Clinical Evaluation and Imaging of the Patellofemoral Joint

Common clinical syndromes

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Objectives

- Anatomy of patellofemoral joint
- Basic biomechanics
- Clinical evaluation
- Radiological evaluation
- Common syndromes
Bony Anatomy

largest sesamoid bone

3 medial and 3 lateral facets articulate with femoral groove

The odd facet only articulates with the MFC in deep knee flexion

distal pole (extraarticular part)
Bursa & cartilage

measuring close to 5 mm
Patella types

Wiberg & Baumgartl classification

Most common

Patellar hypoplasia, aplasia, patella bipartite or multipartite, fragmentation, and duplication are some of the most common dysplasias
The Insall-Salvati ratio length tendon (TL)/length patella (PL) should normally be within 20% of 1.0.

can block knee flexion and place excessive loads on the patella, resulting in pain and progressive OA

is often more mobile, resulting in an increased risk of instability
Throclear anatomy

lateral and medial facets of the femoral sulcus

the trochlea deepens from proximal to distal
Merchant view

The femoral sulcus angle usually varies in the range 138±6°

The congruence angle in 25 knees with proven recurrent dislocation the angle measured +23 ° whereas in 200 normal knees (100 individuals) it measured -6 ° (SD = 11°)
Troclear dysplasia

**Dysplasia Type A**
- Crossing sign
- Shallow trochlea $>145^\circ$

**Dysplasia Type B**
- Supra trochlear spur
- Flat trochlea

**Dysplasia Type C**
- Double contour
- Lateral convexity
- Medial hypoplasia

**Dysplasia Type D**
- Double contour
- Cliff
- Supra trochlear spur
Biomechanics

The main biomechanical function is to lengthen the extension moment arm of the knee at full extension.

Change in patella tilt results in changing lever arm length between the patella tendon and quadriceps tendon.

As the lever arm decreases, force on the tendon increases, resulting in greater patella tendon force in extension and greater quadriceps tendon force in flexion.
Due to changing lever arms, quadriceps force and patella tendon force also vary with knee flexion angle, with greater quadriceps force occurring at high flexion angles.

**Patellofemoral compression force** is the result of compression of the patella into the trochlea groove resulting from a combination of quadriceps and patella tendon forces.

With standard weight bearing activities, maximum patella femoral contact force is thought to occur at approximately 70 to 80 degrees of knee flexion.
Patella femoral contact force is affected by body position, decreasing as patients forward flex at the hip during stair climbing.

Patella femoral contact force increases **four fold** with leg extension exercises at 30 degrees.
The Q angle is defined as the angle between the quadriceps mechanism and the patella tendon and is a helpful measure of patella tracking.

The greater the anatomic valgus, or the greater external rotation present in the tibia, the larger the Q angle will be, resulting in laterally directed force vector.
Clinical evaluation

Typically, all patients complaining of anterior knee symptoms are lumped into a general category by physicians and therapists and treated with a standard, nonspecific, “patellofemoral” protocol.
Location of pain

Pain at the knee cap that is worse walking down stairs can be:
- Chondromalacia/ runner’s knee/Patellofemoral pain
- Patella or patella tracking
- Bursitis, Arthritis

Pain on the inside (medial aspect) can be:
- Medial meniscus tears,
- Medial collateral ligament injuries
- Arthritis of the joint
- Bursitis (Pes Anserine Bursa).
  Pain along the inside edge of the knee just below the knee cap

Pain below knee cap may be:
- Osgood-Schlatter disease
- Osteochondritis dissecans
- Jumper’s Knee
- Patellofemoral instability
Standing Evaluation: Static

leg length assessment, pelvic balance, Q angle, varus-\textit{valgus} alignment, knee recurvatum, flexion deformities, foot position

Increased foot pronation
Standing Evaluation: Dynamic

Single leg loading

Stresses P/F joint (Pain, crepitus)

Step up / step down
Supine evaluation

Inspection
Q angle
Swelling
Effusion
Old scars
Osgood Schlatter
Passive Rom
Provocative tests

Patellar compression test

Patellar grind test

Patella apprehension test
Provocative tests

**Patellar tilt test**: inability to lift the lateral facet more than 15 degrees = tight lateral retinaculum

The **J sign** indicates the presence of severe lateral translation of the patella in terminal extension of the knee and suggests instability.
Radiological evaluation – X-rays

AP view,

Lateral view

Merchant view
Grelsamer & Meadows modified Insall and Salvati A/B ratio (averaged 1.5) whereas a ratio of 1.25 is the cutoff between normal and patella alta.
**Kushino and Sugimoto** ratio of PT/FT for (A) infants and (B) adolescents with normal range 0.9 to 1.3

Leung's patella alta index of \( \frac{A_1 + A_2}{B} \) had a mean of 2.98 with the 95% cutoff being 3.37.
Sulcus depth

Distance is normally 7.8 mm with a threshold of dysplasia of <4 mm.
Dysplasia
Patella tilt
CT scan

Tibial tubercle – trochlear groove (TT-TG) distance (abnormal > 15)
MRI scan

T-2 chondral mapping
Bone scan
Common syndromes

- Anterior Knee Pain
- Dislocation
- Instability
- Osgood Schalter
- Hyperpression
- Vascular disorder
- Tendinitis
- Psychologic
- Subluxation
- Patellar Painful Syndrome
Common syndromes

Lateral patella compression syndrome (LPCS)

MPFL rupture – patella instability

Chondromalacia patellae
Lateral patella compression syndrome (LPCS)

- originally described by Ficat in 1975

- excess pressure along the lateral facet of the patella, usually associated with a tight lateral retinaculum and radiographic evidence of patella tilt

Patients will present with complaints of pain rather than instability.

Manual compression of the patella into the trochlea will often exacerbate the pain
Lateral patella compression syndrome (LPCS)

Conservative

The mainstay of treatment for LPCS is non-operative

- rest, ice, and AIA

- improving patella alignment

- stretching of the tight lateral retinaculum and IT Band.

- VMO strengthening will help dynamically medialize the patella and unload the lateral facet.
MPFL rupture – patella instability
Isometric behavior of the reconstructed medial patellofemoral ligament using two different femoral pulleys: A cadaveric study

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MPFL Reconstruction for Recurrent Patella Dislocation: A New Surgical Technique and Review of the Literature

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Patella dislocation

Patella centralization
Chondromalacia

The term chondromalacia refers specifically to the pathological appearance of damaged articular cartilage

May be caused by repetitive normal biomechanical loading, a single traumatic episode, asymmetric overload caused by malalignment, or by arthritic conditions
Chondromalacia

Pain, etiology unclear (adjacent synovium, subchondral bone)

crepitus, and possibly a joint effusion

Patella compression test (+)

Outerbridge classification

Combination with tight retinaculum or insufficient medial restraints
Treatment

associated malalignment
VMO strengthening
lateral retinaculum stretching
Taping or bracing techniques
Orthotics (hyperpronation)
NSAID, Donarot
If a patient presents with Grade 3 chondromalacia of the central ridge of the patella with a history of a direct blow to this area

If a patient presents with a long history of progressive symptoms with lateral facet CM, a tight lateral retinaculum, and evidence of lateral patellar compression syndrome,

If a patient has a history of recurring patella dislocation or subluxation

Decision Making (try to understand the etiology)

- simple debridement
- debridement plus lateral retinacular release
- stabilization procedure along with arthroscopic debridement