Patellofemoral Joint
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The patellofemoral joint is located in the hind leg of a canine and plays a key role in dynamic mobility. This joint enables the dog to sit, walk, run, jump and move about in all directions. The patellofemoral joint, in combination with other joints of the knee, allows the dog not only to bend its hind legs, but provides shock absorption. This joint is one of the most important joints in a canine’s body. It plays an essential part in carrying the body weight in a forward motion, such as running and walking, and in vertical directions such as jumping. The purpose of this paper is to explain the biomechanics of the patellofemoral joint in the canine and to illustrate some common problems often caused by abnormalities in this joint.

WHAT IS THE JOINT MADE UP OF? WHERE IS IT CONNECTED?

The knee joint or stifle is one of the most complicated joints in a canine’s body. Consisting of three bones, the thigh bone (femur), the shin bone (tibia) and the kneecap (patella) all which make-up two joints, the tibiofemoral and patellofemoral joints.

The patellofemoral joint is made up of the patella and the groove in the concave region at the lower end of the femur known as the trochlear groove. The trochlear groove is cartilage-covered and it is in this
The patella is a somewhat rounded triangular shaped bone, located cranially to the joint and is the largest sesamoid bone in the body. The patella is embedded in the femoral quadriceps tendon and at the bottom of the tendon, below the patella; it becomes the patellar ligament attaching to the tibia at the tibial tuberosity. (See figure below)

![Patellar Joint Diagram](http://www.vetnext.com/images/z/73334160554%20225.jpg)

**DESCRIBE THE CARTILAGE ENDS OF THE JOINT**

Cartilage is a thin, elastic tissue that protects the bone and makes certain that the joint surfaces can slide easily over each other. In the knee joint, it ensures supple knee movement. “Cartilage on the undersurface of the patella is the thickest of any found in the body. This thick joint cartilage acts as a cushion, absorbing shock in the greatest weight bearing joint in the body during the process of deceleration.” The entire system is constantly lubricated by synovial joint fluid to help reduce friction. It works so that there is total freedom of motion between the structures.

**ACTION OF THE JOINT**

The patellofemoral joint is a gliding synovial joint. The strong quadriceps muscle in the front of the thigh helps to extend the knee joint while in the back of the thigh; the hamstring muscle helps to flex the knee joint. During this complex interaction of muscle, ligaments and tendons, the patella glides smoothly across the trochlear groove on the femur. The patellofemoral joint must be mobile enough to allow for a smooth gliding action, yet at the same time constrain the patella enough so that it does not deviate from within the groove.
WHAT WILL IT LOOK LIKE IF IT WAS OUT OF ALIGNMENT

Imagine a dog running across the grass, chasing a ball or jumping to catch a Frisbee, when all of a sudden he yelps in pain and pulls his hind leg up off the ground. He starts limping around for a few minutes and may be seen shaking and extending his leg before regaining use of it. This happens often, causing a brief bout of skipping or lameness, so much so that the dog sometimes doesn’t notice. Other times a dog may be affected much more severely, holding their leg up for days and exhibiting significant discomfort. This affliction is likely caused by an abnormality involving the patellofemoral joint that plays a key role in the canine’s mobility. Problems with the patellofemoral joint are particularly noteworthy. According to the American College of Veterinarian Surgeons, “Patellar luxation is one of the most common orthopedic conditions in dogs, diagnosed in 7% of puppies.”1 It is a condition that is widely believed to be genetically inherited.

Patellar dislocation or subluxation is a condition where the patella slides outside of the trochlear groove when the knee is flexed. In some dogs, because of malformation or trauma, the ridges forming the patellar groove are not prominent, and a too-shallow groove is created. In a dog with shallow grooves, the patella will luxate (jump out of the groove) to the inside (medially) or to the outside (laterally). “In young puppies with severe medial patellar luxation, the rear legs often present a “bow-legged” appearance that worsens with growth. Large breed dogs with lateral patellar luxation may have a “knocked-in knee” appearance.”3 When the patella luxates from the groove of the femur, it usually cannot return to its normal position until the quadriceps muscle relaxes and increases in length. This explains why the affected dog may be forced to hold his leg up for a few minutes or so after the initial incident. While the muscles are contracted and the patella is luxated from its correct position, the joint is held in the flexed or bent position. This misalignment depicting the patella outside of the patellar groove can be seen on X-ray, MRI, CT scan and palpation during an orthopedic examination. Patellar subluxation can often lead to complex skeletal abnormalities, malformation of the leg bones and abnormal alignment of the hips are often seen.
IS THE PROBLEM MORE COMMON IN SOME BREEDS

“Patellar subluxation is quite common in Pomeranians, dachshunds, toy and miniature poodles, Yorkshire terriers and Boston bulldogs. It is also seen occasionally in Boykin spaniels, cocker spaniels, chow chows, Belington terriers, Australian terriers, Japanese chin, shar-pei, mi-ki, Lhasa Apsos, Tibetans spaniels, Tibetan terriers, and Labrador retrievers (more or less in that order of frequency).” 4    Research indicates that patellar problems in larger dogs appear to actually start out as hip problems. There is an excellent article titled “The Luxating Knee” found at http://www.offa.org/pl_overview.html (Orthopedic Foundation for Animals website) which explains in depth the tendencies toward subluxation among breeds and how the symptoms are exhibited in each case.
WHAT SYMPTOMS OR ISSUES WOULD BE EXHIBITED OR LOOK LIKE

Symptoms associated with patellar luxation vary greatly with the severity of the disease or extent of trauma. Symptoms exhibited may also depend on how long the problem has existed. When the patella luxates the dog will pull the limb off the ground. When it returns to its normal position in the trochlear groove, the dog will place normal weight on the affected limb. Owners will occasionally describe a popping noise in their pet’s knee or will be able to feel the instability in the knee cap when touching their pet’s back legs. Most dogs do not seem to experience much pain when the patella luxates, they simply not use the limb with the patella outside of its normal position. Most owners just notice that their pet begins to occasionally skip when it runs. Then, after a few steps, the leg usually returns to normal and the dog seems unconcerned. “Those most severely affected may not even use their rear legs, walking by balancing themselves on their front legs like a circus act, holding their hindquarters completely off the ground.”

WHAT TECHNIQUES WOULD BE EMPLOYED TO REBALANCE OR FIX IT

Surgical treatment is not necessary in every individual with this condition, however research indicates that surgery is usually the treatment of choice. Surgery can alter both the affected structures and the movement of the patella. Some of the more common procedures are:

Trochlear modification - The groove at the base of the femur may be surgically deepened to better contain the knee cap.

Lateral imbrication - The knee cap itself may be "tied down" laterally (on the outside) to prevent it from deviating medially (toward the inside.)

Tibial crest transposition - The bony protuberance at the site of the attachment of the quadriceps tendon on the tibia may be cut off and then re-attached in a more lateral position, or more medial position.

Research indicates that all of these procedures work well and the type performed depends on the individual case and the clinician. Depending upon the procedure, dogs usually respond well and should completely recover within 30-60 days. “Most vets suggest that beginning three weeks or so after surgery, physical therapy, swimming, hydrotherapy and range of motion exercises should begin to help prevent muscle contraction and reluctance to use the leg.”

There was more information pertaining to alternative treatments for humans with patellofemoral issues than there were for canines. However, I did find one website which was remarkable similar in its treatment protocol for canines. They recommended regular exercise such as walking and hydrotherapy to strengthen the canines quadriceps muscles, and suggested massage to increase muscle tone for flexibility around the joints. The muscles and ligaments that surround the patellofemoral joint must work together to bring stabilization to the joint and maintain normal patellar motion. Deep stroking massage increases blood flow and helps relieve discomfort and tightness in muscles surrounding the patellofemoral joint. Compression, joint mobilization, rocking and positional release increase flexibility in joints and strengthen tendons and ligaments at the sites of attachment.
CONCLUSION

The patellofemoral joint is a complex significant joint in the canine body. It is crucial to a dog’s health and well being. When this joint is afflicted through trauma or other inherited defect, it brings not only great discomfort to the dog, but greatly inhibits the dog’s mobility. Often times the joint is so badly impaired that it requires surgical intervention. However, as usual, proper nutrition and a physical strength and conditioning regime can maintain a canine’s muscles, ligaments, tendons and bones to help the joint remain stabilized. Should the joint become afflicted or surgery be performed, massage therapy is a great adjunct therapy/modality to bring back optimum functionality and performance to the joint.

Notes

American College of Veterinarian Surgeons (https://www.acvs.org/small-animal/patellar-luxations)

Knee Extensor Mechanism Problems Are You Weak in the Knees? (http://www.hughston.com/hha/a.extmech.htm)

American College of Veterinarian Surgeons (https://www.acvs.org/small-animal/patellar-luxations)
Knee Problems In Your Dog (http://www.2ndchance.info/patella.htm)


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http://www.fleetfiretimbers.com/FFT/Articles/PhysicalTherapyForDogsProneToLuxatingPatellas.htm

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Patellar Luxation (http://www.nashvillevetspecialists.com/specialties/surgery/common-medical-conditions/patellar-luxation/)

Luxating Patella (http://en.wikipedia.org/wiki/Luxating_patella)

Stifle Joint Anatomy (http://www.orthopets.com/stifleanatomu.htm)

Dog Anatomy and Coloring Atlas, by Robert A. Kainer, DVM, MS and Thomas McCracken, MS

http://www.fleetfiretimbers.com/FFT/Articles/PhysicalTherapyForDogsProneToLuxatingPatellas.htm