Cranial cruciate ligament rupture is one of the most common causes of hindlimb lameness in the dog and the major cause of degenerative joint disease (arthritis) in the stifle joint.

**Function of the CrCL ligament:**
The cranial cruciate ligament (CrCL) provides stability to the knee (stifle) joint by controlling internal rotation and preventing cranial (forward) translation of the tibia during weight-bearing. A complete or partial tear of the cranial cruciate ligament causes instability in the joint which is why your pet doesn’t want to bear full weight on the limb. This tear in the ligament creates inflammation, increased joint fluid (effusion), and arthritis formation in the joint. In addition to the torn cranial cruciate ligament, the meniscus can also be damaged. The meniscus is a cartilage cushion between the femur and the tibia. Surgical intervention will benefit your pet’s knee by allowing the damaged tissue to be removed and returning stability to the joint.

**Cause:**
Cruciate ligament ruptures in dogs are usually not due to an isolated acute traumatic event as is the case in humans, but are due to degenerative processes that slowly weaken the ligament until ultimate failure. Obesity, steroid use, or some endocrine diseases can hasten failure of the ligament.

**Clinical Signs:**
Many dogs are middle aged or older when the ligament rupture occurs, however we are seeing increasing numbers of younger dogs (1-4 years old). Breeds commonly affected include Labrador Retrievers, Pit bulls, Rottweilers, Akitas, Golden Retrievers, Border Collies, Huskies, German Shepherds and Mastiffs. Many small breed dogs and some cats also develop cruciate ligament tears.

Common signs include:
- stiffness on the limb after rest
- varying degrees of weight-bearing lameness
- not bearing weight on the limb
- if the meniscus is damaged sometimes a clicking noise is heard from the stifle when the pet walks on the limb or when the stifle is flexed
- dogs with bilateral disease may have difficulty getting up and walking
Diagnosis:
Cranial cruciate ligament injuries can be diagnosed by reproducing the instability with the tibial compression test or the cranial drawer test (drawer sign). If the meniscus is damaged, a click may be audible or palpable. The stifle is thickened. Radiographs (X-rays) reveal effusion (fluid) within the stifle joint and signs of osteoarthritis, and these radiographic signs may be evident even before the tear in the cruciate ligament is obvious on physical examination.

About 40% of dogs will tear the cranial cruciate ligament in the opposite limb within 1 to 2 years; some already have a cranial cruciate ligament tear in the opposite stifle at the time of diagnosis.

Treatment:
There are many surgical options to treat cranial cruciate ligament injuries in dogs and cats. These include geometry modifying techniques - TPLO (tibial plateau leveling osteotomy) and the TTA (tibial tuberosity advancement) - and lateral imbrication (extracapsular) techniques - the fishing line technique and the tightrope procedure. Dr. Lawrence can discuss these procedures with you and recommend the best option for your pet.

Following surgery, the staff at VSC recommend physical rehabilitation sessions with Carrie and Dr. Lawrence (both Certified in Canine Rehabilitation). Physical rehabilitation improves the recovery of pets from surgical conditions and injury by the use of physical modalities in conjunction with therapeutic exercises, analogous to “physical therapy” in humans. At VSC, we customize a rehabilitation protocol for each patient, utilizing a combination of cold Class 4 laser, neuromuscular stimulation (NMES), cavaletti poles, therabands, stability balls, manual techniques (stretching, passive range-of-motion exercises), underwater treadmill sessions and proprioceptive training. We also provide owners with at-home exercises to perform between rehabilitation sessions, or if owners want to do home exercises instead.

Tibial Plateau Leveling Osteotomy
The TPLO surgery is a very successful treatment for cranial cruciate ligament rupture. Dr. Lawrence has performed thousands of these surgeries with excellent clinical results (90-95% of dogs returning to normal function). The TPLO is the only procedure that has been shown to reduce the progression of arthritis. One study demonstrated a four-fold reduction in the progression of arthritis following TPLO surgery versus dogs that were treated with the lateral imbrication (extracapsular) technique.
Preoperative X-rays are taken and the slope of the tibial plateau is measured. At surgery, stifle joint exploration is performed to assess the medial and lateral meniscus cartilages (that sit between the femur and tibia), and if a damaged meniscus is identified the damaged portion is removed. A curved cut in the bone (an osteotomy) is performed in the top of the tibia, and the bone segment is rotated to flatten the slope the tibial plateau, and prevent cranial tibial thrust (it is this cranial tibial thrust that occurs during weight-bearing that causes the lameness and instability when your pet weight-bears associated with CrCL disease). The bones are held in place with a plate and screws while the bone heals (typically 8 to 10 weeks).
TPLO and Small Breed Dogs
The TPLO procedure is especially useful for active small breed dogs. In our experience, many small dogs have a steep tibial plateau angle, and these dogs typically do not do well with the lateral imbrication (extracapsular) technique.

TPLO and Medial Patella Luxation
Dr. Lawrence is experienced at performing concurrent TPLO and medial patella luxation correction in both large and small breed dogs. By performing both procedures at the same time we can shorten your pet’s recovery time and reduce the number of surgeries needed to correct all the problems.

Revision Surgeries
Dr. Lawrence is experienced in performing the TPLO procedure in dogs that have previously been operated using another technique. These dogs will frequently improve with the TPLO surgery, but the outcome may not be as good as it would have been if a TPLO had been performed initially.

TTA-MMP (the Modified Maquet Procedure)
The MMP is a modification of the TTA procedure described for surgical stabilization of the stifle after cranial cruciate ligament rupture. The MMP uses “Orthofoam”, which is a hard porous titanium foam wedge used to advance the tibial tuberosity instead of a metal cage (as in the original TTA). This allows bony ingrowth which promotes a solid bone fixation, and a bone graft is not required. At VSC we perform the MMP.

“Orthofoam” is biologically compatible and is strong enough to be implanted into a weight-bearing bone. Specific measurements are taken of your pet’s stifle (knee) so that the appropriate size “Orthofoam” implant can be placed at surgery.

The MMP requires a linear cut along the tibia, which allows advancement of the tibial tuberosity (the front of that tibial bone) forward so the orientation of the quadriceps muscle to the tibial plateau is 90 degrees. By advancing the tibial tuberosity the knee becomes stable in weight-bearing. The “Orthofoam” is held in place initially by it’s porosity and rough surface (which grips the bone) and a pin, and bony ingrowth provides permanent fixation.

There are some dogs, due to their anatomical conformation, in which an MMP or TTA is not the most ideal technique. Surgeon’s preference, anatomy of the pet’s leg and any other concurrent problems will influence the surgeon’s decision whether to perform a TPLO or an MMP.
Lateral Imbrication (Extracapsular Stabilization) - TightRope CCL Technique
This technique is an extracapsular stabilization technique that utilizes bone tunnels allowing bone-to-bone fixation. The TightRope is FiberTape (Arthrex Vet Systems), which is stronger than the monofilament nylon that is commonly used with other extracapsular techniques.

We do not recommend the Tightrope procedure at VSC.

Lateral Imbrication (Extracapsular Stabilization) - monofilament nylon
At VSC, we generally reserve this technique for smaller dogs and cats. The extracapsular technique is not recommended for patients which may have compromised connective tissue healing.

Cranial Cruciate Ligament Disease in Cats
Cats can rupture either the cranial or the caudal cruciate ligaments. Typically the cause is trauma. Cats present with a non-weight-bearing or a weight-bearing lameness that will improve over time, but not resolve. While their small size means they will often function without surgical stabilization of the stifle, generally they will have a faster recovery and a better return to function if surgery is performed.

Non-Surgical management of Cranial Cruciate Ligament Disease
While stabilization (TPLO, MMP) is recommended for the best short and long-term function, quality of life, and comfort, and is considered the standard of care, in the past 7 years the use of custom orthosis (brace) has become available as an alternative to surgery when surgery is not appropriate for any reason. Occasionally a pet may have other health issues, unacceptable surgical or anesthesia risk, advanced age, or the owners may have financial constraints. In this situation, we can discuss the use of a custom-made stifle brace.

An orthosis is not the correct therapy for all patients, and before choosing an orthosis the following points are important to keep in mind:
1. The device MUST be put on every morning and removed every night and it must be used whenever your dog will be standing and/or moving about. The device is not used at night and your dog must not be allowed to move about at night (jump on or off bed, wander the house, go outside through a dog door, etc.).
2. Adjustments are expected and are a normal part of the custom orthosis process.
3. Follow-up is critical to success.
4. Even with an orthosis, surgery may be required if meniscal damage develops because of continued stifle instability.
5. Regular and ongoing rehabilitation sessions are needed to ensure a high level of success with an orthosis. Dr. Lawrence and Carrie are both Certified in Canine Rehabilitation and can measure and fit your pet with the initial orthotic device as well as create an ongoing rehabilitation plan.
6. Arthritis management is key.