

Knee Cap or Patella Pain

*Prepared for our Patients:
by Gary Savatsky, MD
Orthopedic Spine and Sports Medicine Center*



Kneecap or patella pain can occur in any age group but is most common in Pre-teens and adolescents. The pain is most frequently described as located in front, deep inside, or underneath the kneecap. It can also be felt at the sides of the patella or even in the back of the leg, behind the knee itself.

Once present, patella pain is usually aggravated by sitting for extended periods of time, by walking stairs or by kneeling or squatting. When rising from a seated position the knee may feel very stiff and even buckle or collapse. During athletics the pain may become more intense, but frequently discomfort may present two to three hours after the end of athletics.

What causes kneecap pain?

Kneecap pain frequently presents in individuals with high activity levels. Patella pain commonly occurs in athletes who participate in sports that demand a great deal of running,

frequent jumping or extensive kneeling. Examples of these sports are soccer, track, basketball, volleyball and the position of catcher on a baseball team.



At times, however, patella pain may arise without any unusual source of stress or increase in activity levels. In the past, such non-athletic episodes of knee pain in children were attributed to “growing pains” which are thought to result from changes in the relationship between the length of muscles and bones in rapidly growing children. In adults, the sudden onset of patella pain in the absence of any unusual stress may arise from early degenerative changes, which spontaneously develop on the joint surface of the patella and then suddenly produce discomfort.

Lastly, patella pain may result from a direct blow to the kneecap, injuring the joint surface and making the knee cap more sensitive to the very large stresses that are normally transmitted by this small joint.

Whether as a result of athletic stress, a direct blow to the kneecap, early degeneration of the patella surface, or changes in the lengths of muscles and bones in growing children, patella pain can almost always be successfully treated.

How do these stresses and changes in the patella surface result in pain?

Athletic stress, injury or joint degeneration lead to knee cap pain through a peculiar characteristic of patella movement, the tendency of the knee cap to push to the outside of its joint during bending or straightening of the knee. This lateral patella pushing arises from the fact that the knee cap's top muscular tendon, strong bottom tendon and the knee cap itself form an angle, called the "Q Angle", [as shown below in figure one]. The size of the "Q Angle" varies from person to person, measuring on average between twelve and twenty five degrees. The greater the size of the "Q Angle" the more forcibly the patella will be pushed laterally in its joint.



Figure 1. Shows the angle [called the Q angle] produced by the attachments of the top and bottom tendons on the patella, or kneecap. This angle produces an outside pushing force [or valgus vector] on the cap.

When the joint is seen from underneath [as depicted below in figure two], the lateral pushing force of the Q Angle tilts the kneecap in its groove. Tilting of the kneecap concentrates the joint forces on the outer half of the patella, rather than distributing the pressure evenly over the entire patella surface. Patella tilting in this manner leads to abnormally high concentrations of joint pressure which in turn results in the typical patella pain we are treating.

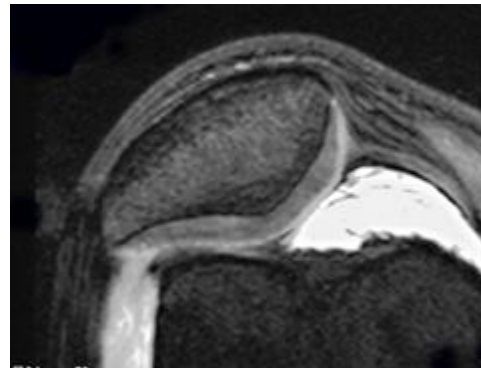


Figure 2 Shows the kneecap tilting to the right [outside], concentrating the joint forces on only one side of the patella. This produces the characteristics of patella pain.

Running and activities of flexion, such as stair climbing, squatting and jumping, are generally very stressful to the kneecap. These exercises can generate large forces across the patellofemoral joint that may momentarily exceed *six to eight times body weight*. A 125 pound teenager, for example, running up a flight of stairs can generate over eight hundred pounds of force across his or her kneecap. *One can easily appreciate how in even a normal joint, the concentration of these large forces on only one side of the patella can produce pain, or how lesser amounts of tilting or stress may produce discomfort if the joint surface has been damaged by direct injury, arthritic degeneration, or inflammation.*

In summary, the unique alignment of each individual's kneecap work in concert with varied stresses, injury and surface degeneration to produce characteristic knee cap pain and limitation.

The “natural history” or what happens to patella pain over time

Patella pain can be successfully treated in the great majority of individuals with a conservative program of activity modification and strengthening. Eighty five percent of all cases of adolescent kneecap pain will resolve entirely by the time that the patient reaches his or her early twenties. In addition, in the absence of severe joint injury, patella pain will almost never develop into significant arthritic problems later on in life. Kneecap pain is in general a “self limited” problem.

In only a few patients, particularly those whose knee cap pain has occurred as the result of severe injury or advanced degeneration, may some degree of patella discomfort persist despite treatment. Even in these cases, however, surgery is rarely indicated and treatment remains based on the conservative principles of exercise and common sense activity modification.

How is patella pain treated?

The characteristic alignment, or tilt of the patella can be dramatically improved by strengthening the front thigh, or quadriceps muscles. Though the quadriceps' major function is to extend, or straighten the knee, these muscles also hold the kneecap centrally in its groove, counter balancing the effects of the patella's “Q Angle”. Strong quadriceps muscles reduce kneecap pain by effectively reversing lateral patella tilt, which in turn distributes the joint forces more evenly across the entire patella surface.

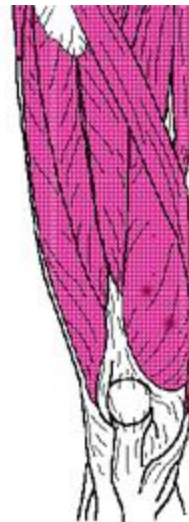


fig 3 quadriceps muscles

The performance of any program designed to strengthen the quadriceps produces momentary increases in kneecap pressure. This unwanted by-product of quadriceps strengthening can, at times, lead to an aggravation of patella inflammation and pain. To reduce the effects of exercise on the kneecap, we prescribe a limited “closed chain” program. A “closed chain” quadriceps program comprises a series of exercises, which exerts the least possible force across the inflamed patella surface during strengthening. These exercises center largely on the use of an exercise bike, wall slides and if available, the leg press machine. Swimming, though generally inconvenient, is another excellent exercise.

Exercises that produce high loads across the knee cap, such as leg extensions, full squats, step aerobics and the use of stair equipment should be avoided by individuals with significant kneecap dysfunction. Running, or aerobic walking, though

good cardiac exercises, unfortunately strengthens predominantly the back thigh, or hamstring muscles, and offers little in the way of patella improvement.

Lastly, in certain individuals the kneecap can become so inflamed and painful that even a properly instructed closed chain program cannot be tolerated. In this situation the patient should be started on a supervised program at an approved physical therapy center until he or she is comfortable carrying out an effective home program.

A conservative trial of exercise may last up to four to six months. During this period we encourage our patients to participate in activities of their choosing, using comfort as a common sense guide to participation.

Besides exercises, is there anything else to help reduce knee cap pain?

In addition to exercises, a patella brace [figure 4] may be helpful in assisting the quadriceps to hold the kneecap centrally in place.

Occasionally orthotics [or arch supports] may also be prescribed for patients with kneecap pain in combination with severe hind foot pronation, or flat feet.



Figure 4

Lastly, since kneecap pain may take months to fully resolve, some level of activity modification is usually considered helpful in reducing patella discomfort. We may suggest, for example, that a softball catcher instead play first base, that a basketball player eliminate rebounding drills during practice, or a jogger to alternate his running program with swimming or biking. In an effort to reduce patella stress in a work environment, an accommodation may involve advising a mechanic whom frequently squats and kneels to use a stool or low seat instead.



figure 5

In summary, the treatment of patella pain is best treated conservatively, based on the concepts of strengthening, bracing and activity modification. In those patients who have failed all conservative treatments and whose pain is felt to arise from an abnormally high Q angle, an operation to improve patella alignment can be helpful. Patella Pain Syndrome can at times be frustrating, but the eventual outcome, that of a strong comfortable knee is attainable and worth pursuing.