Management of CCL insufficiency with concomitant patellar luxation

What is cranial cruciate ligament disease?

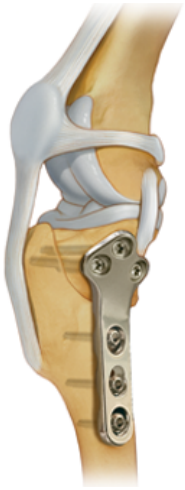
The cranial cruciate ligament (CCL) is the main stabiliser of the stifle joint (knee). CCL tears are the most common orthopaedic problem in dogs and typically occur secondary to degenerative changes in the ligament. Rarely, dogs may be affected as young as 3 or 4 months of age. After the CCL tears, joint instability leads to inflammation and development and progression of osteoarthritis. Instability of the knee predisposes to secondary meniscal injury.

Multiple factors may influence the early onset of degeneration of the CCL including genetics, sex, hormones and obesity and degenerative changes will typically affect the CCL in both stifles. Purely traumatic injury is rare, although trauma may be associated with tearing of an already weakened ligament.

Treatment options

TPLO is considered the **gold standard** for the management of cranial cruciate ligament injuries in dogs and is the procedure favoured by most orthopaedic surgeons. TPLO has superior clinical and functional outcomes in both the short and long term, markedly lower rates of both minor and serious complications, a significantly lower rate of post-surgical meniscal injuries and the progression of osteoarthritis is **reduced** compared to other techniques.

What is TPLO?



TPLO involves making a curved cut in the top of the tibia (shin bone), rotating the separated segment of bone (the tibial plateau) and securing it in a new position with a bone plate and screws. This alters the biomechanics of the knee, dramatically reducing **cranial tibial thrust** thus creating **dynamic craniocaudal stability.** In simple terms, the knee is no longer unstable, despite the lack of a functional cranial cruciate ligament.

Prior to cutting the tibia, the joint is inspected, the menisci (joint cartilages) are examined, and any damaged meniscal tissue is removed. Any remnants of the CCL are usually completely removed; however, if most of the ligament is intact and functional, the torn fibres may be debrided, and the remaining ligament left in place. X-rays are taken at the completion of surgery and are typically repeated approximately six to eight weeks after surgery to assess bone healing and implants.

Outcome and potential risks of surgery

Most dogs progress well following a TPLO and can return to normal activities. TPLO yields **better** limb function, **fewer** problems, **less** osteoarthritis, and **rapid** recovery times compared to other techniques. Nevertheless, it may take up to six months to fully recover. Dogs with chronic knee problems, especially those with substantial muscle wastage or that have had previous surgery are expected to progress more slowly.

As with any surgery, complications may arise as detailed below, although serious complications are uncommon and complication rates have been shown to be lower with TPLO compared to other techniques.

- Infection is an uncommon complication as strict sterile technique is used during the surgery and antibiotics are administered during and potentially after the procedure. Should an infection occur, early detection and treatment often result in rapid resolution, although sometimes removal of the implants may be required once the bone has healed. More serious problems may occur if the infection progresses untreated or if your dog suffers an infection that is resistant to multiple antibiotics e.g., MRSA. Some medical conditions will increase the risk of post-surgical infection, such as diabetes or pre-existing infection elsewhere e.g., skin and ear infections, cystitis, and gingivitis. Pre-existing infections should be eliminated whenever possible.
- Excessive early activity increases the risk of damaging or breaking the plate or screws.
- Partial or complete tearing of the patellar tendon in the recovery period is a rare but serious complication. Increased tendon loading and reduced blood supply in the postsurgical period may play a role, as may damage

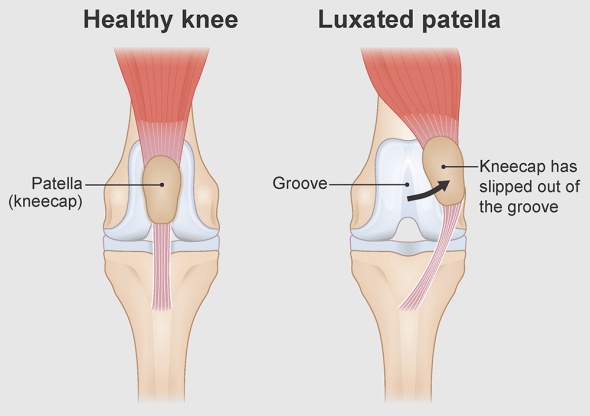
during surgery; obesity, age hormonal influences and excessive activity are potential risk factors.

- Fracture of the tibial tuberosity occurs relatively rarely. Fractures of the tibial plateau are extremely rare but serious complications and typically require substantial force soon after surgery before the bone has had time to heal and remodel. This should not occur if dogs are appropriately managed after surgery.
- Even after the bone has healed it is still important to have a controlled, gradual increase in activity, similar to human patients undergoing rehabilitation. If activity in dogs is increased too quickly after surgery straining of the patellar ligament or other joint structures may occur. Rest and anti-inflammatory medications typically resolve these problems.
- Arthritis is usually present at the time of surgery and will progress regardless of treatment. If the CCL has been ruptured for some time significant additional joint injury may have occurred and arthritis is typically more advanced. Previous knee surgery is also often associated with a more rapid progression of arthritis. It is not possible to reverse the arthritic changes in the joint or undo other damage already done but the surgery will stabilise the knee thereby reducing inflammation, which may help to reduce the ongoing progression of arthritis.
- Damage to the menisci (cartilage pads in the knee) may occur following tearing of the CCL ligament i.e. it is a complication of cruciate ligament injury. Damaged menisci are resected at the time of surgery. Menisci can also be injured after surgery; this may occur at any time, weeks or even years after surgery. In comparison to other techniques, TPLO significantly reduces the risk of subsequent meniscal injury, but cannot eliminate it.

For further information and explanatory videos go to: bonevet.com.au/review-articles/ccl-treatment-options/

Canine Patellar Luxation

What is patellar luxation?



The patella or “knee cap” sits at the front of the knee within the quadriceps muscle and sides up and down within a groove. Patellar Luxation is when the knee cap slips out (dislocates) from the groove. This typically occurs secondary to malalignment of the quadriceps mechanism. Deformities in the hip, femur (thigh bone) and tibia (shin bone) typically contribute to poor alignment of the quadriceps muscle group "pulling" the patella out of position. These deformities develop early in life during the growth phase. The onset of patella luxation may occur at this time or not until much later following a traumatic event; soft tissues that have previously resisted the “pull” created by malalignment finally tear, allowing the patella to luxate i.e. an underlying problem was already present that predisposed to patellar luxation. A simple 1 to 4 grading system represents the severity of malalignment. Assessment is based on how often the patella is luxated and the ease of reduction; the patella is permanently luxated for grades 3 & 4 and cannot be reduced for grade 4.

Patellar luxation is painful and destabilises the knee, placing increased strain on other joint stabilisers including the cranial cruciate ligament (CCL). Chronic patella luxation is a risk factor for tearing of the CCL. When the patellar luxates there is abrasion between the underside of the patella and the trochlear ridges, resulting in permanent wear to the articular cartilage; a deep “ulcer” in the articular cartilage of the underside of the patella can eventually develop exposing the subchondral bone. This is painful and irreversible, causing increased inflammation and the rate of progression of osteoarthritis. Patellar luxation is preferably treated as **early as possible** to minimise cartilage damage and strain on the CCL.

Treatment Options

Surgery is primarily aimed at improving overall alignment, although additional procedures are typically performed; these may include deepening the patella groove (performed if the existing groove is too shallow), tightening the outside of the knee joint (imbrication) and relieving tension on the inside of the knee joint (releasing incision) for medial patella luxation, or the reverse for lateral luxation. Surgery to improve alignment at the level of the attachment of the patella tendon on the tibia with a tibial tuberosity transposition will be sufficient to stop the patella luxating in most cases; however sometimes the patella will continue to luxate despite these initial corrections. This is not unexpected given the complexity of the deformities from **hip to knee** that contributes to patellar luxation and the relatively simple alignment adjustment that is typically used to manage this condition. In cases of persistent luxation, further surgery to correct deformities of the distal femur and/or at the level of the hip **may be necessary**. For some grade 3 and particularly for Grade 4 luxations, surgery to correct deformities of the distal femur and at the level of the hip may be necessary as components of the primary surgery.

The cranial cruciate ligament will also be assessed during exploration of the knee joint (patellar luxation increases strain on CCL). If tearing of the CCL is identified additional surgical procedures are typically necessary (e.g. TPLO, IPLS) which will incur **additional fees**. Please discuss this scenario with your Vet prior to surgery.

Outcome and potential risks of surgery

Most dogs progress uneventfully following surgery to correct patella luxation and are eventually able to return to their normal activities. Many dogs improve significantly within the first month following surgery; nevertheless, it may take several months before a dog has **fully** recovered. Dogs with chronic knee problems and especially those with substantial muscle atrophy and/or dogs that have had previous surgery will progress more slowly.

As with any surgery, complications may arise as detailed below, although serious complications are uncommon.

- Infection: see previous discussion for TPLO.
- Excessive early activity may increase the risk of loosening or breakage of pins, wires and screws and/or fracture of the tibial tuberosity or trochlea, which may necessitate further surgery.
- Partial or complete tearing of the patellar tendon in the recovery period is a rare but serious complication. Increased tendon loading and reduced blood supply in the postsurgical period may play a role; obesity, age hormonal influences and excessive activity are potential risk factors.
- Repeated patella luxation gradually wears away the cartilage on the underside of the patella, which cannot be reversed. In cases of severe wear, underlying bone may be exposed which can be a source of chronic pain.
- Arthritis is usually present at the time of surgery and will progress to some degree regardless of treatment. In cases of chronic patella luxation, significant joint injury may have occurred, and arthritis is typically more advanced. Previous knee surgery may also be associated with a more rapid progression of arthritis. Unfortunately, it is not possible to reverse the arthritic changes in the joint or undo the damage already done, but stabilising the knee may reduce inflammation and slow the ongoing progression of arthritis.
- Persistence or recurrence of patella luxation may occur, including luxation in the opposite direction, and is the most common complication after surgery. Quadriceps malalignment involves deformities of the hip, femur, and tibia; whilst improving alignment at the level of the tibia will often be sufficient to resolve patella luxation it does not address all deformities present. Further surgery is indicated to manage persistent patellar luxation and may include revising tibial tuberosity transposition, transposition of muscle attachments at the stifle or hip and distal femoral osteotomy to address femoral deformities.

Postoperative care

A pad may be covering the wound at the time of discharge from the hospital. This can be removed after several days, or immediately if soiled.

Medications e.g., Pain killers will be dispensed.

Ice packs may also be helpful in the days following surgery to reduce swelling and improve comfort.

Your dog should be kept confined to **eliminate running and jumping** for the first 6 to 8 weeks: a single room with non-slip flooring and no furniture may be sufficient, however, a large cage is more effective. Short leash walks in the garden (a few minutes four to six times daily) are recommended initially to allow toileting.

- Two weeks following surgery: commence lead walking for 5 minutes at a time, two to three times daily.
- Three weeks following surgery: continue lead walking to 5 minutes at a time, two to three times daily.
- Four weeks following surgery: increase lead walking to 7 - 9 minutes at a time, two to three times daily.
- Five weeks following surgery: increase lead walking to 10 minutes at a time, two to three times daily.
- Six weeks following surgery: increase lead walking to 12 - 15 minutes at a time, two to three times daily.

Maintain confinement **at all other times**; running, jumping and play must be avoided for at least 8 weeks.

Staged TPLO & MPL procedures versus a combined single procedure

It is possible to combine tibial plateau levelling osteotomy (TPLO) and tibial tuberosity transposition (TTT) to manage both CCL tears (TPLO) and patellar luxation (TTT); however, as reported by Kowaleski et al in 2018, the construct strength is significantly reduced, such that the force required to induce fixation failure is almost halved compared to a standard TPLO. There is little published data on the incidence of fixation failure when combining TPLO and TTT; only two publications report on complications and long-term outcomes when combining TPLO and TTT procedures. The first study, published in 2016, was also by Kowaleski's group and included data from 11 dogs (thirteen stifles), none of which suffered major post-operative complications. The second study, published in 2024, included 22 dogs (24 stifles); three cases developed surgical site infections, but no fixation failures were reported. Whilst the studies are far too small to reliably predict the risk of complications, it may be reasonable to assume that with **strict adherence** to appropriate confinement in the first 6 weeks, the increased risk of fixation failure is likely manageable and **may** not be markedly higher than when staging the procedures.

Performing a combined procedure requires a longer anaesthetic thus potentially increasing the risk of anaesthetic complications, and infection; the longer anaesthetic proportionately suppresses the immune system temporarily increasing the risk of infection. Conversely, operating on a site that has previously had surgery (as is the case when staging procedures) also incurs an increased risk of infection.

It is important to note that **combined procedures are not covered** under the 12-month warranty on unilateral TPLO procedures (see link for full terms and conditions). https://bonevet.com.au/tplo-guarantee/

In summary, staging procedures (typically separated by six to 12 weeks) is somewhat safer, but it is not unreasonable to combine the procedures and benefit from a shorter recovery period.

Declaration

I have read the information contained herein and am satisfied I have a sufficient understanding of the described procedures and the increased risks of combining TPLO and TTT to manage both cranial cruciate tearing and patellar luxation; I hereby consent for my dog to undergo: (tick preference **and** strike out undesired option)

☐ **either** TPLO **OR** TTT surgery as deemed appropriate by the surgeon (staging procedures).

☐ combined TPLO/TTT surgery if both patellar luxation and a CCL tear are present.

Owner's name: Dog's Name:

Owner's signature: Date:

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