Inlay Resurfacing Arthroplasty

Phil Davidson, M.D.
Heiden-Davidson Orthopaedics
Park City, Utah

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OUTLINE

- Perspective on resurfacing
- Introduction of Inlay Arthroplasty Concept
  - Biomechanical Basis
- Knee CAP
  - HemiCAP, UniCAP, PF
  - Indications
  - Technique
  - Cases

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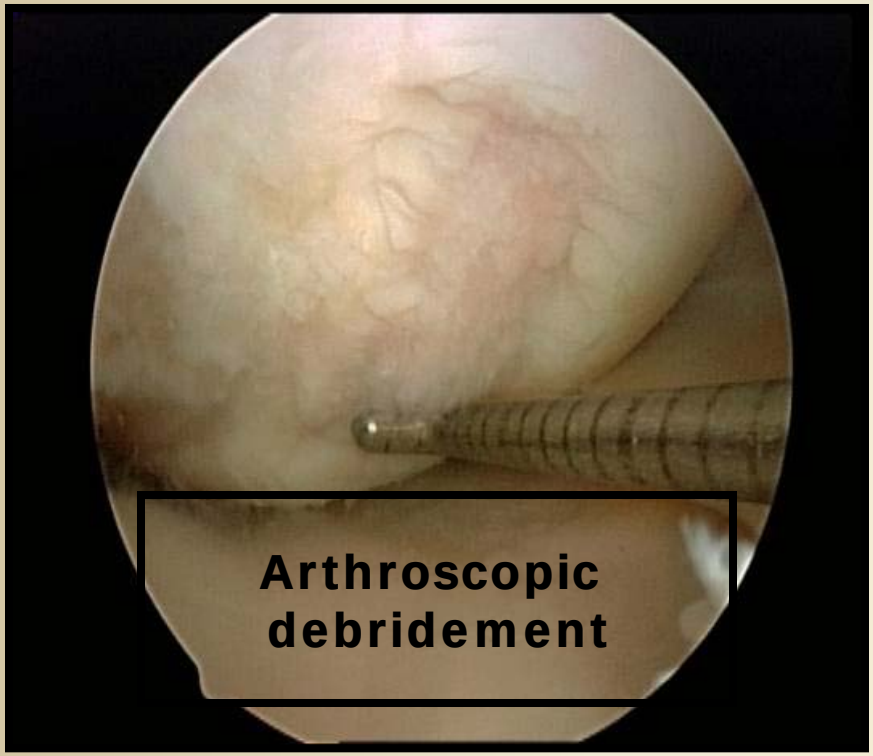
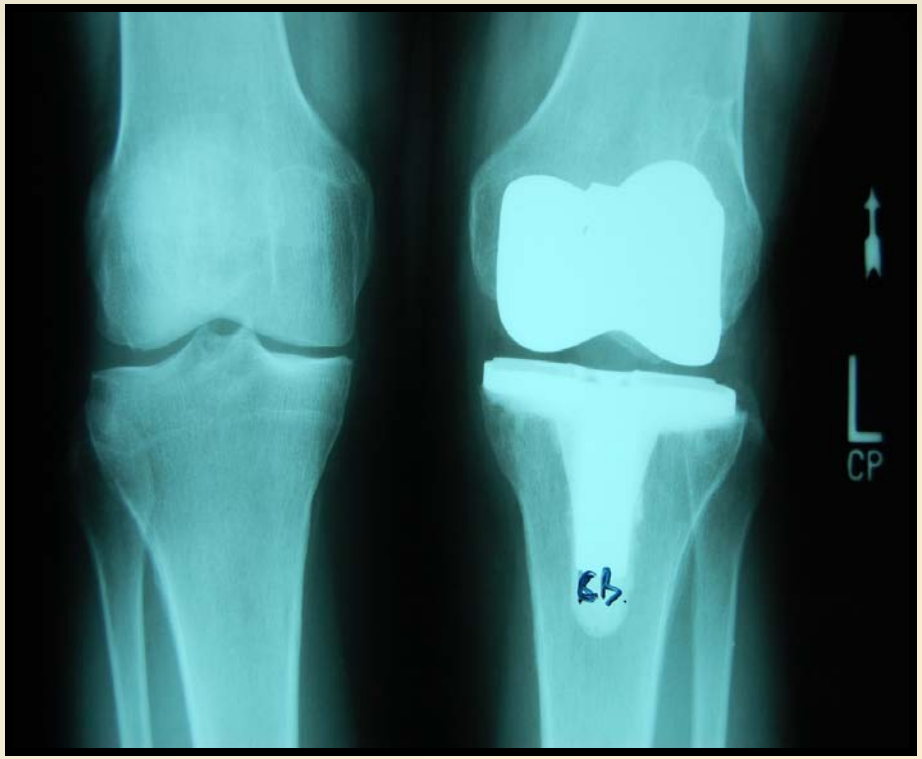
Joint Resurfacing
A wide realm between…..





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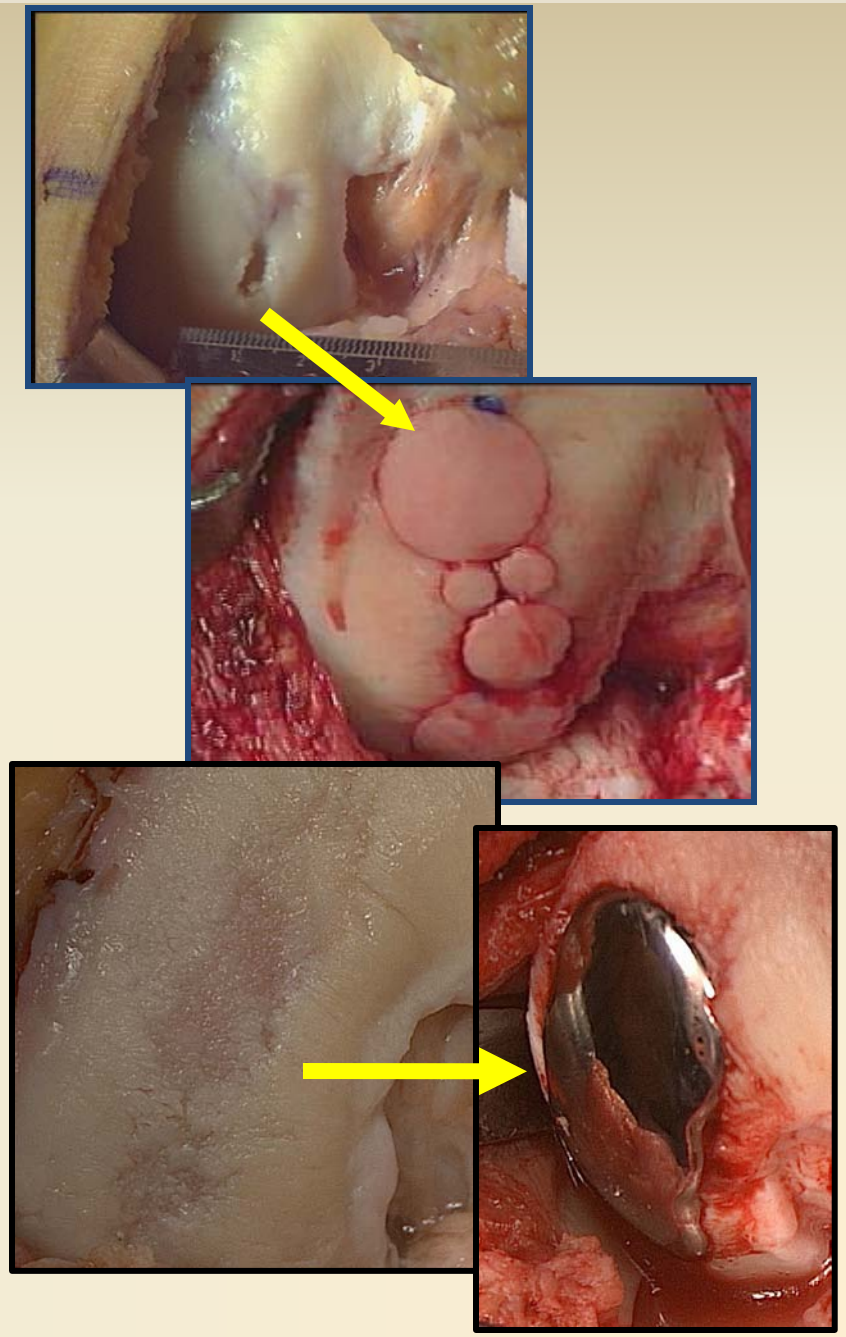
Goals:
Cartilage Restoration & Joint Resurfacing

- Relieve pain
- Restore functional
- Improve Mechanics
- Long lasting
- Prevent or Limit Future Degenerative Changes
- Retain Options for younger or more active individuals



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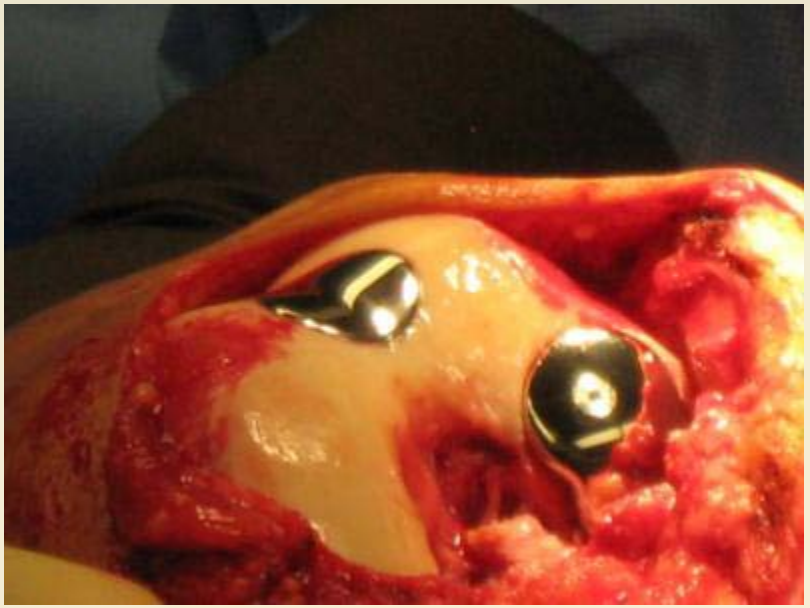
Theme of Minimally Invasive Joint Restoration

- Spectrum of Pathology
- Individualize according to the specific patient
- Wide array of treatment options
- Biologic Restoration in youth, when possible
- Appropriate Minimally Invasive Prostheses
- Continually incorporating new technologies



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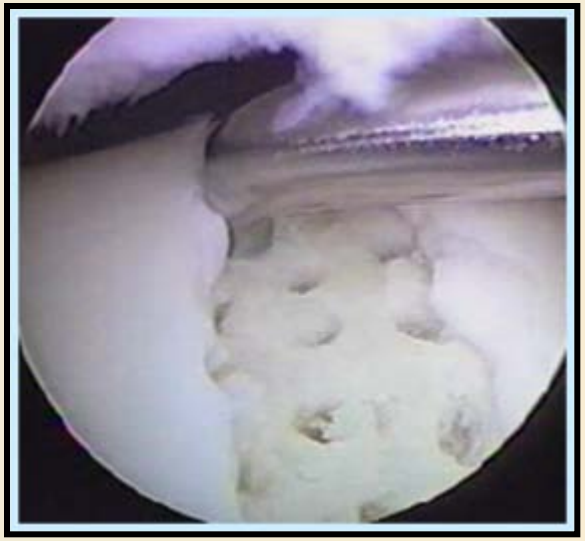
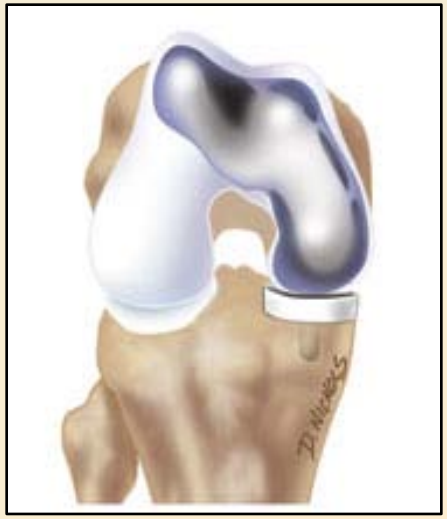
Cartilage Restoration and Joint Resurfacing Treatments:

…an evolving continuum of options

- Marrow stimulation
- Biological restoration
  - Biologics
  - Bio-synthetics/scaffolds
  - Modulated therapy
  - Cellular therapy
- Joint Resurfacing
  - Prosthetic resurfacing
  - Micro-invasive
  - Bio-elements
  - Inlay Arthroplasty
  - Onlay Arthroplasty
  - Total Joint





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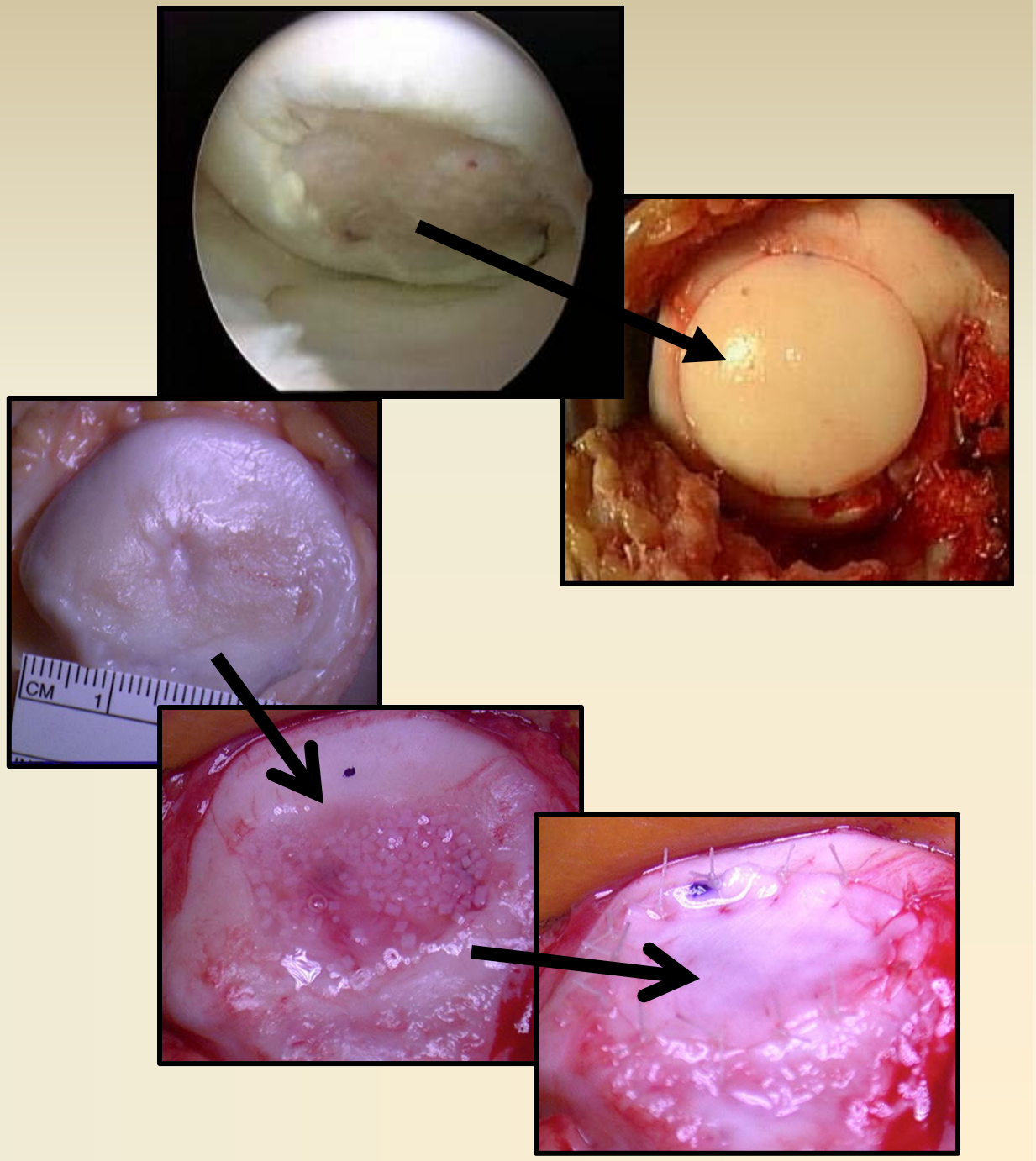
Biological Options

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



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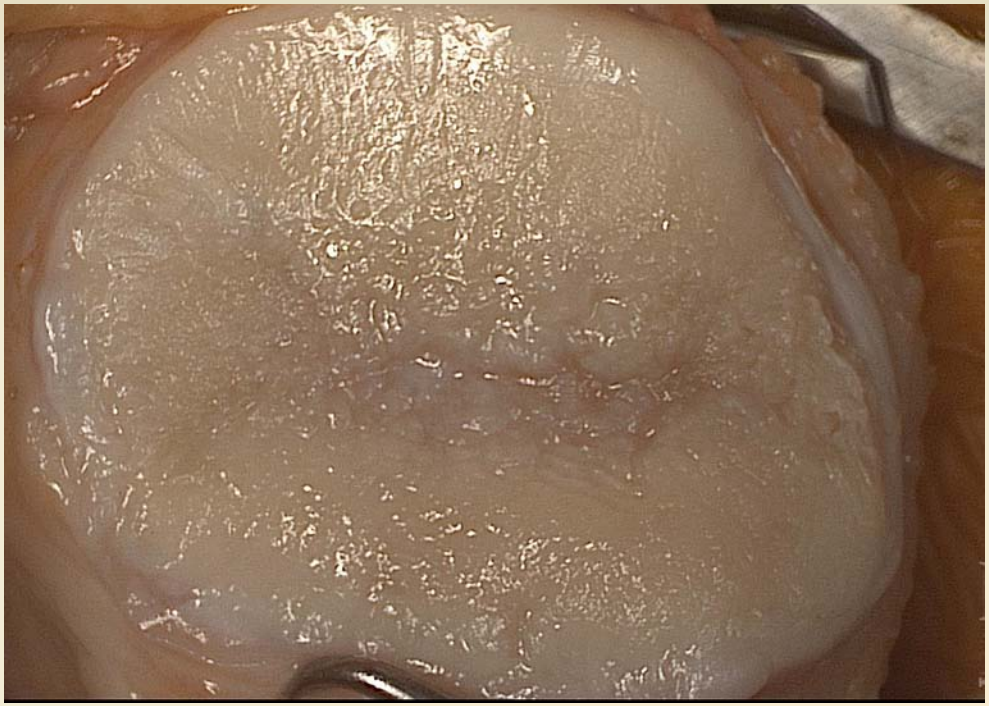
Transitional thinking from biologics to prosthetics

- Age, health
- Pathology
  - Kissing lesions
  - Joint “out of round”
- Comorbidities
  - Health
  - Same joint
    - Stability, alignment, meniscus



Inverted patella 31 year old

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Mandates associated with
Minimally Invasive Joint Resurfacing

- Minimize Perioperative morbidity
- Retain future options – as possible
- Maximize Outcomes
  - Equal, or better than traditional treatments

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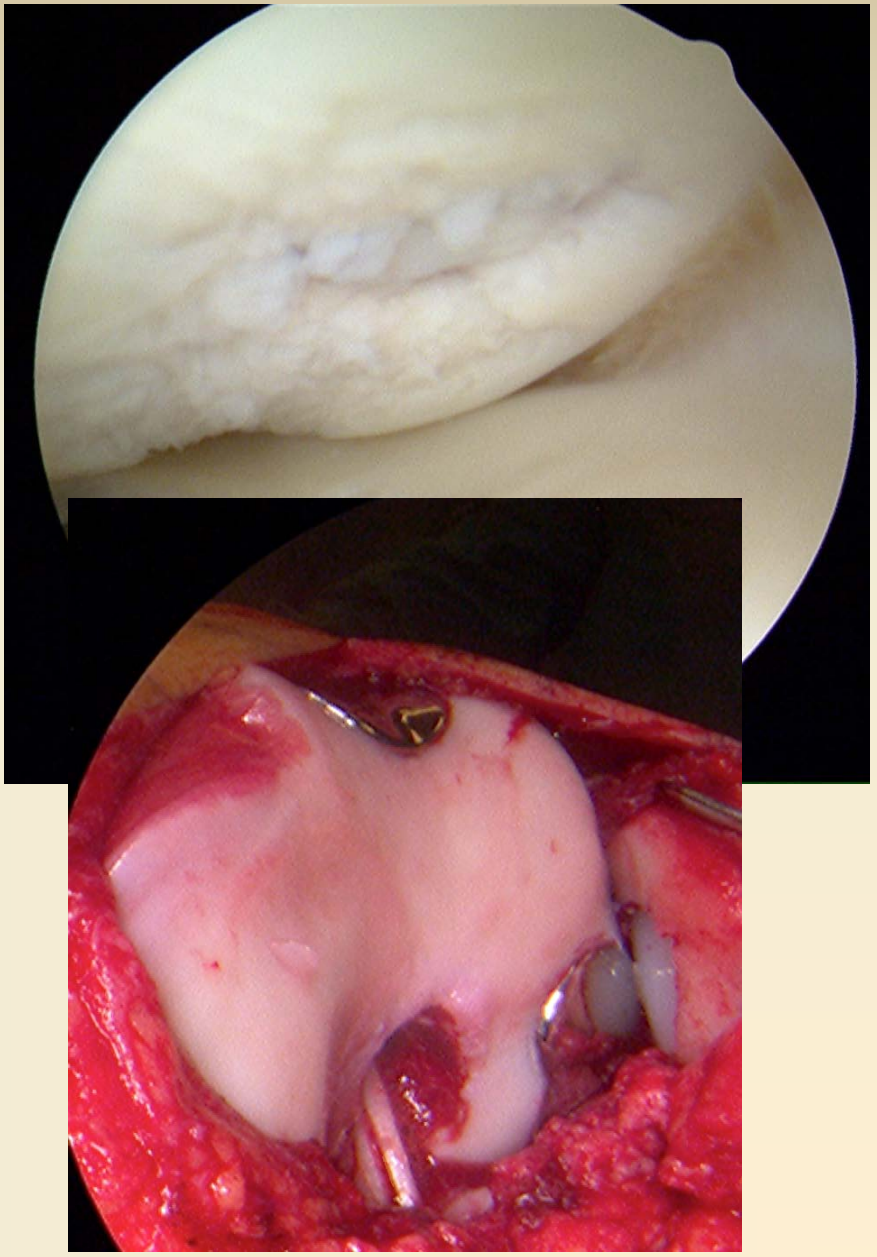
Anatomical Reconstruction

- Concave and convex geometric surfaces – complicated curvatures
- Intraoperative articular mapping involves measuring/replicating complex surface configurations
- Inlay Arthroplasty allows for ideal anatomic reconstructions
- Accounts for morphologic variability



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ANATOMY- Alignment

- Must know alignment, potentially correct or accommodate with resurfacing
- Must have long leg standing films available
- Inlay **<u>minimal</u>** deformity

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“Ideal” First Patient for CAP

- 30-60 yrs
- Nearly normal alignment
- Any comorbidity mitigating against Biological solution
- Unicompartmental disease (III b,c or IV)
- “Staging” Scope

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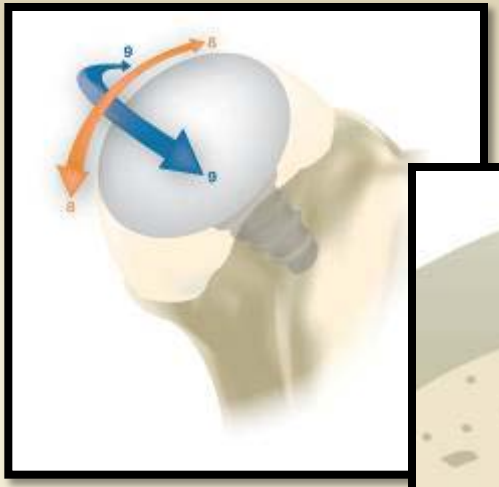
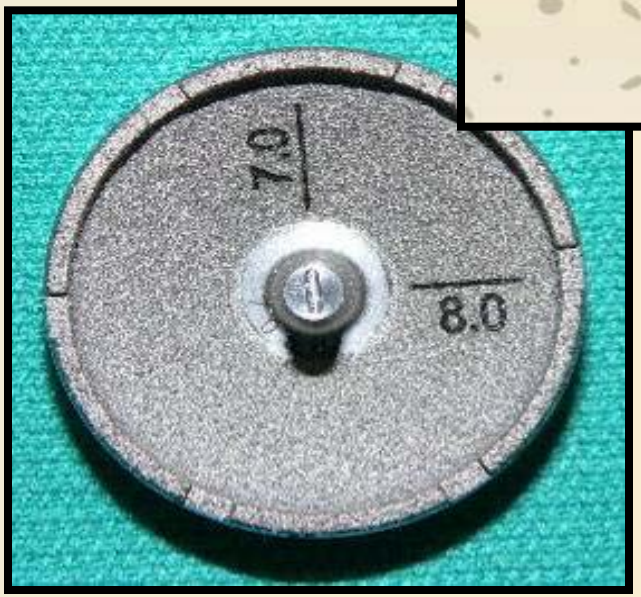
Introduction of CAP

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





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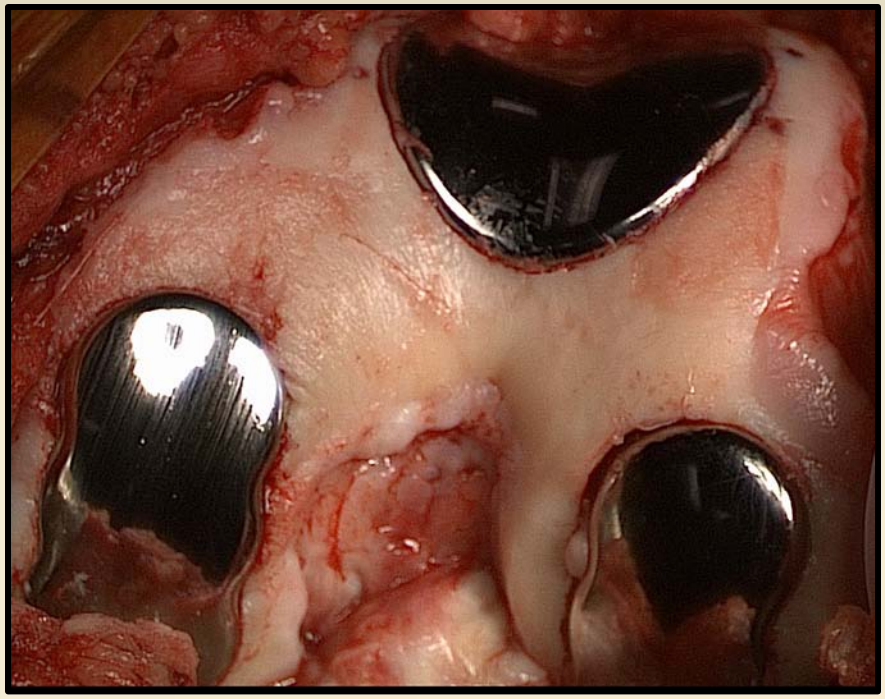
Knee Implants

- HemiCAP (small unipolar knee)
  - Not currently FDA approved in US
- UniCAP
  - Developed Medial, used Medial and Lateral
  - Includes Tibial Inlay
- PF HemiCAP
  - Regular & XLT(large FTG)



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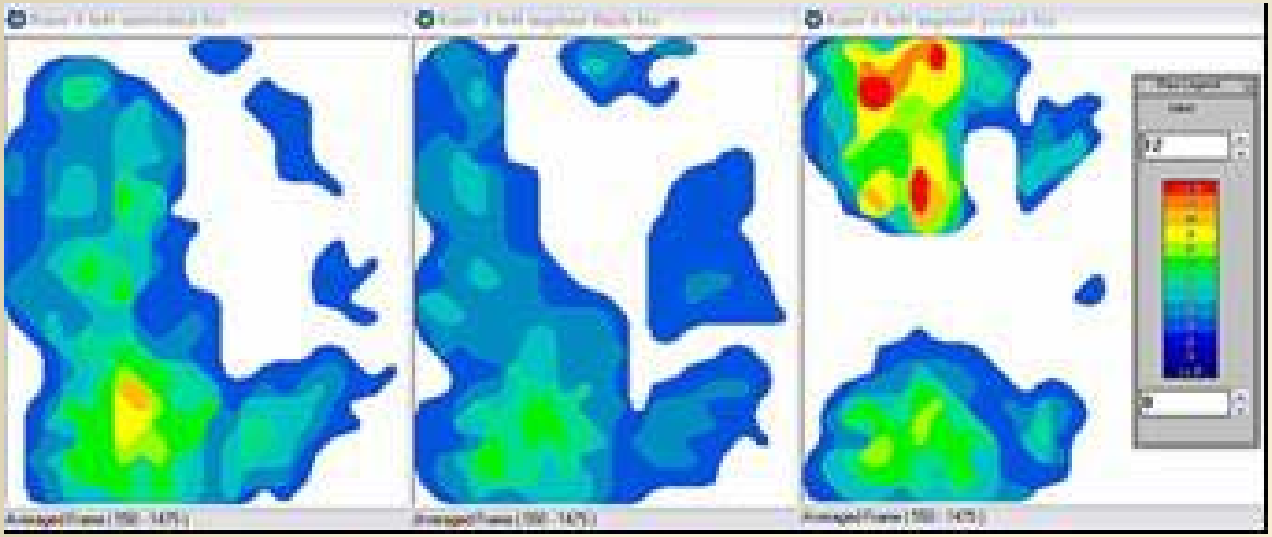
Basic Science- Pressure Studies- reciprocal surface (tibial plateau)

Anterior

Posterior



untreated knee **flush HemiCAP®** **1mm proud HemiCAP®**

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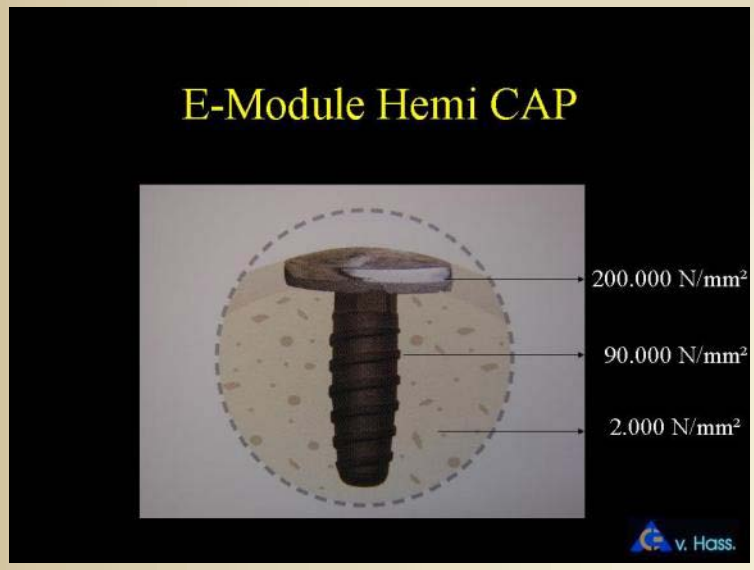
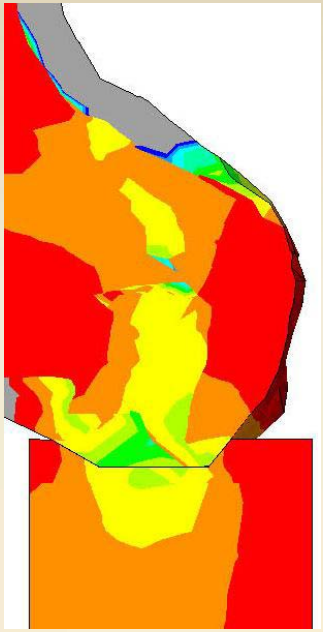
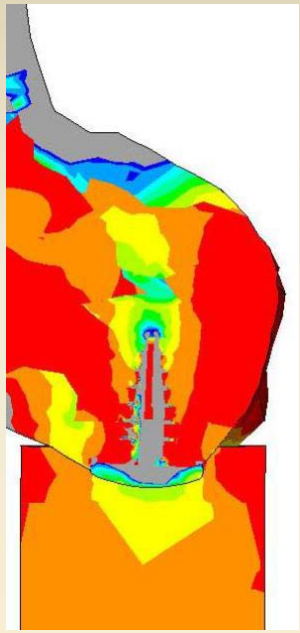
Finite Element - Analysis



Physiological



With HemiCAP



Conclusion:

- No stress shielding
- Effective load transmission into underlying bone

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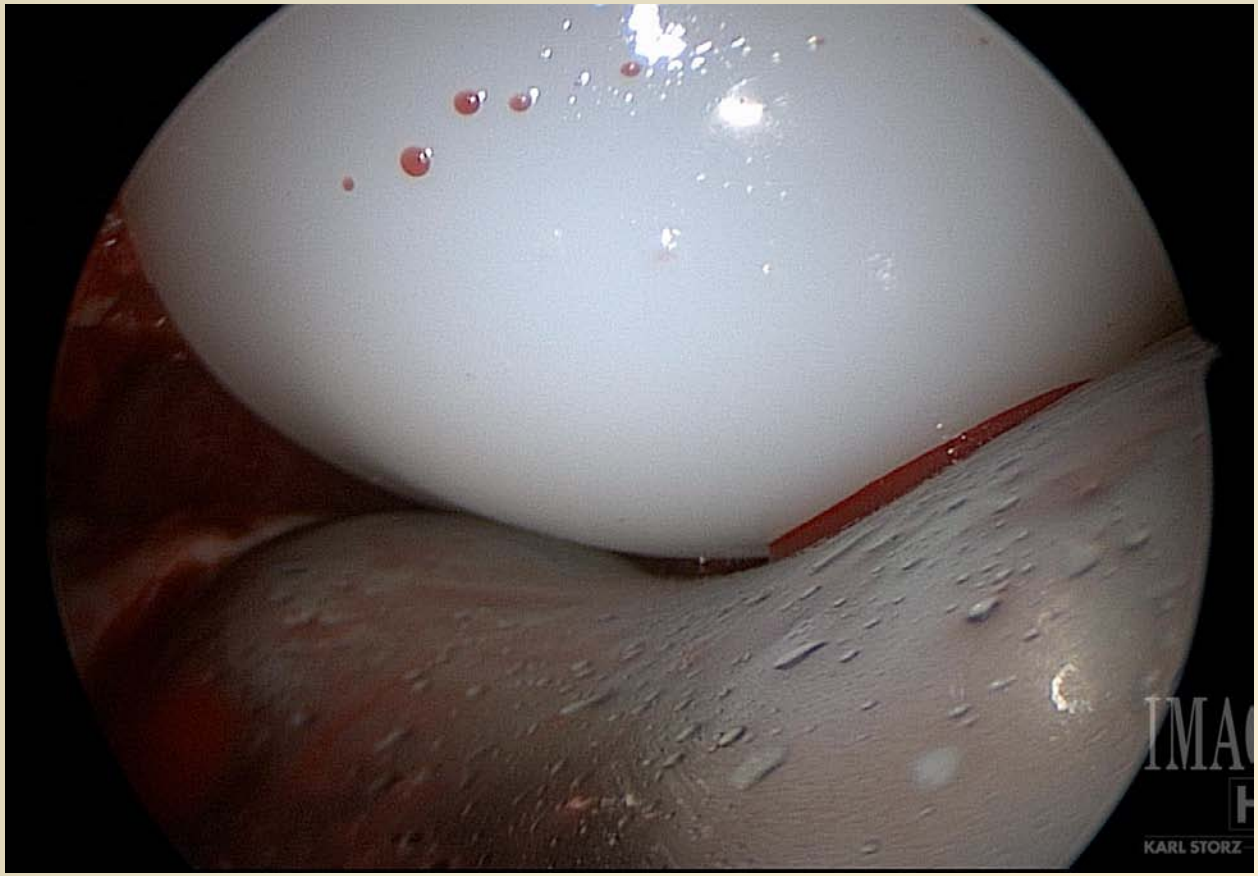
P-F XLT ”Wave” Inlay Prosthesis



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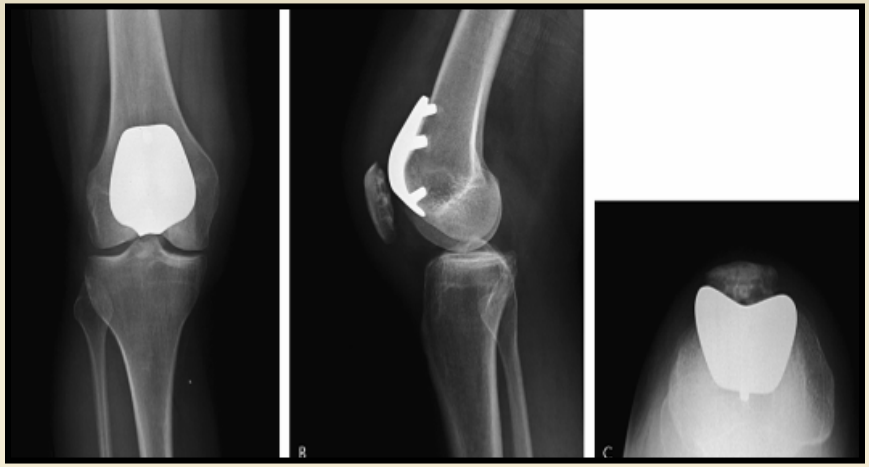
PF- PROSTHETIC RESURFACING

- Trochlea alone **or** Bipolar
- Traditional prostheses limited success and rarely used
- Inlay device allows for concurrent re-alignment easily, as no overstuffing
- Inlay device for younger patients



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Trochlear Implants
Variety of Geometry

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Patellar Implants
Variety of Sizes/Shapes, Cemented

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Case Report #1

- 41 year old female
- 2 prior knee surgeries
- Anterior knee pain
- Former “hard core” athlete
- Could not even walk with kids

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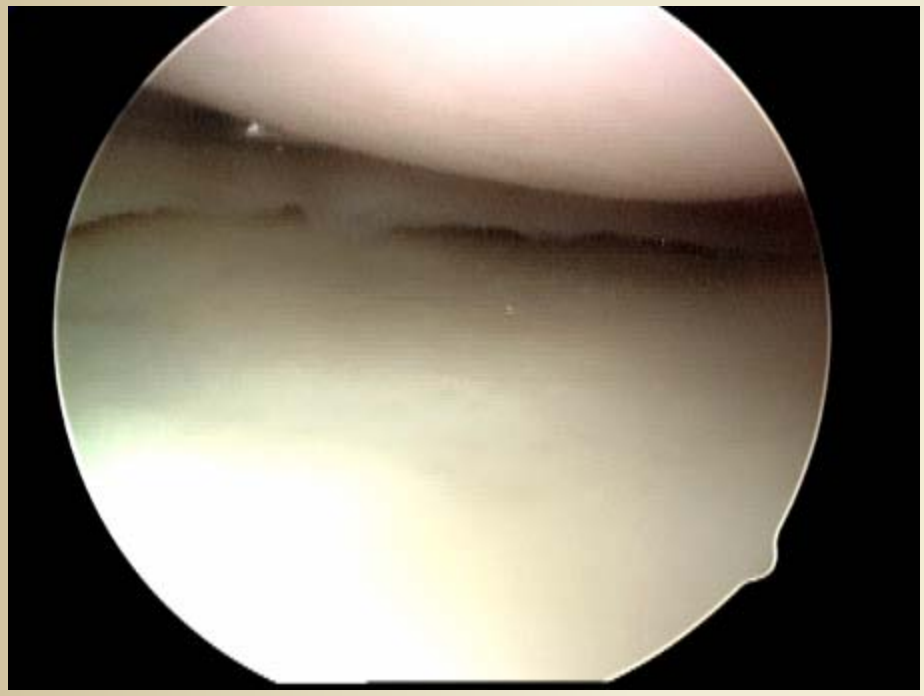
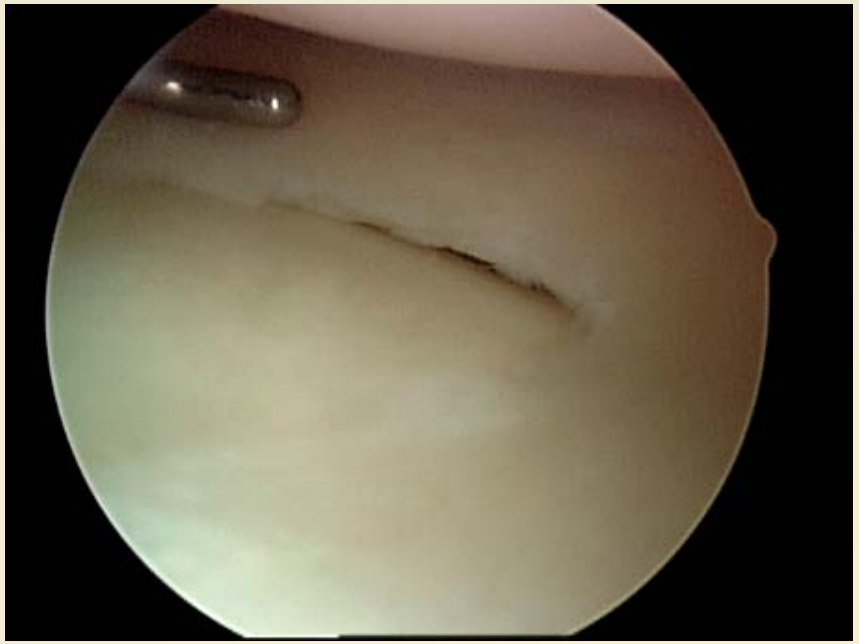
Case #1
(healthy medial and lateral)





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Surgical Exposure

1st - Arthroscopic Lateral Release

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Surgical Exposure
Either MIS medial incision (or midline)

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Technique –

- Guidewire key to cannulated system
- Perpendicular placement
  - Careful attention to this!!

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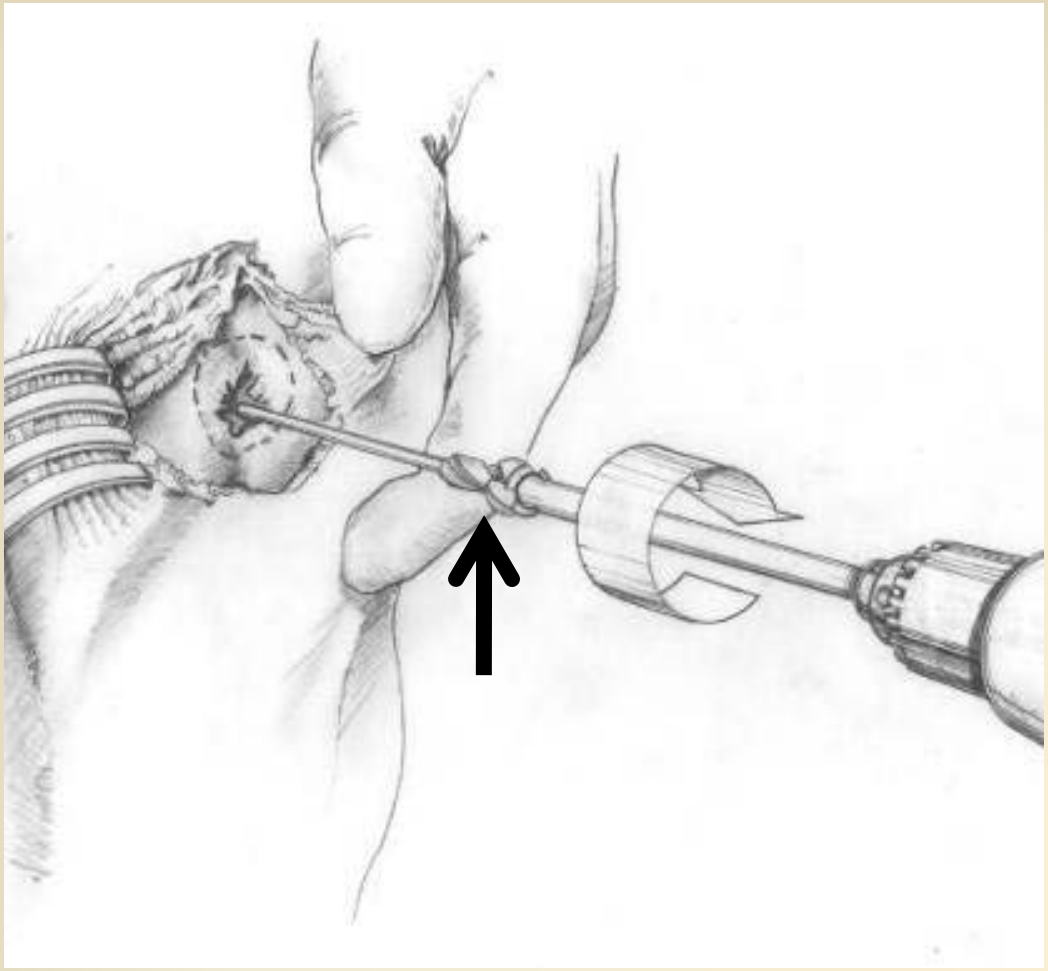
Technique- Drill for set screw (no plunge)



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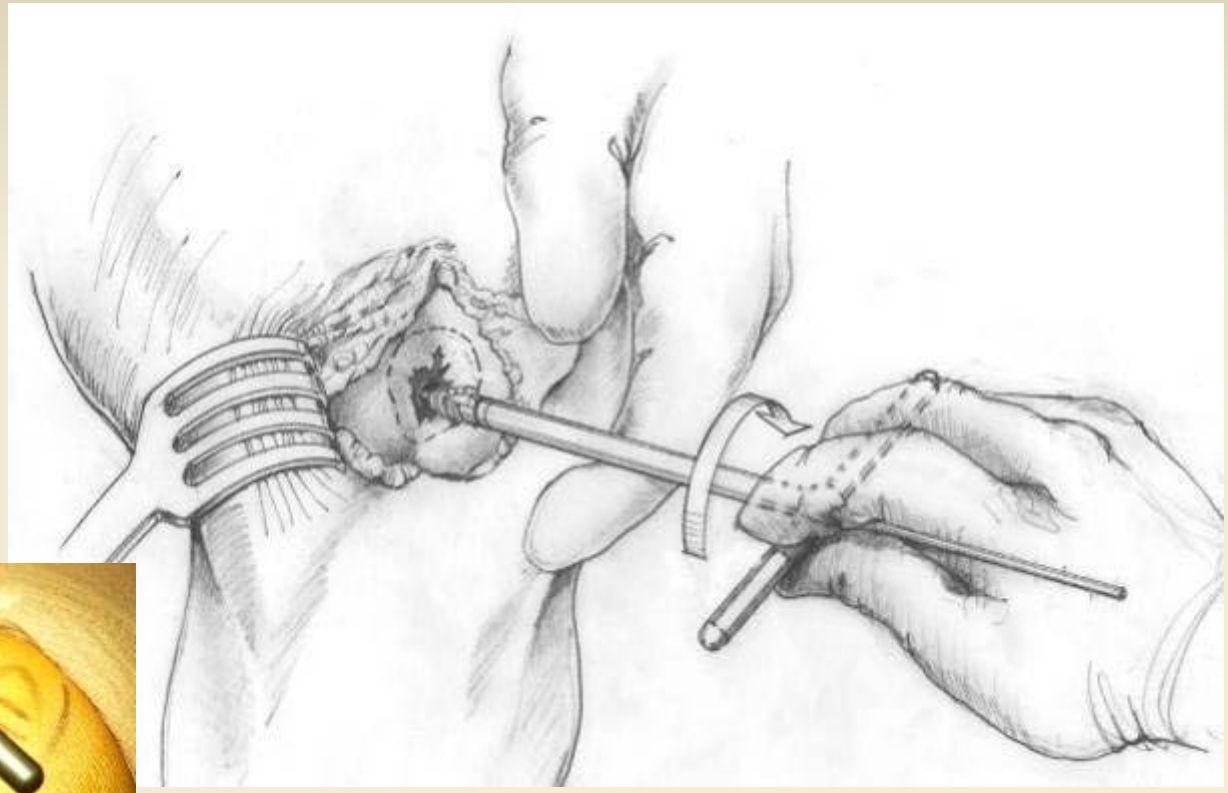
Technique – Tap (undertap)



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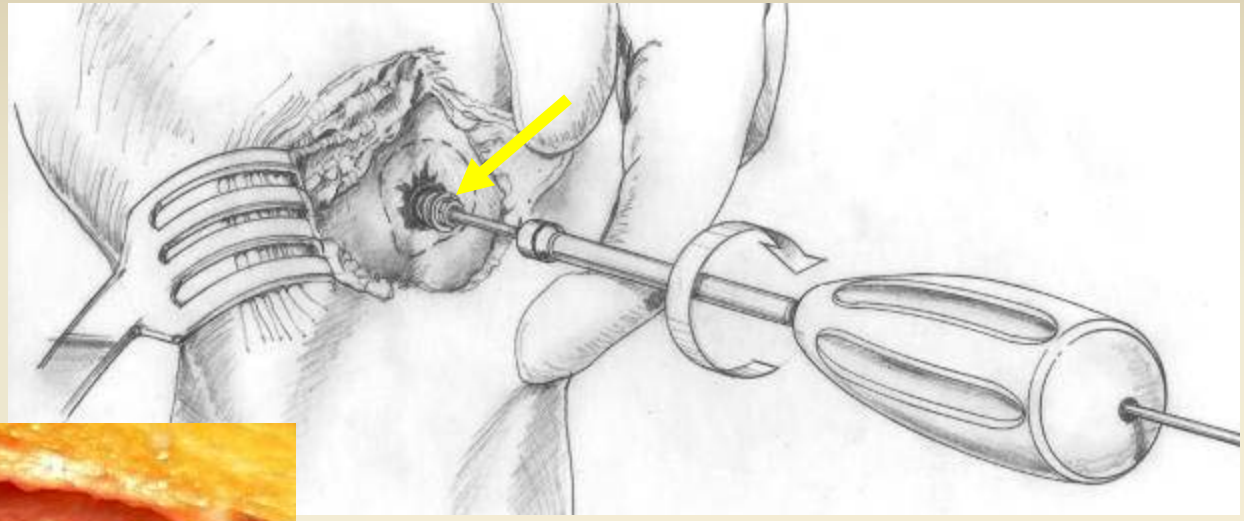
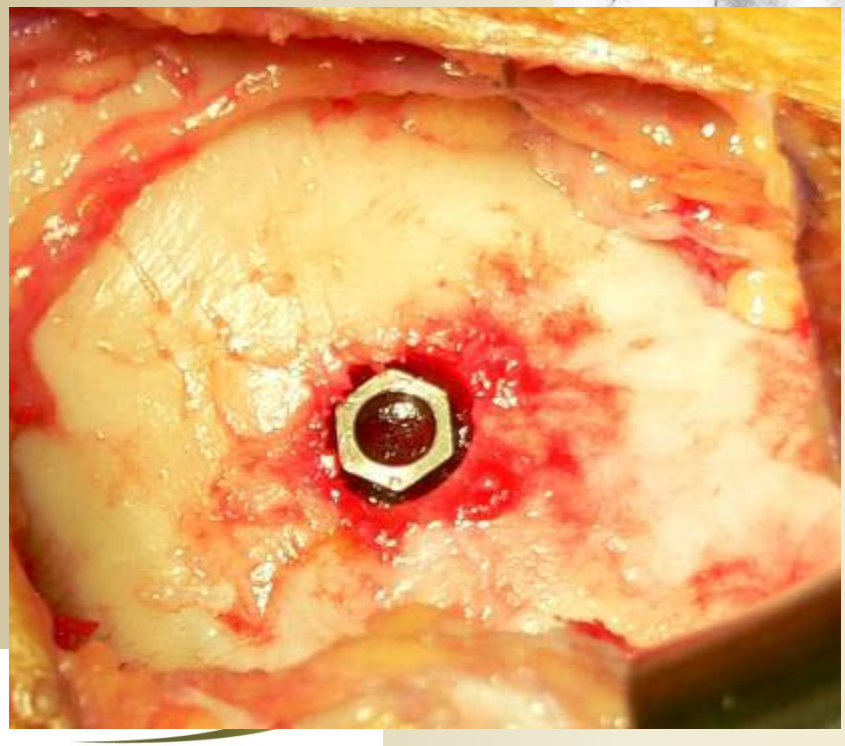
Insert set screw (not too deep!)





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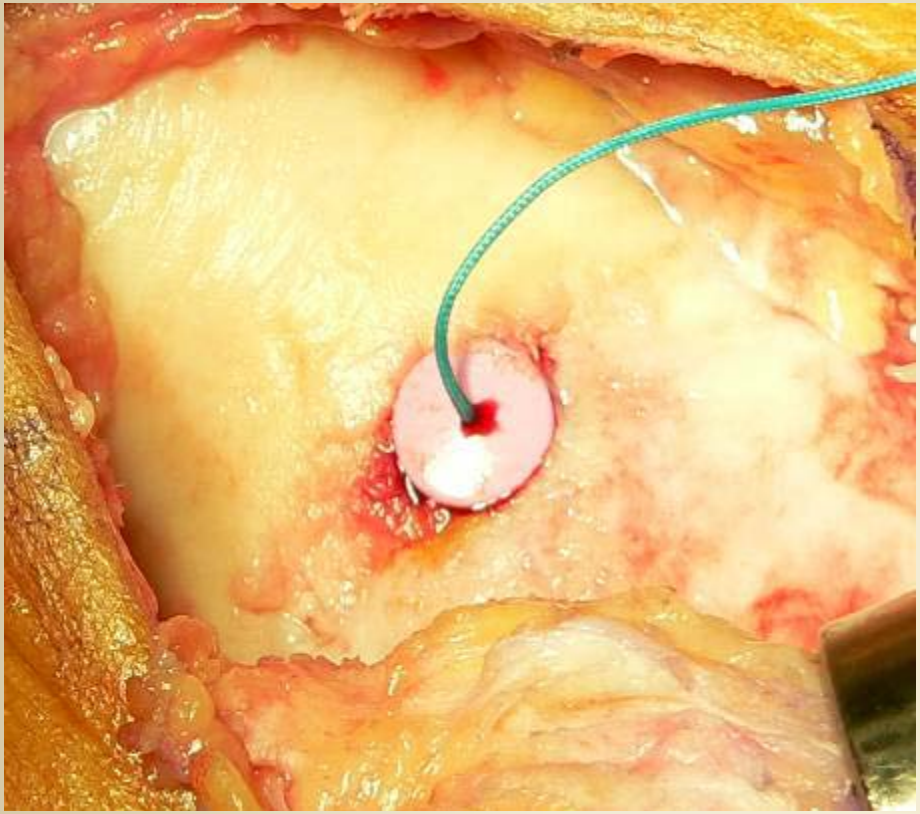
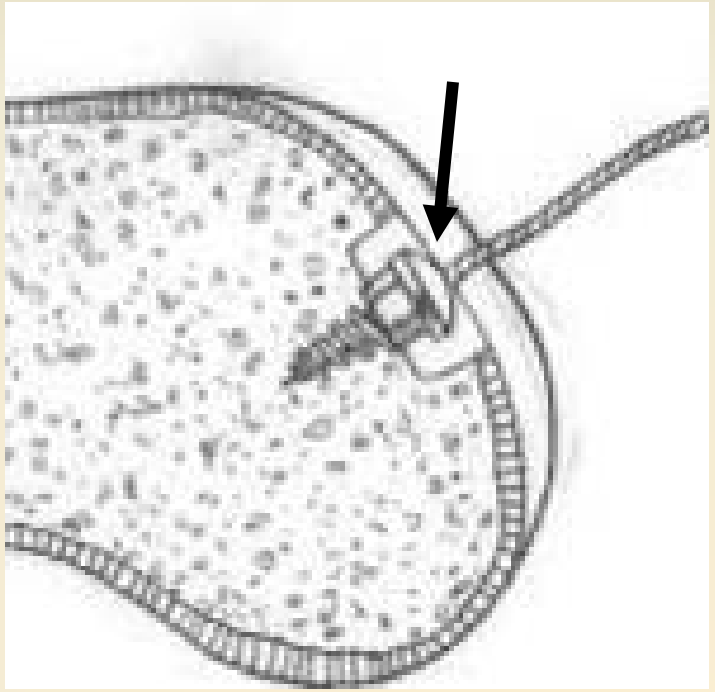
Height measuring cap





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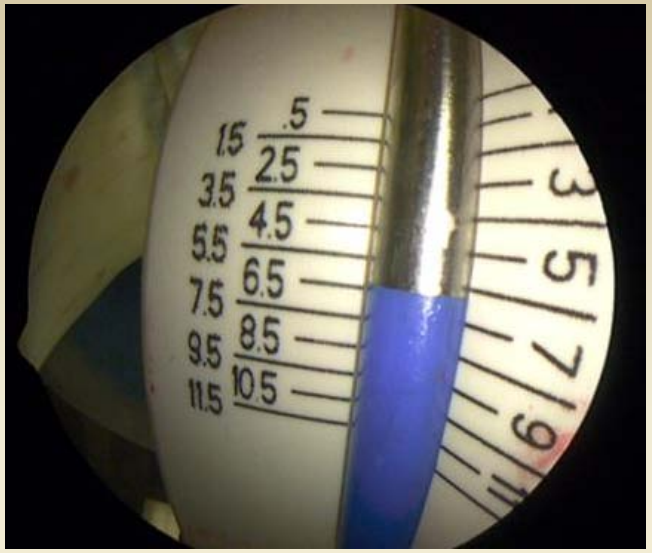
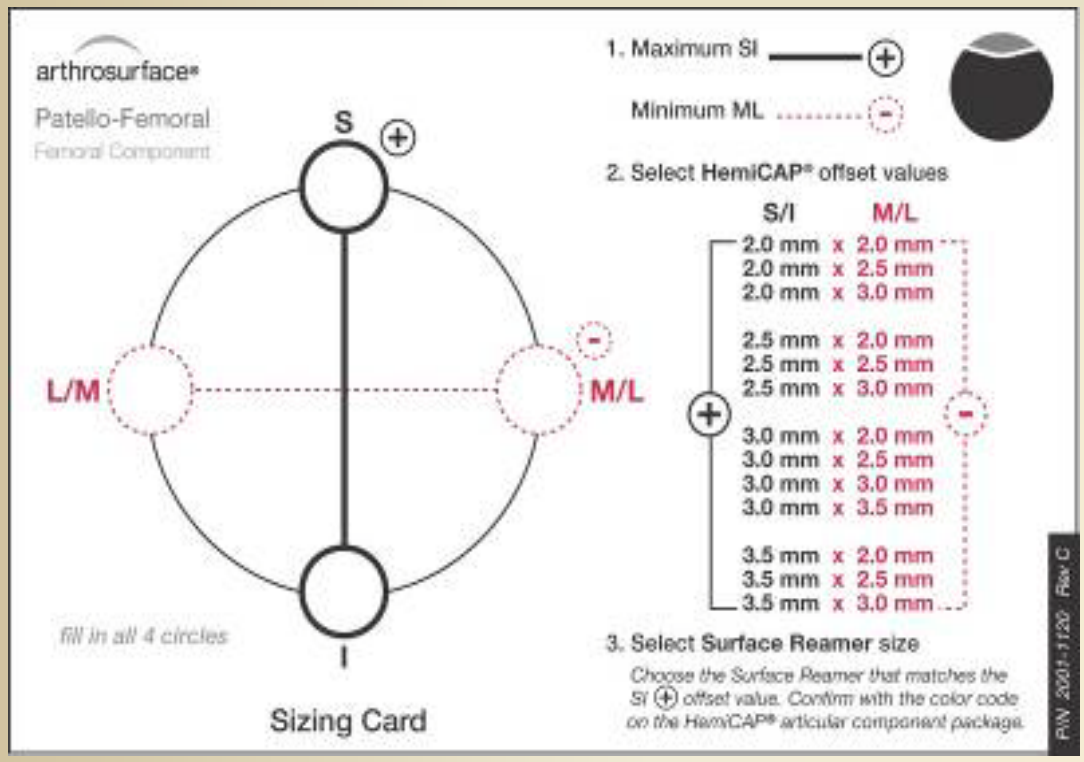
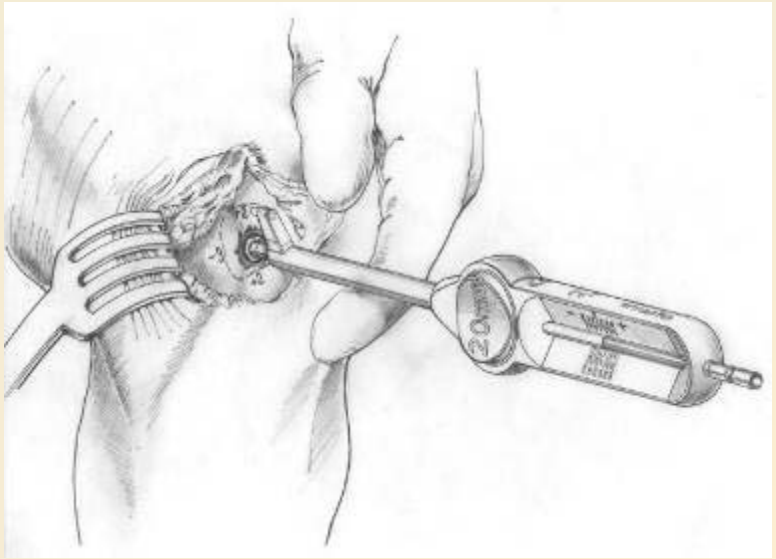
Articular Mapping

…if measured values NOT on chart, must consider WHY







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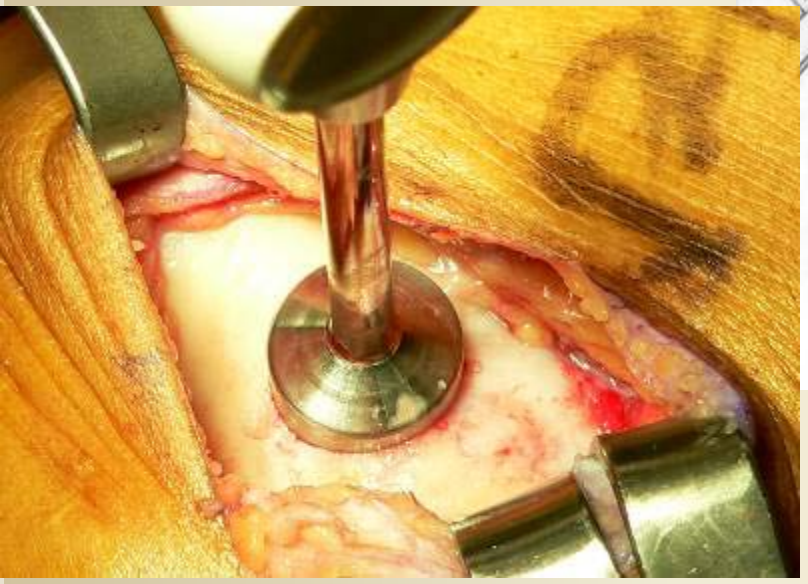
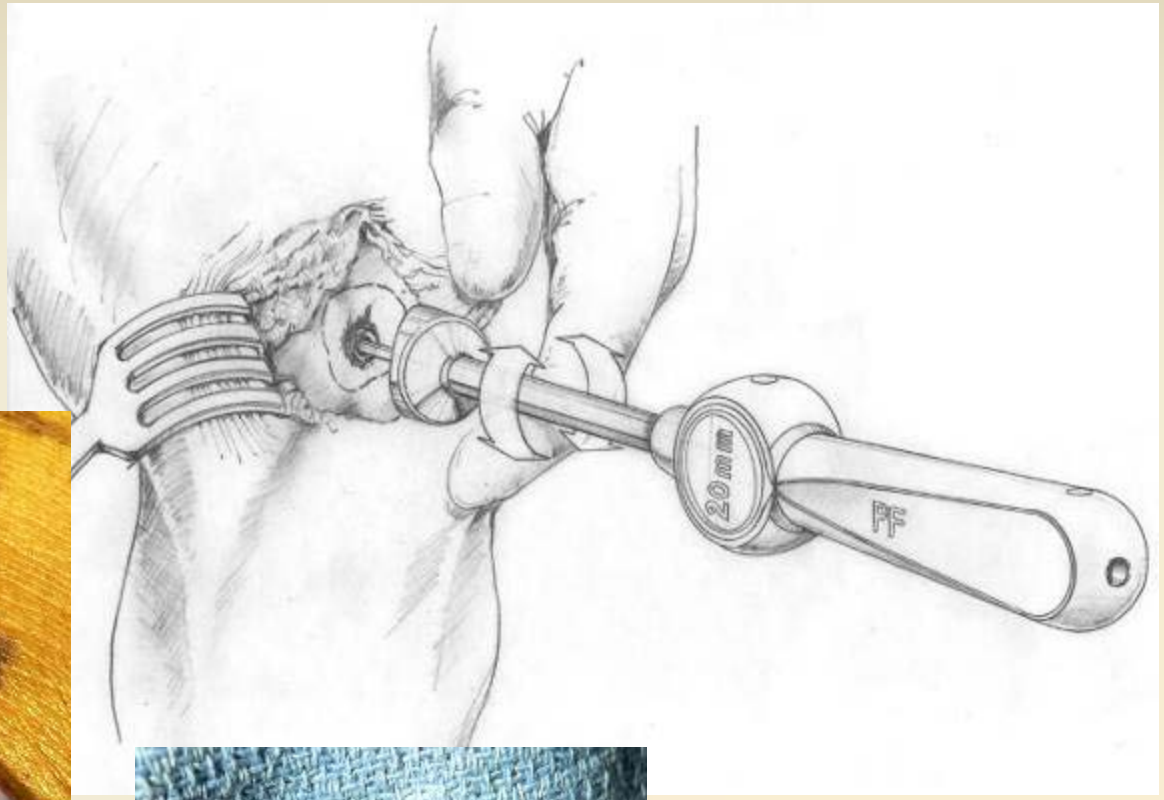
Peripheral cutting - protect ambient cartilage





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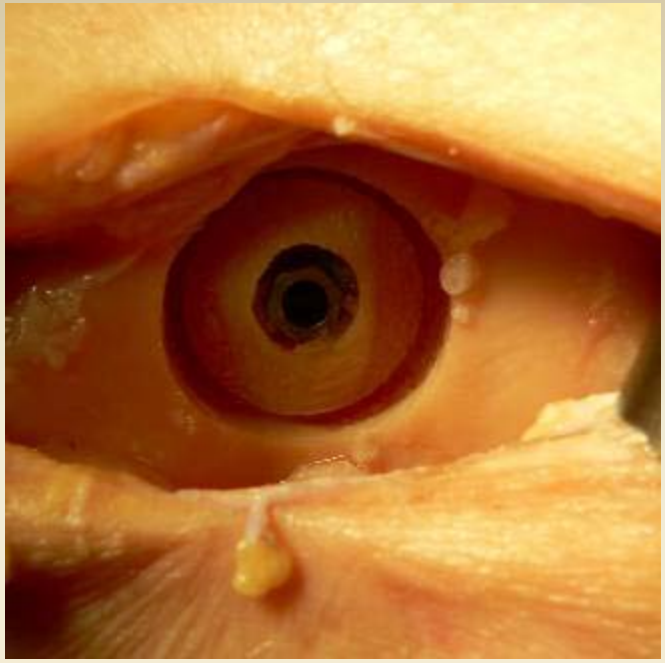
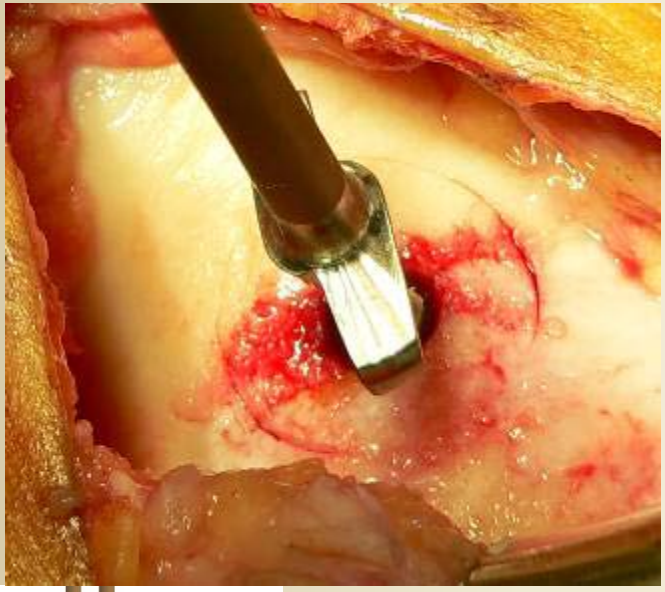
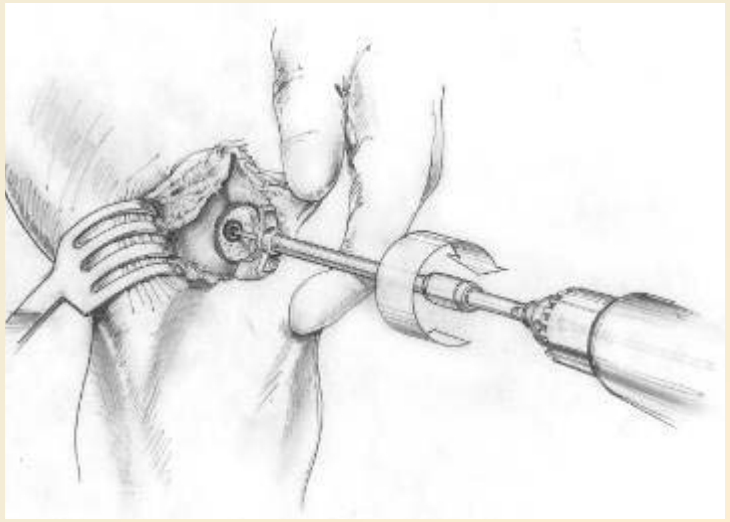
Drilling for implant



- High speed drill
- Do not use reamer
- Cooling irrigation





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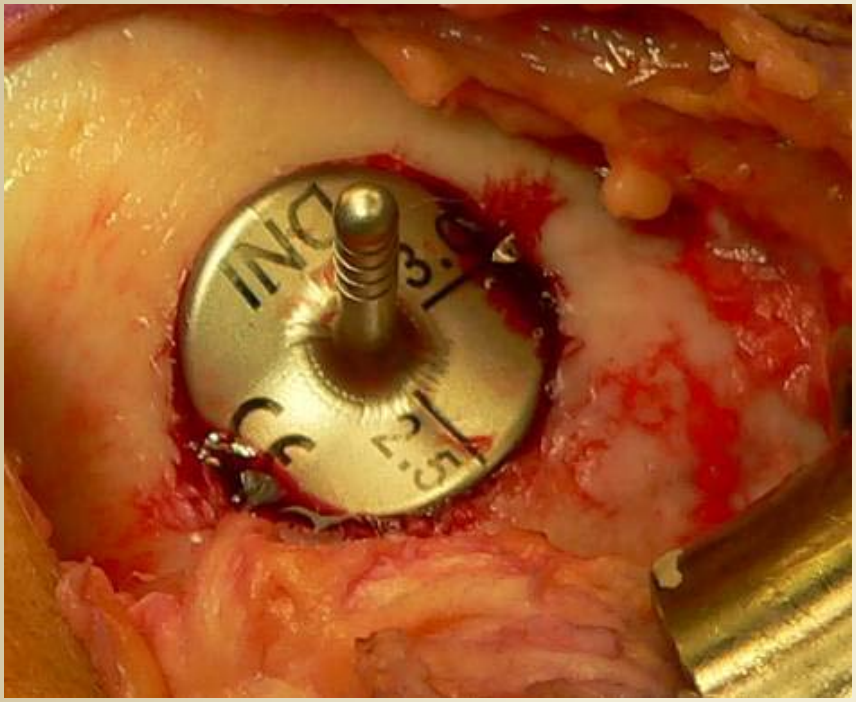
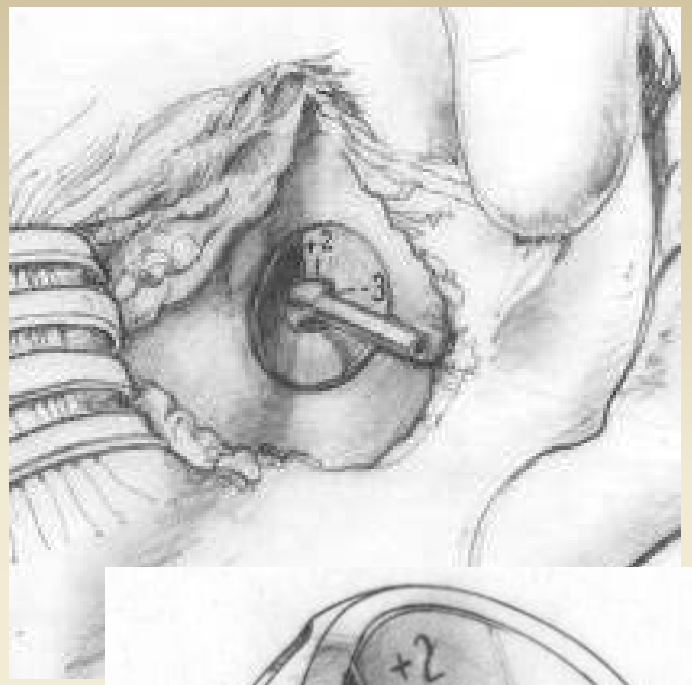
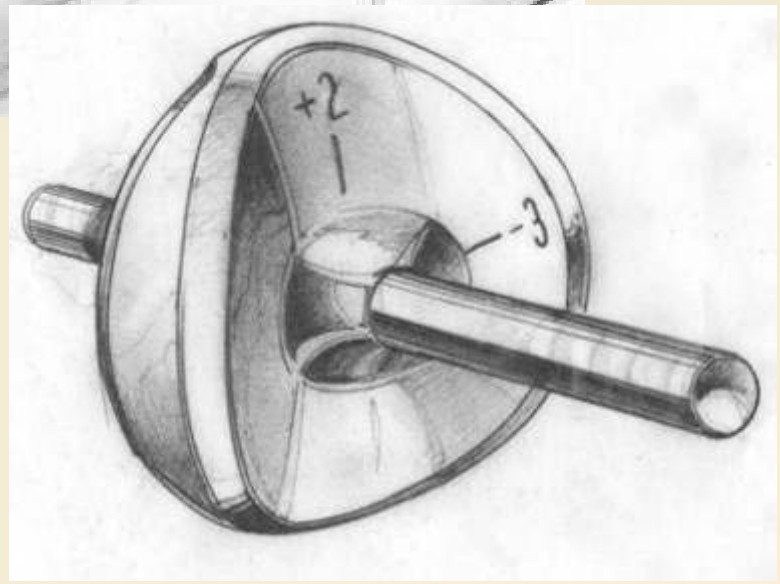
Device Trial







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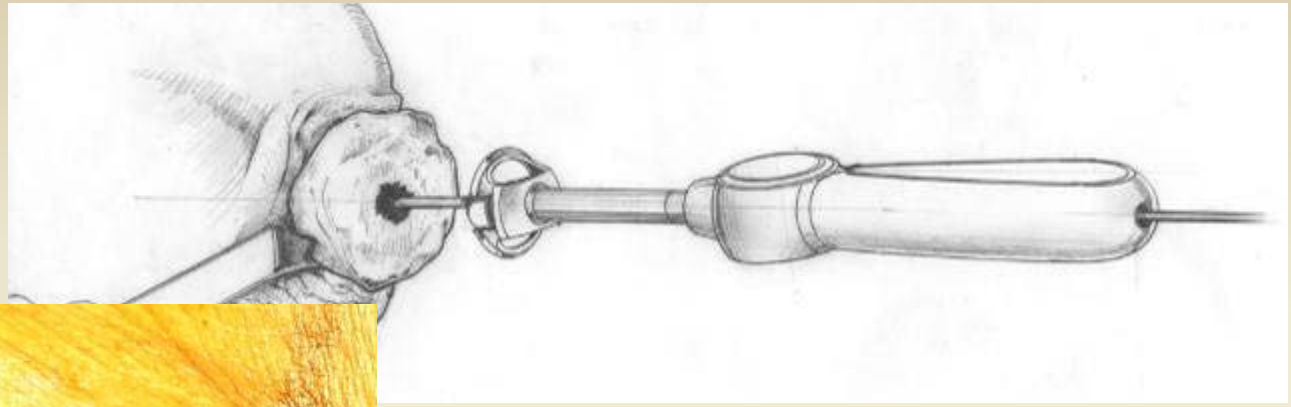
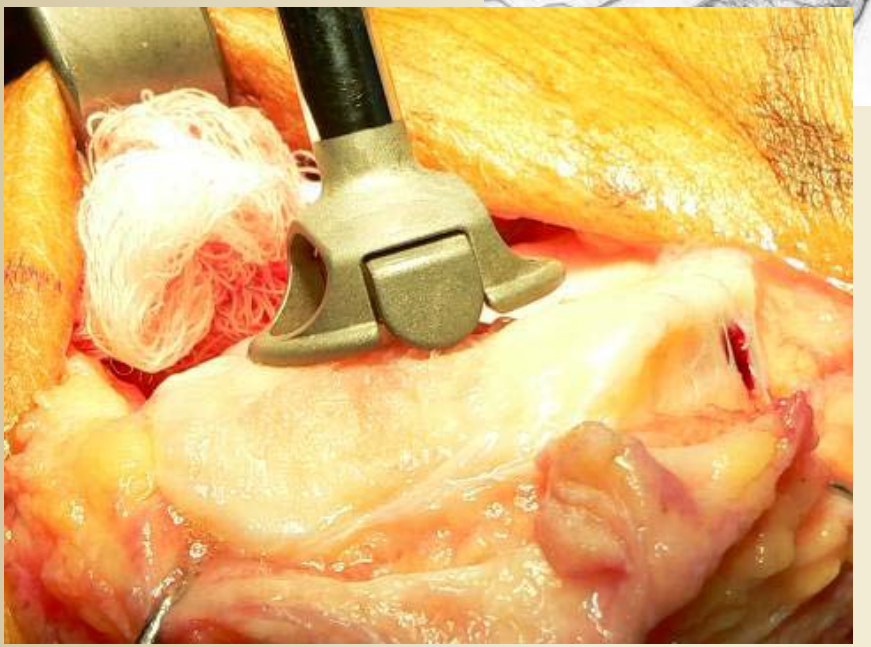
Patellar guide and wire





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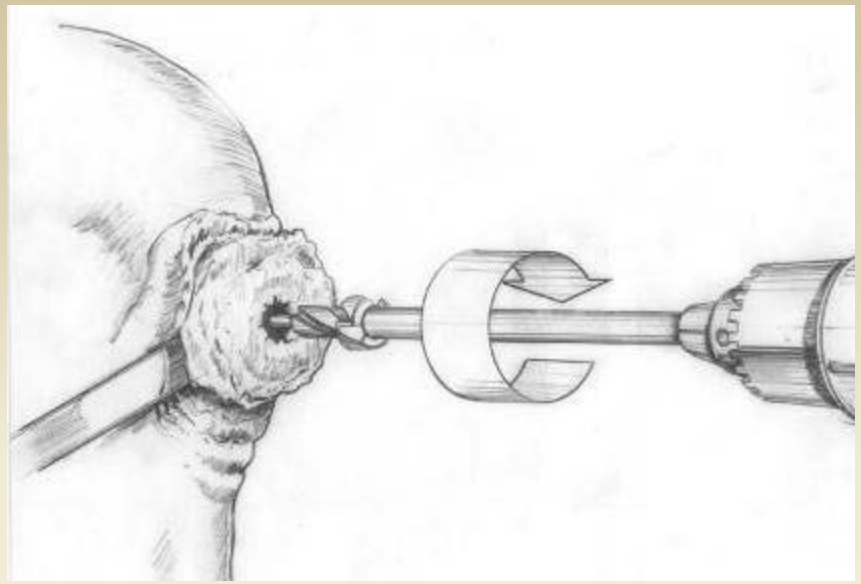
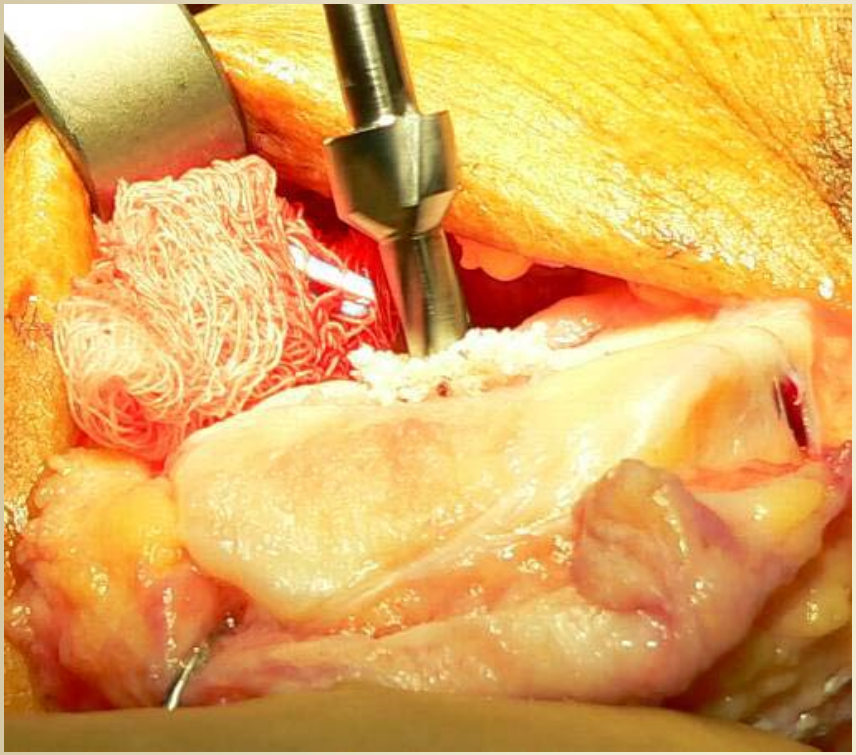
Starter drill over guidewire





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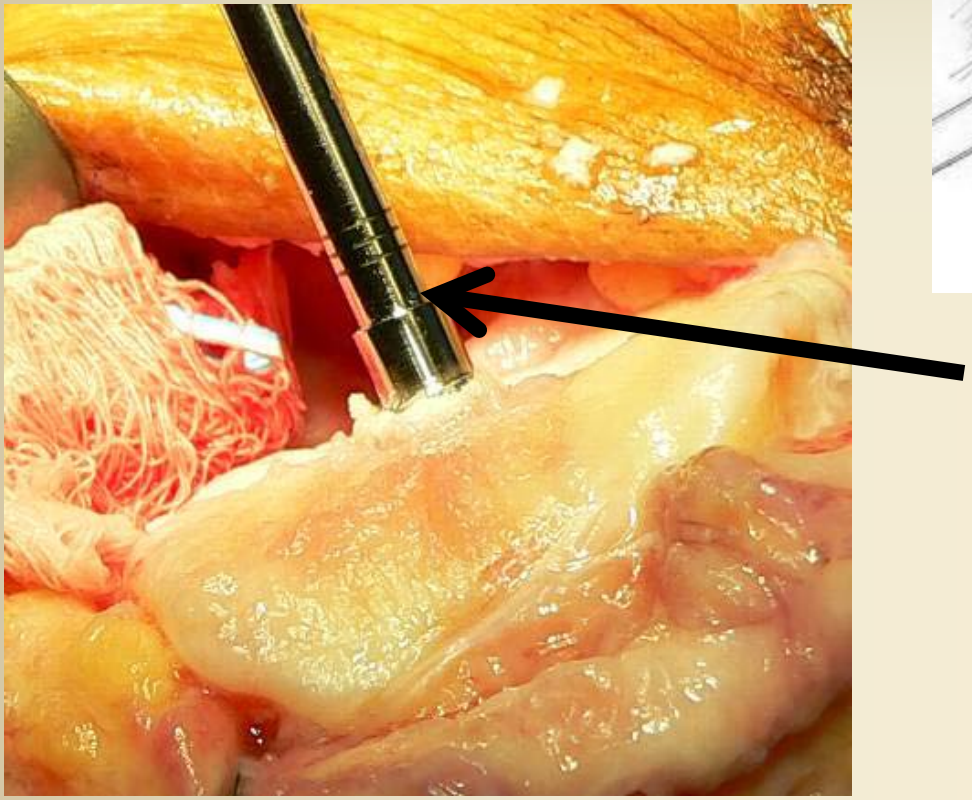
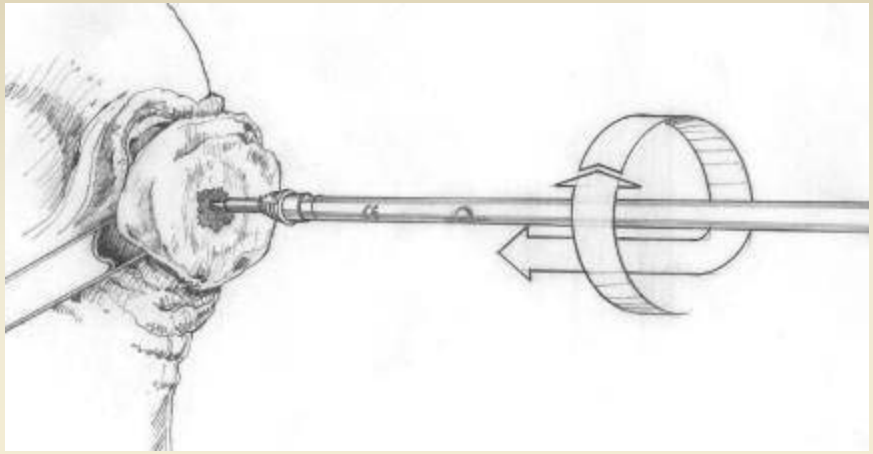
Insert centering shaft/depth limiter





This shoulder limits drill depth in next step

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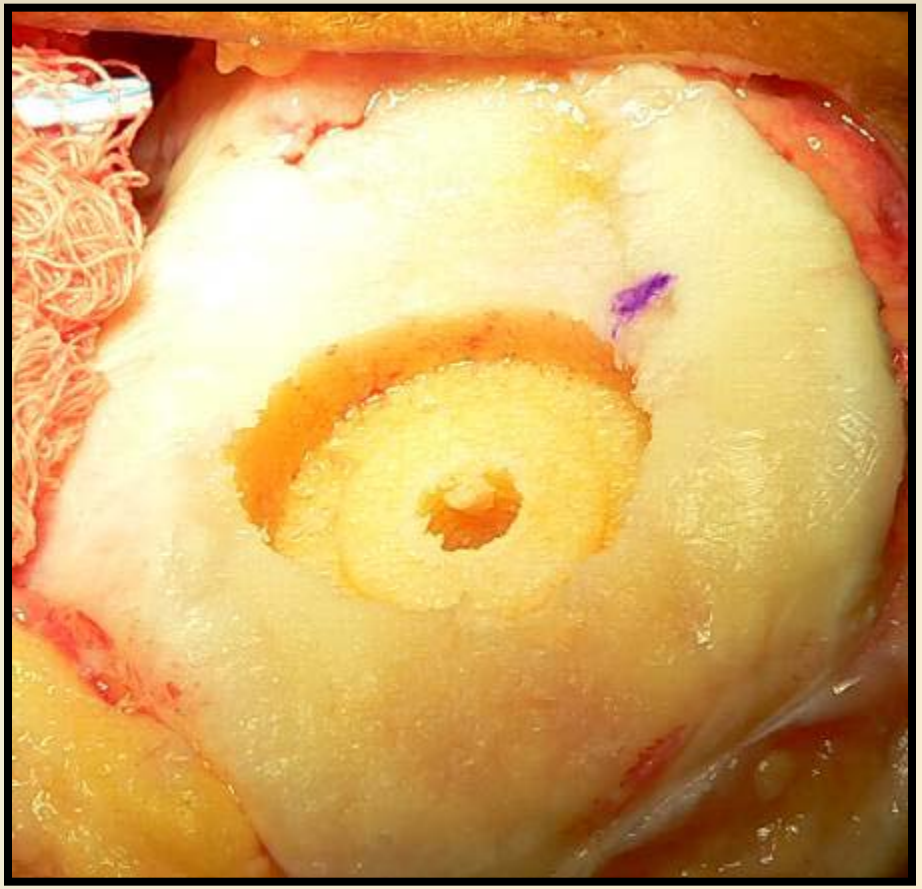
Drill to depth stop

basically need patella “deep enough”



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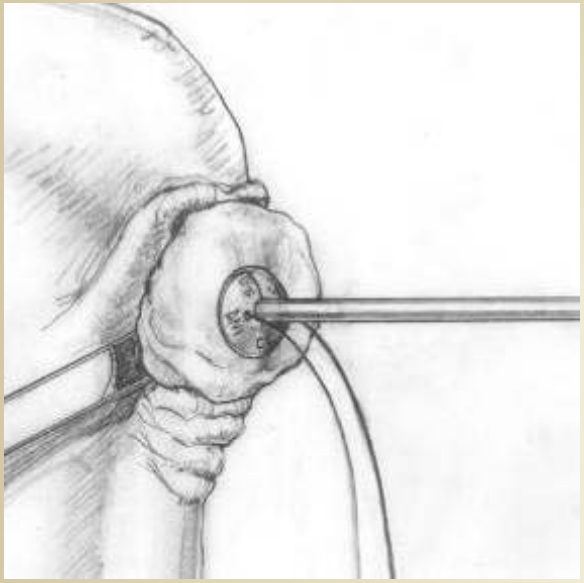
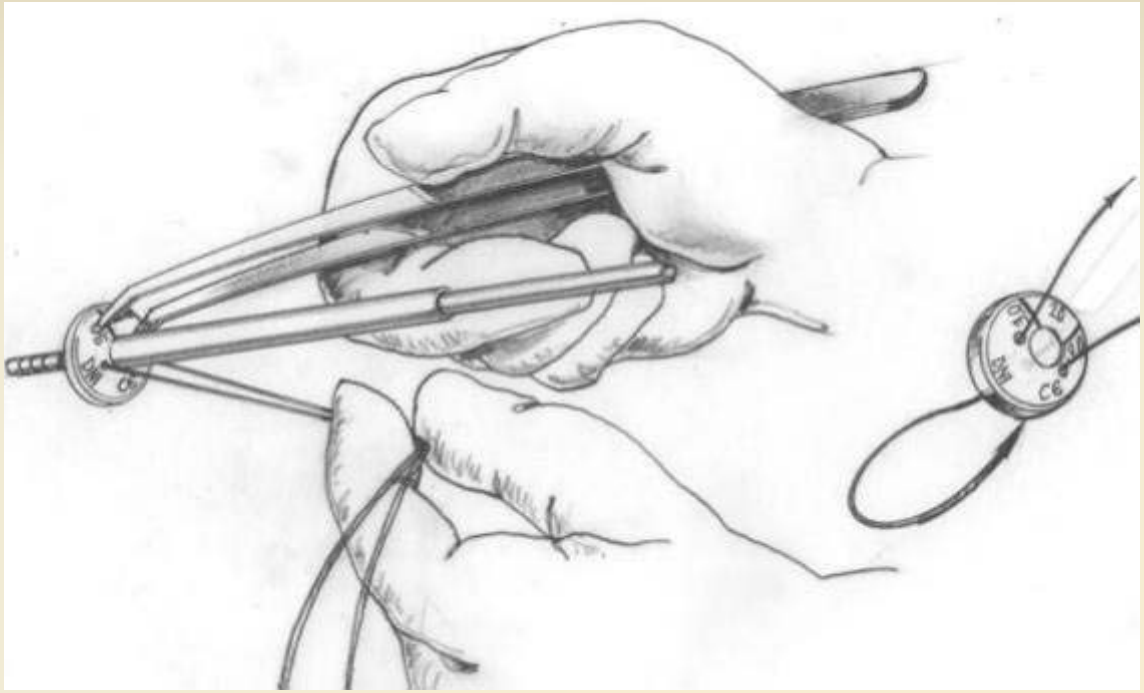
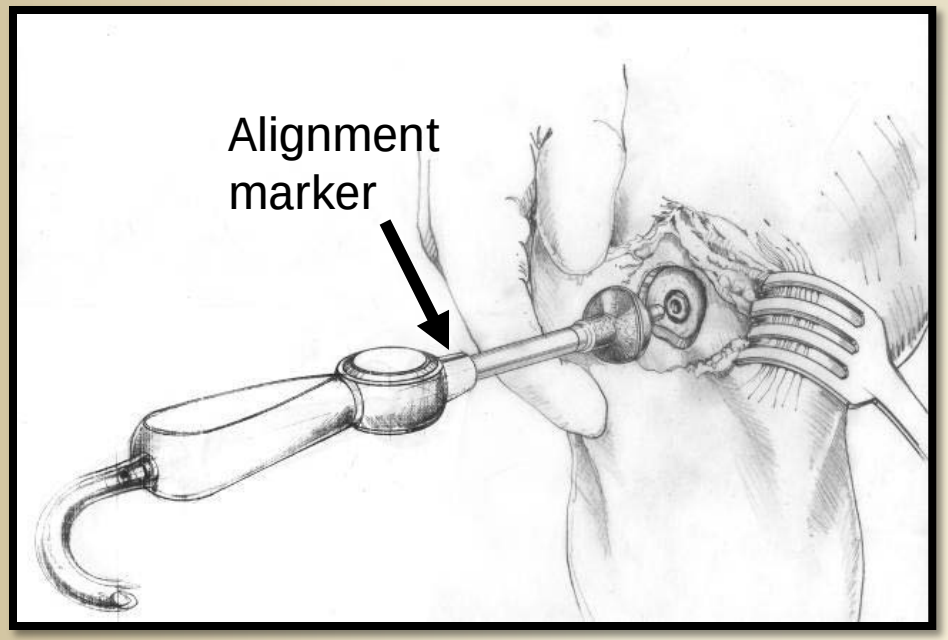
Patellar Trial





Insert Trochlea – Suction inserter with alignment



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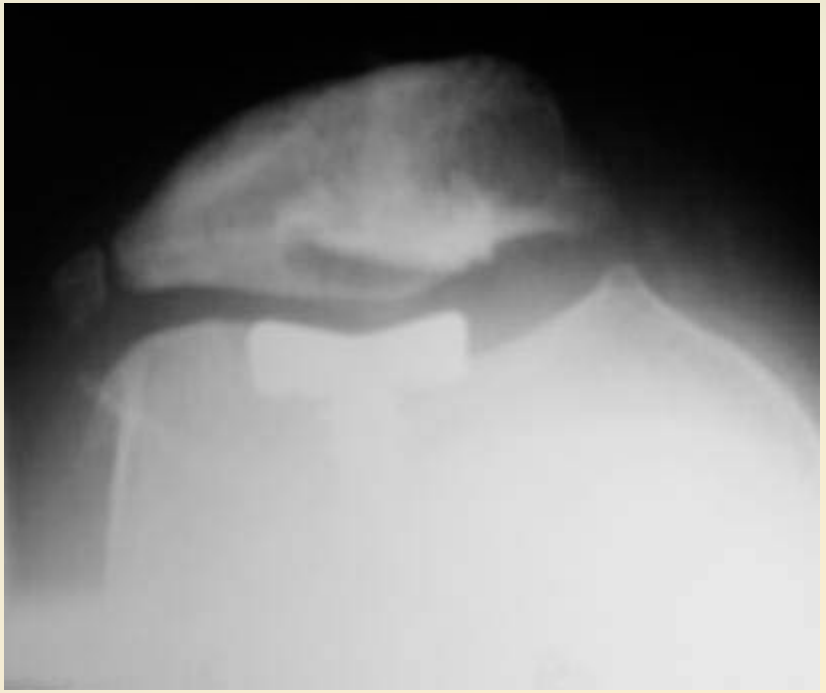
Radiographs pre and post



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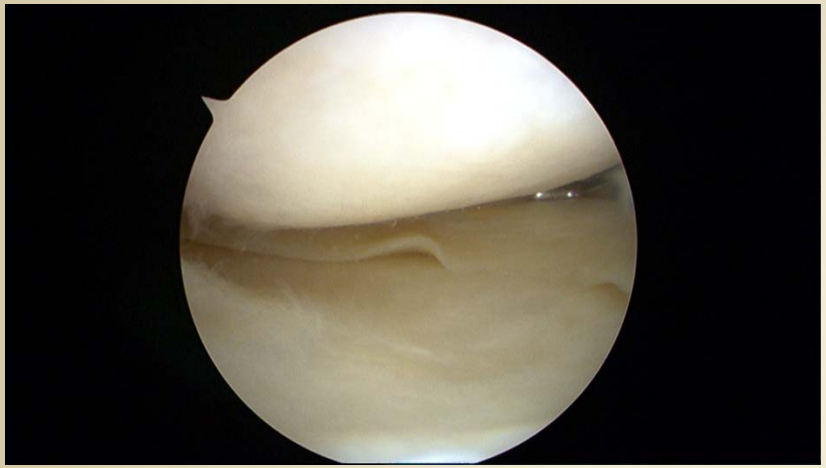
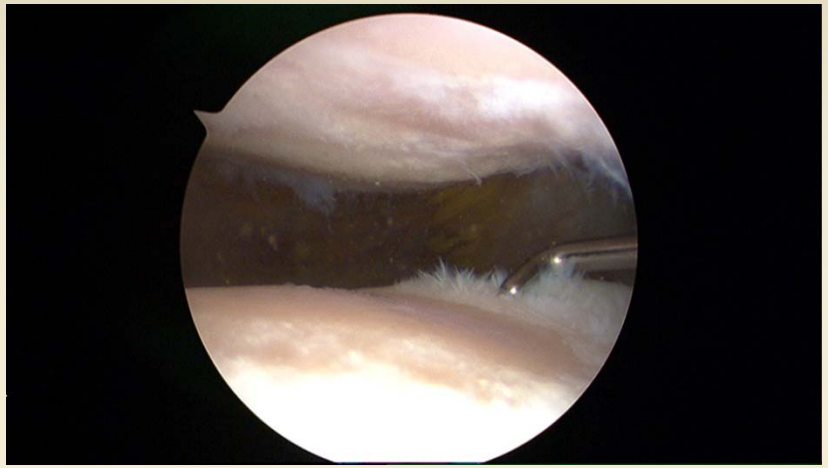
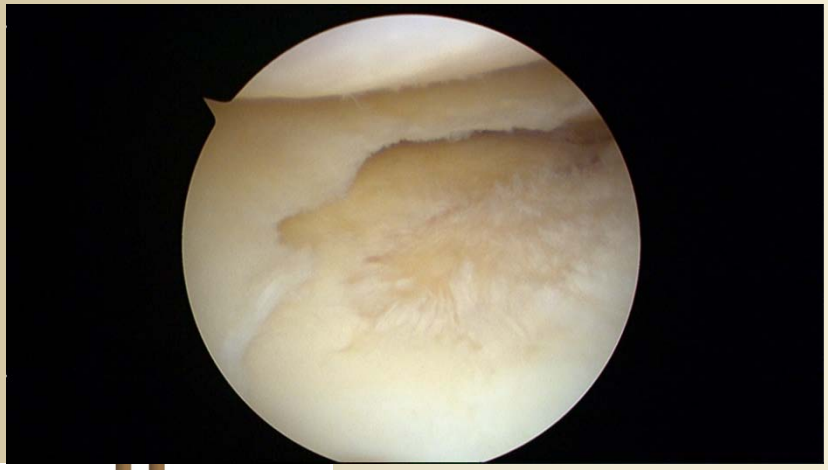
Case # 2 – 42 year old female







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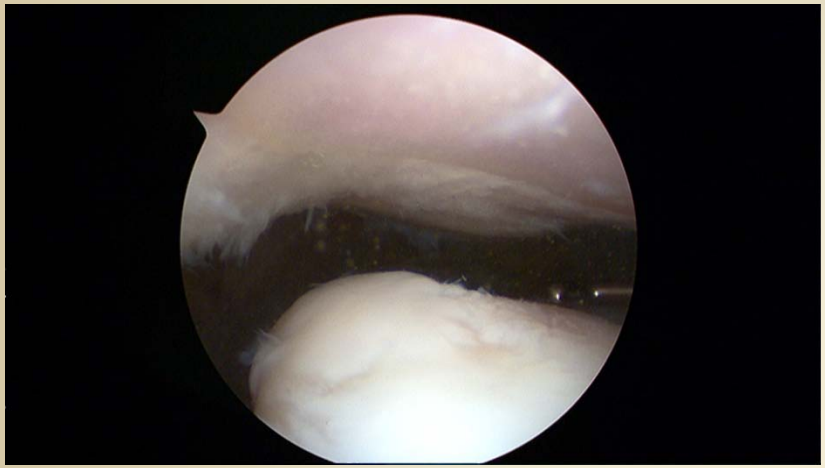
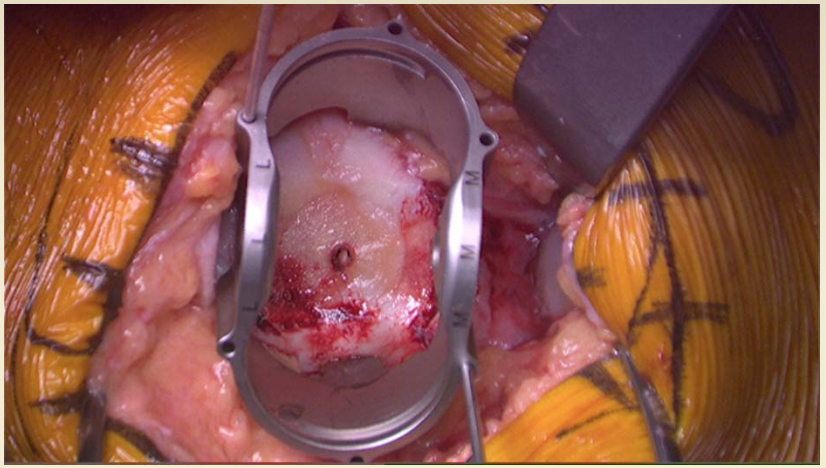
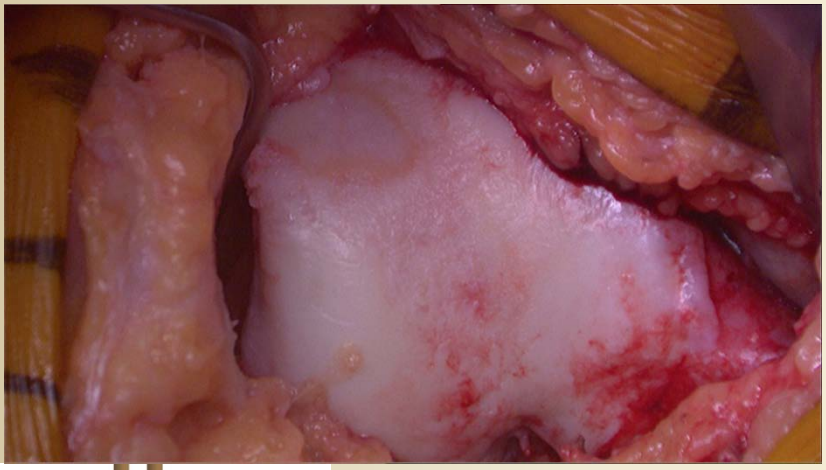
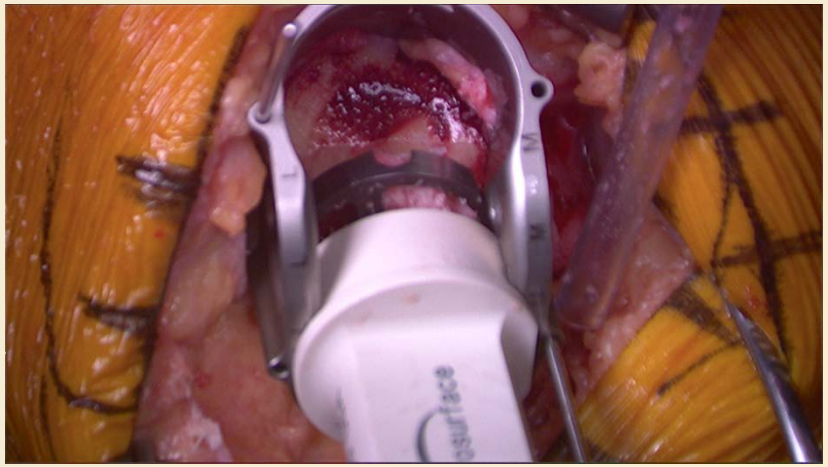
Case #2









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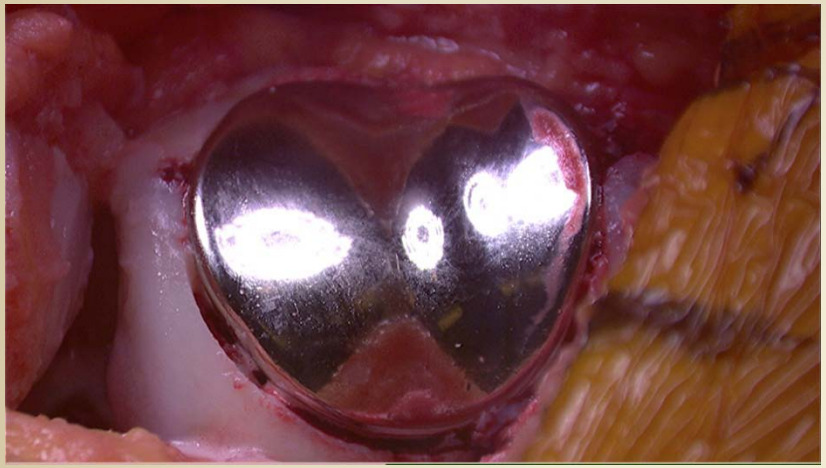
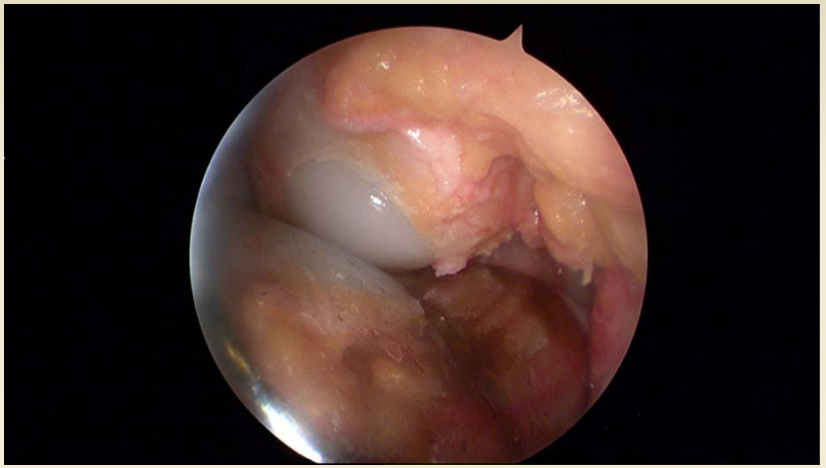
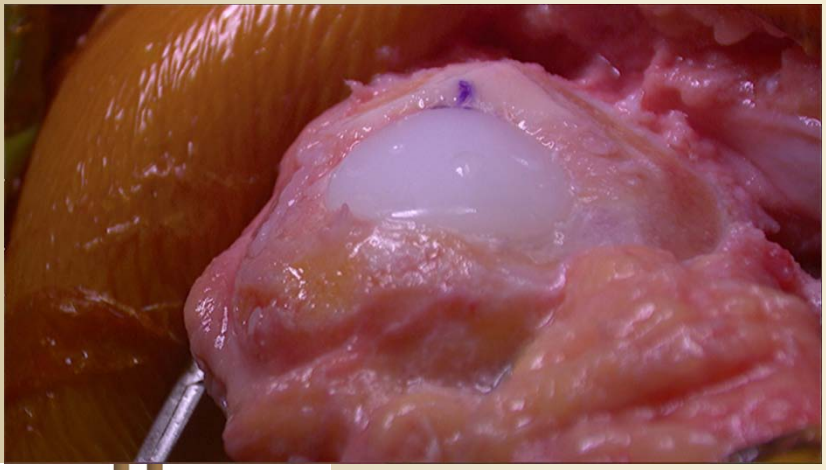
Case #2







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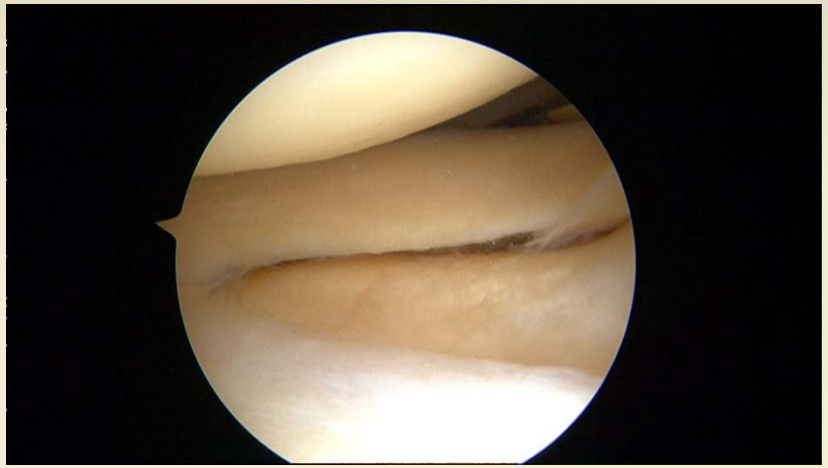
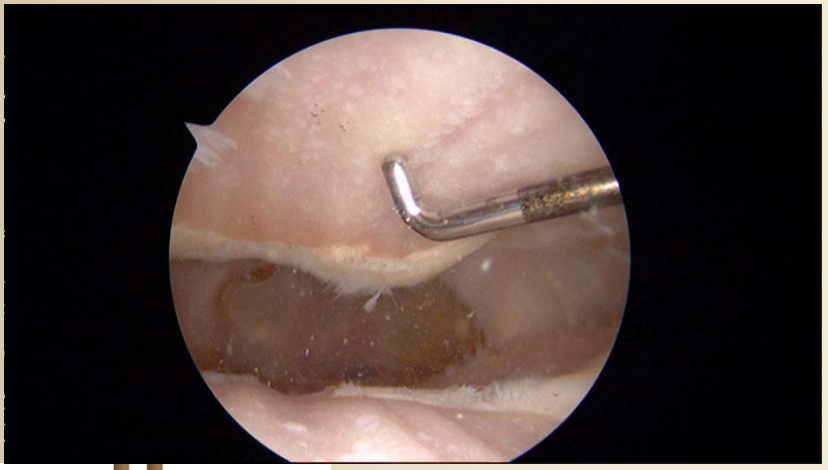
Case # 3 50 year old





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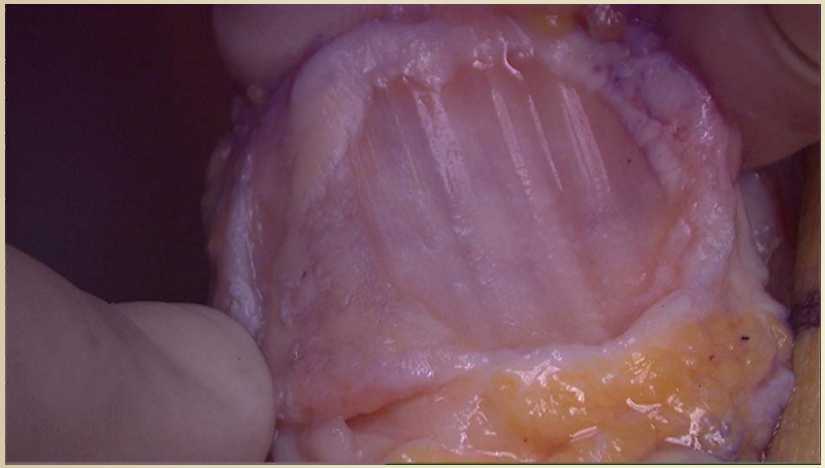
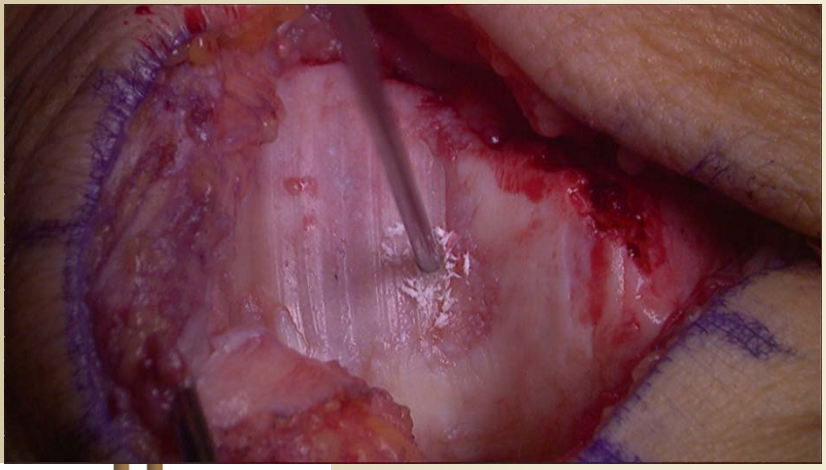
Case #3





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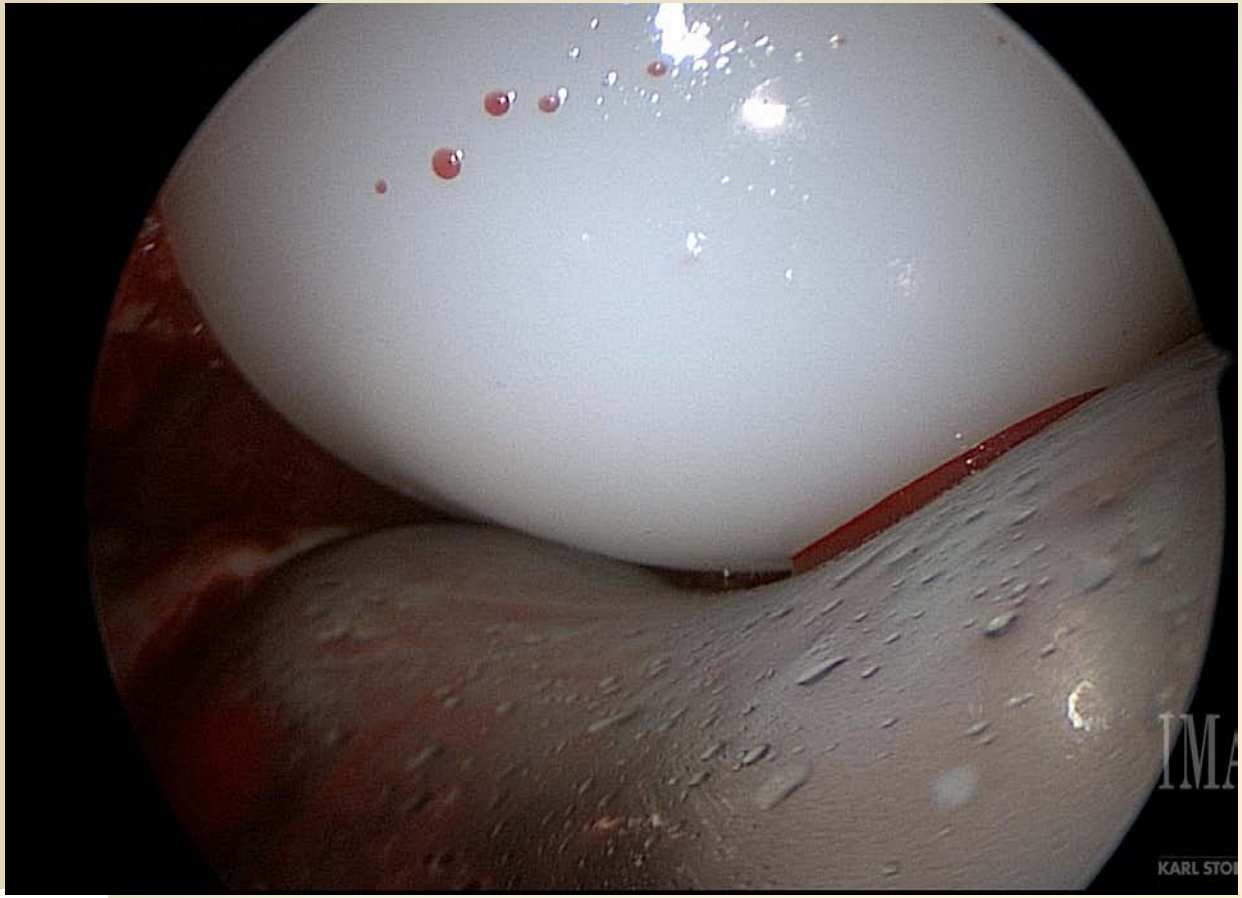
Patella-Trochlea alignment

Key step- Patella directly over FTG

cannot have poly on cartilage/bone



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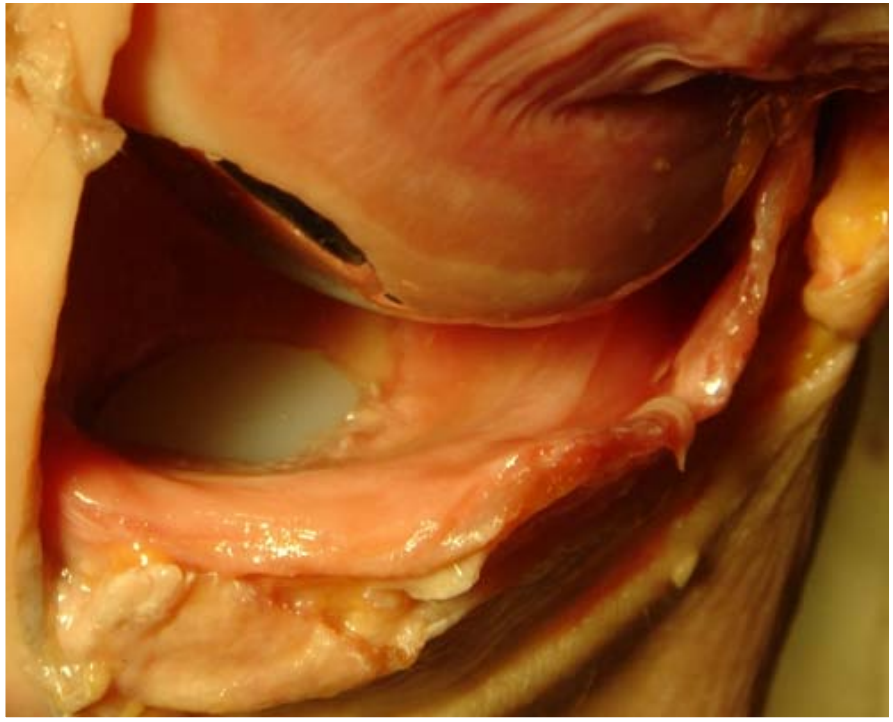
UniCAP™

aka… inlay arthroplasty, scope assisted Uni, AKR , etc..



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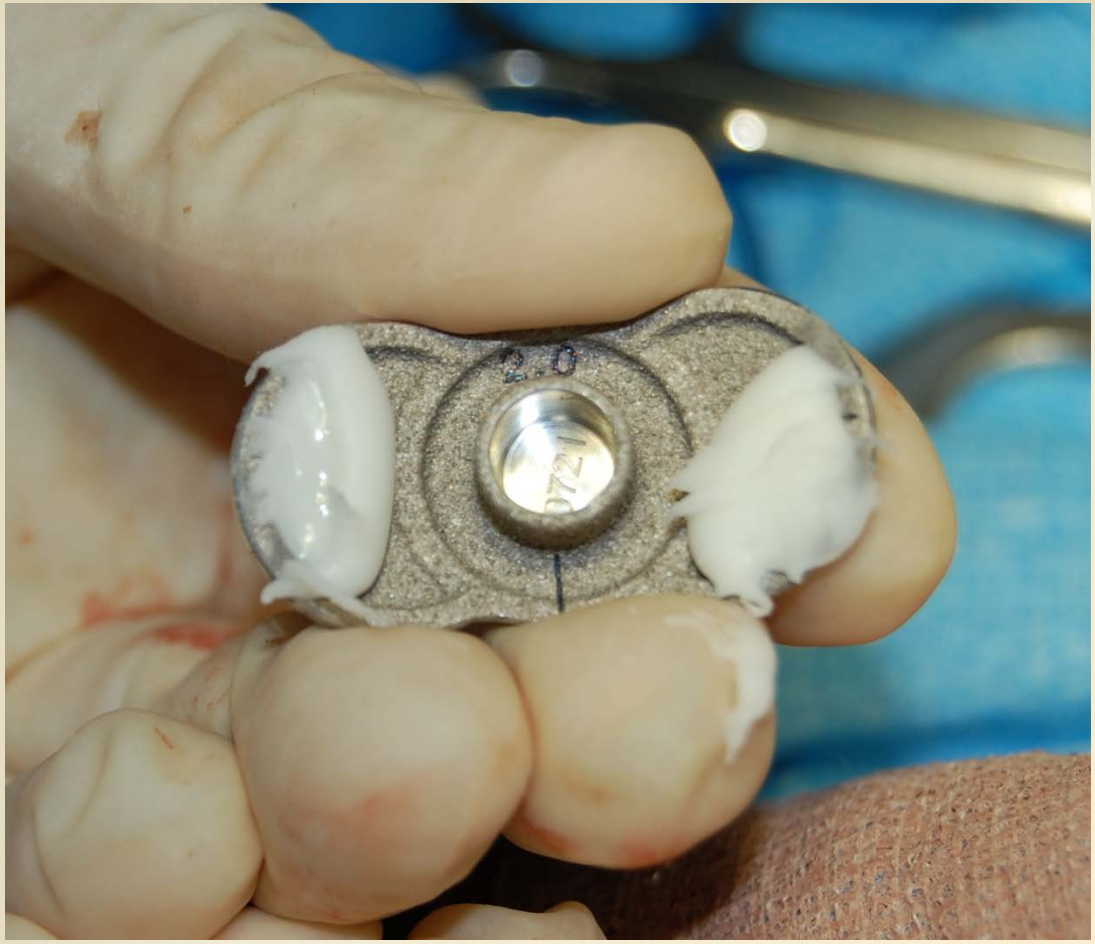
Cement and FDA



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UniCAP Advantages

- UniCAP may prevent patello-femoral complications/encroachment of conventional UKA through inlay resurfacing
- Revision to standard UKA may be possible due to shallow implant bed resurfacing technique
  - UniCAP avoids L-cut
- Ample room for ACL, osteotomy, soft tissue procedures
- Meniscal sparing technology for patients with healthy, functional meniscus

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UniCAP Limitations and Concerns

- Limited/Little angular correction can be obtained with an inlay resurfacing
- Tibial surface:
  - UniCAP only for central lesions
  - More common peripheral
  - Extensive tibial loss, need other option
- Patient selection remains critical:
  - Treat all pathology in the knee – homeostasis
- Be cautious and specific about referred pain and radiating pain patterns
  - Extending tibial pain is important to note!
  - Don’t want to undertreat tibia

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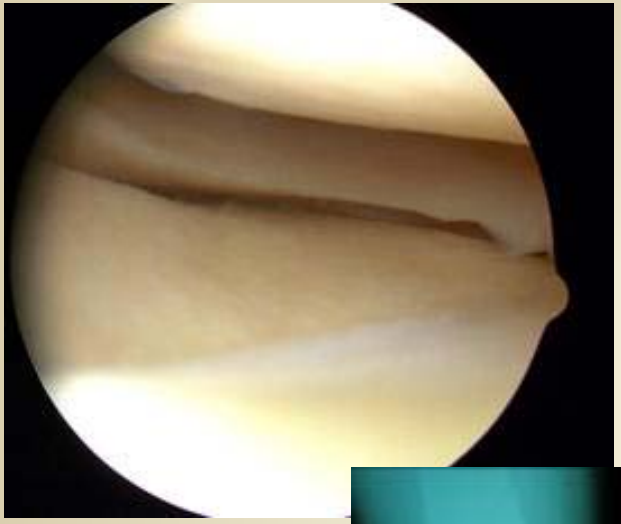
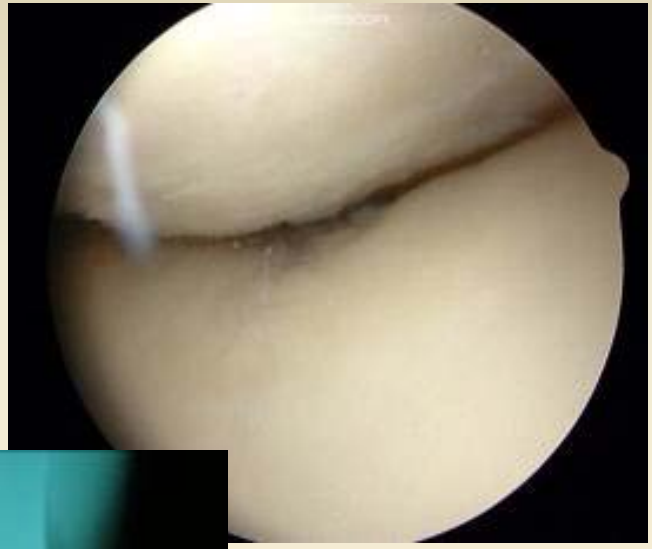
UniCAP case example –
medial knee resurfacing 46 year old cyclist





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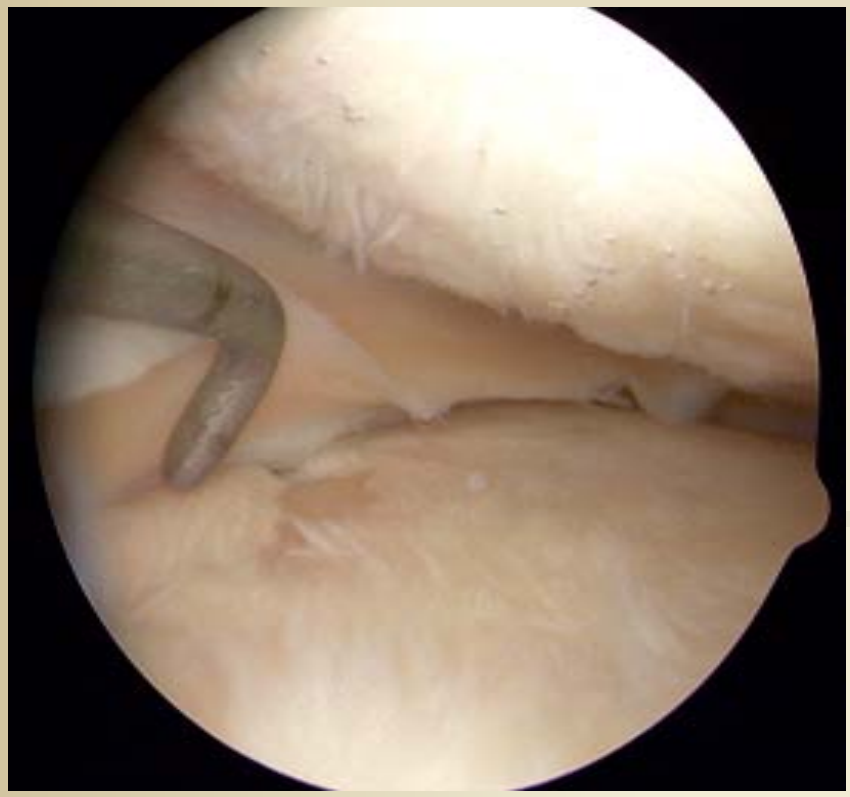
UniCAP – medial knee resurfacing



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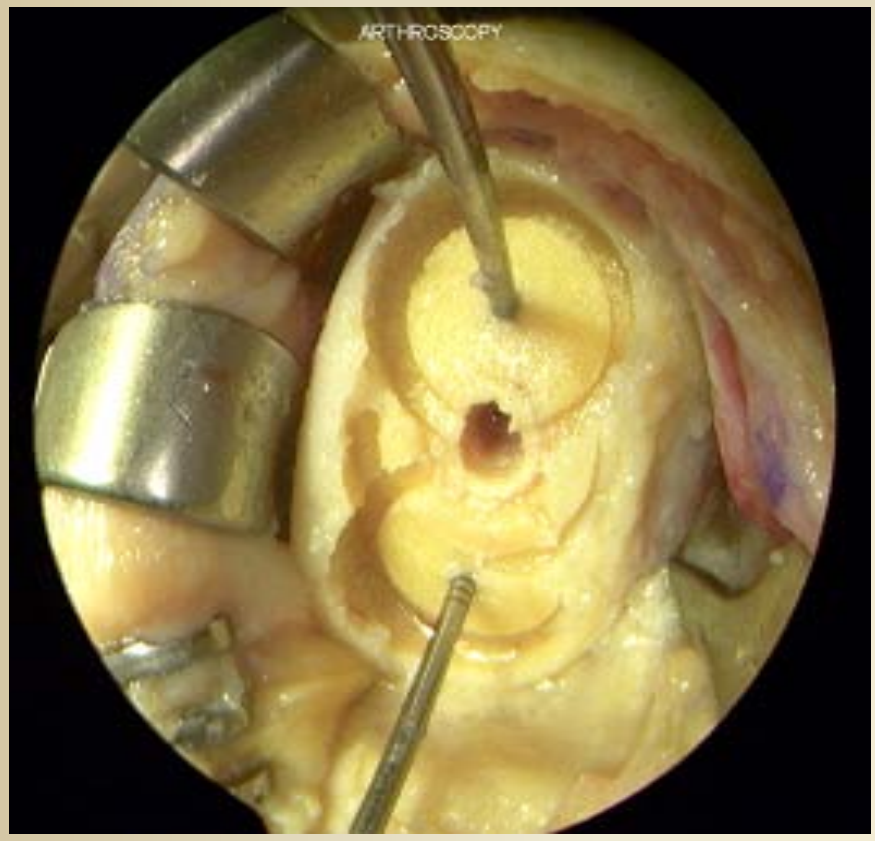
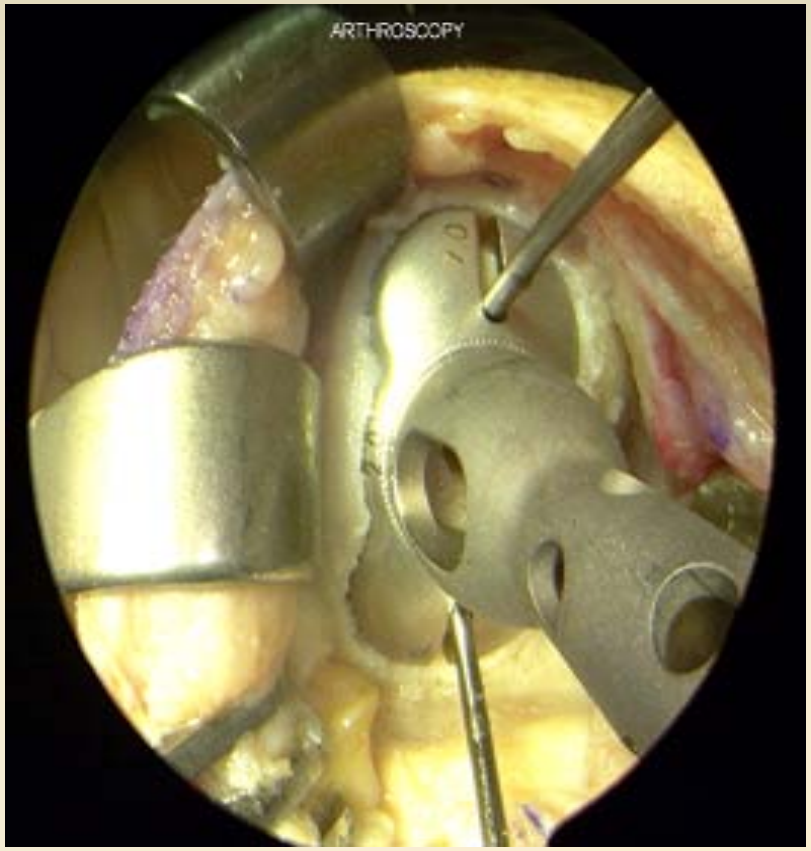
UniCAP – medial knee resurfacing





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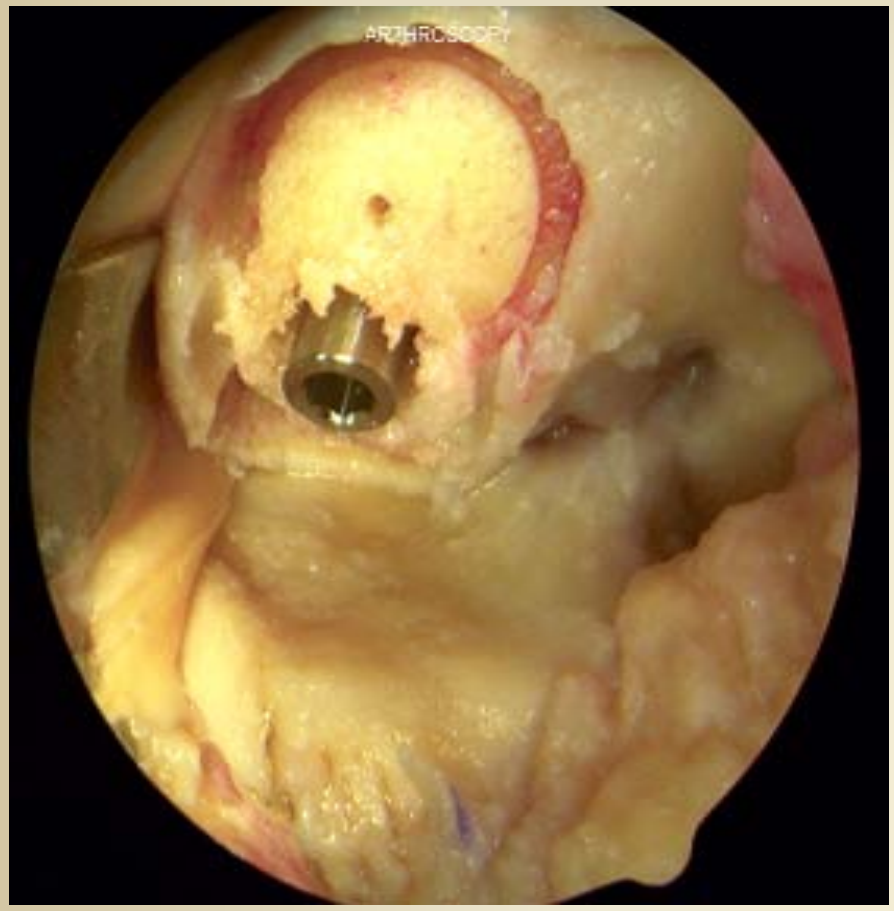
UniCAP – medial knee resurfacing



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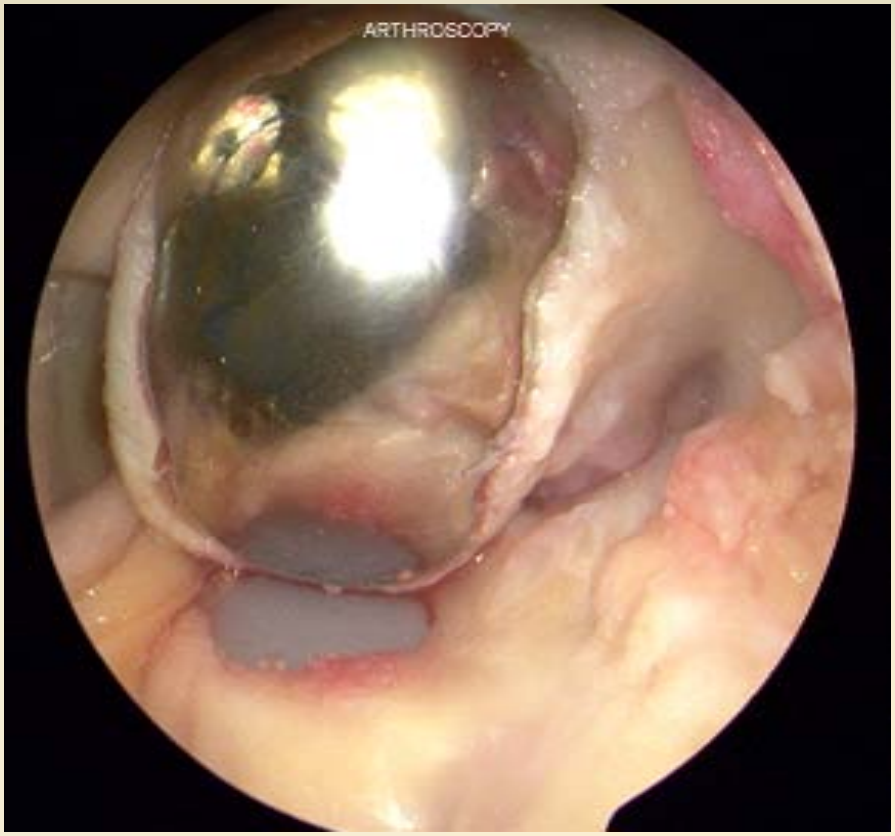
UniCAP – medial knee resurfacing



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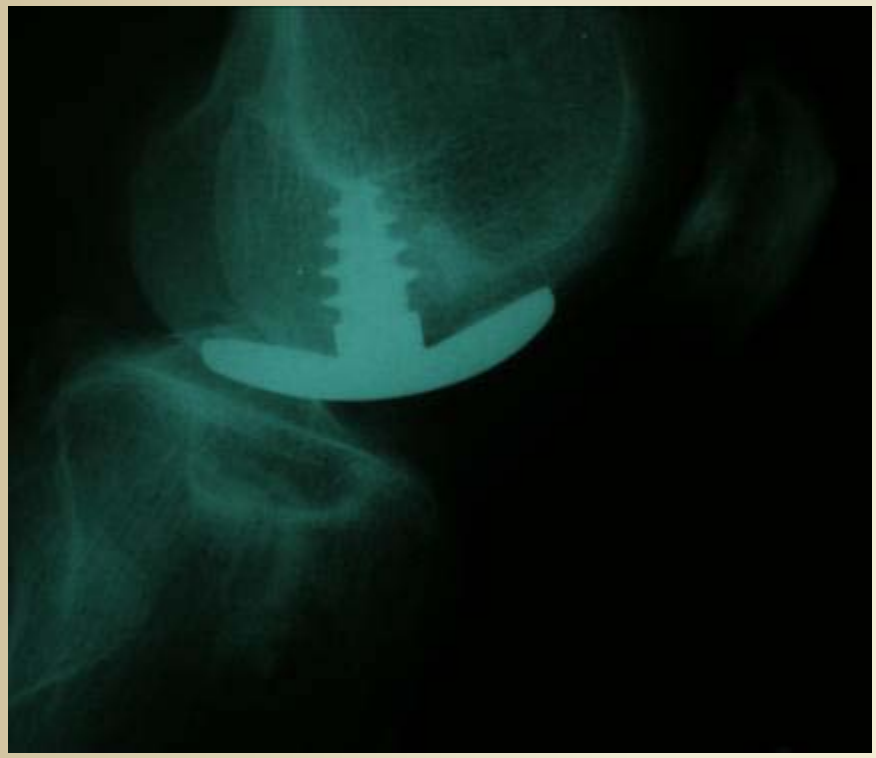
UniCAP – medial knee resurfacing



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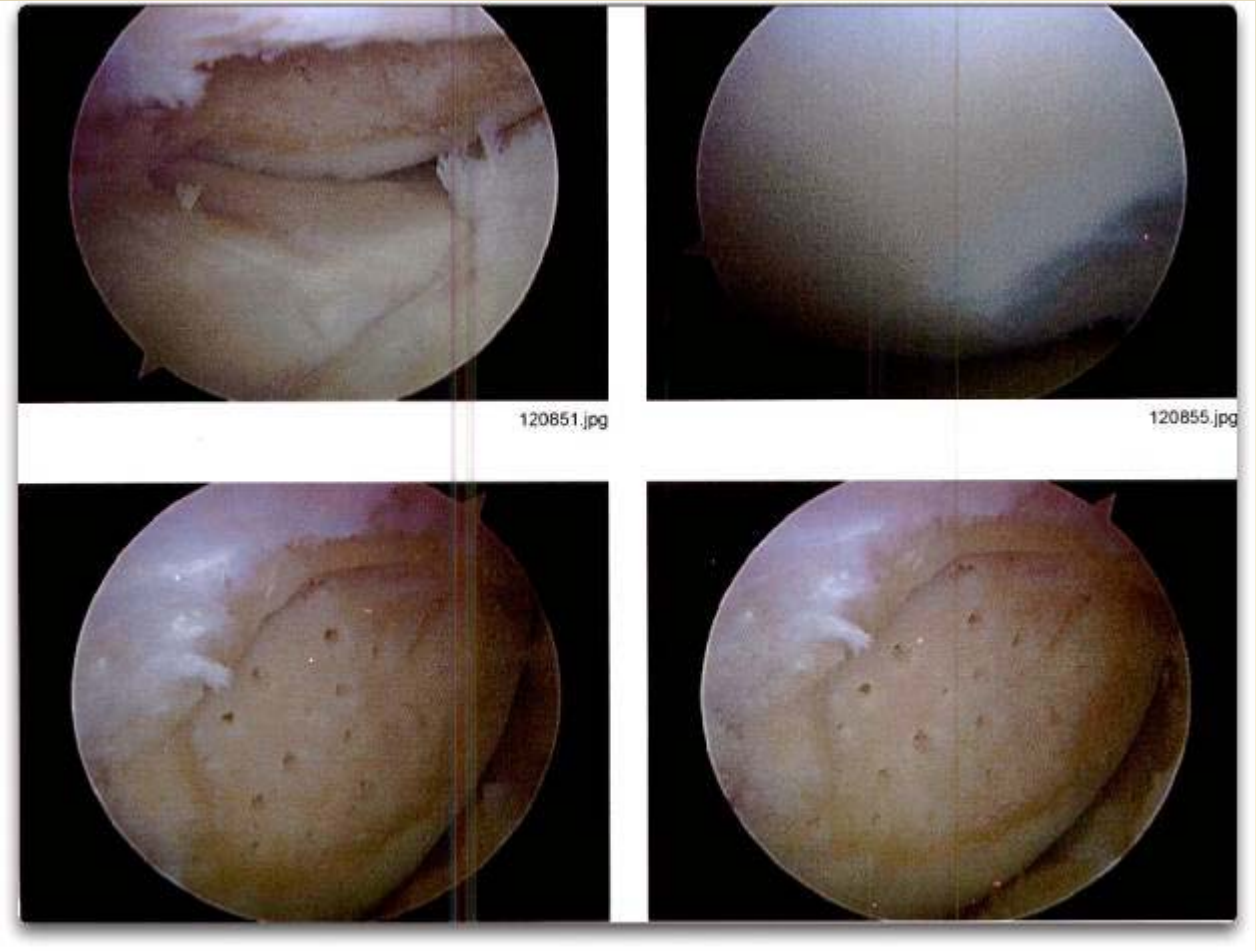
Case Report –
51 year old, failed Microfracture, unable to exercise due to medial knee pain



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1 year post microfracture,no pain relief

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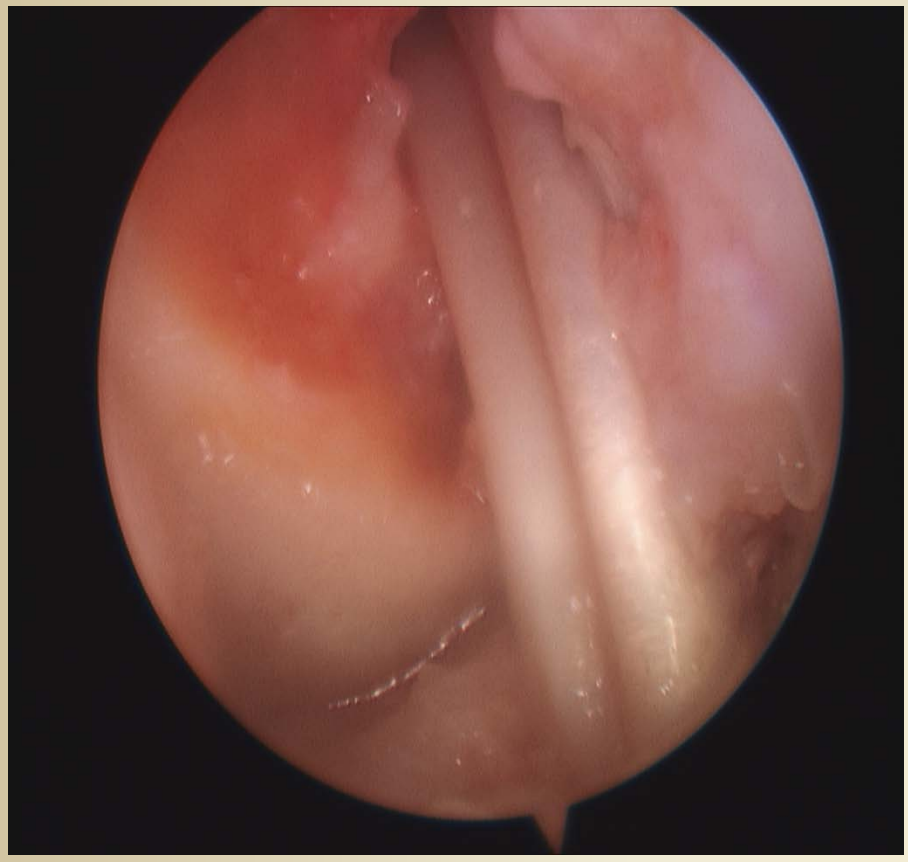
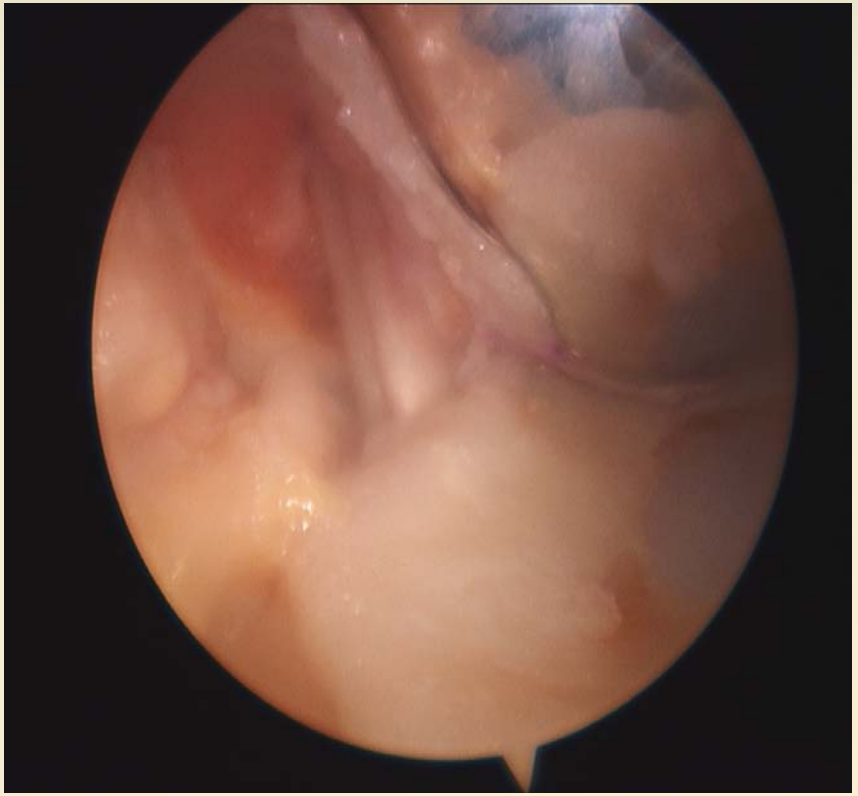
ACL graft – Medial UniCAP





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Case Report
63 year old business man, hiker

- Neutral alignment
- Told he needed a TKA
- Seen 6 doctors, essentially refusing to accept TKA
- Healthy, ideal body weight

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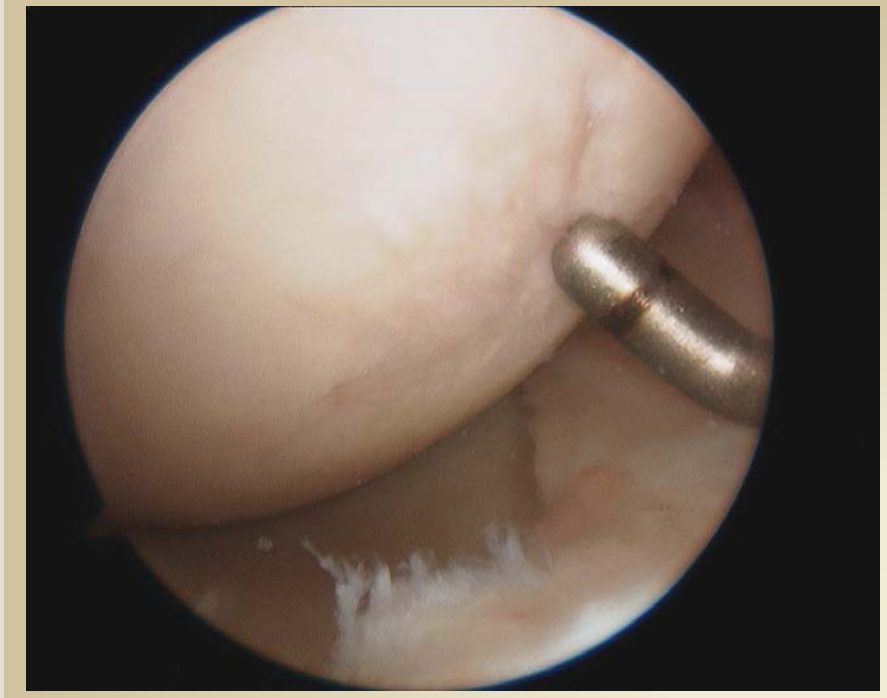

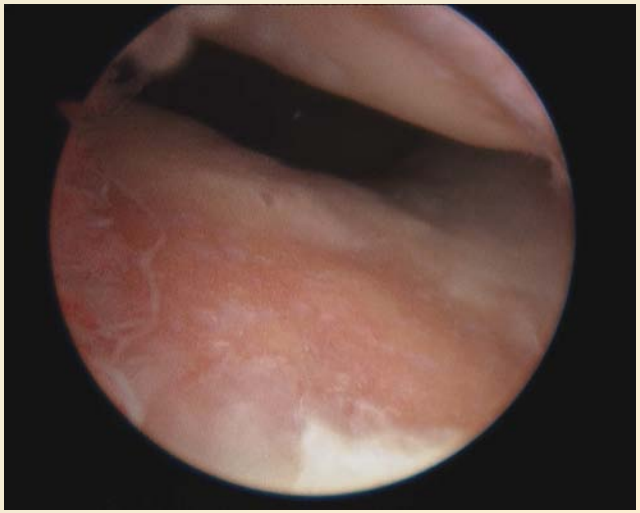

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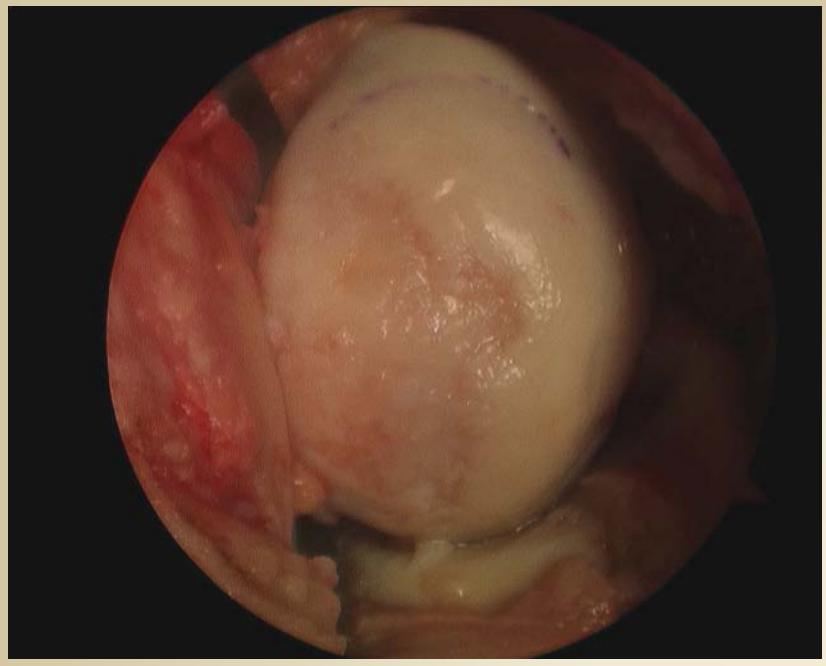

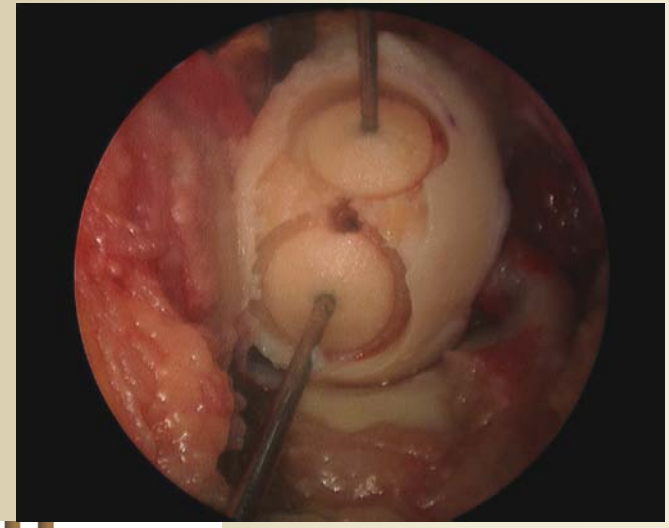

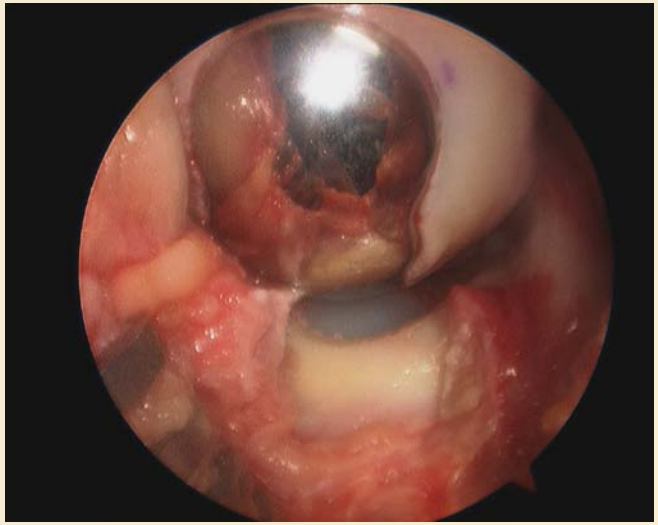

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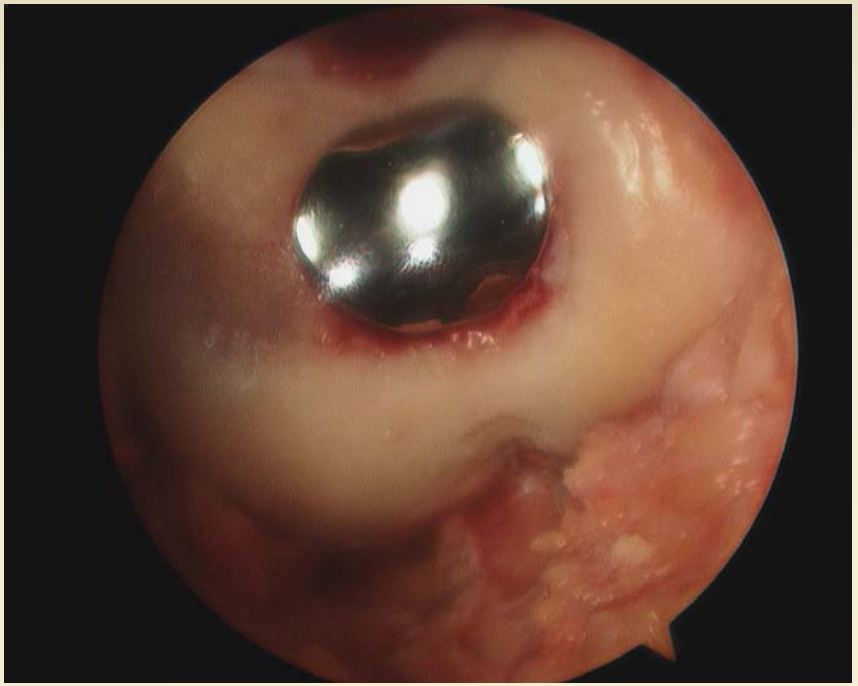

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Combining Biologics with Inlay Arthroplasty

29 year old firefighter

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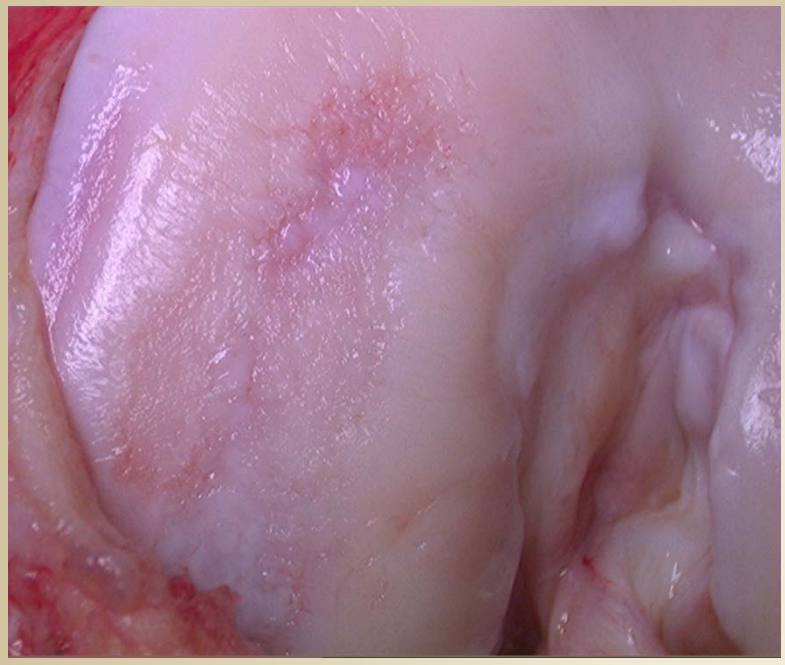

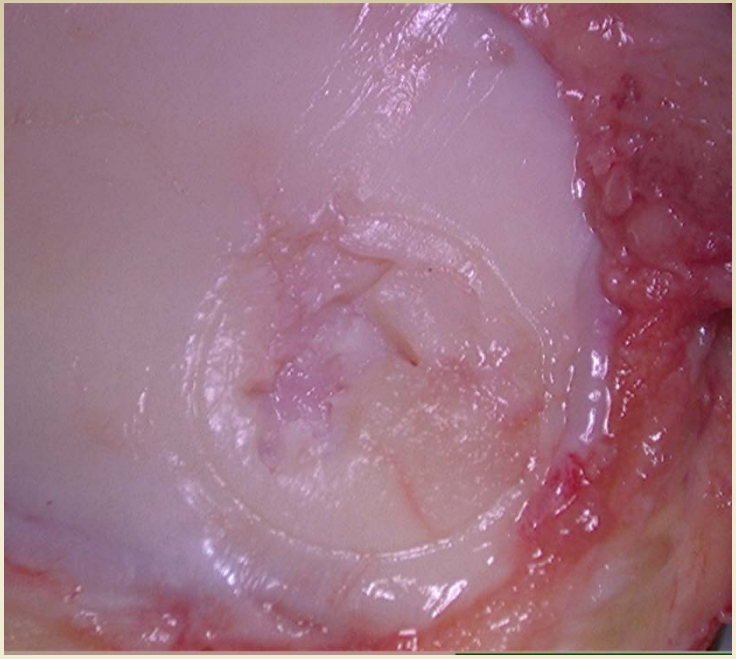

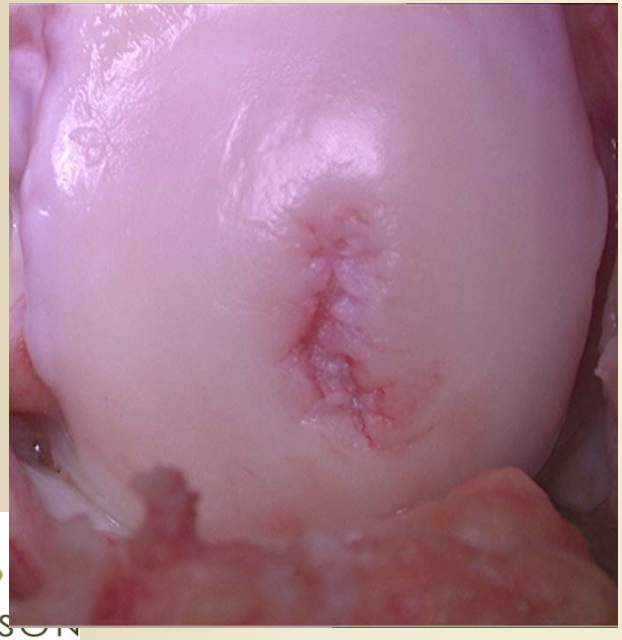

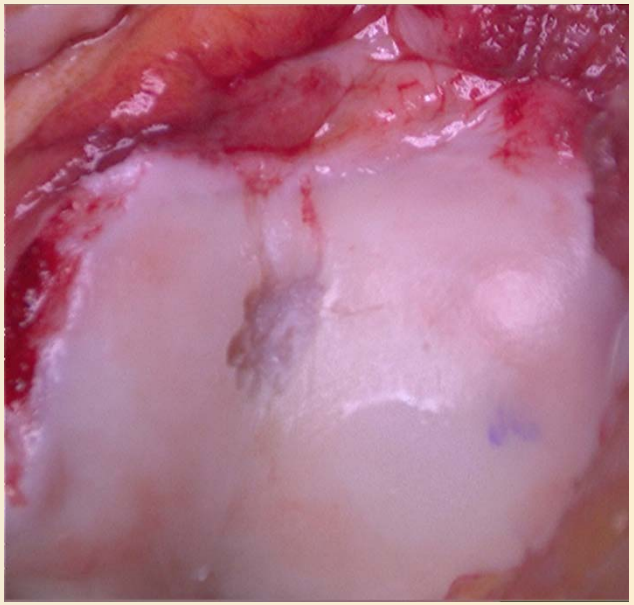

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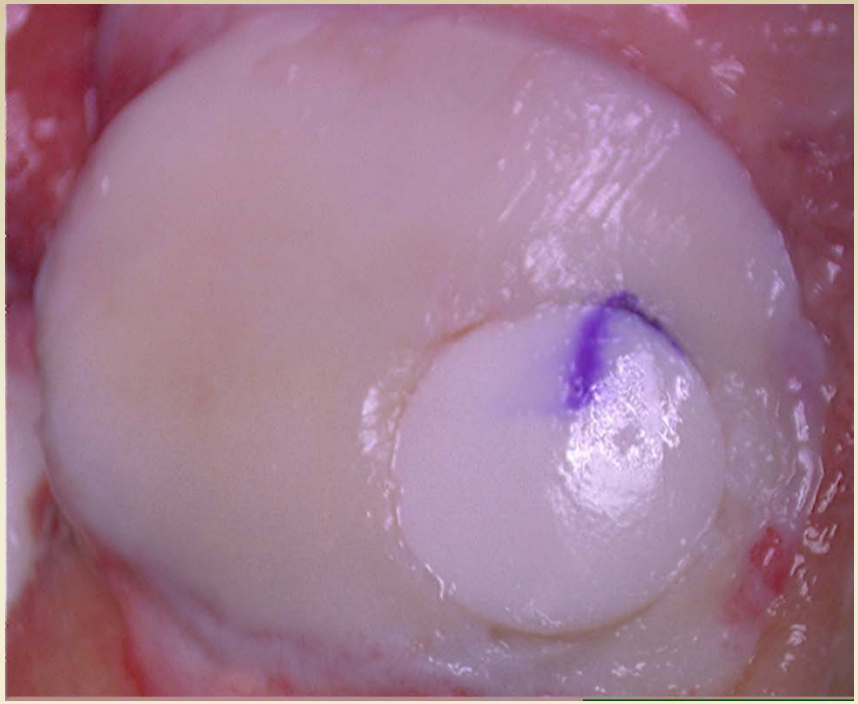

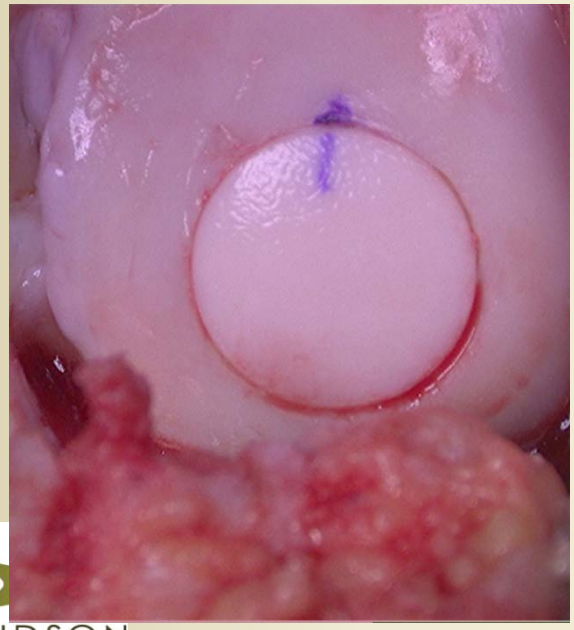

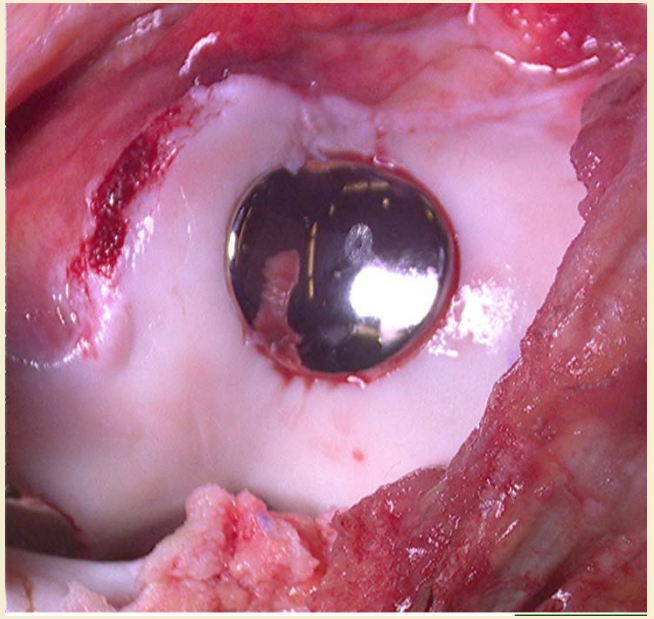

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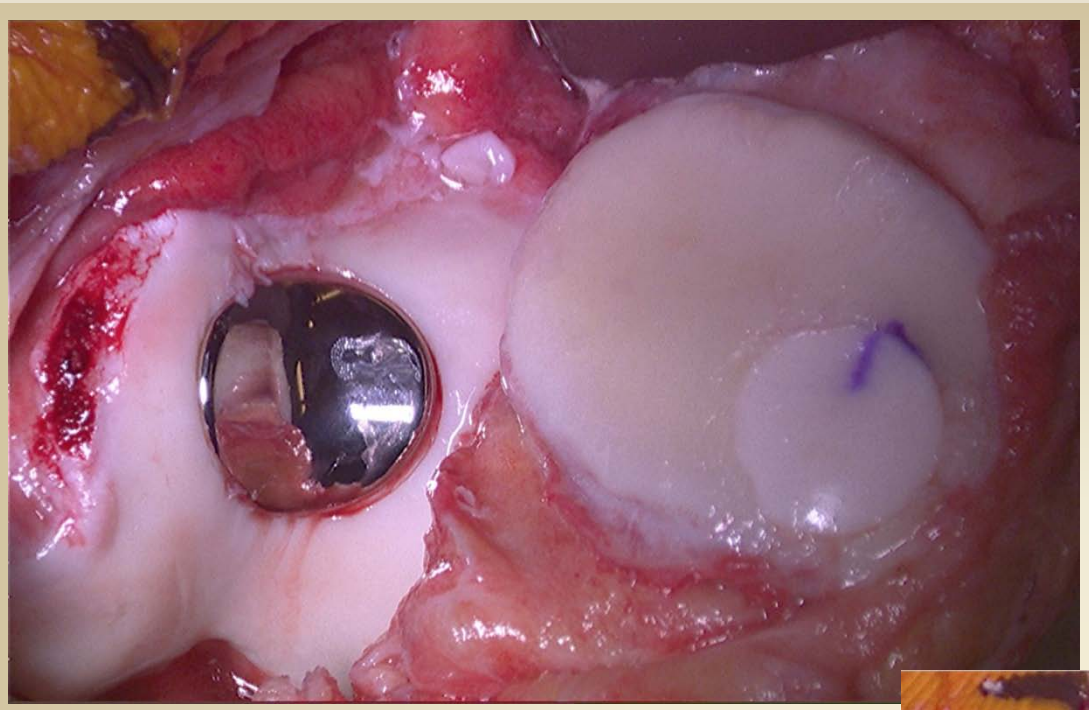

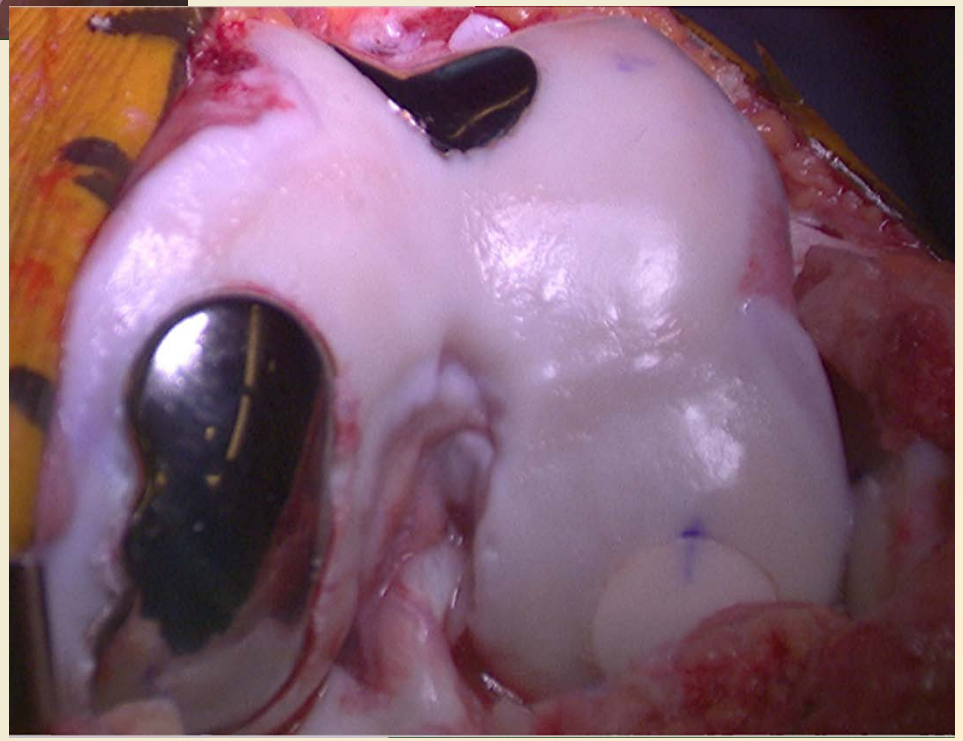

- 6 wks post op back at work light duty
- 12 wks post op full RTW as firefighter

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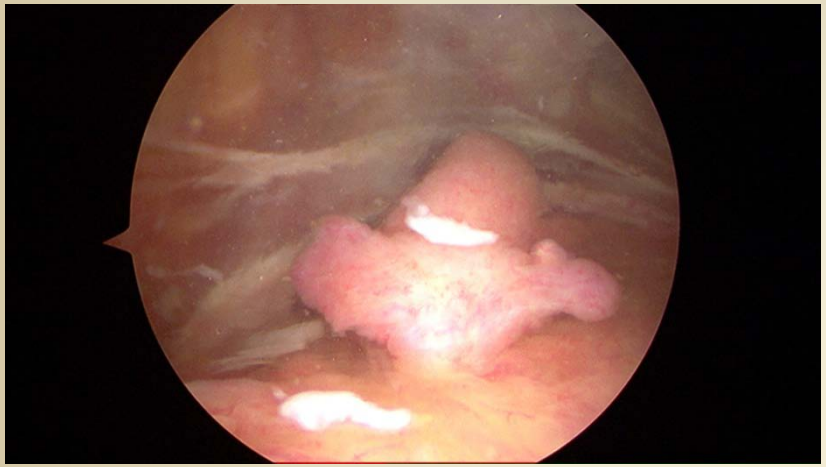
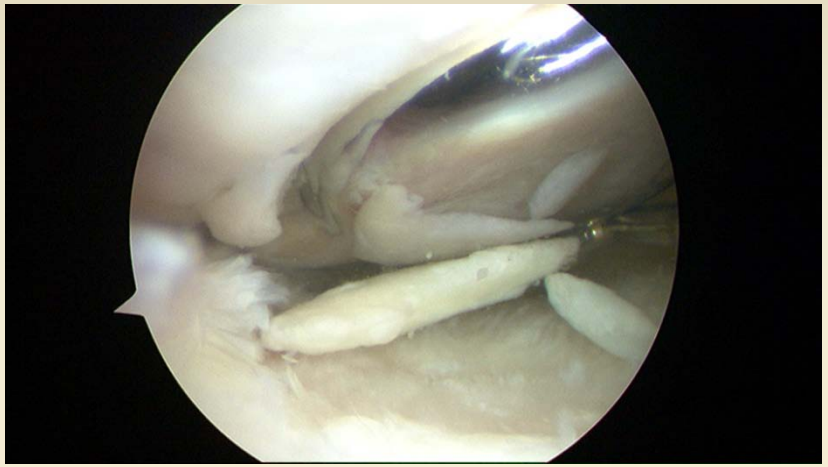
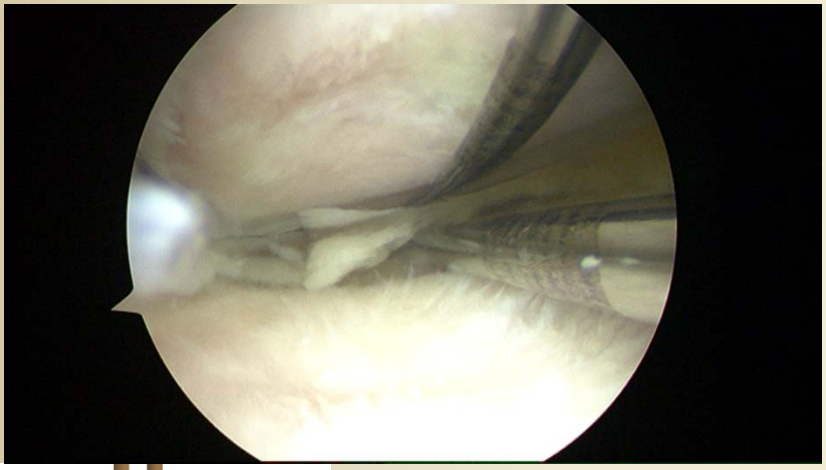
Technical Failure

38 yr old 9 mos post op - no pain relief from unipolar UniCAP
synovitis, cartilage debris, UniCAPproud, tibial wear, FTG defect







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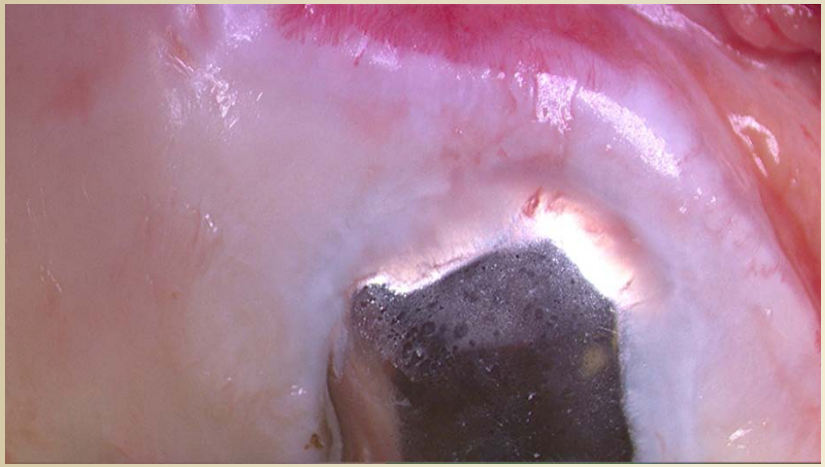
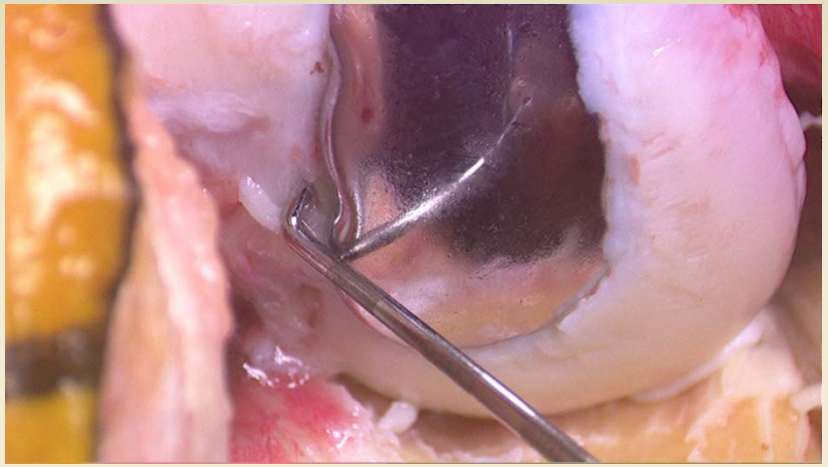
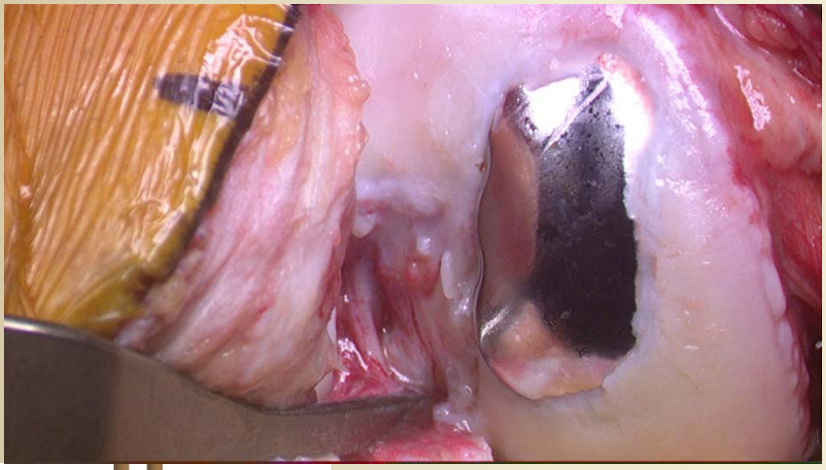
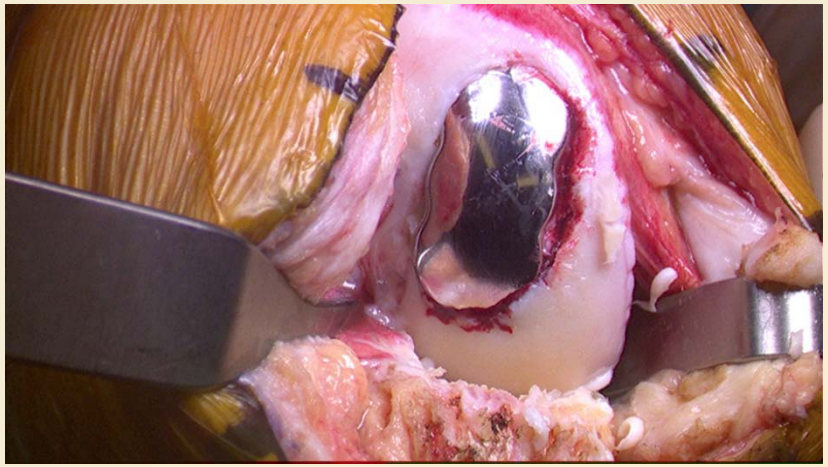
Failure

“normal” fibrous overgrowth, asymetric, proud









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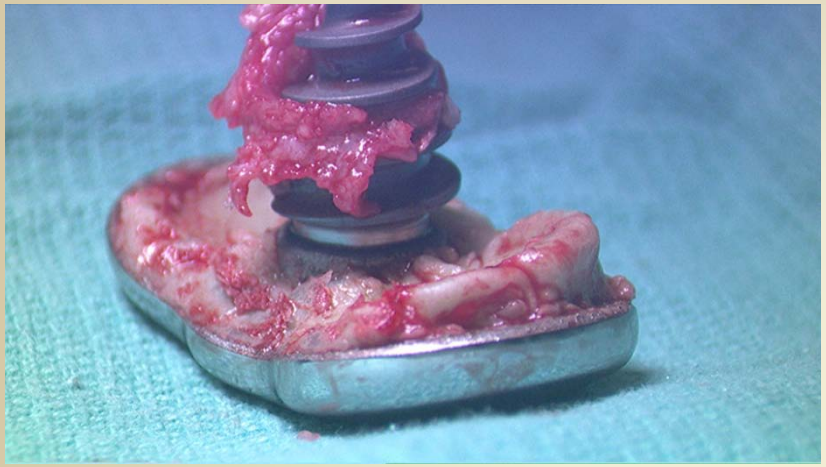
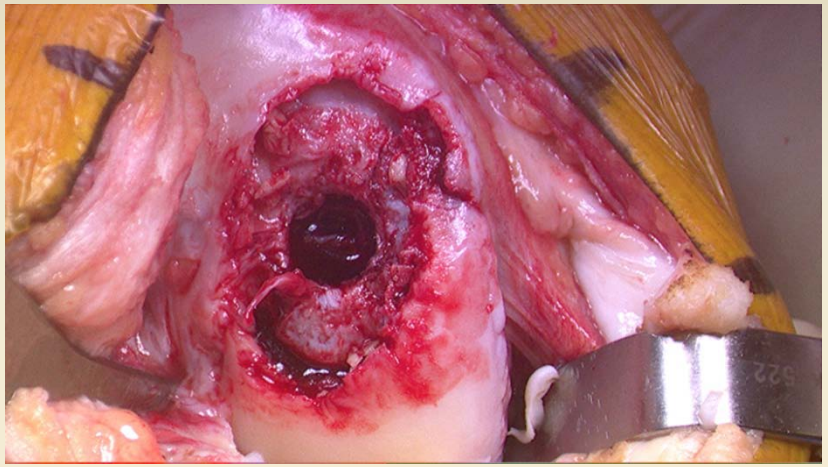
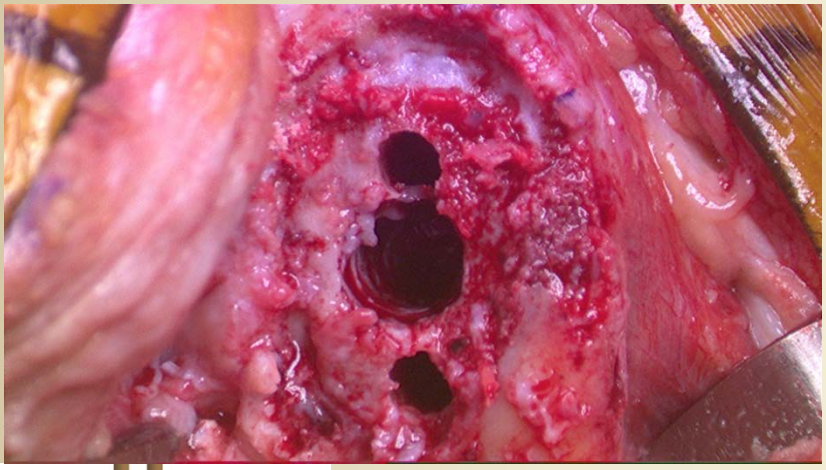
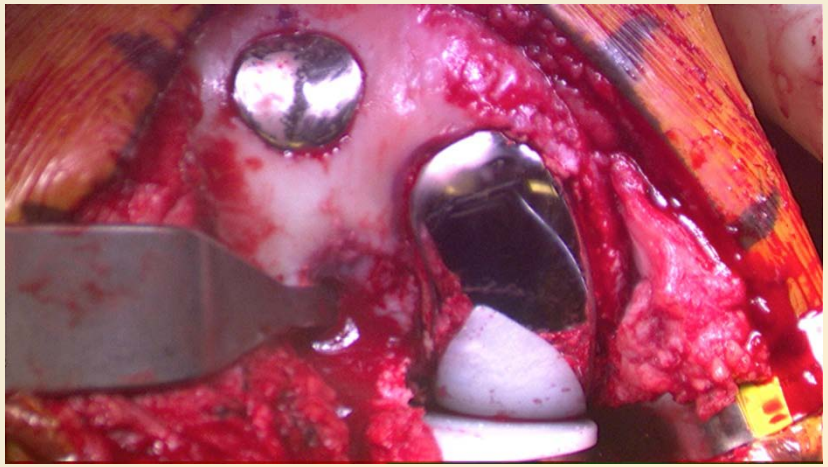
UniCAP removal- revision to UKA









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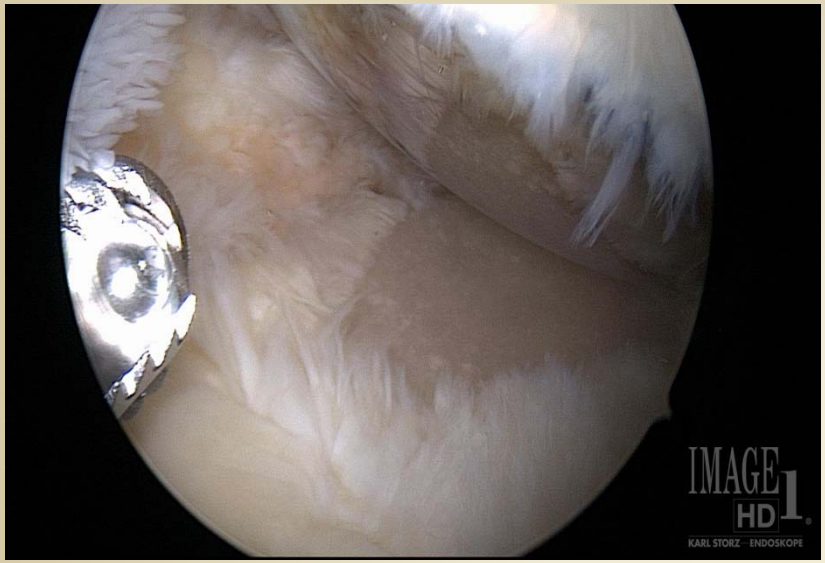
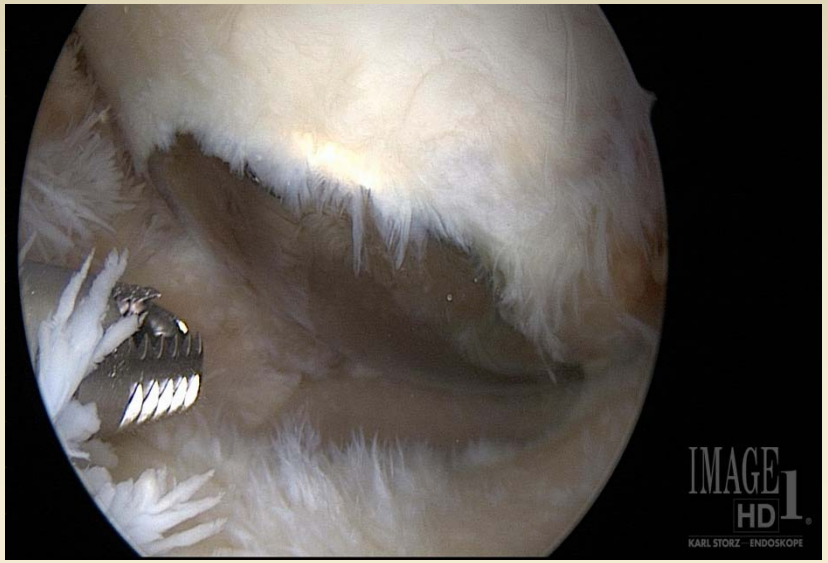
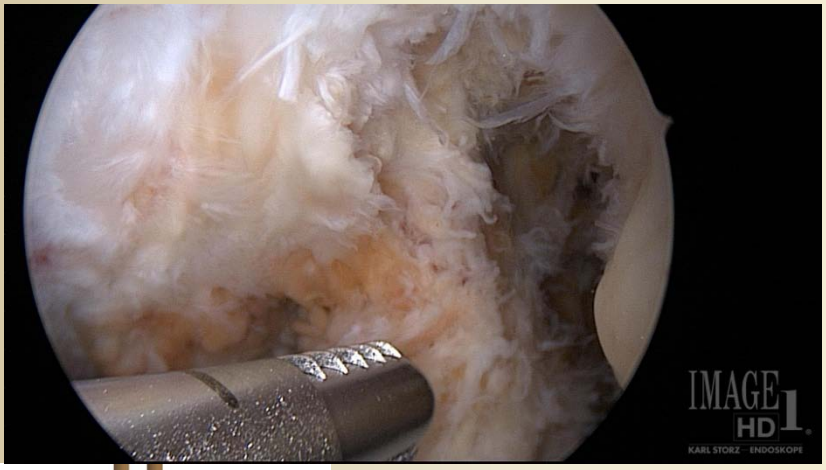
Indication Failure – complex revision

53 yr old Navy MD, persistent medial/PF pain and instability







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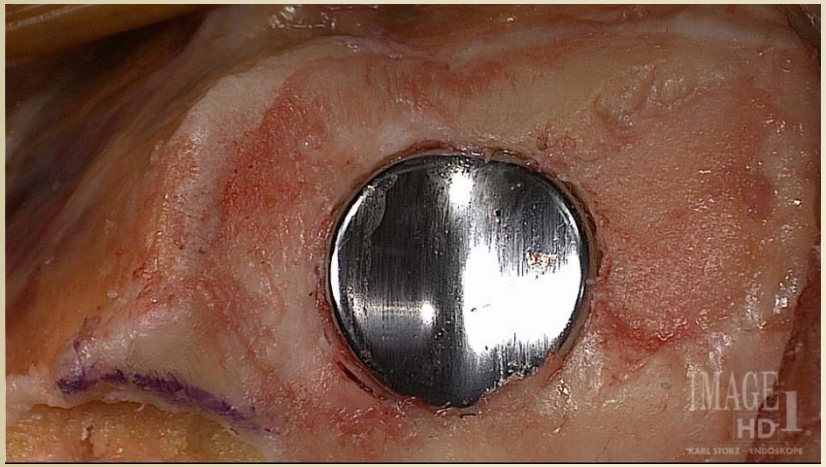
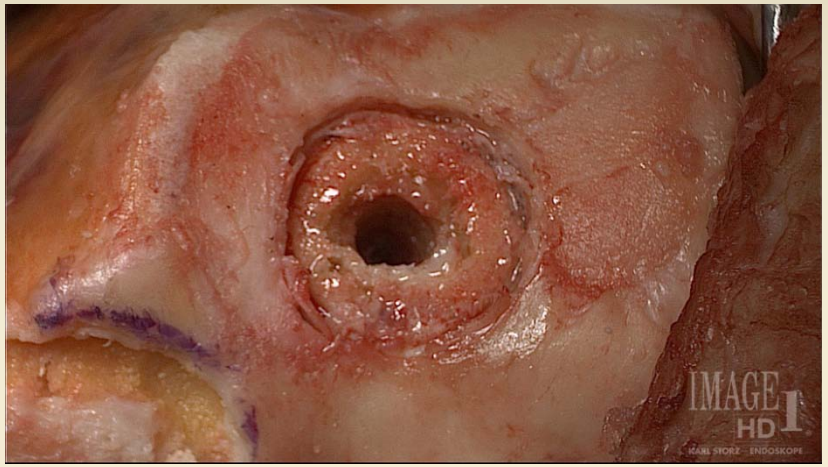
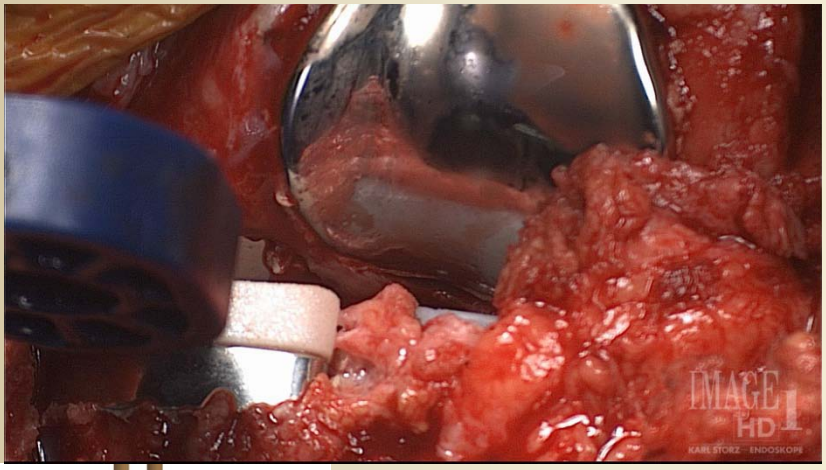
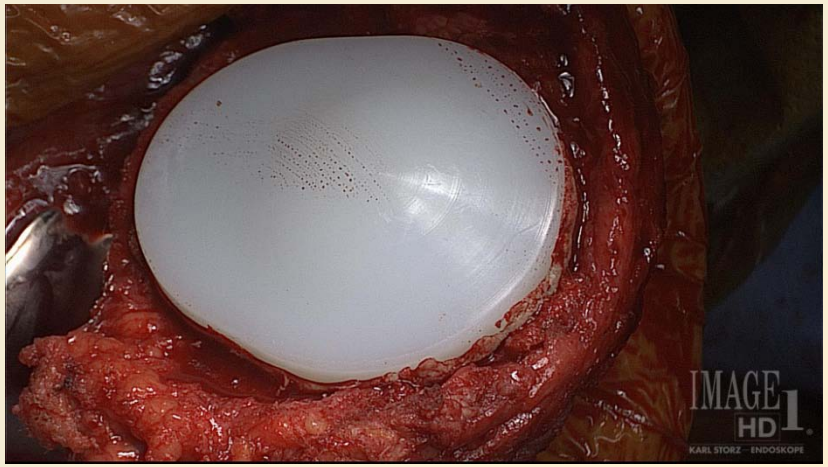
Complex revision

retained medial UKA, new lat UKA, PFA and ACL









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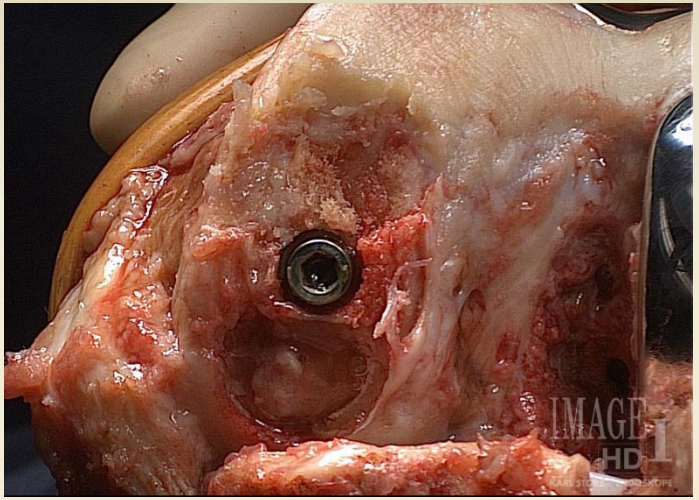
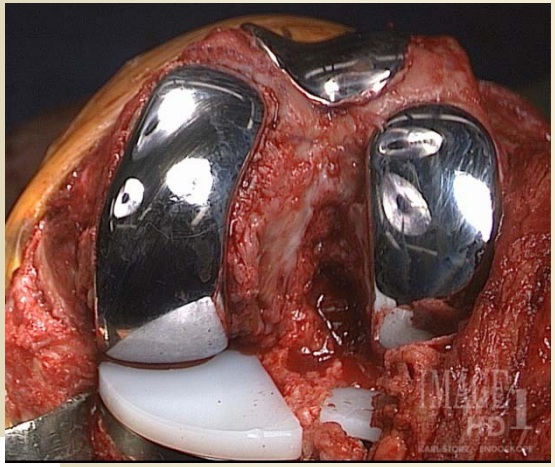
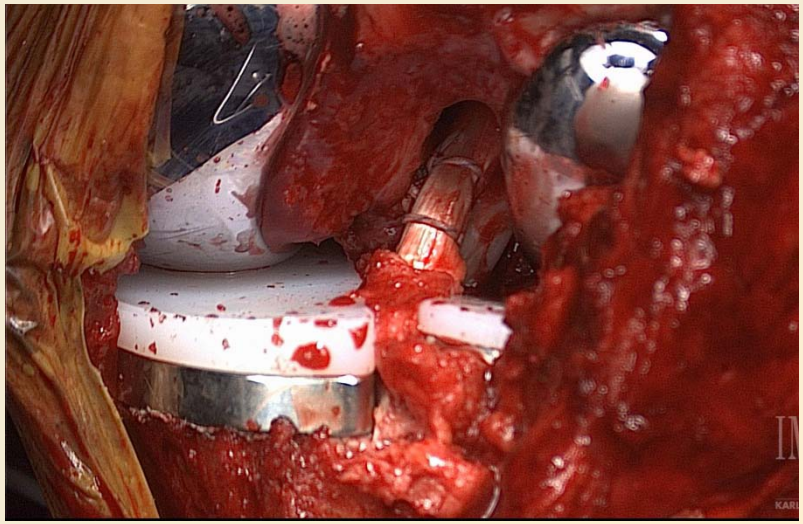
Complex Revision

3 compartments, ACL







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Inlay Indications

- Minimal angular deformity
- Large focal or limited degenerative lesions
- Limited, not diffuse disease
- ICRS Grade IIIB,C,D or IV
- PF- can address severe deformity

Contraindications

- Extensile T-F disease
- Tricompartmental
- Angular deformity
- Large or Peripheral Tibial defects
- Crystalline arthropathy
- Chondropenia - diffuse

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Managing Utilization

- Staging scope
- Scope photos
- MRI – 3T Fat Suppressed Fast Spin Echo, cartilage sequences
- Have multiple options available
- Multiple cases in one day

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Shoulder Series HemiCAP *Osteoarthritis*

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Traditional Surgical Alternatives
for G-H Osteoarthritis

- Total Shoulder Arthroplasty
- Hemiarthroplasty (stemmed)
- Hemiarthroplasty (non-stemmed)
  - "Copeland style"

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Traditional Treatment Options

Total Shoulder

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

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Traditional Treatment Options-
Non-stemmed Hemiarthroplasty

- Humerus is “milled” to accommodate implant
- Problem:
  - non-native convexity/geometry
- This is counter- intuitive

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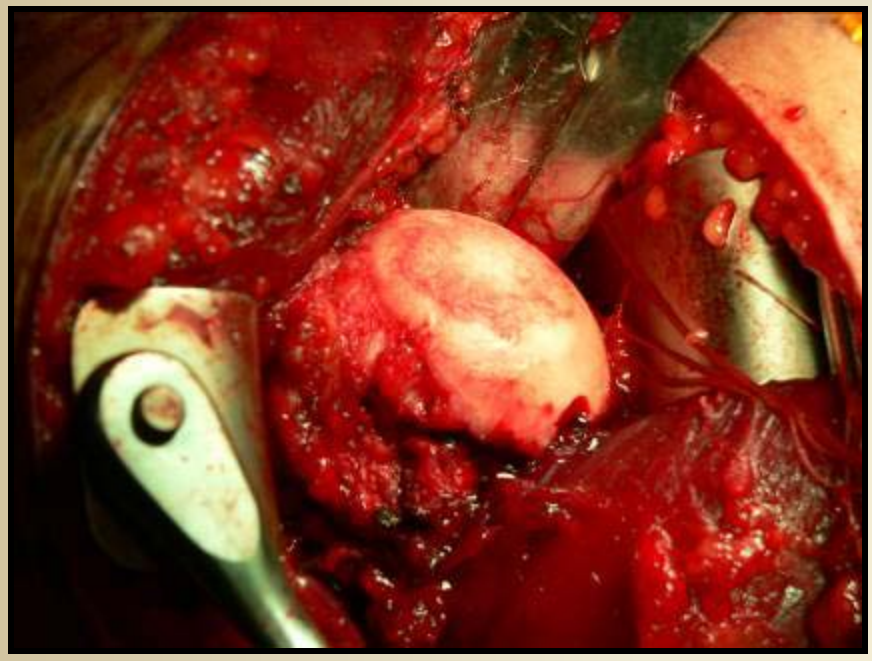
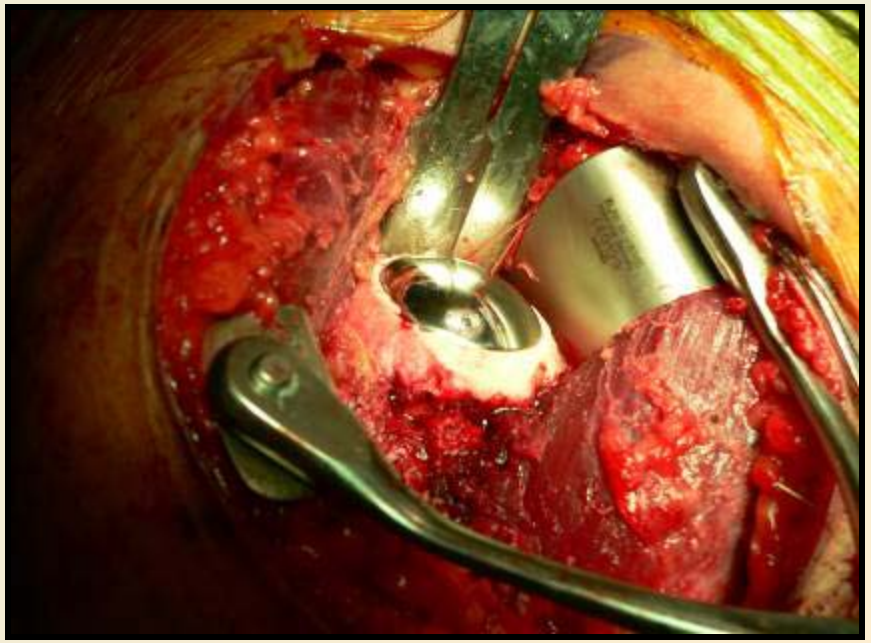
Osteoarthritis – typical case





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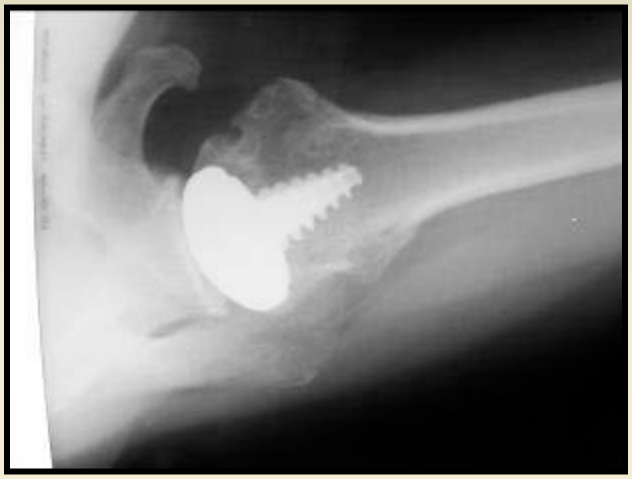
Osteoarthritis- typical case



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HemiCAP for RCT **and** Osteoarthritis

- 73 y/o Male, Tennis player with a failed previous rotator cuff repair
- Previous surgical findings of articular disease

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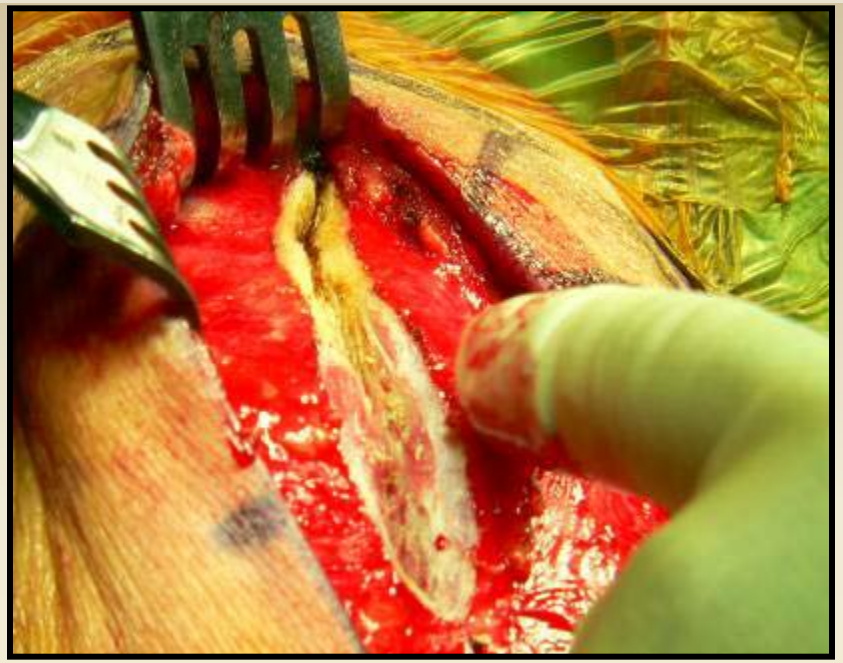

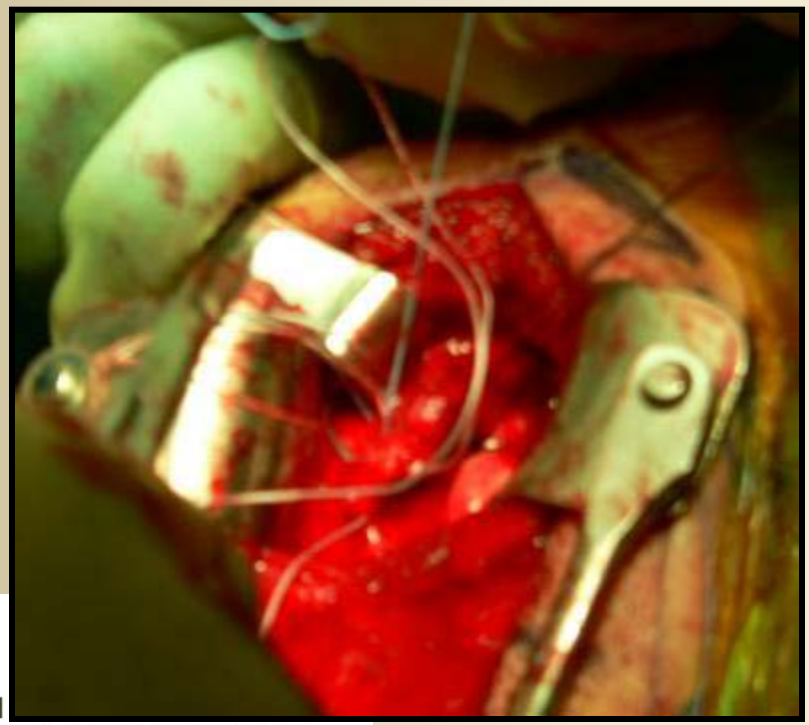

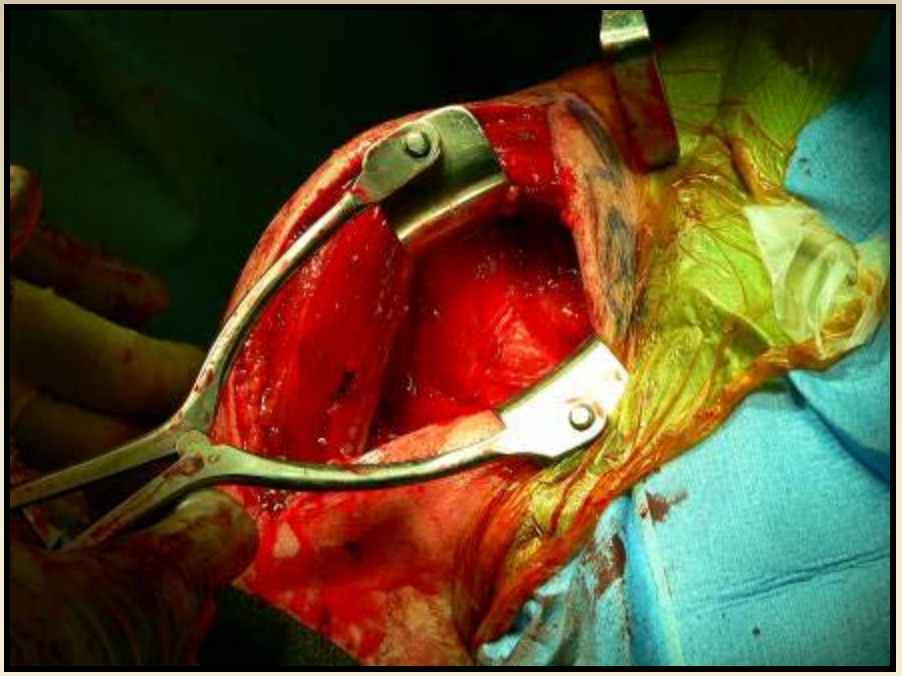

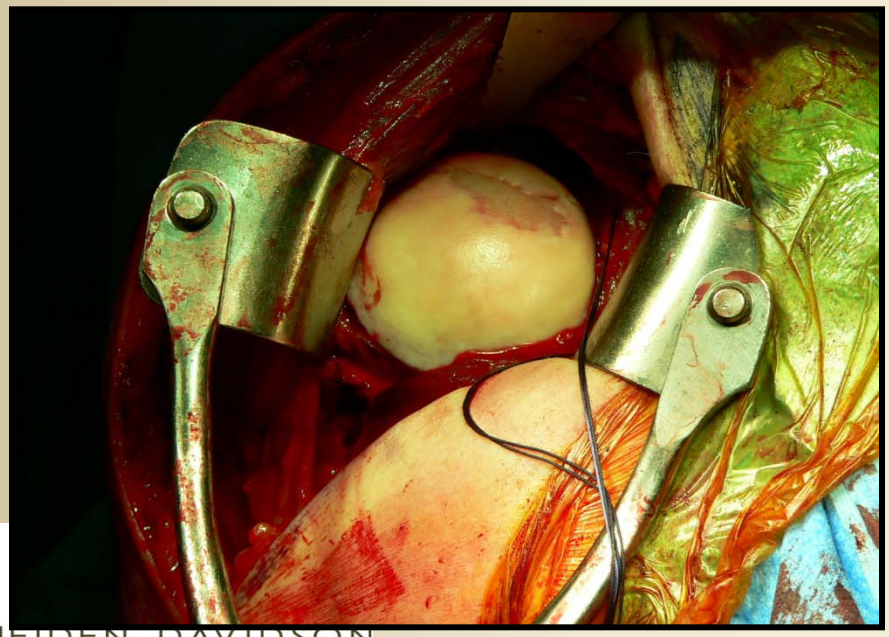

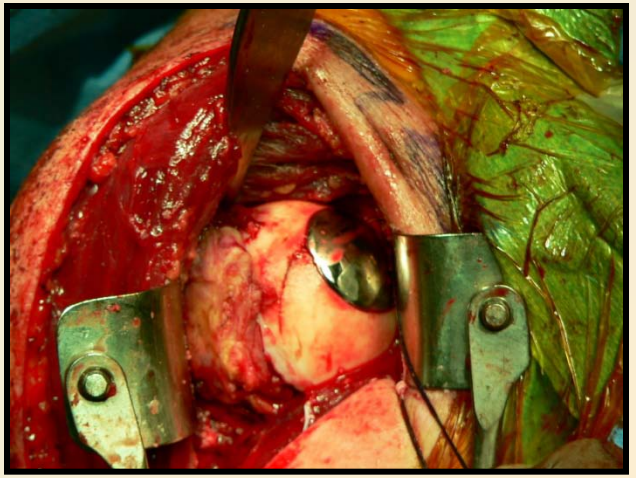

- Open Rev. RCR with Augmentation, HemiCap for RCT and Osteoarthritis
  - Post-op marked pain relief
  - Improved ROM
  - Marked decrease in pain

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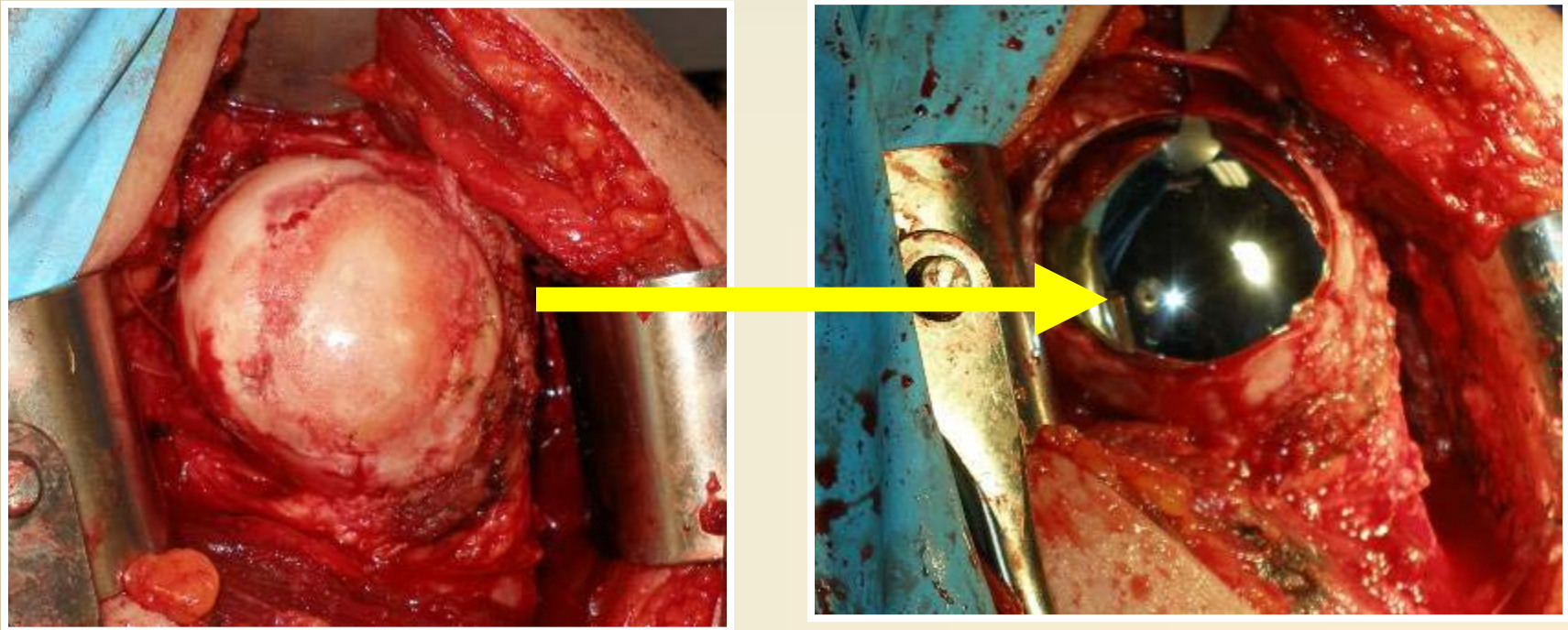
ANATOMIC INLAY RESURFACING FOR GLENOHUMERAL OSTEOARTHRITIS

Clinical Results in a Consecutive Case Series



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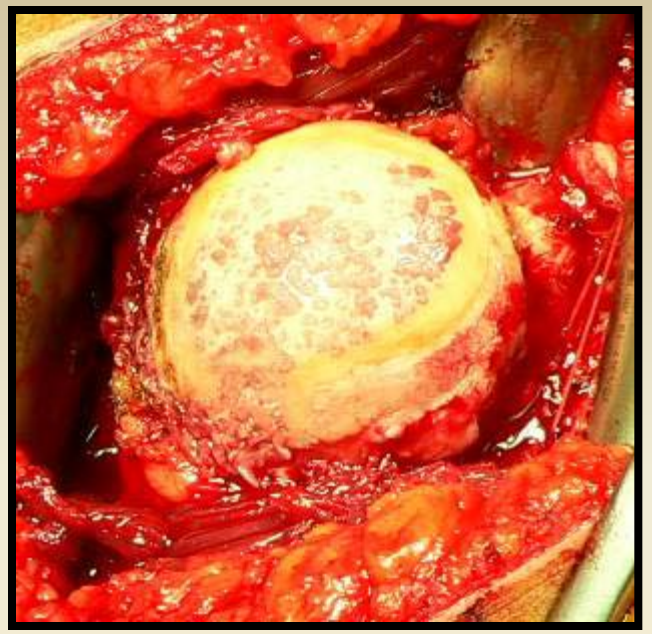
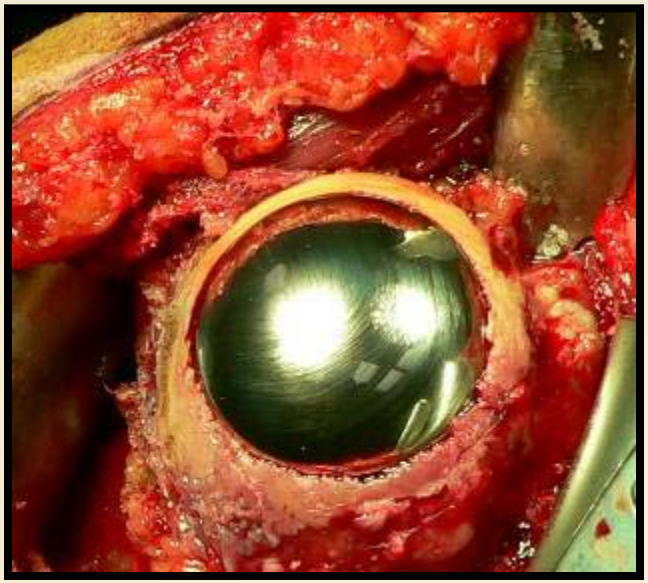
Surgical Technique

- Anterior approach
- Subscapularis take down
- Capsular releases
- Osteophyte resection on both humerus and glenoid
- NO glenoid resurfacing or reaming





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Demographic Data

- N = 48
  - Males – 29
  - Female – 19
- Mean age at surgery
  - 61 years
- Follow-up
  - Mean – 28 mos.
  - Max – 36 mos.
  - Min – 13 mos.
- Side
  - Right – 19
  - Left - 14

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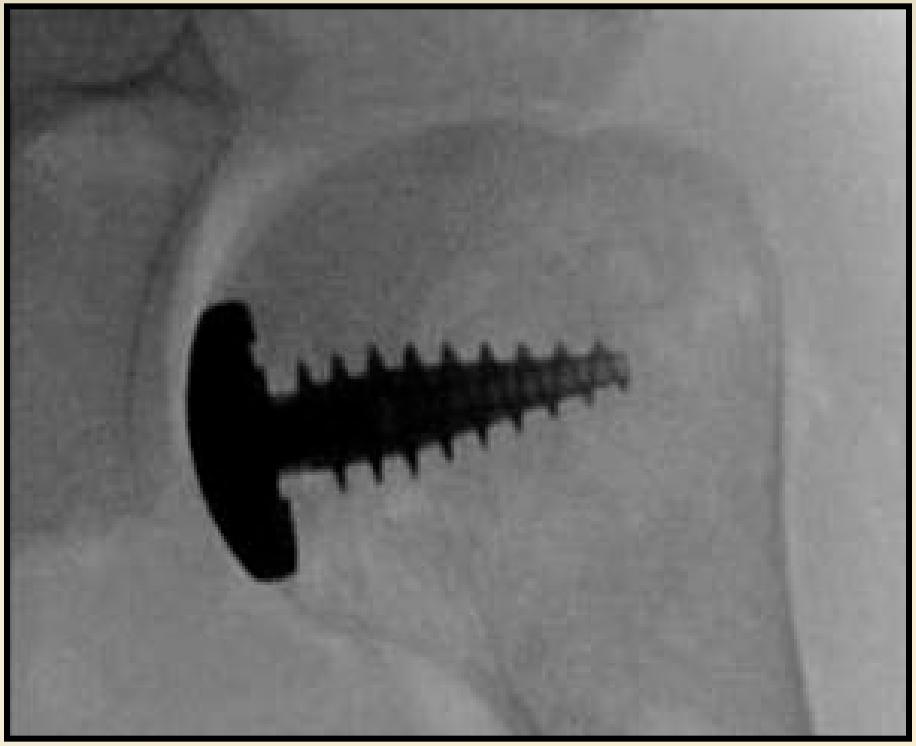
HemiCAP in OA

- Concurrent Procedures
  - Rotator Cuff Repair
    - 12
  - Subacromial Decompression
    - 25
  - Distal Clavicle Resection
    - 23
  - Biceps Tenodesis
    - 2
  - Biceps Tenotomy
    - 21
  - Capsulolabral Repair
    - 5
  - Hardware Removal
    - 1



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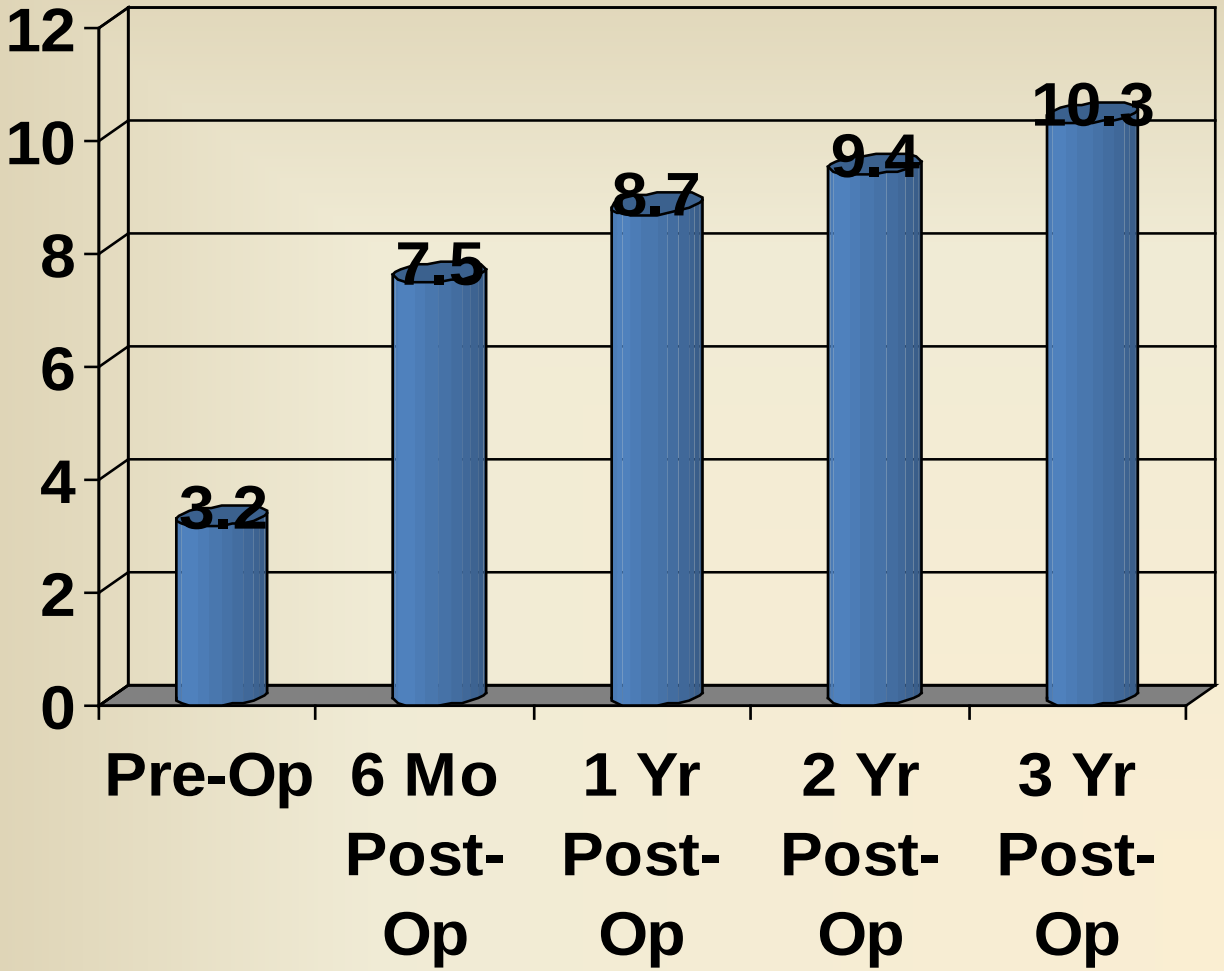
Simple Shoulder Test



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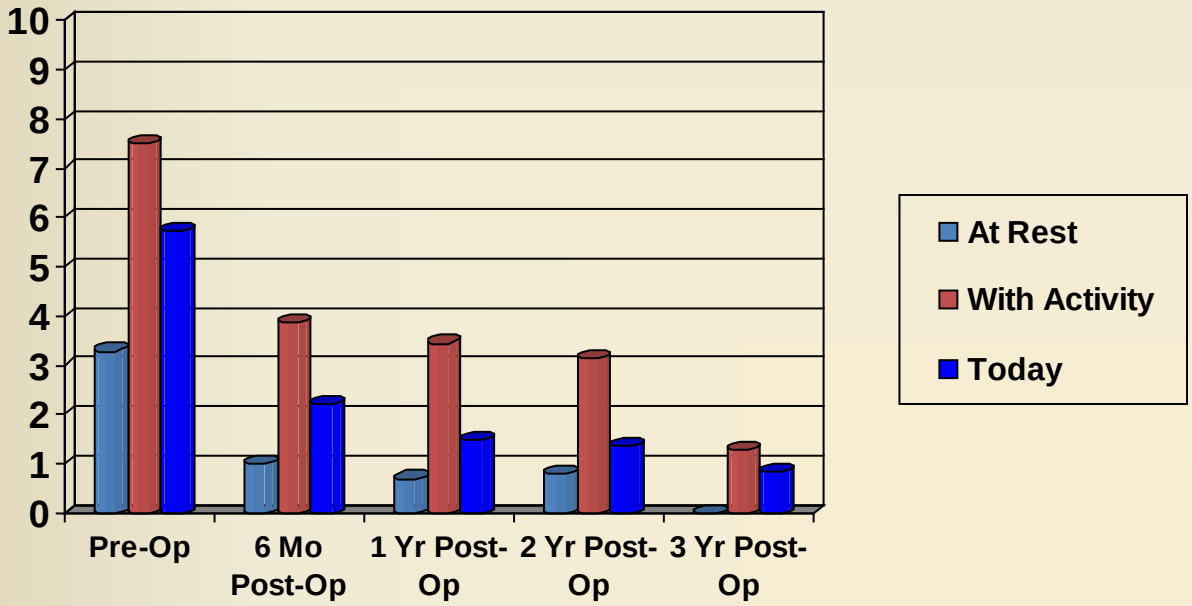
VAS Pain



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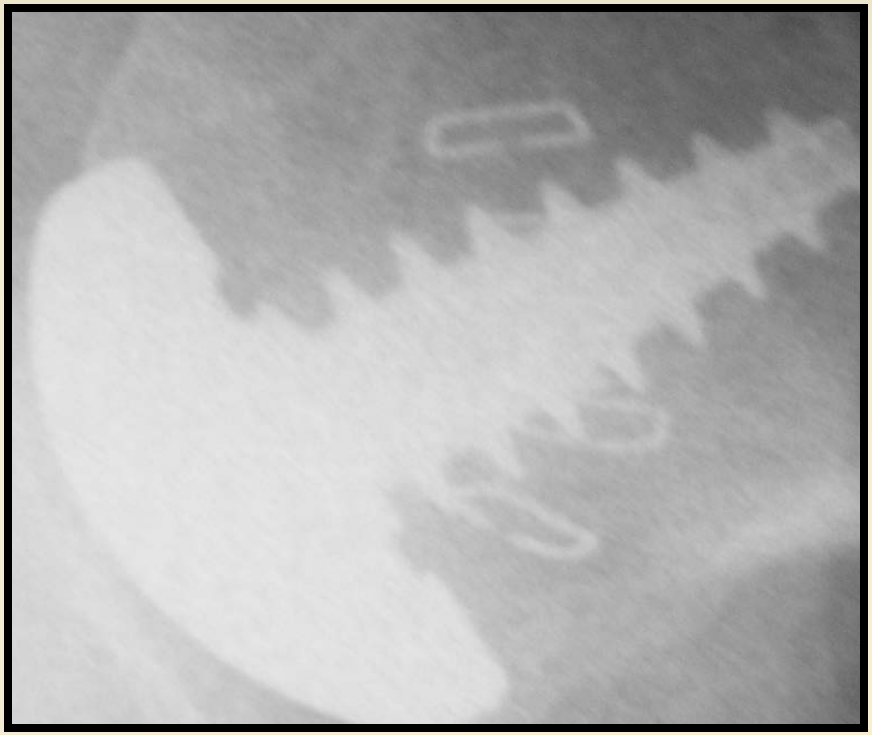
NO reported loosening of implant in the shoulder

No signs of

- Device disengagement
- Progressive periprosthetic radiolucency
- Implant subsidence



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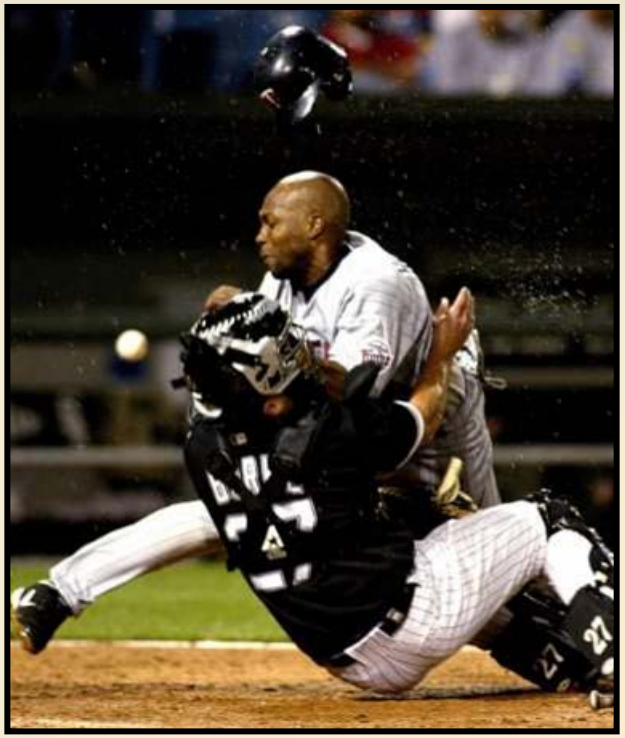
Complications

One patient suffered a traumatic, high-energy injury 3 months postoperatively, subsequently

resulting in revision surgery



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Osteoarthritis- Perhaps a prime indication for the HemiCAP

- How much pain from glenoid??
- Surprisingly little!!!
- Removal of Osteophytes critically important
- Soft tissue releases
- Treat concurrent pathologies

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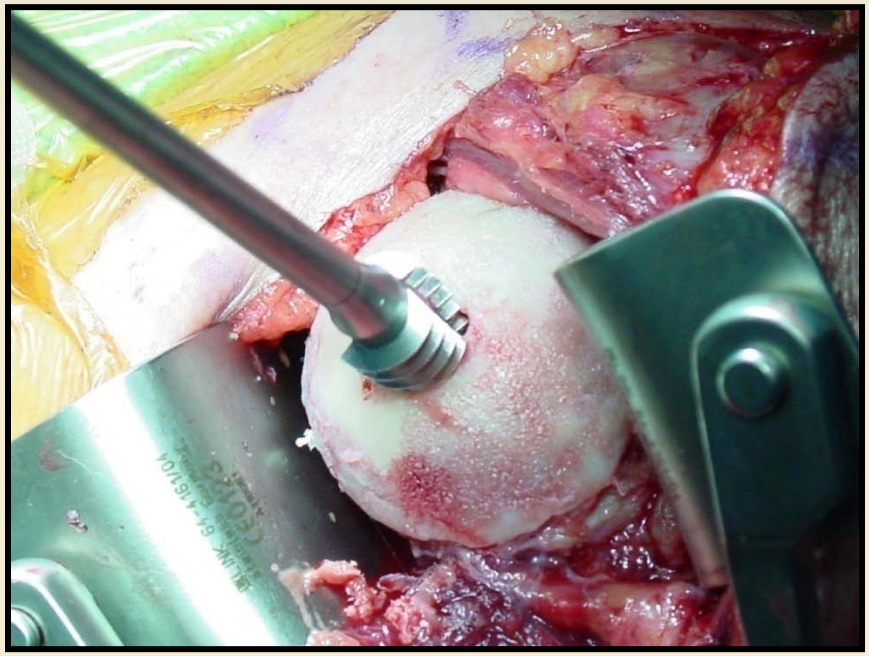
Expanding Indications Beyond "Focal Defects"

- Osteoarthritis
- Rheumatoid arthritis
- Post traumatic arthritis
- Rotator Cuff Tears
- Avascular Necrosis
- Hill-Sachs (some)



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CONCLUSIONS

Shoulder Resurfacing with HemiCAP for Glenohumeral Osteoarthritis

- Short term (3 year) results very encouraging
- Restoration of native anatomy
- Comprehensive pathology treatment is key
- Excellent option for primary OA of Shoulder

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Advantages of CAP

- Immediate, excellent pain relief
- Simple, canulated, reproducible, yet elegant surgery
- Very few soft tissue balancing challenges
- Minimally bone sacrificing
- Minimal EBL, can be outpatient
- Can easily convert to traditional or reverse arthroplasty
- Patient acceptance
- Allows concurrent soft tissue procedure
- Maintain cartilage restoration principles
- Based on patient, or ambient anatomy

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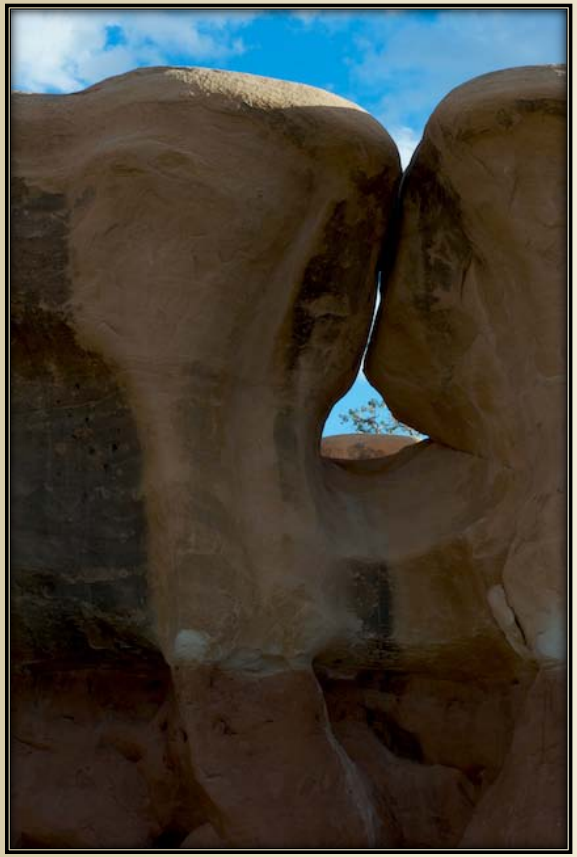
Thank You

phildavidsonmd@gmail.com
www.phildavidsonmd.com



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