

An anatomical model of a knee joint, showing the femur, tibia, and patella. A surgical incision is visible on the anterior surface of the knee, revealing the underlying joint structures. The model is held in place by several fingers, suggesting it is being demonstrated or examined.

# **A Biological Approach to Knee and Shoulder Restoration in the Injured Worker**

**Phil Davidson, MD**

**Heiden-Davidson Orthopedics**

**Compensable Disability Seminar: Update 2011**

# Introduction – Dr. Phil Davidson

- **Park City and SLC clinics**
- **Education: Harvard, Cornell, Baylor, Kerlan-Jobe Clinic**
- **Surgical Specialist in Cartilage Restoration & Joint Resurfacing**  
**\*Knee and Shoulder**
- **Committed researcher and educator**
- **Incorporating new technologies to offer more choices to patients**
- **Affiliated – NFL, MLB, PGA, FDA**
- **Florida- EMA, nominated by state WC judges and appointed by governor (served 8 years)**



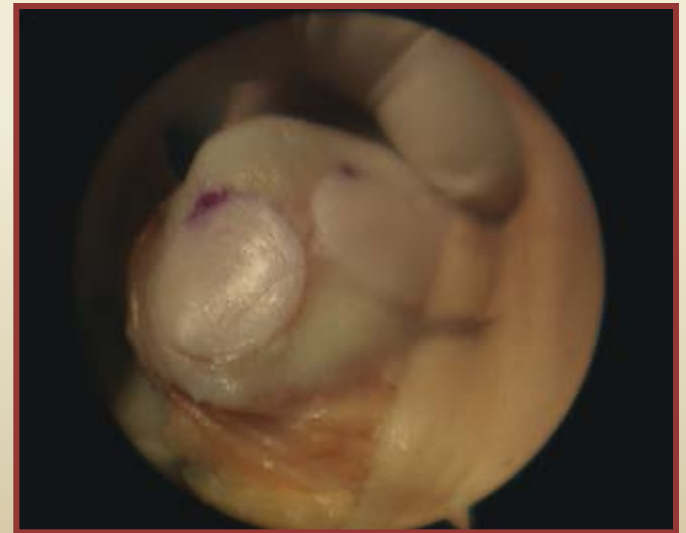
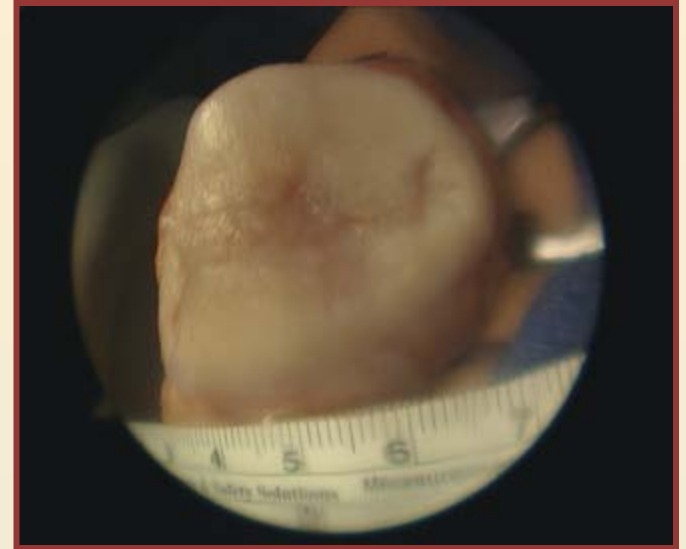
# Outline

- **Biologic Approach**
- **Introduction to the Knee**
- **Introduction to the Shoulder**
- **Cartilage Restoration**
- **Joint Resurfacing**
- **Common problems affecting the knee and shoulder**
- **Treatment strategies**
- **Treatment options**
- **Focus on new techniques**
- **Issues Specific to WC**
- **Questions and Answers**



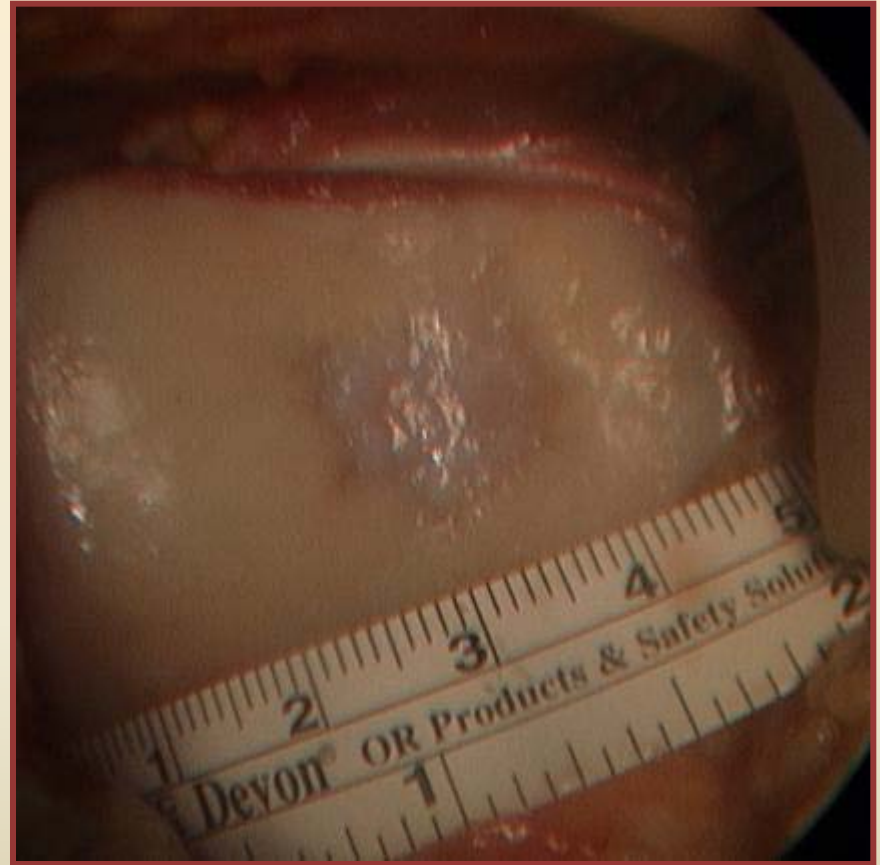
# Biologic Approach

- Incorporates an array of methods and technologies to optimize healing through the application of maximally effective, minimally invasive, precise treatments taking advantage and promoting the patient's healing capacities

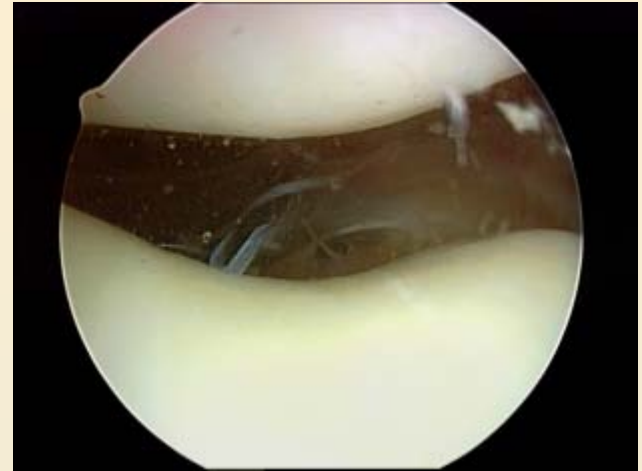


# Biologic Approach

- Restore normal anatomy
- Preserve healthy anatomy
- Customize each and every treatment to the individual in light of their unique circumstance
- NOT an advocate for one device or procedure

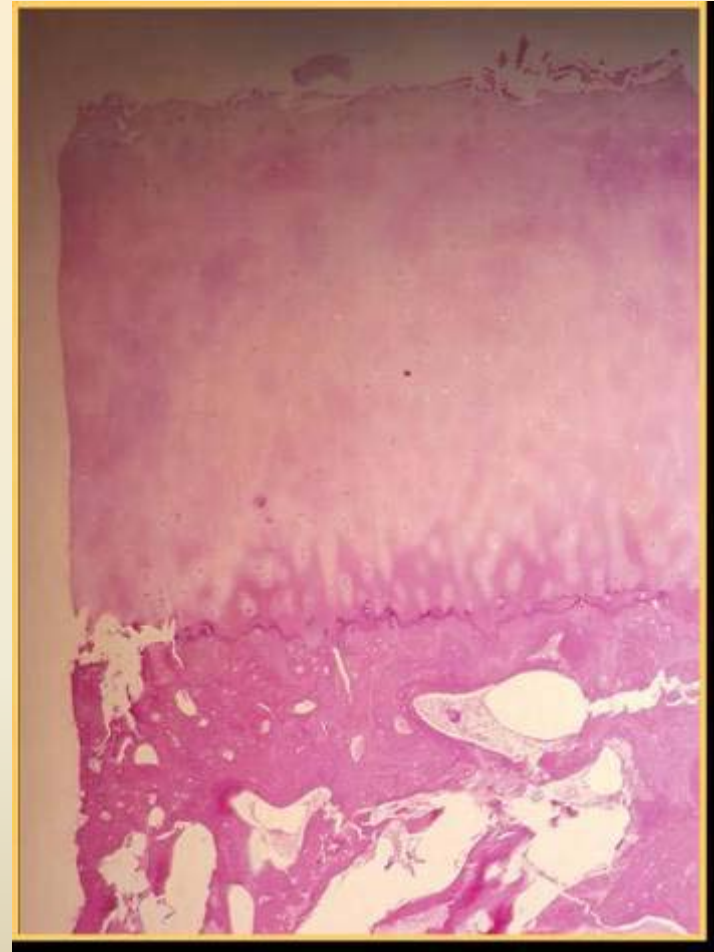


# Surgical views of the knee



# Cartilage – Different types

- Articular cartilage
- Meniscal cartilage
- Many different in body
- Joint surface
  - Articular cartilage
  - Tidemark region
  - Subchondral bone
  - Analogy, “tire tread”



# Articular Cartilage Degeneration





# Multiple Etiologies Yield Grade IV (full thickness) Lesions

- Trauma
- OCD
  - Osteochondritis desiccans
  - Osteonecrosis
  - Osteochondral defect
- Focal degeneration
- Instability
- Iatrogenic injury



# Weight Bearing Articular Cartilage Defects

- Pain, Clicking, Catching
- Loose pieces
- Progressive problem
- Limits activities
- Can be result of injury or gradual problem



# Shoulder Anatomy



# Surgical Views of Shoulder



# Shoulder Anatomy



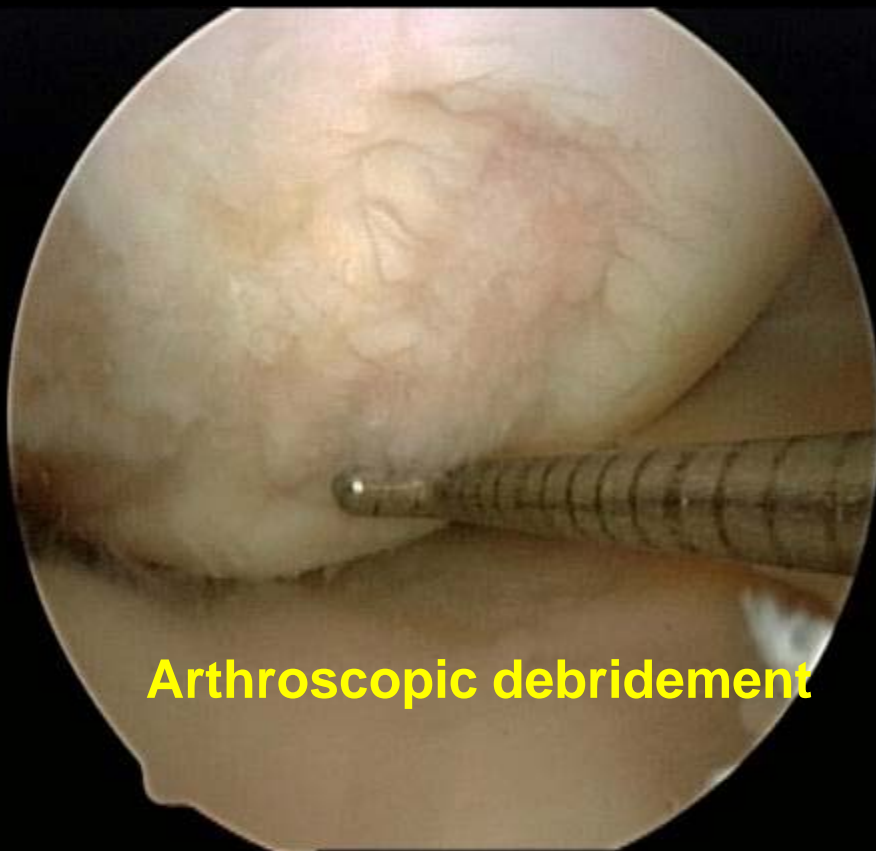
# The Rotator Cuff



- Set of tendons that secure the humerus into the glenoid socket
- Very common source of pain and weakness about the shoulder
- Often degenerates, then can be traumatically injured

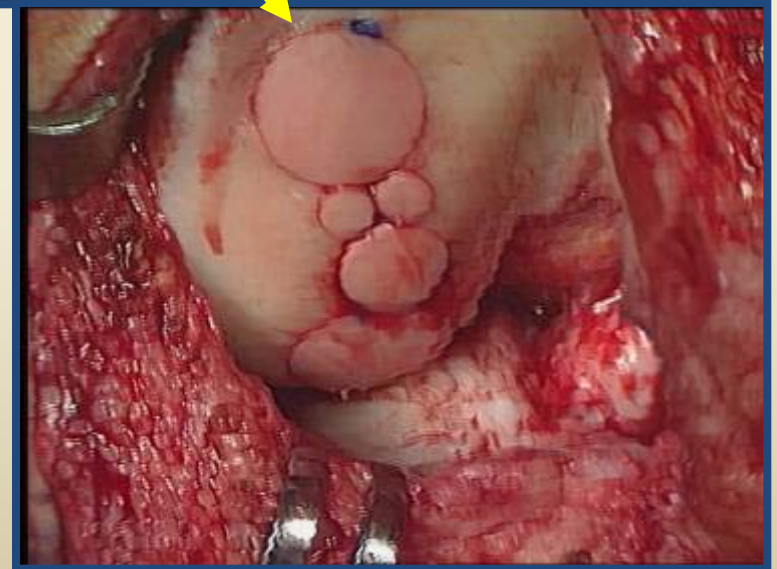
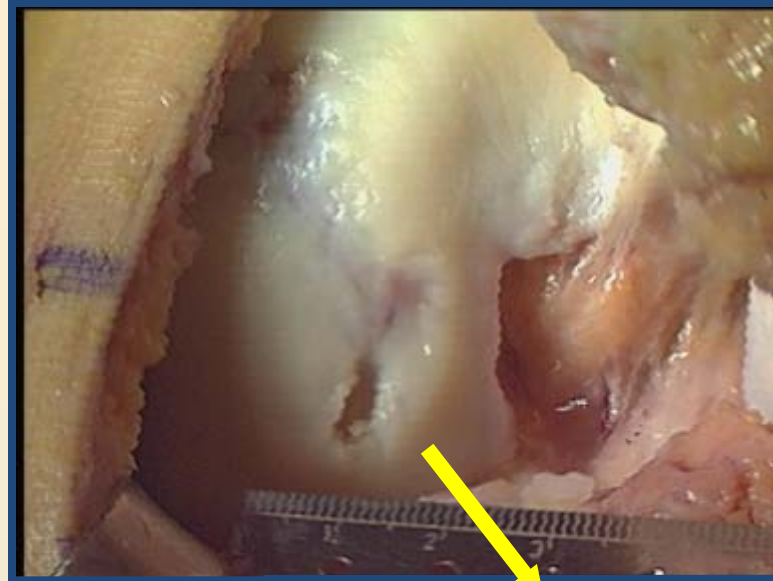
# Cartilage Restoration & Joint Resurfacing

A wide realm between.....



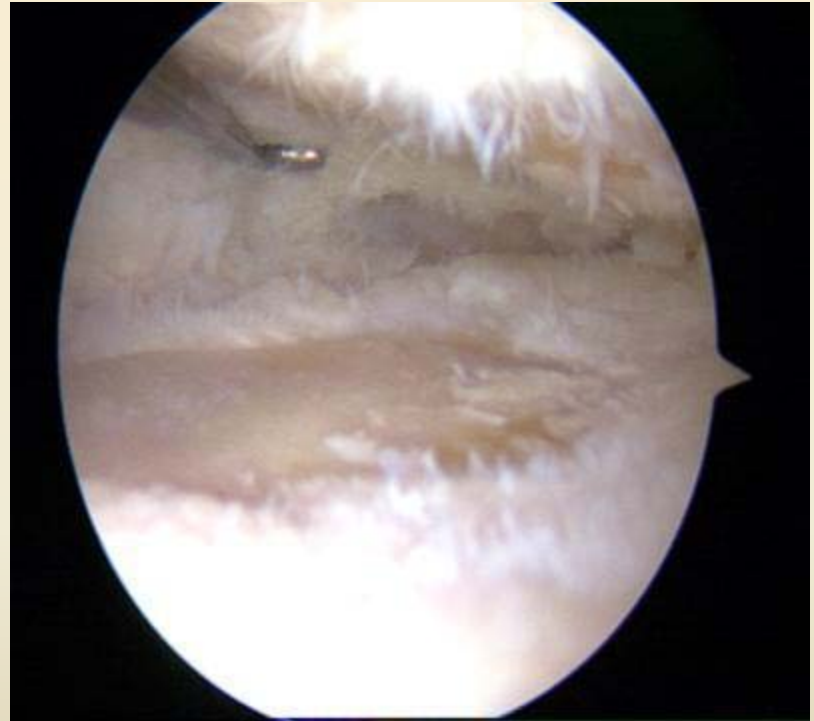
# Goals: Biological Cartilage Restoration

- Relieve pain
- Restore functional histologic architecture
- Improve Mechanics
- Long lasting
- Prevent or Limit Future Degenerative Changes





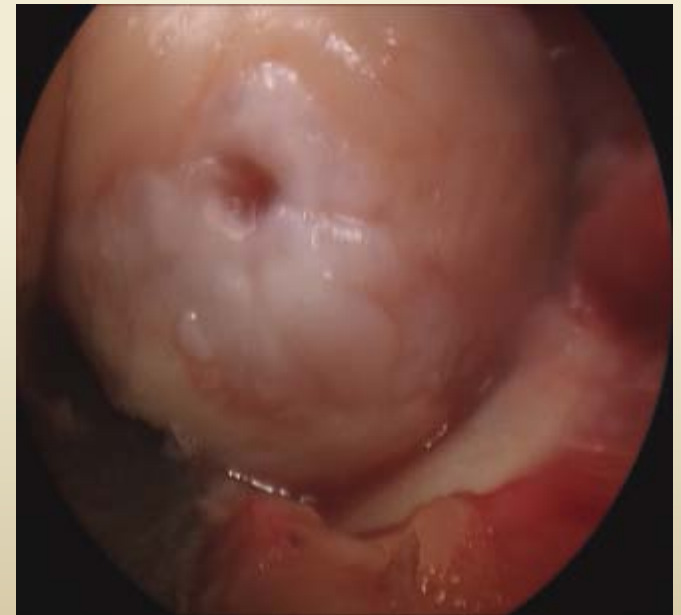
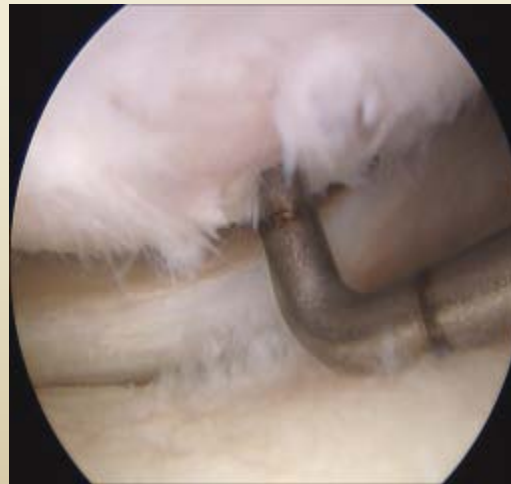
How do we systematically, scientifically and effectively get a handle on these challenging cases?



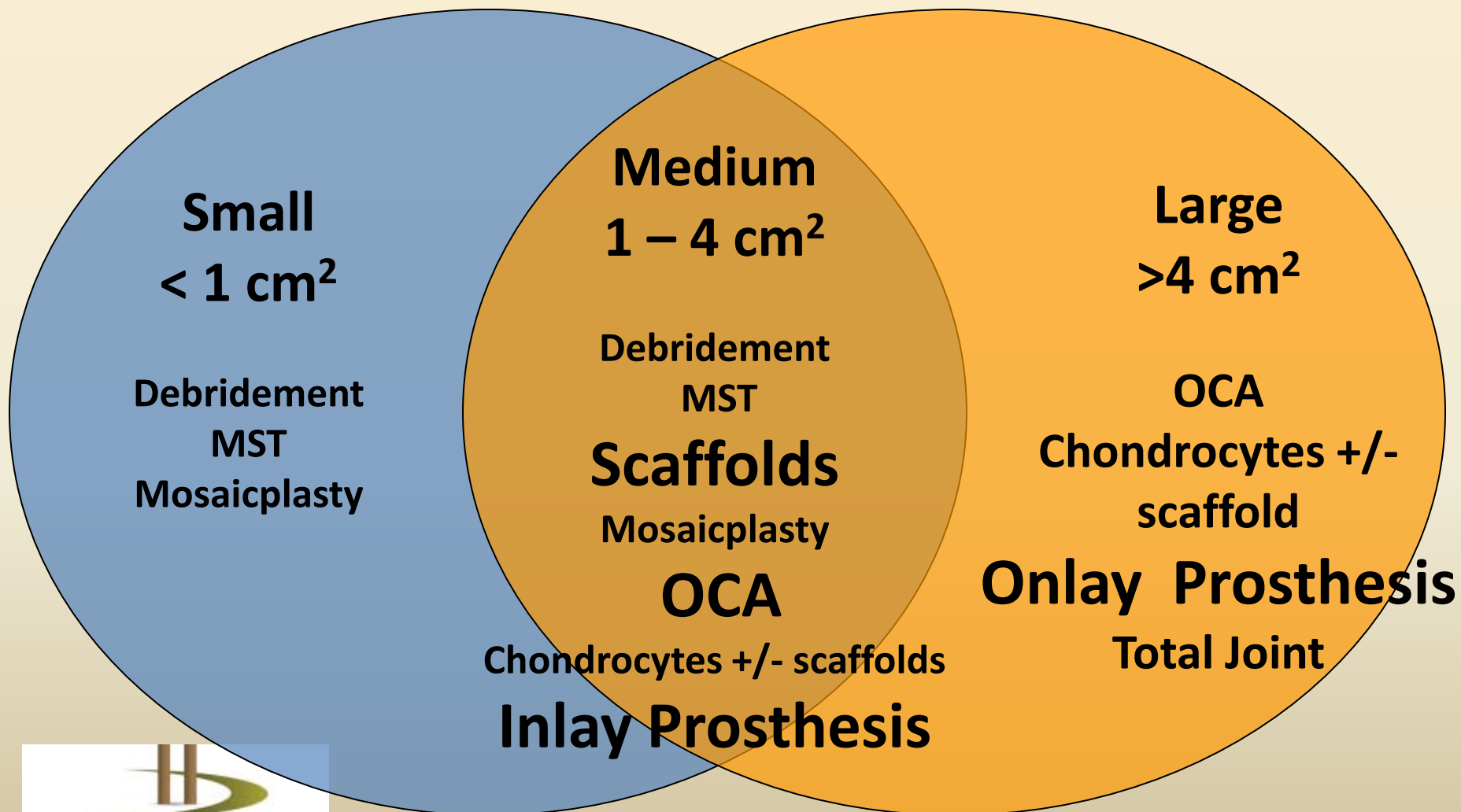
# Spectrum of Pathology

# Spectrum of Treatments

- ...solution lies in understanding comprehensive pathology and full realm of treatments



# Treatment Options for Symptomatic Cartilage +/- Bone Defects Based on **Size**

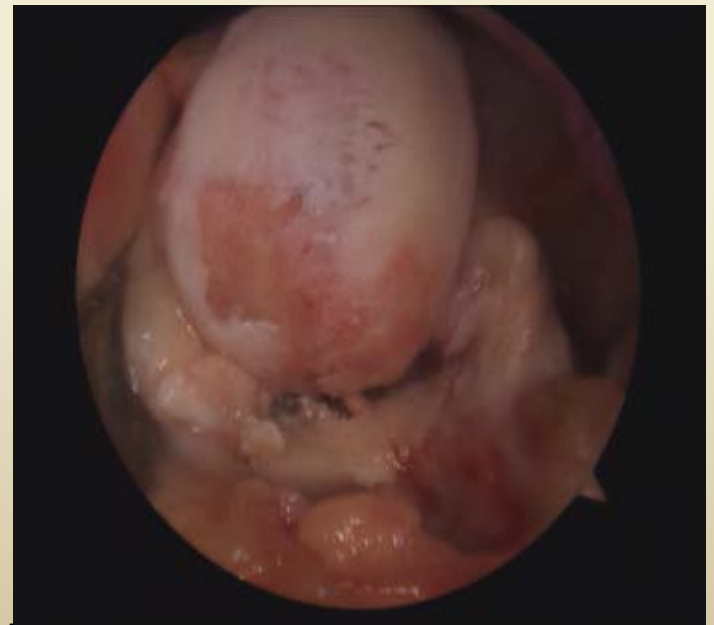
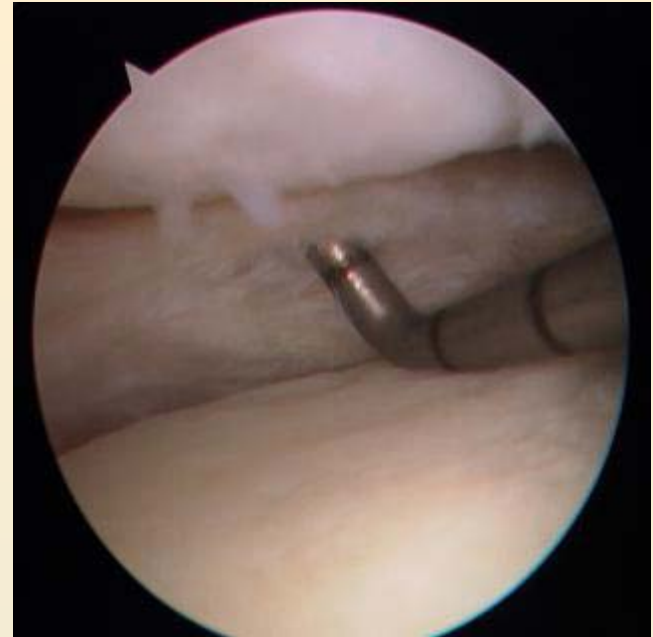


- Demand
  - Expectations
  - Job
  - Activities
  - Complicity
- Age
  - Biological, not just chronological
- Comorbidities
  - BMI
  - Diabetes
  - Smoking
  - Medical Illness



# Relevant Pathoanatomy

- Cartilage
  - Full depth loss??
  - Chondropenia
- Bone
  - Loss of bone
  - Osteopenia
- Meniscus
  - Consider degree of meniscal remnant



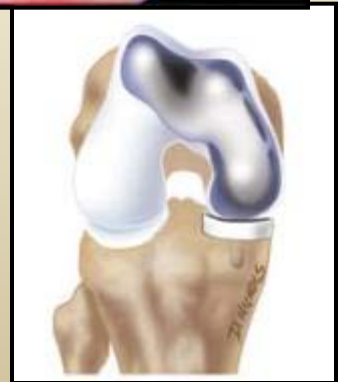
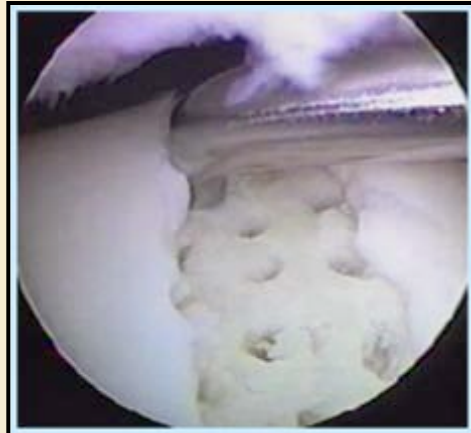
# Relevant Pathoanatomy

- Alignment
  - Exact degree of alignment critical in decision making
  - Cannot expect biological solution to work in overloaded compartment
- Stability
  - Knee must be stable



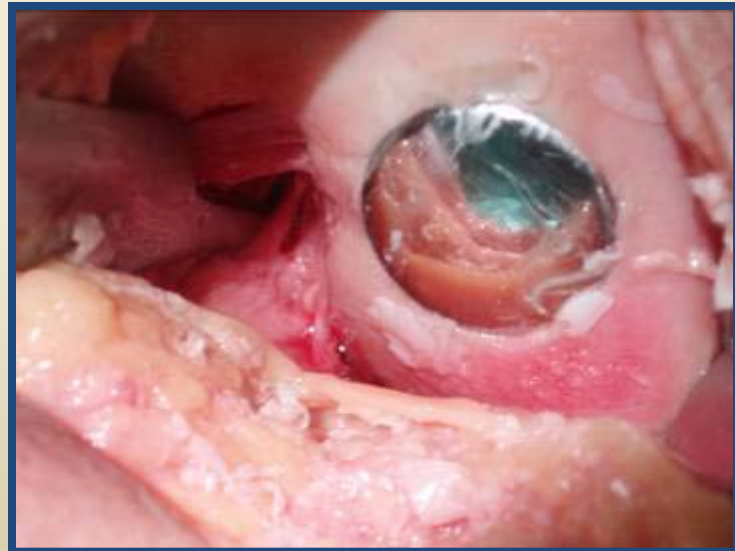
# Cartilage Restoration/Joint Resurfacing Treatments: *...an evolving continuum of options*

- Marrow stimulation
- Biological restoration
  - Mosaicplasty / OATS
  - OCA
  - Chondral Auto and Allografts
  - Bio-synthetics/scaffolds
  - Modulated therapy
  - Cellular therapy
- Joint Resurfacing
  - Polymeric/Hydrogels
  - Inlay Arthroplasty
  - Micro-invasive prostheses
  - Digitally custom onlay
  - Total Joint



# *Transitional Thinking about treatments...*

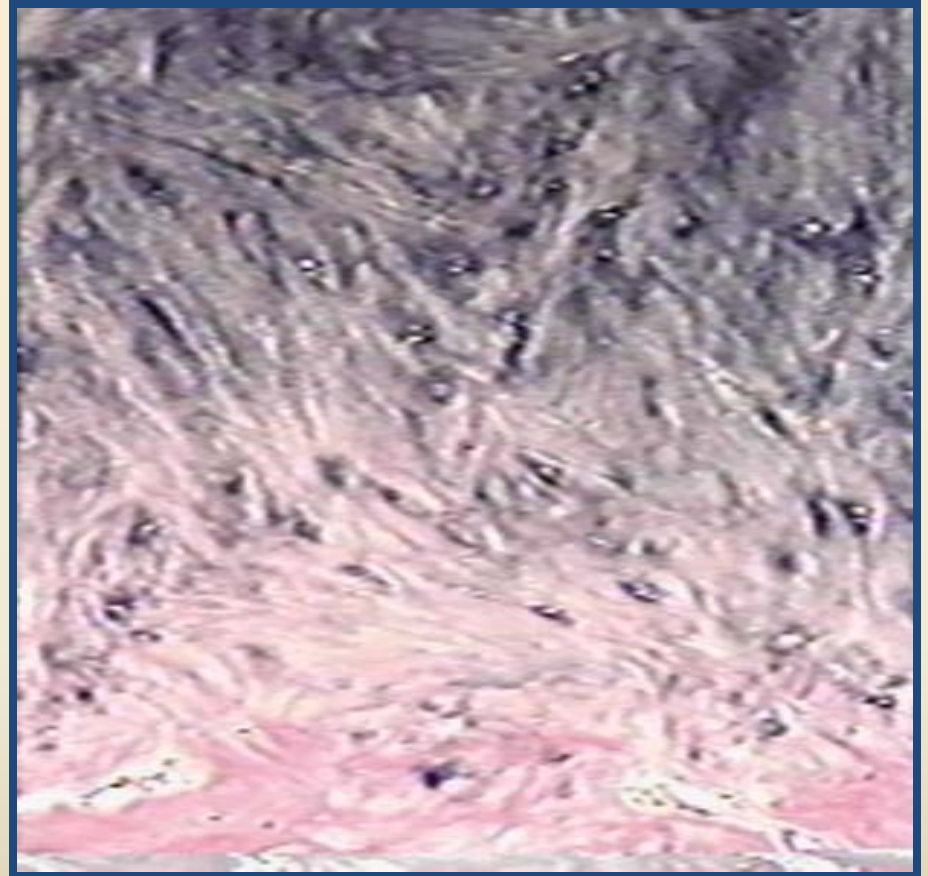
- As lesions get larger....
  - Need bulk restoration
- As patients get older.....
  - Go from biologic to prosthetic solutions
- Constant incorporation of new options with these principals in mind





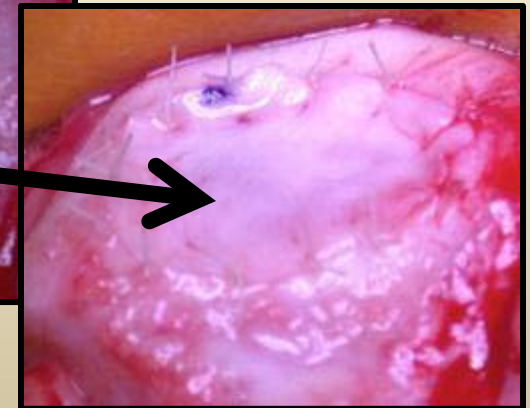
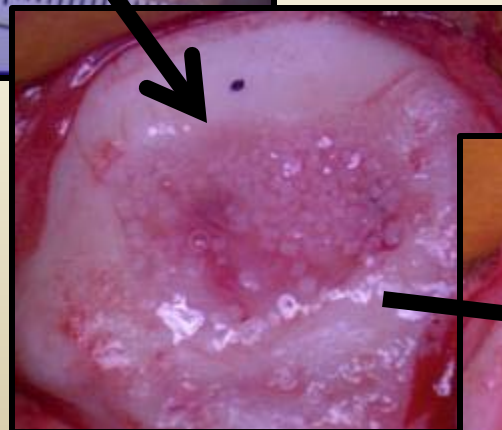
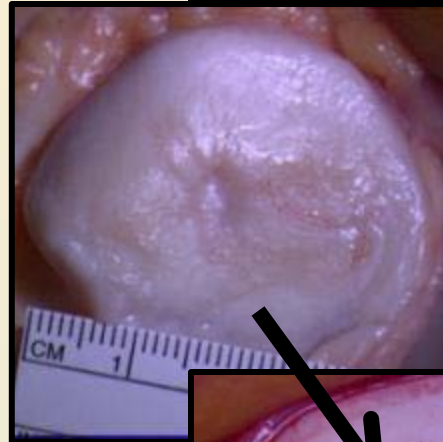
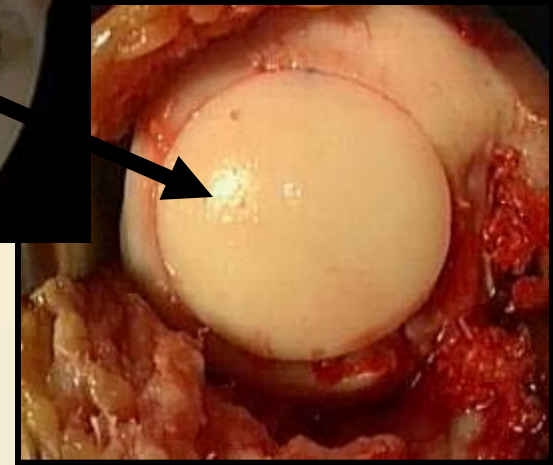
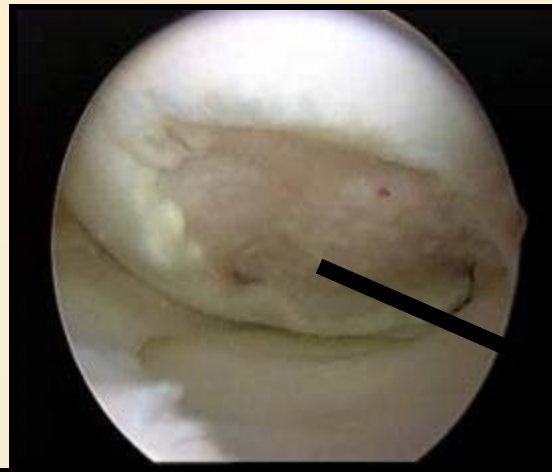
# Marrow Stimulation

- Techniques
  - Drilling
  - Picking
  - Abrasion
  - Microfracture
- Marrow stimulation results:
  - Fibrocartilage
- Limited potential with increased age, injury chronicity
- Cheap, fast, easy
  - Short term efficacy seductive.



# Biological Options

- Autologous Chondrocytes
  - ACI
  - MACI
- Osteochondral Grafts
  - Autogenous
  - Allogeneic
- Chondral grafts
- Biologically Active Scaffolds

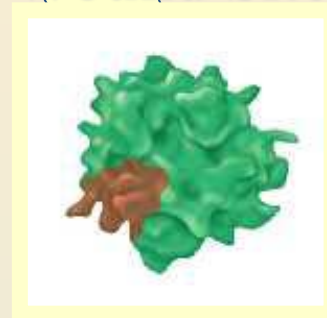


# What is needed for scaffold to be effective ?

**Scaffolds:**  
**Orthobiologic Implant**



**Stimulants:**  
**Wound Site**



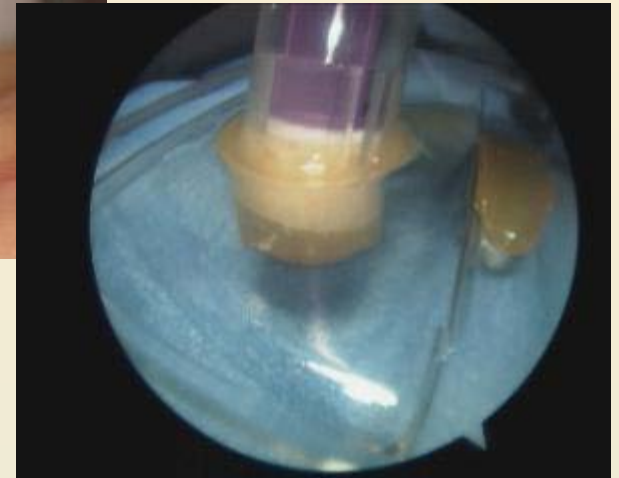
*Surgical  
Technique +  
Rehab*

**Cells:Patient**



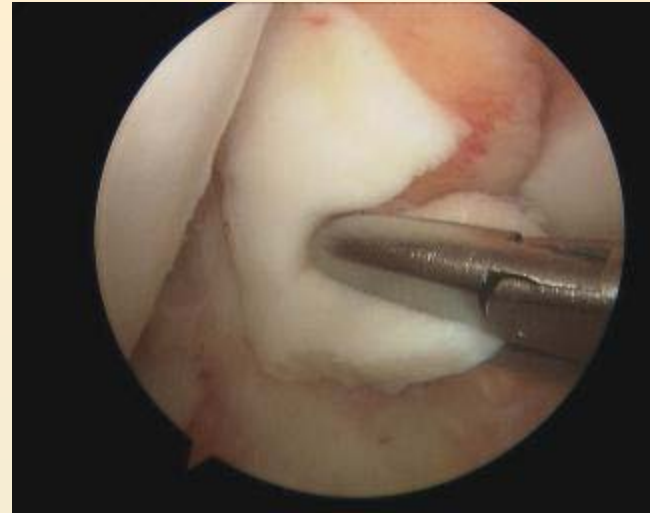
# Where does orthobiologic osteochondral scaffold fit in?

- Off the shelf alternative theoretically better than microfracture
- Less morbidity than mosaicplasty
- Fill donor sites mosaicplasty
- No allograft donor issues
- Smaller type defects
  - < appx 2cm

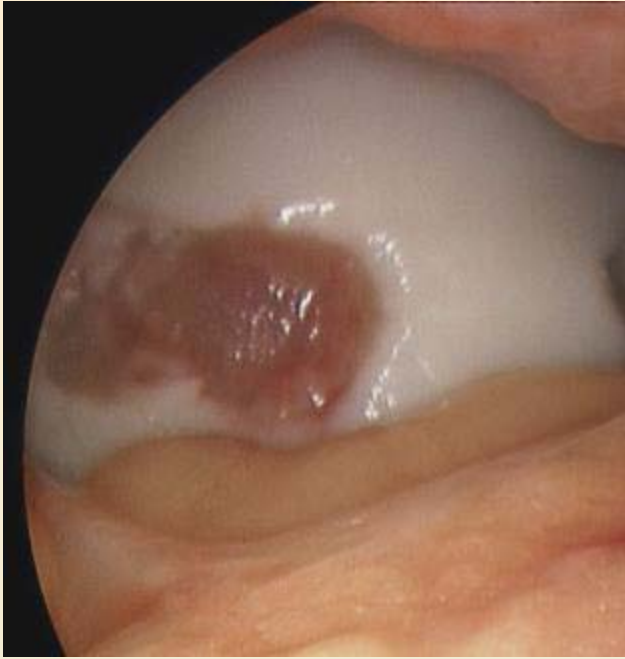


# Illustrative Case

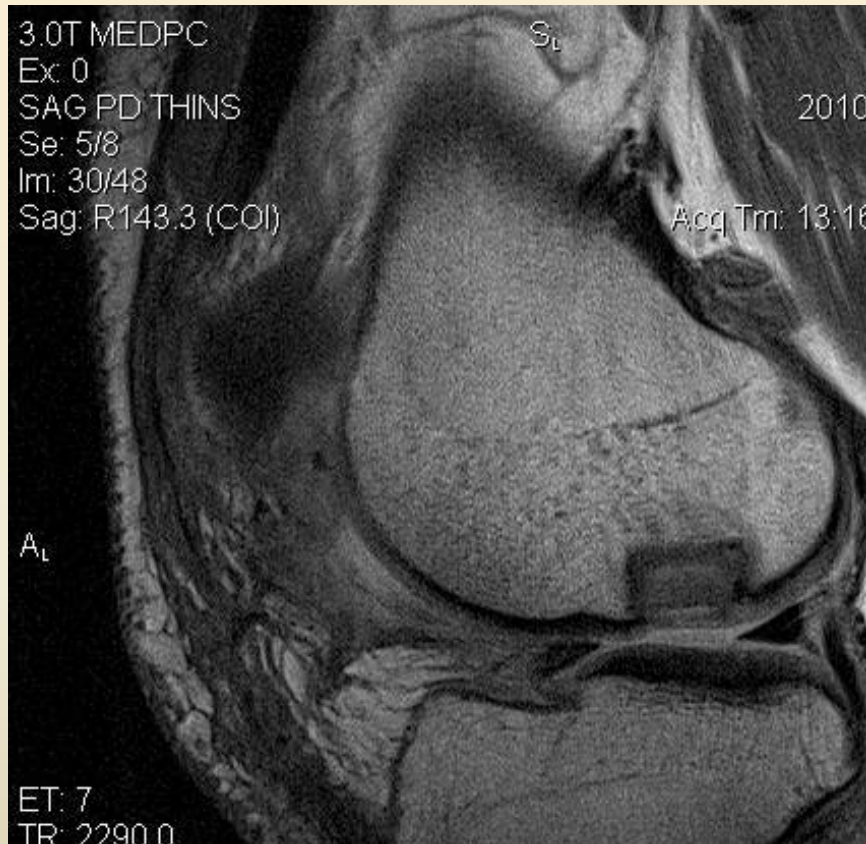
- 22 yr old truck driver
- Traumatic patellar dislocation while fastening load



# Intraoperative photos



# Post Op MRI 17 mos



# Davidson Series

- F-U > 2 years
- Sequential patients enrolled
- IRB approved
- Inclusion- full thickness defects, consented patients
- Lesions < 20 mm
- Failures defined by revision “cartilage” procedure



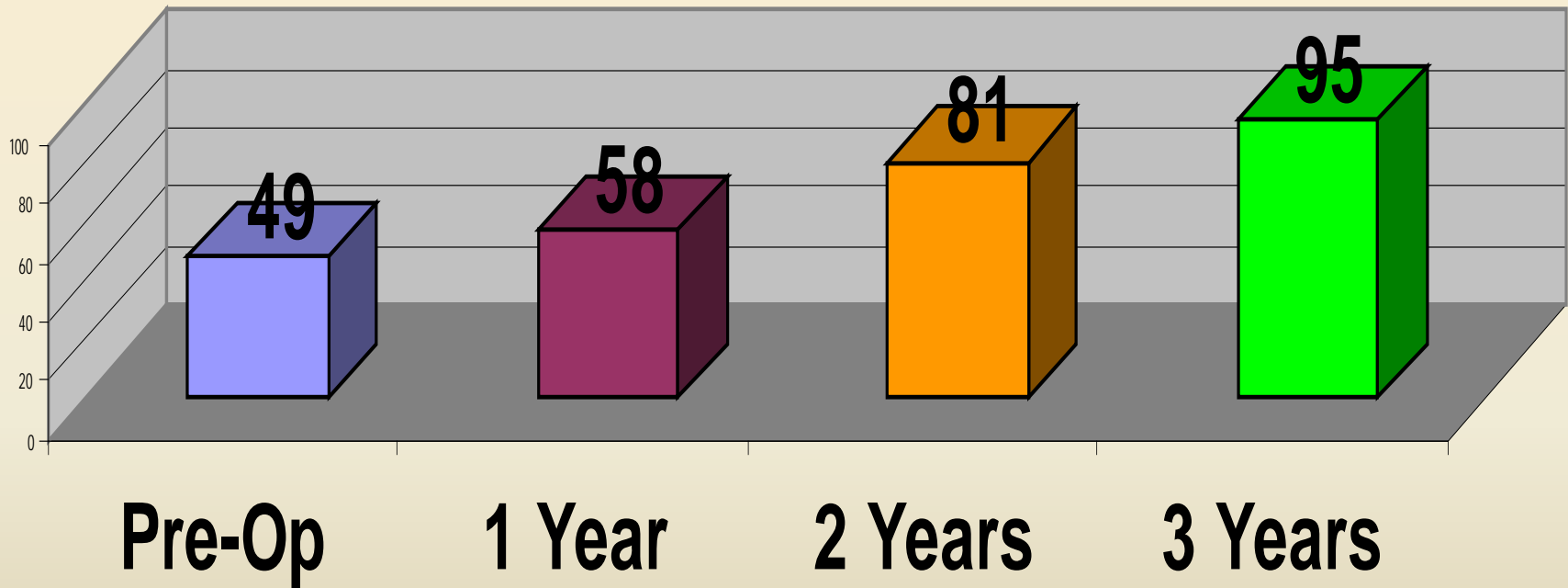


# Davidson Series - Knee *Articular* Grafts

## *Patient Demographics*

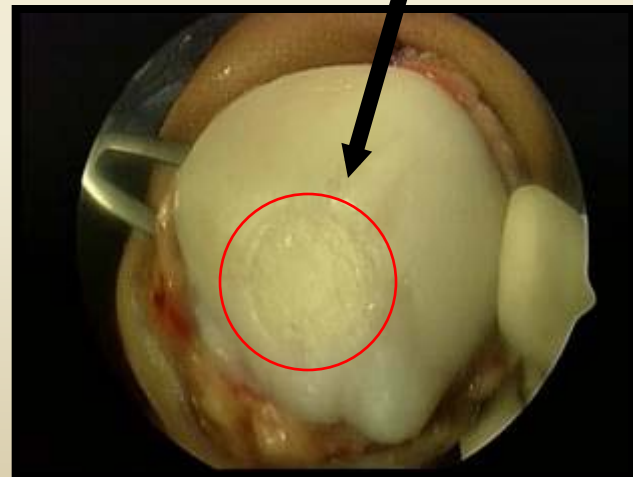
- Patients: 30
- Age : Mean 40yrs.
  - Range : 20 – 59
- Sex
  - Females - 14
  - Males - 16
- Grafts – 48
  - Mean – 1.8
  - Range 1 to 4
- Size Mean – 1.7 cm<sup>2</sup>
  - Range 0.7 to 5.7 cm<sup>2</sup>
- Placement
  - MFC – 14
  - LFC – 5
  - FTG – 11
  - Patella – 4
- Mean BMI was 30 (range 21 to 53).
- Follow Up: Mean 18 months (range 6 to 48 months)

# KOOS Mean Pain Score



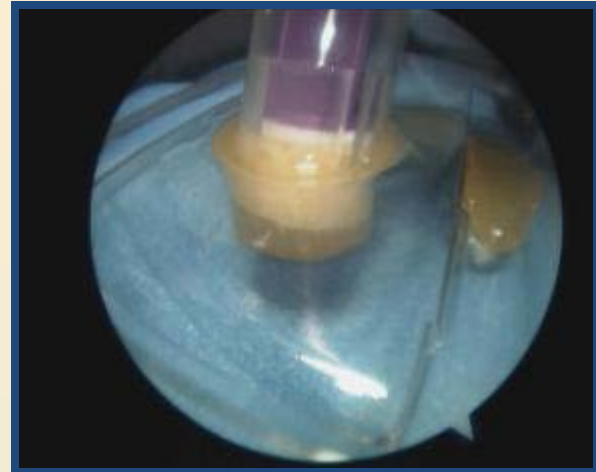
# Rehabilitation

- Protected weight bearing 6 weeks
  - Med + Lat FC
  - Full WB PF
- Early full motion
- CPM when possible
- Return to light work- 6-12 weeks
- MMI appx 4-5 mos



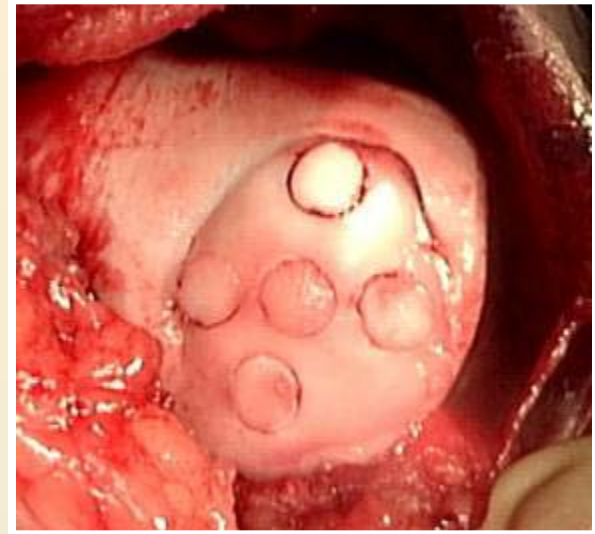
# Current Study – Scaffold for Articular Cartilage Defects

- FDA trial “EAGLE “
- Scaffold vs. Microfx
- RCT (randomized controlled trial)
- Principal Investigator
- Validated outcome tools
- Post Op MRI
- WC patients eligible



# Osteochondral Grafts - Auto vs. Allo

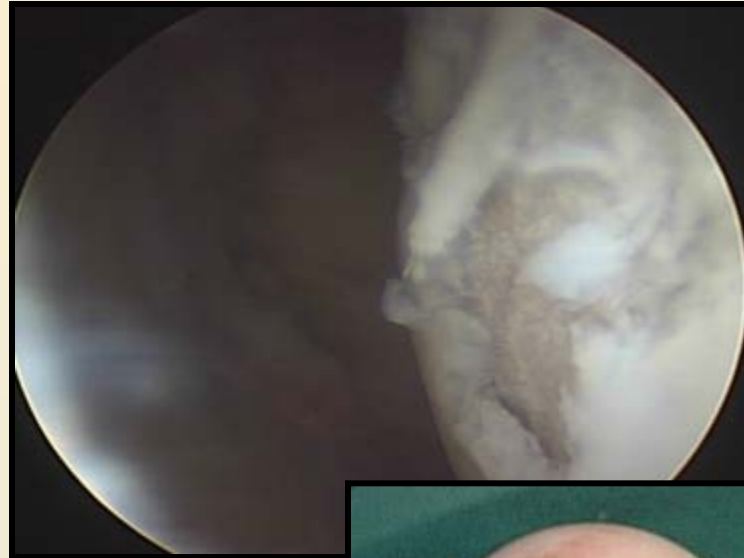
- Autograft (OATS)
  - No donor needed
  - Limited availability
  - Small lesions only
  - Repair OCD
- Allograft (OCA)
  - Very effective
  - Young patients
  - Handle Bone loss
  - Larger lesions
    - Generally  $> 2 \text{ cm}^2$



# Resurfacing Treatment Options

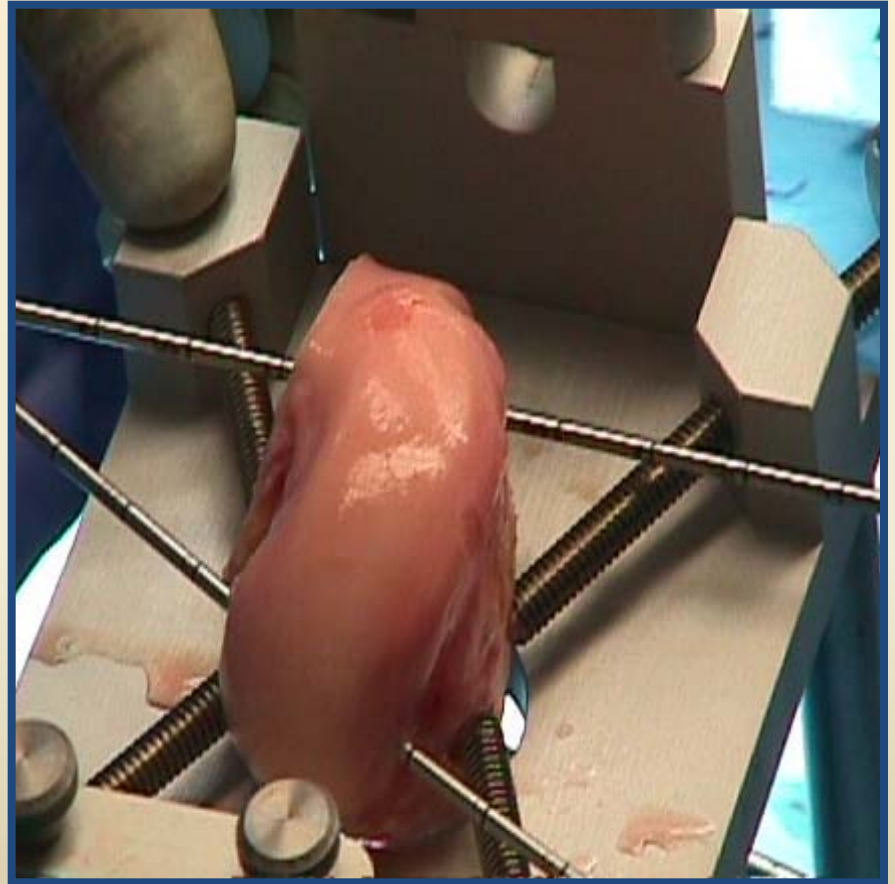
## OCA

- Larger defects
- Can handle bone loss
- Young patients
- Open procedure



# OCA– Relative Indications

- Larger Defects (>2 cm sq)
- Deeper defects
- Bone loss
- Patellofemoral
- Younger Patients
- OCD
- No diffuse DJD



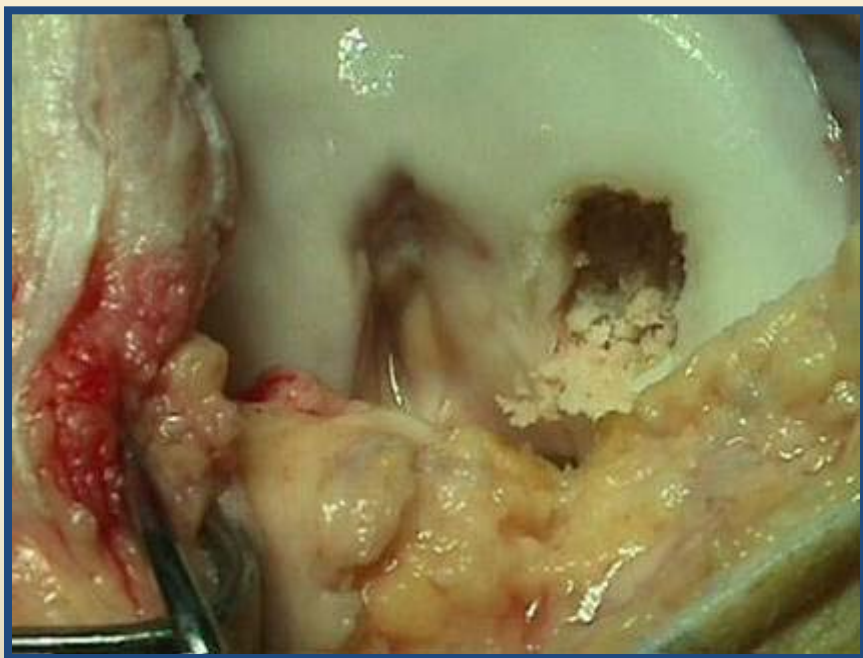
# OCA donor tissue

- Fresh, or now only Fresh Stored
- Microbial Surveillance
- Donor Testing/Screening
- Limited Availability
- Expensive
- No game day decisions
- No rejection or anti-rejection drugs
- VERY differentiated surgeon access

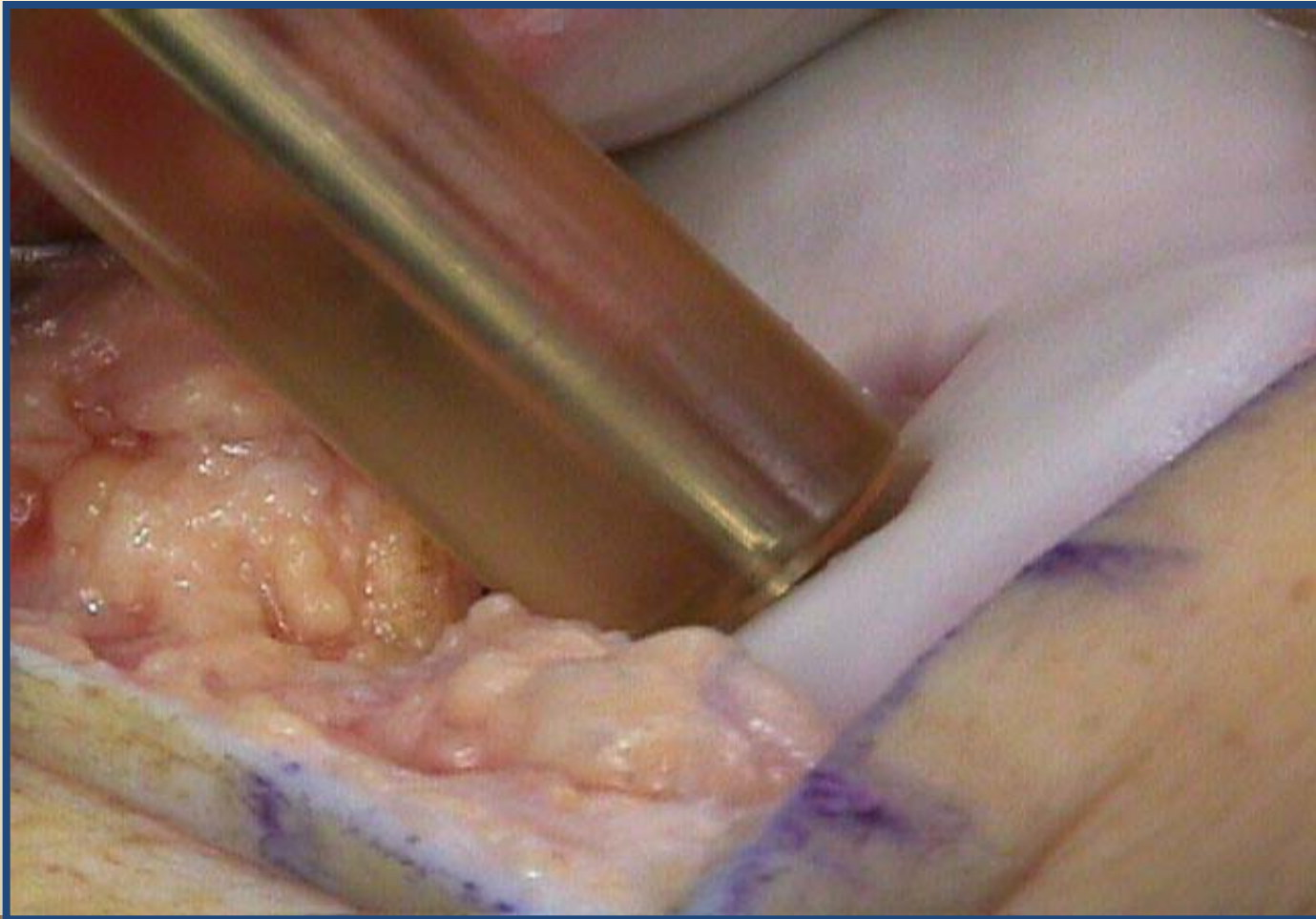




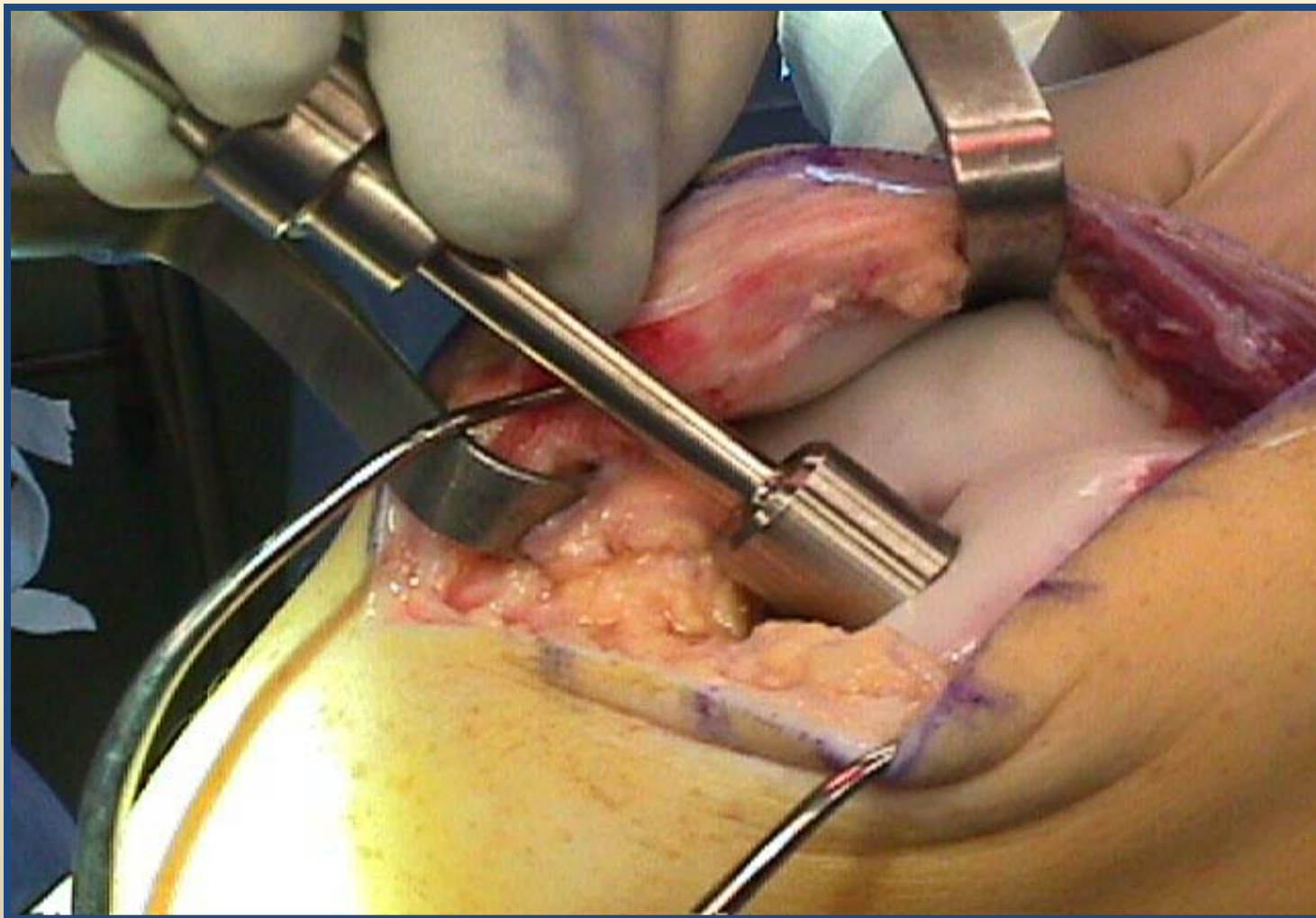
# OCA - Procedure



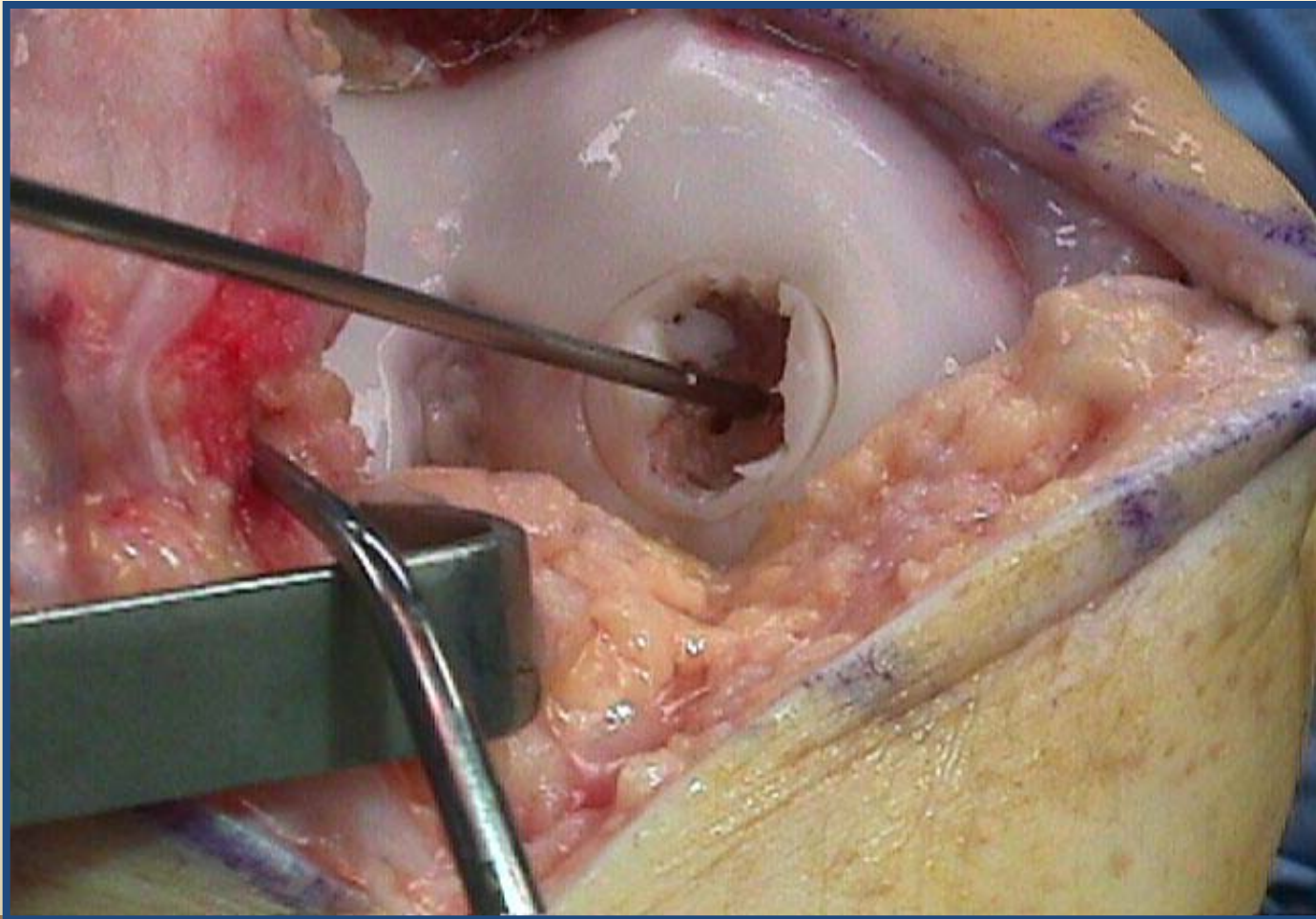
# OCA - Procedure



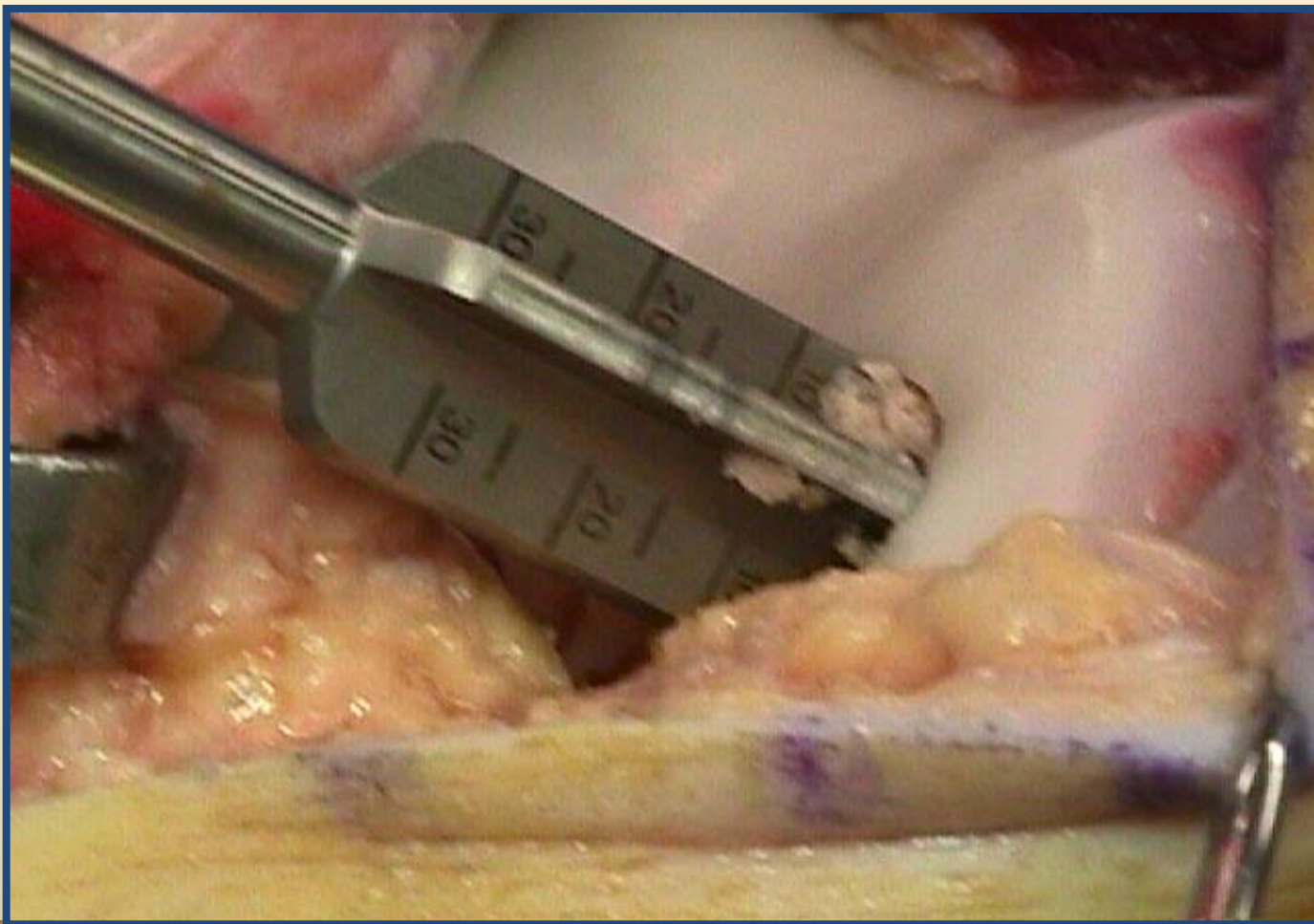
# OCA - Procedure



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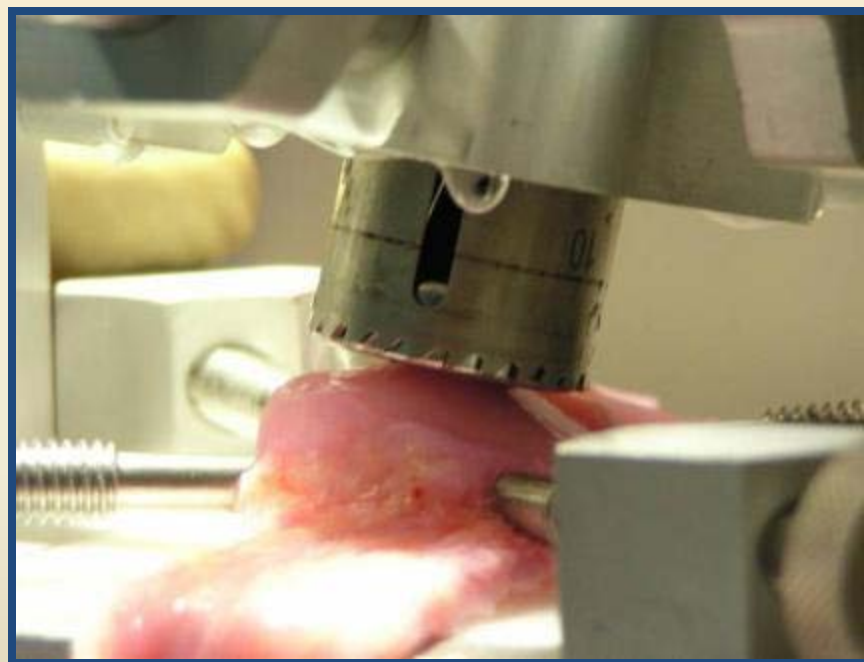
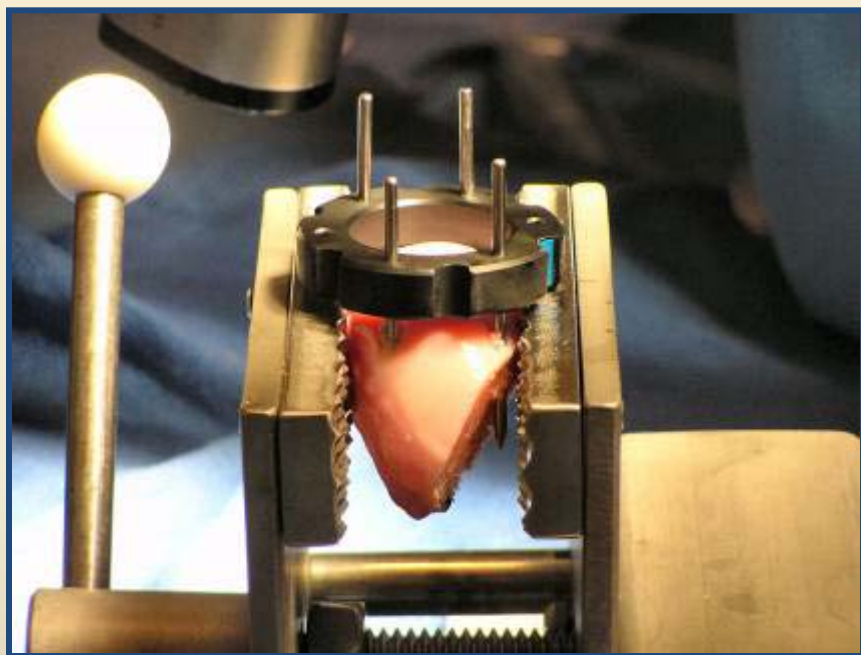
# OCA - Procedure



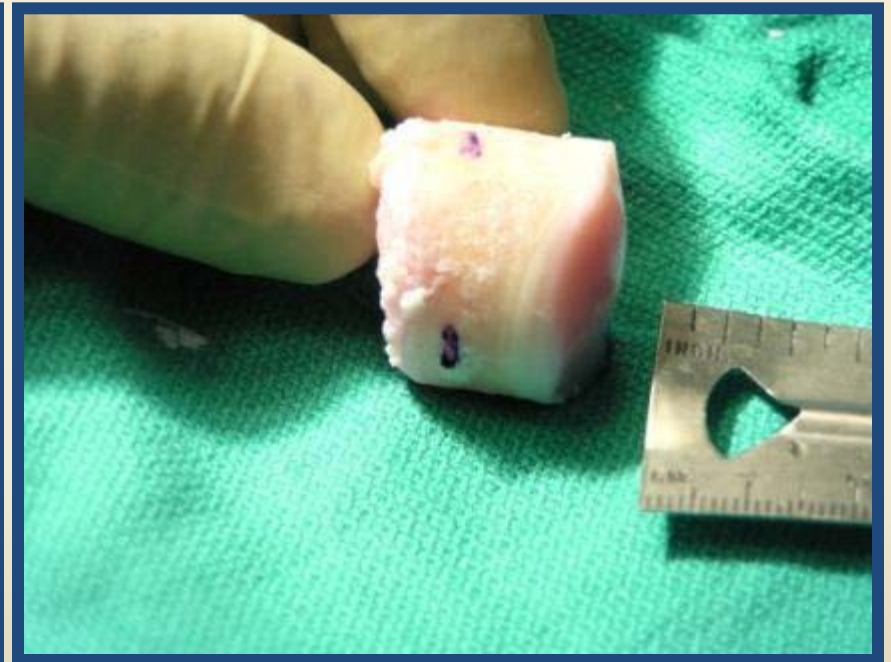
# OCA - Procedure



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# OCA - Procedure

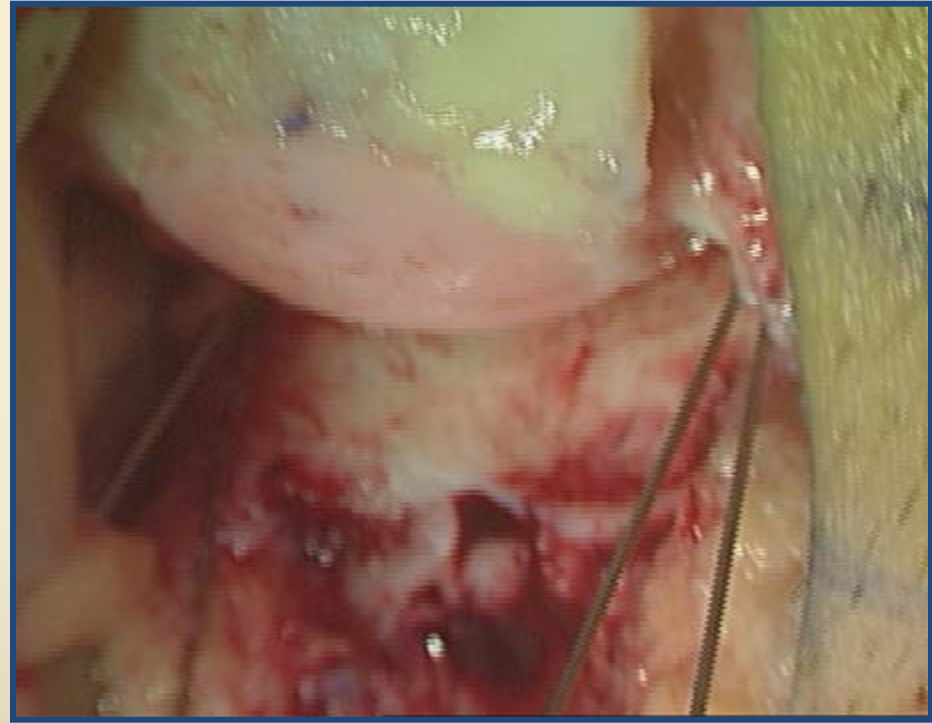
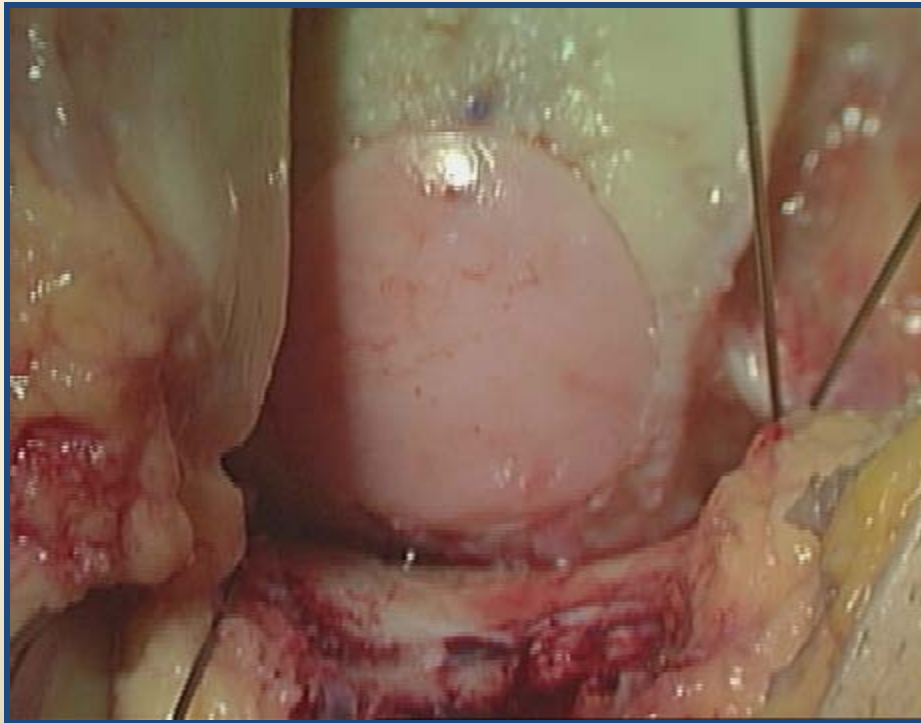




# OCA - Procedure

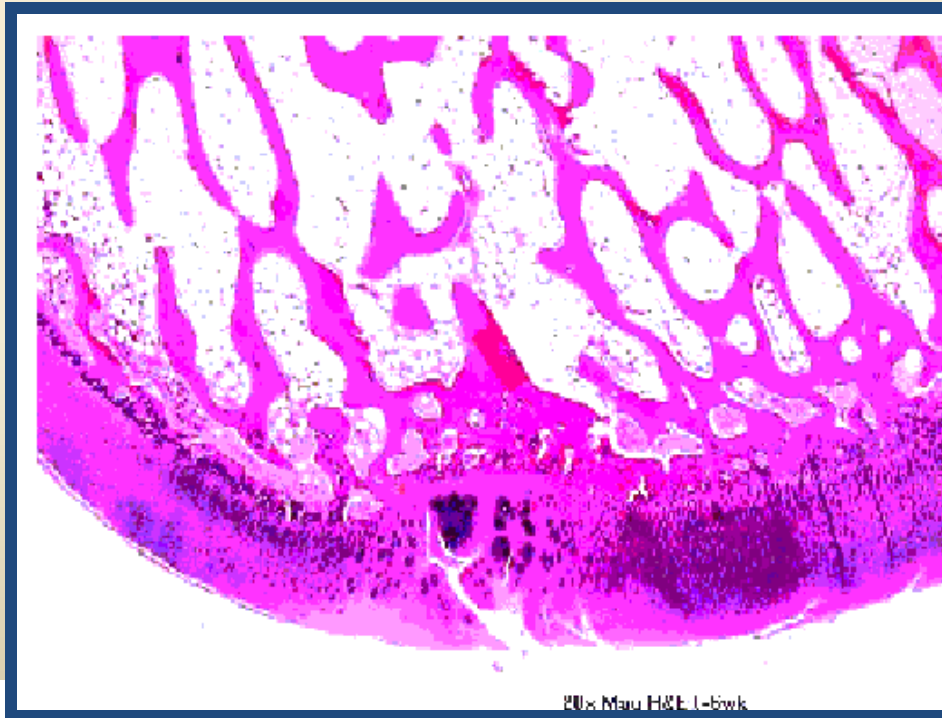


# OCA - Procedure

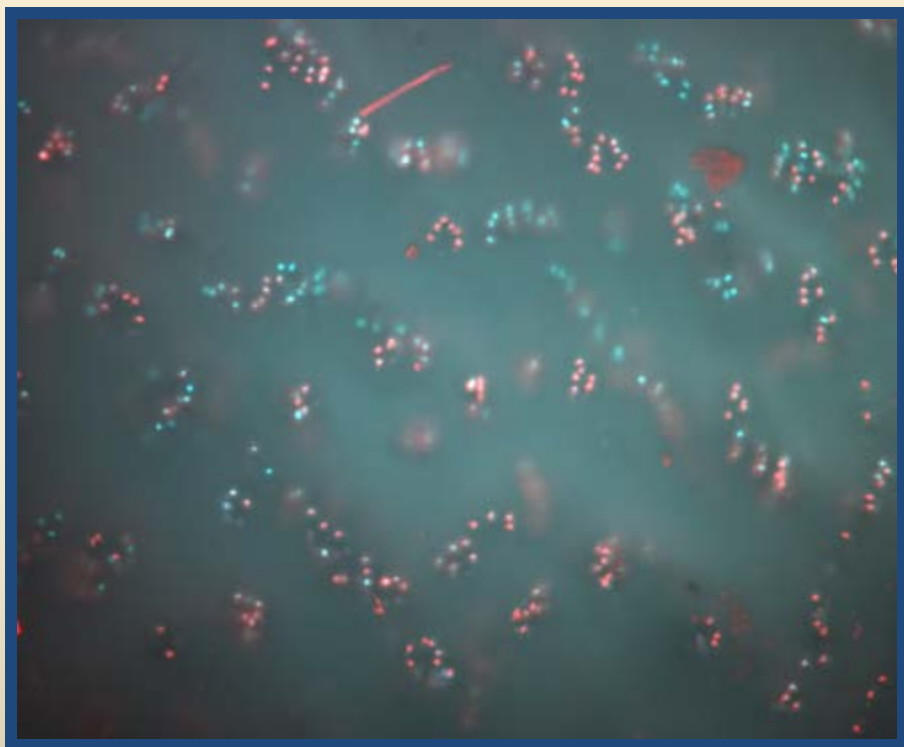


# Two-Year Clinical, Histologic and Radiographic Outcomes of Distal Femoral Resurfacing with Fresh-Stored Osteoarticular Allografts

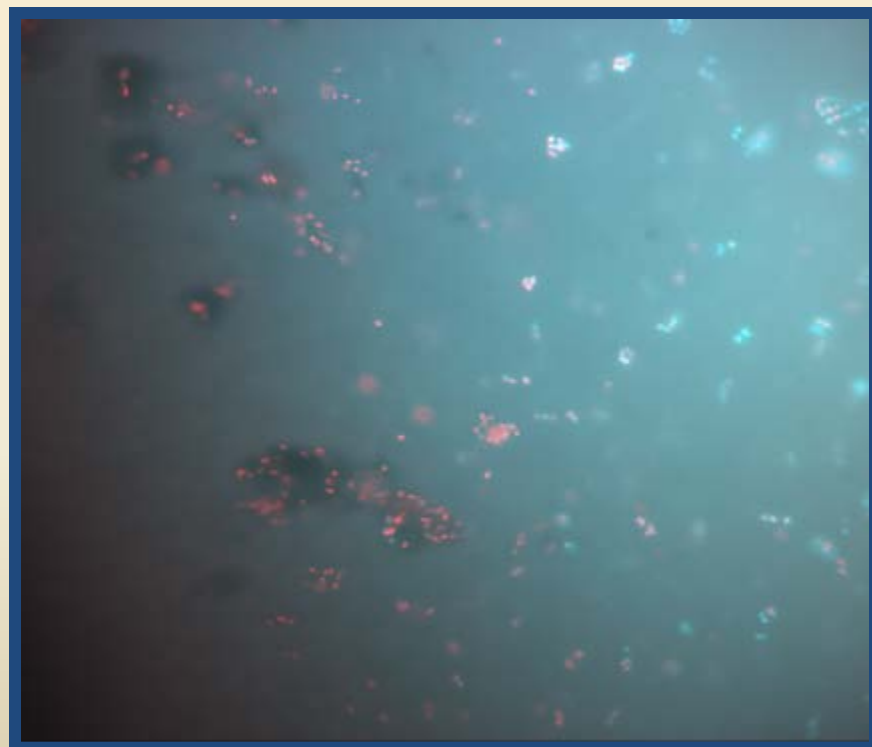
Davidson,PA; Rivenburgh, DW; Dawson,P; Rozin, R.  
Am J Sports Med July 2007 Vol. 35 p. 1082-1091.



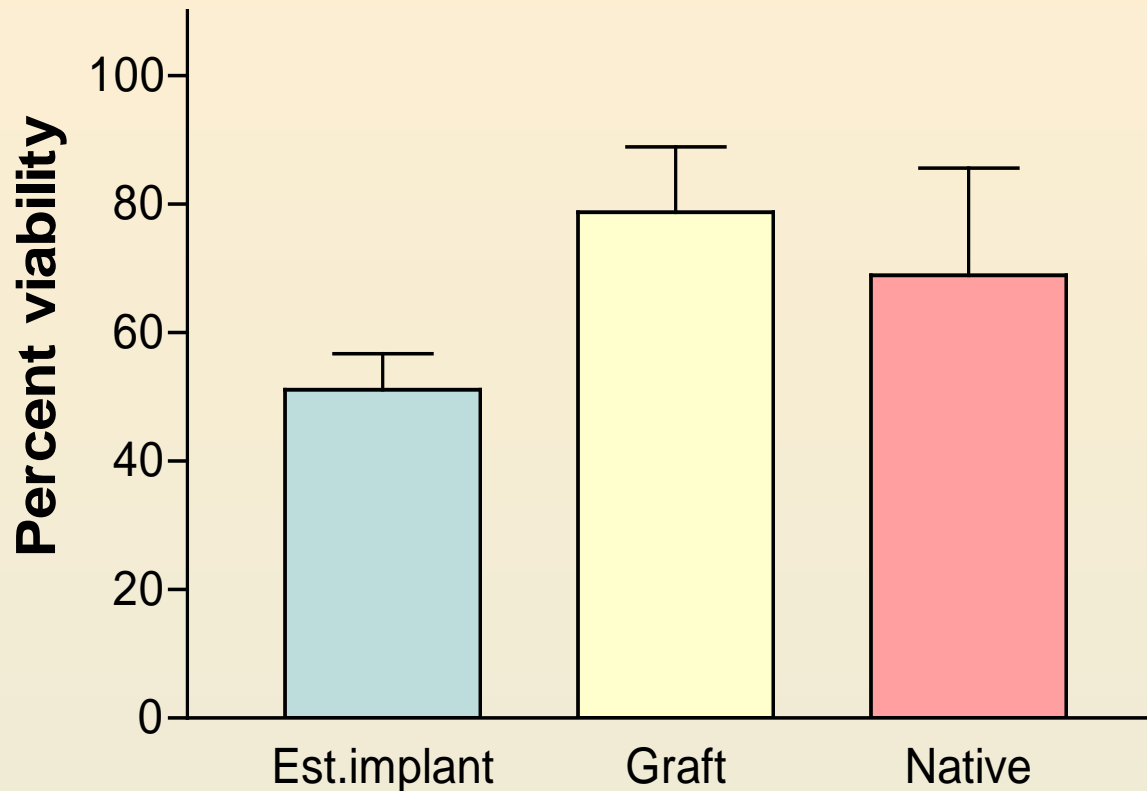
**Patient E.– Native cartilage  
Approximately 67% Viable**



**Patient E. – Graft cartilage  
Approximately 76% Viable**



# Davidson OA Biopsy Study



Implants were performed at a mean of 32 days post-asystole

Biopsies were taken at a mean of 34 months post-implant

- Estimated original graft viability
- Graft viability at biopsy
- Native viability at biopsy

# Results: IKDC Scores

- 0-100 point system
- Pre-op mean: 41 (range 27-62)
- Post-op mean: 88 (range 61-97)



# PRP- platelet rich plasma

## *“Supercharged healing”*

- Concentrate healing elements from own blood – Growth factors
- Can create variety of forms, liquid, gel, membrane to facilitate biologic healing of surgical repairs
- ACL reconstruction, Meniscal repair, Rotator Cuff Repair



# Torn Ligament (ACL seen here)





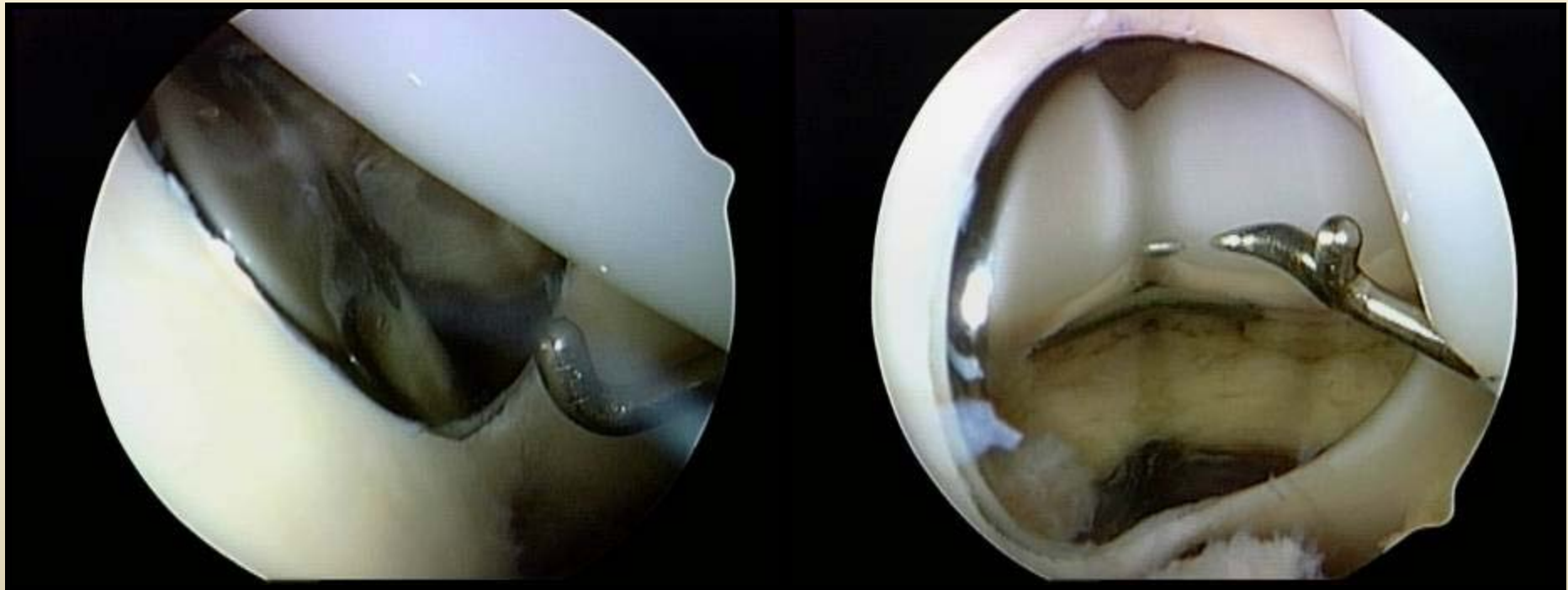
# Biological ACL Surgery

- Graft, incorporates allograft , autograft and PRP
- Allograft gives large amount of collagen
- Autograft, gracilis
  - Promotes healing
  - Very small, not missed



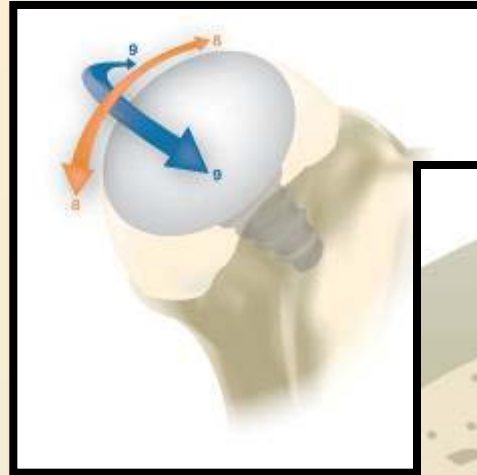
What if biologics will not or cannot work?  
...defect too large, no longer “young”, obese, smoking,  
diabetic, Joint “out of round”, non-compliant . Etc.....

## ***Inlay Prostheses***

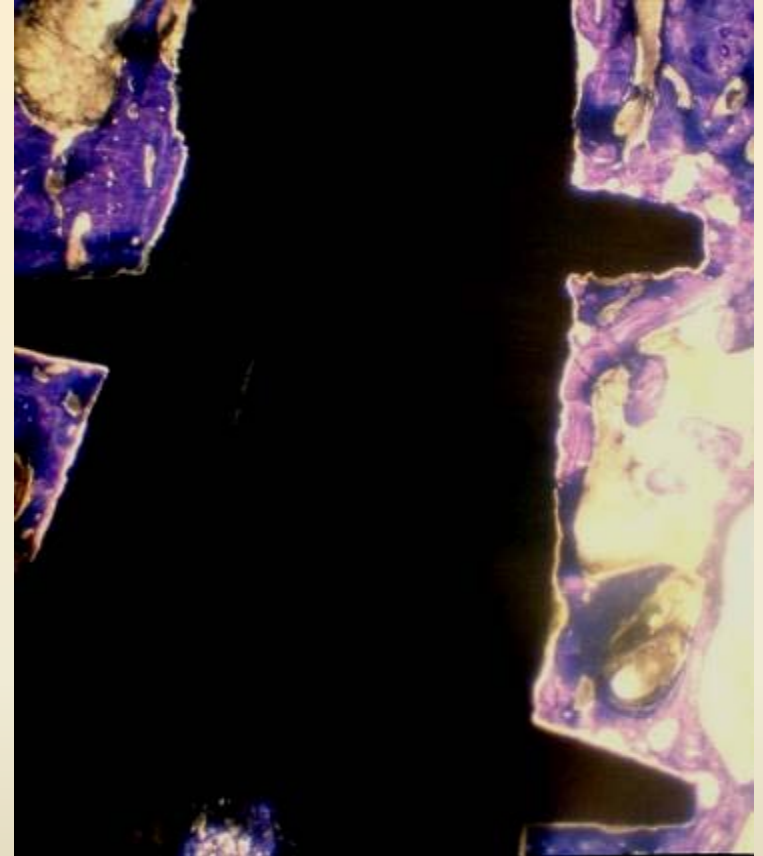


# *A new paradigm for joint resurfacing*

- Geometry based on patient's native anatomy
- Intraoperative joint mapping
- Account for complex asymmetrical geometry
- Extension of biological resurfacing

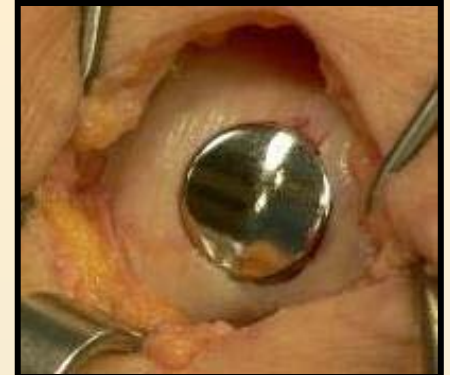


# Inlay Resurfacing

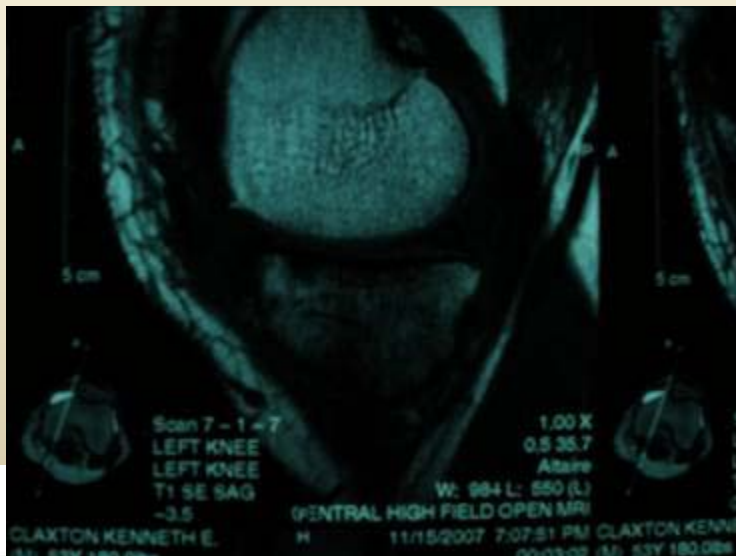
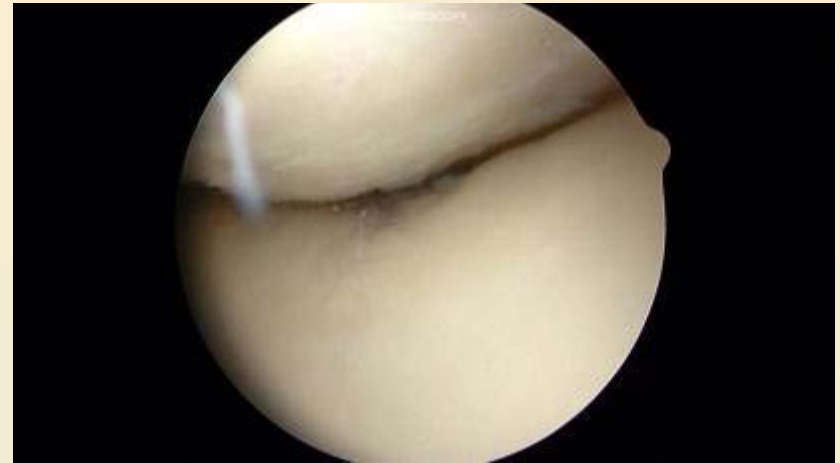
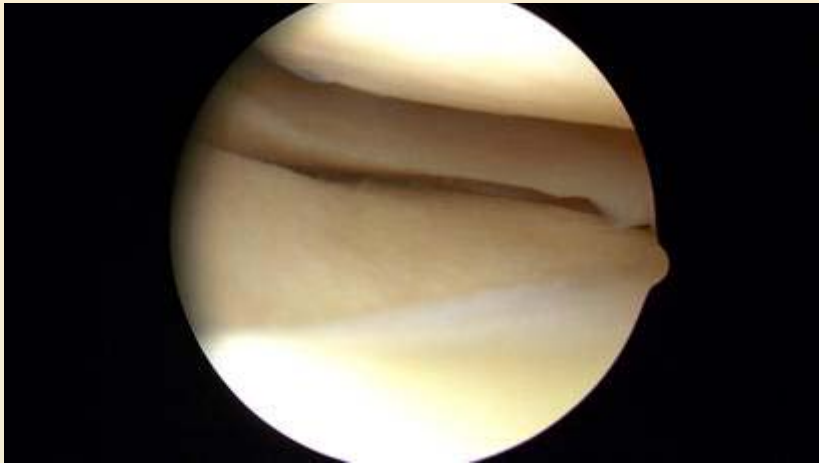


# Knee Inlay Implants

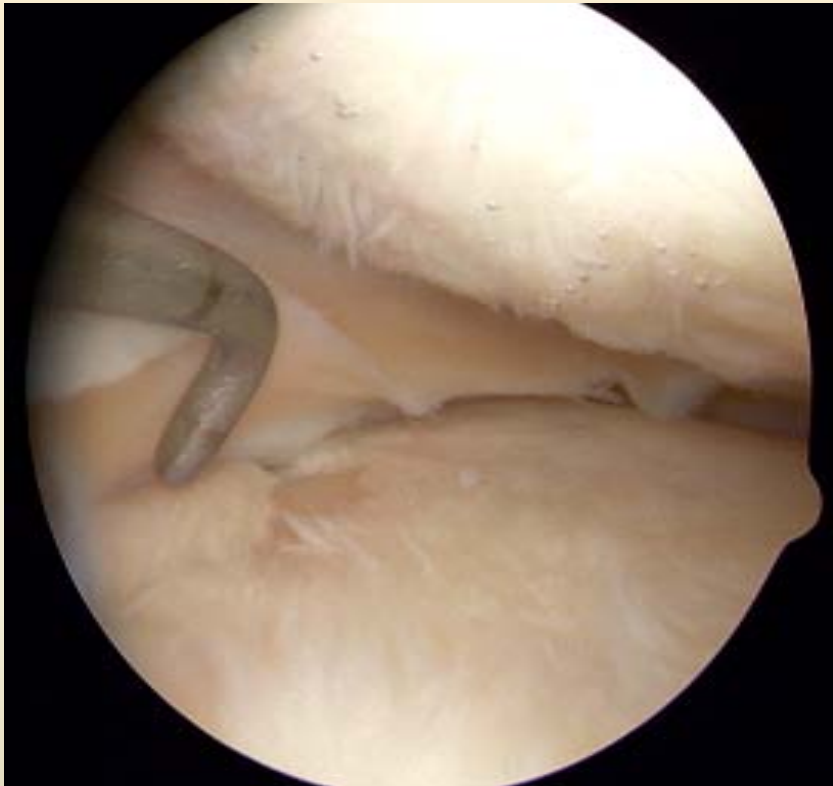
- HemiCAP
  - small unipolar knee
- UniCAP
  - Medial and Lateral
  - Includes Tibial Inlay
- PF HemiCAP
  - Regular & XLT“wave”



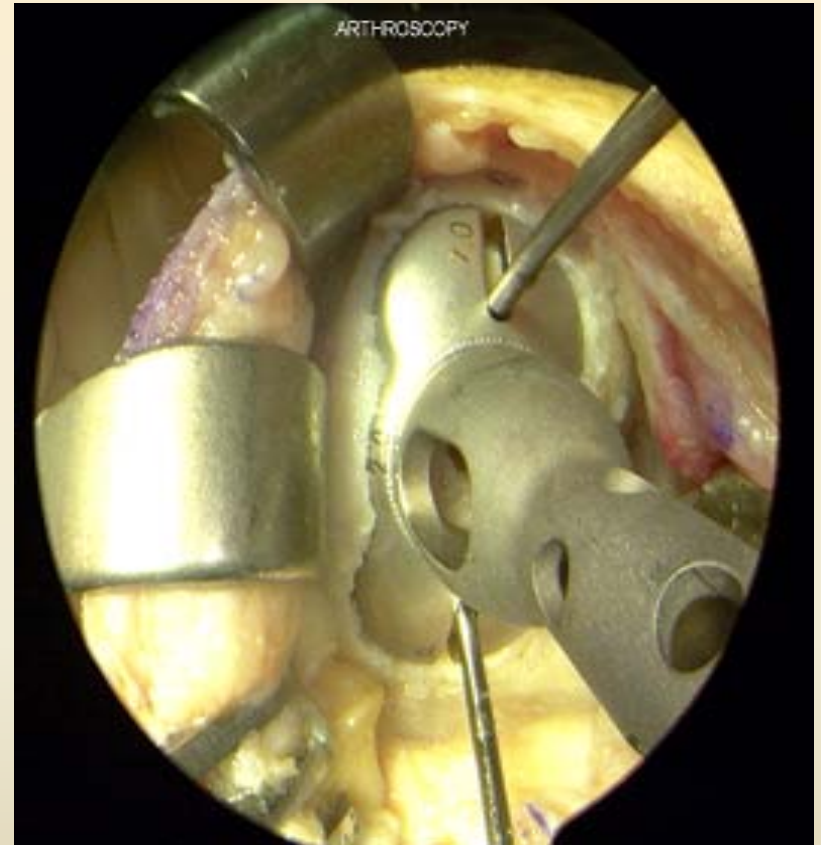
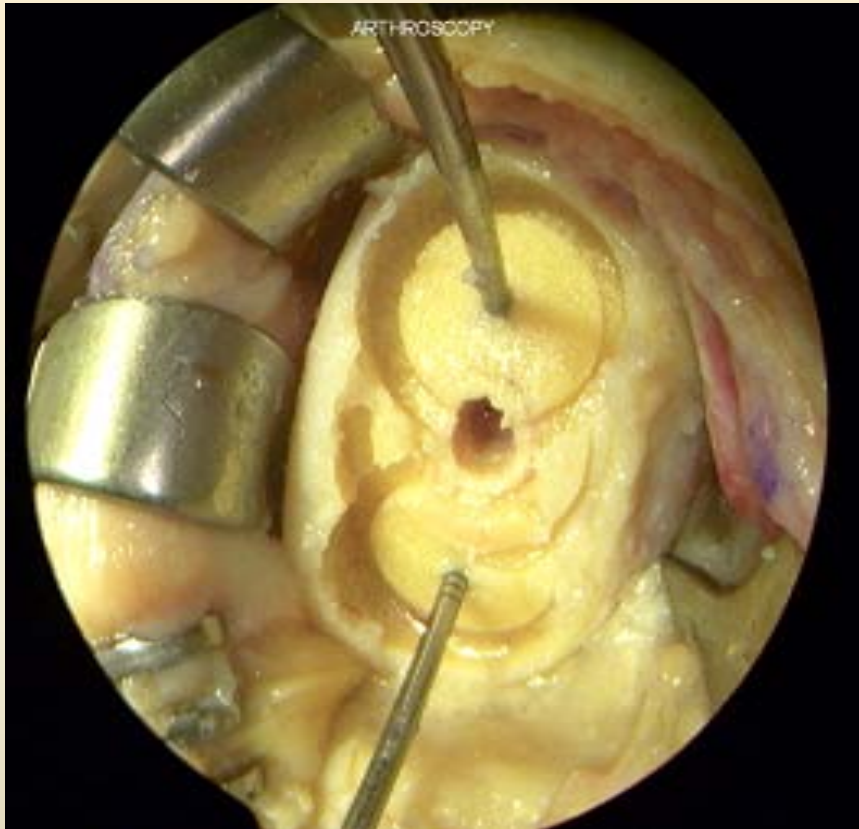
# Inlay resurfacing – medial knee 46 year old construction worker



# Inlay – medial knee resurfacing



# UniCAP – medial knee resurfacing





# UniCAP – medial knee resurfacing



# UniCAP – medial knee resurfacing



# UniCAP – medial knee resurfacing



# Patellofemoral Resurfacing



# Radiographs

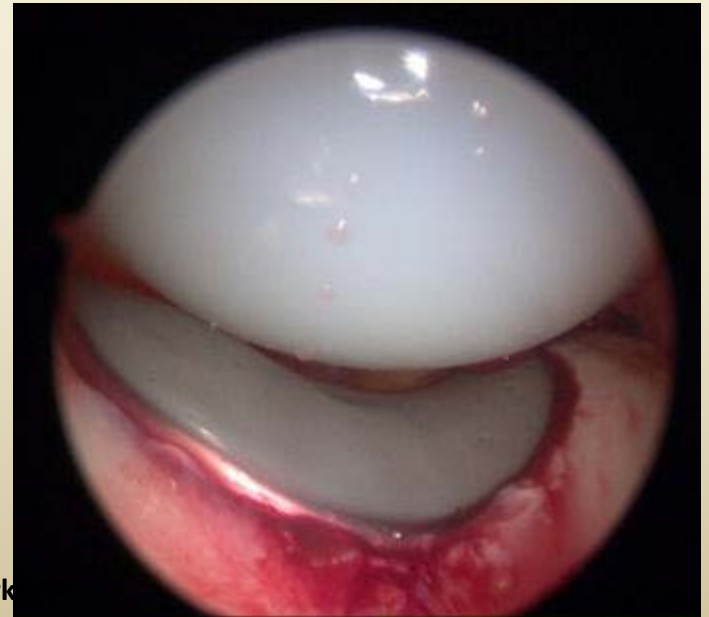


# Post op – 6 days



# 50 year old day care worker

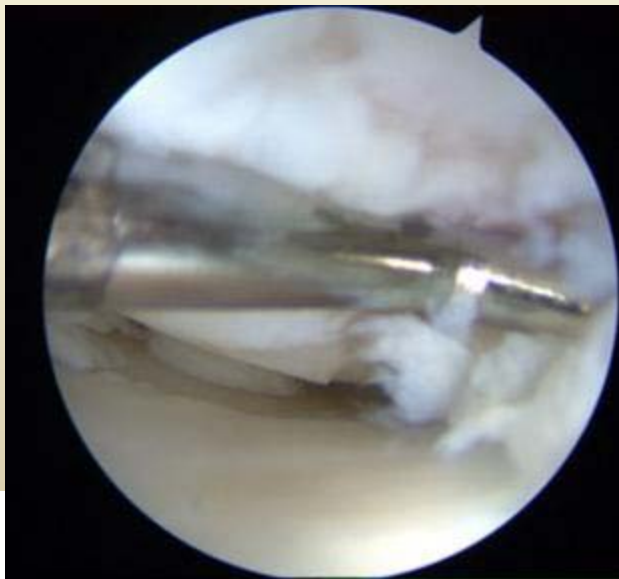
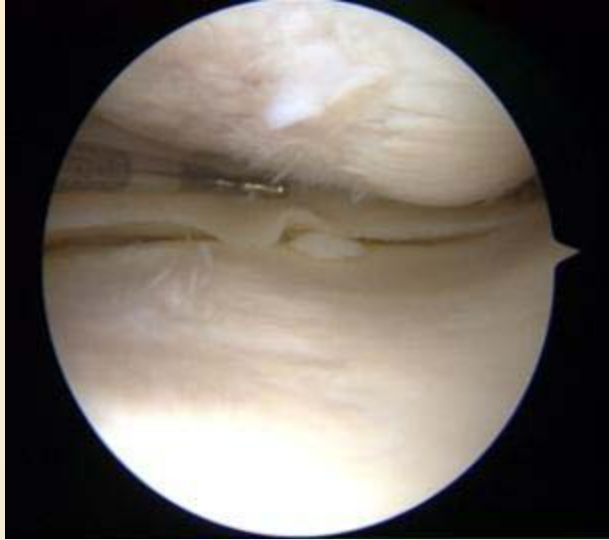


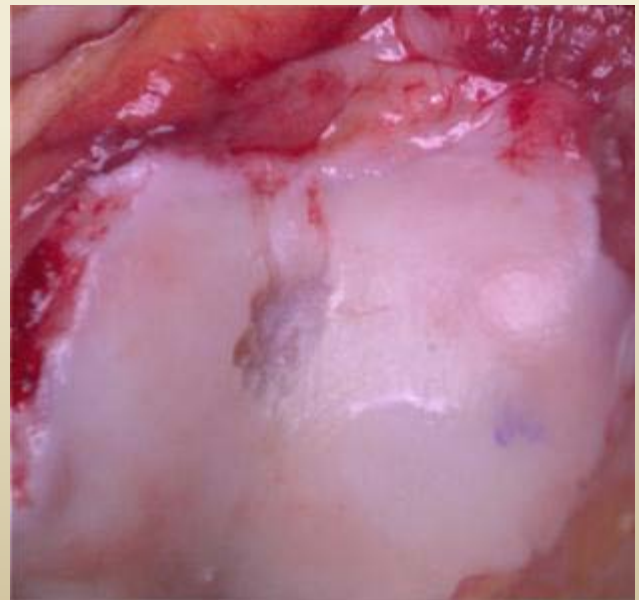


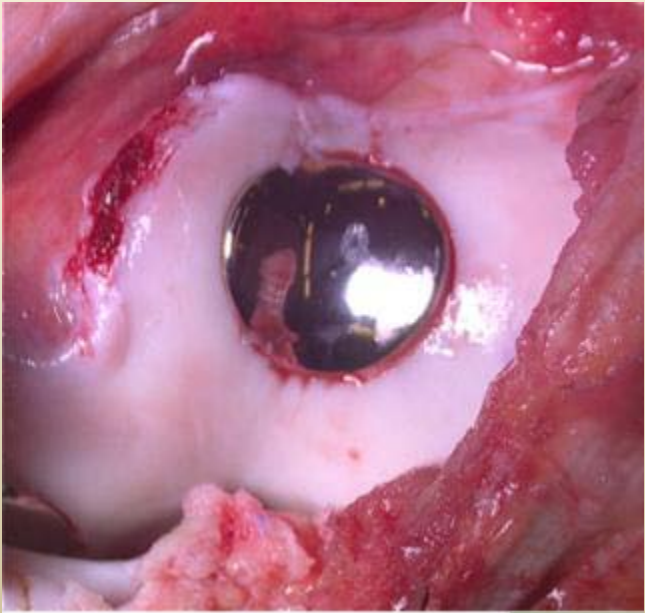
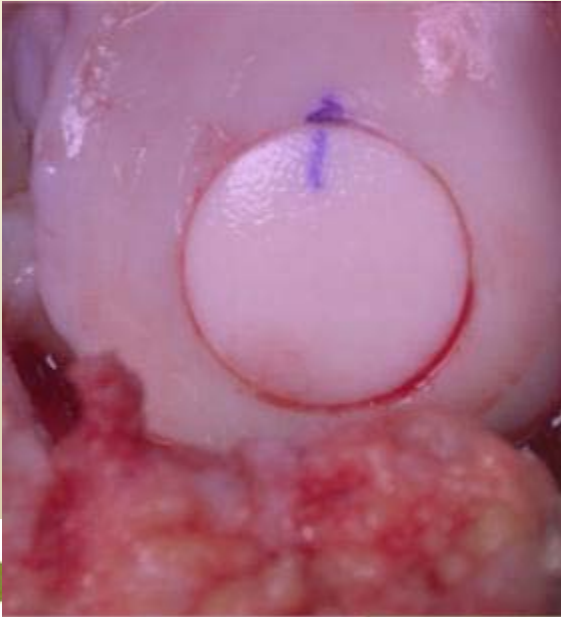


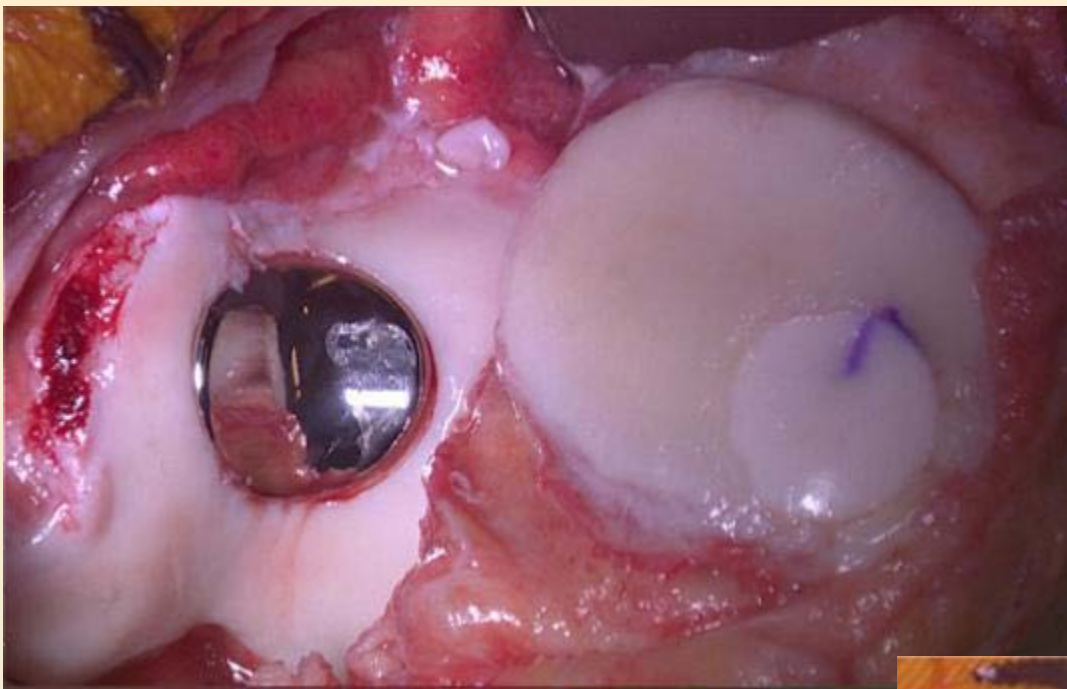
# Combining Biologics with Inlay Arthroplasty

29 year old firefighter

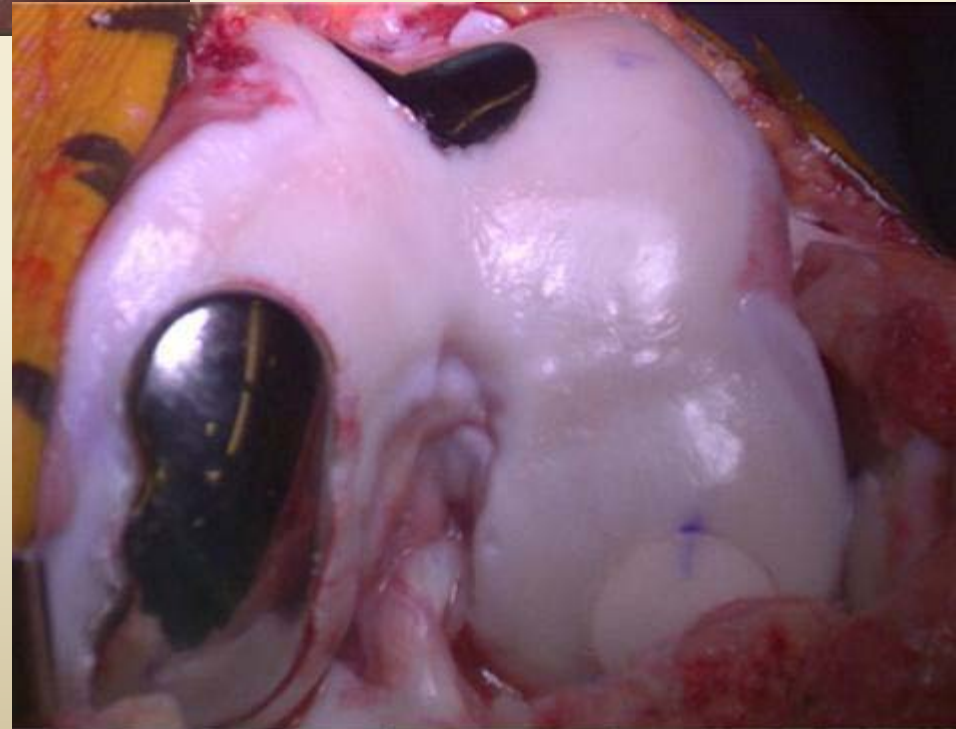






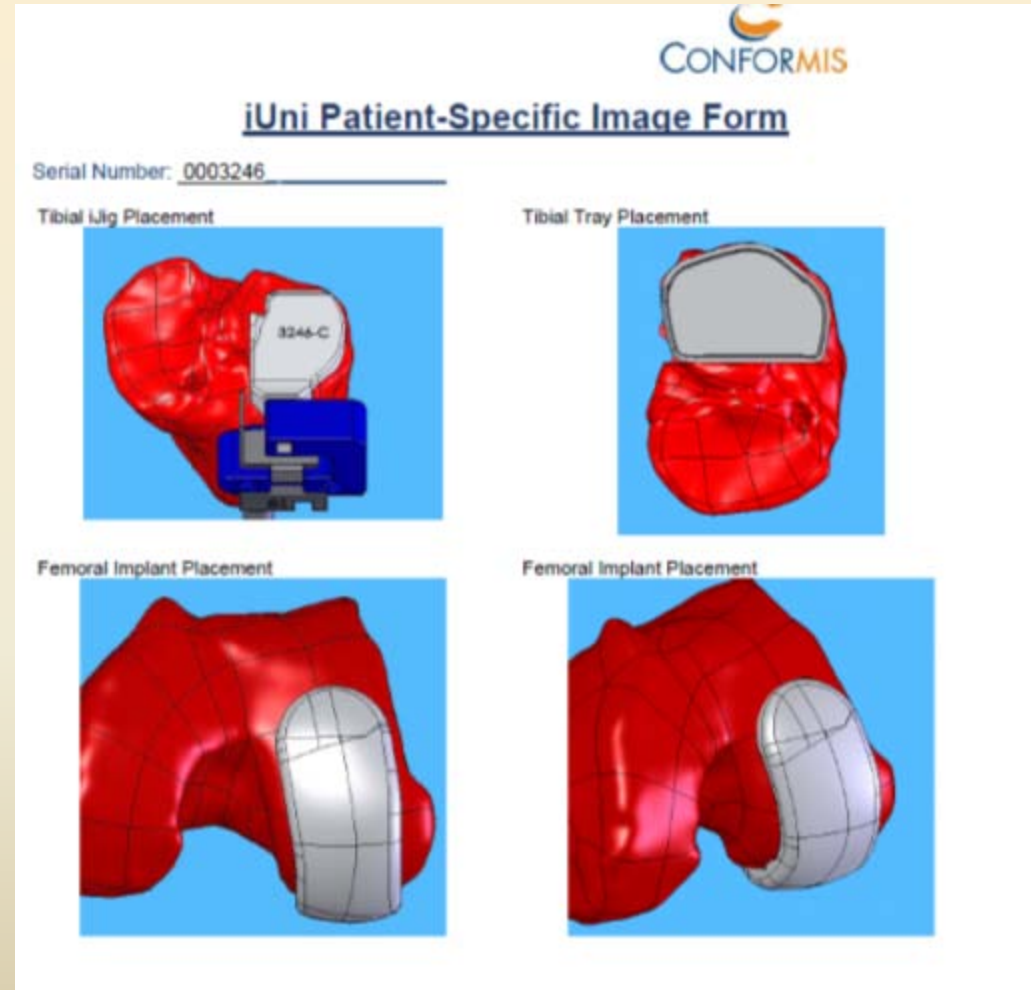


- 6 wks post op back at work  
light duty
- 12 wks post op full RTW as  
firefighter



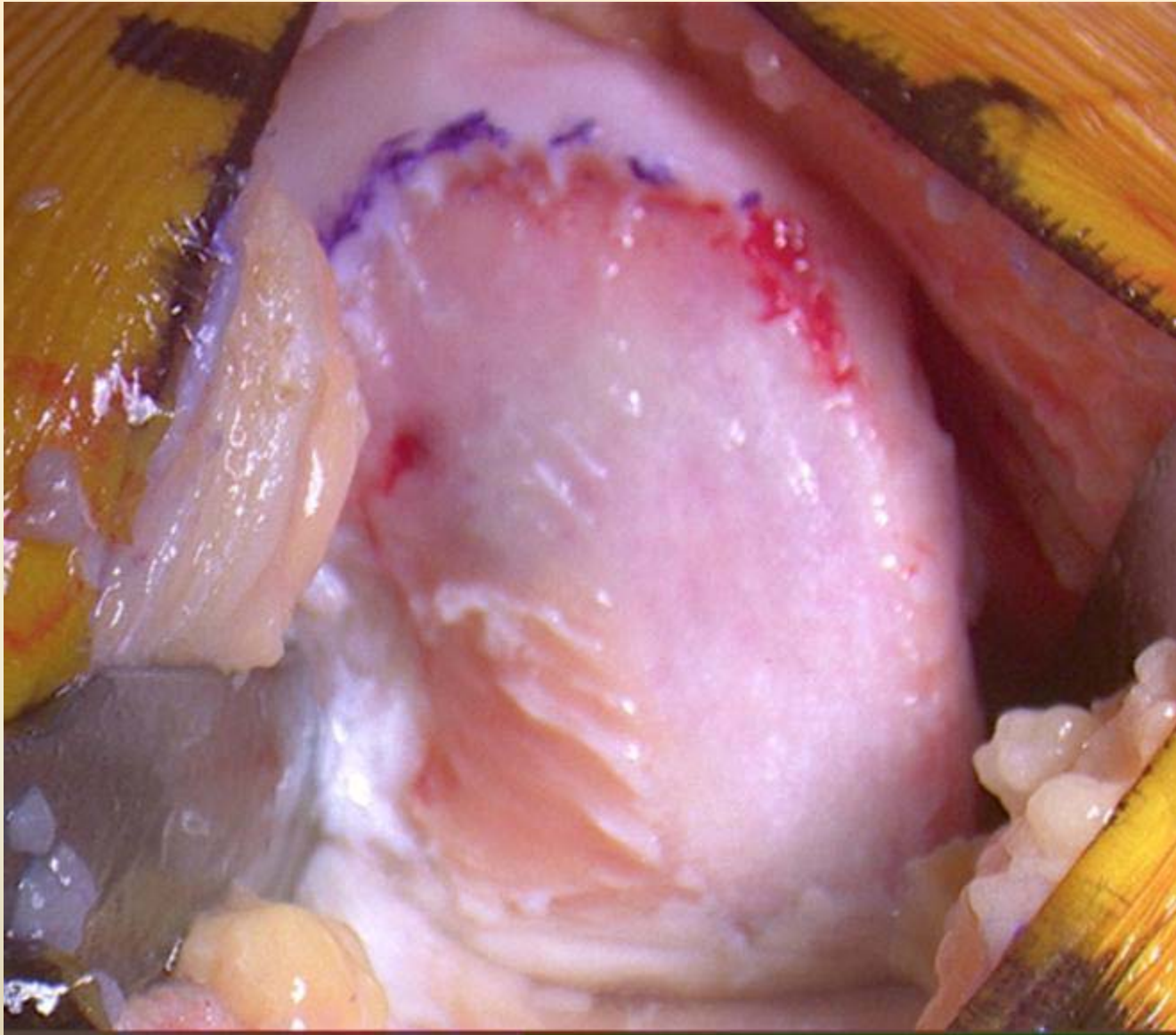
# Onlay Resurfacing

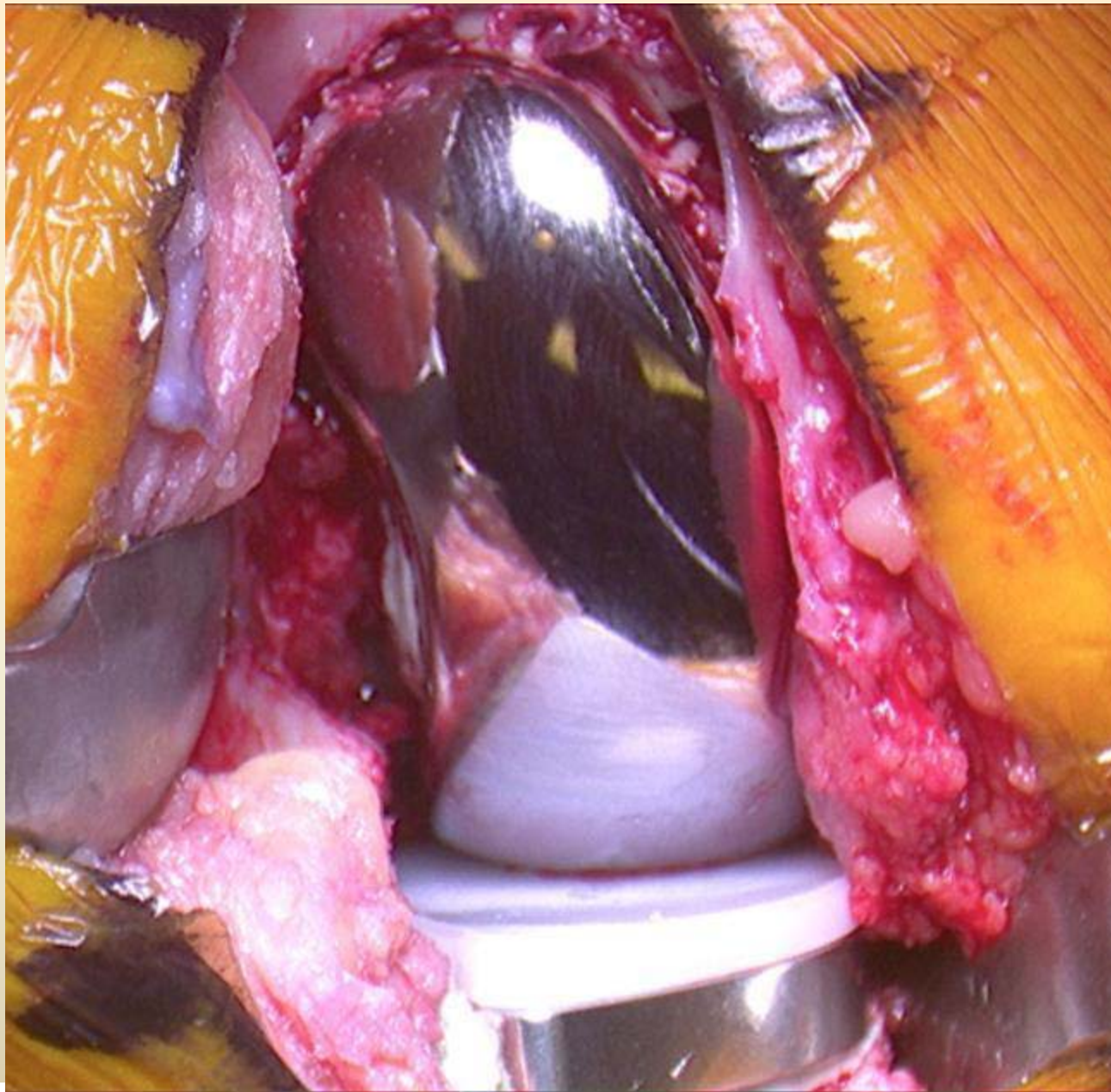
- More extensive than Inlay
- Very little bone resection
- Implants custom made from CT scan



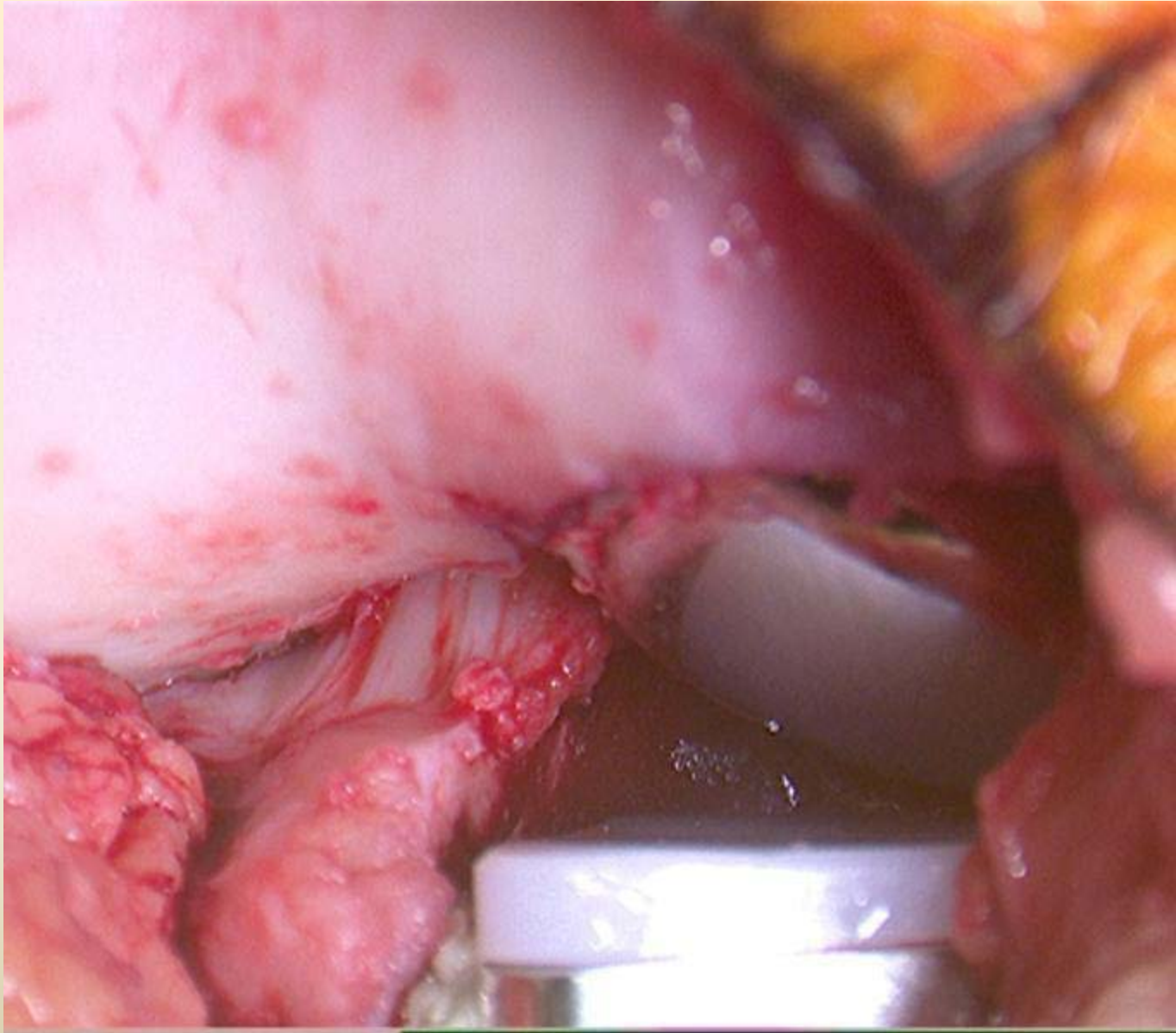
# 42 year old FedEx Driver









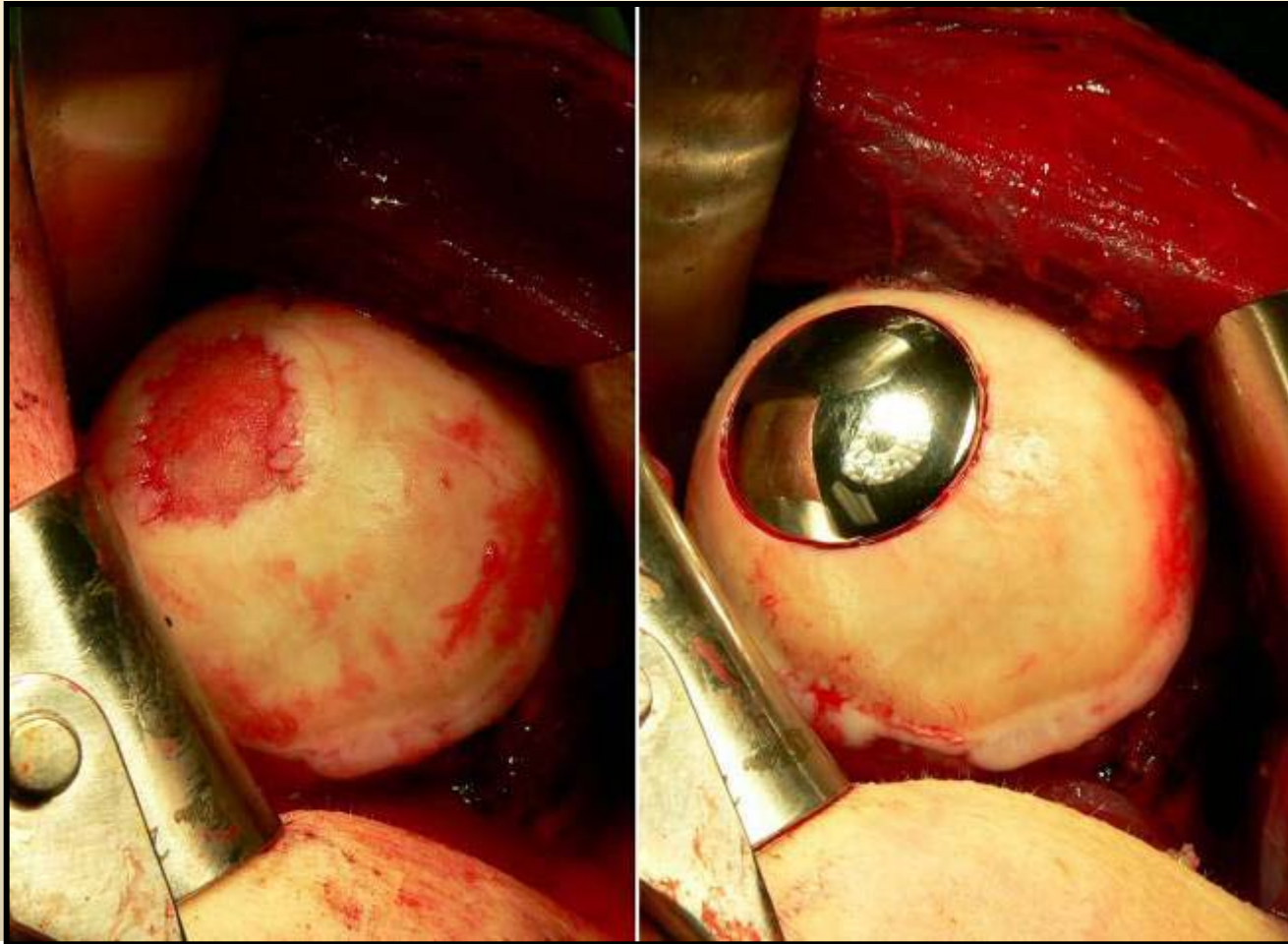


# Onlay Resurfacing

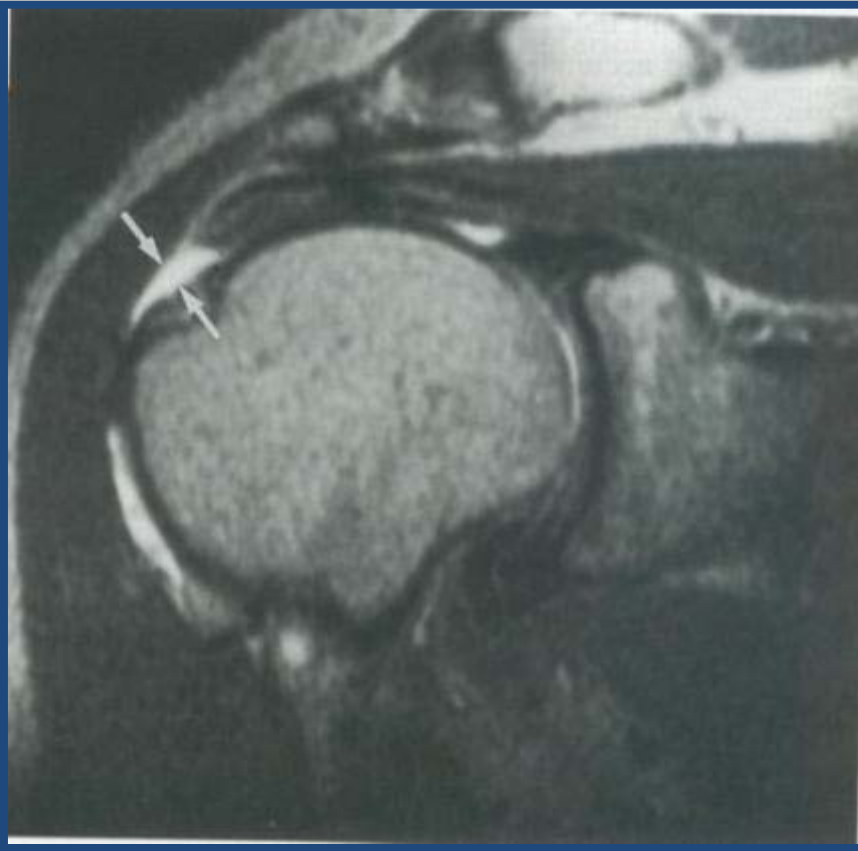
- Outpatient or one night stay
- Full WB immediately
- RTW
  - Light duty 6 weeks
  - Full duty appx 12 weeks



# Shoulder Injuries



# Common Shoulder Injuries



- Cartilage Damage
- Rotator Cuff Tear
- Subscapularis Tears
- Dislocations and Instability
- Labrum Problems and SLAP Tears
- AC Joint
- Bicep Problems

# Traditional Treatment Option for Damaged GH Joint ----*Total Shoulder*

- Potential Problems:
  - Tissue balance
  - Blood loss
  - Overstuffing
  - Humeral height and version
  - Glenoid Loosening
  - Patient acceptance
  - Surgically difficult

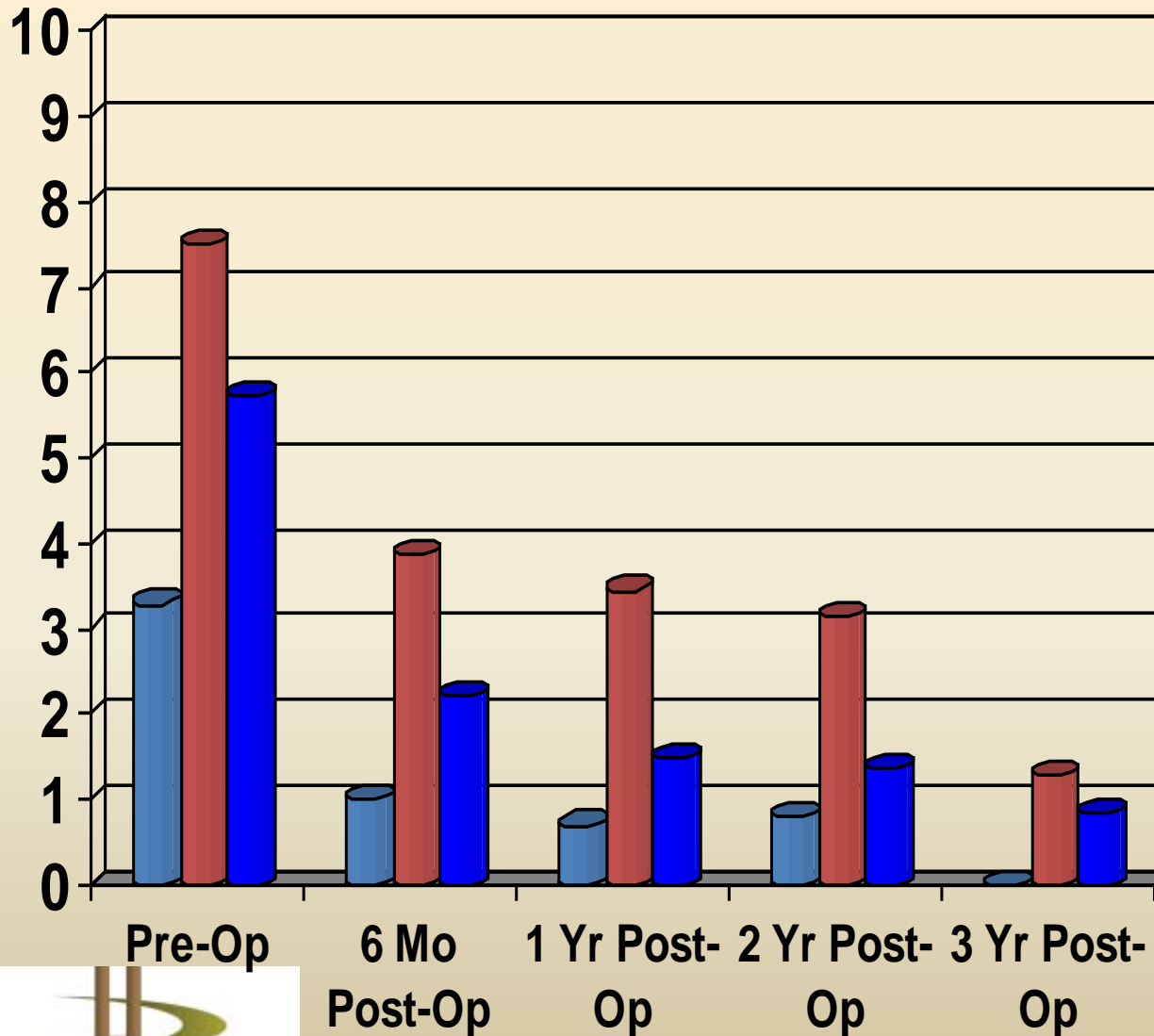


# Where does Shoulder Resurfacing fit in?

- Anatomically based alternative for treatment of cartilage damage and arthritis
- Before or, **hopefully**, to avoid a traditional arthroplasty
- Less invasive procedure
- Outpatient
- Quicker return to work, less work restrictions

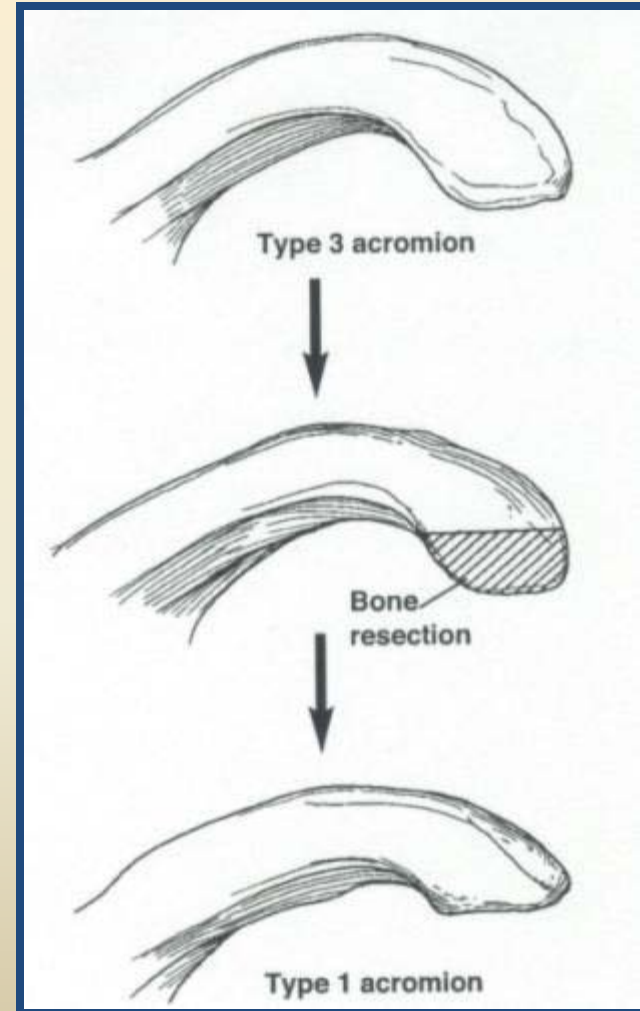


# Davidson Series - VAS Pain



# “Impingement”

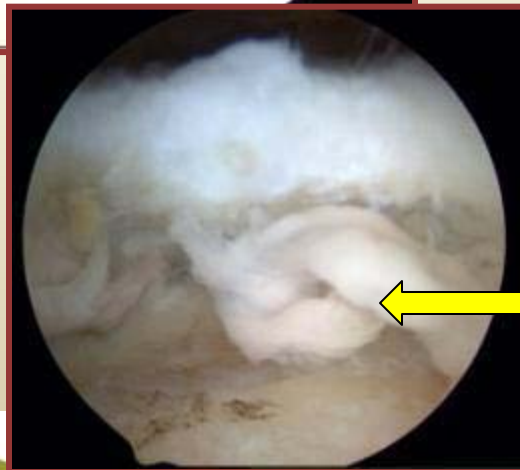
- Relevant for overuse tendinopathy and tendon tears
- Acromioplasty (SAD) for “impingement” and RC decompression
- Goal of procedure is to remove any area of arch prominence causing pressure on subjacent bursal sided cuff surface



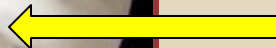


# Rotator Cuff Tear/Repair

Anatomic Repair, biologically augmented



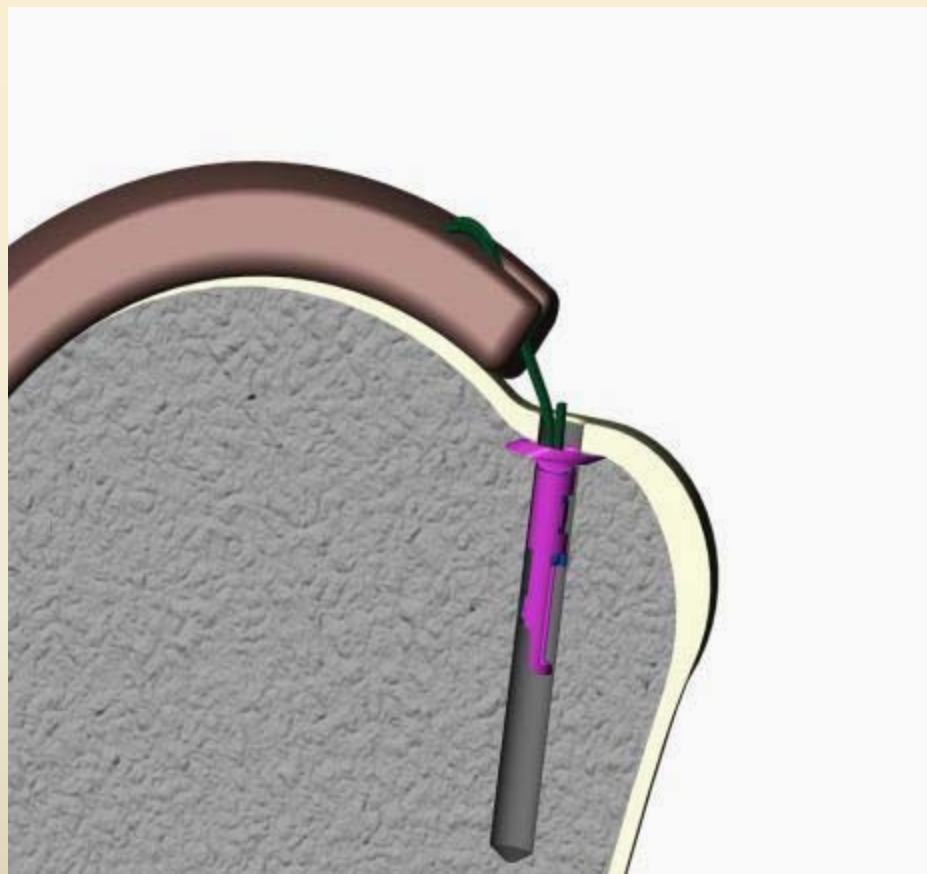
PRFM graft



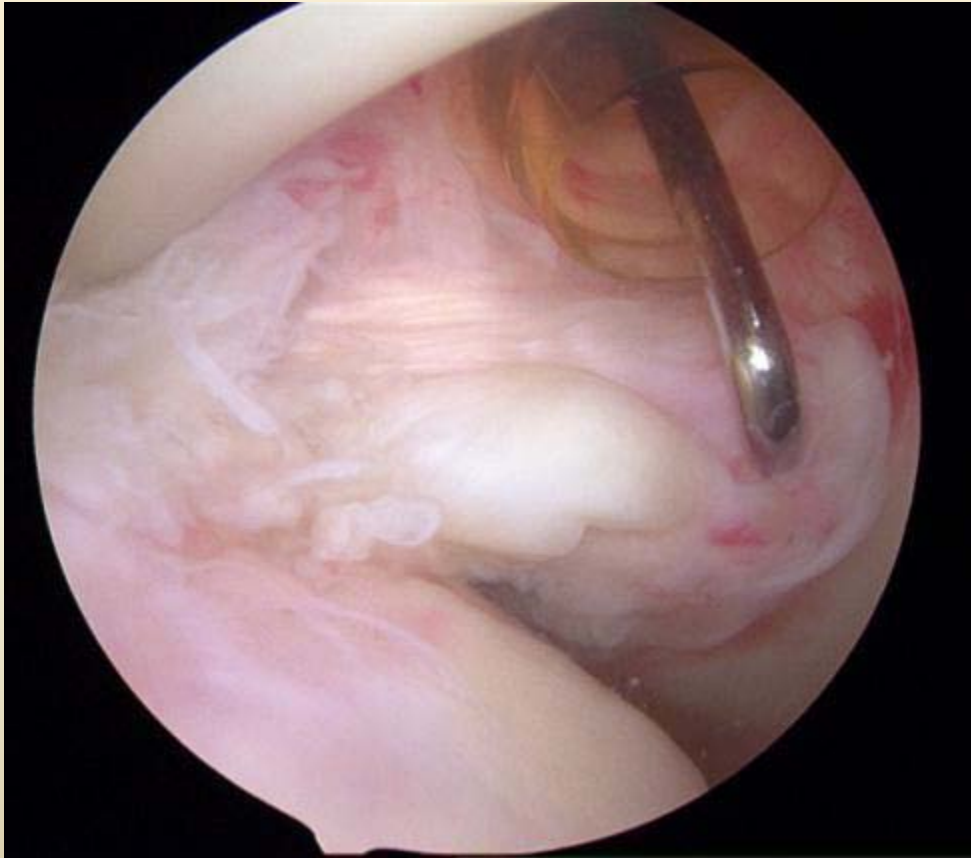
# Rotator Cuff Repairs

*(true for all tendon repairs)*

- Goal is to reattach tendon to bone, allowing it to heal
- Rehab/RTW guides:
  - Tear size
  - Tendon quality
  - Patient “health”
  - Rehab:  
quality/compliance

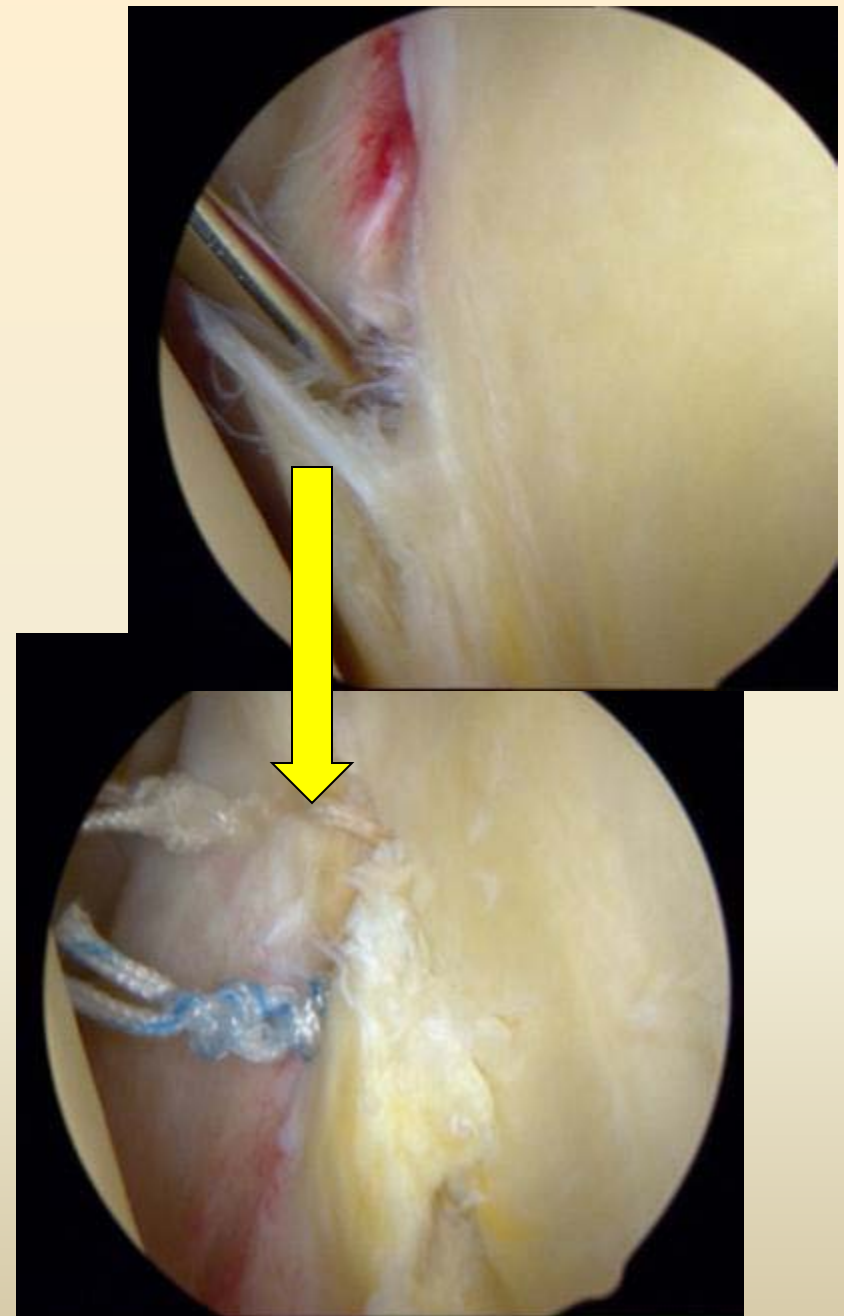


# Traumatic Tendon Tear (Subscapularis)



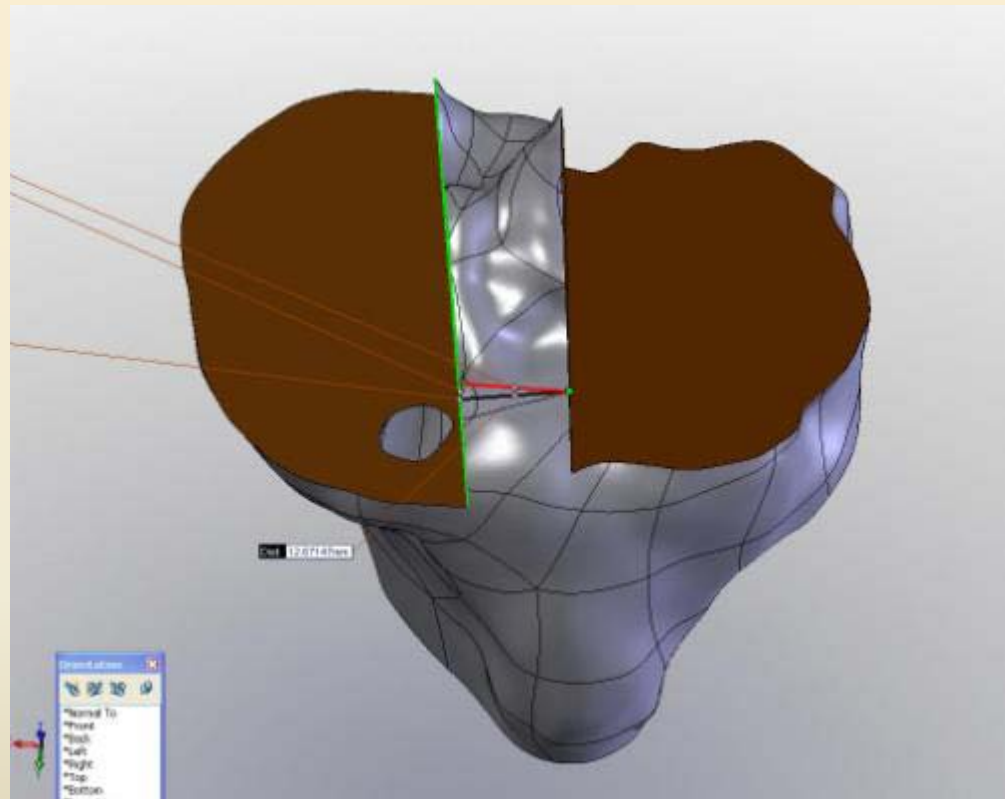
# Glenohumeral Instability

- Treatment focuses on anatomic restoration
- Capsular stretching occurs before avulsion from glenoid
- SLAP, Bankart, HAGL, Hill Sachs



# Summary – Anatomical Treatments

- Continually adding more treatment options for patients with knee and shoulder injuries
- Biological Restoration may offer long lasting solutions, where little or no choices were previously available
- Prosthetic Options are becoming progressively less invasive and more anatomical, offering exciting options to younger patients with **faster RTW**
- Biological and “smart” resurfacing devices can help many, but not all, patients return to work and live more active and productive lives



# Orthopedic Evaluation and Treatment of the Injured Worker



# Outline

- Physician's perspective
- Mechanics of the evaluation
- Veracity testing
- FCE's
- RTW
- Impairments



# My Perspective

- Must maintain neutral, expert posture
- Explain at outset thoughts on causality
- Must honestly serve patient and employer
- Synthesize prior treatment, assess current situation and prognosticate need for further treatment and outlook for future
- Some injuries simple to eval and treat, others can be very complex
- Keep the patient working....



# Mechanics of an evaluation

- Must have **communication**
  - Adjuster
  - RN manager
  - Employer
  - Patient
  - Other treating providers
    - PT, DC, etc...
- Evaluations to determine different things
  - Causality
  - Diagnosis
  - Overt discrepancy
  - Need for surgery
  - Apportionment
  - Disability



# Taking the history

- Clarify prior pathology
- Clearly delineate injury
  - Acute and/or overuse
- Maintain neutrality
- Get a good health profile
- Non-injury health issues may help guide treatment
- Establish mutual respect
  - some patients consider encounter adversarial

# Physical Exam

- Patient must be made comfortable, as much as possible
- Histrionics noted, no exam versus tears or resistance
- If visible distress, I often offer to “take a break” and step out, noting this in record
- Acquire objective data, discern data block on part of patient, report as such

# Return to work

- Set expectations overtly
- Explain roles, implications
- Generally....
  - Smaller procedure:
    - Off 3 wks
    - Light duty, then MMI by appx 12 weeks
  - Reconstruction:
    - Off 3-6 weeks
    - Light duty, then MMI by appx 4-6 mos

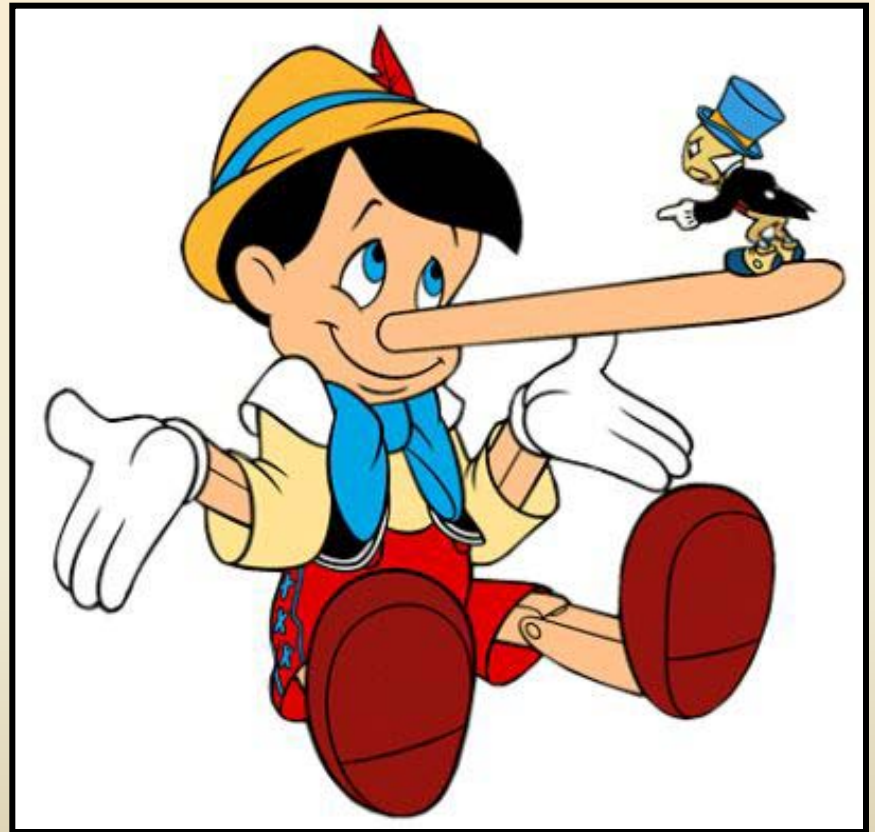


# Pain Meds and Pain Management

- My role :
  - Surgical specialist, acute injury and surgical pain
  - Ethical, humane and overt topic
- Narcotics:
  - None pre-op (unless seen in acute distress)
  - Recognition of typical patterns, needs and dependency
  - Generally 6 weeks or less post op
- Pain needs
  - Many patients present habituated
  - Many of these patients need narcotics > 6 weeks
- Will refer for narcotic weaning and non-narcotic pain mgmt, coordinate with pain specialists/PCP

# Veracity Testing

- Waddell's testing
- Stimuli applied to known sites away from pathology
- Report of pain precedes application of force
- Disproportionate pain response
- Inconsistent report of pain
- Exaggerated pain response



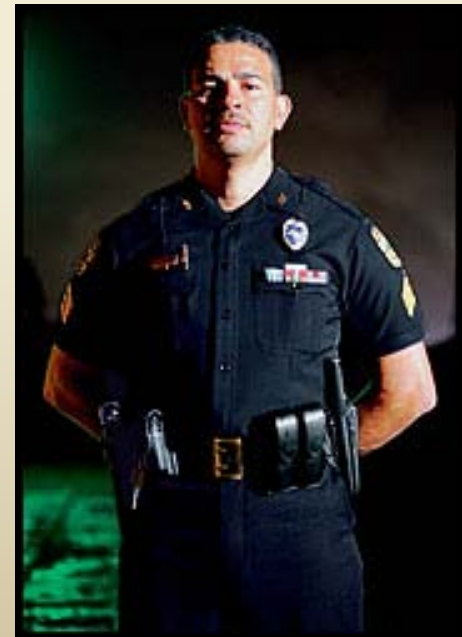
# Veracity Testing

- Simple observation
- Inconsistent ROM
- Intermittent give-way
- Watch entry/exit from exam
- Feigned behaviors



# FCE's

- Useful in situations where expectations entirely unrealistic
- Diffuse or deflect angry worker
- Method to minimize or avoid confrontation
- Most useful in determining consistency of effort
- Inconsistent effort easily documented





# Impairments

- Based on objective criterion
- Utah (state) guidelines
  - AMA guidelines
- Patient/Injured workers often harbor unrealistic expectations
- Never discussed during exam, always defer to accurate calculation

# Impairments

- Patient expectations
  - Often unrealistic financially
- Patient fears
  - Typical perception that “can’t work” as before
- Education can assist greatly in process
  - What are workers entitlement ?
  - What can worker expect from employer ?
  - What future medical care is available and at what cost to them ?
  - This is where physician and patient need help!!

# Impairments - Roles

- Physician:
  - Definitively ascribe need for future care
  - Define Work Capacity
  - Assign objective, quantified impairment
  - Maintain compassion with injured worker
  - Be able to say “that’s it”
  - Ascribe some care needs to patient and PCP

# Closing thoughts

- Willing to listen and learn
- Hopeful to build valuable alliances and relationships to benefit injured workers regionally
- Communication KEY!



# Thank You

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