

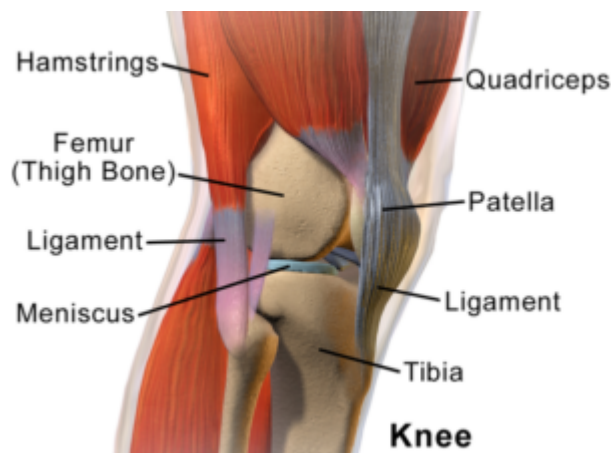
Patellofemoral Pain Syndrome (PFPS) — Pathophysiology and Risk Factors

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Patellofemoral pain syndrome (PFPS) is a common condition that is characterized by anterior knee pain. The condition is more commonly seen in young women. Patellofemoral pain syndrome is characterized by the absence of any significant structural changes and with a normal articular cartilage. PFPS is a diagnosis of exclusion.



Overview



[Image:](#) "Knee Anatomy." by Blausen.com staff (2014). "Medical

PFPS can be associated with other symptoms in addition to pain which includes crepitus and functional deficit. The functional deficit can be severe enough to limit the activity of professional athletes. PFPS can be thought of as a precursor to osteoarthritis as most cases eventually develop osteoarthritis.

PFPS incidence is high and estimated to be around 22 per 1000 per year. The condition is seen twice more commonly in women compared to men.

Epidemiology of the Patellofemoral Pain Syndrome

PFPS occurs very frequently in physically active people. The age range for frequent incidence of PFPS is 15 to 30. Even though the condition is a common one, there isn't a lot of research done on its occurrence. Moreover, an assumption exists that females experience the condition more than males.

Pathophysiology of the Patellofemoral Pain Syndrome

There are different hypotheses that try to explain the pathophysiology of PFPS. The main focus of recent research in the pathogenesis of PFPS has been on patella maltracking, an imbalance in the action of vastus lateralis and vastus medialis muscles, abnormal malalignment, hip instability, rear-foot eversion, hamstring imbalance, knee-spine syndrome and psychological factors. Therefore, most scholars agree that PFPS is a multifactorial disease where one has different players that are working together to cause a tracking problem of the patella.

Patellar Mal-tracking in Patellofemoral Pain Syndrome

The patella in patients with PFPS is shown to be more dynamic and to be poorly aligned to the adjacent structures. For instance, dynamic magnetic resonance imaging studies of the knee in patients with PFPS show the patella to be localized more laterally compared to what is expected in a healthy individual. The patella is also found to be hypermobile in patients with PFPS.

When the patient goes from a standing position to a squatting position, the patella is found to be gliding more in patients with PFPS. These findings are suggestive of a tracking issue of the patella which is thought to play a key role in the pathogenesis of PFPS.

Vastus Lateralis and Vastus Medialis Role in the Pathogenesis of PFPS

For the patella to be hypermobile and more lateralized, one would expect the muscles attached to it to be abnormally active and imbalanced. This hypothesis was confirmed in a recent study that showed an imbalance between vastus medialis and vastus lateralis in patients with PFPS. Vastus medialis is activated later than expected; hence, the patella is pulled laterally by the vastus lateralis muscle.

When patients are climbing upstairs or downstairs, both vastus lateralis and medialis are

expected to be activated equally and at the same time for the patella to remain in the correct position. The imbalance between the two muscles is a crucial pathologic finding in patients with PFPS and is linked to the abnormal tracking of the patella.

Joint Malalignment in PFPS

Patients with PFPS usually do not have a malalignment problem of the femoral and tibial bones in the knee. On the other hand, patients with an abnormal alignment manifested as an increased Q-angle are more likely to develop knee problems including PFPS. Therefore, it is now recommended to follow athletes with an increased Q-angle more closely to exclude the emergence of osteoarthritis or PFPS and treat knee pain as early as possible.

On the other hand, some physicians have noticed an abnormal dynamic alignment of the knee joint during walking in patients with PFPS. For instance, the dynamic valgus alignment was seen more often in female athletes who have PFPS compared to those who do not. Dynamic magnetic resonance imaging of the patellofemoral joint in patients with PFPS showed abnormal joint kinematics. As expected from the mal-tracking hypothesis of pathogenesis, the femur was found to be excessively medially rotated in patients with PFPS, whereas the patella was laterally rotated.

These abnormal dynamic valgus alignments can be confirmed with the patient doing one-legged squats. The knee joint is found to collapse during one-legged squats.

Hip Stability and PFPS

The functional or dynamic malalignment of the knee joint we explained in the previous paragraph was found to be caused by impaired hip stability rather than an internal knee problem. Patients with PFPS are found to have increased internal “medial” rotation of the femur. This is caused because of a weakness of the hip external rotators and abductors “gluteus medius and gluteus minimus muscles.”

Therefore, in the physical examination of a patient with PFPS, one expects to find a decrease in the strength of hip abduction and external rotation. Another examination technique is to ask the patient to stand on one leg for one minute. If the patient fails to stabilize the pelvis while standing on one leg, the leg the patient is standing on is affected and is believed to have weak hip muscles.

Rear-foot Eversion and PFPS

Patients with PFPS also have abnormal foot mechanics. The tibia is also internally rotated while standing and walking in patients with PFPS, which again gives the impression of a more lateralized patella. The internal rotation of the tibia is caused by rear-foot eversion; therefore, the presence of rear-foot eversion is associated with a higher risk of PFPS.

Hamstring Imbalance in PFPS

Most of the previous evidence about the pathology of PFPS was concerned with abnormal frontal plane knee motion. Patients with PFPS also have abnormal hamstring tightness. Patients with PFPS have more pronounced and earlier contraction of the lateral hamstring muscle compared to the medial one. An imbalance between the hamstring muscles is associated with increased stress on the patella, patellar tracking, and eventually PFPS.

Knee-Spine Syndrome

Older patients with PFPS might have a decrease in the sacral inclination angle. This finding is not seen in younger patients with PFPS; therefore, the role of spinal abnormality in PFPS in your typical young female patient is not established.

Psychological Factors and PFPS

Anxious patients are more likely to complain of knee pain and PFPS compared to healthy subjects. Additionally, patients with PFPS are more likely to avoid sports and daily activities because of the fear of pain, which can have drastic impacts on the general wellbeing of the patient.

Trigger of PFPS

Patients with the previous abnormal patellofemoral mechanics develop pain and PFPS when they overuse the knee joint. This can happen when the patient undergoes high-intensity training.

Risk Factors of the Patellofemoral Pain Syndrome

The factors that may lead to PFPS include the following:

- **Sex of The Person:** Patellofemoral pain is twice as common in women than it is in men. The reason for greater occurrence in women may be the angle between the bones meeting at the knee joint. This angle is greater in women because of wider pelvis.
- **Age of The Person:** PFPS is usually associated with young adults and adolescents. With older patients, arthritis is the common cause of knee-related conditions.
- **Some Types of Sports:** Partaking in certain sports can also cause PFPS. Running sports, for example, can result in additional stress on the knees, particularly after one has recently increase their training level.

Treatment of the Patellofemoral Pain Syndrome

When a patient is diagnosed with PFPS, the treating physician usually faces a dilemma. As this is a diagnosis based on exclusion, should one go for surgical intervention or simple conservative management? The answer to this question can be obtained from the current literature about the different treatment options for PFPS. The addition of a surgical intervention to the physiotherapy program was deemed not superior to physiotherapy or conservative therapy alone; therefore, it is not recommended to perform any surgery on the patient with PFPS.

Non-steroidal anti-inflammatory drugs are usually ineffective in the management of PFPS. Taping is helpful as it can prevent the lateral tracking of the patella. Taping should be combined with physiotherapy and rehabilitation. Patella braces might be useful in the management of PFPS, but more research is still needed. Patients with foot disorders in combination with PFPS might benefit from a foot orthosis in addition to taping and physiotherapy.

The only treatment that is proven to be very effective in the management of PFPS is strengthening exercises of the hip muscles, trunk stability, quadriceps, and hamstrings.

This treatment is evidence-based and is also supported by our current understanding of the pathogenesis of PFPS.

Prognosis of the Patellofemoral Pain Syndrome

Majority of patients respond well to suitable physiotherapy. Patients usually take many weeks to return to normal levels of functionality. Rehabilitation time is considerably longer with some cases. With all patients with PFPS, early physiotherapy plays a significant role in reducing recovery time.

References

Petersen W, Ellermann A, Gösele-Koppenburg A, et al. Patellofemoral pain syndrome. *Knee Surgery, Sports Traumatology, Arthroscopy*. 2014;22(10):2264-2274. doi:10.1007/s00167-013-2759-6.

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