Sports Knee Injury
Effusions
MRI

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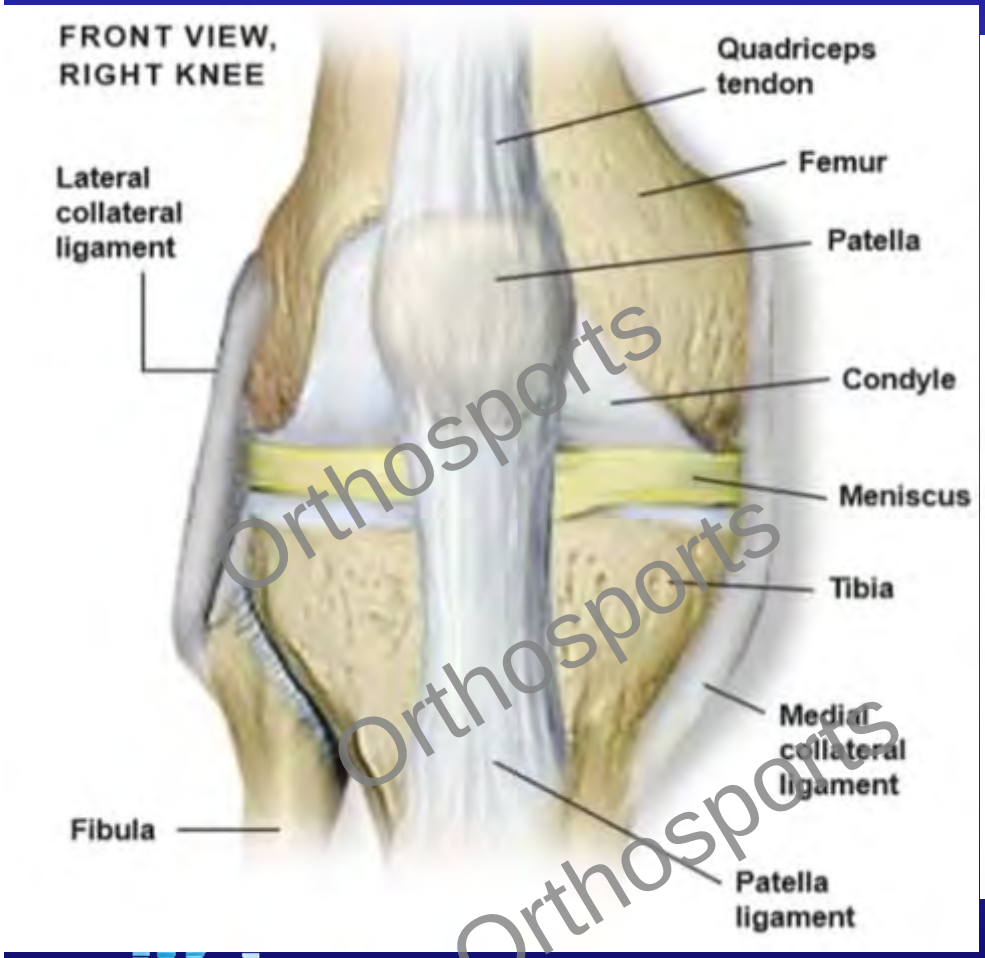
Learning Objectives

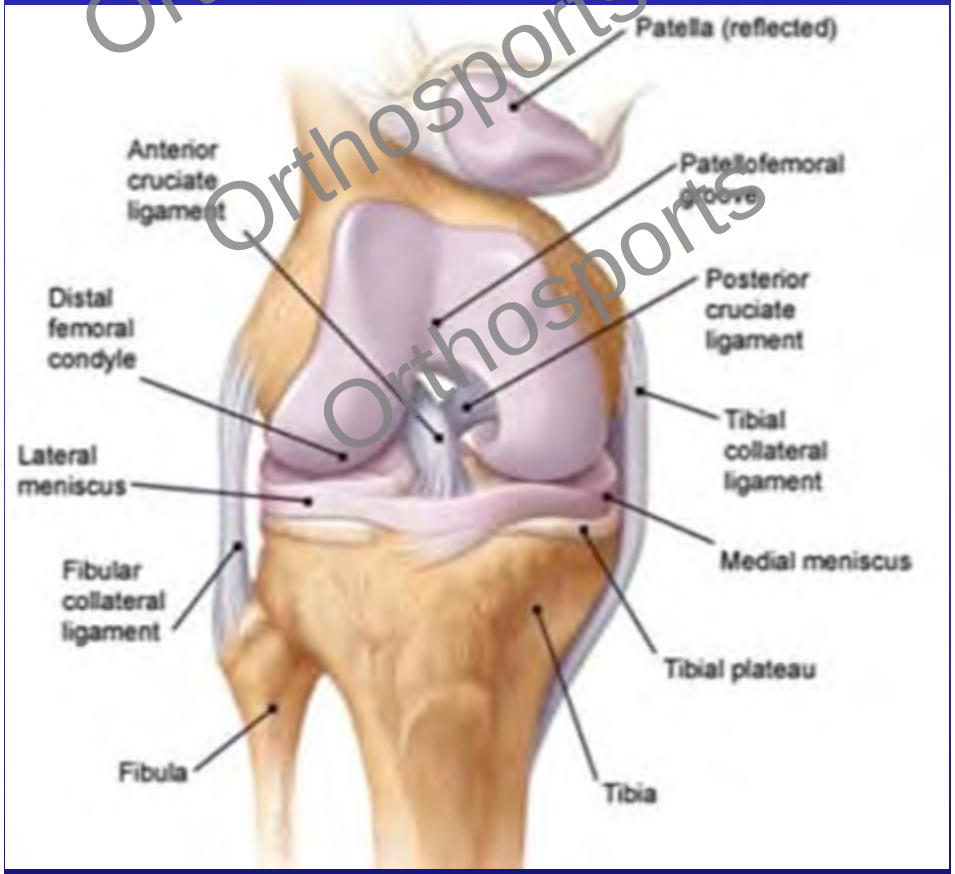
- Anatomy
- History Taking
- Clinical Examination
- Imaging
- Treatment
- Effusions
- When to refer

Anatomy

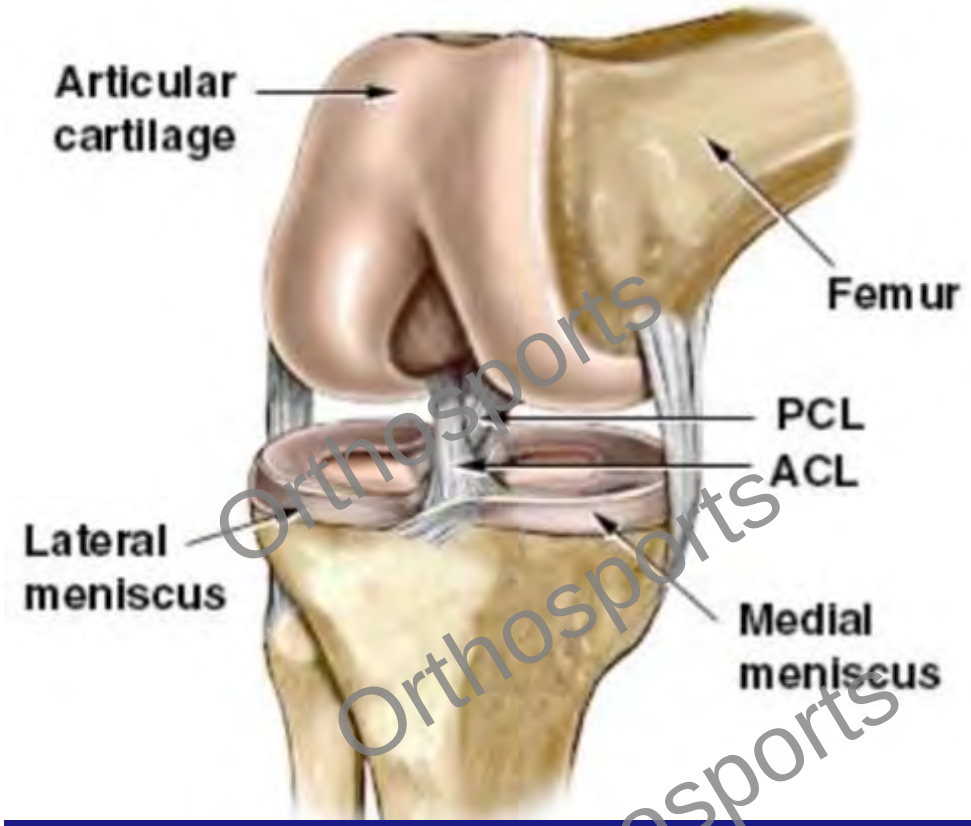
Anterior



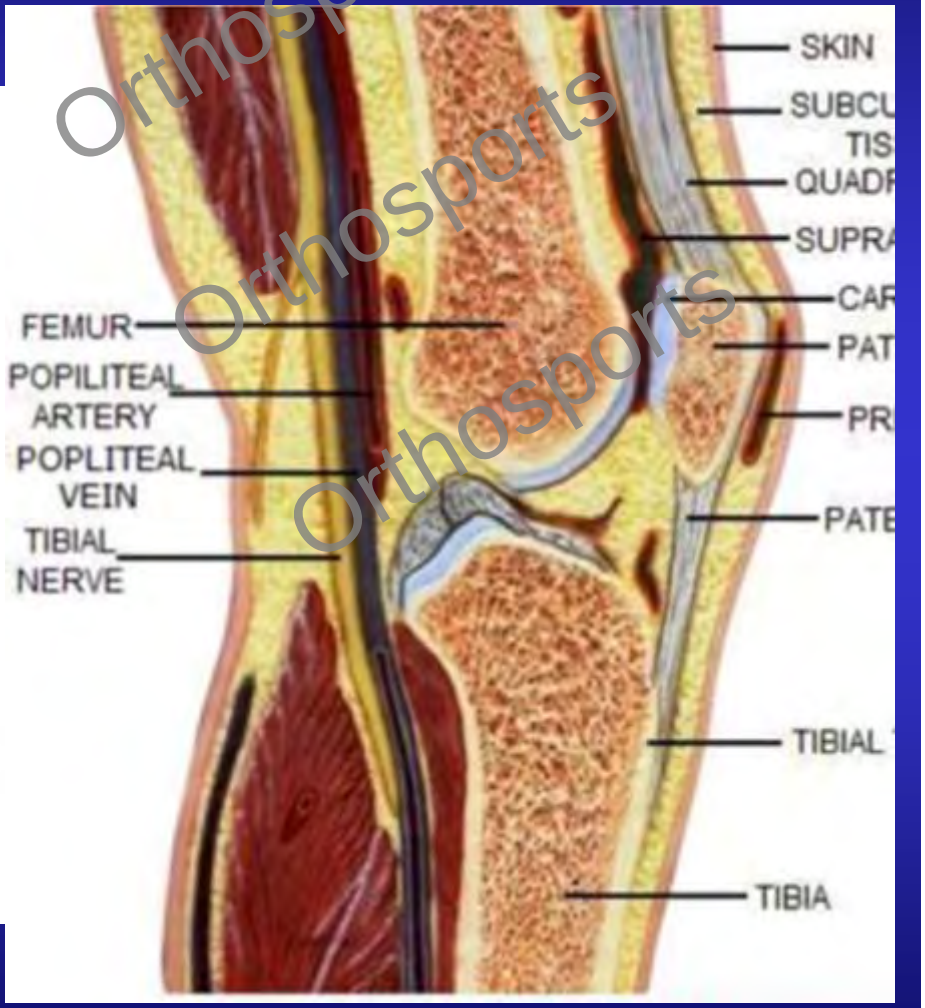
Patella Removed



Flexed



Lateral



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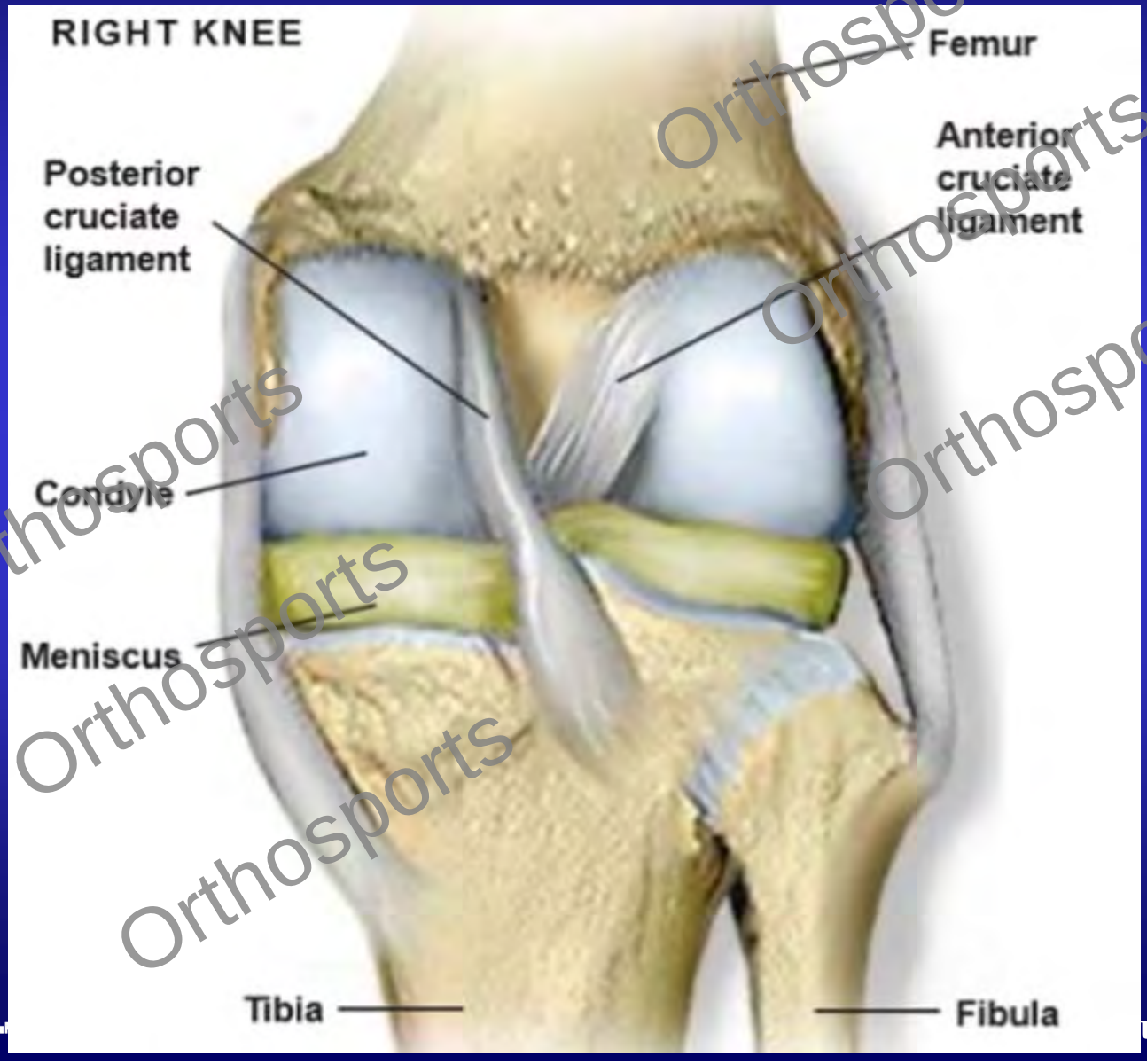
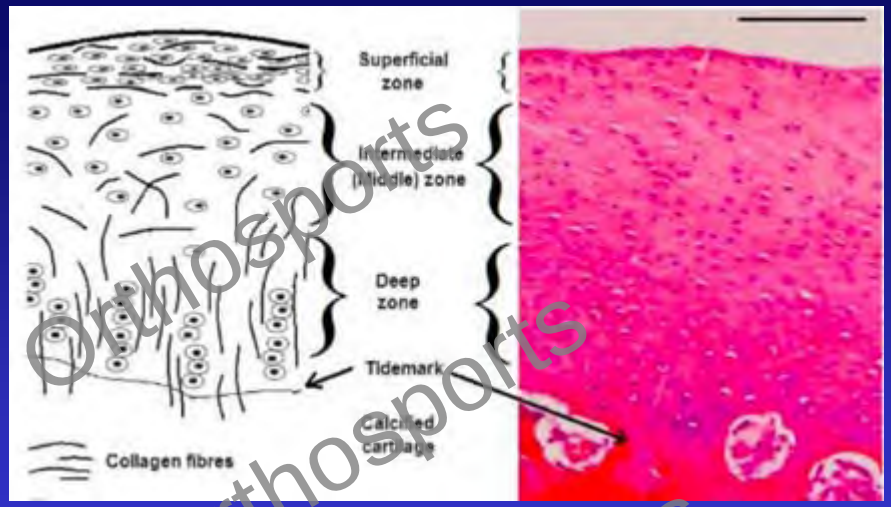
Posterior



Chondral Cartilage

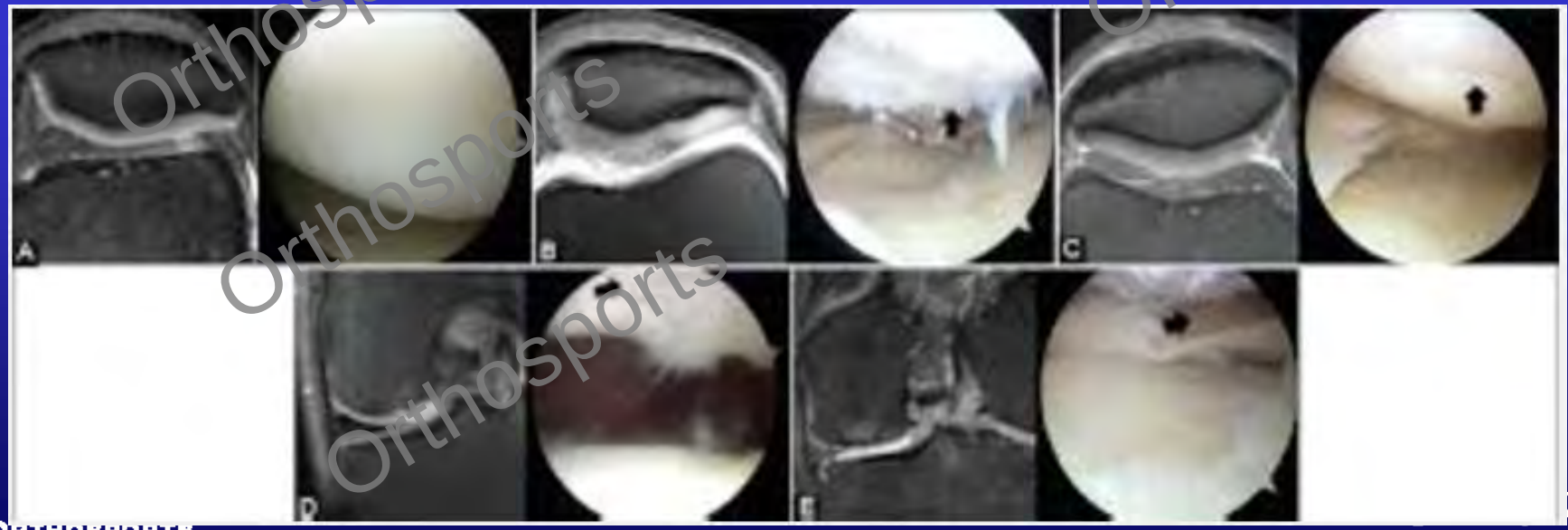
Cartilage



- Type II collagen
- Cross linked type IX collagen
- 80% water
- 20-40% dry weight of glycosaminoglycans
- Chondrocytes and a composite gel
- No blood supply

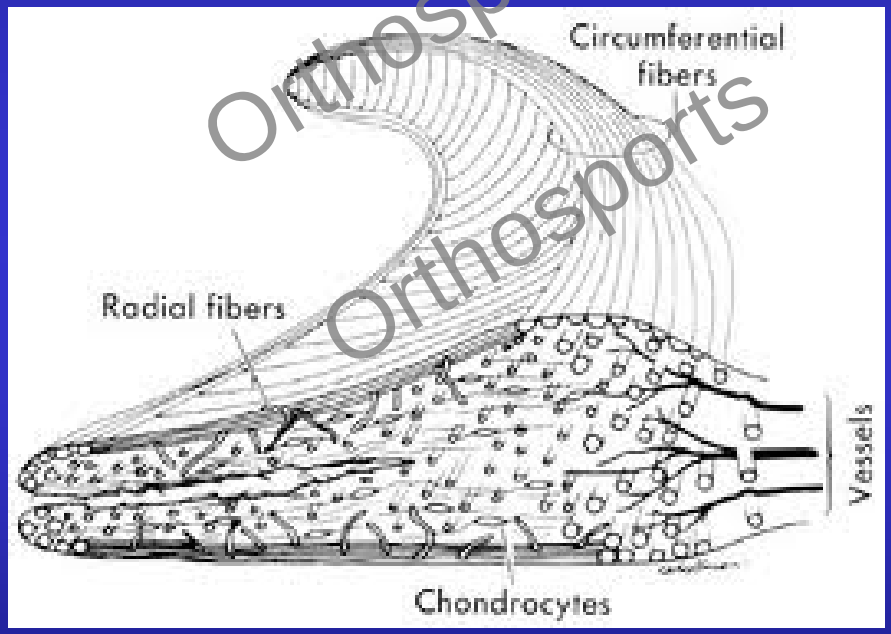
Outerbridge Classification

- 1- softening of cartilage
- 2- fibrillation superficial
- 3- fibrillation down to subchondral bone
- 4- exposed bone



Meniscus

Meniscus - Anatomy



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Structural Anatomy

- Type I collagen
  - strong in tensile stress
  - Oriented in a circumferential direction
  - Prevent radial extrusion (Radial,longitudinal & oblique)
  - Maintain structural integrity during load bearing
- Lateral meniscus more important in weight bearing, more mobile too
- Medial meniscus contributes to joint stability

Meniscus - Function

- Load distribution
- Shock absorption
- Joint stability
- Joint lubrication

Meniscal Function

- Lateral meniscus covers 76% of the articular cartilage
- Medial meniscus covers 60%

Meniscal Function

- Load transmission
  - 45 – 50% load transmitted to menisci in extension
  - 85% load transmitted to menisci in flexion
  - Medial side, MM and MTP share load
  - Lateral side, LM takes 80% load

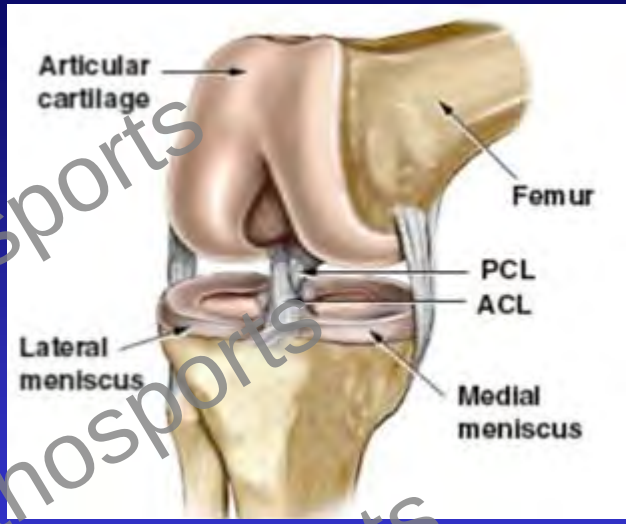
Mechanical Function

- Removing MM decreases contact area MFC by 50 – 70%
  - 100% stress increase on MTP
- Removing LM 45 – 50% decrease in contact area
  - 235 – 335% increase in local contact pressures LTP

Swelling and Meniscus Tears

- Isolated meniscal tears do not cause recurrent swelling
- If the knee is swollen there is almost certainly chondral damage

Knee Biomechanics



- ACL is primary stabiliser
- Menisci secondary stabilisers
  - Medial meniscectomy
    - ACL-intact - little effect on AP motion
    - ACL-deficient -Increased AP translation up to 58% at 90° of flexion.
- Hinge joint - only slight rotation and translation possible
- Synovial layer secretes fluid
  - Lubrication and nutrition for articular cartilage.

History Taking

- Activity level
- Employment
- Pain profile
- Joint profile
- Functional profile
- Remember referred pain
  - Back or Hip

Pain

- Location
- Rest
- Night
- Stair climbing
- After sitting
- Squatting
- Barometric pressure changes

PF jt involved

Symptoms

- Swelling
- Catching
- Instability
- Onset of symptoms

- Response to prior treatment

Giving way

Primary Instability

- Joint actually gives way
  - Ligament deficiency
  - Not painful but knee hurts afterwards /swells
  - Repeated giving way leads to arthritis.

Secondary Instability

- Pain within the joint.
  - Quads relax involuntarily
  - Leg buckles
  - Sensation of giving way
  - Remove the pain = no giving way
  - Meniscal tear, loose body, arthritis, or synovitis.

Giving way

Primary Instability

- Surgery required to fix the problem
  - ACL
  - PCL
  - LCL
  - PLC
  - PFJ

Secondary Instability

- Generally not causing further damage
- Patella subluxing can be felt as giving way
- Giving way often non-specific
  - Loose bodies, patellar chondromalacia, and quads weakness

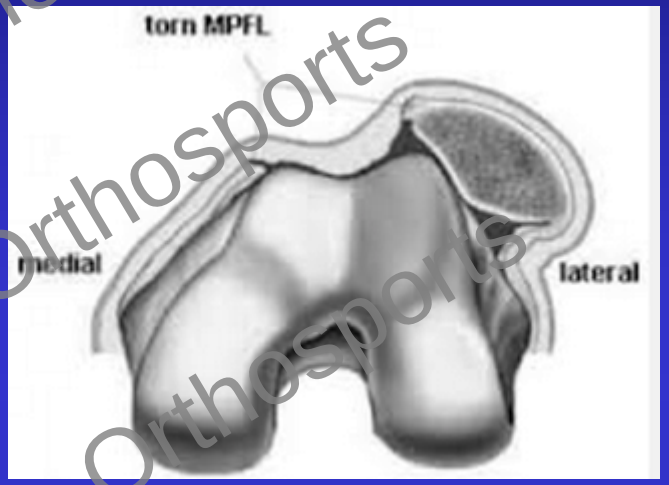
Patella

Patella Stability

- Bones most important structures
- Quads also important

Patella Dislocation

- Direct blow or twist
- Often hear two clicks
- Notice lump
- May require hospital reduction
- Predisposing factors
  - Shallow trochlear
  - Femoral torsion
  - Patella Alta



Patella Dislocation

- Xray for fracture
- Rice
- Splint 1-2 weeks comfort
- Physio
- Quads strengthening
- Rarely require surgery

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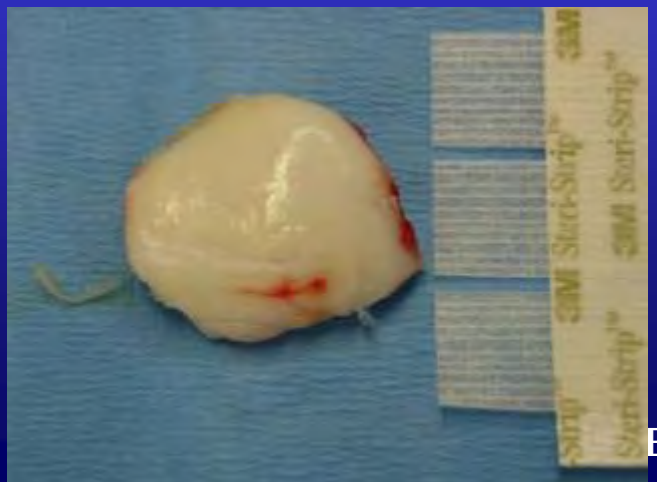
Patella Dislocation - Earlier Referral

- Dislocation and large effusion or crepitus implies articular cartilage damage
- >3 dislocations
- Audible crepitus
- Mechanical symptoms
- *These days surgery more reliable and smaller*

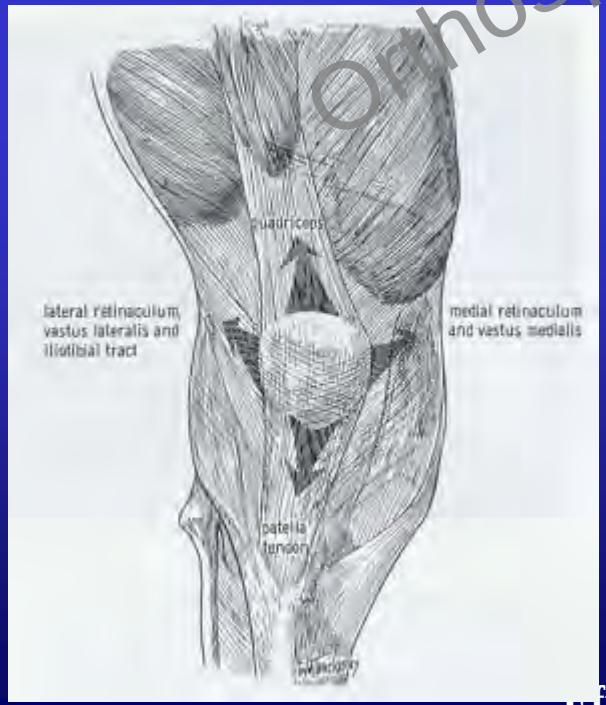


Extensor Mechanism

Extensor Mechanism

- Quadriceps or patella tendon rupture
- Unable to straight leg raise
- Tenderness
- Defect

- Early referral



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Medial & Lateral Jt Line Pain

- Meniscus
- Articular cartilage
- MCL
- Avascular necrosis
- Plica
- Bursa
- Tib fib joint
- Referred

Anterior Knee Pain

- Chondromalacia
- Subluxation
- Maltracking
- Traumatic
- Non specific
  - (see overuse later)

Anterior Cruciate Ligament

ACL

- Controls 90% of stability to anterior displacement of the tibia
- Varus, valgus, rotational restraint
- Anteromedial bundle tightens in flexion and the posterolateral becomes lax

ACL - HISTORY

- Usually twisting injury
- Older patients often no trauma
- Swelling several hours later or next day
- Pain
- Clicking
- Locking
- Giving way
- Swelling-effusions only 50% cases

ACL

- Best time to examine is immediate
- Worst is 3-7 days
- No need for urgent referral
- Not everyone needs surgery
- No harm at all in watching the older patients to see if they have instability

Refer Earlier If

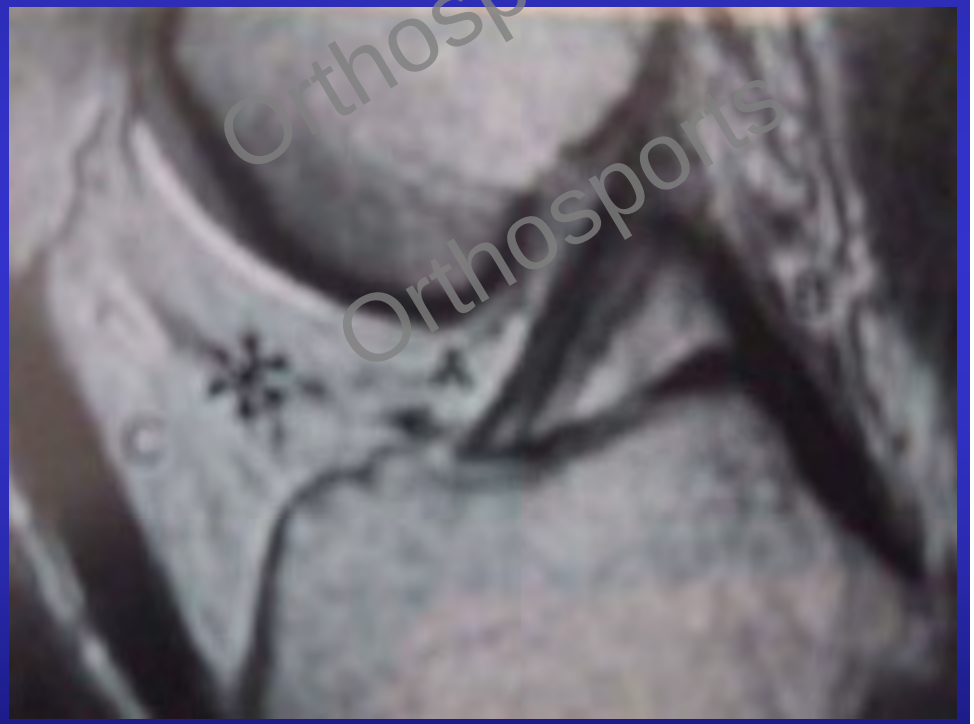
- Competitive sports
- Articular surface damage particularly patellofemoral and medial compartment
- Medial meniscus loss
- Heavy people who are more likely to stretch secondary restraints
- Varus alignment
- Younger

ACL – Operate if:

- Giving way with activities of daily living
- Want to get back to pivoting sports
- Meniscal injury

Best to have relatively full painfree ROM prior to surgery

ACL



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Locked Knee

- True locking is lack of 10 – 15 degrees of extension
- Not unable to flex
- Try and work out if it is a mechanical block or pain
- Patella pathology often mimics locked knee

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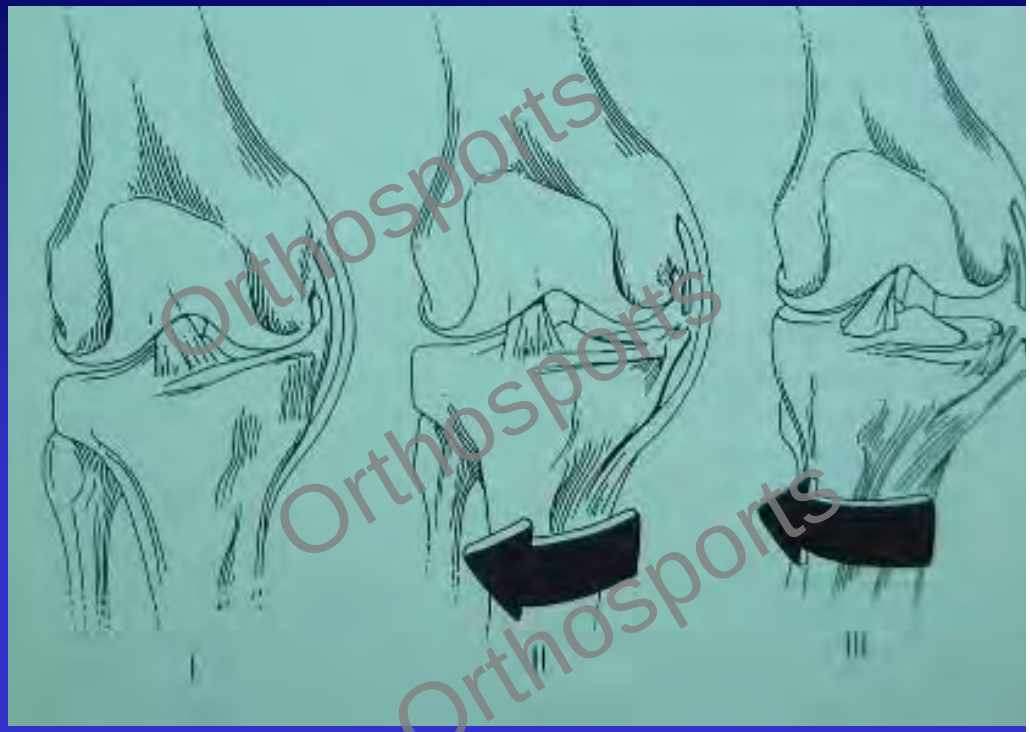
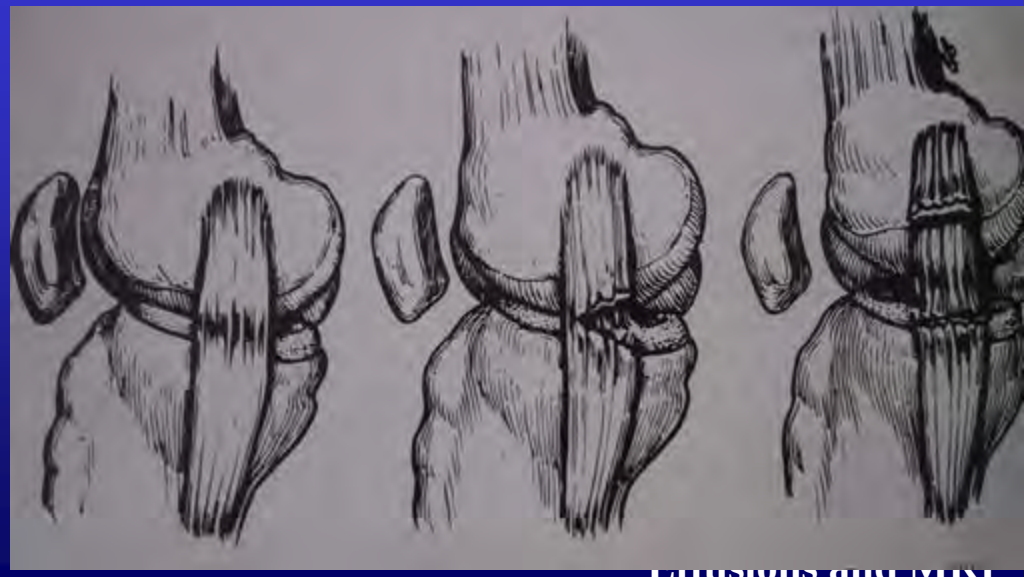
MCL

- Common from acute trauma.
  - Misstep / collision
  - Valgus stress
  - Immediate pain and swelling
- Point tenderness medial joint line / mcl
- Valgus stress at 30^0 reproduces pain
- Clearly defined end point = grade 1 or grade 2 sprain
- Complete medial instability = full rupture or grade 3 sprain

MCL Injury: Grades

- Usually secondary to valgus strain
- Grades I, II & III





LCL

- LCL injury <<< MCL
- Varus stress to the knee
  - Runner plants one foot and turns toward the ipsilateral knee.
- Acute onset of lateral knee pain / stop the activity
- Point tenderness at lateral joint line.
- Instability or pain occurs with varus stress testing of the knee at 30 degrees.

Overuse Syndromes

- Lateral Knee Pain
  - Aggravated by activity
    - Running downhill and climbing stairs.
    - Excessive friction between the iliotibial band and the lateral femoral condyle
    - Commonly occurs in runners and cyclists,
- Tightness of the iliotibial band, excessive foot pronation, genu varum, and tibial torsion

Overuse Syndromes (cont)

- PF pain syndrome (chondromalacia patellae)
  - Vague history of mild to moderate pain
  - After prolonged sitting
- Almost always tight hamstrings
- Treatment
  - Physiotherapy to stretch the hamstrings and unload the patellofemoral joint

Children

Children – Most Commonly

- Patella instability
- Anterior knee pain
- Osgood schlatters
- OCD

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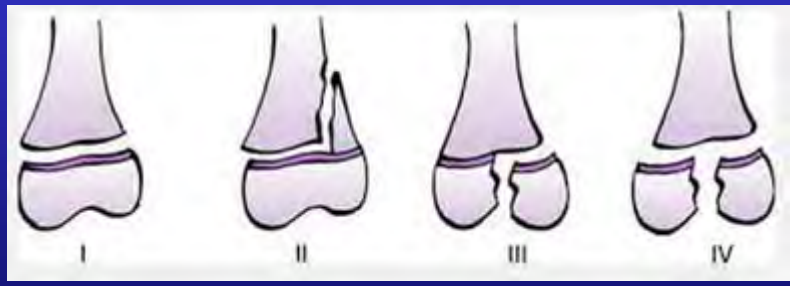
Children - Don’t miss these

- Referred pain from the Hip
- Growth plate fractures
- Tumour
- Infection
- Inflammatory Arthritis



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Children - Don't miss these

- Referred pain from the Hip
  - Can have both hip and knee pathology
  - Restricted abduction in flexion indicates hip pathology until proven otherwise.
- Growth plate fractures
  - Isolated injury rare under 14 yrs (ligaments are stronger than the physes)
- Limps or unable to weight bear suspect a fracture even if initial X ray is normal

Kids continued

- Tumour
  - Present with pain, swelling or pathological fracture
  - If symptoms and signs are atypical think of this
- Infection (same as adult)
- Inflammatory Arthritis

Clinical Examination

Clinical Examination

- Remove socks and expose thighs
- Try standing and walking
- Examine the good leg first

LOOK – FEEL - MOVE

Functional Anatomy / Assessment

- Gait
- Alignment
- Range of Motion
- Hip
- Knee
- Ankle/Foot

Clinical Assessment

- Body habitus
- Gait – antalgic, thrust, stiff etc
- Swelling
- Scars
- Muscle Wasting
- Tenderness
- Instability
- Neurovascular status

Ligamentous laxity

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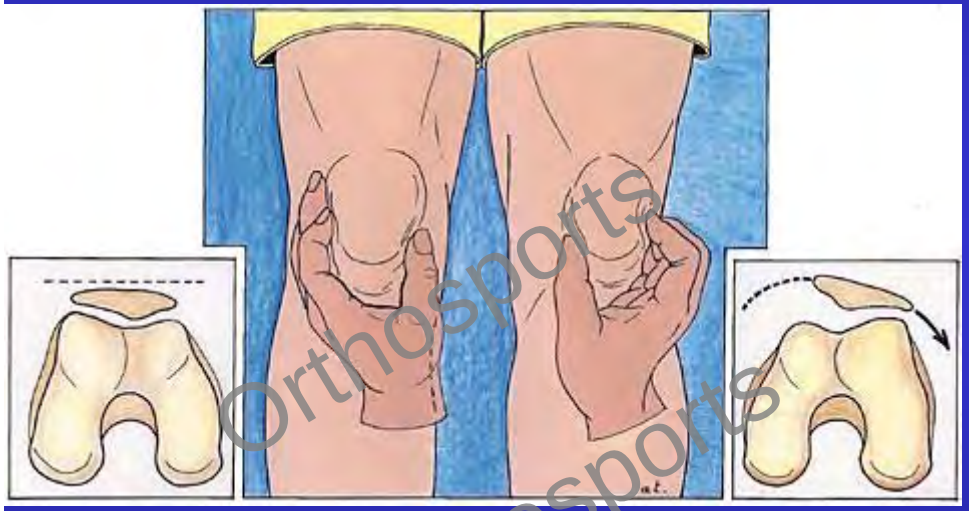
Sporting Knee
Effusions and MRI



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Sporting Knee
Effusions and MRI

Check for effusion

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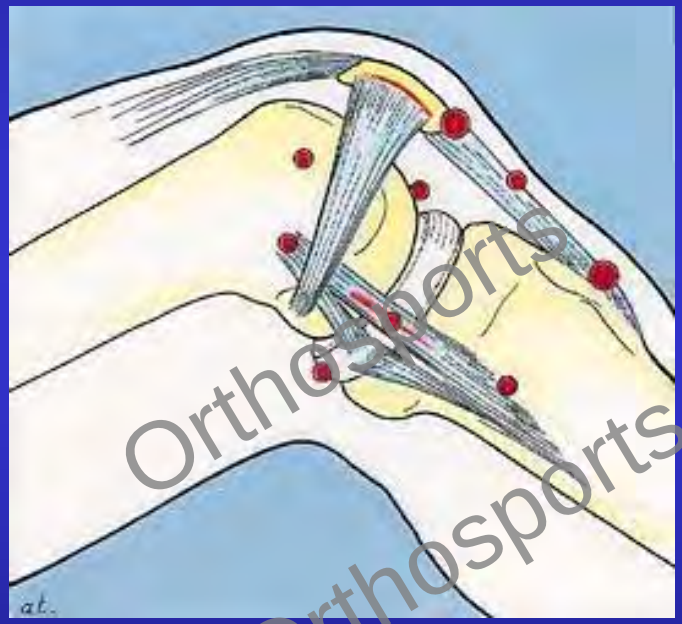
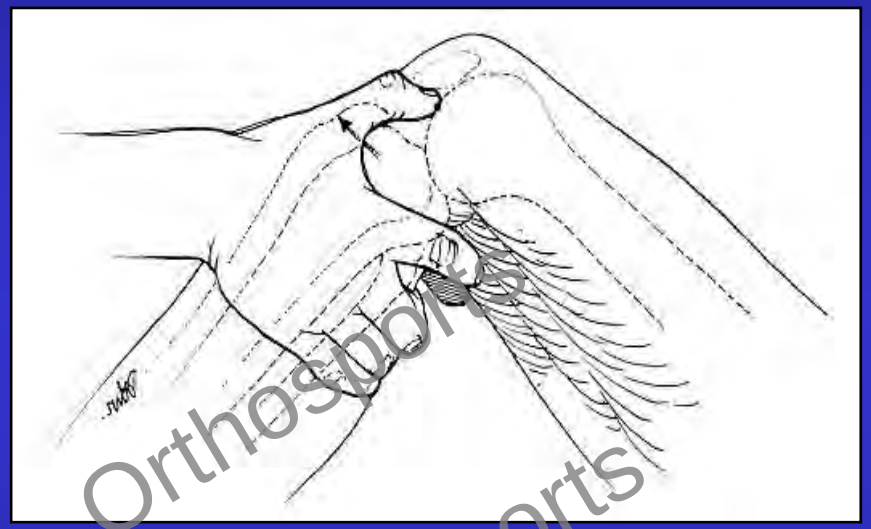
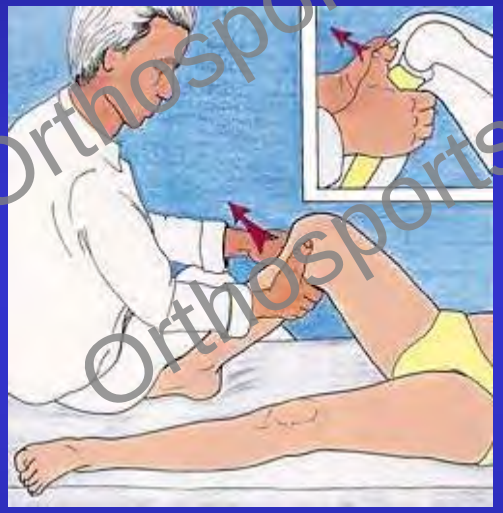
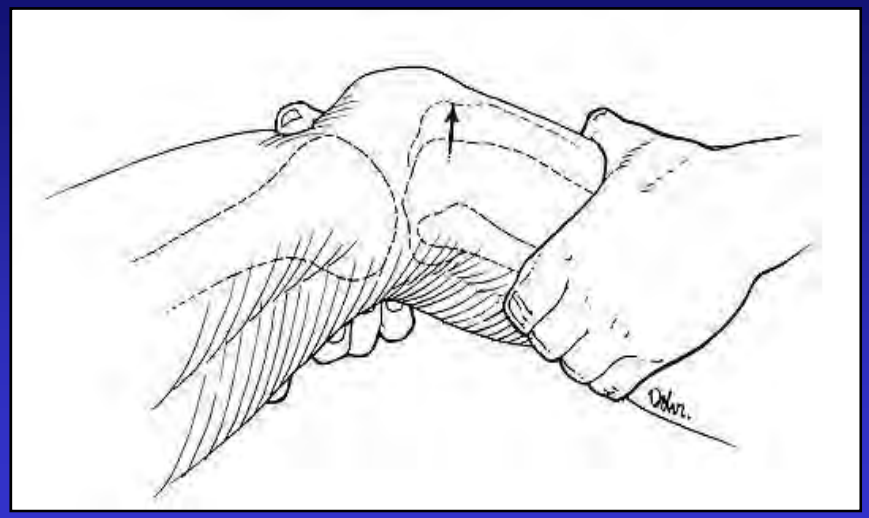
Palpation



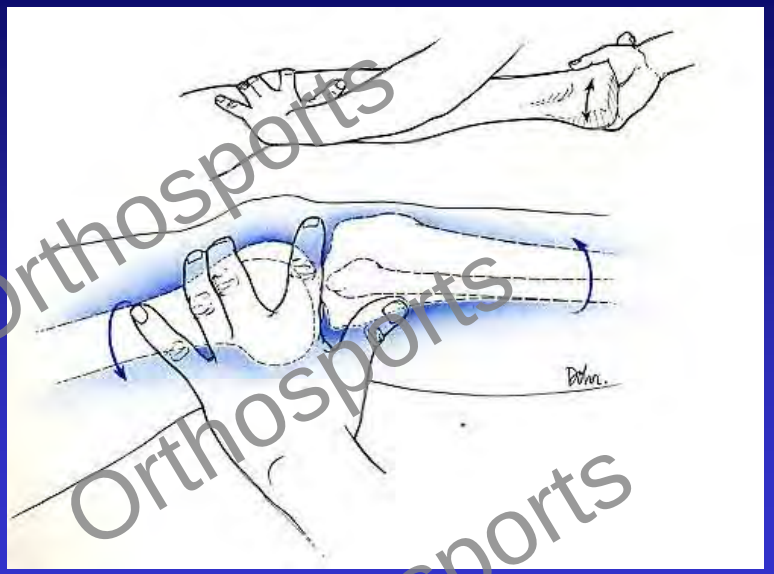
Anterior Drawer







Lachmann



Pivot Shift

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PCL: Posterior Drawer Test

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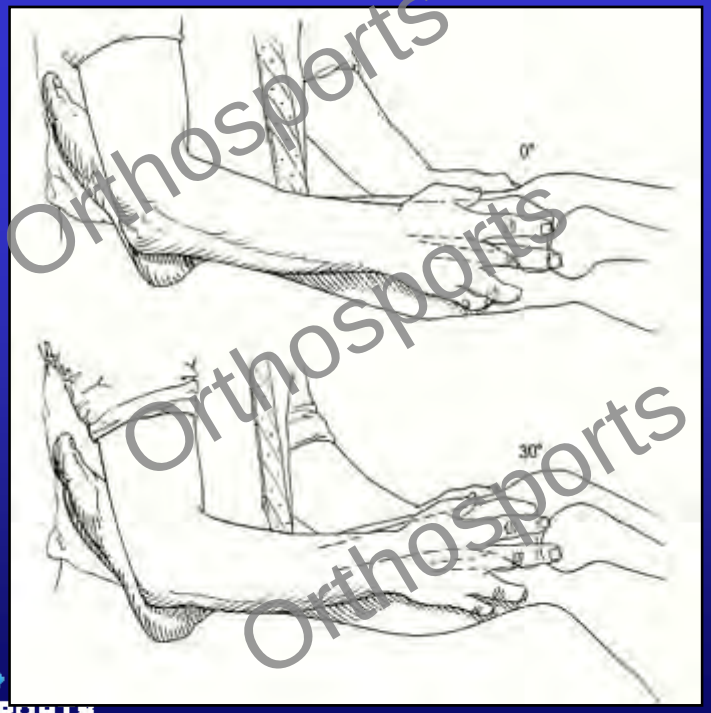

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Sporting Knee
Effusions and MRI

McMurray's Test

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Thessaly's test

- Patient stands on affected foot
- Examiner holds pt's outstretched hands
- Pt rotates knee & body internally and externally three times with the knee in variable degrees of flexion
- Medial or lateral joint line discomfort or a sense of locking or catching constitutes a positive test

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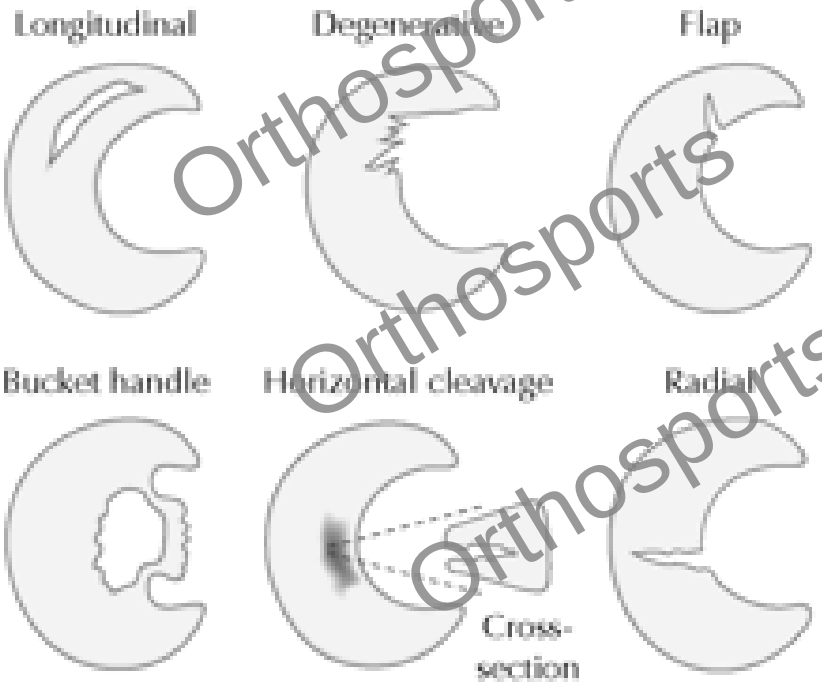
Sporting Knee
Effusions and MRI

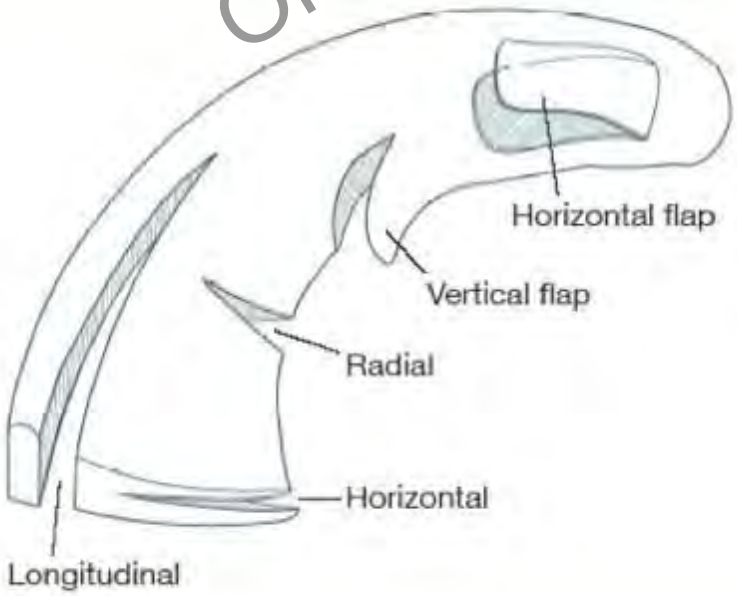
Med Meniscus Clinical Findings

- Joint line tenderness
  - Medial in cross leg position
  - Lateral at 30^0 flexion
- Pain on forced flexion
- McMurray's / Thessaly's Test
- Loss of extension
- Clunking of meniscus

Meniscal Injuries

Meniscus tear types





Meniscal tears

- Younger patients are more likely to have an acute traumatic event as the cause of their meniscal pathology

- Acute ACL injury
  - Lat > Med
- Chronic ACL
  - Med > Lat

Meniscal Tears - Diagnosis

- Diagnosis made from a careful history
- The onset of symptoms and mechanism of injury are often clues to the diagnosis
  - Twisting injury
  - Hyperflexion
    - Acute pain and swelling.
  - Pain when kneeling or standing from sitting

Meniscal tears - Diagnosis

- Locking /catching
  - Also from chondral injury or patellofemoral chondrosis
- Loss of motion / mechanical block to extension
  - displaced bucket handle meniscal tear (or a loose body)
  - Usually requires acute surgical treatment. It can also be caused by a loose body though.

Degenerative Tears

- Older patients (>40 years)
  - Atraumatic chronic mild joint swelling
  - Joint line pain
  - Mechanical symptoms
  - Often associated with some chondral damage.
- Try to reproduce Snaps, clicks, catches or jerks when examining

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Effusions and MRI

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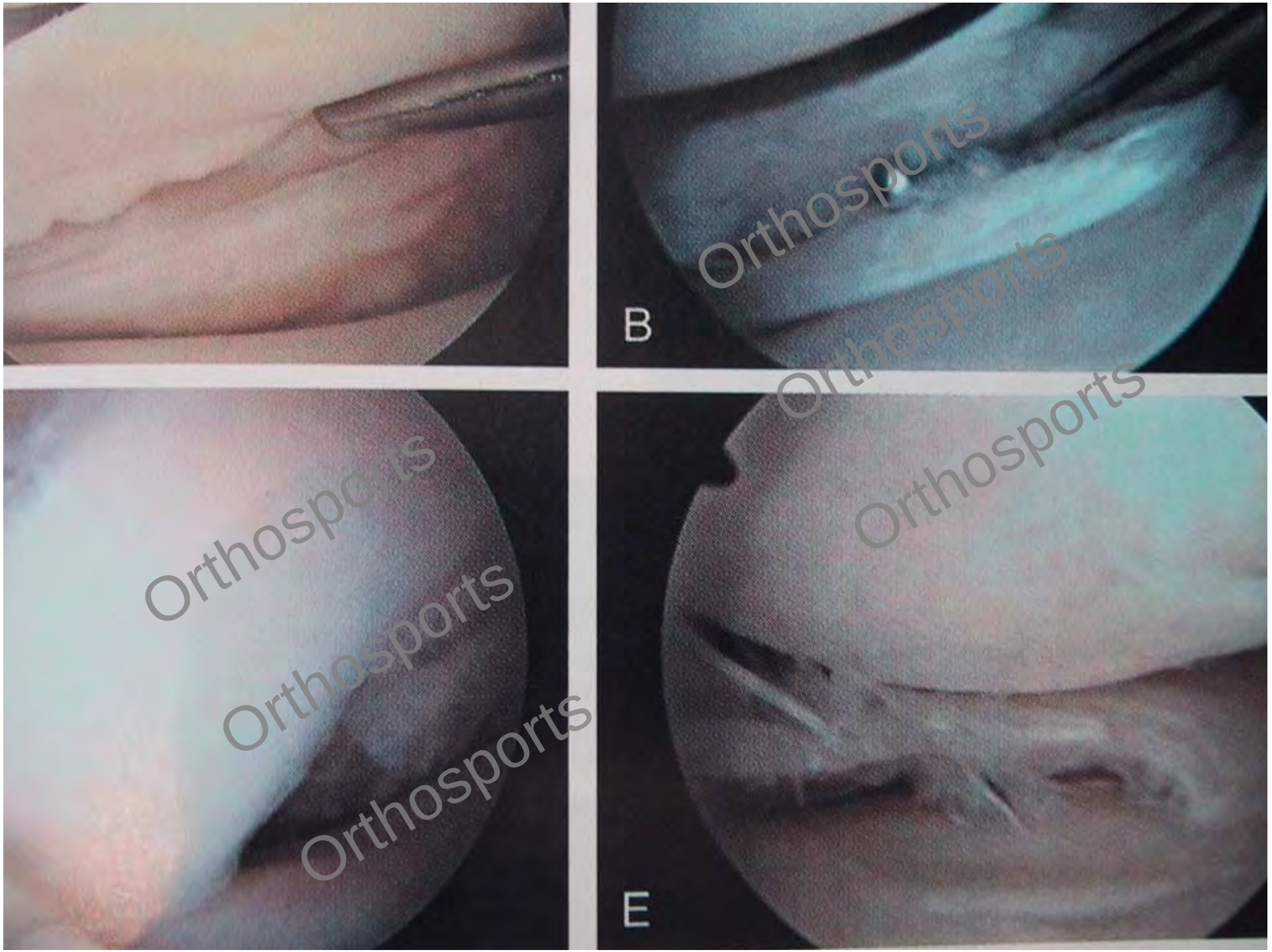

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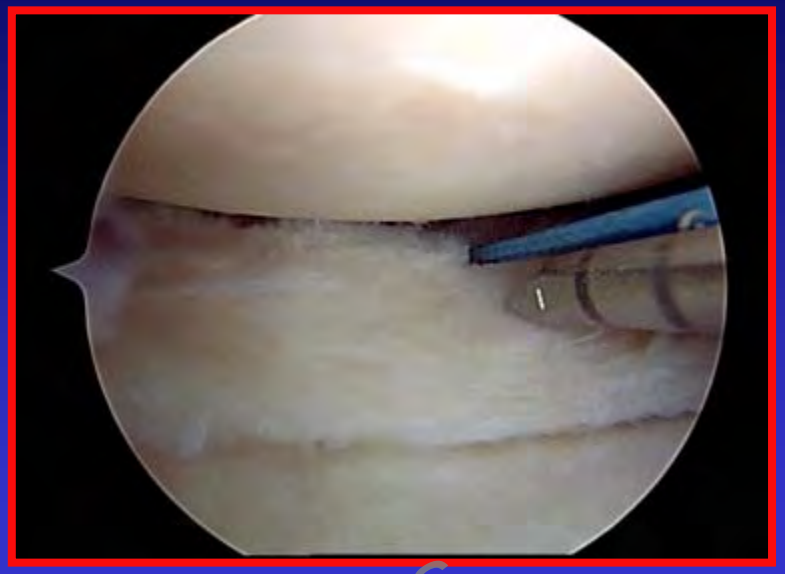

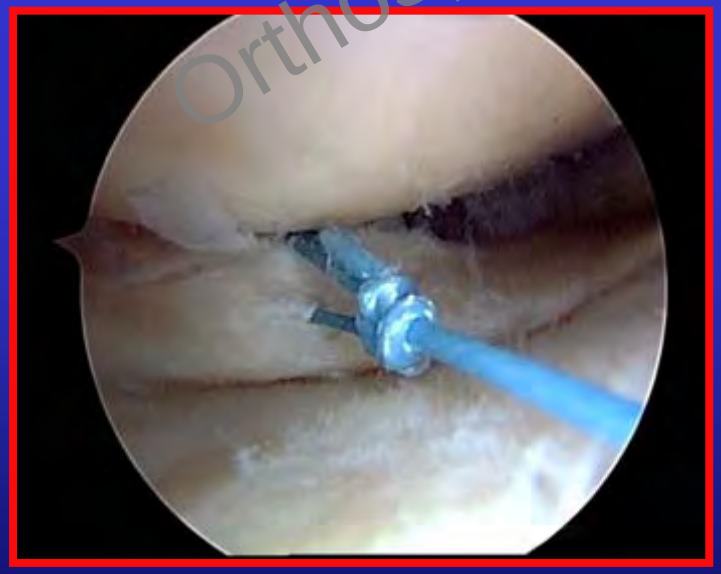

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Sporting Knee
Effusions and MRI

Effusion

Effusion

- Traumatic *(acute)*
- Systemic disease *(acute or recurrent)*
- Overuse *(recurrent)*

The history provides the diagnosis the majority of the time and is confirmed with a careful clinical examination

Spontaneous Swelling

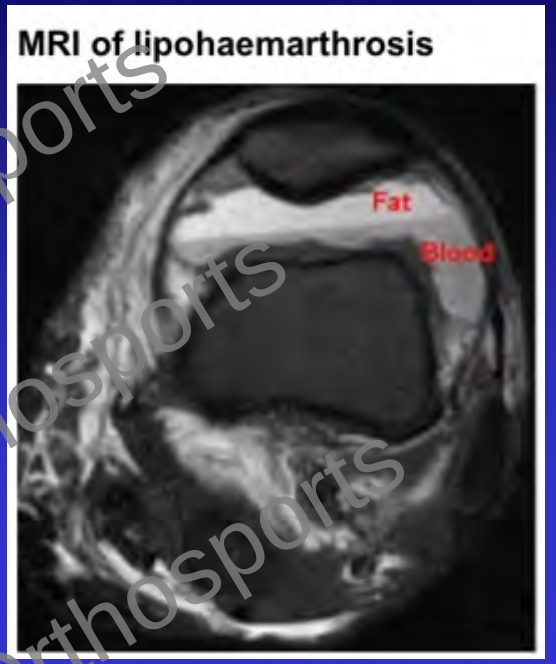
- Often the first sign of arthritis
- Tumour or infection
  - Systemic symptoms
    - fevers or chills, intravenous drug use, sexual contact, night pain or weight loss
    - monoarticular arthritis with joint redness, swelling, pain and loss of motion
  - Infiltrative disorders such as gout and pseudogout
  - sometimes the only way to differentiate between them is with a joint aspiration
  - Most common joint involved in both benign and malignant tumors.

Effusion

- Rapid onset (<2 hrs) large, tense effusion
  - Lig rupture or fracture
- Slower onset (24 - 36 hrs) mild to mod
  - Meniscal injury / lig sprain/tear / infection
- Isolated meniscal tears do not always cause swelling and tend to indicate some chondral damage

Effusion

- Non-traumatic
  - Arthritis
  - Crystal deposition (gout/pseudogout)
  - Infection
  - Tumour



A joint effusion without trauma is a very specific sign of joint inflammation but other symptoms include pain, warmth and erythema

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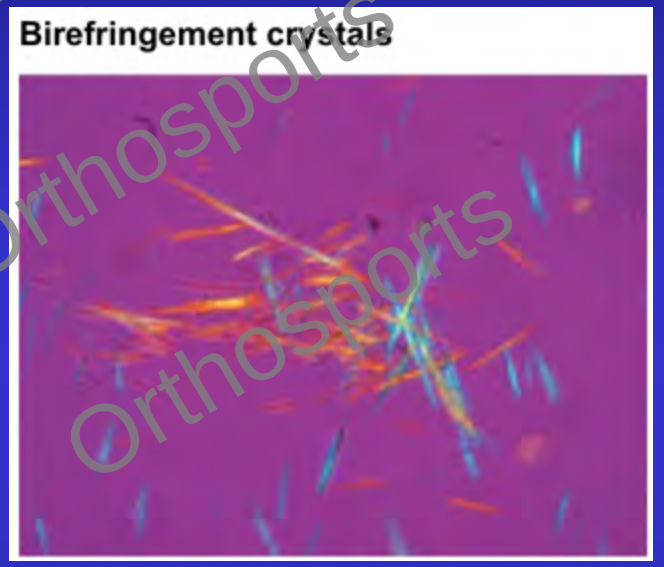
Crystal-Induced Inflammatory Arthropathy



- Gout or Pseudogout
  - Acute inflammation
  - Pain and swelling
  - No trauma
- Gout - sodium urate crystals
- Pseudogout - calcium pyrophosphate

Infection

- Sudden onset of pain and swelling
- No history of trauma
- Warm, swollen, exquisitely tender
- Slight motion causes intense pain
- Any age
  - Immunocompromised
    - (diabetes, alcoholism, AIDS, or corticosteroid therapy)

Diagnosis

- Blood tests
- Aspiration
  - Crystals / organisms / culture (M,C&S)

Blood Tests

- Spontaneous effusion
- With normal x-ray:
  - FBC, EUC, LFTs, ESR, CRP, ANA, Rh Factor, Anti CCP, Serum Immunoglobulins and HLA B27.

Is it infected?

- Elevated blood WBC, ESR and CRP
  - Remember Fungi, TB and Lyme disease
    - Fluid cell counts of 50-100x10^9/L suggestive of infection
- Crystal-induced arthritis can present in a similar fashion as an infection
- Sodium urate crystals precipitate in the knee joint and cause an intense inflammatory response

Is it infection or crystals?

- **S**lightly cloudy synovial fluid
  - WBC count 2 - 75 × 10^9/L
  - Polarized-light microscopy
  - Negatively birefringent rods with gout
  - Positively birefringent rhomboids with pseudogout.

- The presence of crystals does not rule out an infection, as the two may co-exist
  - No Abs unless infection proven

Rheumatic disease (Inflammatory)

- Synovial Fluid
  - WBC count 2 - 50 × 10^9/L suggest an inflammatory process

Rheumatology referral within 6 weeks is recommended for patients in whom inflammatory arthritis is suspected

Treatment

- General measures to relieve knee pain and swelling
  - Splinting, assisted weight bearing, ice packs, and NSAID's
  - No AB's until specimens taken
  - No HC if suspect infection
- Arthroscopy is rare with acute swelling of the knee without trauma

Knee Injection

Extended lateral approach

- Target
  - Retro-patellar space

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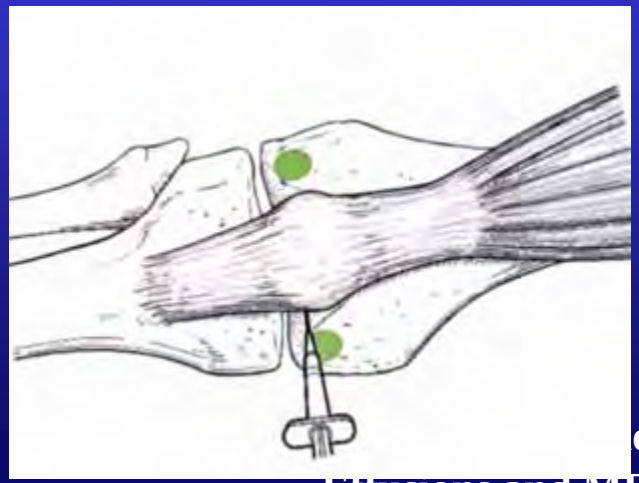
Knee Injection:

Knee extended: Medial Approach

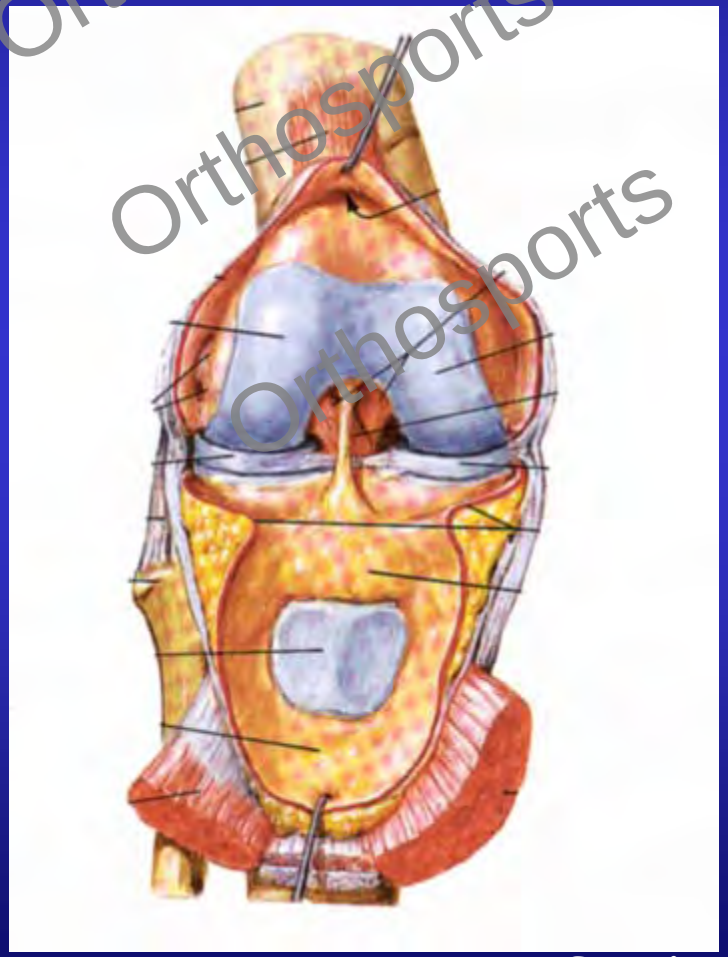
- Patient relaxes quads.
- Examiner pushes patella medially
- Needle Position:
  - midway between superior and inferior pole of patella
  - Needle Horizontal



Knee Injection:

Flexed Medial Approach

- Target:
  - Intercondylar notch
- Landmarks:
  - Hollow along the joint line just medial to the patellar tendon



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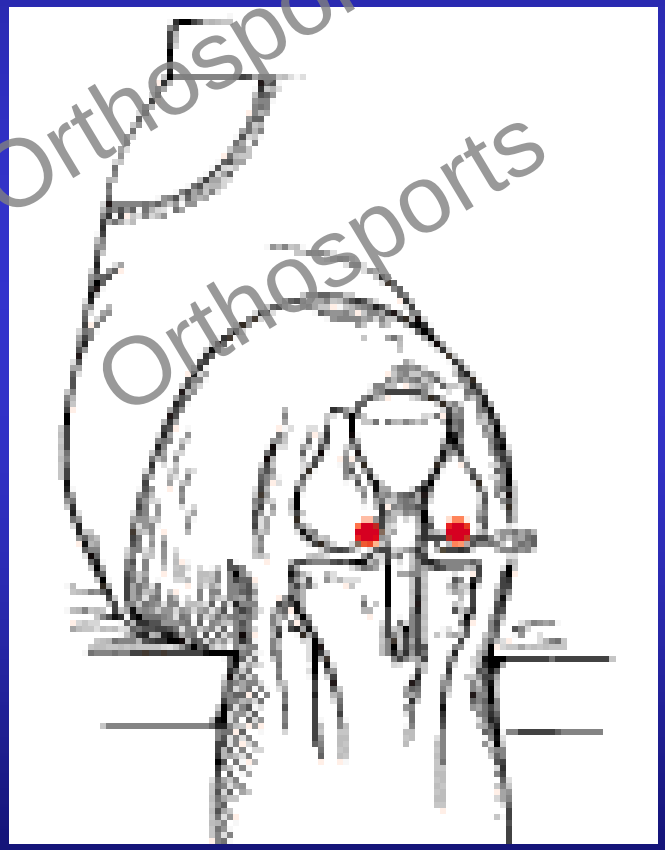
Knee Injection:
Flexed Medial Approach

- Patient sitting:
  BEWARE syncope!!!
- Needle Position:
  - 30^0 laterally and slightly superiorly
- Resistance:
  - caused by bone or cruciates
  - redirect



Relatively normal looking synovial fluid

Synovial fluid vs saline

Lipohaemarthrosis fatty layer on the top of the blood

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Sporting Knee
Effusions and MRI

Swelling outside the knee

- Prepatella bursa (housemaids knee)
  - Treated with splinting /NSAIDS / antibiotics
  - Swelling localized anterior to the patella
    - Does not involve the knee joint itself
  - ROM usually OK

Small prepatellar bursitis | Large prepatellar bursitis | Infected prepatellar bursitis

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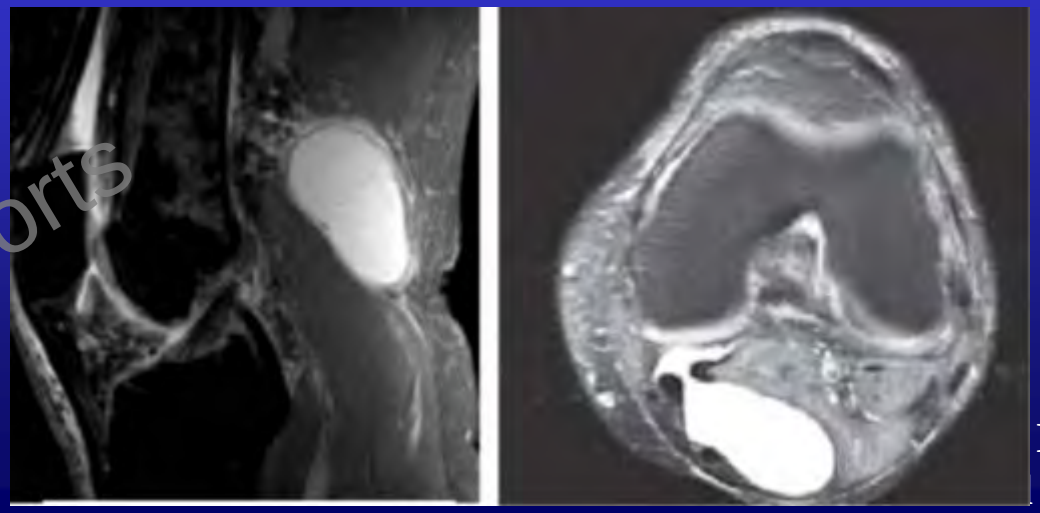
Popliteal Cyst

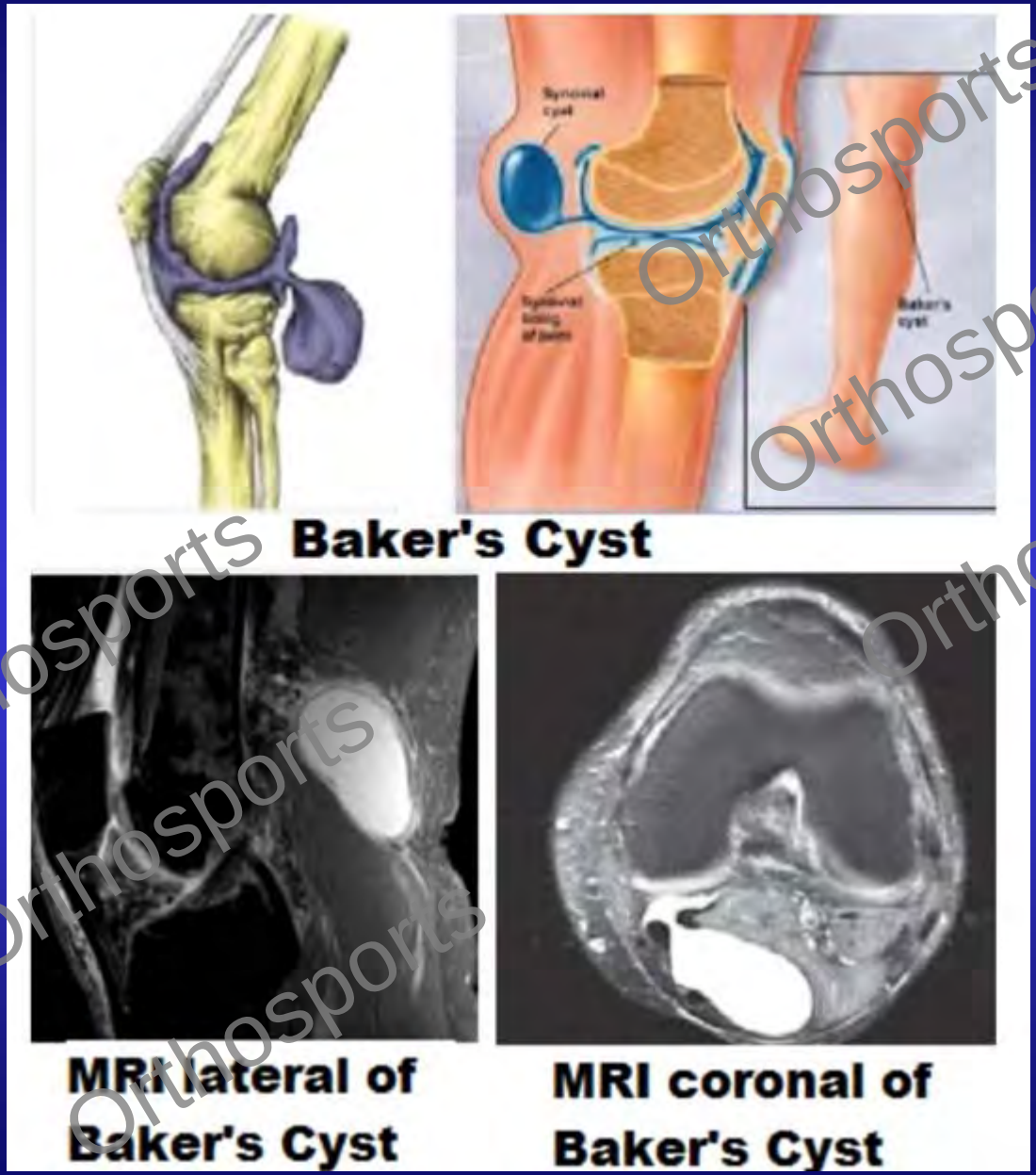
- Swelling behind the knee (Baker's Cyst)
- Most common synovial cyst of the knee
  - Fluid production in the knee
  - Treat the cause of the swelling (often arthritis)



Knee MRI

Popliteal Cyst

- Origin – posteromedial - Gastrocnemius / Semimembranous bursa
  - Insidious onset of mild to moderate pain posteriorly
  - Usually symptomatic when very large or rupture
  - Rupture - quite severe calf pain and swelling and difficulty walking may look like a DVT.



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Post Knee Pain DDx

- Arterial popliteal aneurysm
- Adipose tissue
- Tumour
- DVT

Traumatic Injury

- Can't WB = fracture
- Pop/giving = ACL tear
- Pain with twisting, kneeling or standing from sitting = meniscal injury
- Isolated meniscal tears do not cause swelling
  - Chondral injuries do
- Haemarthrosis becomes less bloodstained and more serous in appearance with time

Who gets an Xray?

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Ottawa knee rules

- After **acute knee injury** knee x-rays are indicated if any of the following criteria present:
  - *aged 55 years or over*
  - *tenderness at the head of the fibula*
  - *isolated tenderness of the patella*
  - *inability to flex knee to 90 degrees*
  - *inability to bear weight (defined as an inability to take four steps, ie. two steps on each leg, regardless of limping) immediately and at presentation*

Ottawa knee rules

- Majority of acute knee injuries are soft tissue injuries not identifiable on plain radiographs.
- A normal looking knee X-ray after acute trauma does not exclude a fracture
  - Tibial plateau fractures, Segond fractures Salter-Harris type 1 fractures are easily missed if not complemented with clinical findings
  - Follow up should be recommended if symptoms persist.

Investigation

- Xray
- Xray
- Xray
- Xray
- Xray

Routine Imaging

- Weight Bearing AP
- Lateral
- Notch View
- Skyline Patella

Investigations / Imaging

- Plain radiography
- Stress radiography
- Ultrasound
- CT Scan
- MRI Scan
- Bone Scan

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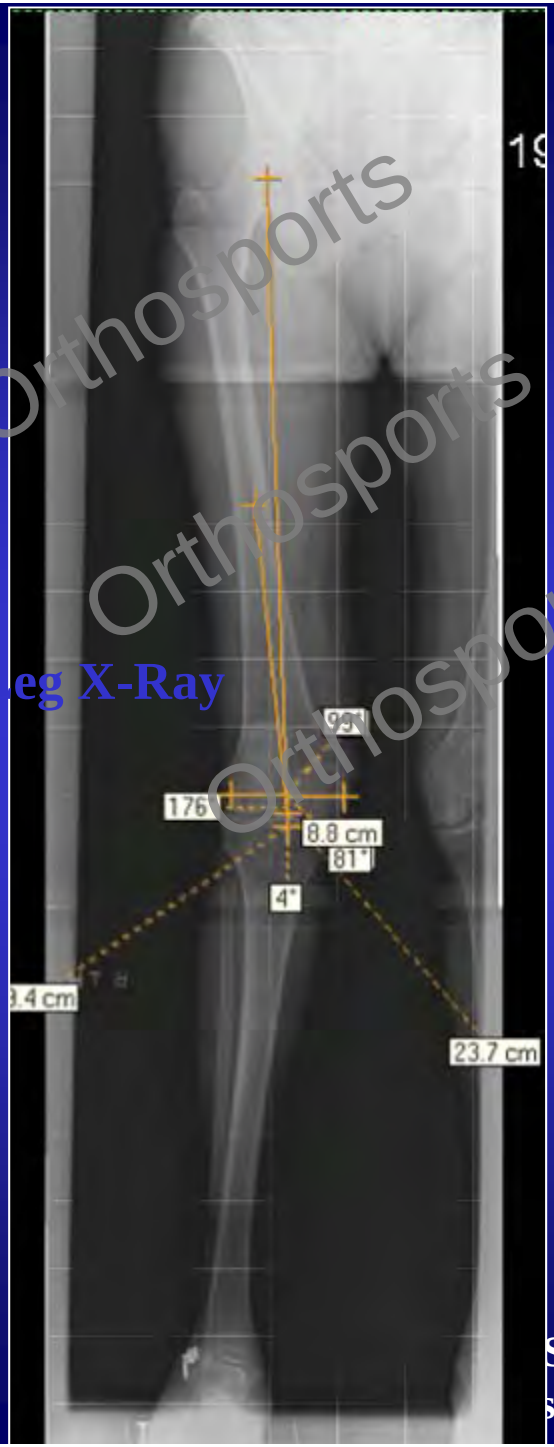

eg X-Ray

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Sporting Knee
sions and MRI

Imaging

- After doing a plain xray:
  - MRI
    - 30% of asymptomatic contralateral knees have torn menisci on MRI – Am J Rheum 2003
    - 76% matched control volunteers with tears JBJS 2003
    - 13% healthy volunteers under 45yrs - Clin Orthop Rel Res 1992
    - 36% over 45yrs had tears – Clin Orthop Rel Res 1992
  - Check that the MRI correlates with clinical symptoms

MRI

- Noninvasive nature
- Multiple planes
- No ionizing radiation
- See other structures within the joint
- Relatively high cost
- Overcalls pathology
- Not all magnets and reports equal

MRI

- Accuracy >95%
  - **<u>Unfortunately being used as the first investigation for a painful knee</u>**
  - Common to see meniscal tear & chondral damage
  - Weight bearing xrays show arthritis, which is actually what the patient needs treatment for
  - Normal clinical exam = MRI only 5% chance of showing a meniscal tear
  - Asymptomatic patients:
    - <45 yrs old, 13% have a meniscal tear
    - >45 years old, 36% have a meniscal tear

Reading an MRI

- T1
- T2
- Gadolinium

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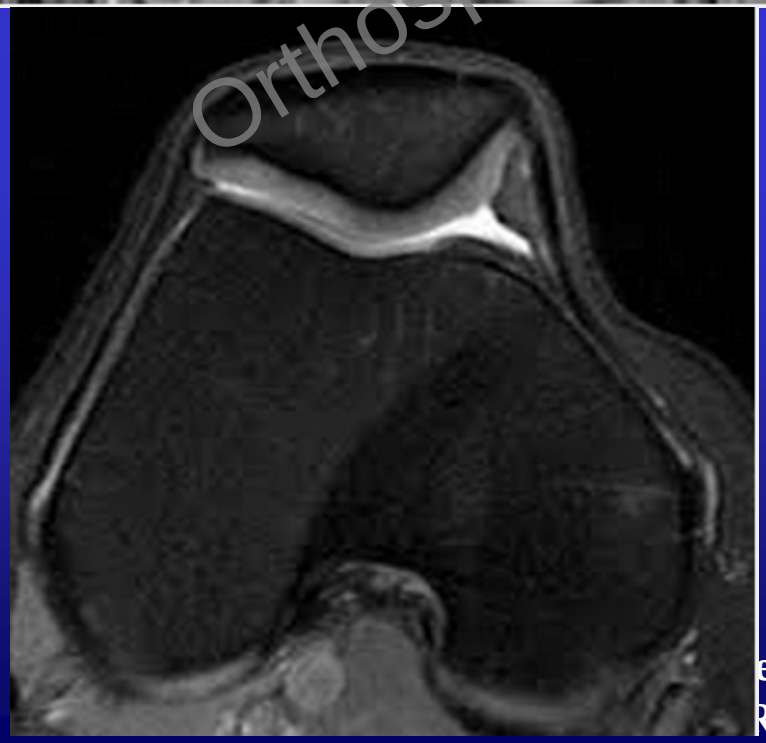
Sporting Knee
Effusions and MRI



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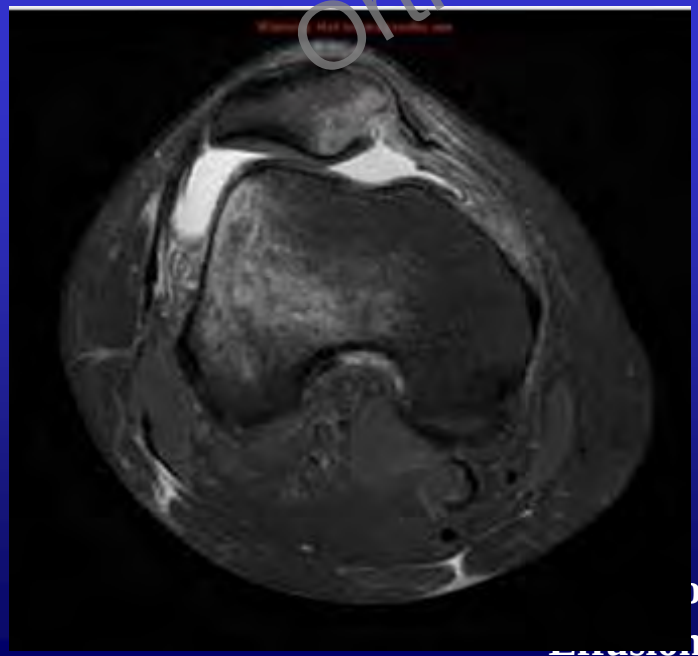
Sporting Knee
Effusions and MRI



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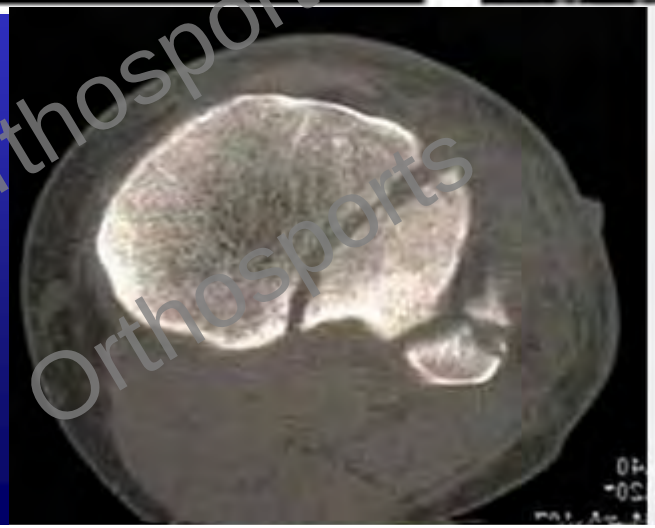
Erasions and MRI



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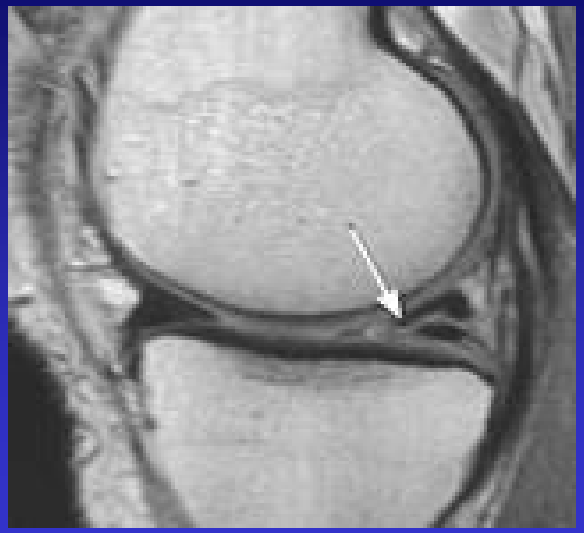
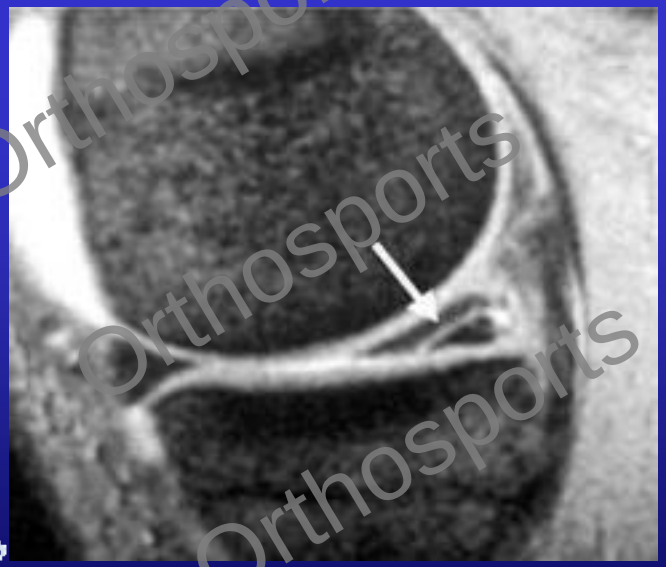
Sporting Knee
Effusions and MRI





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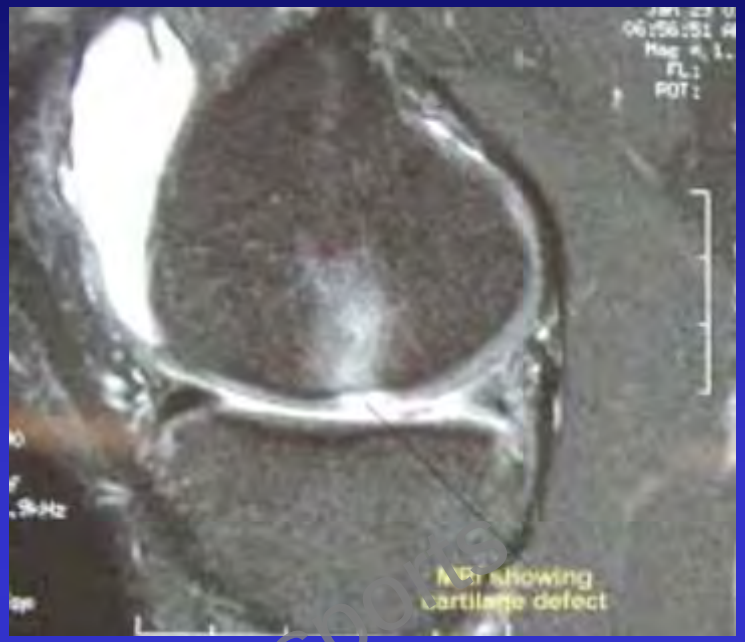
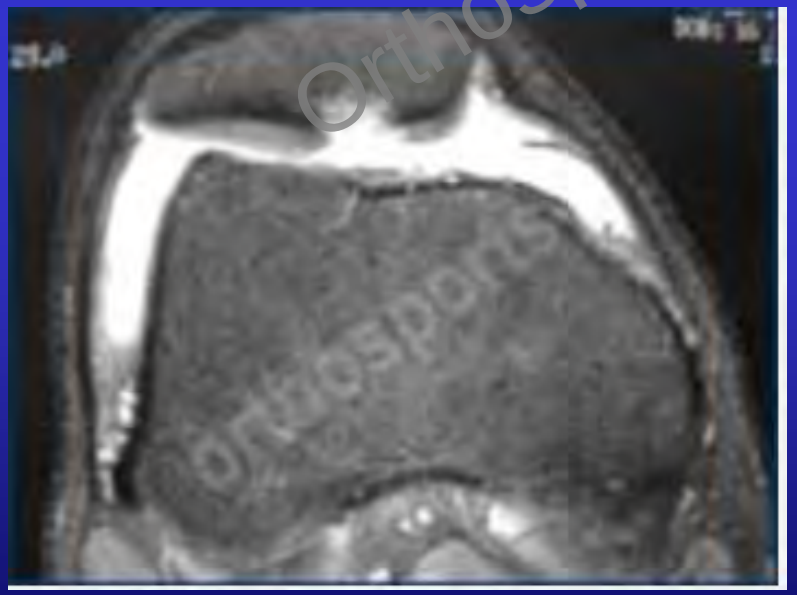
Effusions and MRI





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Sporting Knee
Effusions and MRI

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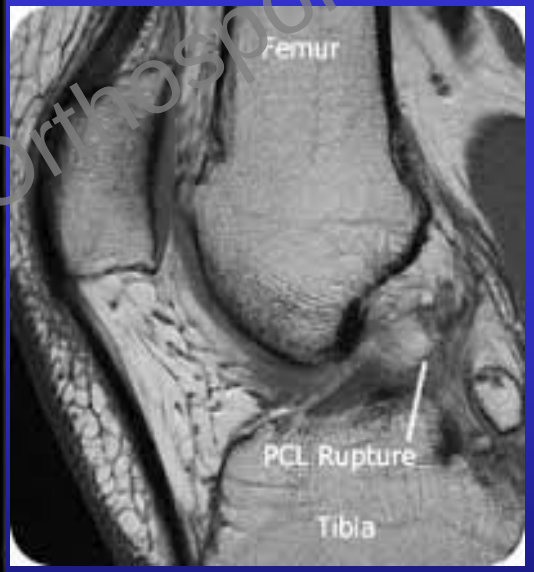
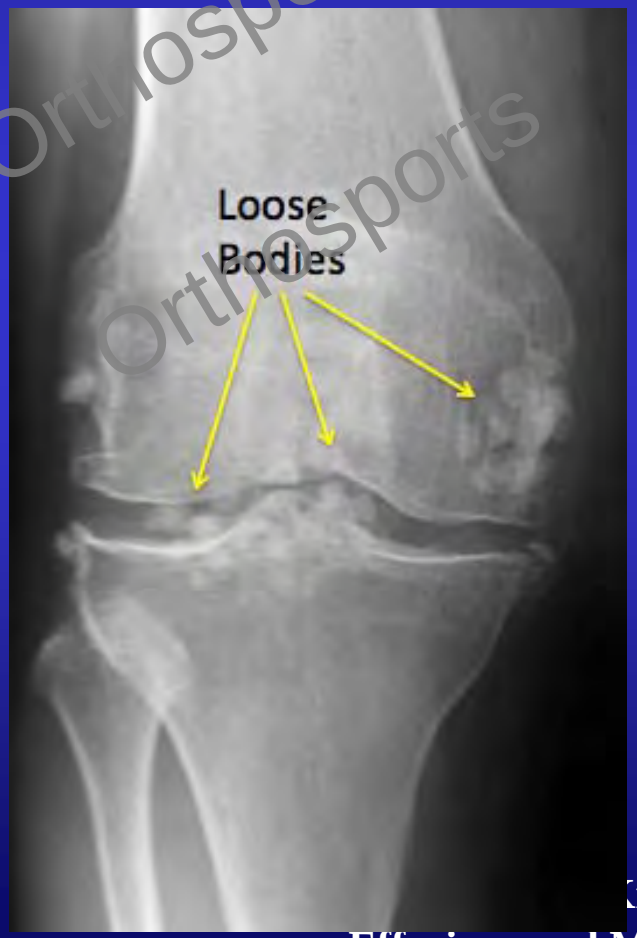
Sporting Knee
Effusions and MRI

Imaging

- MRI



MRI is not always better



Arthritis vs Meniscal Tear

- Clinical exam less reliable in these pts
  - Different, less acute mechanism of injury
  - Numerous other possible degenerative causes contributing to their intra-articular knee pain
  - Very high incidence of meniscal tears on MRI scanning with OA
  - The decision as to whether or not to operate is often difficult

Arthritis vs Meniscal Tear

- A meniscal tear can lead to knee OA, but knee OA can also lead to a spontaneous meniscal tear
- A degenerative meniscal lesion often suggests early-stage knee OA
- Surgical resection of non-obstructive degenerate lesions may merely remove evidence of the disorder while the OA and associated symptoms proceed.

Arthritis vs Meniscal Tear

- Arthroscopic debridement for chronic OA is no better than a sham procedure in relieving knee pain or improving functional status
- No better than physio WHEN THIS IS THE FIRST FORM OF TREATMENT

Swedish study

- 45–64 yrs old, knee pain, meniscal tear on MRI and OA on xray (minor)
- Rigorous exercise regimen alone vs Exercise regimen with surgery
- Outcomes 2, 6, 24 and 60 months
- Both groups improved considerably over the first 6 months and maintained improvements in pain and functional status over 60 months

Swedish study

- 30% of the subjects randomised to the non-operative arm had persistent pain and crossed over to have surgery
    - And had similar outcomes to those randomised to receive surgery at the outset.

Try physio 1st and operate if they don't get better

MeTeOR

- The Meniscal Tear in Osteoarthritis Research (MeTeOR) Trial
- Aged ≥45 with meniscal tear on MRI and underlying OA change on xray or MRI
- As in Herrlin et al about 30% of MeTeOR subjects crossed over from non-operative therapy to surgery.

Meteor and knee OA

- No role for arthroscopy unless they have clinical and imaging evidence of a tear AND mechanical symptoms (Catching, locking, popping etc)
- Patients who fail to improve with physio can try surgery
- Recovery from menisectomy surgery at 1 year:
  - Worse if female and worse OA
  - No different based on Age, BMI, depth of meniscal excision, involvement of 1 or both menisci, extent of meniscal tear

Surgical Decision Making for Meniscal Tears

- Indications for Arthroscopic Treatment:
  - Symptoms affecting ADLs, work, sports
  - Positive physical findings
    - Joint line tenderness, joint effusion, limitation of motion, and provocative signs
  - Failure to respond to nonsurgical treatment,
  - Absence of other causes of knee pain

Surgical Decision Making for Meniscal Tears with ACL

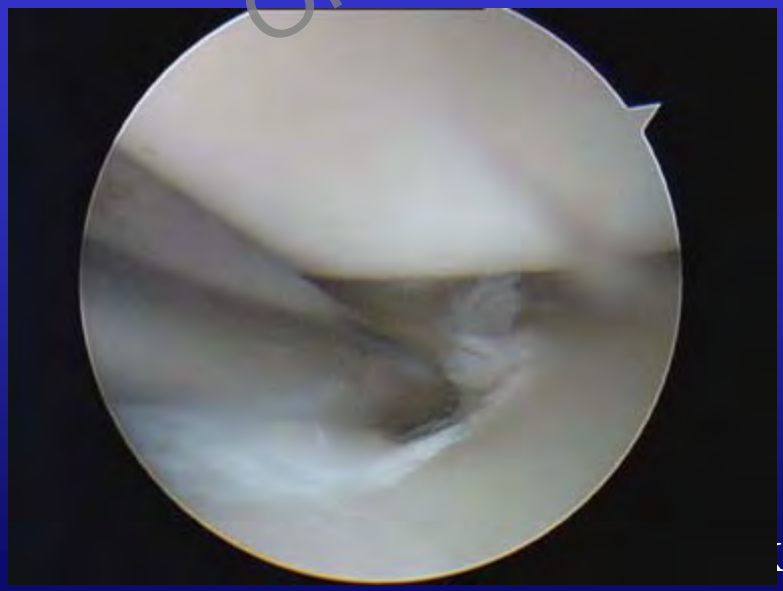
- Most often done concurrently with ACL reconstruction
  - Surgical timing dictated by:
    - ROM
    - Swelling
    - Quads function
    - Other Lig injuries
    - Locked knee

Rules Of Thumb

- Ongoing pain affecting ADL's
- Meniscal pathology will do better than articular cartilage
- Younger more likely to be meniscal
- Clicking more likely to be meniscal
- Sudden onset of pain generally does better
- Mechanical symptoms do better

Refer Early

- Locked knee
- Terrible pain, unable to walk for no apparent reason
  - Keep infection in the back of your mind
- Treat the elderly for a bit longer as more likely to be articular
- Joint line cysts(=meniscal tear) can come and go but most require surgery (LATERAL>>MEDIAL)



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Urgent Referral

- Infection
- Locked Knee
- Lateral ligament

Thank you

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