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MINI-SYMPOSIUM: SOFT TISSUE KNEE PROBLEMS

(iv) Patellofemoral dysfunction—Extensor mechanism malalignment

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Summary
Anterior knee pain has many causes. When it arises from the knee extensor mechanism, those with normal alignment must be distinguished from those with malalignment. Patellar dislocation is at one extreme of a spectrum of disorders that are due to malalignment of the extensor mechanism of the knee. This article discusses important aspects of extensor mechanism malalignment and a logical approach to operative treatment for patients with failed conservative therapy.
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Introduction

The patella is a sesamoid bone that acts as a marker for the extensor mechanism of the knee. Patellofemoral dysfunction comprises a number of disorders of the extensor mechanism of the knee. There are two main presentations: anterior knee pain, and abnormal patellar movements, but both may be present at the same time. The disorders presenting as anterior knee pain are listed in Table 1.

Abnormalities of patellar movements range from permanent dislocation through subluxation to a tight lateral retinaculum.

Anatomy

The patellofemoral joint includes the entire extensor mechanism of the knee, i.e. the quadriceps tendon, patella and patellar ligament. The trochlear groove and an arch of articular cartilage around the intercondylar notch make up the femoral side of the joint. It is important to remember that the tibial articular surface comes into contact with a different part of the femur to the patella, except at the tibial spines. It is also important to remember that intercondylar notch osteophytes usually arise from patellofemoral disease.

The movements of the patellofemoral joint are complex.[1] In full extension only the distal part of the patellar articular surface is in contact with the femoral groove. As flexion proceeds, the contact area on the patella sweeps proximally until at 90° flexion the proximal part is in contact with the distal groove. From 90° flexion the odd facet (the most medial) articulates with the lateral edge of the medial femoral condyle, and the lateral facet articulates with the medial edge of the lateral femoral condyle. The medial facet lies in contact with the synovium overlying the anterior cruciate ligament.

There are synovial folds that fill in any space between the non-contacting articular surfaces of the patella and femur.[2]

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Table 1 The causes of anterior knee pain.

Adolescent anterior knee pain (Painful patella syndrome)
Patellar malalignment syndromes including dislocation
Patellofemoral pathology
- Patellofemoral arthritis
- Infections
- Tumours
- Complex regional pain syndromes

Extensor mechanism pathology
- Patellar tendonitis (Sindig–Larsen, Osgood–Schlatter's)
- Quadriceps tendonitis

Tibiofemoral pathology
- Medial meniscal tear
- Lateral meniscal tear
- Osteochondritis dissecans

Hip pathology
- Osteoid osteoma
- Osteosarcoma/Ewing's

Postural abnormalities
- Tight quadriceps/hamstrings
- Hyperlordotic lumbar spine
- Pronated feet

Psychological problems

Highlighted conditions covered in article.

In full extension the patella rests on the synovium of the supracondylar fat pad. This has a leading edge that moves 2–3 mm distally in the first 20° of knee flexion. As the contact area on the patella moves proximally, progressively more of the supracondylar fat pad lies in contact with the quadriceps tendon. In the inferior part of the patellofemoral joint the synovial folds are more complex. As the knee flexes, the inferior articular surface of the patella becomes more progressively covered by the alar folds of the infrapatellar fat pad. Initially the alar folds face inwards, but beyond 90° flexion the alar folds move away like opening curtains to face away from each other (the way they are typically depicted in anatomy textbooks). The movement of the synovial folds sweeps the articular cartilage and may be important for joint lubrication and nutrition.

Clinical features

Pain is typically felt at the front of the knee around the patella. It is worse with exercise, on squatting or getting out of a chair, and on going upstairs. Increased pain on going downstairs is more typical of medial tibiofemoral pathology (medial meniscal tear or arthritis). Patients may complain of the knee locking, despite there being no mechanical block to extension. This pseudo-locking occurs when the patellar and trochlear lesions come into contact causing pain which inhibits knee movement. Feelings of instability and giving way are also typical, either because the quadriceps is weak from pain, or due to extensor mechanism malalignment.

Table 2 The signs that should be noted in a patient with patellofemoral dysfunction.

Lower limb alignment including hip rotation and tibial torsion
Quadriceps bulk, and the presence of the vastus medialis obliquus (VMO)
The presence of an effusion
The patellar tilt, and excursion, and tightness of the lateral retinaculum
Patellar apprehension and areas of tenderness
The range of knee movement and the presence of crepitus
The tracking of the patella
The tibiofemoral joint
The hypermobility index

Clinically if the patient can squat easily, and duck waddle (move about in the squatting position), there is unlikely to be serious pathology within the knee. The clinical signs that should be noted are listed in Table 2.

Patellofemoral syndromes

Adolescent anterior knee pain

Adolescent anterior knee pain (AAKP) has many synonyms. It is common; in a case series of 446 children, 30% both boys and girls experienced it. Of these only 10% of the boys, and 30% of girls presented to doctors. There was no association with any anthropometric measure (although benign joint laxity syndrome was not recognised at that time), but it was associated with sporting activity.[3] In a mean of 16 years follow-up of girls 71% were symptomatically improved, 88% took no painkillers, 90% played regular sports, and 25% had intermittent significant symptoms after 20 years.[4]

Chondromalacia patellae is a commonly used synonym. However, it is an arthroscopic diagnosis and can be inferred from an MRI scan. It should only be used when the macroscopic state of the articular cartilage of the patella is softened. However, it can be present secondary to chronic trauma, notably in trochlear dysplasia (see below), which is not AAKP.

My view is that AAKP is result of chronic overload of the extensor mechanism in the growing sporty child. It occurs because the femur and tibia are growing faster than the soft tissues of the extensor mechanism, and therefore causes a relative overload during sports. The typical age of onset is around 12 years old. The pain is worse with exercise, and eases with rest. It usually resolves over 4–5 years. It is not a disease, and should not be treated operatively, but it is important to exclude other causes of anterior knee pain, most notably extensor mechanism malalignment with trochlear dysplasia.

Patellar malalignment syndromes

The literature on the management of patellar instability is confusing. There is no standardisation of diagnoses, e.g.

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