Cranial Cruciate Ligament Repair

One of the most common injuries to the knee of dogs is tearing of the cranial cruciate ligament (CCL). This ligament is similar to the anterior cruciate ligament (ACL) in humans. There are actually two cruciate ligaments inside the knee: the cranial cruciate ligament and caudal cruciate ligament. They are called “cruciate” because they “cross” over each other inside the middle of the knee. For more information on these ligaments and how they can become damaged, see the handout “Cranial Ligament Rupture in Dogs.”

When the CCL is torn or injured, the shin bone (tibia) slides forward with respect to the thigh bone (femur), which is known as a *positive drawer sign.* Most dogs with this injury cannot walk normally and experience pain. The resulting instability damages the cartilage and surrounding bones and leads to osteoarthritis (OA).

What options are there for repairing my dog’s torn CCL?

When the cranial cruciate ligament is torn, surgical stabilization of the knee joint is often required, especially in larger or more active dogs. Surgery is generally recommended as quickly as possible to reduce permanent, irreversible joint damage and relieve pain.

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Several surgical techniques are currently used to correct CCL rupture. Each procedure has unique advantages and potential drawbacks. Your veterinarian will guide you through the decision-making process and advise you on the best surgical option for your pet. This handout covers two types of CCL surgery: tibial plateau leveling osteotomy (TPLO) and tibial tuberosity advancement (TTA). For information on other types of surgery used to correct CCL injuries in dogs, see the handout “Cranial Cruciate Ligament Repair: Extracapsular Repair and TightRope® Procedure

My veterinarian is recommending a tibial plateau leveling osteotomy to fix my dog’s torn CCL. What does this surgery involve?

A major advancement in the treatment of CCL rupture has been the development of tibial plateau leveling osteotomy or TPLO. This surgery changes the angle and relationship of the femur and the tibia. The overall intent of the surgery is to reduce the amount that shifts forward during a stride. This is accomplished by making a semicircular cut through the top of the tibia, rotating the top of the tibia, and using a bone plate to allow the tibia to heal. This realignment of the surfaces within the stifle helps to provide stability during a stride, and helps to reduce future joint inflammation and OA. By carefully adjusting the angle or slope of the top of the tibia, surgeons are able to replicate a more normal configuration of the knee joint and reduce mechanical stress.

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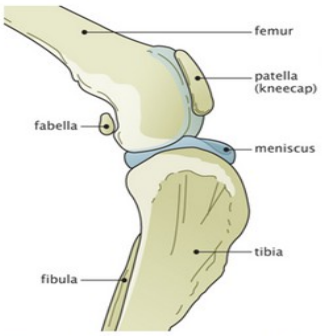
To better understand the purpose of leveling the tibia, we often use the analogy of a wagon on a hill.

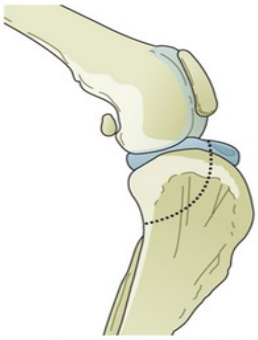
Imagine a wagon tied to a post on the slope of a hill. As long as the rope holds, the wagon doesn't roll downhill. If we add excess weight (or downward force) to the wagon, the rope could break and the wagon will roll down the hill. However, if the wagon is on level ground, it will not roll forward with added weight, even if the rope is broken.

In this example, the wagon is the femur, and it slides down slope of the top of the tibia when the CCL is ruptured. This instability leads to damage and destruction of the cartilage and bones of the knee joint. TPLO surgery "levels" the tibia to prevent the femur from sliding forward, thereby stabilizing the joint.

TPLO surgery involves making a curved cut in the tibia from the front to the back, much like half a smiley face. The top section of the tibia is then rotated backward until the angle between the tibia and femur is deemed "appropriately level," typically between 2 and 14 degrees, with 5 degrees being the ideal angle. A metal bone plate is then used to affix the two sections of tibia in the desired positions, allowing the tibia to heal in its new configuration.



The configuration of the femur and tibia prior to TPLO/TTA surgery.


In preparation for "leveling" the tibial plateau, a semicircular cut is made through the bone.

My veterinarian is recommending a tibial tuberosity advancement (TTA). What does this surgery involve?

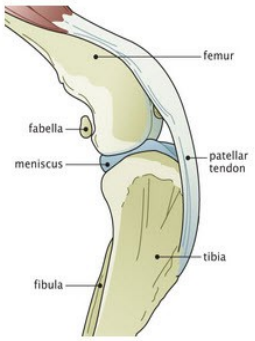

Once the cut in the tibia is made, the bone segment is rotated to achieve a "level" tibial plateau.


The rotated tibial segment is secured for healing using a specially designed orthopedic plate. It may be appropriate to consider removal of this plate once healing is complete.

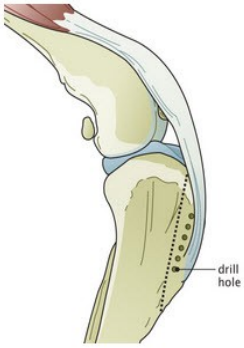
TTA is similar in concept to TPLO. Because it is considered slightly less invasive than TPLO, many dogs appear to recover slightly quicker. Most dogs, regardless of which of these two procedures are performed, are nearly normal 4 months after surgery.

The TTA procedure is more commonly performed in dogs with a steep tibial plateau, or angle of the top part of the tibia. Your dog's surgeon will evaluate the joint geometry to determine which procedure is ideal.

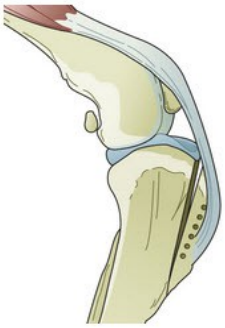
In simplest terms, the front part of the tibia is cut and separated from the rest of the tibia. A special orthopedic spacer is screwed into the space between the two sections of bone to slide the front part of the lower knee forward and up. This moves the patellar ligament (the thick fibrous band that runs on the front of the knee from the top to the bottom of the joint) into better alignment, thereby removing some of the abnormal sliding movement. A bone plate is then attached to hold the front section of the tibia in the proper position. By changing the alignment of the patellar ligament, the forces that cause the femur to slip backward when the CCL is torn instead move straight down the tibia, resulting in less shearing force or instability.



The configuration of the femur and tibia prior to TPLO/TTA surgery.



In the TTA surgery, a cut is made through the front of the tibia in order to move that segment forward.



The front part of the tibia is advanced to make room for the spacer.

The completed TTA procedure showing the spacer in place and the special bone plate securing the tibial tuberosity so it can heal.

How long will it take for my dog to recover from TPLO or TTA surgery?

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Healing from TPLO and TTA surgery is generally rapid.

- About half of all canine patients will begin walking on the injured leg within 24 hours after surgery.
- At 2 weeks postoperatively, most dogs are bearing moderate to complete amounts of weight on the affected leg.
- By 10 weeks, most dogs do not have an appreciable limp or gait abnormality.
- As mentioned above, at 4 months postoperatively, the majority of dogs can begin walking and playing normally, with only the most stressful activities restricted.
- Within 6 months, most dogs can resume full physical activity.

Pain management during and after stifle surgery is critical, so be sure to give all medications as prescribed and use them until they are gone. Physical rehabilitation post-operatively will speed healing. Ask your veterinarian about incorporating rehabilitation into your dog's recovery plan.

The most common complication after TPLO or TTA is infection. Studies conclude that infection occurs in less than 10% of all patients, with many surgeons reporting much lower complication rates. Your dog will need several recheck examinations and radiographs (x-rays) to ensure that the area is healing properly.

Are TPLO and TTA better than other types of CCL surgeries?

> “TPLO and TTA offer many benefits over older procedures such as extracapsular repairs (ECLS), especially for larger or athletic dogs.”

TPLO and TTA offer some benefits over older procedures such as extracapsular repairs (ECLS), especially for larger or athletic dogs. Dogs undergoing TPLO or TTA tend to heal faster, resume normal activities quicker, and have a better range of motion in the knee.

Currently, most veterinary surgeons consider TPLO and TTA to be the preferred treatments for larger, more active dogs. Also, newer data suggests that it may be wise to have the TPLO plate removed sometime after the leg is completely healed to prevent a reaction to the orthopedic implant.

Your veterinarian will guide you through the decision-making process to determine which procedure provides your dog with the best chance of full recovery.

This client information sheet is based on material written by: Ernest Ward, DVM, and Robin Downing, DVM, CVPP, DAAPM.