Patellofemoral Joint

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No disclosures

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Anterior Knee Pain

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Anterior Knee Pain

- Patellar chondromalacia
- Patellofemoral Pain
- Patellofemoral syndrome PFS
- Loose kneecaps
- Patellar malalignment
- Girl's knees
- Tendinitis
- Growing pains

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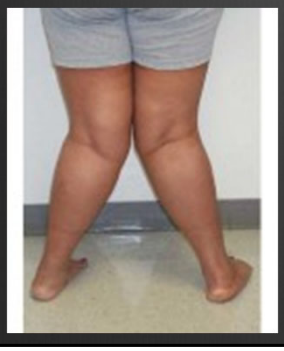
Anterior Knee Pain

- Important to differentiate pain versus instability
- Symptoms can overlap, but typically caused by one or the other



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Patellofemoral Syndrome

- Pathology
  - Overuse
  - Malalignment
  - Trauma

- Increased subchondral bone activity
- X-rays differentiate from osteoarthritis
  - Older patients
- Typically normal radiological studies
  - Including MRI

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PFS - History

- Typically atraumatic
  - Sometimes describe remote injury or fall
- Can describe knee giving way or buckling
  - But not a true dislocation or subluxation
- Pain with stairs
- Pain with prolonged knee flexion
- Can have some anterior swelling
  - But not a frank effusion

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PFS - Exam

- Pain with patellar compression/grind
  - Differentiate from patellar apprehension
- Rule out
  - Patellar tendinitis
  - Pes anserine bursitis
  - Medial plica
  - Saphenous neuritis
  - IT band syndrome

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PFS - Management

- Nonsurgical - Mainstay of treatment
  - Activity modification
  - GLUTES, GLUTES, GLUTES
  - Quadriceps Strengthening
    - Closed versus open chain
    - Traditional Isolated VMO exercises
      - Not supported by recent literature
  - Hip/Core strengthening
  - Flexibility - quadriceps
  - Bracing/Taping
  - Shoe inserts

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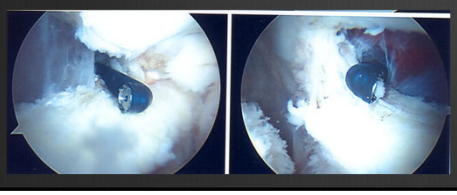
PFS - Management

- Surgical
  - Rarely necessary
  - Minimum 3 months of compliant rehab
  - Reconsider differential diagnosis
- Lateral release
  - For lateral patellar tilt
  - No history of patellar instability
  - Minimal patellar chondromalacia



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Patellar instability

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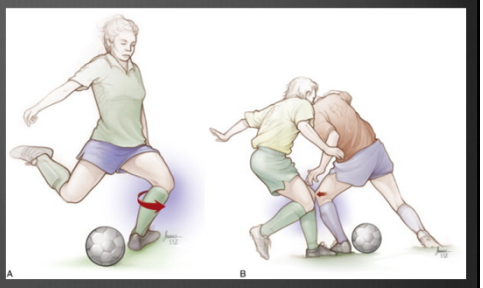
Epidemiology



- Annual incidence 5.8/100,000
  - 35/100,000 in 10-17 year old population
  - ACL incidence 70/100K - 200/100K in young athletes
- 11% Musculoskeletal Symptoms in office setting
- Higher incidence in females
- Etiology
  - 61-89% associated with sporting activities/military
  - Mechanism
    - Indirect 66-82% - noncontact
    - Direct – medial or lateral contact at 20-30deg of flexion

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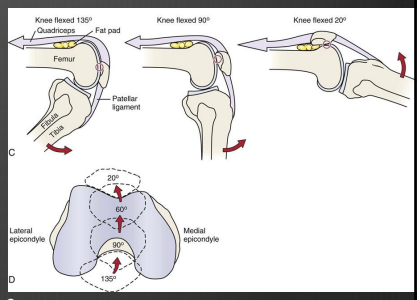
Anatomy/Biomechanics

- Patellar Tracking
  - Osseous constraints between patella and trochlea
    - Trochlear Morphology – single most important factor of patellar stability
    - Initial 20-30 degrees of knee flexion
      - Patella migrates medially
      - Slides into trochlear groove
      - Becomes centered in trochlea
      - Delayed engagement – increased risk of patellar instability
        - Trochlea dysplasia
        - Patella alta



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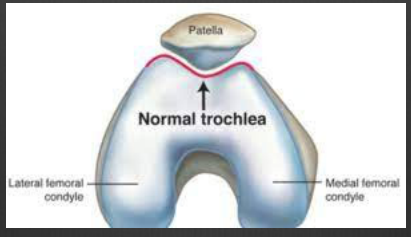
Anatomy/Biomechanics

- Beyond 30deg
  - Patellar stability achieved by medial and lateral osseous constraints
  - MPFL has minimal



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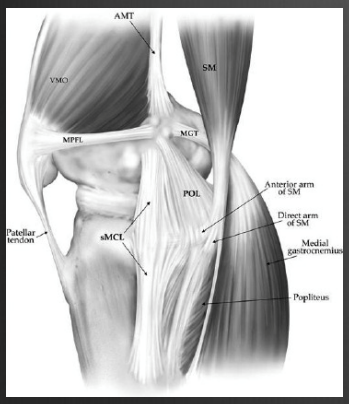
Anatomy/Biomechanics



- Soft tissue structures that provide static and dynamic stabilization
  - Dynamic stabilizers
    - Quadriceps (VMO)
    - IT band
  - Static stabilizers
    - Medial Retinaculum – Medial Patello Femoral Ligament (MPFL)
  - 0-30 degrees
    - MPFL is primary stabilizer of the patella

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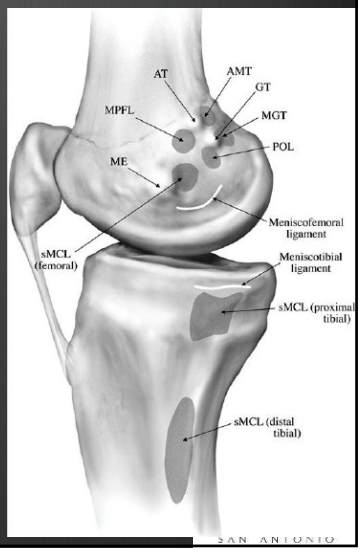
Anatomy/Biomechanics

- MPFL
  - Inserts on superomedial patella, 6mm below superior pole
  - Origin – entire height of anterior aspect of medial femoral epicondyle
    - Anterior and distal to add tubercle
    - Posterior and superior to medial epicondyle



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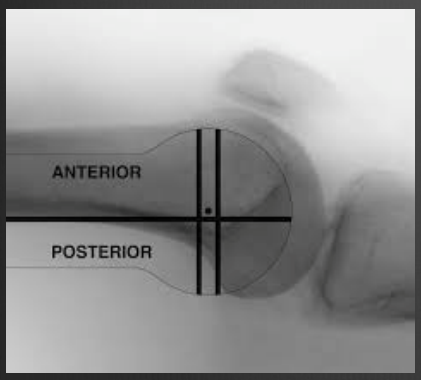
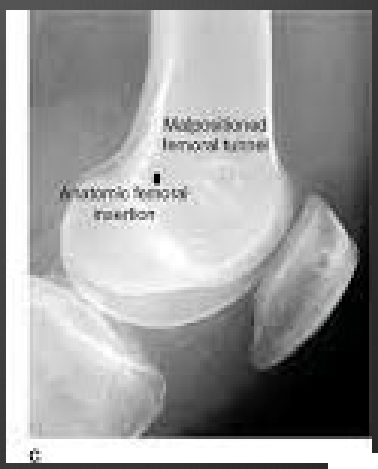
Anatomy/Biomechanics

Radiographic Landmarks





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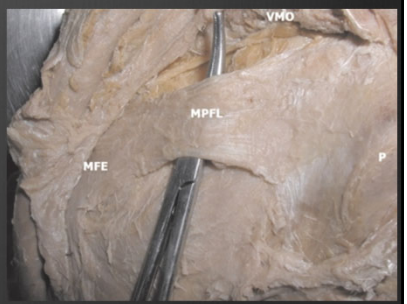
Anatomy/Biomechanics

- MPFL
  - Thickening of medial retinaculum
  - Early studies found variable existence of MPFL
  - More recent studies have shown a distinct structure 100%
  - Mean failure load – 208N
  - Almost universally disrupted in patella dislocation
    - Femoral insertion injury in Adults
    - Patellar sided injury in children
    - Rarely intrasubstance injury
  - Minimal contribution to stability beyond engagement into trochlea



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Anatomy/Biomechanics

Forces through the patellofemoral joint

Activity	Force	% Body Weight	Pounds of Force
Walking	850 N	½ x BW	100lbs
Bike	850 N	½ x BW	100lbs
Stair Ascend	1500 N	3.3 x BW	660lbs
Stair Descend	4000 N	5 x BW	1000lbs
Jogging	5000 N	7 x BW	1400lbs
Squatting	5000 N	7 x BW	1400lbs
Deep Squatting	15,000 N	20 x BW	4000lbs

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Mechanism of instability

- 5 Major Anatomic Risk Factors

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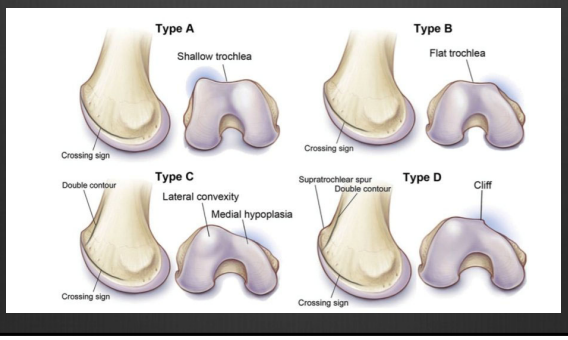
Mechanism of Instability

1. **Trochlear Dysplasia**
   - Absence of normal concavity
   - Dejour classification
   - Found in 85% of patients with patellar instability



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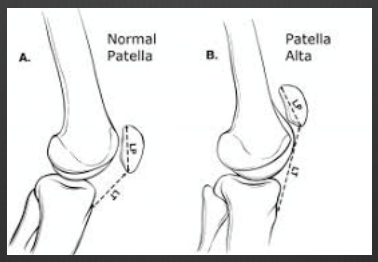
Mechanism of instability

2. **Patella Alta**
   - Patella engages in trochlea beyond the normal 20-30deg flexion
   - Greater range of vulnerability of patella relying on medial soft tissues for stability
   - 3x higher prevalence in patients with patellar instability
   - Several ways to measure – Caton-Deschamps



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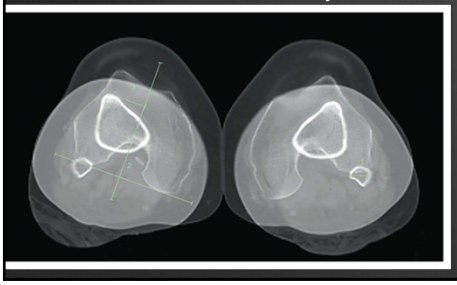
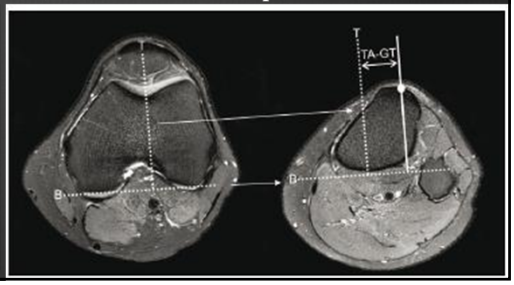
Mechanism of instability

3. **Increased Tibial Tubercle to Trochlear Groove distance (TT-TG)**
   - Measure of the lateralization of the tibial tubercle relative to the trochlear groove
   - TT-TG > 20mm is abnormal
     - 90% association with patellar instability
   - Traditionally assessed on CT, but MRI is commonplace now





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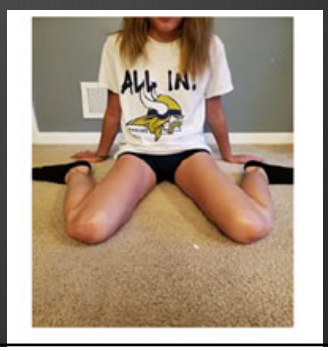
Mechanism of instability

4. **Abnormal lateral tilt of the patella**
5. **Torsional malalignment of the femur and/or tibia**
   - Increased femoral anteversion
   - Increased external tibial torsion
   - Both cause increased lateral force on the patella



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Mechanism of instability

- Lateral instability – 95%
  - Almost always identifiable anatomic risk factors
- Medial instability – 5%
  - Direct trauma or iatrogenic causes
    - Over-aggressive lateral release
    - Over-constrained medial repair or reconstruction

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History and Physical exam

- History
  - Traumatic? Reduction necessary?
  - Acute/Chronic/Recurrent
  - Mechanism of Injury
  - Swelling
- Exam
  - Effusion
    - Hemarthrosis
      - ACL
      - Meniscus
      - Patella dislocation
  - Joint line tenderness
  - Thorough ligamentous exam
  - Apprehension test/Laxity
  - Compare contralateral side/signs of hyperlaxity

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Imaging

- Radiographs
  - AP
  - Lateral
    - Patellar Height
    - Trochlear dysplasia
  - Sunrise
    - Reduction
    - Tilt
    - Degenerative changes

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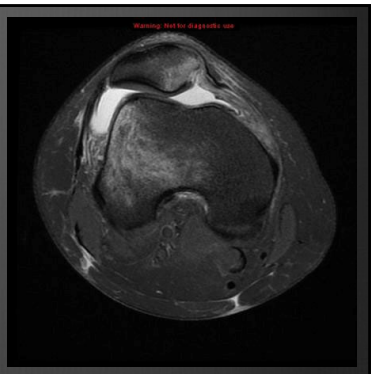
Imaging

- MRI
  - Confirm injury
    - Evaluate ACL, MCL, meniscus
  - Evaluation of medial-sided structures
    - 85% sensitive for MPFL injuries
    - 50-80% MPFL disrupted from femoral origin
  - Identifying chondral injuries/loose bodies
  - Typical bone bruise pattern



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Associated Injuries

- Osteochondral Injury – up to 70% in first time dislocations
  - Medial patellar facet
  - Lateral femoral condyle
  - Loose bodies

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Management

- Nonoperative treatment – acute dislocation
  - **Immobilization** 3-6 weeks
    - Stiffness
    - Similar recurrence as early motion
  - **Immediate functional rehabilitation**
    - Functional patellar brace
    - Early rom
    - Closed chain exercises
  - 40-60% recurrence rate either treatment
    - Only 16% return to play by 6 weeks
    - Only 2/3 RTP by 6 months

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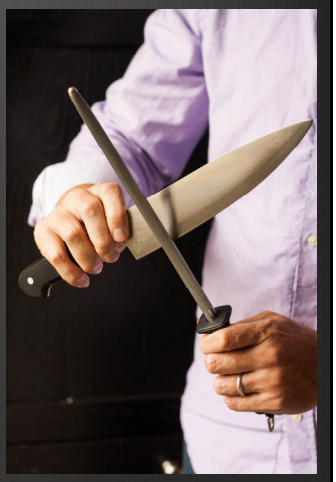
Management

- SURGERY
  - Old Operative indications
    - Osteochondral loose bodies
    - Failure of nonoperative management
    - Recurrent instability
    - Avulsion of MPFL – femur or patella
    - Persistent patellar subluxation
- Growing indications for early surgery
  - Even after first time dislocation
  - Consider age, activity level, season



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Operative Treatment

- More than 100 described operations
  - REPAIR
  - RECONSTRUCT
  - RELEASE
  - REALIGN
- **M**edial **P**atello**F**emoral **L**igament Reconstruction has become the Gold standard
  - Very low rates of recurrent dislocation
  - High return to play rates

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MPFL Repair

- Medial Retinacular Repair (Reefing)
  - Traditional surgical option +/- lateral release
  - High redislocation rates
  - Has fallen out of favor over the last decade

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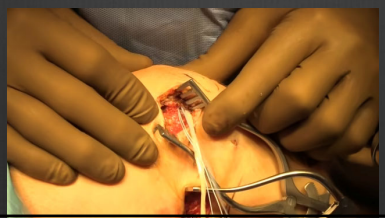
MPFL Reconstruction

- 1990s – Biomechanical Importance of MPFL
  - Techniques evolved
    - Several graft choices
    - Numerous fixation methods
  - All graft choices well exceed 208N threshold
  - Graft just needed to guide patella into trochlea at 10-30deg
    - Not expected to hold patella in place once engaged in trochlea
    - OVER-TENSIONING is a bad problem
    - Different than ACL surgery



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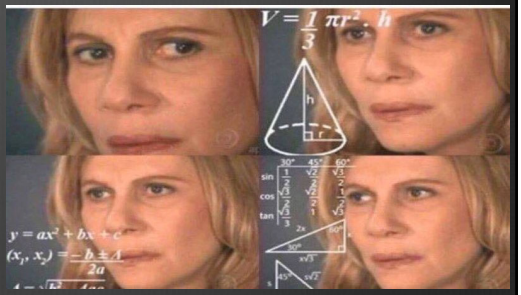
MPFL Reconstruction

- No gold standard technique
  - Numerous graft choices
    - Hamstring
    - Patella
    - Quad
    - allograft
  - Numerous fixation methods
    - Tunnels
    - Suture anchors
    - Suture buttons
    - Interference screws
    - Screw and washer



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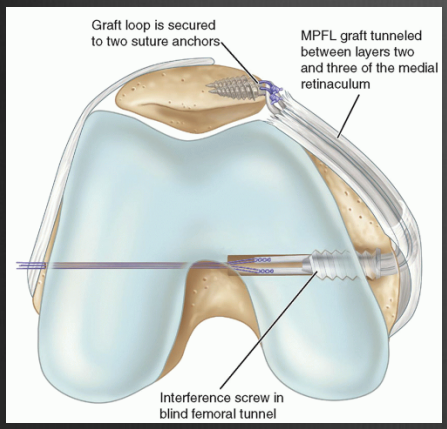

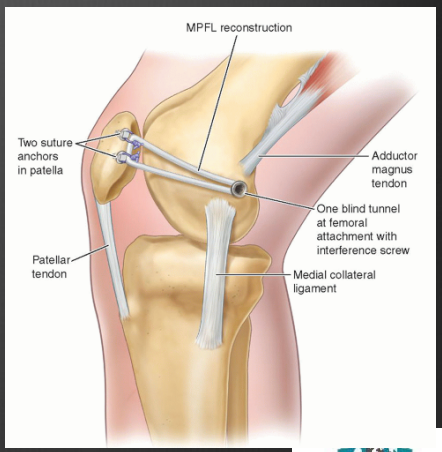

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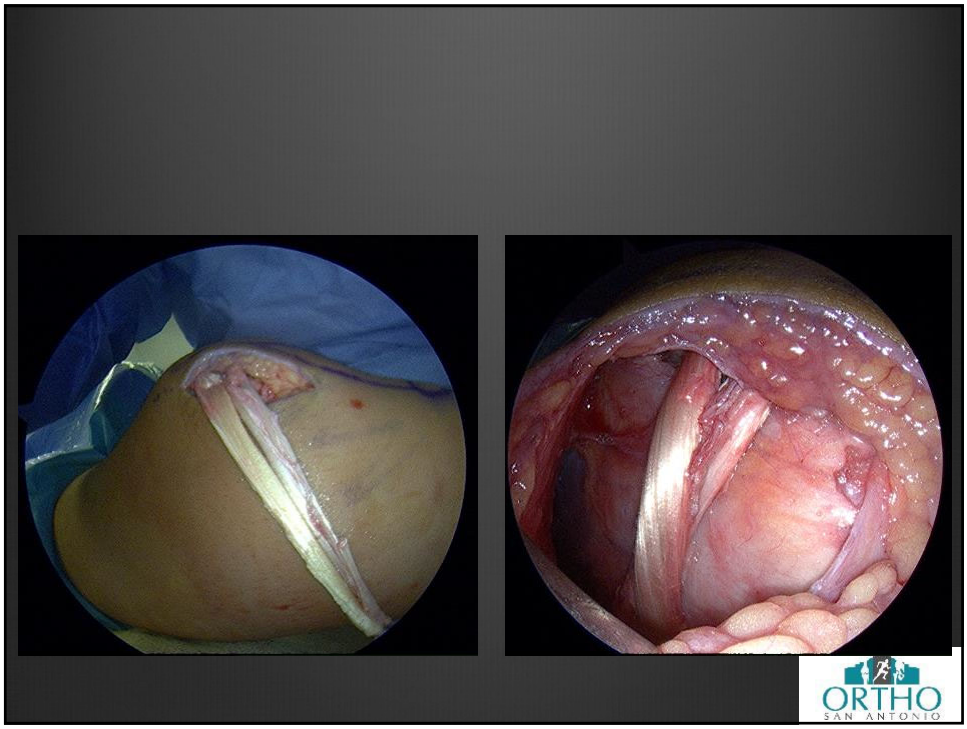

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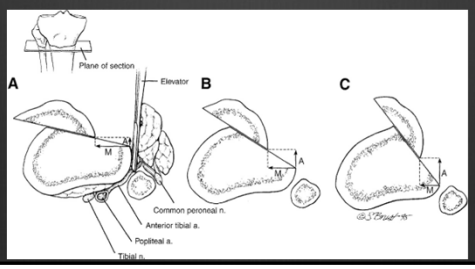
Distal Realignment

- Patella Alta
- Increased Tibial Rotation (TT-TG > 20mm)
- Fulkerson Osteotomy (Anteromedialization)
  - Decreases lateral pull on patella
  - Centers patella in trochlea groove at 30deg



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Distal Realignment

- Growing evidence that tubercle osteotomy can be avoided
  - Skeletally Immature patients
  - Isolated MPFL Reconstruction
    - Patella Alta
    - Increased TT-TG (15-25mm)
  - Encouraging early and mid term results
    - Low re-dislocation rates
    - High return to play rates
    - Worse prognosis with patellar chondral lesion

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Rehabilitation

- Previous repair/reefing rehab was typically slower
- MPFL Reconstruction
  - Immediate Weight bearing with brace locked
    - Unlocked to 30 at 2 weeks
    - Wear 6 weeks total
    - NO functional patella brace
- Start therapy at 2 weeks
  - Full ROM by 2-3mo
- Weights/strength work at 6-8 weeks
- Running 3-4 months
- Return to play typically at 6 months
- Overall, comparable to ACL rehab

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Summary

- The treatment for patellofemoral syndrome is physical therapy
- Non-operative treatment typical for primary patella dislocation
  - 40-60% recurrence rate
- Surgical management for 1st time dislocation
  - Growing indications for early reconstruction over rehab regardless of MRI findings
  - Repair/Reefing has fallen out of favor
- Distal realignment
  - Increasing evidence that isolated MPFL reconstruction is successful regardless of TT-TG and patella alta

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Thank you

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