Focus On
Patellar Tendinosis

Introduction
‘Jumper’s knee’ or patellar tendinosis is a common condition affecting athletes with an incidence in this subpopulation of 13% to 20%. It is particularly prevalent in sports involving jumping and heavy landing, rapid acceleration or deceleration and kicking, such as basketball, volleyball, soccer, tennis, long jump and high jump. It has a tendency to become chronic and, in elite athletes, the incidence of having to retire from their sport is as high as 53%. By comparison, injury is known to be the main reason for ending the careers of elite athletes in only 20% of cases. Long-term studies have also shown that symptoms can persist for many years although do not typically affect a patient’s work or leisure activities once they have retired from elite sport.

There are both intrinsic and extrinsic factors that are thought to contribute to the development of jumper’s knee. Extrinsic factors include training frequency, intensity of training, playing surfaces that are hard, and footwear. Intrinsic factors include a variety of physical parameters within the athlete themselves that are thought to contribute to the development of this condition, such as patellar height, malalignment, limb length discrepancy, muscular imbalance or a combination of these. Most of the studies suggesting that these parameters may be causative are retrospective. A prospective two-year study of 138 students entering a sports programme found that the only significant determining factor was muscular flexibility. Recently, patellar morphology has been thought to play a role with several authors suggesting that impingement of the inferior pole of the patella on the dorsal fibres of the patellar tendon may be responsible. Other studies have shown an elongation of the non-articular portion of the inferior pole which could also be causative, although this may be a traction or secondary phenomenon.

The traditional theory of patellar tendonitis was one of an inflammatory process secondary to tensile forces. More recently an impingement model of patellar tendonitis was proposed by Johnson, Wakeley and Watt based primarily on the location of the tendon lesion found on MRI studies. Other imaging studies and histological retrieval specimens have also shown that the pathological tissue is limited to the dorsal fibres of the proximal insertion of the patellar tendon. Schmid et al performed MRI scans of knees in varying degrees of flexion and demonstrated that the angle between the patella and patellar tendon changed from 157° to 145° during flexion with a maximum angulation between 50° and 70° of knee flexion. Hamilton and Purdam proposed that patellar tendinosis is actually an adaptive process secondary to impingement and compressive forces at approximately 60° of knee flexion rather than a degenerative or inflammatory process from tensile forces.

Histopathology
Alfredson et al used a microdialysis technique to show that there were no inflammatory cells in patellar tendinosis but high levels of the neurotransmitter glutamate, suggesting that this may be a source of the pain associated with patellar tendinosis. Several studies have examined excised tissue in the region of the insertion of the patellar tendon into the inferior pole of the patella. The tendon is often expanded in this area with loss of demarcation of the collagen bundles and an increase in mucoid degeneration, intratendinous calcification, fibrinoid necrosis and features of tendinosis. Inflammatory cells are not typically seen. The histological changes also include elevated high-molecular-weight proteoglycans and type III collagen which Hamilton and Purdam further suggest is more consistent with compressive loads and adaptive changes.

Classification
Blazina et al proposed a classification for jumper’s knee in six stages according to symptoms, which can be used to guide treatment options; this has been modified by Roels et al as seen below.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No pain</td>
</tr>
<tr>
<td>1</td>
<td>Pain only after intense sports activity; no undue functional impairment</td>
</tr>
<tr>
<td>2</td>
<td>Pain at the beginning and after sports activity; still able to perform at a satisfactory level</td>
</tr>
<tr>
<td>3</td>
<td>Pain during sports activity; increasing difficulty in performing at a satisfactory level</td>
</tr>
<tr>
<td>4</td>
<td>Pain during sports activity; unable to participate in sport at a satisfactory level</td>
</tr>
<tr>
<td>5</td>
<td>Pain during daily activity; unable to participate in sport at any level</td>
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</tbody>
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Imaging
Both ultrasound and MRI have been described for the diagnosis of patellar tendinosis. Ultrasound has traditionally been used to...
image tendons and reveals consistent findings in patellar tendinitis.\(^{17}\) The tendon reveals an area of hypoechogenic signal change and increased thickness corresponding to the area of clinical tenderness.\(^6\) Colour Doppler examination is a useful adjunct as it has been shown to identify vascularity and neovessels in the area of structural change.\(^{18,19}\) MRI has also been shown to identify a signal defect in the proximal patellar tendon and increased thickness in the tendon.\(^{20-22}\) However, there is some disagreement within MRI studies over what lesions represent pathology or normal variants; asymptomatic patients can also have reportedly unequivocal findings on MRI.\(^{23,24}\)

**Management**

Patellar tendinosis is typically managed conservatively in the early stages. Non-operative management includes activity restriction or modification, ice, anti-inflammatories, eccentric stretching, massage or taping. Bahr et al.\(^{25}\) have performed one of the few randomised controlled trials of operative versus conservative management of patellar tendinosis. They found that both groups showed significant improvements over a twelve-month period although there was no statistical significance between the two groups. A further, successful conservative measure is sclerosant injections under ultrasound guidance. Alfredson et al.\(^{26}\) published good clinical results in 12 out of 15 tendons. All patients were found to have evidence of neovascularisation inside and outside the dorsal part of the proximal patellar tendon on Doppler ultrasound and were treated with an injection of sclerosant under ultrasound guidance. Subsequent imaging showed a reduction or complete loss of the neovascularisation; this correlated with good outcomes over a four- to six-month period. Similar results have been seen with Achilles tendinopathy.\(^{27,28}\) Because of the long period of time needed to realise good results, a series of arthroscopically-treated cases was subsequently published.\(^29\) In this series of 15 patients, arthroscopic shaving of the dorsal tendon was performed and no additional bony procedure unless there was an osteophyte on the inferior pole. Patients were able to return to sport within two months in the majority of cases.

There are multiple open surgical procedures for patellar tendinosis described but the most common involves an open excision of the diseased portion of the patellar tendon. Treatment of the paratenon greatly varies, as does post-operative immobilisation. In addition, some surgeons have described drilling, debridging or excising the distal pole of the patella.\(^{30-32}\) Kaeding, Pedroza and Powers performed a recent systematic review of patellar tendinosis debridement, or both. These studies have all reported success rates in terms of symptomatic improvement >85%. Coleman et al described a return to sports of only 46% in their series.\(^35\) Two other studies showed a return to the previous level of sporting function of >85%\(^{29,37}\) and one did not report on this.\(^36\) Time to return to sport was reported as between two and six months in these studies.

**Summary**

Patellar tendinosis is a common condition that has proven difficult to explain in terms of its aetiology and the best way in which it should be managed. Understanding of this condition has evolved from models proposing inflammatory and degenerative tendinosis created by tensile forces to a concept of impingement and compressive forces resulting in neovascularisation of the dorsal proximal pole of the patella tendon. Conservative management should be employed in the early stages, including activity modification and eccentric strength training. Sclerosing injections have also been proven successful. Surgery that is directed to either the tendon or the inferior pole of patella can yield satisfactory results. Arthroscopic surgery appears to provide results that are as good as open surgery, but with reduced morbidity and a more rapid return of function.

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**References**


