

# CCL (Cranial Cruciate Ligament) Disease

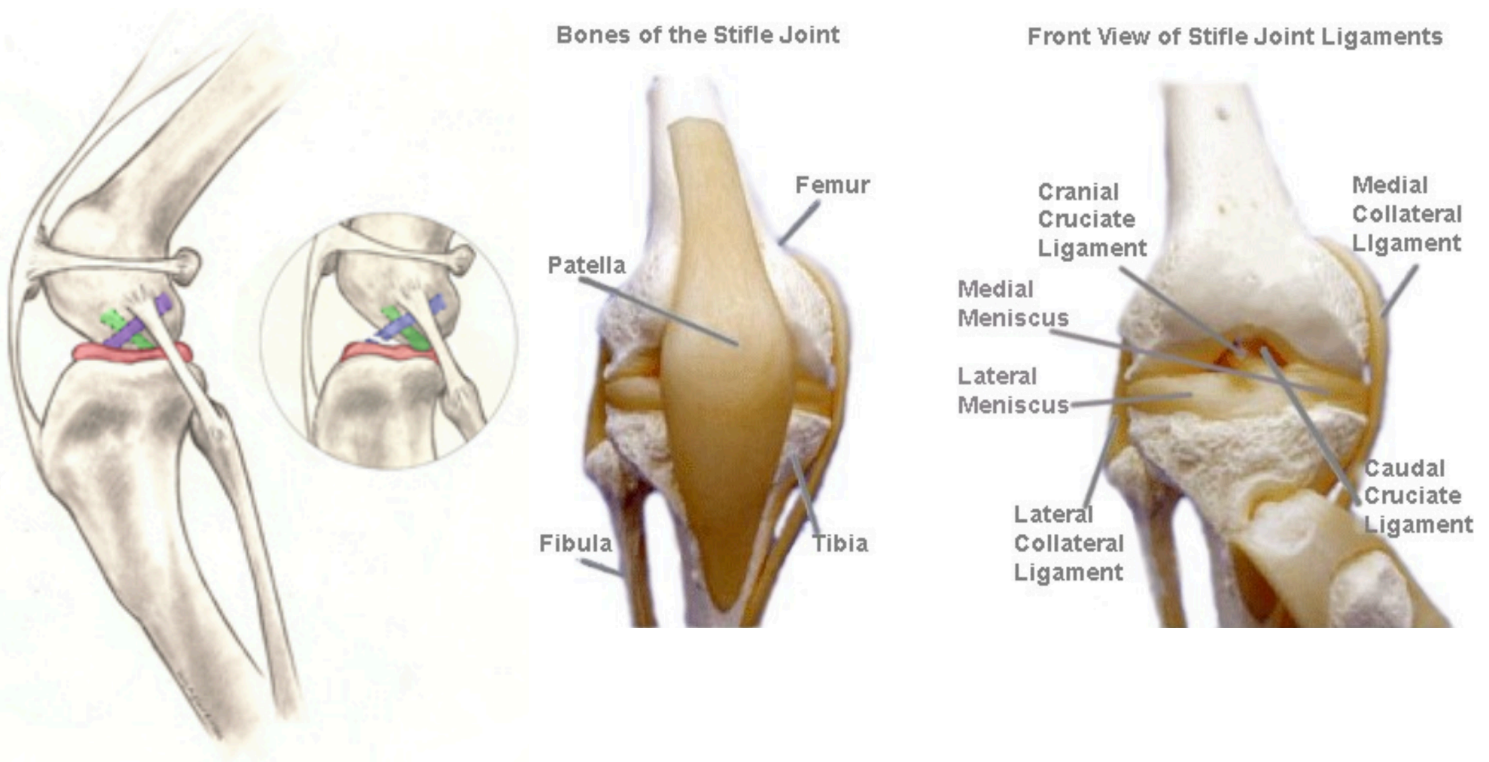
Associated Terms:

ACL (Anterior Cruciate Ligament), Cruciate Disease, Ruptured Cranial Cruciate Ligament, Torn Cranial Cruciate Ligament, Partial ACL Injury, TPLO (Tibial Plateau Leveling Osteotomy), Tibial Tuberosity Advancement, Lateral Suture Stabilization, Meniscal Tear

## OVERVIEW

The cranial cruciate ligament (CrCL, see Figure 1) is one of the most important stabilizers inside the canine knee (stifle) joint, the middle joint in the back leg.

In humans the CrCL is called the anterior cruciate ligament (ACL).



The meniscus (Figure 1) is a 'cartilage-like' structure that sits in between the femur (thigh) & tibia (shin) bones. It serves many important purposes in the joint such as shock absorption, position-sensing & load-bearing & can be damaged when the CrCL is ruptured.

**Rupture of the CrCL is one of the most common reasons for hind limb lameness, pain & subsequent knee arthritis.** Since the development of this problem in dogs is much more complex than in humans & they experience different degrees of rupture (partial or complete), the canine condition is referred to as 'cranial cruciate ligament disease' (CrCLD). While the clinical signs (symptoms) associated with CrCLD vary, the condition invariably causes rear limb dysfunction & pain.

Most commonly CrCLD is caused by a combination of many factors, including aging of the ligament (degeneration), obesity, poor physical condition, genetics, conformation (skeletal shape & configuration) & breed. With CrCLD, ligament rupture is a result of subtle, slow degeneration that has been taking place over a few months or even years rather than the result of acute (sudden) trauma to an otherwise healthy ligament (which is very rare). This difference between people & dogs explains 2 important features of canine CrCLD:

1. 40-60% of dogs that have CrCLD in one knee will, at some future time, develop a similar problem in the other knee.
2. Partial tearing of the CrCL is common in dogs & progresses to a full tear over time.

Cranial cruciate ligament disease can affect dogs of all sizes, breeds & ages, but rarely cats. Certain dog breeds are known to have a higher incidence of CrCLD (Rottweiler, Newfoundland, Staffordshire Terrier, Mastiff, Akita, Saint Bernard, Chesapeake Bay Retriever, & \*\*Labrador Retriever) while others are less often affected (Greyhound, Dachshund, Basset Hound & Old English Sheepdog).

A genetic mode of inheritance has been shown for Newfoundlands & Labrador Retrievers.

\*\*Genetic Test Available for Labrador Retriever.\*\* see website below.

<https://www.vetmed.wisc.edu/lab/corl/canine-genetic-testing/>

**Poor physical body condition & excessive body weight (BW) are risk factors** for the development of CrCLD. Both of these factors can be influenced by pet owners. Consistent physical conditioning with regular activity & close monitoring of food intake to maintain a lean body mass is advisable.

## SIGNS & SYMPTOMS

Dogs with CrCLD may exhibit any combination of the following signs (symptoms):

- decreased activity level
- decreased range of motion (ROM) of the knee joint
- difficulty rising from a sit
- muscle atrophy (decreased muscle mass in the affected leg)
- lameness (limping) of variable severity
- popping noise (which may indicate a meniscal tear)
- pain
- stiffness
- swelling on the inside of the shin bone (fibrosis or scar tissue)
- trouble jumping into the car
- unwillingness to play

## DIAGNOSTICS

Diagnosing complete tears of the CrCL is easily accomplished by a veterinarian using a combination of gait observations, physical exam findings & radiography (X-rays).

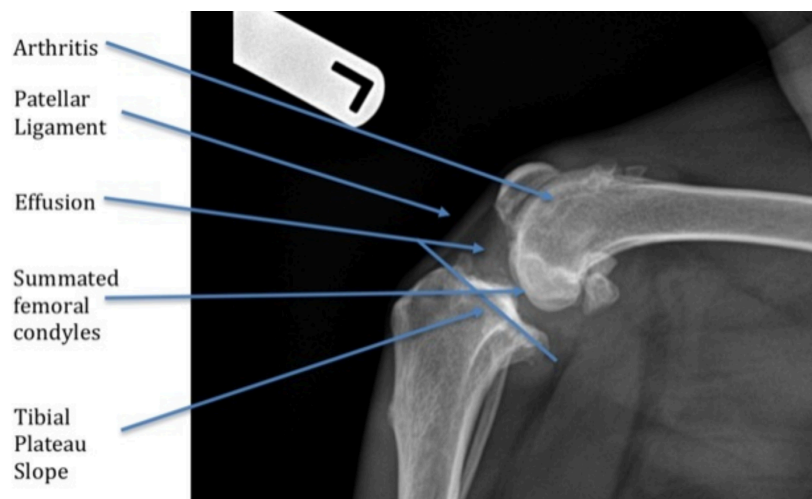
By contrast, partial CrCL tears may be more challenging to diagnose.

X-rays allow your veterinarian to:

- confirm the presence of joint effusion (fluid accumulation in the joint, indicating that there is an abnormality present)
- evaluate for the presence/degree of arthritis
- take measurements for surgical planning (Pre-TPA (Tibial Plateau Angle))
- rule out concurrent disease conditions

Specific palpation techniques that veterinarians use to assess the CrCL include the ‘cranial drawer test’ & the ‘tibial compression test.’

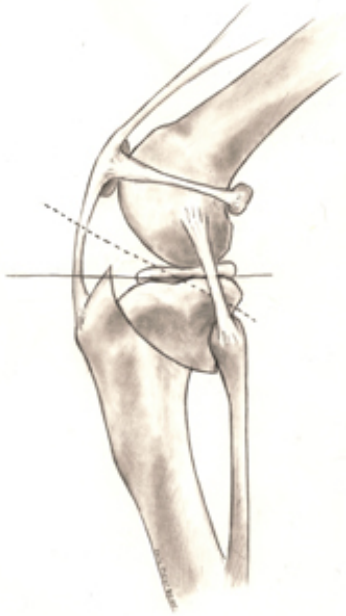
These tests can confirm abnormal motion within the knee consistent with rupture of the CrCL.



## TREATMENT

Many treatment options are available for CrCLD. The first major decision is between surgical treatment & non-surgical (also termed conservative or medical) treatment/management.

The best option for your pet depends on many factors including their: activity levels, size, age, skeletal conformation & degree of knee instability.



**Surgical treatment is typically the best treatment** for CrCLD since it is the only way to permanently control the instability present in the knee joint. Surgery addresses one of the main issues associated with CrCLD—knee instability & the pain it causes as a consequence of the loss of normal CrCL structural support.

The goal of surgery is NOT to “repair” the CrCL itself. Due to biological & mechanical influences, the CrCL has no ability to heal once tearing begins regardless of the degree of severity. Unlike in human ACL surgery, the canine CrCL is NOT typically “replaced” with a graft. This fact is largely due to the major mechanical differences that exist between biped (human) & quadruped (canine) knees that make graft-based techniques less reliable in dogs. If present concurrently, meniscal injury will be addressed by your surgeon by removing the damaged meniscal parts when performing surgery to stabilize the knee. To address knee instability, many surgical treatment options are available. These different techniques can be categorized into 2 groups based on different surgical concepts:



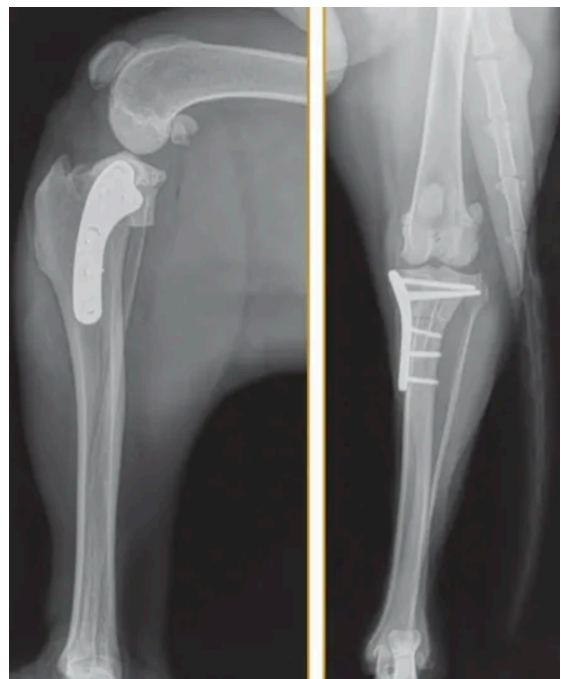
**Osteotomy-based techniques** require a bone cut (osteotomy) which changes the way the quadriceps muscles act on the top of the shin bone (tibial plateau). Stability of the knee joint is achieved without replacing the CrCL itself but rather by changing the biomechanics of the knee joint. This can be accomplished by either advancing the attachment of the muscle (TTA - Tibial Tuberosity Advancement) or by rotating the plateau (slope) of the shin bone (TPLO - Tibial Plateau Leveling Osteotomy).

Many surgeons prefer these **techniques for large, active dogs** because of their consistent outcomes in even the most athletic of patients:

- **Tibial Plateau Leveling Osteotomy (TPLO)** involves making a circular cut around the top of the tibia & rotating its contact surface (tibial plateau) until it attains a near level orientation (approximately 90 degrees) relative to the attachment of the quadriceps muscles (**Figure 2**). This renders the knee more stable, in the absence of the CrCL. The cut in the bone needs to be stabilized by the use of a bridging bone plate & screws (Figure 3). Once the bone has healed, the bone plate & screws are NOT needed, but they are rarely removed unless there is an associated problem (irritation &/or infection).

The perceived advantages of this compared to suture-based techniques are the superior outcomes attained in medium/large/giant dogs relative to limb function & athletic mobility with less progression of arthritis.

The major disadvantage is the need to perform an osteotomy. Any osteotomy requires healing of the bone & if a problem is observed (such as implant failure, failure of the bone to heal), it may require revision surgery that may negatively affect short & long-term outcomes. Fortunately, such complications are rare, especially when the procedure is performed by an experienced veterinary surgeon.



- **Tibial Tuberosity Advancement (TTA)** requires a linear cut along the front of the shin (tibia) bone. The front of the tibia, called the 'tibial tuberosity' is advanced forward until the attachment of the quadriceps is oriented approximately 90 degrees to the tibial plateau (Figure 4). This is another way to accomplish the same mechanical advantage offered by the TPLO that renders the knee more stable in the absence of the CrCL. The TTA & TPLO share similar advantages & disadvantages. Similar to the TPLO, the cut in the bone is stabilized by the use of a specifically designed bridging bone plate & screws. The decision between TPLO & TTA is based purely on the opinion of your veterinary surgeon & their personal technical experience.

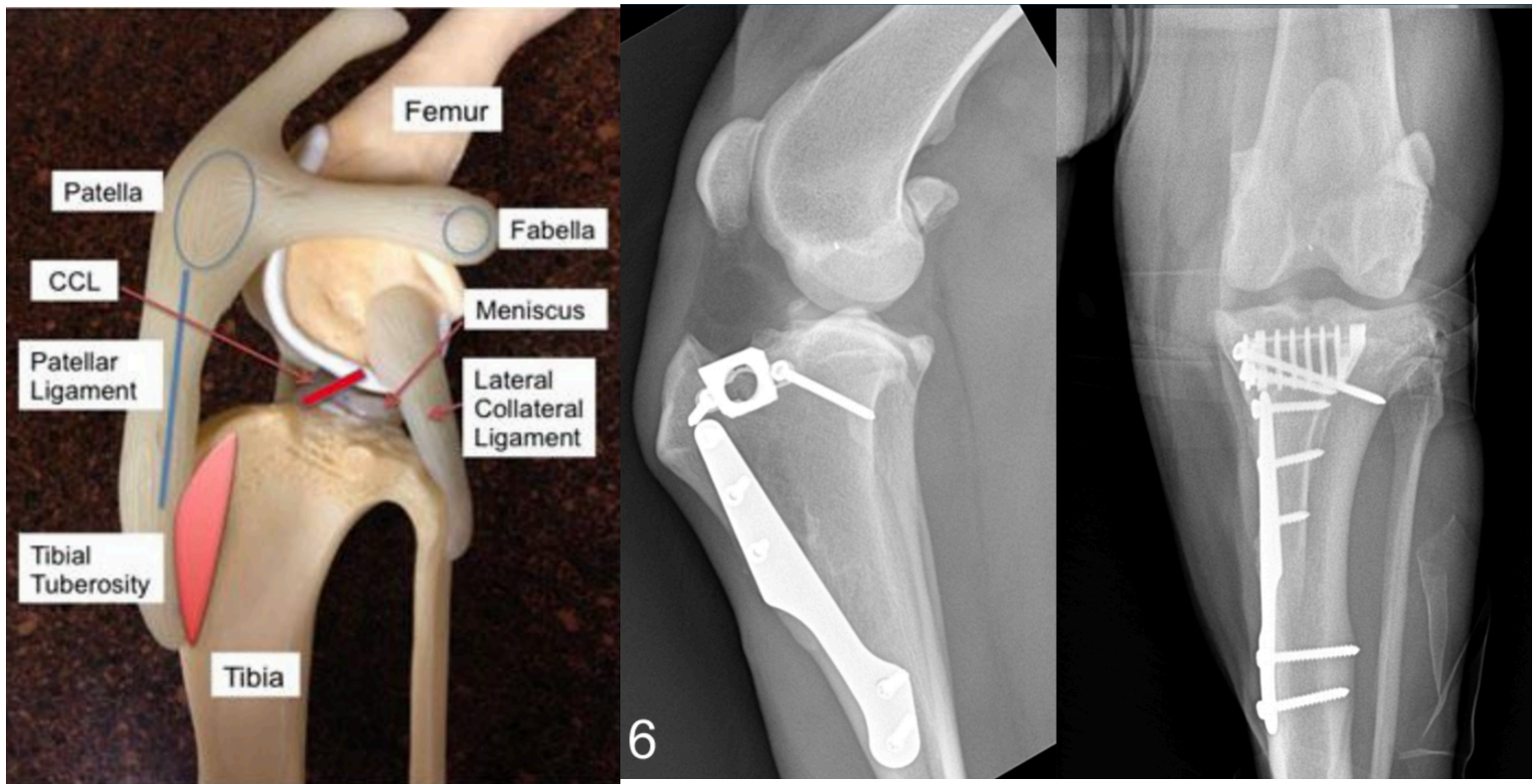
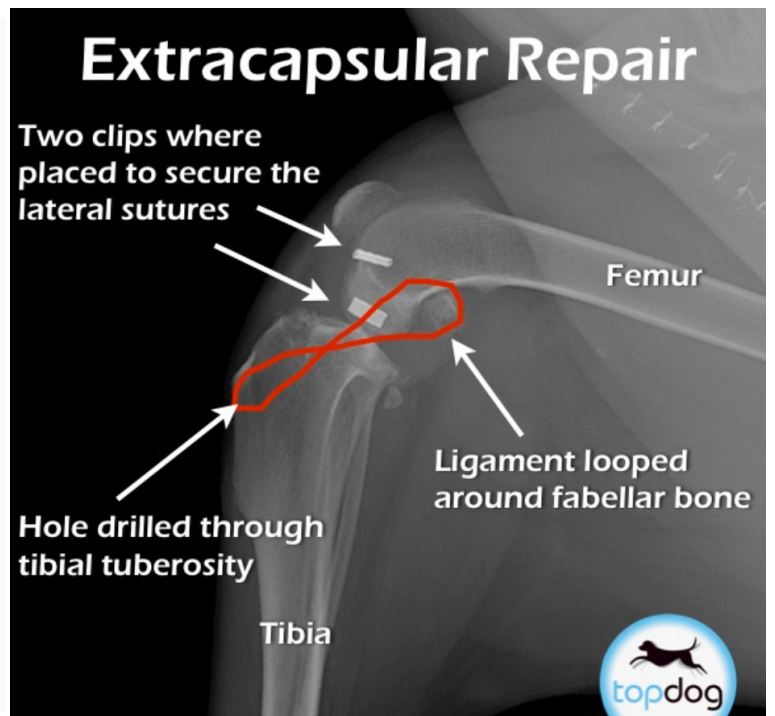
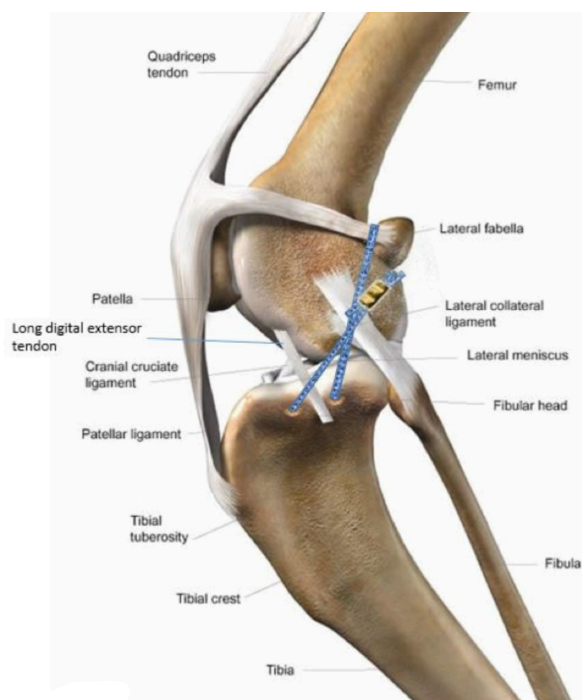


Figure 1 TTA Stifle Anatomy

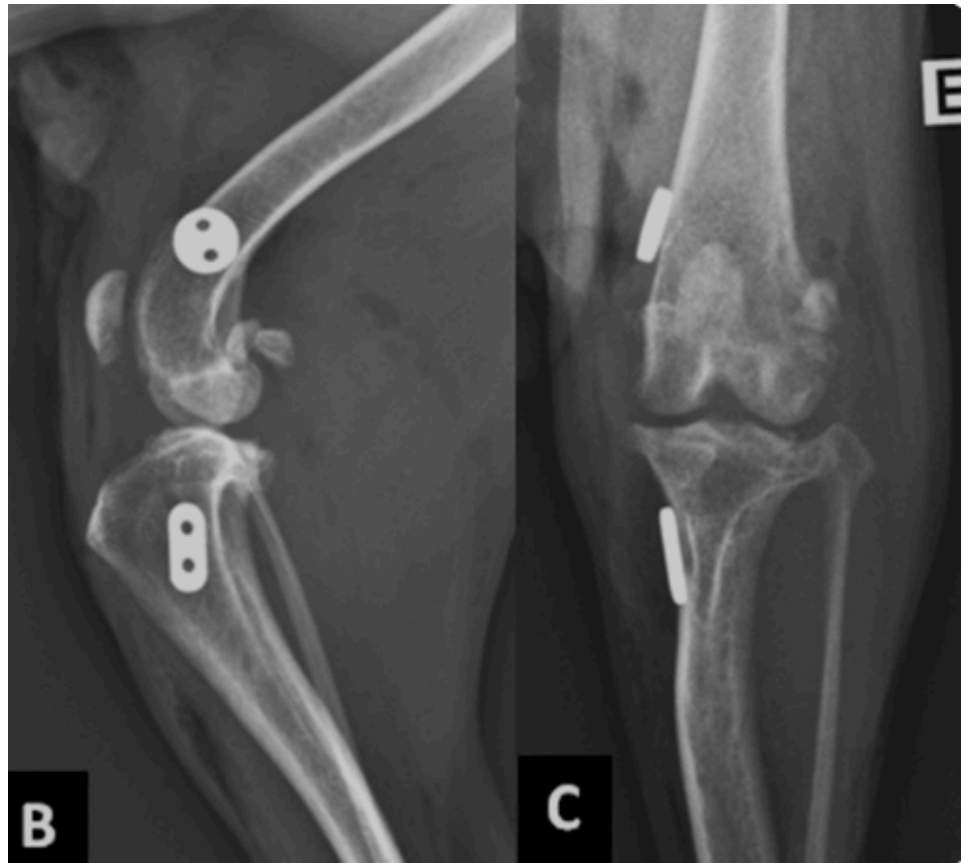
1. **Suture-based techniques** can be divided into intra-articular (within the joint) & extra-articular (outside the joint) procedures. Because of the inconsistency of the results reported with intra-articular techniques in dogs, suture-based procedures are primarily performed in an extra-articular fashion. The most commonly performed technique is called extra-capsular suture stabilization, which utilizes suture material that is placed just on the outside of the knee joint (but under the skin) to mimic the stability offered by the CrCL. A variation of this technique is called Tightrope® & allows the surgeons to use bone tunnels for proper suture placement.

- **Extra-capsular suture stabilization** (also called “Ex-Cap suture,” “lateral fabellar suture stabilization,” & the “fishing line technique”) is a popular technique. While there are many variations of this technique, suture material used & types of securing implants, the consistent goal is to “mimic” the function of the ruptured CrCL with a suture placed in similar orientation to the original ligament. The long-term goal is to facilitate the formation of organized scar tissue periarticular (around the joint) that will provide stability even as the suture gradually stretches or breaks. The most common complications after this procedure involve failure of the suture & progressive development of arthritis. The main risk factors for complications with suture-based techniques are patient size & age; larger & younger patients have more complications. For these reasons, many surgeons reserve suture techniques for micro/mini/small breed, older, &/or inactive dogs. The main advantages of this technique include its typically lower cost, lack of required specialized training to perform & the lack of a bone cut.



- The ***Tightrope*** is a novel “suture” technique that was developed as an alternative to osteotomy-based techniques. It utilizes a specifically developed suture/toggle implant that requires holes to be drilled through the thigh (femur) & shin (tibia) bones for more accurate anatomic placement of the implant (Figure 5).

Advantages of this procedure over other suture-based techniques include more accurate placement of the implant & better “suture” strength.



**Non-surgical treatment** usually involves a combination of pain medications, exercise modification, joint supplements, physical rehabilitation & possibly braces/orthotics.

- 1. *Activity restriction & anti-inflammatories*** – While administration of pain medications to dogs with CrCLD may improve their comfort, knee pain remains because of the persistent knee instability present. For this reason, strict activity restrictions (e.g., leash-based activities) are typically most effective at reducing pain in dogs with CrCLD. For these reasons, this treatment is generally limited to individual dogs in which surgery cannot be performed (i.e., financial constraints, illness, etc.)
- 2. *Rehabilitation therapy*** – There is ample evidence that therapy under the care of a veterinarian fully trained in physical rehabilitation can hasten & even improve the recovery from surgery. However, there is scant evidence to suggest that this is a consistent & predictable alternative to surgical management of CrCLD in dogs.
- 3. *Custom knee bracing/orthotics*** – Custom knee bracing is relatively new to canine orthopedics & there is no published data that supports its viability as a reasonable treatment in dogs with CrCLD. Much of the enthusiasm for dog knee bracing is extrapolated from their successful use in humans with ACL injuries. However, the mechanics of the canine & human knee are vastly different & it is unwise to make any comparisons between them relative to treatment modalities. At this time, there is NOT enough evidence to support any recommendation for knee bracing as a treatment of CrCLD.



## AFTERCARE & OUTCOME

**Postoperative care at home is critical.** Premature, uncontrolled or excessive activities risk complete or partial failure of any surgical repair. Such failure may require extensive surgery to address. Proper postoperative care will be explained to you in detail by your dog's surgeon before & after surgery.

Studies show that physical rehabilitation can speed a dog's recovery & improve final outcomes regardless of the chosen surgical technique. This rehabilitation should start immediately after surgery & usually includes a regime of passive range of motion, balance exercises, controlled walks on leash & so forth. Additional details should be discussed with a veterinary surgeon &/or a primary care veterinarian.

The long-term prognosis for animals undergoing surgical repair of CCLD is good, with reports of significant improvement in 85-90% of the cases. While, arthritis can progress regardless of treatment type, it's expected to be slower when surgery is performed.

Therefore, multimodal osteoarthritis management is recommended for any dog with CrCLD regardless of treatment. What this management might entail should be discussed with your dog's veterinary surgeon &/or primary care veterinarian.

Obesity in pets has numerous health issues associated with it that go beyond CrCLD.

Weight loss should be considered critical to any overweight pet with CrCLD.

Your veterinarian can help you to determine the ideal weight of your pet & how best to reach it.

This booklet serves as a guide during the important post-operative healing period following your pet's ACL/CCL surgery. Included in this booklet is a week-by-week recovery schedule along with visual aids & descriptions to help guide you through the various exercises. Please follow this program.

**Physical Rehabilitation Plan: Day 0 – 14**

The first 24 – 48 hours following your dog's surgery he/she may have a b & age on the affected leg. This b & age has been applied to protect the incision as the skin is sealing & to provide some compression to minimize swelling. Manual therapy can begin as soon as the b & age is removed; 2 to 3 days following surgery. The following routine should be done daily until your pet is consistently using their leg & has full range of motion in the knee (when you can bend & straighten the surgical leg the same amount as the non-surgical leg). At that point, it is still recommended once to twice a week as he/she will be building muscle & compensating for the surgical leg (The other limbs & lower back will often have muscle tension & discomfort).

**MASSAGE & PASSIVE RANGE OF MOTION (PROM)**

Massaging your dog's leg is important for relaxing the muscles prior to performing the exercises for rehabilitation. Lay your pet on his/her side on a comfortable surface with the surgical limb up. Target the muscles above & below the joint. Start the massage by pressing down on the muscles with the heel of your palm. You should not move your hand over the skin, but instead press down hard enough to move the skin over the tissues below. Using the heel of your palm, it's unlikely that you will press too hard & possibly injure healing tissue. If your dog shows no signs of discomfort, go back & massage the same areas with the balls of your fingers, where your fingerprints are, not the tips. This provides a deeper massage. Then run the flats of your h & s over the whole massaged area. Finally, flex & extend the affected limb several times, gently, until a little resistance is felt. Support the joint while doing this to prevent any twisting of the limb. If you have time, your dog will also greatly benefit from this therapy on the other limbs as they have been compensating for the injured leg. It is also a great way to practice your technique on a "healthy" limb to build your confidence

Frequency & Duration: 3 TIMES DAILY for 10 minutes per session



## **CONTROLLED LEASH WALKS**

This exercise requires your dog to be on a short lead very close to your body so that you have complete control of him/her. Body harness or gentle leaders are good options. Leash walks must be done slowly & for short periods of time to build up strength in the leg. For the first few days any walks outside should be for urination or defecation only. By the end of the first week, your dog should be able to walk for ~5 minutes per walk. The slower you walk your dog the more inclined he/she will be to place weight on the leg. Make sure to support the hind end under the belly with a sling if needed. This is particularly important on slippery surfaces. Your dog will benefit more from several short walks in one day rather than a single long walk. If your dog has been sent home with a b & age, please ensure the b & age does not get wet when he/she is outside. If this happens, it needs to be removed immediately. Placing a heavy plastic bag or dog bootie on to go outside should eliminate this possibility. Benefits includes the following:  
Keeping the muscles strong & lubricating the joints  
Encouraging use of the affected limb  
Decreasing pain

Positively rewarding your dog emotionally

Frequency & Duration: 3 TIMES DAILY for 5 minutes per walk

## **ICE THERAPY**

Start on DAY 1 & Day 2. After completing the above exercises, it is especially important to apply cold therapy to the affected knee to reduce pain & inflammation. You can use gel ice packs from the drugstore, frozen bags of popcorn kernels or bags of crushed ice. Wrap the ice material in a towel before applying. Place the ice on both the inside & outside of the knee.

Frequency & Duration: after exercise for 10 – 15 minutes

## **HEAT THERAPY**

By the 3rd day you can begin applying heat to the affected leg at the very start of your therapy session prior to massaging. Heat will draw blood to the area to enhance circulation at the surgical site, which aids the healing process. A variety of products are available such as “Magic Bags” or other heat products from the drugstore. Do not use topical products such as gels or creams. Check the temperature before applying heat to the area & make sure that you use a light towel in-between the product & the skin. Do not apply heat to the joint if it is inflamed (swollen) & warm to the touch.

Frequency & Duration: prior to massage for 5 – 10 minutes

### ACTIVITIES to BUILD STRENGTH, FUNCTION, MUSCLE MASS & BODY AWARENESS

The following exercises will be incorporated into the next 12 weeks of recovery. The intent of this program is to gradually increase strength, balance, & body awareness so that your pet can return to normal activity. All of these exercises are demonstrated on youtube.com webpage. These two pages provide detailed descriptions of the exercises. Please follow the schedule indicated on the table on the following page.

#### **CONTROLLED LEASH WALKS**

Walks should be on a 6' lead with the dog by your side. Up until this point, you have been walking up to 5 minutes per walk 3 – 4 times per day. From this point on, you can add 3 – 5 minutes per walk per week. This activity should only be increased if your pet is consistently using his/her leg at a walk. You can incorporate activities such as: Figure 8 patterns, walking up and down curbs in a S-pattern, gentle inclines (hills), stepping over obstacles/through long grass or snow, and short trotting intervals (10 steps) into these walks to make them more challenging and to increase muscle mass and strength.

#### **WEIGHT SHIFTING EXERCISE**

Have your pet stand squarely on a non-slip surface & gently nudge the hind end from side to side for 10 repetitions. This will help with balance & core strength & will lay the groundwork for further core conditioning. For a further challenge, have your pet stand with the front legs elevated (first on a stable surface like some stairs & then on an unstable one like a cushion, air mattress or FitPAWS equipment). This will force more weight onto the hind end.

#### **EXERCISES TO INCREASE BODY AWARENESS**

These exercises have you walking your dog on a leash in a “figure 8” pattern &/or through a series of obstacles in a “weave” pattern. This exercise helps to encourage the use of the leg & increases proprioception (Proprioception is the knowledge of where all one’s body parts are in space). Another great exercise to help with proprioception is walking slowing through the rungs of a ladder laid on the ground. As your pet walks slowly through this obstacle, they must carefully think about where they are putting their feet. Drop treats in between the rungs to make this an extra fun game.

#### **COOKIE STRETCHES**

Have your pet stand squarely on a non-slip surface & guide his nose to each hip, up, & then down for one repetition. Do this 5 times working up to 10 repetitions. Once he is comfortable with this exercise, you can place him on an unstable surface such as a couch cushion (on the floor), air mattress or FitPAWS giant disc/balance pad/peanut (available for purchase) to further challenge him. This exercise will help with spinal mobility & core strengthening.

### **SIT-to-STAND**

This exercise is a “Doggy Squat”. Have your pet sit squarely & then stand for 5-10 repetitions. They have a tendency to cheat & use their nonsurgical leg to push up so it is often helpful to have their surgical leg against a wall as you perform this exercise. This can also be incorporated into daily walks or at feeding time, you can use part of his kibble to entice him to do this exercise.

### **THREE LEGGED STANDING**

Have your pet stand squarely on a non-slip surface & then gently lift one leg off of the ground & hold for 5 – 10 seconds. Alternate with all but the surgical limb. Once your pet becomes good at this exercise, you can try two legged standing by lifting diagonal legs (left front & right hind) & vice versa.

### **WADING IN WATER**

Once your pet has their sutures removed, they are able to walk in water that is up to hip height. The buoyancy of the water will displace some of your pet’s weight & take some pressure off of the joints. There is also resistance in the water so they are also working on strength & flexibility. **IMPORTANT:** If you pet will not walk in a controlled manner & likes to leap in water then this is not a good activity until after the 8-week x-ray is assessed by your Veterinarian.

### **WALKING IN DEEP SNOW OR IN LONG GRASS**

in deep snow & in longer grass will make your pet pick their legs up higher which will build strength. This should only be done if you have your dog on a short leash & have control of them.

### **SWIMMING**

Swimming is allowed after the 8 week x-rays have been assessed & you have the go ahead from your Veterinarian. The uncontrolled kicking action can be harmful in the early stages of your pet’s recovery so it is important to be aware of this. Swimming is a great cardiovascular workout & is great for weight loss.

### **TUG**

Tug games are a great way to burn energy & to work on strength. The best tug toys have a bungee cord in the tug rope to prevent jarring to your dog’s neck or your shoulders when the taut rope suddenly stops the dog.

Stage of Recovery	Exercise/Manual Therapy	Frequency	Time/Repetitions
0 – 14 days post op	Follow the manual therapy routine listed on pages 3 & 4	Daily	2 – 3 times per day for the first week or until range of motion is normal compared to the opposite limb
<b>AT THIS TIME YOU WILL NEED TO MAKE AN APPOINTMENT TO HAVE THE SUTURES REMOVED. WE WILL ALSO ASSESS YOUR PET'S PROGRESS AND MAKE ADJUSTMENTS TO YOUR REHABILITATION PROGRAM AS NEEDED</b>			
Weeks 3 & 4 post op (If patient is consistently using the leg)	Manual therapy as above	1 – 2 times per week	~ 30 minutes
	Ice Therapy	As needed (after exercise or if your pet overdoes it and is sore)	15 minutes
	Controlled Leash Walks	3 times per day	10 minutes
	Weight Shifting	Once a day	2 minutes
	Figure 8/weaves/ladder	Once a day	2 minutes
	Cookie Stretches	Once a day	5 repetitions working up to 10
	Sit-to-stand	Twice a day	5 repetitions working up to 10
	Three legged standing	Twice a day	2 repetitions working up to 4
Weeks 5 – 8 post op	Manual therapy as above	1 – 2 times per week	~ 30 minutes
	Ice Therapy	As needed (after exercise or if your pet overdoes it and is sore)	15 minutes
	Controlled Leash Walks. Add in short trot intervals and hills into each walk to increase fitness	3 times per day	Add 3 – 5 minutes per walk per week to a maximum of 20 minutes per walk or 60 minutes total per day
	Walking in water/snow/long grass	3 times per week	Incorporate into total walk time (up to 60 minutes for the day)
	Weight Shifting: add unstable footing (air mattress, couch cushion) for further challenge	1 – 2 times per day	4 minutes, add 1 minute per session per week
	Cookie Stretches	1 – 2 times per day	Add 3 - 5 repetitions per session per week up to 15 reps/session
	Sit-to-stand	Twice a day	Add 3 - 5 repetitions per session per week up to 15 reps/session
	Two legged standing	Twice a day	30 seconds each side
<b>AT THIS TIME YOU WILL NEED TO MAKE AN APPOINTMENT FOR A FOLLOW UP X-RAY TO ASSESS BONE HEALING. YOUR VETERINARIAN WILL INFORM YOU IF YOU ARE OKAY TO PROGRESS TO THE FOLLOWING ACTIVITIES:</b>			
Weeks 8 – 12 post op	Activities can be continued as above with the addition of any of the following		
	Off leash activity	Daily	20 minutes working up TO 60 minutes
	Tug	Daily	5 minutes
	Swimming	Daily	5 minutes working up to 20 minutes over several weeks

If you would like assistance with your pet's exercise recovery, please let your veterinary team know so we can provide a referral to a local veterinary physical rehabilitation center.

If you have any questions, please feel free to ask your veterinarian &/or veterinary surgeon.

TREAT Veterinary Surgery Service

Dr. Le-Nguyen, DVM, GPCert Canine/Feline Surgery \*2024

(Practice Limited to Surgery)

(916) 230-8103

TREATVeterinarySurgeryService@gmail.com

TREATVeterinarySurgeryService.com

