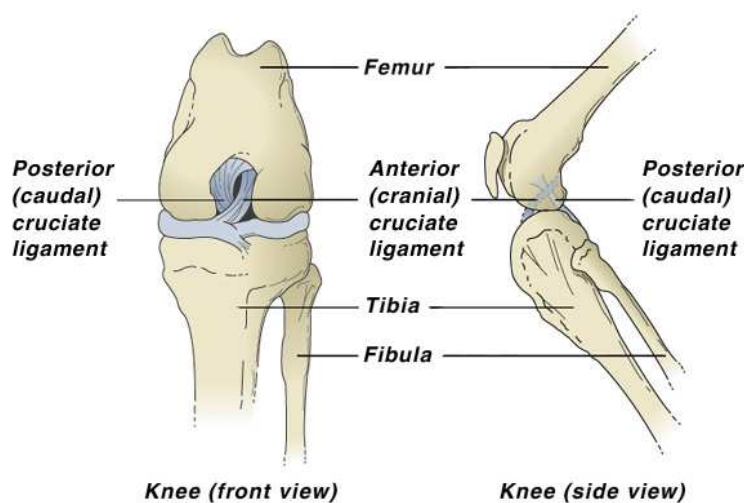


## Tibial Tuberosity Advancement For the Treatment of Cranial Cruciate Deficiency

Cranial cruciate ligament deficiency in the dog is the most common orthopedic lameness seen in practice today. Many reasons are reported to be at cause, to include; genetic conformational abnormalities, obesity (either genetic or overfeeding), excessive athleticism, and chronic degenerative joint disease. Large breed dogs seem to be over represented when compared with small breed dogs and cats. This is probably in due part to their higher levels of physical activity when compared with smaller animals.

There are two cruciate ligaments in the dog knee, termed cranial and caudal. The caudal cruciate ligament rarely tears, but when it does, it is usually concurrently torn with the cranial cruciate ligament. The most common physical reason the cranial



cruciate ligament tears is thought to be a result of excessive internal rotation with the knee in slight extension. Your pet will usually “yelp” when this happens, and will limp either slightly or very severely afterwards. To some degree, they appear to get better in the next few days or so, only to become chronically lame over the next few weeks. During this time, your pet will shift its weight to the good rear leg, increasing the strain

on it. Tearing of the cranial cruciate ligament results in instability of the knee termed “cranial tibial thrust”. Think of the top part of the knee (the femur) as being a car, and the bottom part of knee (the tibia) as being a hill. The cranial cruciate ligament is the parking brake. When it breaks, the car rolls down hill. This is cranial tibial thrust.

During the examination process, the doctor will want to take 2-3 radiographs of the affected leg, the opposite leg, and the hips. This is done to look for additional evidence of a torn cranial cruciate ligament, evaluate for bone abnormalities that may have caused the instability in the knee, and the check for osteoarthritis of the hips. These radiographs will also be used to measure the knee for the proper sized implants for a corrective osteotomy to stabilize the knee.

The literature routinely cites over 100 procedures as being available for the “treatment” of cruciate ligament tear in dogs. All of these procedures show some success, but it seems apparent that this success to some degree is “operator” dependent. In the last 10 years or so, the list of procedures in use has probably dwindled down to 4-5 procedures. More recent research has shown little differences in the success rates amongst these procedures in long term studies. The exception to this idea becomes apparent with procedures like tibial plateau leveling osteotomy (“TPLO<sup>®</sup>”, Slocum) from Oregon, and the more recently proposed tibial tuberosity advancement (“TTA”, Montavan, Tepic, et al) from Zurich.

TPLO was developed in 1993. The purpose of the procedure is to realign the tibial portion of the knee joint in such a manner that the knee is no longer in need of stabilization by the cranial cruciate ligament. TPLO in effect eliminates “the hill” in the knee. Although the recovery period could be considered long (12-16 weeks), the immediate results are considerably better than more traditional procedures. The lengthy healing time is a result of the extensive cut made into the bone. Disadvantages to the procedure include; extensive surgical invasiveness, implant failure, and the procedure itself require a high degree of skill to perform. While only currently a small percentage of cases result in failure, as more practitioners become “certified” to perform the procedure, the failure rate is certain to climb, and has been reported in the literature to be as high as 36%. It has also been proposed that TPLO might over-correct the limb.

TTA is a new-comer to the arena of procedures advocated to stabilize the cranial cruciate deficient knee in the canine. The theory of TTA arose out of a modification of the proposed model by Slocum, in that the net “joint reaction” is approximately parallel to the patellar tendon, and that if the patellar tendon is perpendicular to the tibial plateau (joint surface), the cruciate ligaments are not under any load. If we move the patellar tendon forward to the point that it is perpendicular to the tibial plateau in a standing angle, we relieve the load on the cranial cruciate ligament. The net result being that the patellar tendon takes over the load of the cranial cruciate ligament. Since we know the patellar tendon is capable of loads many times greater than what the cranial cruciate ligament withstood, the joint reaction should not be capable of exceeding the force of the patellar tendon. The net result is a stable knee. In more simple terms, TTA is an “upside-down” TPLO.

Apparent advantages to TTA when compared to TPLO include;

1. Quicker recovery – as a result of less invasive surgical technique, less swelling, shorter surgical time, and improved postoperative stability. Many patients are walking better when they leave the hospital postoperatively.
2. Less implant failure – the implants are made of titanium and are therefore less reactive and less likely to break. The strain put on the implants is less than what is seen with TPLO.
3. Ease of procedure – less technically demanding procedures are less likely to have operator-dependent failures, resulting in better clinical results.
4. Good results with chronically arthritic knees – since TTA does not require a rolling of the tibial plateau (like TPLO), stability is easily achieved even in the most chronic knees.
5. Ability to operate on both knees at once – a small percentage of dogs will have the condition undiagnosed in the opposite knee. TPLO surgery is currently not recommended for both knees at the same time due to stability problems. TTA has been successfully performed in dogs up to 140# on both knees.

The only real disadvantage to TTA at this point is the lack of clinical cases. New procedures mean we do not have a huge case load to reflect upon when things go wrong. No surgery is perfect, and problems can arise. Should something go wrong with a TTA procedure, the knowledge base on dealing with the outcome is limited at this point. TPLO has been around long enough that the majority of the problems that arise have more than one solution.

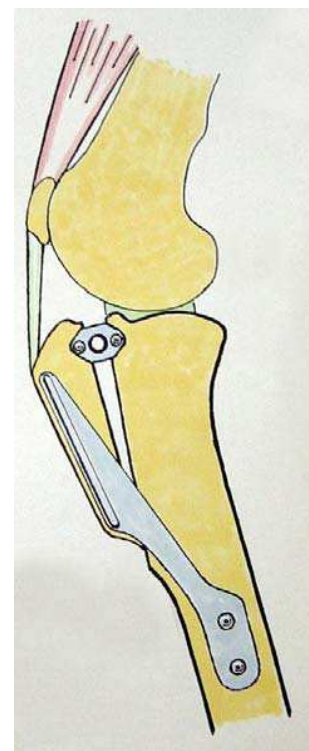
Postoperative recovery from knee surgery, regardless if TPLO or TTA is performed, requires that your pet be kept quiet. Bones have been cut and repositioned to alleviate the cranial cruciate ligament deficit. TTA, more so than TPLO, has resulted in such rapid recovery that many patients begin using the leg too much, too soon. It is imperative to avoid running, jumping, and rough-housing with other pets for a minimum of 8 weeks until the bone has had a chance to adequately heal. Excessive strain placed on the osteotomy in either procedure too early will result in implant failure.

In the immediate postoperative period, you will see some swelling in the mid-tibial area, just past the end of the implants. Applying warm compresses to the leg 3-4 times daily for the first week will help with this. Some dogs will have some drainage from the surgical site for up to 1 week. Staples are irritating to some dogs, and they may try and chew them out. Others will feel so good when they go home that they immediately begin to play with the other dog, or want to run in the backyard. You must keep your pet quiet during the recovery period, even if this means temporarily medicating him/her. Some patients have good luck with diphenhydramine (Benadryl<sup>®</sup>), while others may require tramadol (Ultram<sup>®</sup>), acepromazine, or even phenobarbital to keep them quiet during the convalescent period. Once the swelling is gone, you can begin short leash walks once Dr. Mayo has removed the staples. Do not swim the dog until instructed to do so by Dr. Mayo. Swimming too soon may result in severe patellar tendonitis, or possibly implant failure.

The 8-week postoperative follow up radiograph is important. We are evaluating the leg for proper long-term alignment of the implants, failures, and to assure adequate healing of the osteotomy site. Once healed, a regimen of increased exercise as tolerated by the dog will result in a quick recovery to full use of the limb. Generally, this is about another 1-2 months.



***A postoperative x-ray of a tibial tuberosity advancement***



## **Post-Operative Instructions Tibial Tuberosity Advancement**

Historically, rehabilitation on knee surgeries in general has been limited to one common recommendation – *cage rest!* Veterinarians have been reluctant to allow their patients to perform even the slightest of exercise movements postoperative, for fear that the patient will ruin the work (and expense) already performed. If we have learned one thing from human medicine, the sooner the patient is up and using the leg, the quicker will be the recovery. There is only one modification to this thought that should be stated here, if the leg does not hurt, the dog will use it, and premature overuse of the leg will result in critical damage to the proper healing process. We cannot overemphasize enough, do not let your dog run loose until the doctor has pronounced the surgery a success.

**First Two Weeks:** The first couple days when your pet comes home, the pain will be the worst. Why? Dogs are pretty smart, and they figure out right away that when they act like they are in pain, they will get more attention from their owners. It is important to not let your pet loose to run freely, particularly up and down stairs without assistance. They can go outside ON A LEASH to go to the bathroom, and then they must return inside and rest.

- (1) First 48 hours – ice packs 3-4 times daily for 10-20 minutes. This will help significantly with the swelling.
- (2) Pain medication – as written by the doctor. If this is not working, do not overdose; call the office for further recommendations or additional medications.
- (3) After 48 hours, apply heat to the area 2-3 times daily for 10-20 minutes. Afterwards, begin GENTLE range of motion of the leg that was operated on after the heat pack has been applied. If you are not clear about this, ASK!
- (4) No other exercise is recommended for the first two weeks.
- (5) Clean the wound daily if needed with dilute hydrogen peroxide, and do not allow the dog to lick it. If he attempts to lick the wound, please get an e-collar.

**Second Two Weeks:** At this point, walking on leash is tolerated.

- (1) Pain medication – should be off of prescription medicine, however, giving one aspirin for the average 50-100# dog 30 minutes prior to any physical therapy is advisable.
- (2) Apply heat to the leg for 20 minutes, then exercise the leg through range of motion.
- (3) Walking on a leash is acceptable, but begin with one block and stop. If the dog returns home and is not in pain, you may increase this in 1 block increments every 4-5 days as tolerated, provided your dog is not in pain when the walk is over.
- (4) While walking, push the dog's hips towards the operated leg slightly to help convince him/her that the leg can be used.
- (5) Lift the front end of the dog for 5 second intervals prior to starting the walk to increase the strength of the leg. Try several repetitions.

**Third Two Weeks:** By this time, walks should be in the 20 minute range or better, and tolerated well. Do not run yet. Increase the duration of walking as much as you can without causing the dog pain. Do not exceed the 20 minute range. If you have access to a pool, some hydrotherapy is ok, but NOT unattended nor allowed to swim in water over the dog's head. Any hydrotherapy over 10 minutes is more likely to exaggerate patellar tendon inflammation and result in lameness.

**Fourth Two Weeks:** At the end of this period, it is time to come in for the follow up x-ray. We want to make sure everything has healed prior to increasing the exercise as tolerated. Be forewarned that if you just go home and turn the dog loose, he will be in pain. This is the point where you can SLOWLY build back up to full exercise.