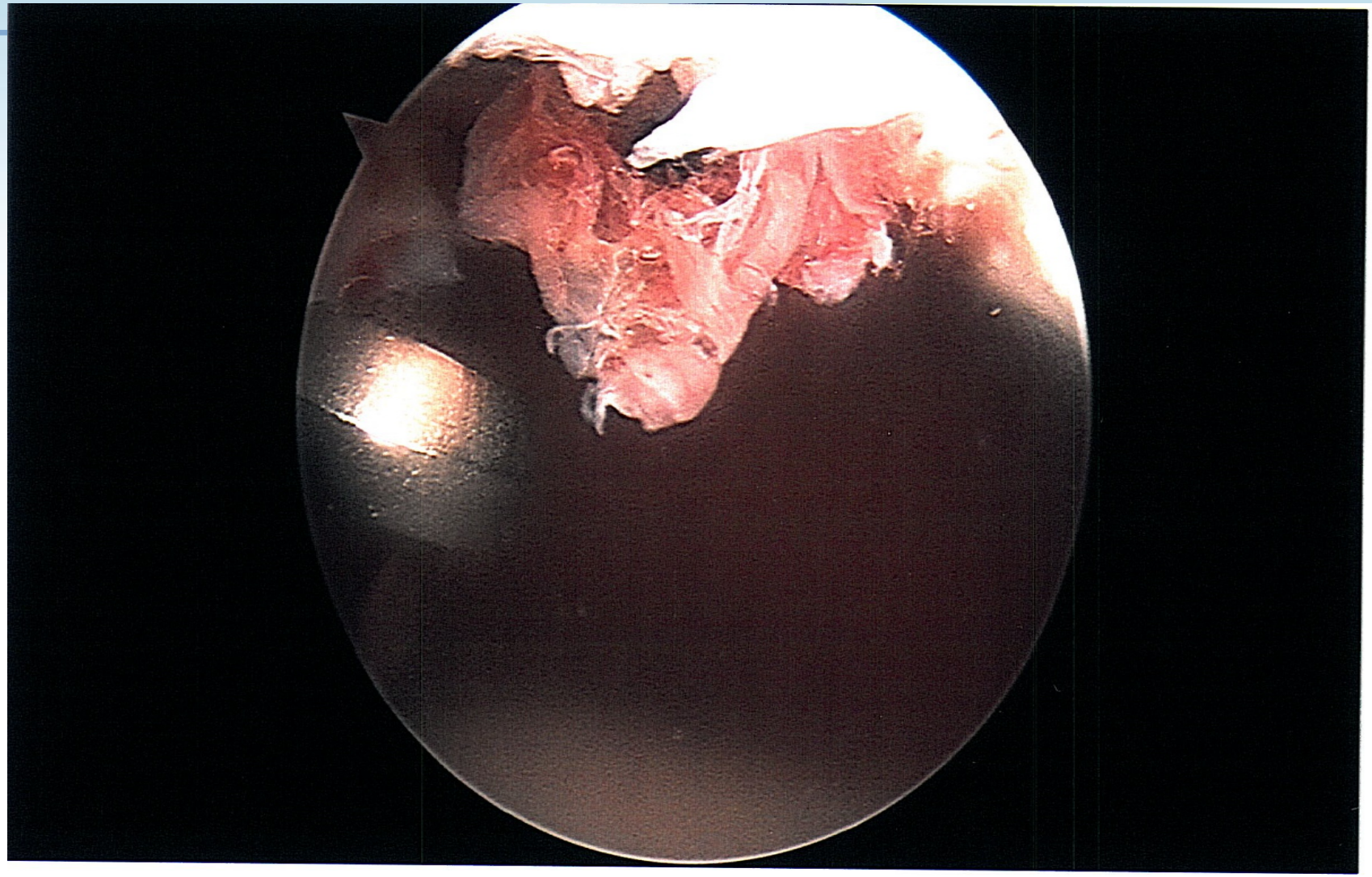
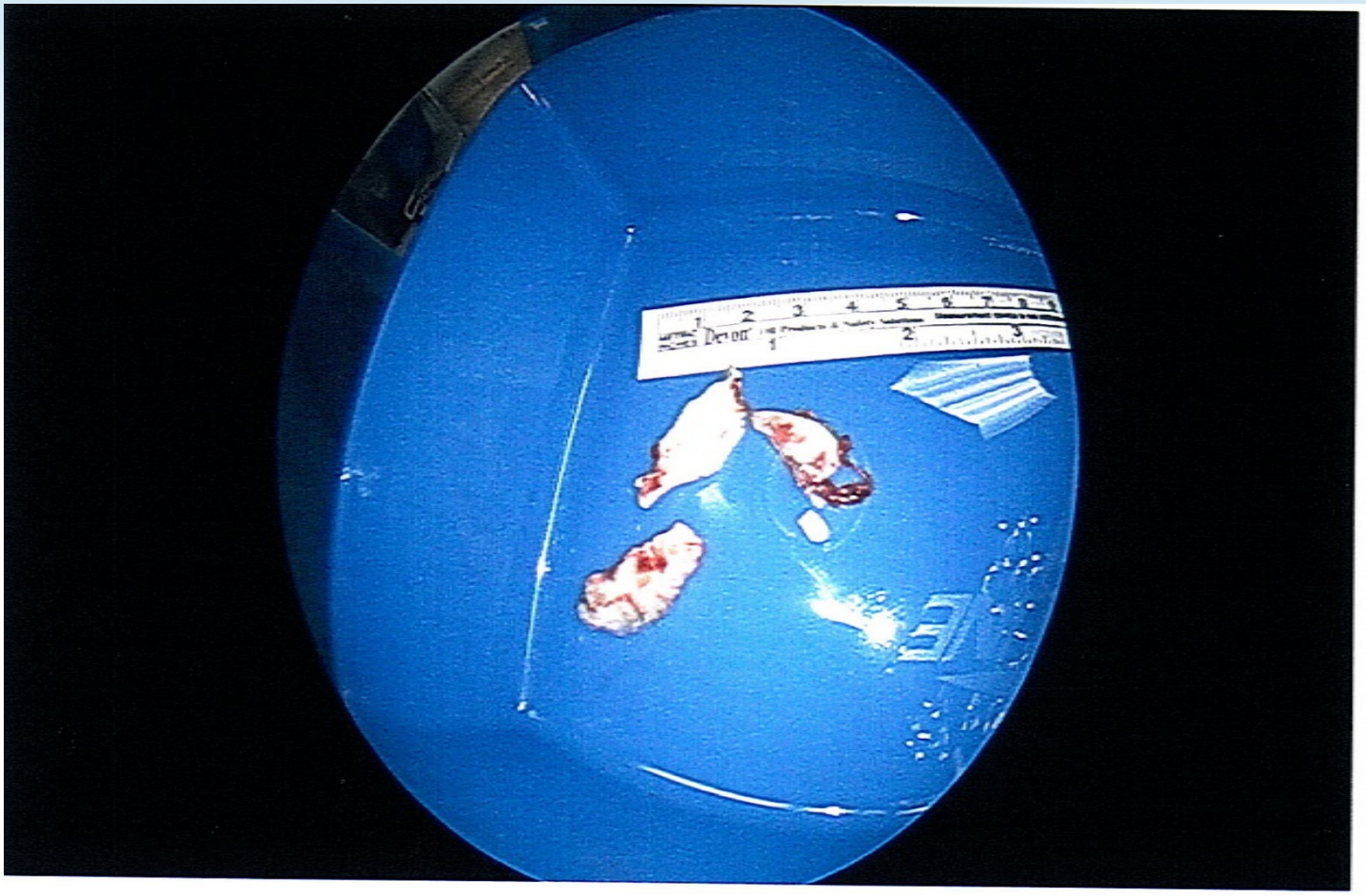


Hinsdale Orthopaedics



Hinsdale Orthopaedics

8 Months Later…

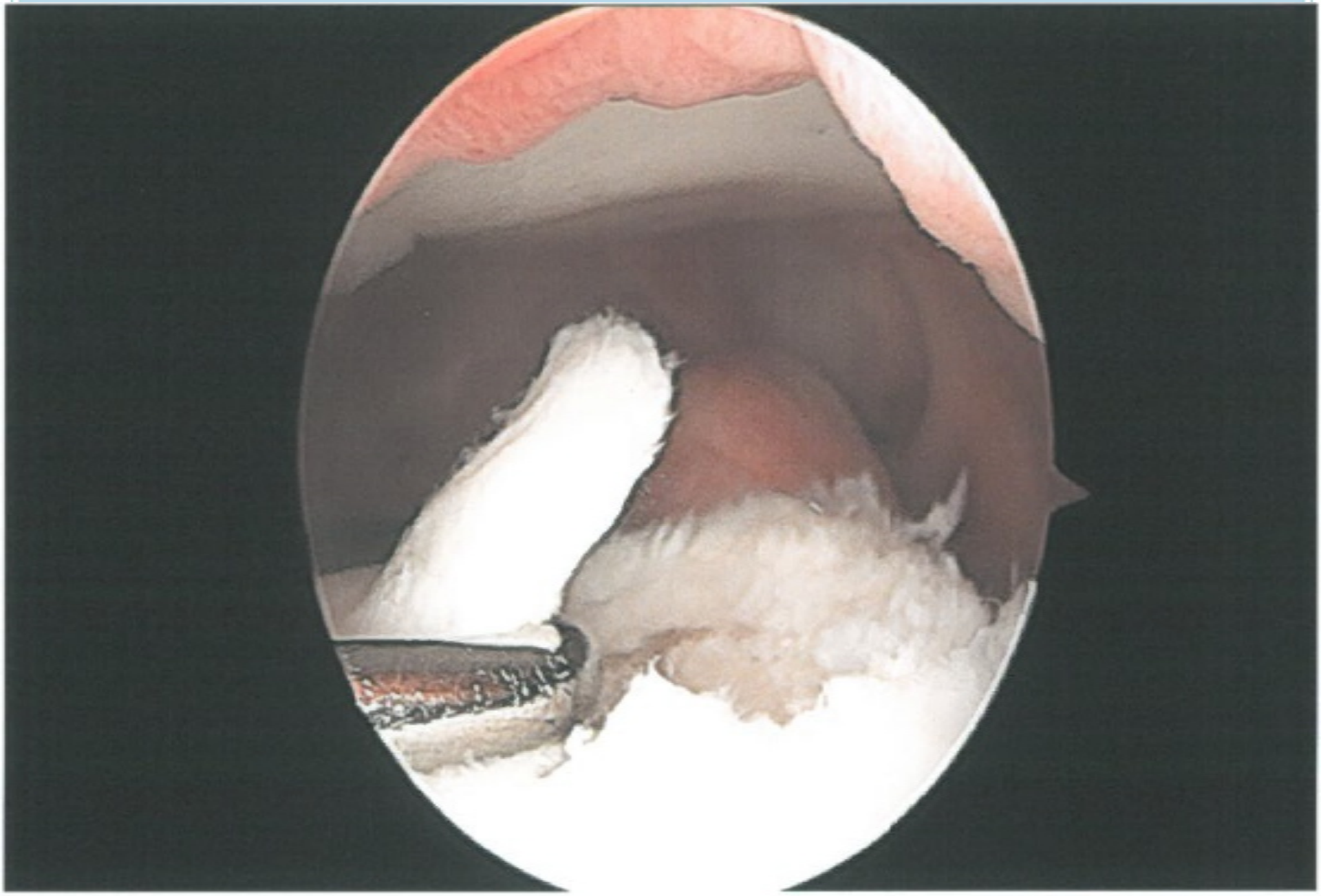
- Persistent patellofemoral pain
- Difficulty with sports
- Pain/intermittent swelling

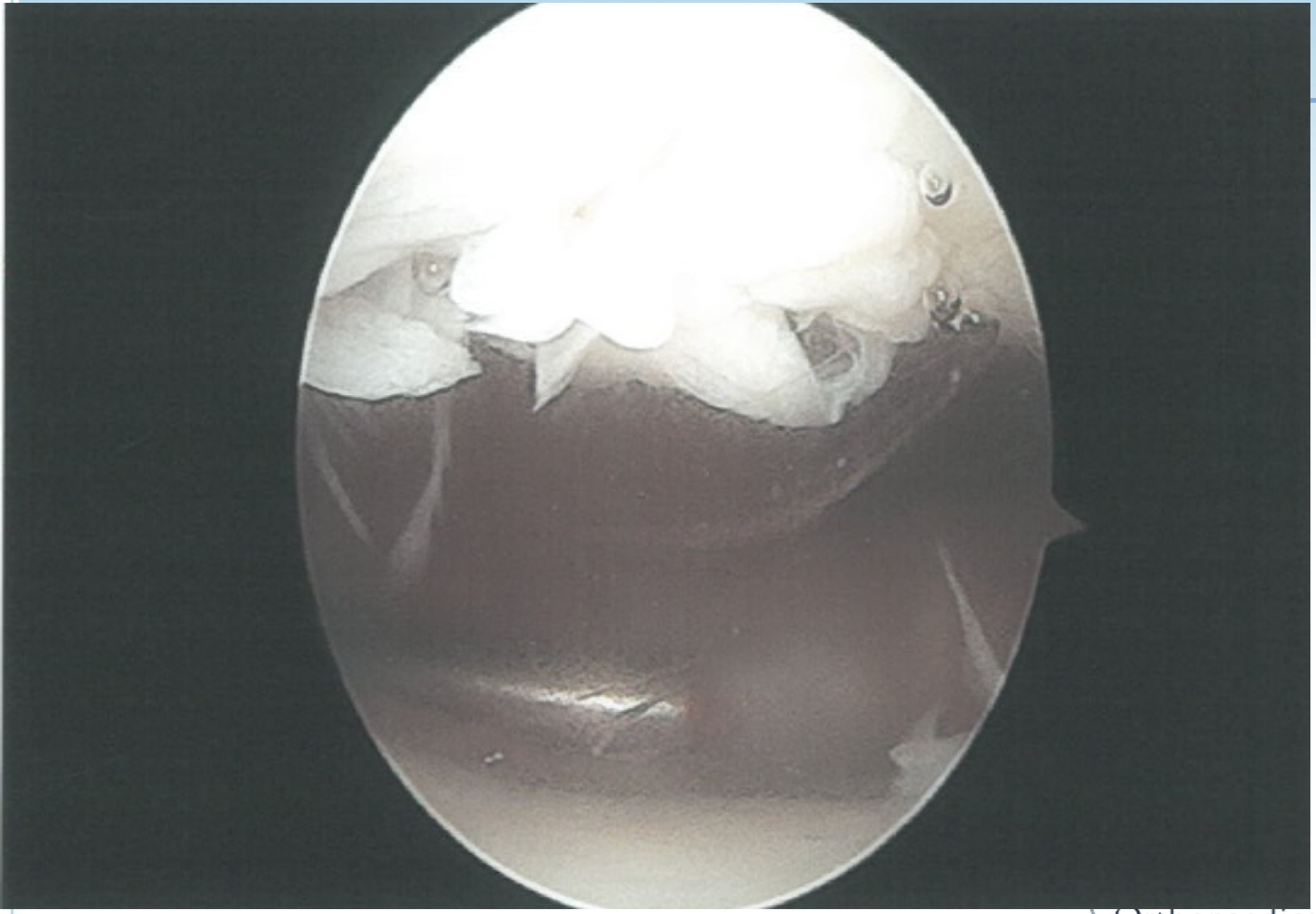
Hinsdale Orthopaedics

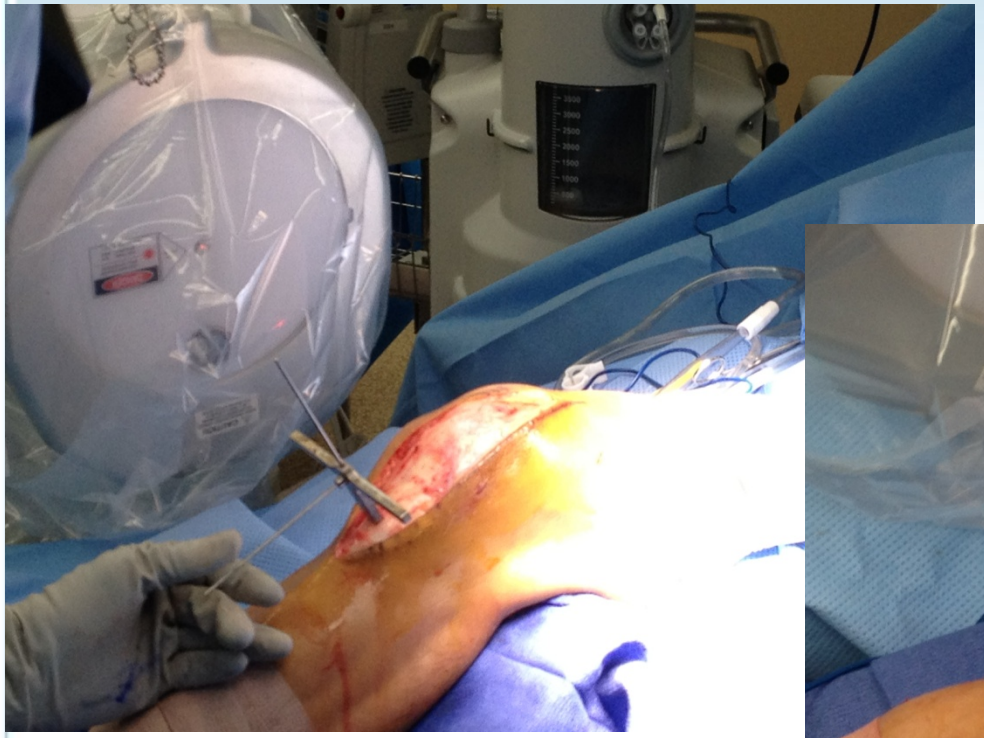
Plan

- Arthroscopy
- Debridement
- 2nd Stage Reimplantation ACI
- TTO (AMZ)

Hinsdale Orthopaedics







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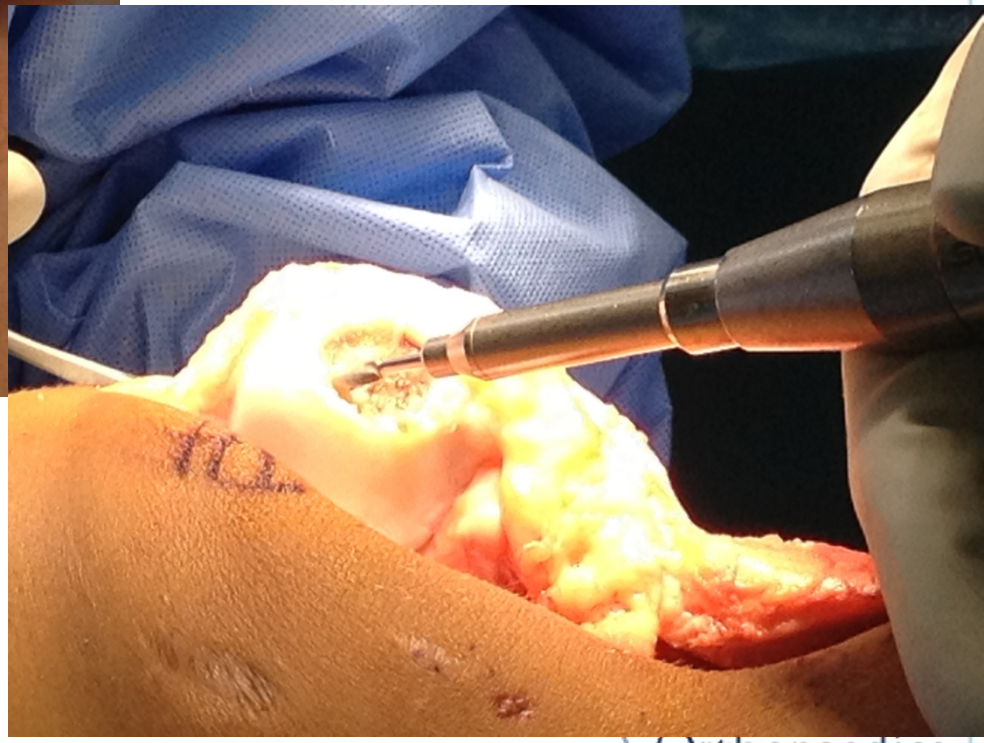
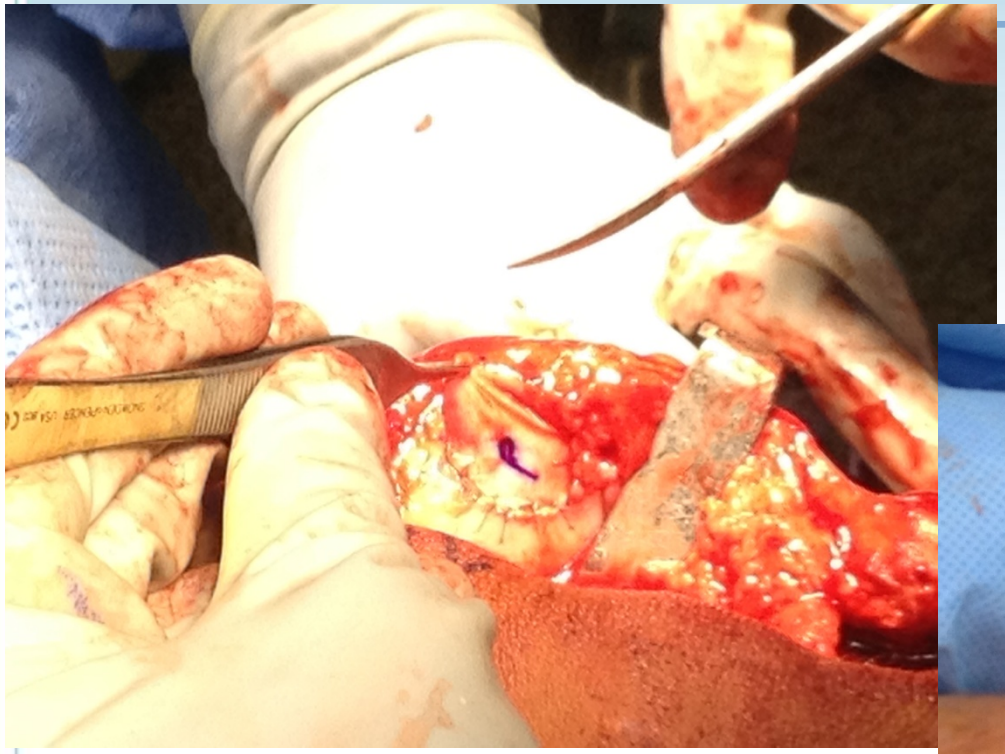
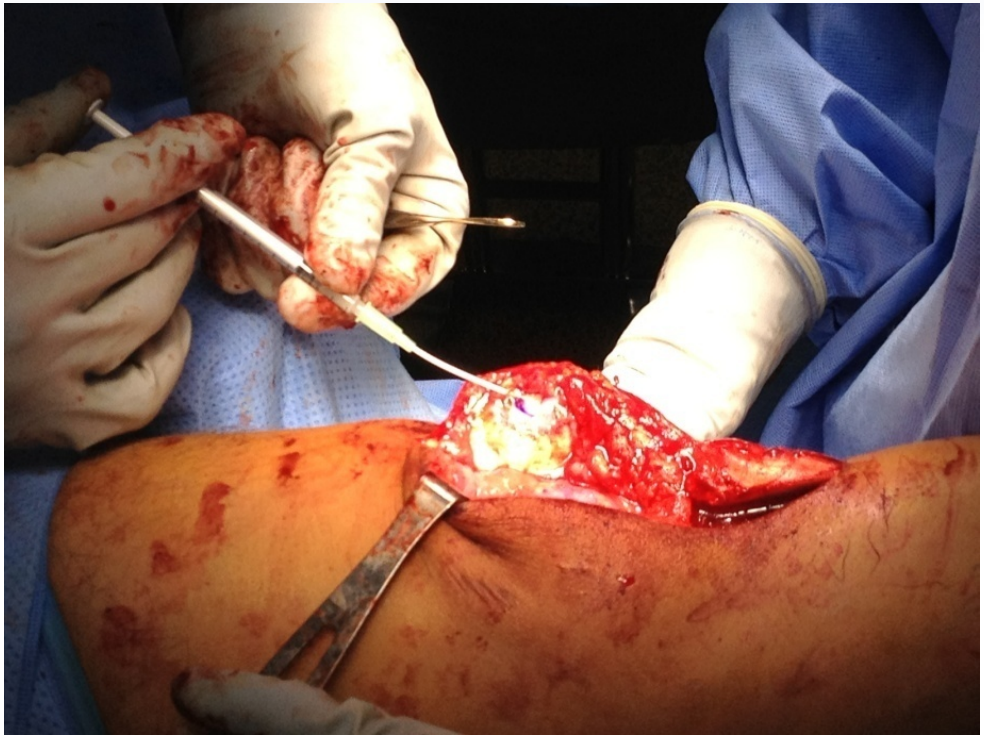


Orthopaedics



Hinsdale Orthopaedics



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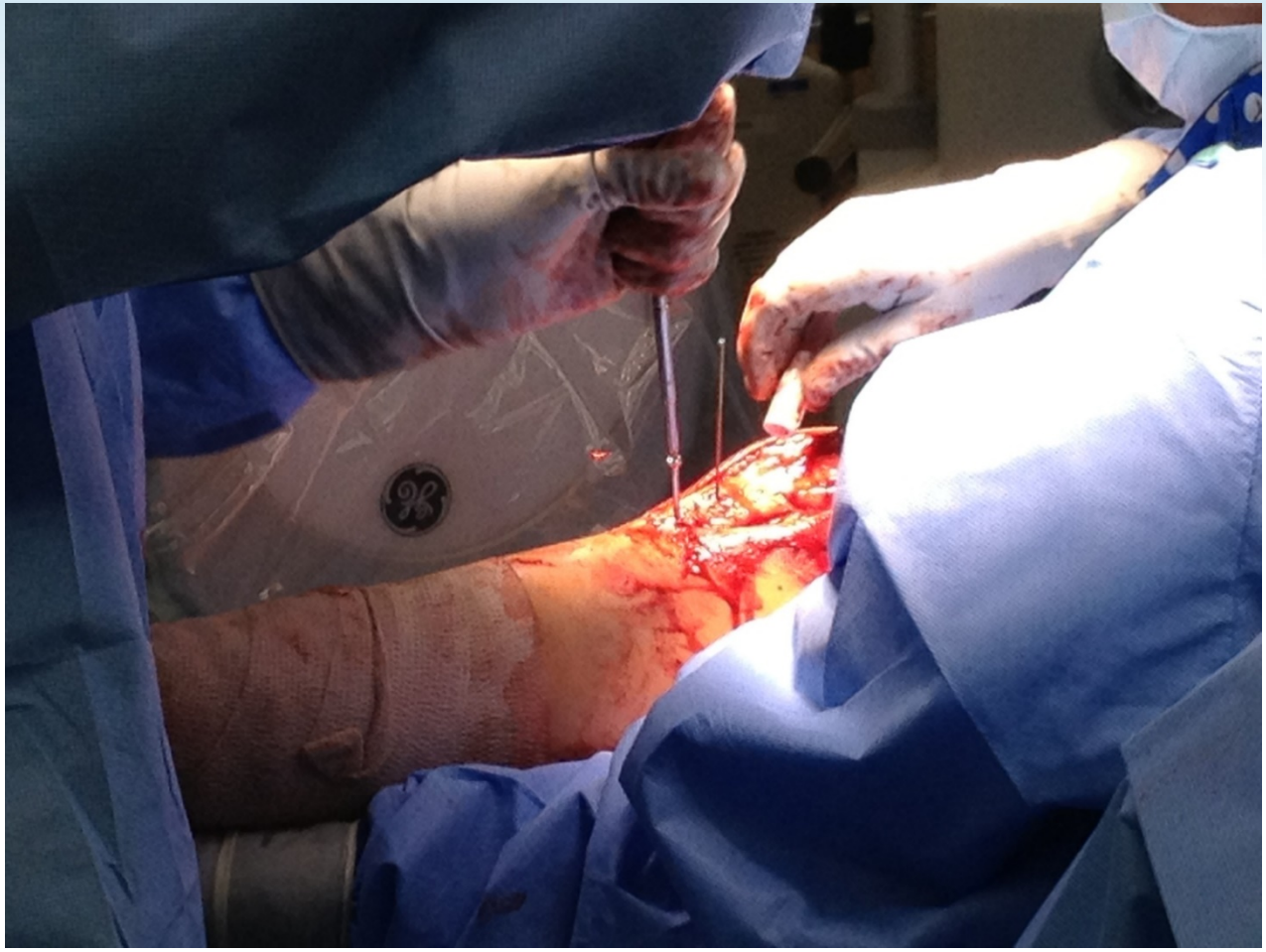

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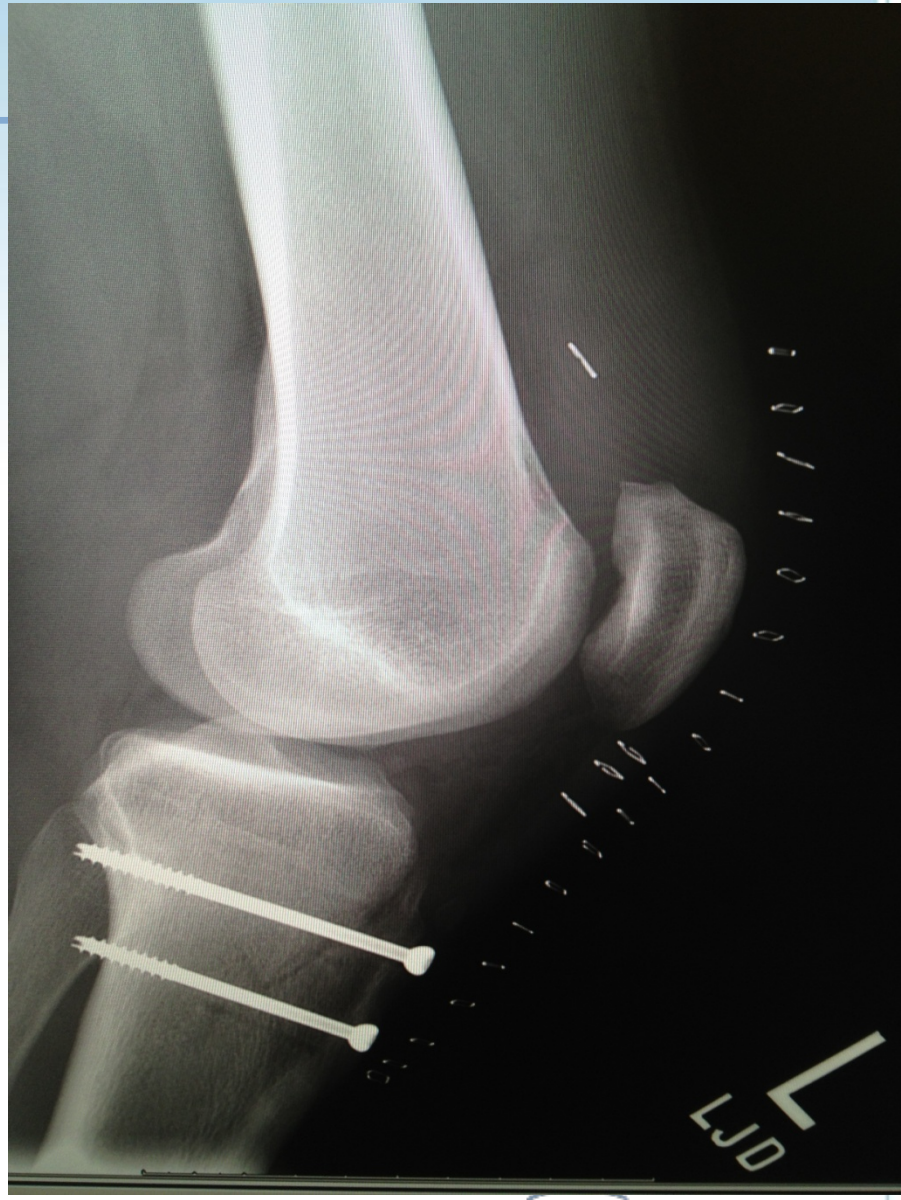

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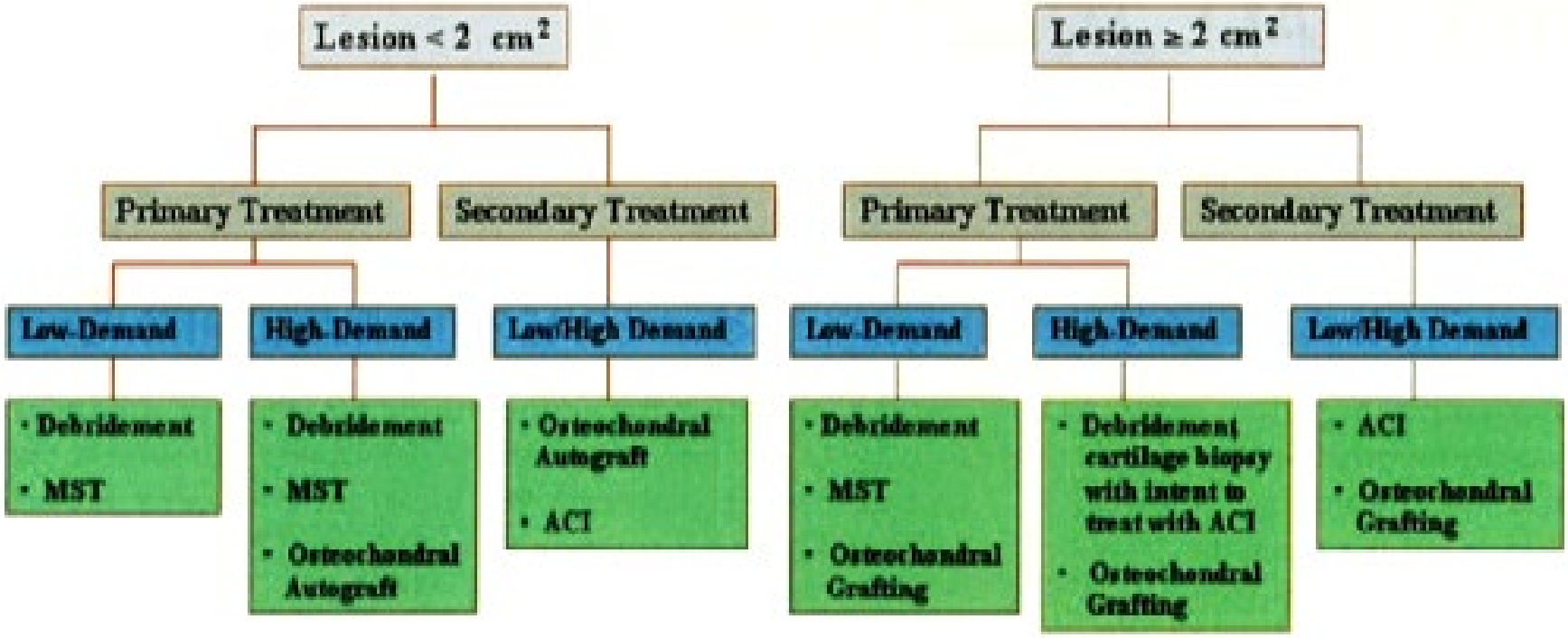
TREATMENT ALGORITHM



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Hinsdale Orthopaedics

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Thank you!

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