

VETLESSONS



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THE CAUSE AND CONSEQUENCES OF PATELLAR LUXATION IN DOGS

WHAT IS PATELLAR LUXATION? *Patella* is the Latin name for kneecap, and luxation is another name for dislocation. Patellar luxation means the kneecap dislocates completely and *subluxation* means it doesn't track perfectly. Patellar luxation is a complex condition which involves at least 15 chromosomal regions.

HIGH-RISK BREEDS Patellar luxation is becoming more common due to the growing popularity of breeds with a high-risk conformation. The commonest form is medial patellar luxation (MPL). It typically affects dogs with short, bowed hindlimbs. Bulldogs are a notable example; however, not all affected dogs have obvious conformational problems. For instance, Pomeranians typically have less hindlimb bowing compared with bulldogs, but they have the highest reported risk, with up to 75% having patellar instability. The consequence of selective breeding for bowed hindlimbs is that the patellae usually dislocate towards the inside of affected knees. This is called medial patellar luxation (MPL). On the rare occasions when lateral patellar luxation (LPL) is diagnosed, it's typically associated with a 'knock-kneed' conformation in a large or giant dog.

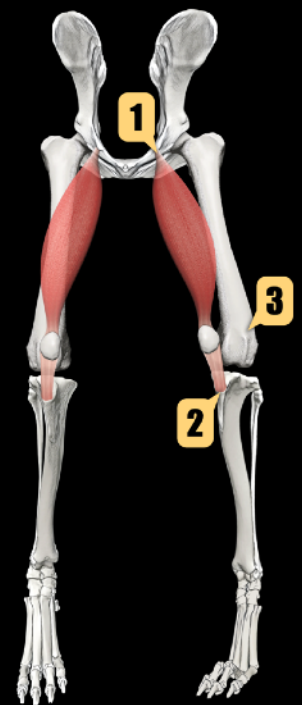


IMAGE 1 Typical skeletal deformities, with a normal limb shown for comparison. Note that inherited (genetic) deformities typically affect both sides. **1.** Medially displaced rectus femoris origin; **2.** Tibial torsion; **3.** Femoral torsion and bowing.

ANIMATION 1 Altered pelvic conformation triggers a cascade of bony deformities. [Watch on YouTube](#)

MALES VERSUS FEMALES In humans, the wider pelvis of females increases the angle formed between the rectus femoris muscle (part of the quadriceps) and the knee joint. This triggers a cascade of developmental bone deformities termed the '*miserable malalignment syndrome*'. It's highly likely that the canine condition, which is also more common in females, has a similar underlying cause. Although females are predisposed, the impact of breed on pelvic conformation is more profound than the effect of gender. This explains why female greyhounds have a very low risk, while male Pomeranians have a very high risk. Small

changes in quadriceps muscle alignment produce profound increases in medially-directed vector forces. In predisposed puppies, these abnormal forces frequently trigger a severe form of 'miserable malalignment'.

IS LUXATION PAINFUL? The commonest sign of patellar luxation is limping, which can be intermittent or constant. Limping is caused by abnormal joint mechanics, pain, or a combination of both. Many affected dogs skip for a few steps, then spontaneously return to normal. In these individuals, it's likely (but not certain) that limping is caused by abnormal joint mechanics. How can we determine if limping is caused by pain? Signs of chronic pain include frequent or constant lameness and reduced exercise tolerance. These signs could indicate a debilitating condition which mirrors **patellofemoral pain syndrome** in people. Unlike humans, dogs can neither verbalise their discomfort nor alleviate their own suffering. Excellent tools are available to help people recognise signs of chronic pain in dogs. The **Liverpool Osteoarthritis in Dogs (LOAD)** pain metric is a free user-friendly resource which has been extensively clinically tested.

IS SKELETAL MATURITY IMPORTANT? Skeletal maturity occurs when the size, shape and mineralisation of bones can no longer change. Claims that dogs don't reach skeletal maturity until 18 months have become popular despite an absence of supporting scientific evidence. **Many studies show growth ceases between 8 and 14 months of age.** In most breeds, residual growth after 8-months is <10%. Importantly, the magnitude of progressive deformity depends on residual growth after the patella dislocates. Thus, luxation occurring after 8-months cannot trigger a cascade of severe deformities. Consequently, surgery performed in adults doesn't have the potential to mitigate severe limb deformities and, contrary to popular opinion, **surgery doesn't reduce the risk of clinically important arthritis.**

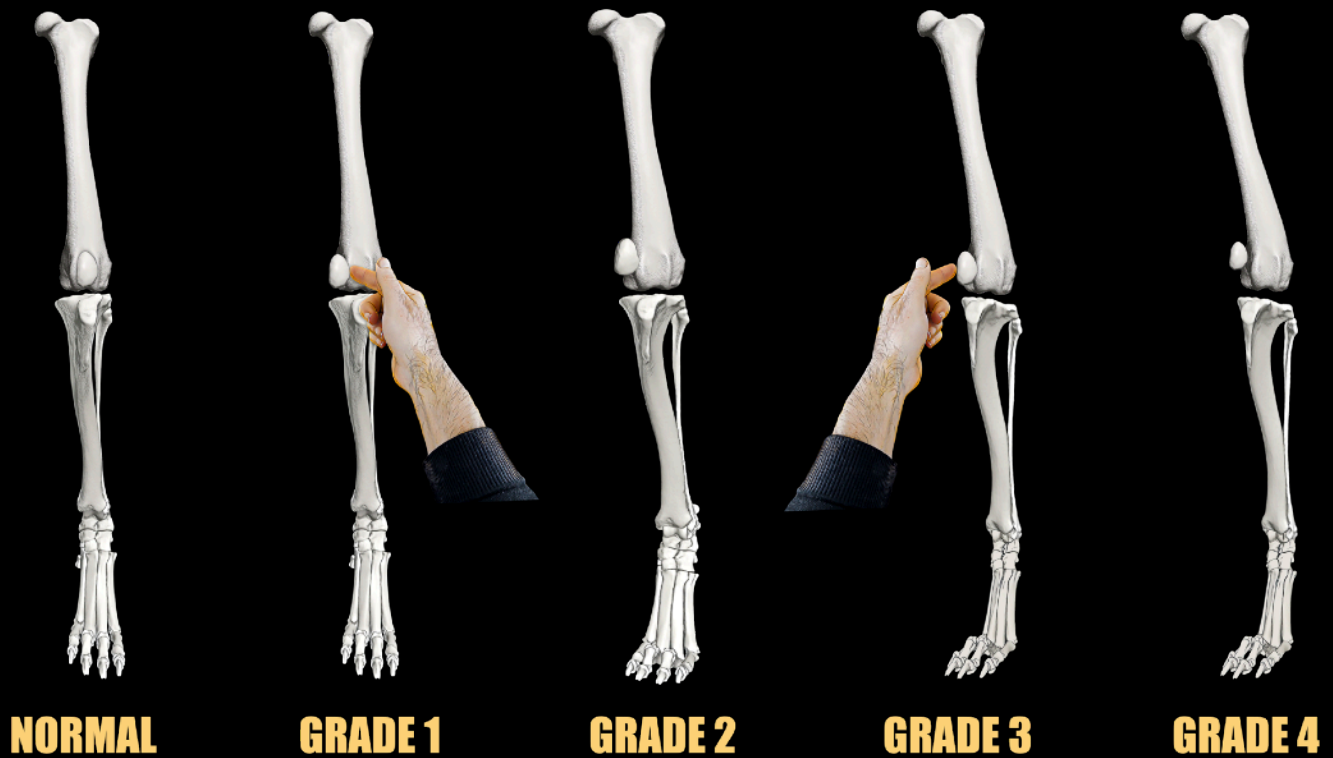


ANIMATION 2 This animation depicts patellar groove development in a growing puppy. A deep groove develops when the patella is central. A normal groove won't develop if the patella luxates before the growth spurt from 2 to 8 months of age. **Watch the animation on YouTube.**

IS SURGERY INDICATED IN PUPPIES? The earlier luxation occurs, the greater the degree of deformity. Bowing and twisting of the thigh bone (femur) and shin bone (tibia) dramatically impact knee joint mechanics. Importantly, normal patellar groove development relies on central alignment relative to the femur. Early luxation causes patellar groove dysplasia. The consequence in many affected puppies is a flat or convex surface contour. Early surgical intervention in growing puppies limits or reverses 'miserable malalignment' and groove

dysplasia. In children, where recurrent patellar dislocation is associated with less profound deformities, surgical management is also considered the gold standard.

IS SURGERY INDICATED IN ADULTS? Surgery is indicated for adult dogs if it's the best option to treat a clinically important problem *at the time of diagnosis*. This animation shows medial patellar luxation (MPL) grading. [Tap here to play the animation on YouTube.](#)



ANIMATION 3 The 4 grades of MPL **0**: Normal patellar tracking; **1**: The patella can be manually dislocated but returns to a normal position when released. Affected dogs aren't lame; **2**: The patella dislocates spontaneously when the stifle is flexed or extended. Reduction is possible by extending the knee or applying lateral pressure to the patella. A torsional deformity of the tibia is typical; **3**: The patella is permanently dislocated but can be manually reduced. It spontaneously dislocates if lateral pressure is released. Severe bony deformities are typical; **4**: The patella is permanently dislocated and cannot be reduced. [Watch the animation on YouTube.](#)

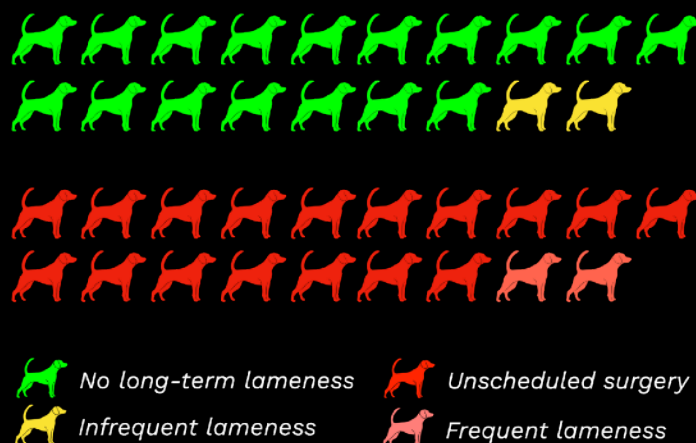
Luxation grade is influenced by examiner experience and chance. For example, a patella might be luxated 90% of the time (grade 3), but spontaneously reduces immediately before the exam (grade 2). This explains why experienced clinicians are very accurate at assigning a binary grade (94% agreement for normal versus abnormal), but [disagree 35% of the time when using the 5-point classification.](#)

Grade and clinical importance are related. In grade 1 MPL, the patella doesn't spontaneously dislocate, so surgery isn't indicated. In contrast, grades 3 and 4 MPL consistently cause lameness, so surgical treatment is justifiable. The ideal management of grade 2 MPL is controversial. This grade covers a broad spectrum of clinical relevance. Some dogs

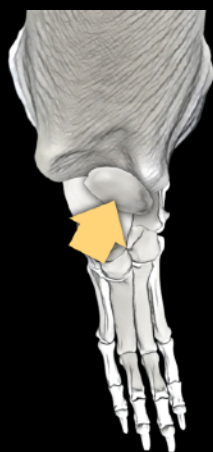
demonstrate frequent or constant lameness, while others have infrequent lameness or no lameness at all. Consequently, for adult dogs with grade 2 MPL, the decision to operate is usually made based on the frequency of lameness episodes. For example, lameness occurring once every year would be managed non-surgically, while constant lameness would be managed surgically. Lameness can worsen over time in dogs with cartilage ulceration or in dogs affected by concurrent cranial cruciate ligament (CCL) injury. **Only grade 4 MPL significantly increases the risk of subsequent CCL injury**, but it's important to remember that the relationship between MPL and CCL injury is two-way. **Concurrent CCL disease is especially common in large breed dogs, with a reported incidence as high as 42%.**

IS SIMULTANEOUS SURGERY ON BOTH KNEES JUSTIFIABLE? Dogs often have two affected knees (bilateral MPL), but only limp on one side. Rationalising surgical treatment is difficult if patellar luxation isn't clinically important at the time of diagnosis. In this scenario, performing surgery means accepting the rehabilitation, risk, and cost of an operation which might be unnecessary.

One study assessed the long-term outcome for dogs with bilateral MPL and unilateral lameness. Thirty-eight dogs underwent unilateral surgery and long-term monitoring for contralateral lameness. After a minimum follow-up of 4-years, 17 dogs remained normal, and 2 had infrequent lameness. Nineteen dogs developed chronic lameness, which was treated surgically in 17 cases.



Based on the results of this study, owners of dogs with unilateral lameness and contralateral grade 2 MPL should ask themselves, "How much future risk is worth my pet enduring bilateral surgery instead of unilateral surgery?" The 50% long-term risk shown in this study must be carefully weighed against increased short-term risks. Although differences are not statistically significant, overall complication rates are higher in dogs having simultaneous versus staged bilateral surgery. **Major complications triggering surgical revision are reported in ~1 in 6 dogs who undergo simultaneously bilateral surgery.**



DO DOGS SUFFER FROM PATELLAR MALTRACKING? The increasingly popular French bulldog is predisposed to a condition which appears very similar to patellar maltracking in humans, albeit with medial maltracking (humans tend to track laterally). Affected individuals have a characteristic intermittent skip, but their veterinary exam reveals apparently normal patellar tracking. In these dogs, digital pressure applied to the patella often induces a pain response which might signify cartilage ulceration. Diagnosis can be challenging, even for specialists. **Watch the animation on YouTube.**

SHOULD WE COPY HUMAN PHYSIOTHERAPY PROTOCOLS?

Do the similarities between canine and human patellar maltracking justify similar treatment protocols? In humans, lateral maltracking without dislocation is treated with physiotherapy. Although there are similarities between canine patellar subluxation and human patellar maltracking, there are also critical differences. Typical bony deformities in affected dogs would be considered extreme in humans. Typical bone deformities in humans with first-time patellar dislocation or patellar maltracking can be overcome with targeted physiotherapy. In humans, recurrent dislocation is defined as two or more episodes of patellar dislocation. In dogs, patellar luxation often involves two or more episodes *every hour*. In human healthcare, selective strengthening of the vastus medialis oblique (VMO), knee bracing, and taping are all supported by **high-quality evidence**.



In contrast, it's difficult to see how selective strengthening of the canine vastus lateralis could be achieved without unwanted strengthening of the rectus femoris. The latter would significantly worsen patellar maltracking. The benefit of knee taping in humans relies on increased confidence because people are aware of the treatment goal. As dogs can't understand the treatment goal, taping is unlikely to add anything other than the constant irritation of sticky tape tugging on their furry skin. Skipping French bulldogs with suspected patellar maltracking are ideal candidates for specialist surgical referral.

WHAT ARE THE ADVANTAGES OF SURGERY? In human healthcare, physiotherapy programmes for recurrent patellar dislocation are consistently outperformed by surgery. For example, in a 2020 meta-analysis of 654 patients, surgery significantly reduced the odds of persistent patella instability and re-dislocation. At the time of writing, there are no controlled studies comparing surgical and non-surgical outcome in dogs. Consequently, dog owners choosing long-term physiotherapy are forced to trust the weakest form of 'scientific' evidence, namely personal anecdote (i.e. testimonials).

In the absence of proper scientific evidence, how should we decide when to operate and when to avoid surgery? Physiotherapists are a valuable source of advice. In human healthcare, they frequently decide when to refer patients for a surgical opinion. In a 2022 survey, registered physiotherapists were 3-times more likely to delay a surgical opinion for recurrent patellar dislocation compared with orthopaedic surgeons. We don't know if a similar mismatch exist in the advice offered by veterinary physiotherapists and orthopaedic surgeons, but we should be aware of the possibility. One definition of failed physiotherapy used in human healthcare is recurrent dislocation despite 6-months of appropriate therapy. In a dog's relatively shorter lifespan of 9-16 years, 6-months is a very long-time.

Lifespan is an especially relevant consideration in dogs, given the high success rates and short recovery times for surgical treatment.



ANIMATIONS There are several effective surgical techniques available to treat patellar luxation. [Watch the surgical animation playlist on YouTube.](#)

In conclusion, the ideal way to avoid compromised care caused by disparate opinions is to adopt a transparent multidisciplinary approach. In other words, patient-centred decisions require regular three-way communication between owners, veterinary physiotherapists and orthopaedic surgeons.

Mike Farrell graduated from the Royal Veterinary College in 1997. At the time of writing, he's published 55 peer-reviewed papers, including studies on the natural history of **hip dysplasia**, **elbow dysplasia**, and **patellar luxation**. Mike holds the ECVS Diploma in small animal surgery, and is an EBVS and RCVS board-certified specialist. This article was published in December 2022.

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