Patellofemoral joint pain in runners

Pain source

The source of anterior knee pain is difficult to identify, with subchondral bone the most commonly hypothesized source in the literature. Subchondral bone is densely innervated with free nerve ending and blood vessels. If the cartilage fails to protect the underlying subchondral bone, this is thought to be the primary tissue responsible for symptoms. It is rare for sedentary people to present with PFP (patellofemoral pain). It has been suggested that the posterior lateral corner may also masquerade as PFP.

This is supported by Scott Dye who wrote a paper in 2005 investigating the pain sources in the knee. He asked a colleague to perform an arthroscopy on his knee without anaesthetic whilst he mapped out the pain sources. The retropatella cartilage and ligaments did not reproduce pain, whereas the subchondral bone, synovial lining and the Hoffa’s fat pad all reproduced pain.

Imaging

Research is being conducted trying to identify the MRI findings that correlate with pain. Early indications have shown that subchondral bone defects and active synovitis correlate with pain. There is thought to be no correlation between cartilage changes and symptoms as it is not a nociceptive source.

Imaging this patient group is not common place. It may be appropriate if the patient does not respond in the time frame expected. When requesting imaging ask the radiologist to look for active synovitis, loose bodies or large osteochondral defects which may present with bony oedema.
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How to diagnose PFP?

PFP is a diagnosis of exclusion if there are no signs of patella tendinopathy, ITB irritation, fat pad impingement or tibiofemoral joint pathology. There are no set diagnostic indicators which guide diagnosis.

Patient with PFP often report pain with loaded flexion. This may be when ascending or descending stairs, walking/running or another activity in loaded flexion. Runners may report pain with daily activities if the symptoms are irritated during a run. The pain with daily activities will settle if they reduce running volume.

Acute Synovitis

These patients complain of higher scores on VAS with less of a mechanical pattern associated with activity. Pain is diffuse in the retropatella area and it is rare for these patient to point to the medial or lateral facet. Patients with synovitis report active swelling with associated changes in central patella measurements. Patients with PFP do not present with knee effusion.

Patients with an active synovitis often report pain at rest, a higher irritability with symptoms taking longer to settle once unloaded, morning stiffness and discomfort towards the end of the day.

Osteochondral defects

Patients with this presentation are often intolerant of loading activity. These may be the patients who progress well through rehabilitation and returning to cycling. However, when they return to running or other impact activities their symptoms flare up and they become symptomatic with daily activities again. If the patient is struggling to tolerate a return to impact activity, there should be a high suspicion of patellofemoral joint or tibiofemoral joint surface involvement. Clinically patients with trochlea defects are harder to manage than retropatella defects as they are less load tolerant.
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Patients may be able to manage with a large defect by making significant changes to the activities that load the knee. However, if this is not appropriate then these patients may be more appropriately managed with surgical intervention. This may involve the classic pepper pot drilling technique to stimulate bleeding and scarring into the defect to get it to fuse over.

This technique works well in the tibiofemoral joint as the compressive forces help to create a barrier of scar tissue between the cartilage layer and subchondral bone. It does not work in the patellofemoral joint due to the presence of large sheering forces. Instead a patient may undergo an arthroscopy to tidy up the defect and make the surface area stable.

**Tibiofemoral joint**

The tibiofemoral joint is rarely involved in anterior knee pain. Patients presenting with tibiofemoral joint problems are often post trauma or post-surgery. PFP is often insidious onset or low grade trauma such as a direct blow onto the patella. It is thought that patellofemoral joint arthritis is a precursor to tibiofemoral joint arthritis.

**Fat pad impingement**

Prolonged standing or walking are the main aggravating factors. These patients present with an extension pattern to symptoms rather than a flexion pattern associated with PFP. The fat pad deforms and moves out of the way into flexion however it may become impinged in extension/hyperextension as has no space to move. The fat pad is highly innervated and has a good blood supply so has the potential for being a pain source. Fat pad impingement is common in patients who hyperextend the knee or have a lack of control of extension during gait.

Fat pad impingement and PFP should be viewed separately as they are managed in different ways. It is possible to have a mixed presentation in a patient overloading the knee who sustains a hyperextension incident however this is rare. If the fat pad become irritated and inflamed it will grow in size and may be irritated with movements other than extension.
If a patient presents with multiple areas of pain, peripheral or central sensitisation should be considered.

**Objective assessment**

**In standing assess:**
- Foot posture
- Relaxed calcaneal stance
- Subtalar joint axis
- Single leg balance – assessing the control of extension. Patients with fat pad irritation often lose the knee into hyperextension which provokes symptoms.
- Single leg squat

If the ability to assess running or stairs is limited the single leg squat has a strong correlation to these activities. When assessing the single leg squat try to identify the drivers for the symptoms. They may be distal from the foot, proximal from the hip or local drivers such as quadriceps insufficiency. These findings then need to be correlated to the patient’s symptoms.

**In supine assess:**
- Knee range of movement including hyperextension
- Patellofemoral crepitus
- Palpation of tibiofemoral joint lines
- Palpation of fat pad under ITB
- Retropatella palpation – good diagnostic indicator of PFP if tenderness on palpation of the lateral facet
- Clarke’s test – compress the patella and ask the patient to perform a static quadriceps contraction. This test has a high specificity and low sensitivity so if it is negative then indicates that the patellofemoral joint is not involved.
- Fat pad stress test – place the knee into slight flexion and push thumbs into the fat pad and forcibly extend the knee. If this test is negative it is a good indication that the fat pad is not involved.
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- Open chain resisted extension – the clinician places their knee under the patient’s knee and extension is resisted. This test loads the patellofemoral joint and patella tendon. The location of symptoms will guide the structures involved.

**Gym based assessment:**
- Single leg drop down – Patient hops down from a small box into a landing to assess what happens with the introduction of ground reaction forces. May not be appropriate for highly irritable patients
- Running assessment – assessing key running variables

**How do I know if the patient would benefit from orthotics?**

A change in midfoot width is reflective of navicular drop. Using long arm calipers compare the mid foot width measurement in weight bearing and non-weight bearing. A change in more than 11mm is predictive of a successful orthosis intervention. An orthotic intervention may be effective in reducing load.

If referral onto a podiatrist is not feasible then low dye taping may be used. The tape should be applied for 2-3 days and the patient should be instructed to perform lots of the activities that provoke their symptoms and any change should be assessed. Instead of orthotics a change in footwear may be appropriate.

**Red flags**

With the knee it is less likely for a sinister pathology to masquerade as musculoskeletal pain. Ask typical general health questions such as recent antibiotics, fevers and body weight to help to exclude non-musculoskeletal pathology. Be aware of the patient with anterior knee pain complaining of locking or giving way symptoms as this may indicate a loose body and may require further imaging. Anterior knee pain symptoms may be referred from the lumbar spine or the hip.
**Saphenous nerve**

Saphenous nerve involvement may be present post arthroscopy as persistent non-mechanical knee pain. It is unlikely to be involved with insidious mechanical symptoms.

**Treatment of the fat pad**

Unloading the knee by reducing walking and standing activity is important to let the symptoms settle. A superior glide K taping technique may help to reduce the patient’s symptoms. Advise female patients to wear a small heel to increase the external extension moment at the knee to reduce the chance of irritating the fat pad into hyperextension. Male patients should be advised to wear running trainers with the addition of a temporary heel raise. Ice and Ibuprofen may also help to reduce symptoms.

Exercise interventions should be focused on preventing quadriceps inhibition. Closed chain inner range exercises either performed in a lunge position with theraband resistance or mini swiss ball squats. Isometric hamstring contractions performed at around 20-30° of knee flexion may provide immediate pain relief.

Education on knee posture and avoiding provocative hyperextension will complement your strengthening focused rehabilitation.

**Treatment of synovitis**

Focus on an unloading approach to help the knee cope with the load placed upon it. Medical input may be beneficial to prescribe oral anti-inflammatories as Ibuprofen is not strong enough. Initially rehabilitation may consist of low resistance cycling, small range quadriceps and gluteal work. Rehabilitation should be progressed slowly as the load tolerance of the knee increases.
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Taping

Modified McConnell taping may help with lateral facet or retropatellar pain. K tape can be applied to provide a medial and superior glide. Taping is a short term intervention which may break the pain cycle and facilitate rehabilitation.

Running

Generally, patients are good at keeping running. Patients with PFP often get symptoms at the start of a run instead of developing after certain distance/time. Runners with long stride and high extension moment at the knee may benefit from a running retraining intervention.

Links mentioned in this episode:

Twitter
Research Gate
Google Scholar
Pure Sports Medicine
Team PFP
TREK – Translation of research education and knowledge

Papers of interest:

Conscious neurosensory mapping of the internal structures of the human knee without intraarticular anaesthesia

Runners with patellofemoral pain have altered biomechanics which targeted interventions can modify: a systematic review and meta-analysis
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Free sports injury assessment and treatment videos:

As mentioned in this episode Brad is presenting a video on patellofemoral pain which you can get free access to at clinicaledge.co/brad

The free videos available for a short time include:
- Shoulder and AC joint injury with Dr Rod Whitely
- Shoulder injury and dislocation management with Adam Meakins
- Hamstring injury screening with Nicol van Dyk
- Lateral knee injuries with Matt Konopinski
- ACL injuries with Dr Enda King

Sports Injury Virtual Conference

Brad Neal also presented at the Sports Injury Virtual Conference hosted by Clinical Edge along with the world leaders in sports injury management.

His presentations discussed:
- Risk factors for developing PFP
- Distal, proximal and local drivers of PFP
- What we know about exercise in PFP
- How to individualise exercise interventions
- What runners would benefit from movement retraining
- How to implement movement retraining
- Load management and how to educate patients about load
- Case study examples