Keys to the Knee: Simplifying Evaluation of the Knee

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DISCLOSURES

I have no personal or financial interests to declare.

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INTRO

Knee special tests (we'll come back to these later)

Physician Assistant Program
JAMES MADISON UNIVERSITY

Knee	
Special Tests	**Pathology**
Bulge Sign (Sweep Test)	Knee Effusion
Ballotable Patella	

PRE-TEST QUESTION #1

- The gold standard test to diagnose an anterior cruciate ligament (ACL) tear is the:
  A. Lachman test
  B. Anterior Drawer test
  C. Pivot Shift test
  D. McMurray's test

PRE-TEST QUESTION #2

- Which of the following statements is true about patellofemoral (PFPS) pain syndrome?
  A. Surgical treatment is the standard of care. Decompression, lateral release, and osteotomy are options to consider.
  B. Radiographs are insufficient to diagnose; MRI is typically needed.
  C. Wearing a properly fitted knee brace is typically curative.
  D. The etiology is multi-factorial. Treatment is conservative and there is no “quick fix”.

PRE-TEST QUESTION #3

- A 54 year old male presents with pain and mechanical symptoms in his right knee. He has done some reading on "WebMD" and believes he has a meniscus tear. Your next best step is to:
  A. Order a knee MRI to assess for meniscus tear
  B. Refer him to Orthopedics; meniscus tears are surgical problems
  C. Obtain radiographs, including Rosenberg views
  D. Obtain radiographs; the standard three views only (AP, lateral, oblique)

INTRODUCTION & BACKGROUND

- Largest joint in the body
  - volume
  - surface area of articular cartilage

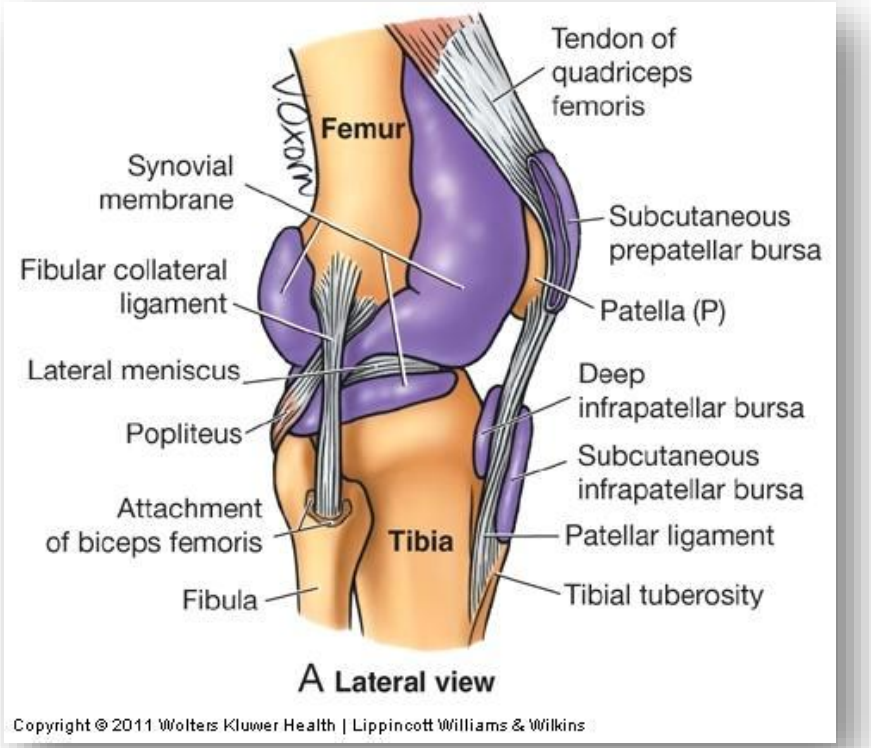
- Susceptible to:
  - acute injury
  - overuse syndromes
  - degeneration (“osteoarthritis”)
  - inflammatory arthritis
  - septic arthritis

INTRODUCTION & BACKGROUND

- Most commonly injured joint in athletics
- Second most common MSK complaint (back pain first)

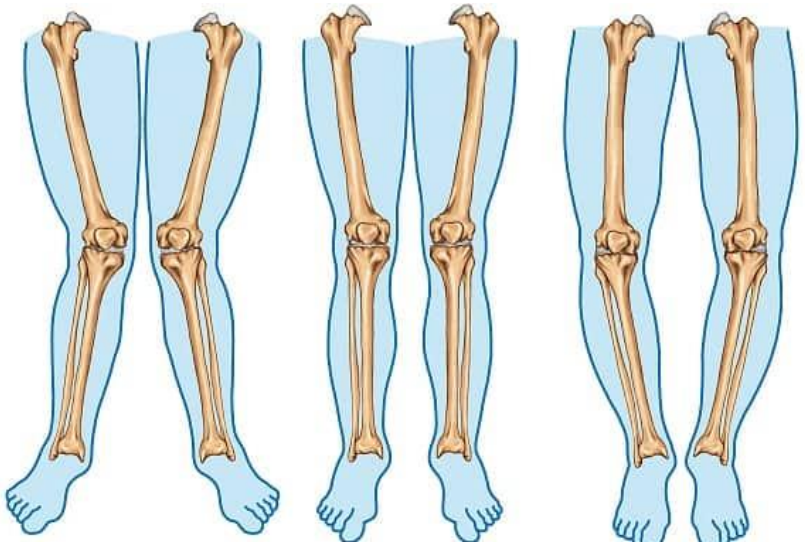
INTRODUCTION & BACKGROUND

- Joint capsule anatomy



INTRODUCTION & BACKGROUND

- Terminology

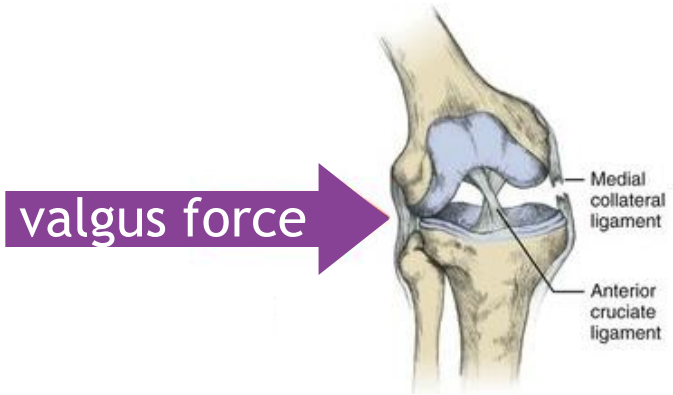


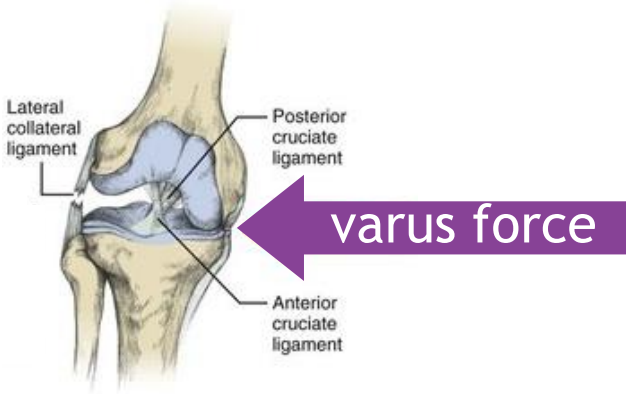
Genu Valgum
Valgus Deformity
“Knock Knees”

Genu Varum
Varus Deformity
“Bow Legged”

INTRODUCTION & BACKGROUND

- Terminology

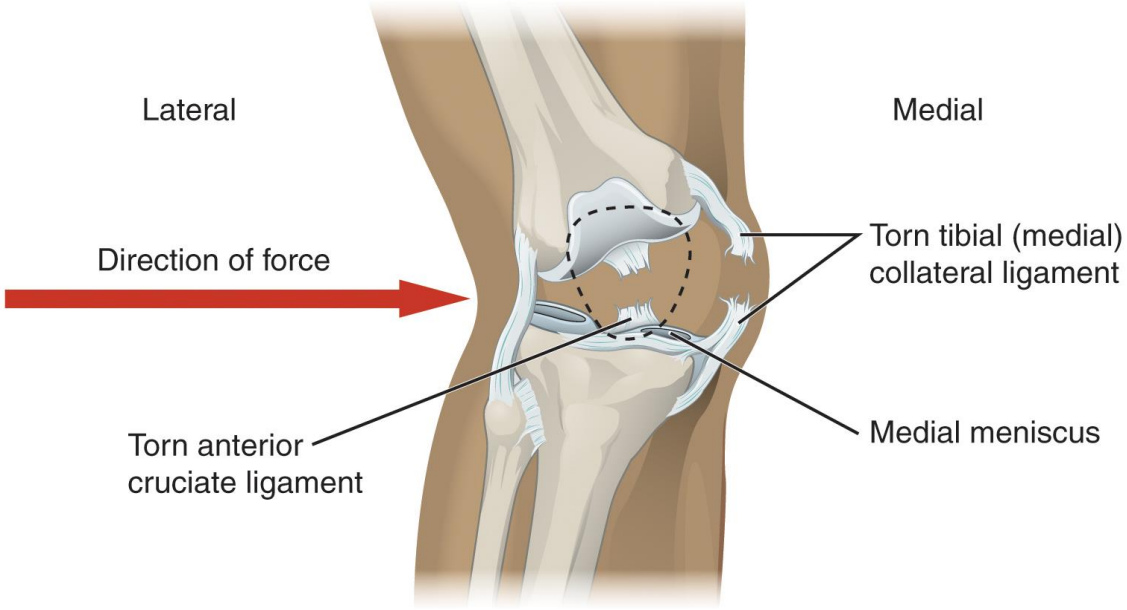




MCL SPRAIN/TEAR

History

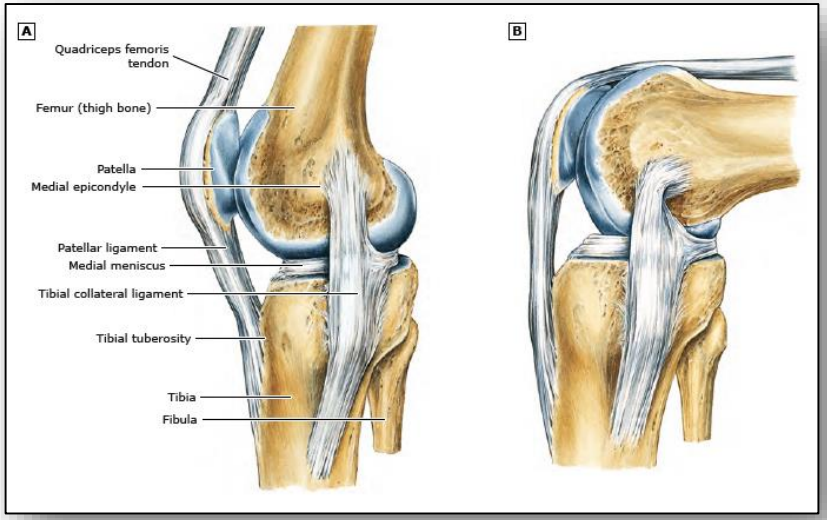
- MOI: ***valgus*** stress (contact or non-contact)
- c/o medial knee pain (typically very painful)
- often able to bear weight, but hurts to walk
- lack of effusion (b/c MCL is extra-articular!)



MCL SPRAIN/TEAR

Physical Exam

- tender to palpation medially over MCL
- ROM & strength may be limited by pain



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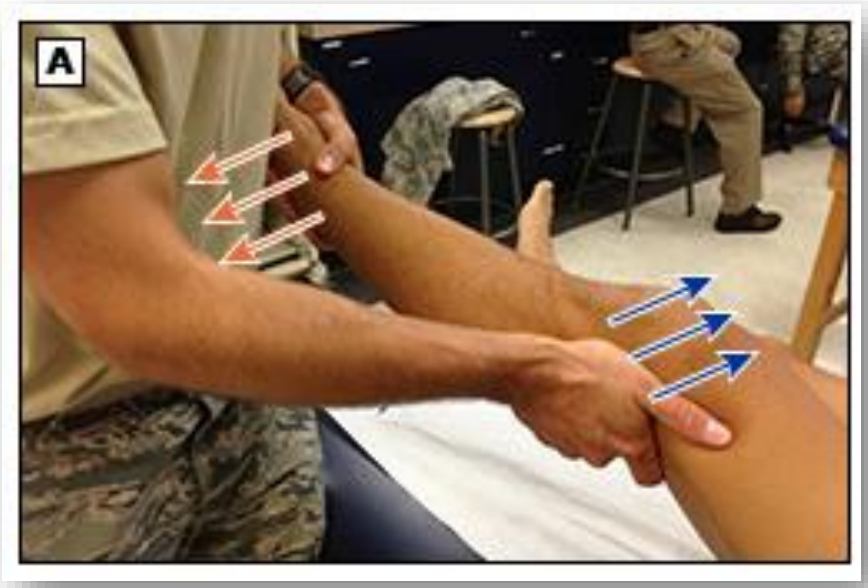
MCL SPRAIN/TEAR

Physical Exam: Special Test

- **Valgus stress test**
  - at 0º combined MCL & capsule
  - at 30º isolates MCL (*more sensitive*)



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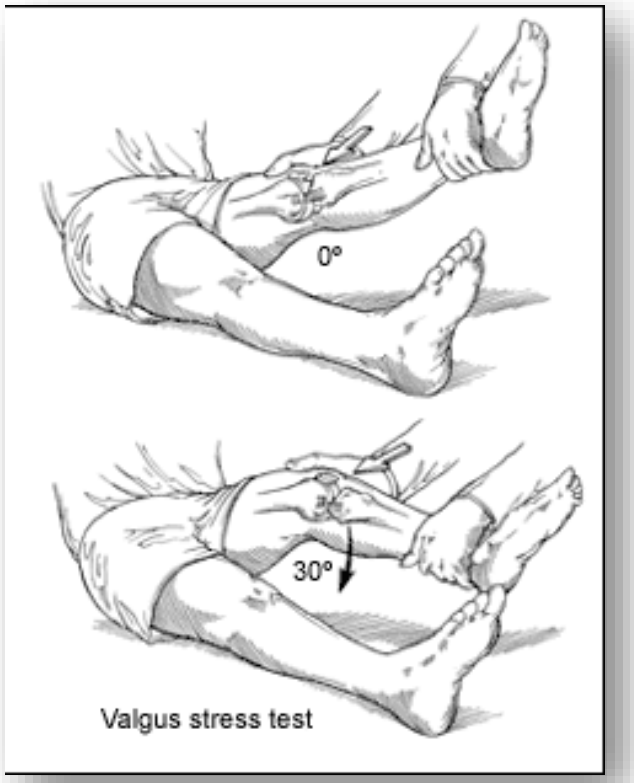


MCL SPRAIN/TEAR

Physical Exam: Special Test

- **Valgus stress test**
  - at 0º combined MCL & capsule
  - at 30º isolates MCL (*more sensitive*)

MCL SPRAIN/TEAR

Imaging: none

- typically no imaging needed, this is a clinical diagnosis

- MRI only warranted if you think there is also a meniscus injury or an ACL injury

MCL SPRAIN/TEAR

- ***hinged*** knee brace
  - typically 6-8 weeks

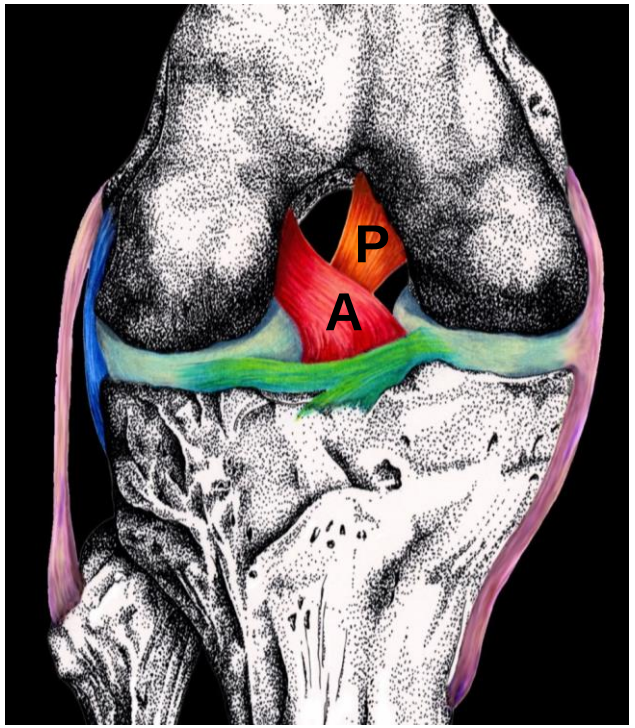
- therapeutic exercise

- Prognosis:
  - grade 1: 1 week
  - grade 2: 4 weeks
  - grade 3: 8+ weeks

ACL TEAR

History

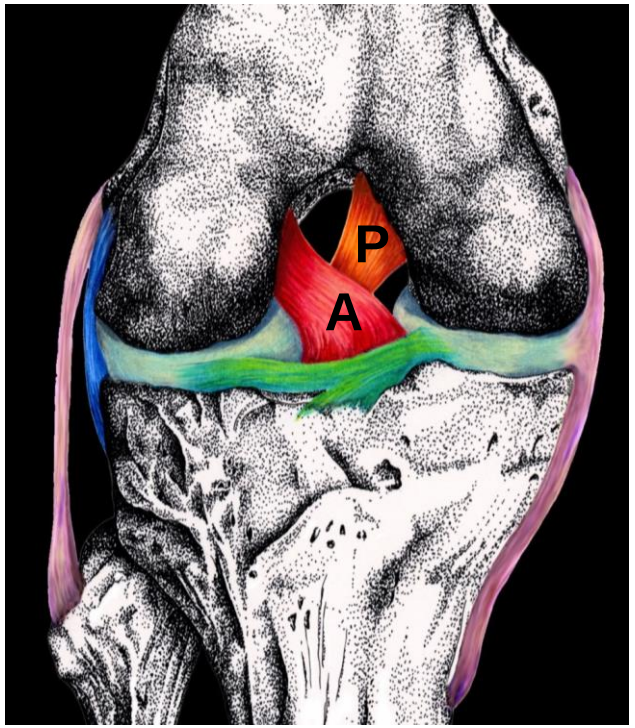
- ***MOI: twisting, cutting, changing direction (non-contact)***
- MOI: Contact causing hyperextension or valgus stress
- Feel and/or hear a “pop”
- Unable to return-to-play
- ***Immediate*** effusion (hemarthrosis)
- “Giving way”



ACL TEAR

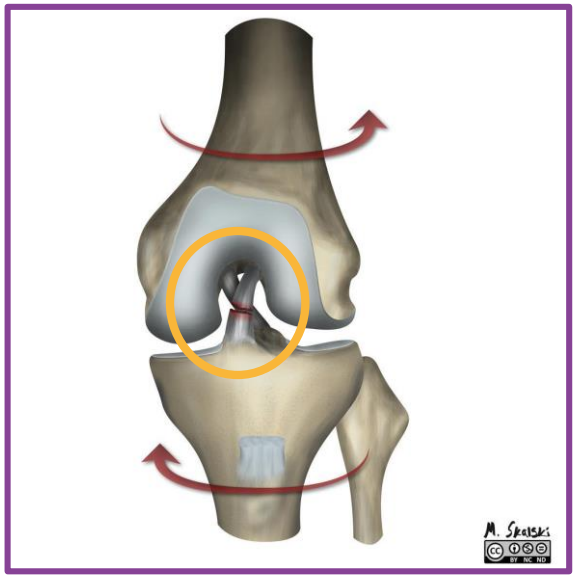
History

- 40-50% of all ligamentous injuries
- 70% of ACL tears are from athletics
- 7x more common in females
  - skiing
  - soccer
  - basketball

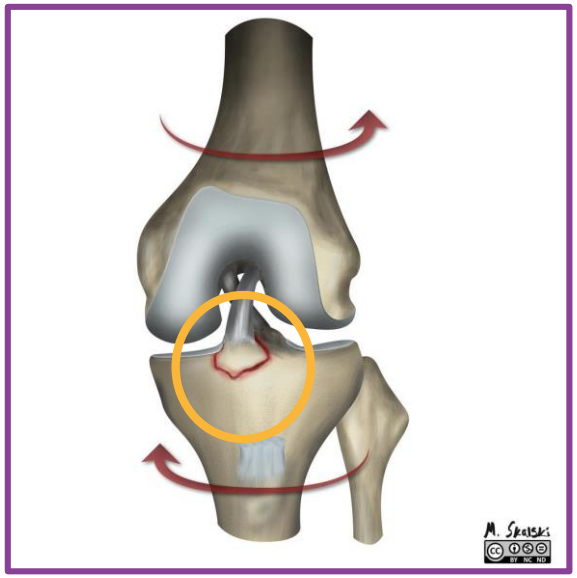


ACL TEAR

Most: Mid-substance Tear



Some: Avulsion of Distal Insertion



ACL TEAR

Physical Exam

- No specific area of palpable tenderness
- (+) effusion (hemarthrosis)
- ROM becomes more & more limited as the effusion/hemarthrosis gets larger
- Strength limited by effusion/hemarthrosis

ACL TEAR

- Physical Exam: Special Tests
  1. Lachman Test (gold standard, most specific)
  2. Anterior Drawer Test
  3. Pivot Shift Test

ACL TEAR

Physical Exam: Special Tests

1. **Lachman Test**
   - gold standard, most specific
   - difficult to perform, so clinicians often don't

Image from UpToDate © 2018

Step 1: Patient supine, flex knee 20-30 degrees
Step 2: Place one hand behind the tibia with thumb on tibial tuberosity and the other grasping the patients thigh
Step 3: Pull tibia forward to assess amount of anterior translation (motion) of the tibia in comparison to the femur

ACL TEAR

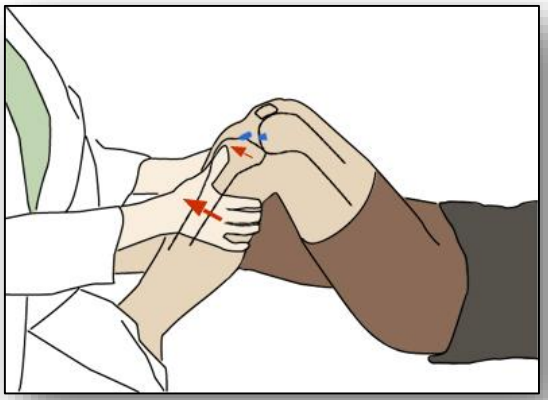
Physical Exam: Special Tests

1. **Lachman Test**
   - gold standard, most specific
   - difficult to perform, so clinicians often don't

ACL TEAR

Physical Exam: Special Tests

2. **Anterior Drawer Test**
   - fairly sensitive, but not specific
   - easy to perform, so often done by clinicians



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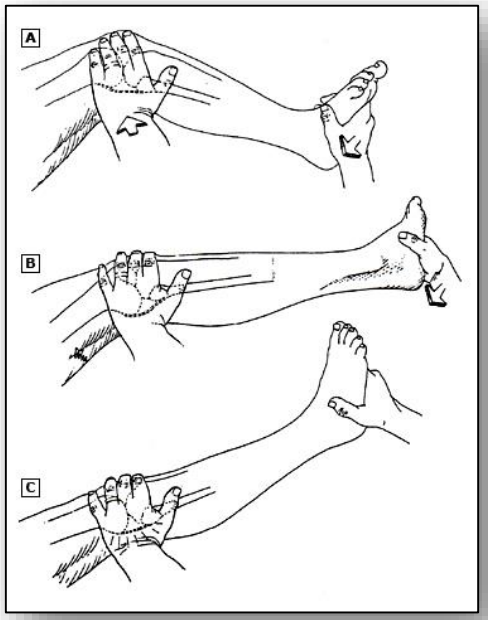
ACL TEAR

Physical Exam: Special Tests

3. **Pivot Shift Test**
   - fairly specific, but very difficult to perform if patient is not fully relaxed
   - often done as EUA



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ACL TEAR

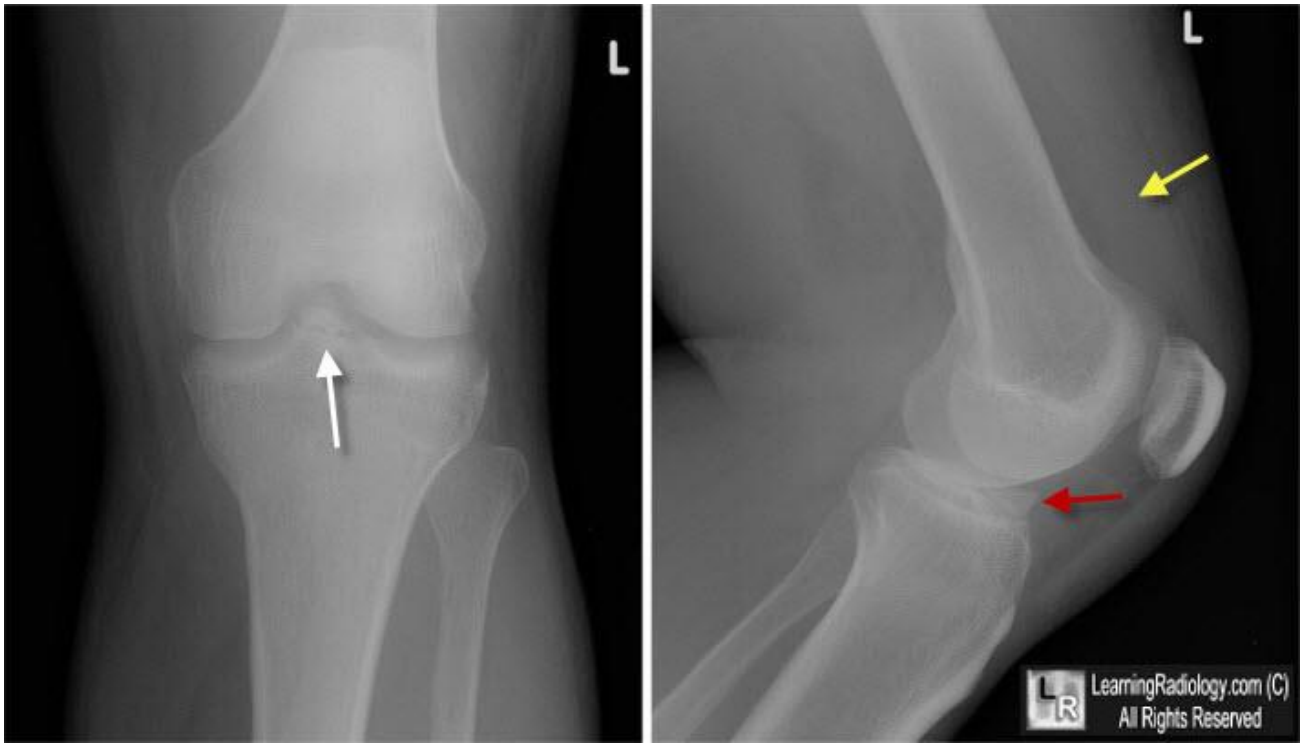
Physical Exam: Special Tests

3. **Pivot Shift Test**
   - fairly specific, but very difficult to perform if patient is not fully relaxed
   - often done as EUA

ACL TEAR

Imaging: X-Rays for acute injury

- ***always*** X-ray for acute effusion (even if non-contact injury)



ACL TEAR

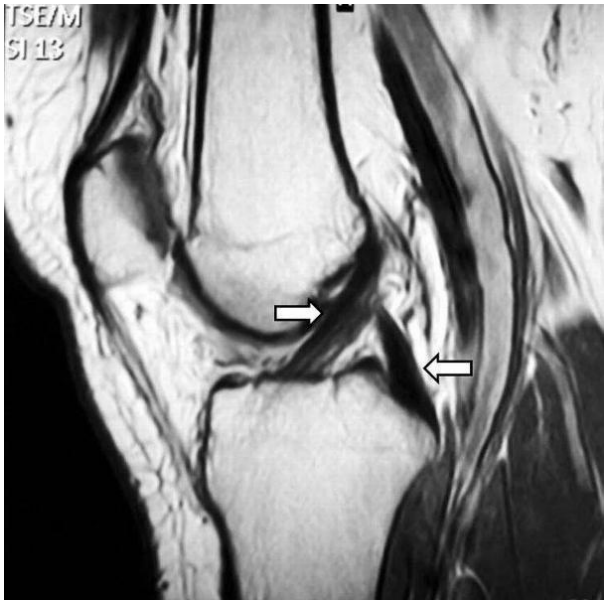
≈100% traumatic effusions are:

1. Intra-articular fracture (bone or chondral surface)
2. Cruciate ligament tear (ACL or PCL)
3. Patella dislocation
4. Meniscus tear

ACL TEAR

Imaging: MRI to assess ligament

- >95% accuracy for ACL tear
- decreased “signal intensity”
- less taut



Normal ACL

ACL Rupture

ACL TEAR

Imaging: MRI also assess bone

- secondary sign: bone contusions (“kissing lesions”)

ACL TEAR

Treatment:

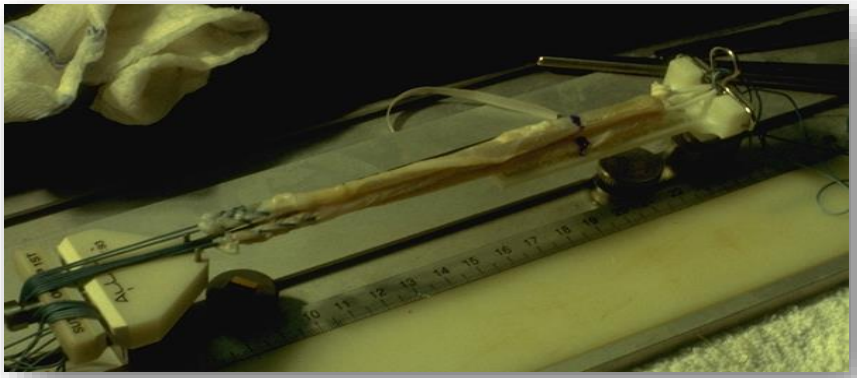
- Sedentary: therapy/strengthening, no surgery
- Active: surgical ***reconstruction***

**Reconstruction prevents repetitive microtrauma to the articular surfaces, and therefore prevents early DJD from occurring

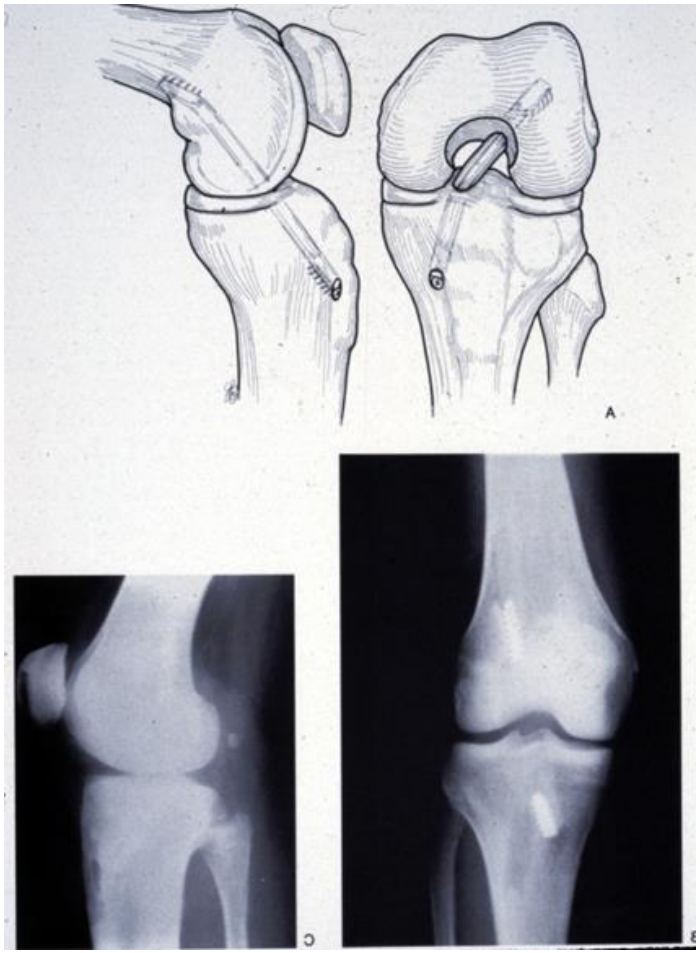
ACL TEAR

Grafts:

- patellar tendon autograft**
- hamstring tendon autograft**
- Achilles tendon allograft
- synthetic?



ACL TEAR

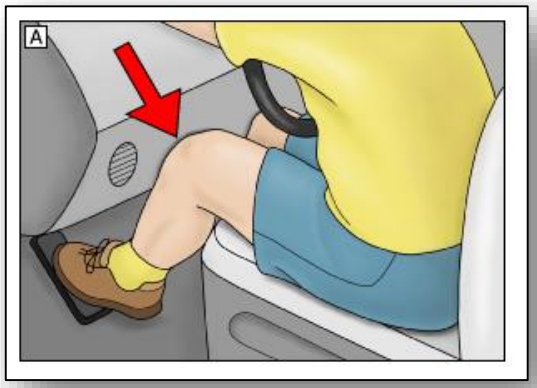


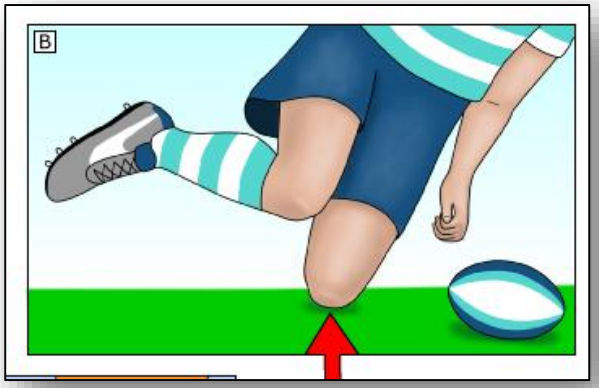
- Return to Play: ~1-year

PCL INJURY

History

- Mechanism of injury
  - forced hyperextension
  - blow to anterior tibia (MVC – “dashboard injury”)
- Often no frank instability
- Much less common than ACL injuries





PCL INJURY

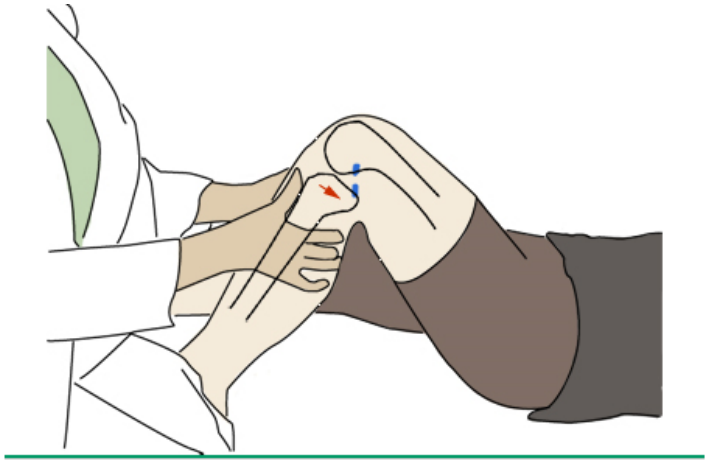
Physical Exam: Special Tests

1. Posterior Drawer Test (gold standard, most specific)
2. Quadriceps Active Test
3. Sag Sign

PCL INJURY

Physical Exam: Special Tests

1. **Posterior Drawer Test**
   - gold standard, most specific



The posterior drawer test is used to assess the integrity of the posterior cruciate ligament. With the knee flexed to 90 degrees and the foot stabilized (often the examiner sits on the patient's foot), the proximal tibia is grasped firmly with both hands and the tibia is forcibly pushed posteriorly, noting any laxity compared with the other side.

PCL INJURY

Physical Exam: Special Tests

1. **Posterior Drawer Test**
   - gold standard, most specific

PCL INJURY

Physical Exam: Special Tests

2. Quadriceps Active Test

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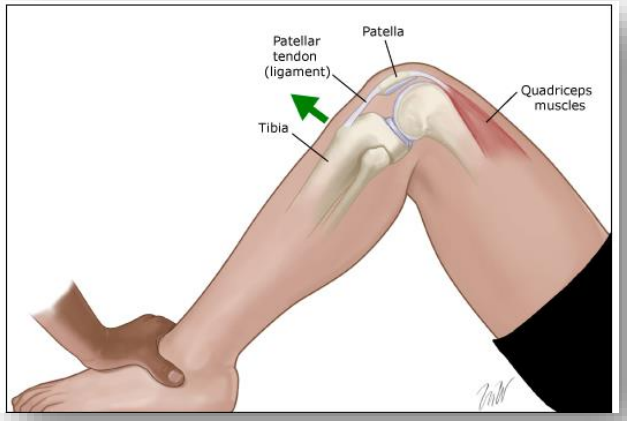


I. Patient supine, knee flexed at 90°
II. Ask to "fire" (activate) quadriceps
III. Tibia moves from subluxed to reduced

PCL INJURY

Physical Exam: Special Tests

2. **Quadriceps Active Test**

PCL INJURY

Physical Exam: Special Tests

3. **Sag Sign**
   - also known as Godfrey 90/90 test

Sag sign of the knee with posterior cruciate ligament (PCL) injury

Image from UpToDate © 2019

PCL INJURY

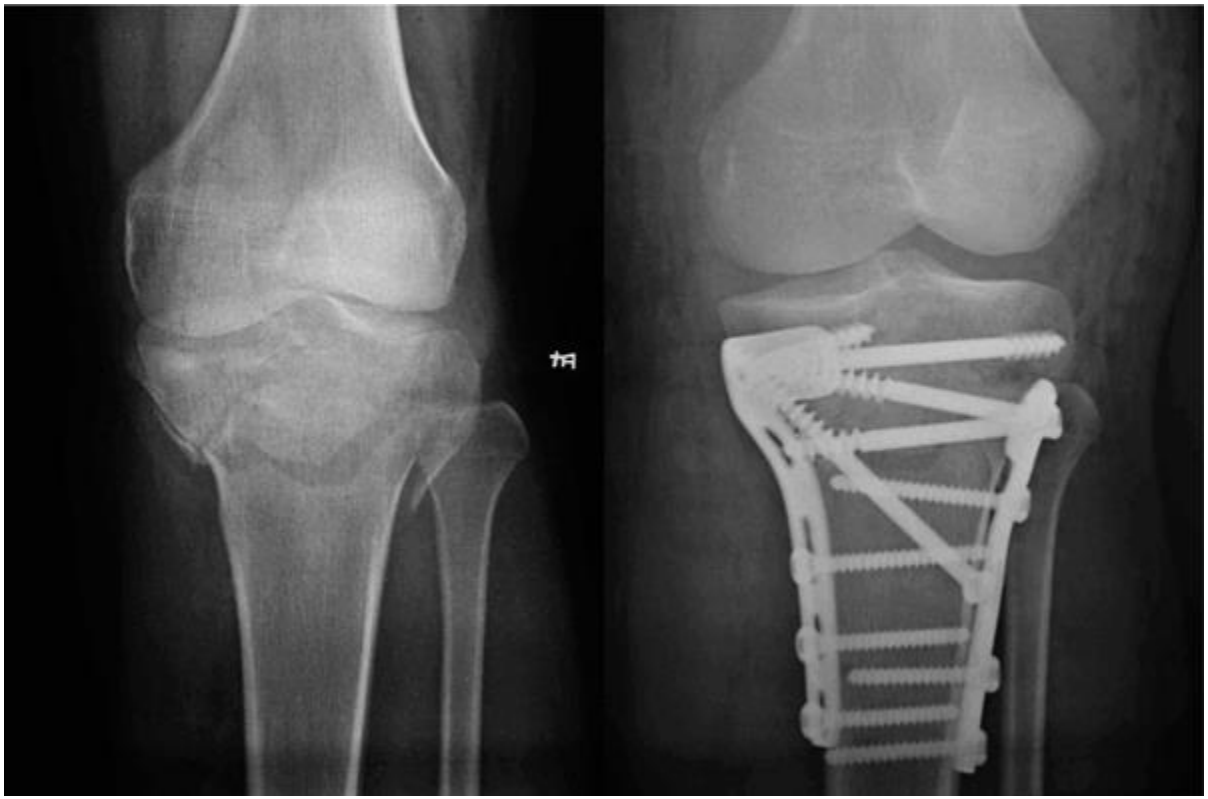
Physical Exam: Special Tests

3. **Sag Sign**
   - also known as Godfrey 90/90 test

PCL INJURY

Imaging: X-Rays for acute injury

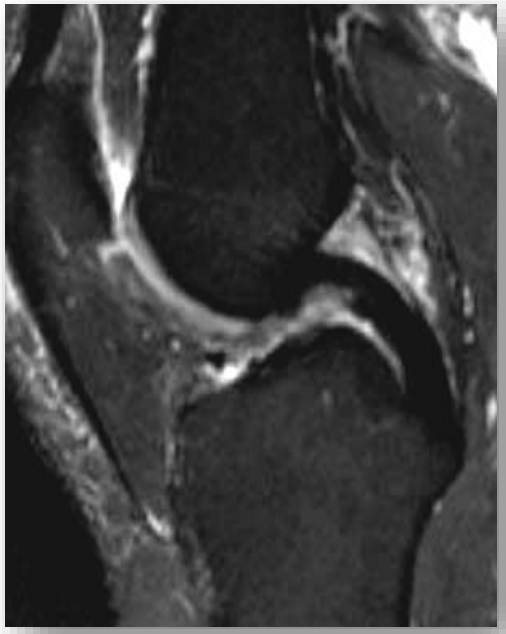
- ***always*** X-ray for acute effusion (even if non-contact injury)



PCL INJURY

Imaging: MRI to assess ligament

- PCL is normally more arched than ACL
- torn PCL is not taught (looks serpiginous)



Normal PCL

PCL Ruptures

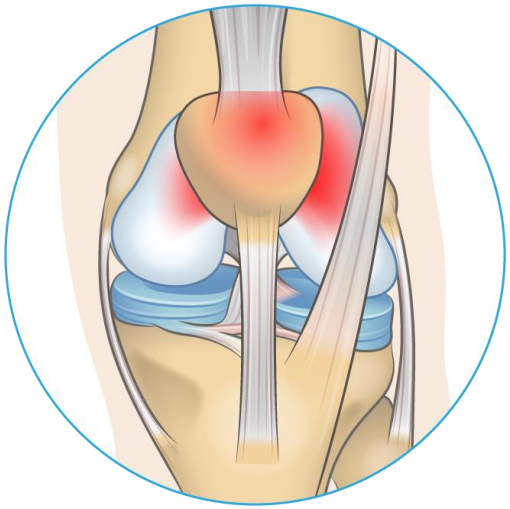
PCL INJURY

Treatment

- conservative for most
- PCL (unlike ACL) has some healing potential
- intensive therapeutic exercise (muscle strengthening)
- surgery if failed conservative Tx or for athletes

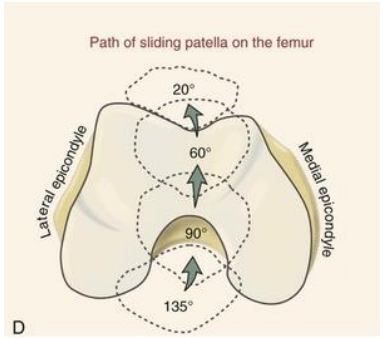
PATELLOFEMORAL PAIN SYNDROME

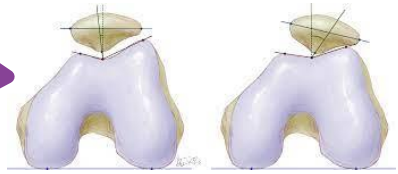
- aka Runner's Knee
- Antiquated terms:
  - *anterior knee pain*: non-descript
  - *chondromalacia*: "soft cartilage"
- Overuse syndrome
  - not an injury

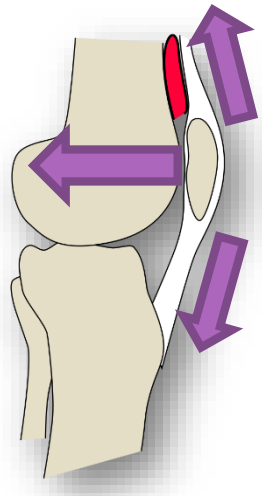


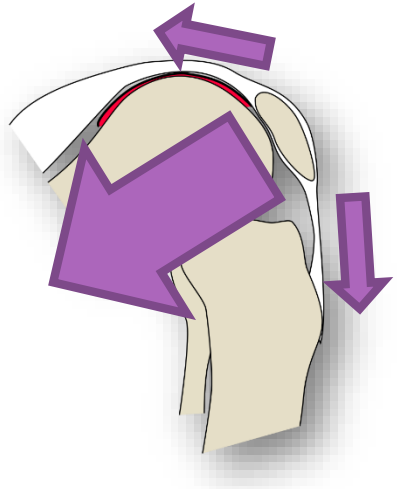
PATELLOFEMORAL PAIN SYNDROME

- Biomechanics
  - patellofemoral tracking
  - patella tilt
  - joint compression force



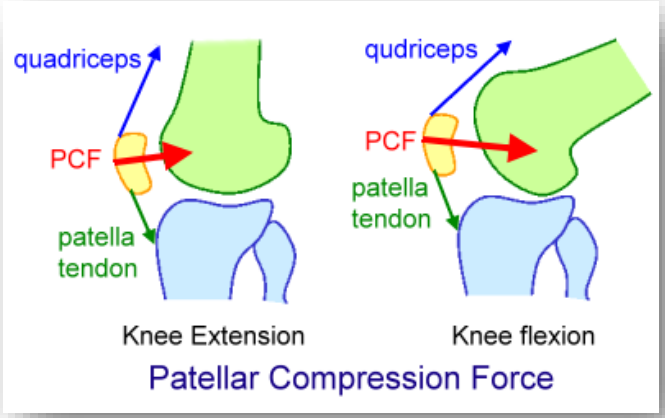






PATELLOFEMORAL PAIN SYNDROME

- Risk factors
  - overactivity
  - muscle imbalances
  - patella mal-alignment
- Pain worse with:
  - stairs
  - running
  - prolonged sitting



PATELLOFEMORAL PAIN SYNDROME

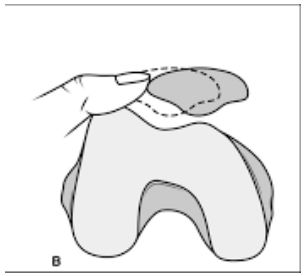
History

- typically ***bilateral***
- “achy” pain
- pseudo-locking
- “theatre sign”
- “C-sign”

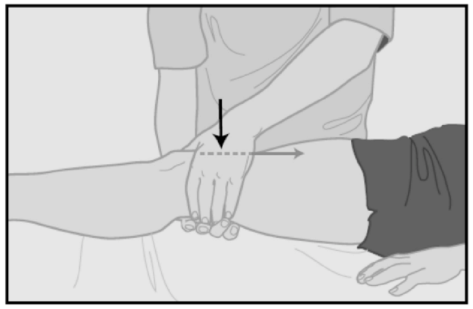
PATELLOFEMORAL PAIN SYNDROME

Physical Exam

- retro-patellar tenderness to palpation



- Special test:
  - Patella Grind Test (aka Clarke sign) – not a good test

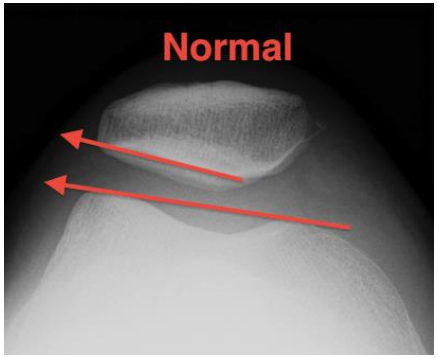


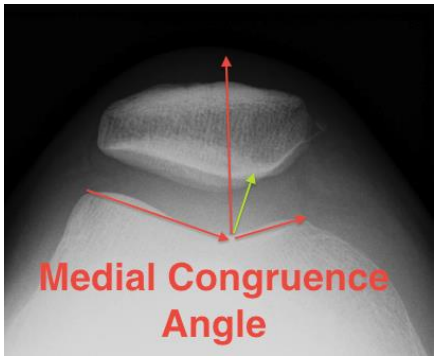
PATELLOFEMORAL PAIN SYNDROME

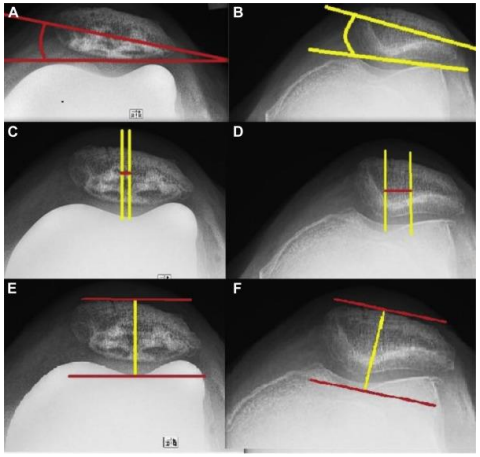
Imaging:

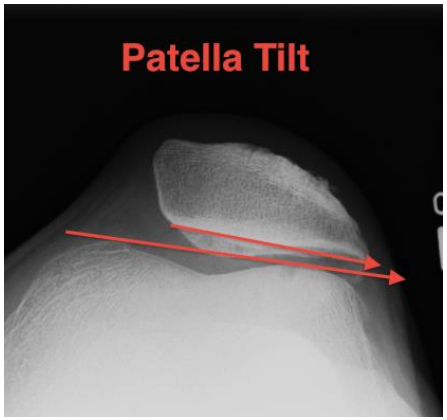
- no imaging needed to diagnose

  …but baseline X-rays ***to assess alignment*** can be helpful









PATELLOFEMORAL PAIN SYNDROME

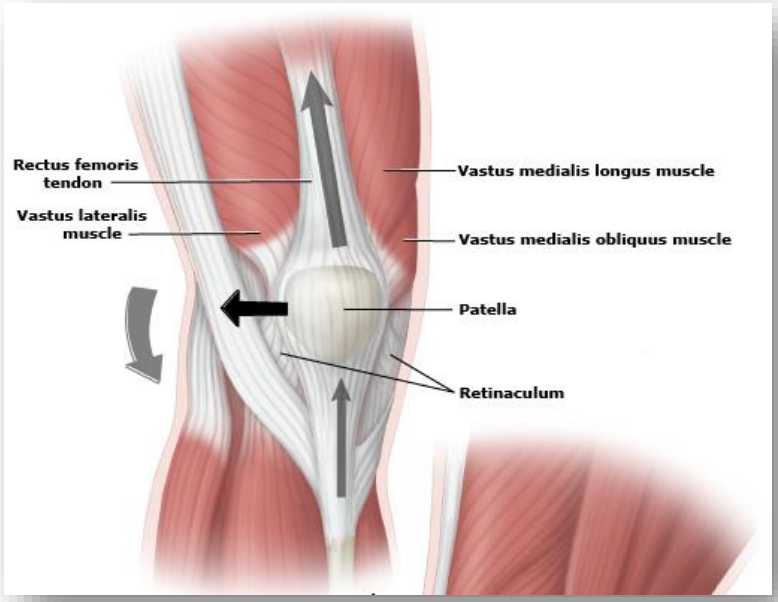
Treatment

- OTC analgesics
- braces, sleeves, straps?

PATELLOFEMORAL PAIN SYNDROME

Treatment

- therapeutic exercise:
  - stretching the ***hamstrings***
  - strengthening the ***quadriceps*** & ***hip abductors***



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PATELLOFEMORAL PAIN SYNDROME

- Patient education
  - “good news/bad news”
  - joint compression forces

- Athletes (runners):
  - cross-training, swimming

- Non-athletes:
  - weight loss: 1lb body wt. loss = 4lbs less stress to each knee

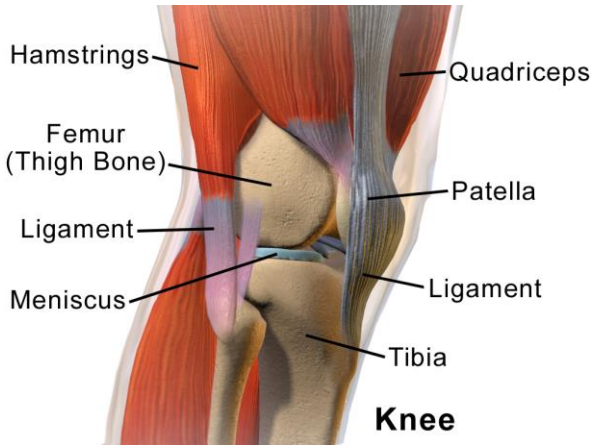
TENDON RUPTURES

History:

- acute injury
- c/o sharp pain at onset, then less

Risk factors:

- anabolic steroid abuse
- chronic alcoholism



TENDON RUPTURES

Consider:

- More common to rupture…
  - quadriceps tendon if >40 years old
  - patellar tendon if <40 years old

TENDON RUPTURES

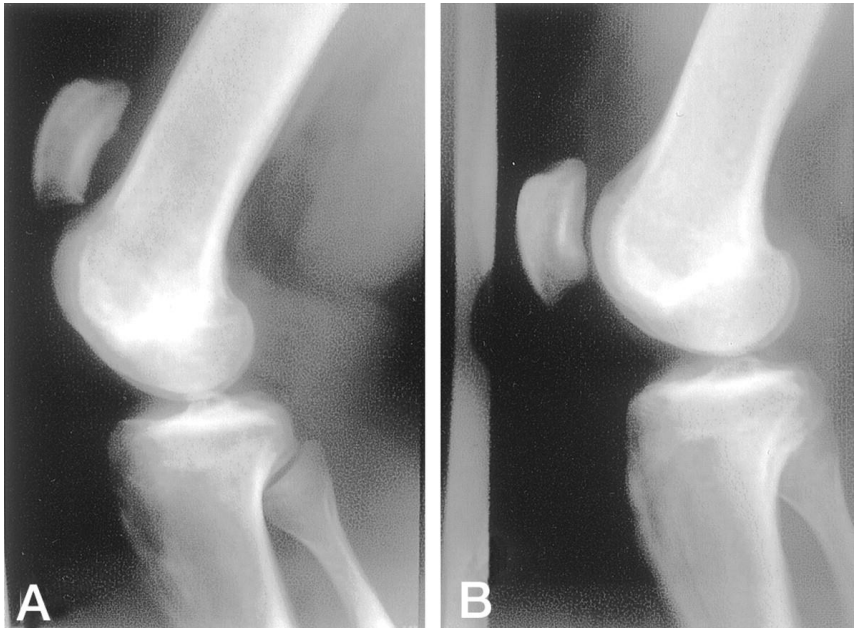
Physical Exam:

- focal tenderness to palpation
- focal defect to palpation
- no special tests
- ROM/strength is the key:
  - unable to perform ***active*** straight leg raise

TENDON RUPTURES

Imaging:

- X-rays may show high-riding patella ("patella alta") in cases of ***patellar*** tendon rupture



Patella Alta Normal

TENDON RUPTURES

- Imaging: MRI to confirm

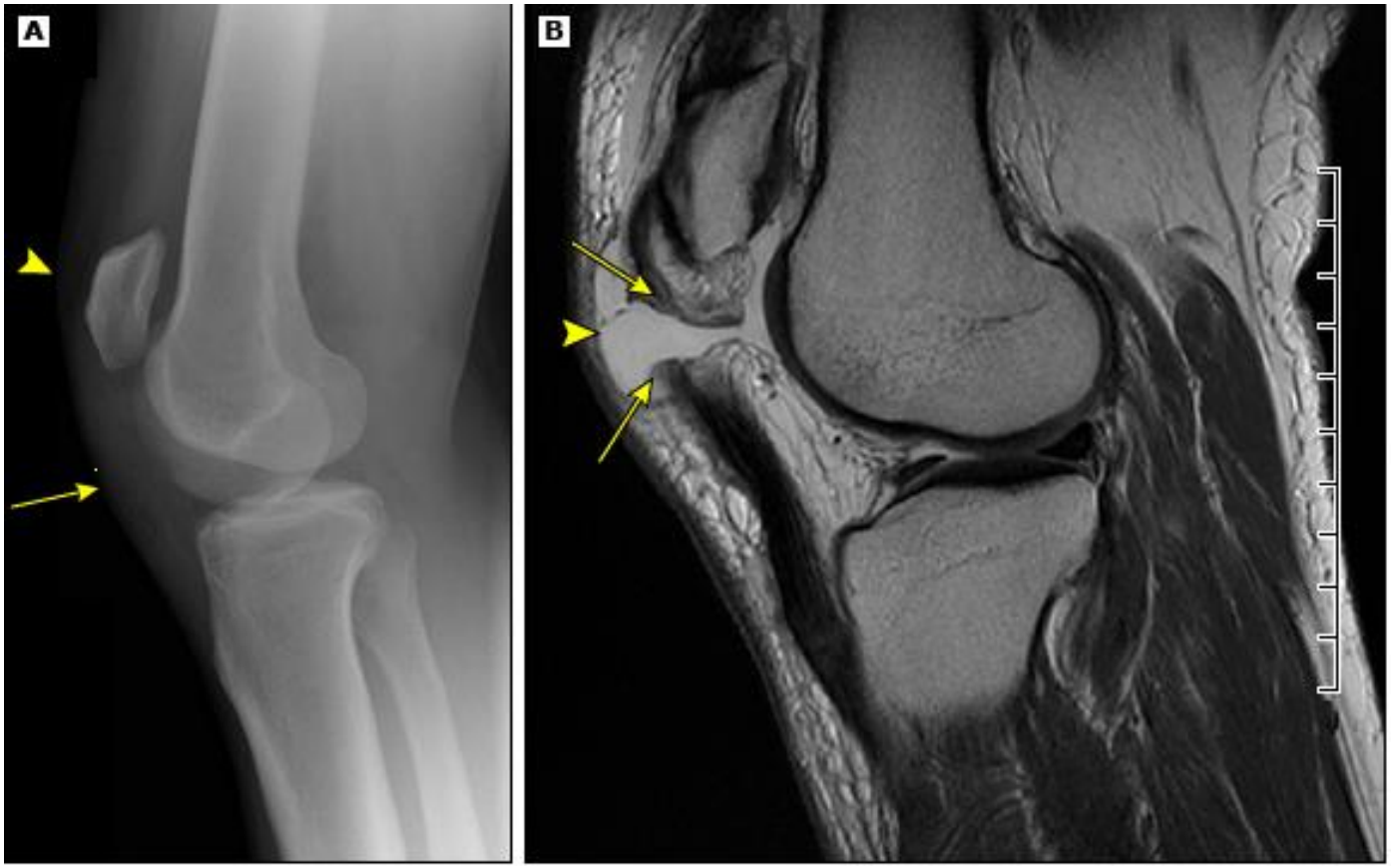
Normal

Patellar Tendon Rupture

Quadriceps Tendon Rupture

TENDON RUPTURES

- Imaging



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TENDON RUPTURES

- Acute Treatment
  - knee immobilizer - full extension
  - crutches - partial weight bearing
  - refer to Orthopedics

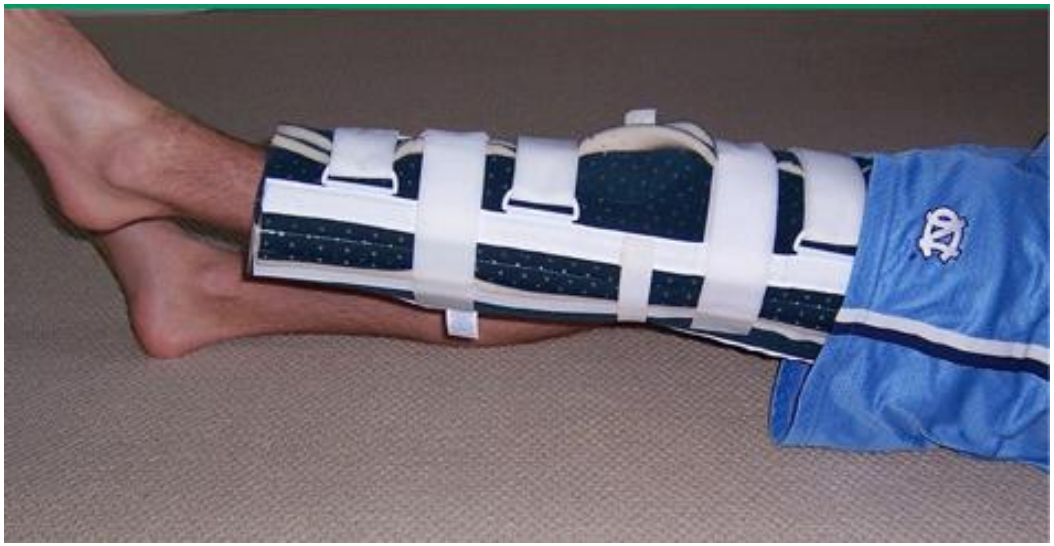
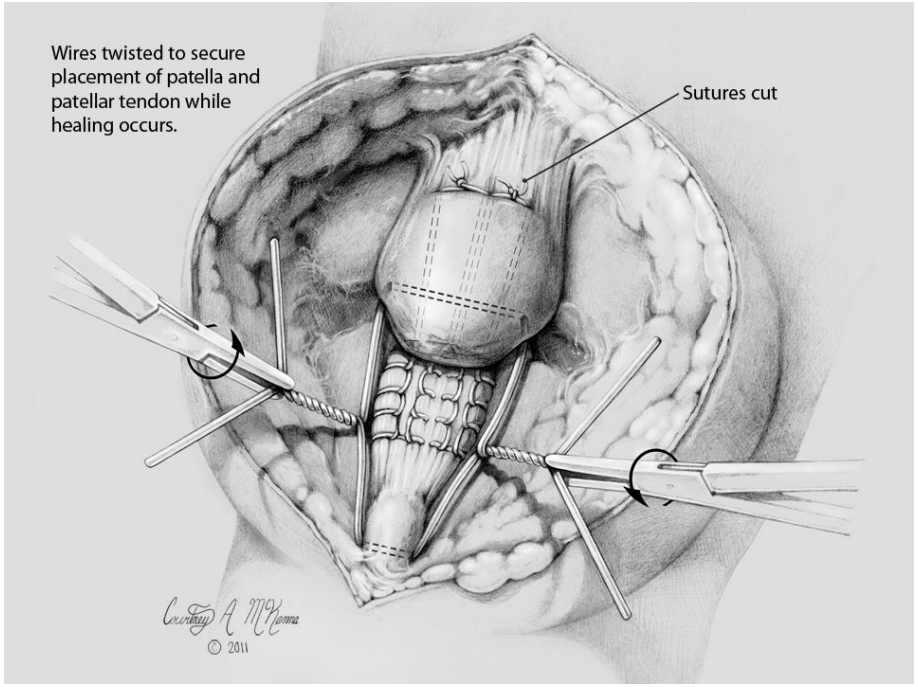
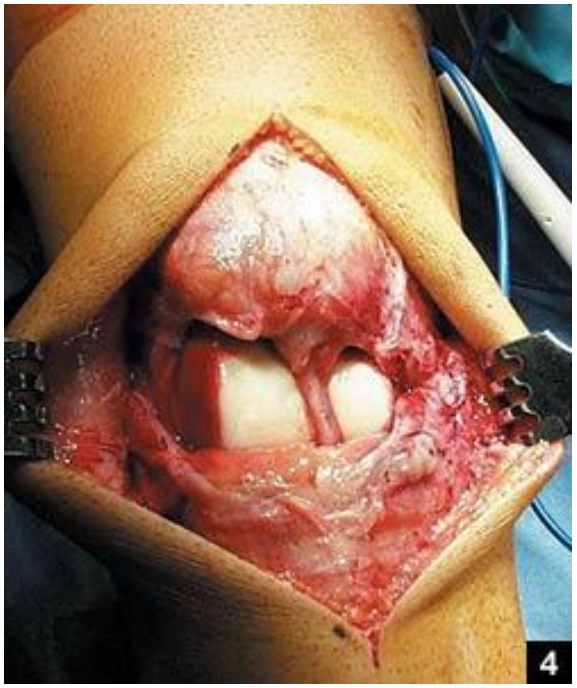


Image from UpToDate © 2019

TENDON RUPTURES

- Definitive Treatment
  - surgical tendon ***repair*** ASAP (within 2 weeks)
  - otherwise risk tendon retraction & scarred down
    - then need for tendon ***reconstruction***





DEGENERATIVE JOINT DISEASE

History

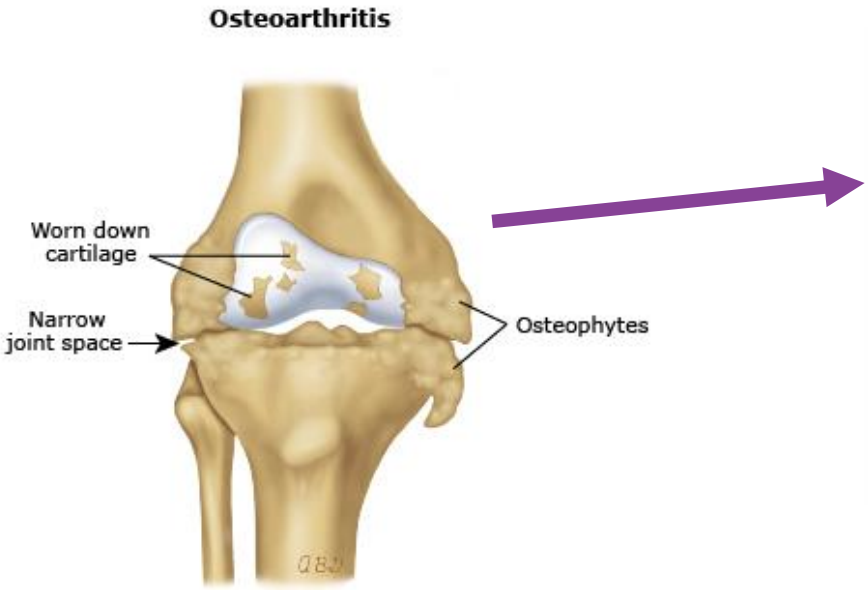
- typically age >45
- no injury
- “achy” pain
- overweight/obese?
- c/o pain ***medially***

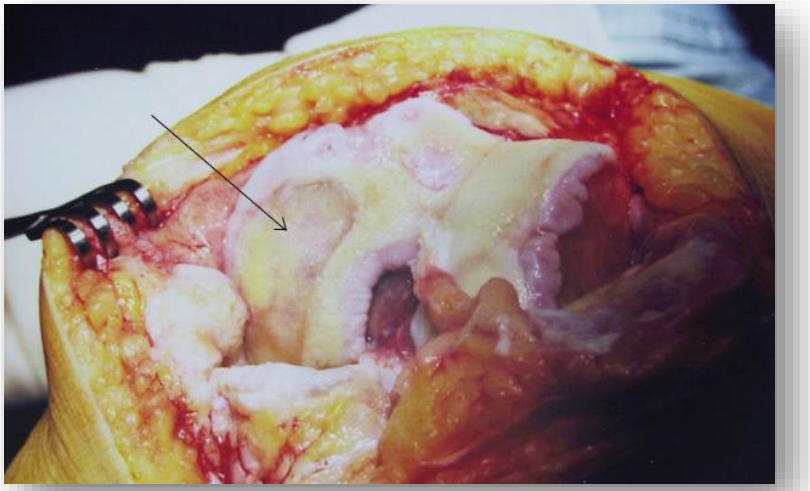
Image from UpToDate © 2018

DEGENERATIVE JOINT DISEASE

Physical Exam

- palpable crepitus?
- tenderness to palpation ***medially***
- ROM/strength limited by pain

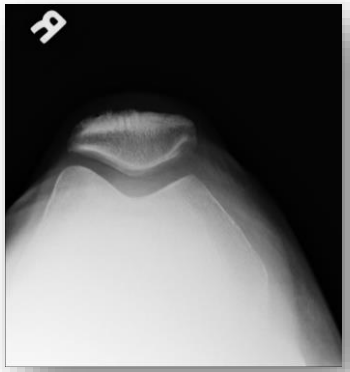




DEGENERATIVE JOINT DISEASE

Imaging: X-rays are *essential*

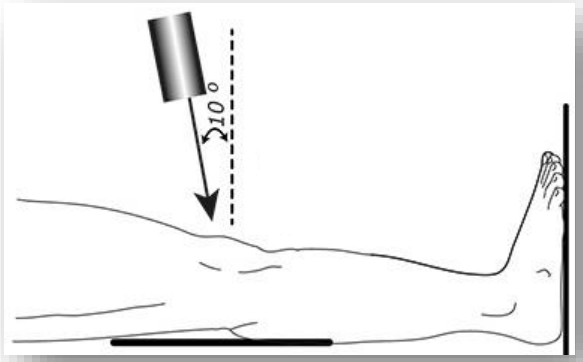
1. solidify diagnosis
2. aid in tracking disease progression
3. patient education

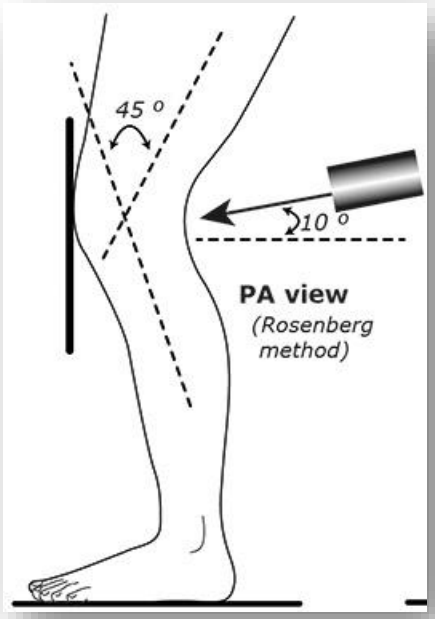


But standard knee views do NOT tell the whole story…

DEGENERATIVE JOINT DISEASE

- Imaging: X-rays

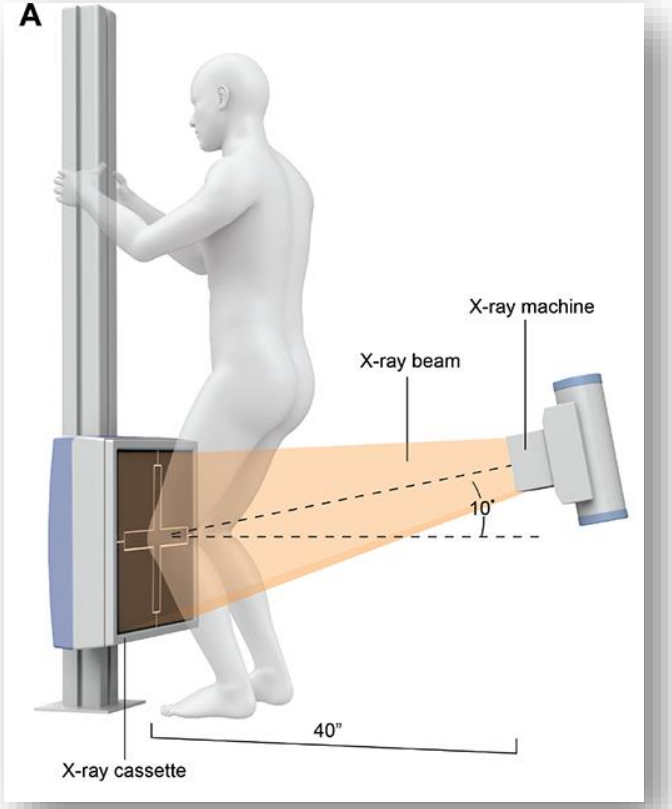


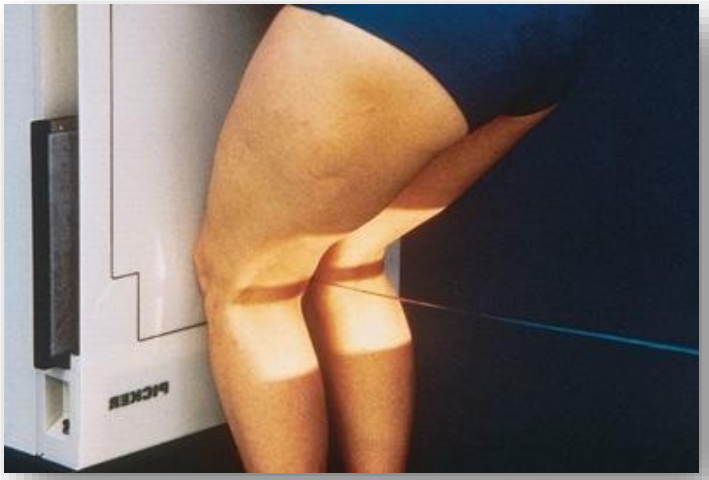


DEGENERATIVE JOINT DISEASE

Imaging: X-rays

- Rosenberg views!
- aka bilateral, flexion, weight-bearing, PA views

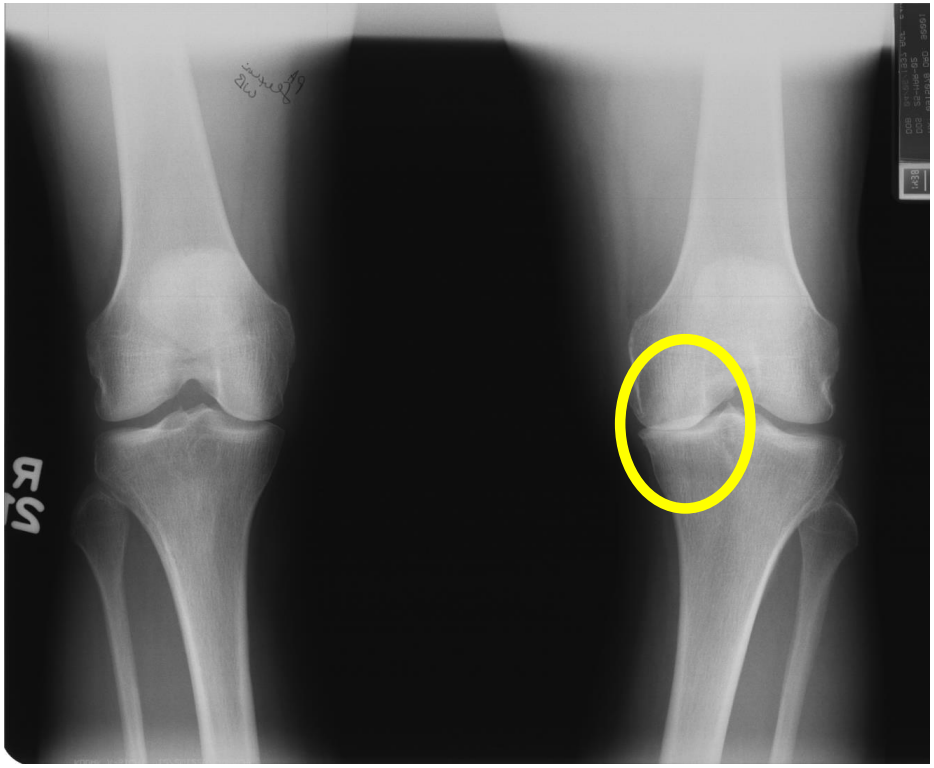




DEGENERATIVE JOINT DISEASE

Imaging: X-rays

- Rosenberg views



DEGENERATIVE JOINT DISEASE

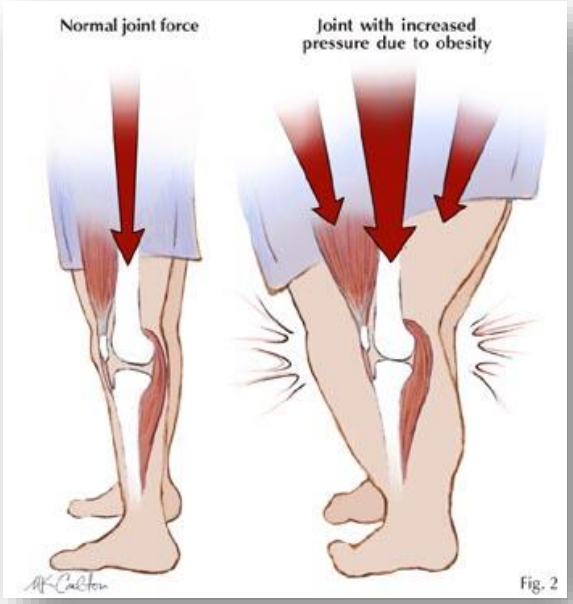
Treatment

- oral analgesics
- therapeutic exercise (physical therapy)
- glucosamine supplementation
- corticosteroid injections
- hyaluronic acid injections
- arthroplasty (joint replacement)

DEGENERATIVE JOINT DISEASE

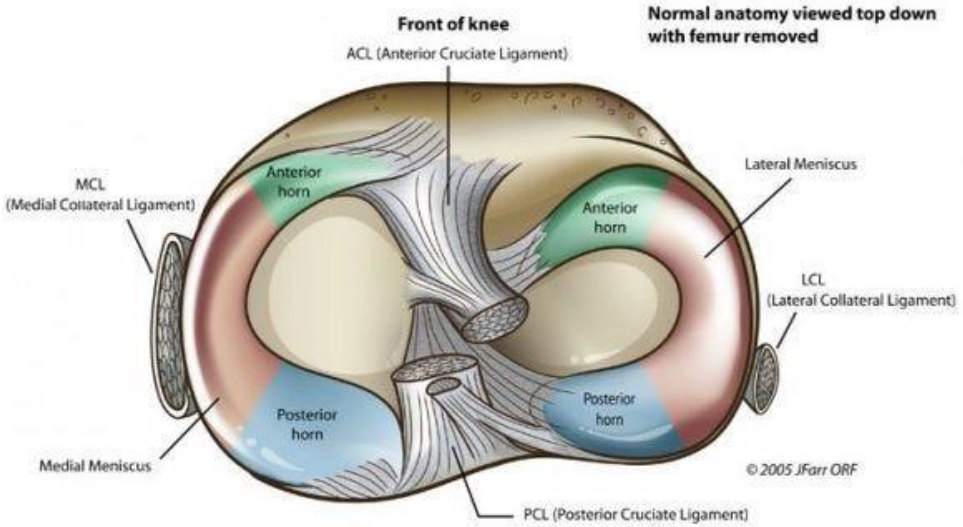
Patient Education

- weight loss
  - obesity increases biomechanical loading of joint
  - every 1 lb. over ideal body weight = *3-5 lbs. extra weight to **each** knee*



MENISCUS TEARS

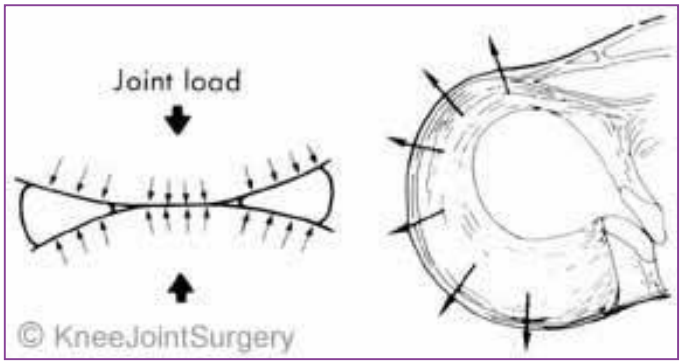
- Anatomy/Terminology

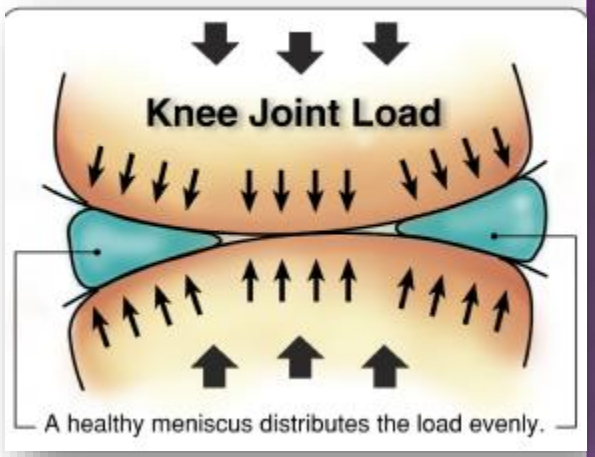


- Lateral meniscus: circular “O” shaped
- Medial meniscus: “C” shaped

MENISCUS TEARS

- meniscus function (physiology)
  - load sharing
  - congruity
  - stability





MENISCUS TEARS

TWO TYPES	
Acute Tear	**Degenerative Tear**
acute injury	insidious onset
often twisting/pivoting of knee	degenerative, secondary to knee DJD
single, discrete tear	frayed, ratty, meniscal tissue (but no specific tear)

MENISCUS TEARS

History (acute tear)

- MOI: twisting/pivoting
- often felt “pop”
- mechanical symptoms: catching, clicking…locking?
- effusion: ***not immediate*** (the next day)

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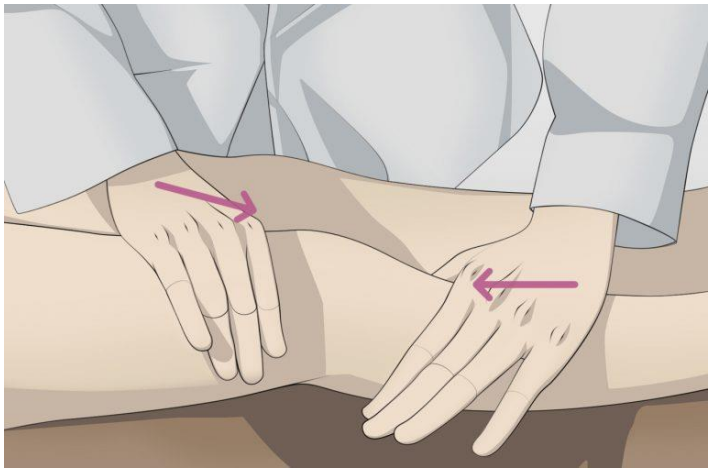
MENISCUS TEARS

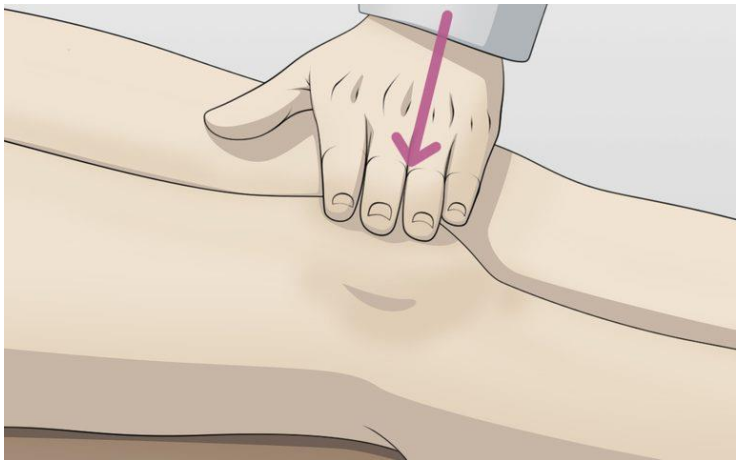
Physical Exam (acute tear)

- (+) effusion

Sweep Test



Ballotable Patella Test

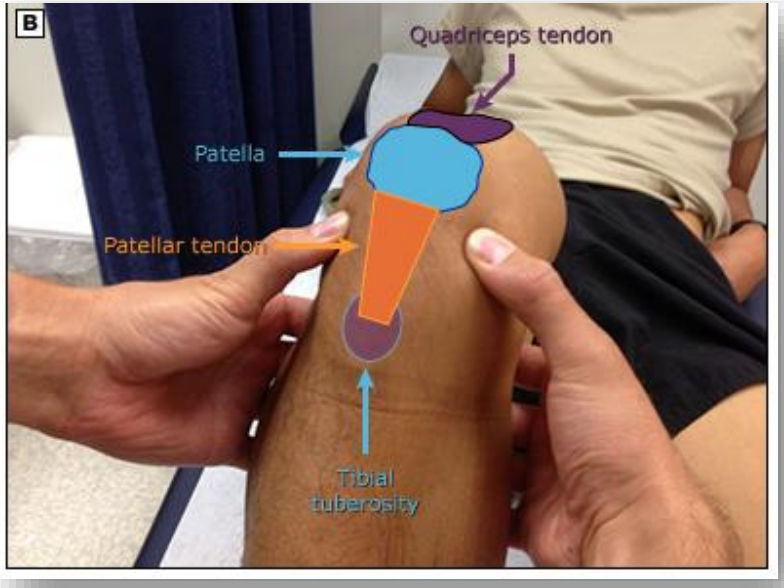


MENISCUS TEARS

Physical Exam (acute tear)

- joint line tenderness!!

(80% sensitivity, 80% specificity)



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MENISCUS TEARS

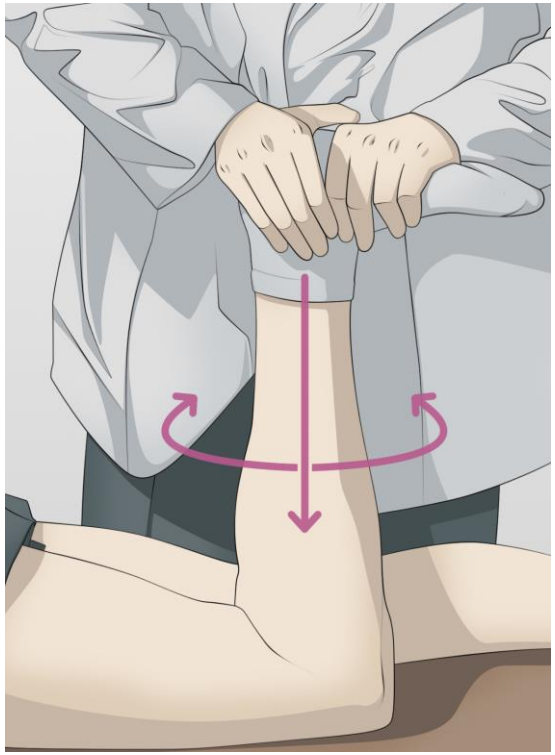
Physical Exam (acute tear)

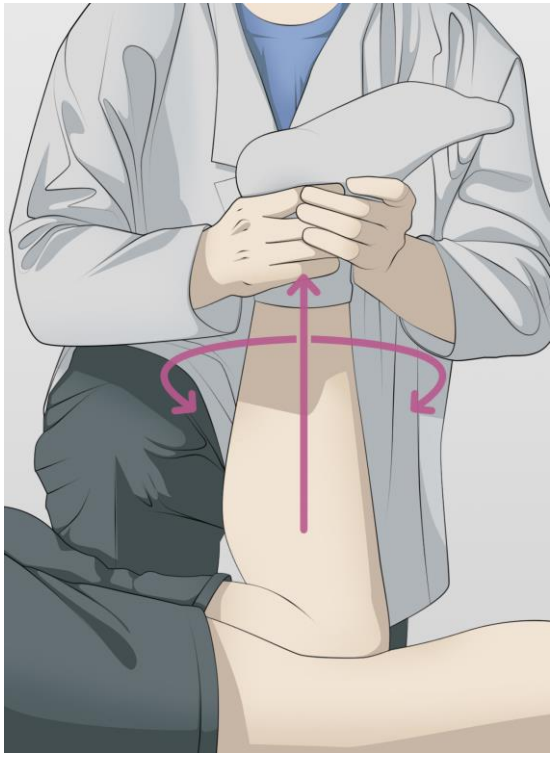
- Special Tests:
  1. Apley's compression/distraction test
  2. McMurray's test
  3. Bounce home test
  4. Thessaly test

MENISCUS TEARS

Physical Exam (acute tear)

- Special Tests:
  1. *Apley's compression/distraction test*





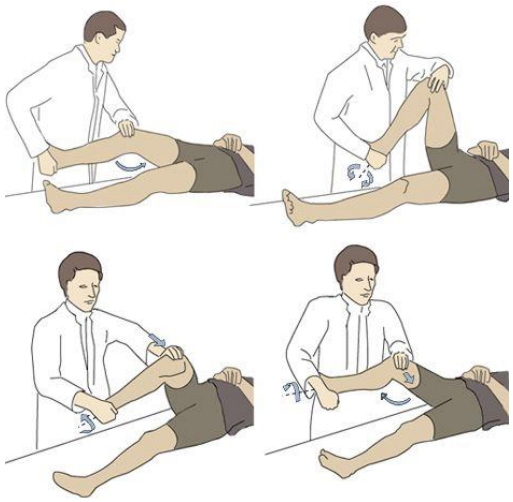
MENISCUS TEARS

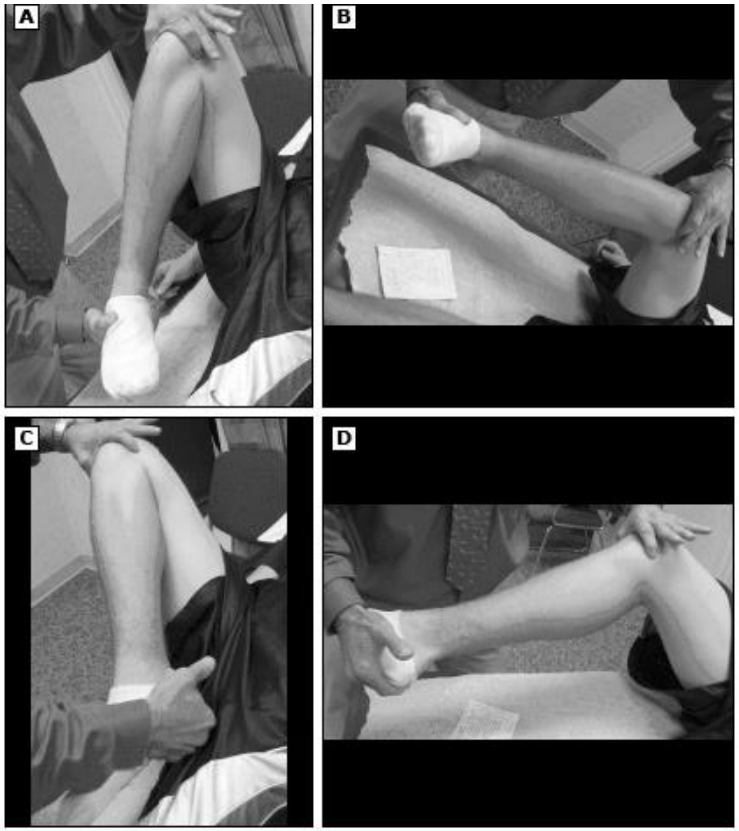
Physical Exam (acute tear)

- Special Tests:

  2. McMurray's test

  (50% sensitivity, 80% specificity)





The McMurray test is used to assess both knee motion and meniscal injury. To perform the maneuver, the examiner places their thumb and index finger on the medial and lateral joint lines while the knee is passively flexed and extended several times in a smooth back and forth motion. Flexion and extension is performed with the tibia internally rotated for several repetitions (A and B), and then with the tibia externally rotated for several repetitions (C and D). While performing the maneuver, the clinician feels for a popping sensation along the joint line. The test is positive when there is pain at the joint line, with or without a "clunk," and possibly limited range of motion. A positive test suggests meniscal injury.

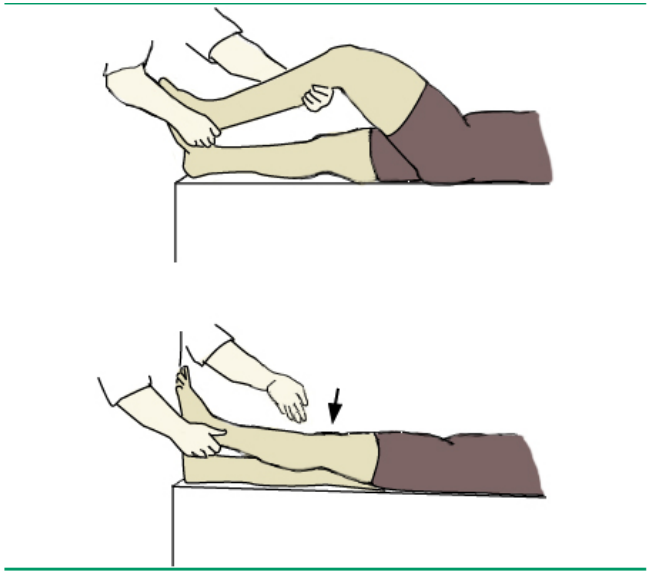
MENISCUS TEARS

Physical Exam (acute tear)

- Special Tests:

  3. Bounce home test

  (47% sensitivity, 67% specificity)



The bounce home test is a test of knee extension. It is performed with the patient supine. The knee is passively flexed to approximately 15 degrees and then permitted to fall into extension with gravity. The test is positive if the knee does not fully extend.

MENISCUS TEARS

Physical Exam (acute tear)

- Special Tests:

  4. Thessaly test

  (90% sensitivity, 90% specificity)

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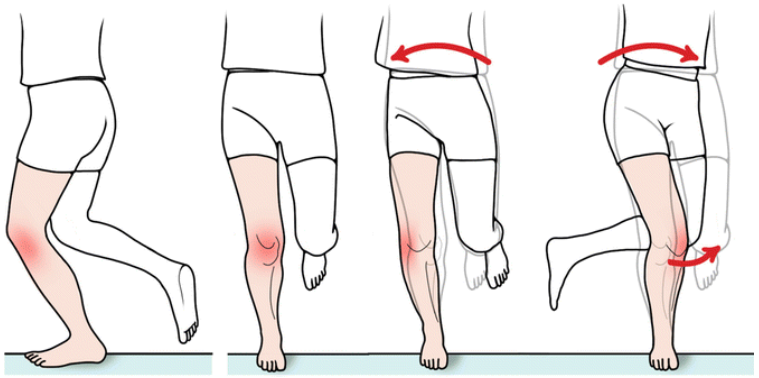
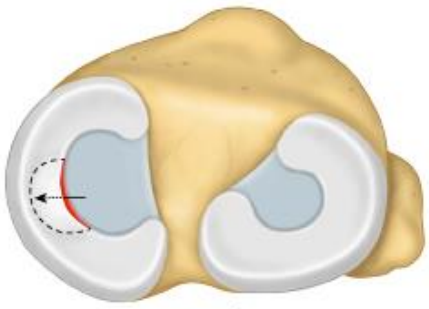
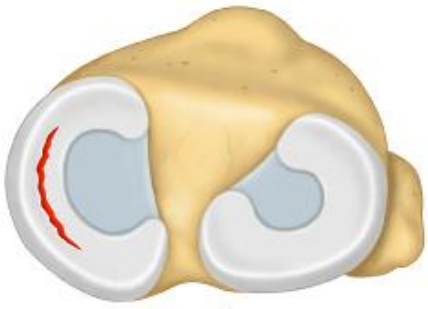


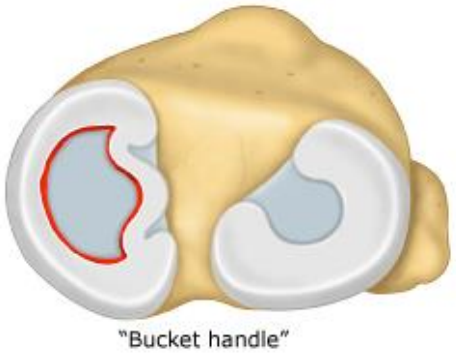
Step 1: Patient stands flat footed on one leg
Step 2: Examiner holds patient's hands
Step 3: Patient flexes knee to 20°
Step 4: Ask patient to twist body side-to-side 3-5 times

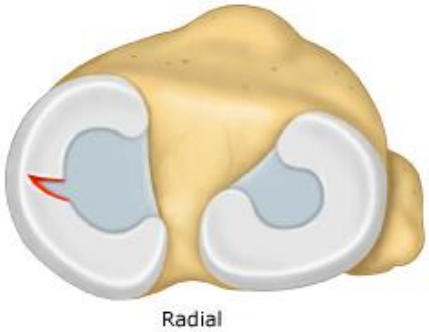
MENISCUS TEARS

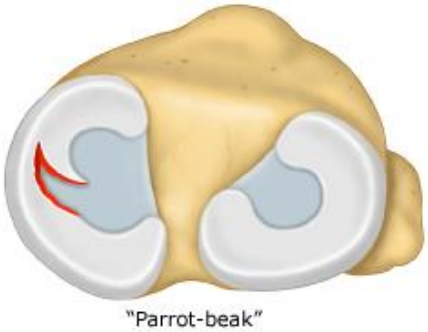
- Tear Types





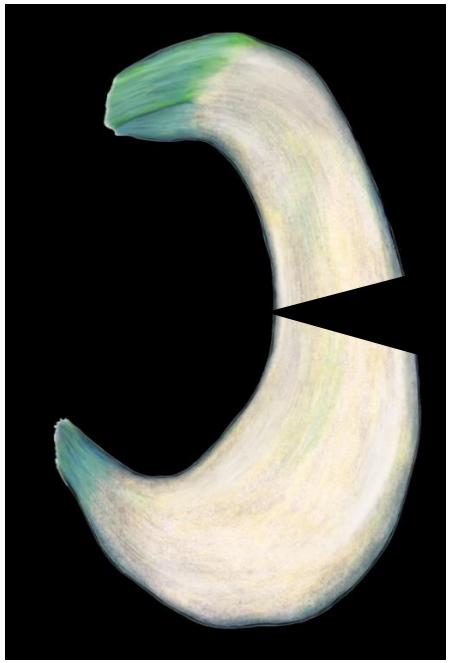


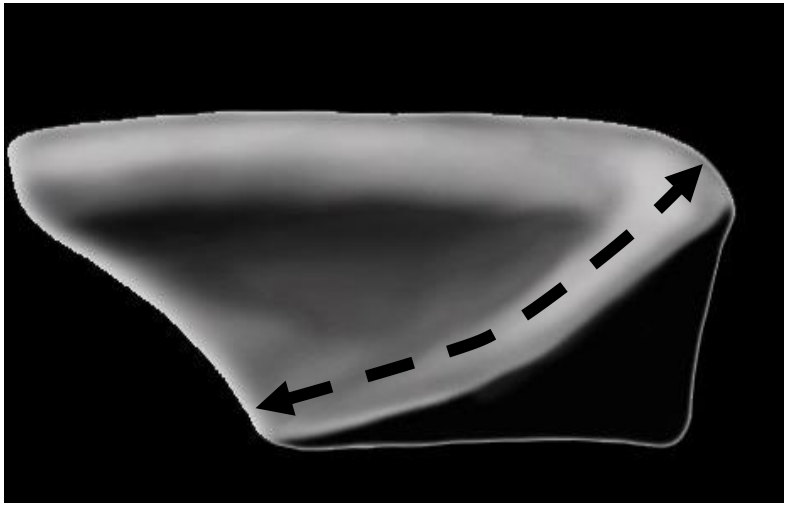




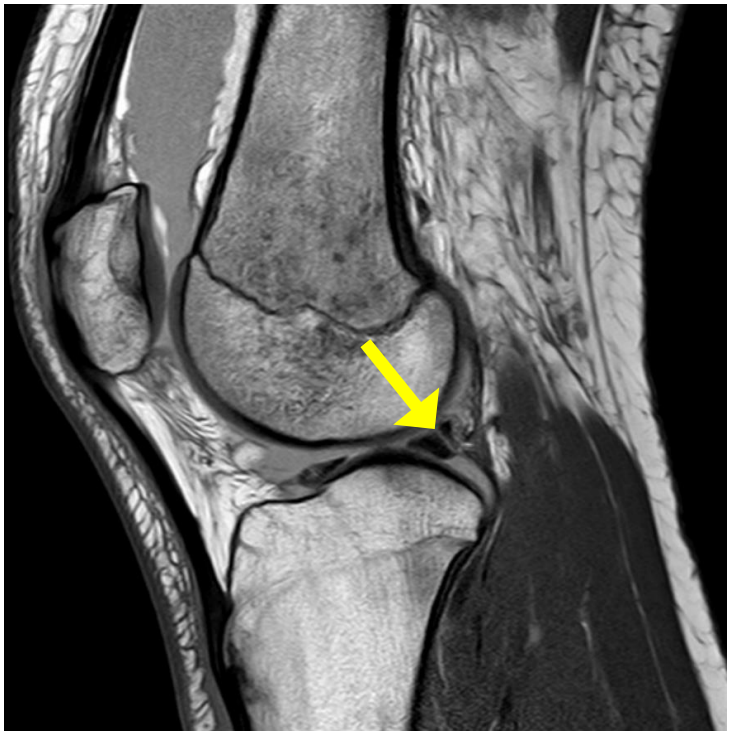
MENISCUS TEARS

- Imaging: MRI



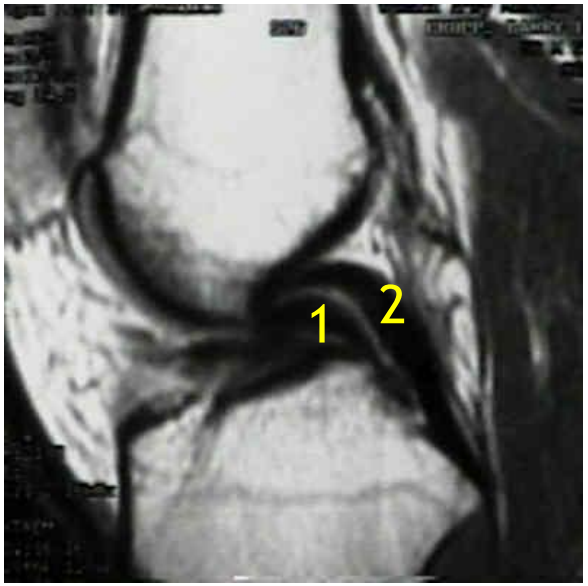


MENISCUS TEARS



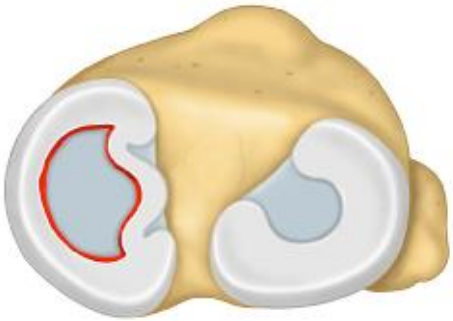
Acute Posterior Meniscus Tears

MENISCUS TEARS



"double PCL sign"

=

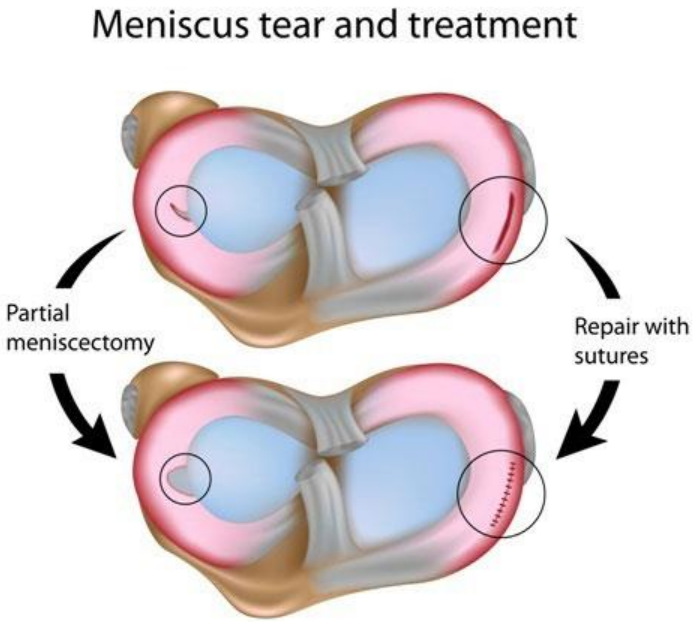


Bucket Handle Meniscus Tear

MENISCUS TEARS

Two surgical options for ***acute*** meniscus tears:

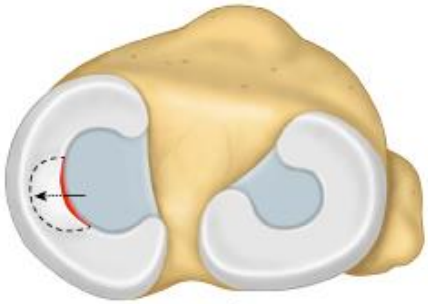
1. partial meniscectomy
2. meniscus repair

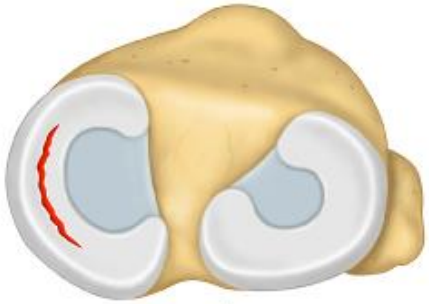


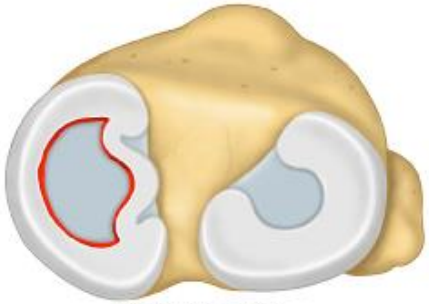
MENISCUS TEARS

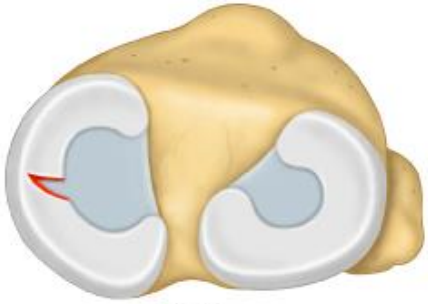
Treatment (acute tear)

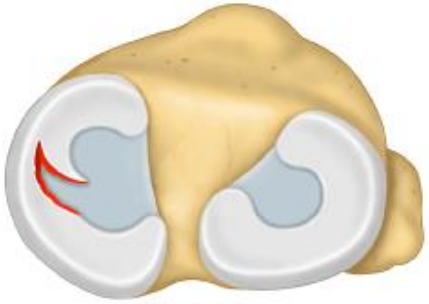
- ***repair*** if at all possible
- healing rates depend on ***location*** and ***tear type***


Horizontal


Vertical


"Bucket handle"


Radial

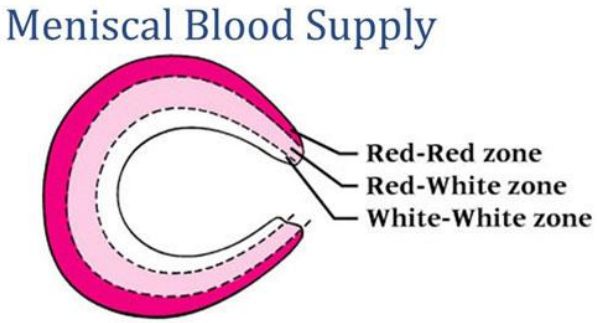

"Parrot-beak"

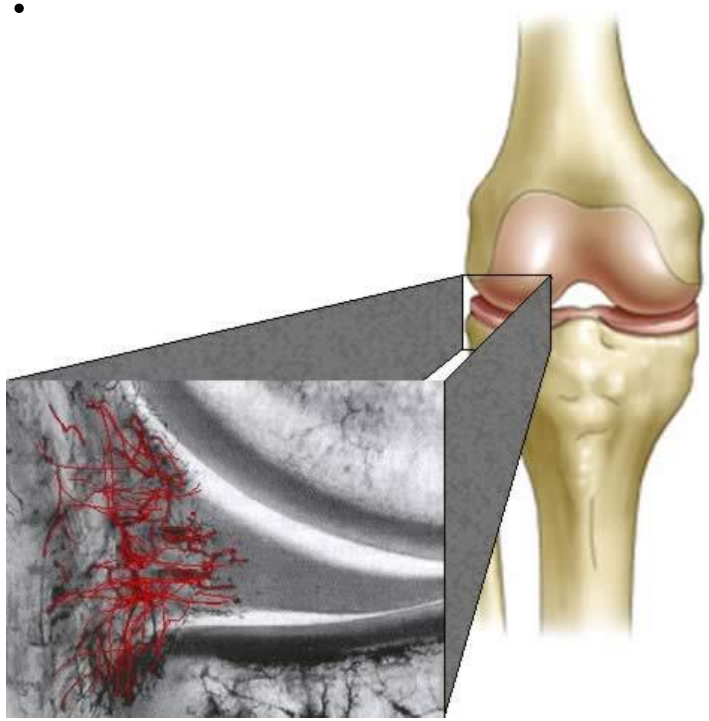
MENISCUS TEARS

Treatment (acute tear)

- ***repair*** if at all possible
- healing rates depend on ***location*** and ***tear type***

- Three zones of vascularity:

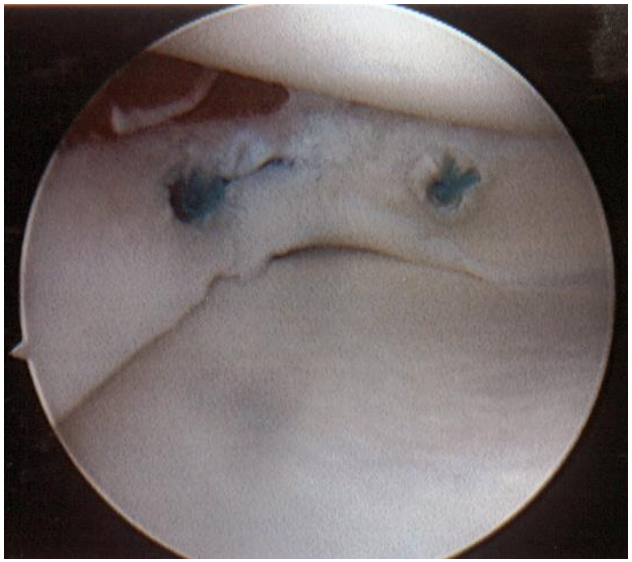




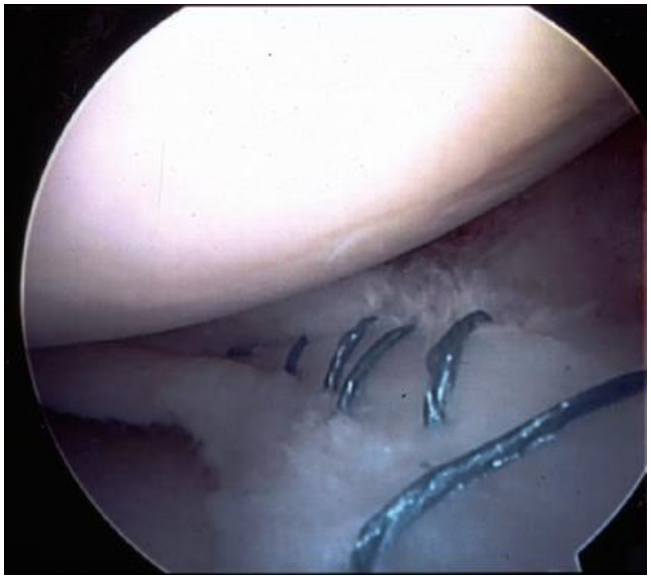
MENISCUS TEARS

Treatment (acute tear)

- arthroscopic ***meniscus repair***



Repair w/ Anchors

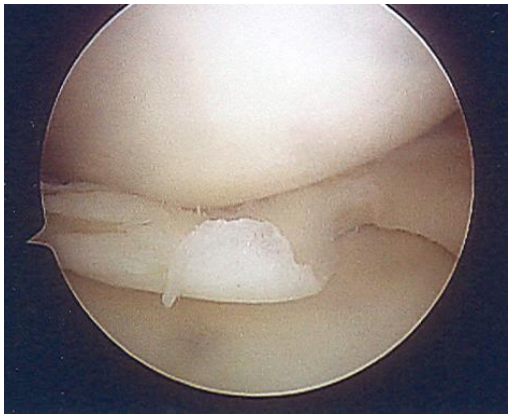


Repair w/ Traditional Sutures

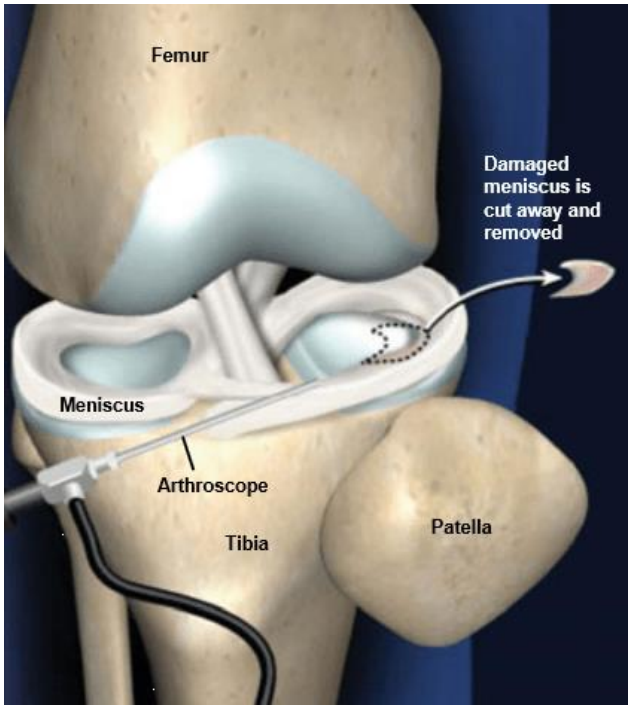
MENISCUS TEARS

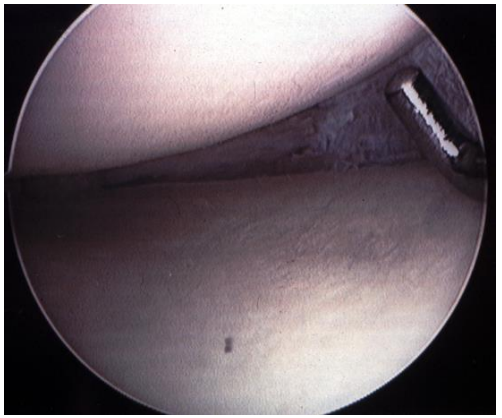
Treatment (acute tear)

- arthroscopic ***partial meniscectomy***



Radial Tear



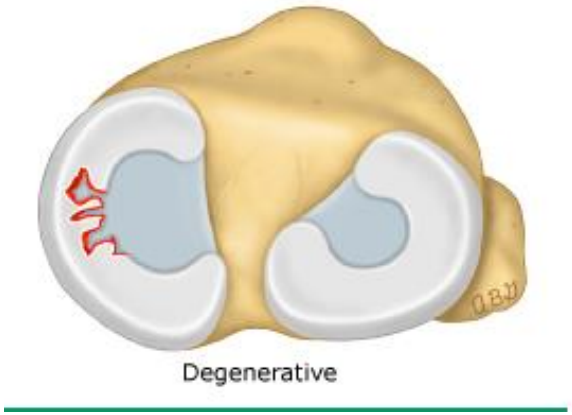


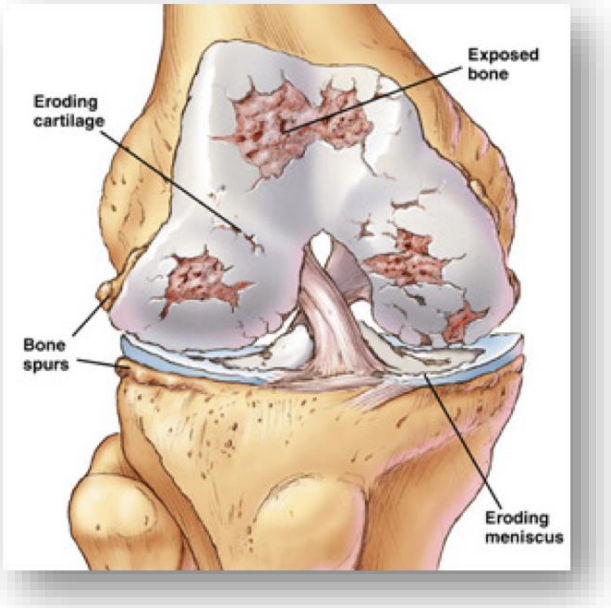
Meniscus Trimmed

MENISCUS TEARS

Degenerative tears

- no injury - ***insidious onset of pain***
- so what causes degenerative tears?? DJD!!

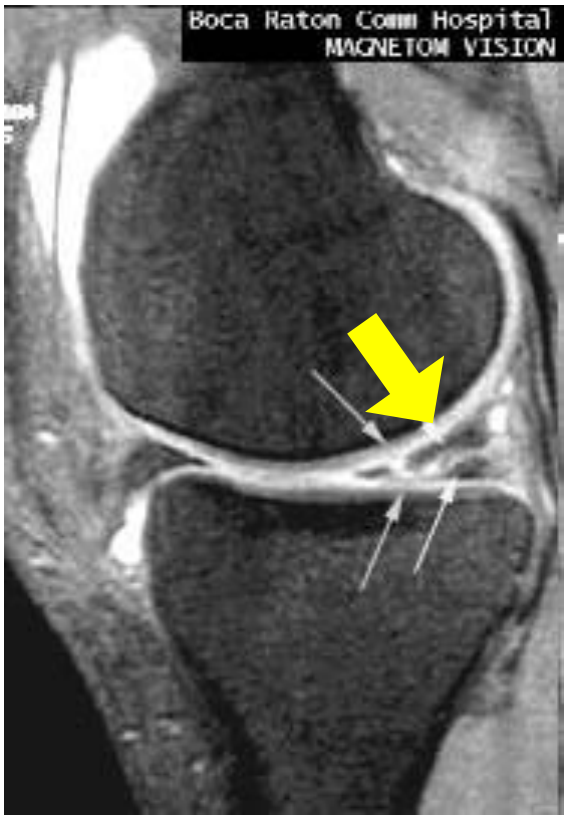


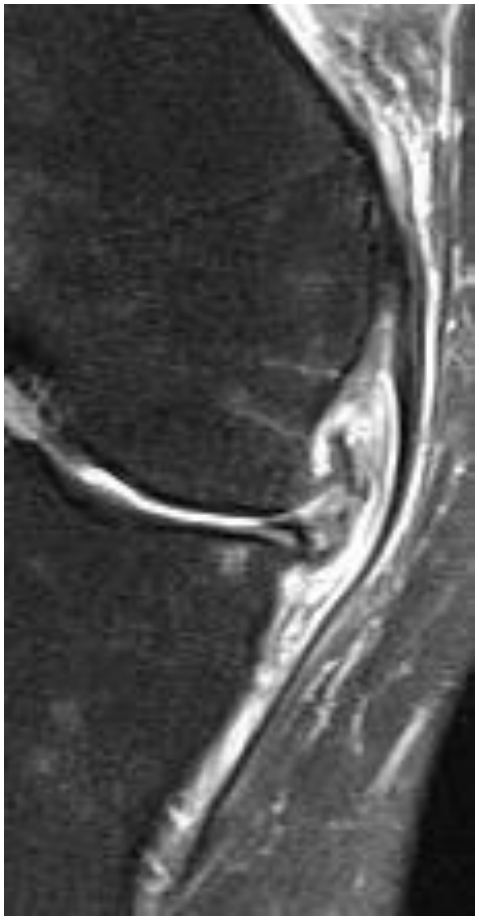


MENISCUS TEARS

Degenerative tears - Imaging

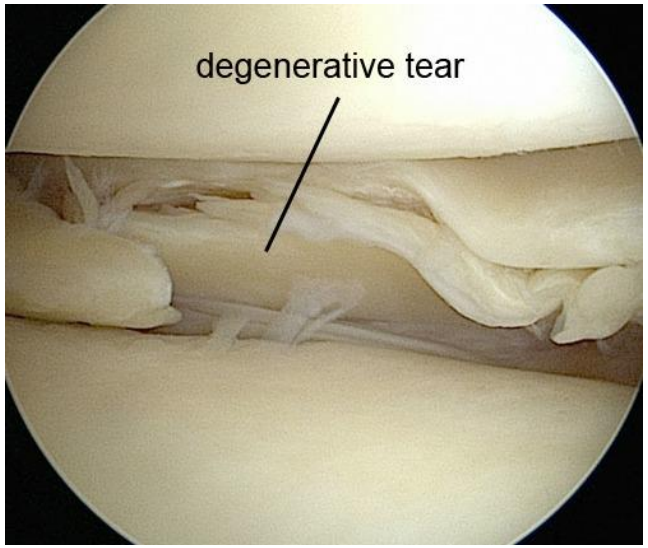
- no discrete tear
- ratty, meniscal tissue





MENISCUS TEARS

- Degenerative tears



MENISCUS TEARS

Degenerative tears

- *ALL* degenerative knees have degenerative meniscus tears
- *DO NOT order an MRI!!*

- Obtain Rosenburg views
- Treat the DJD

MENISCUS TEARS

- ***Acute*** tears:
  - more common in men than women by 3:1
  - more likely in patients age <40
  - most common activities: soccer, basketball, football, wrestling, skiing
  - medial meniscus tears more common than lateral

- ***Degenerative*** tears:
  - more likely to be chronic, not from discrete injury
  - secondary to knee DJD

SUMMARY

Special Tests	
Lachman	anterior cruciate ligament (ACL)
Anterior Drawer	
Pivot Shift	
Posterior Drawer	posterior cruciate ligament (PCL)
Quadriceps Active	
Sag Sign	
Valgus Stress	medial collateral ligament (MCL)
Sweep	knee effusion
Ballotable Patella	
Apley's Compression/Distraction	acute meniscus tear
McMurray's	
Bounce Home	
Thessaly	

LESSONS FOR PRACTICE

- **MCL Sprain/Tear**: lack of effusion, valgus stress, hinged knee brace
- **ACL Tear**: non-contact, immediate effusion, Lachman
- **PCL Injury**: not common, dashboard injury, posterior drawer
- **PFPS**: overuse syndrome, joint compression forces
- **Tendon Ruptures**: disruption of extensor mechanism
- **DJD/"Osteoarthritis"**: Rosenberg view, weight loss
- **Meniscus Tears**: acute vs. degenerative tear, joint line tenderness

POST-TEST QUESTION #1

- The gold standard test to diagnose an anterior cruciate ligament (ACL) tear is the:
  A. Lachman test
  B. Anterior Drawer test
  C. Pivot Shift test
  D. McMurray's test

POST-TEST QUESTION #1

- The gold standard test to diagnose an anterior cruciate ligament (ACL) tear is the:
  A. ***Lachman test***
  B. Anterior Drawer test
  C. Pivot Shift test
  D. McMurray's test

POST-TEST QUESTION #2

- Which of the following statements is true about patellofemoral (PFPS) pain syndrome?
  A. Surgical treatment is the standard of care. Decompression, lateral release, and osteotomy are options to consider.
  B. Radiographs are insufficient to diagnose; MRI is typically needed.
  C. Wearing a properly fitted knee brace is typically curative.
  D. The etiology is multi-factorial. Treatment is conservative and there is no “quick fix”.

POST-TEST QUESTION #2

- Which of the following statements is true about patellofemoral (PFPS) pain syndrome?
  A. Surgical treatment is the standard of care. Decompression, lateral release, and osteotomy are options to consider.
  B. Radiographs are insufficient to diagnose; MRI is typically needed.
  C. Wearing a properly fitted knee brace is typically curative.
  D. ***The etiology is multi-factorial. Treatment is conservative and there is no "quick fix".***

POST-TEST QUESTION #3

- A 54 year old male presents with pain and mechanical symptoms in his right knee. He has done some reading on "WebMD" and believes he has a meniscus tear. Your next best step is to:
  A. Order a knee MRI to assess for meniscus tear
  B. Refer him to Orthopedics; meniscus tears are surgical problems
  C. Obtain radiographs, including Rosenberg views
  D. Obtain radiographs; the standard three views only (AP, lateral, oblique)

POST-TEST QUESTION #3

- A 54 year old male presents with pain and mechanical symptoms in his right knee. He has done some reading on "WebMD" and believes he has a meniscus tear. Your next best step is to:

A. Order a knee MRI to assess for meniscus tear
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