



Tibial Plateau Leveling Osteotomy

Treatment of Ruptured Cranial Cruciate Ligament

The most common cause of rear limb lameness in the dog is rupture of the cranial (anterior) cruciate ligament. This leads to degenerative changes (osteoarthritis) in the stifle (knee) joint including cartilage damage, osteophyte (bone spur) production, and meniscal injury.

Figure 1a shows a normal canine knee joint (stifle) and Figure 1b depicts osteophytes and a ruptured ligament. The tibial plateau leveling osteotomy (TPLO) has proven effective in returning these stifles to full function.

Biomechanics

Although the knee joints of both dogs and humans are similarly constructed, the forces applied to the surfaces of these joints during weightbearing are vastly different. This is due to differences in anatomic configuration. In humans, the hip, knee, and ankle joints are parallel to each other and perpendicular to the weightbearing surface (the feet). Humans can stand easily with little stress on any ligamentous structure. Dogs, however, stand on their toes with their ankles up in the air and

Figure 1a.
Frontal view of normal left stifle

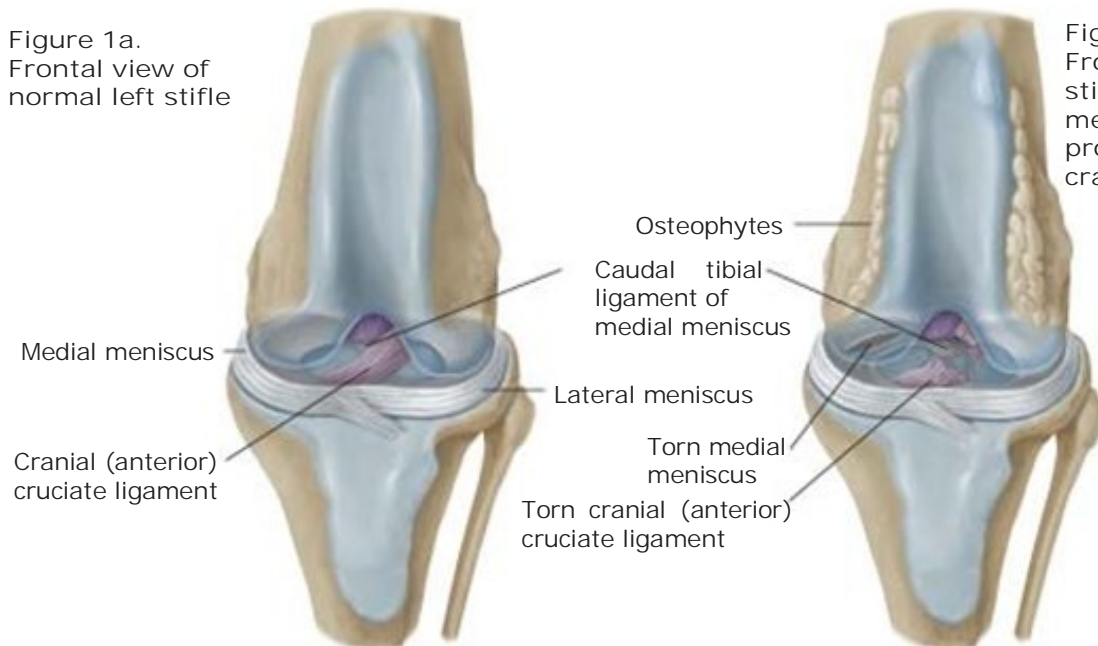


Figure 1b.
Frontal view of left stifle showing torn meniscus, osteophyte production and slight cranial drawer

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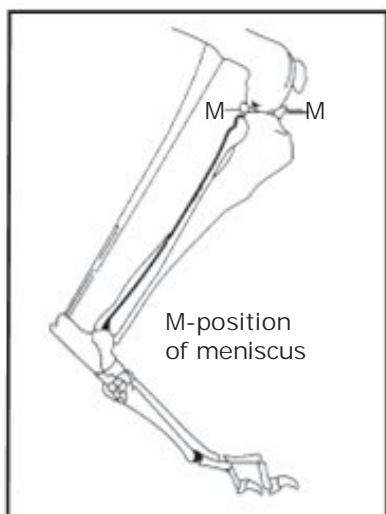


Figure 2. Side view of rear leg

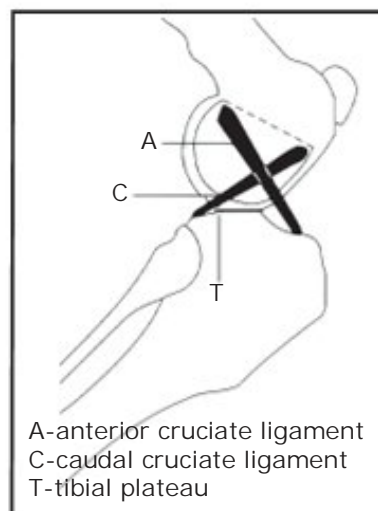


Figure 3. Detail of stifle (knee) joint

their knees bent forward (see Figure 2). The upper portion of the canine tibia (the tibial plateau) is sloped. Weightbearing creates a force that pushes the femur down the sloping tibial plateau, thereby moving the tibia forward. This force is called cranial tibial thrust. It is opposed only by the anterior cruciate ligament (Figure 3). Just as an unrestrained car on a hill would tend to roll down the hill, the anterior cruciate ligament acts like the cable in Figure 4A to restrict the downhill roll of the femur. With every step a dog takes, stress is applied to the anterior cruciate ligament. Over time, dogs with a high tibial plateau slope place enormous stress on the anterior cruciate ligament. Therefore, when the cranial tibial thrust is too great, the anterior cruciate ligament ruptures (Figure 5).

Anterior cruciate ligament ruptures can occur in several different ways. There may be a single incident that causes a sudden complete rupture of the ligament with severe pain and non-weightbearing lameness. Anterior cruciate ligament ruptures can also occur in small increments or a little bit at a time. These are

known as partial ruptures of the anterior cruciate ligament. These partial ruptures cause a small amount of pain and a mild lameness. When partial ruptures proceed to complete ruptures, the transition is often gradual.

Two other important structures in the knee are the medial and lateral menisci (cartilage pads) (see Figure 1a). The menisci are also prone to injury when the stifle joint is unstable from a cruciate ligament tear.

Clinical Signs

Once the cranial cruciate ligament ruptures, the tibia can slide forward and the femur is free to ride down the slope of the tibial plateau, just as the car rolls down the hill once the cable is cut (see Figure 4A). The meniscus is often damaged as the femur rides over the top of it. When the ligament tears, pain, swelling, and marked lameness will occur. If not stabilized, the joint will become dramatically arthritic over time. Rest and antiinflammatory medications have little effect upon the pain and lameness the dog experiences.

Figure 4. Forces on Stifle Joint

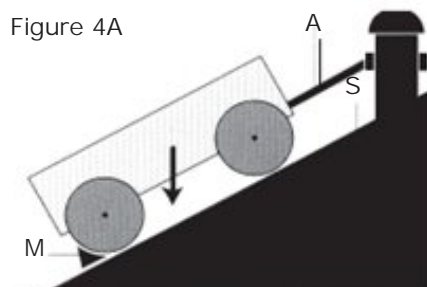


Figure 4A

A- anterior cruciate ligament
 M- meniscus
 S- sloped tibial plateau
 L- leveled tibial plateau

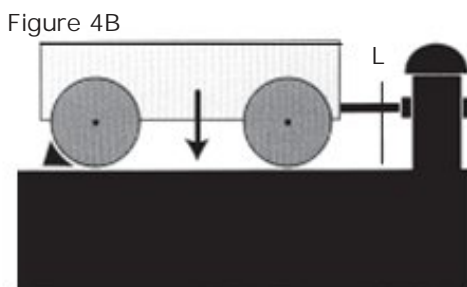


Figure 4B

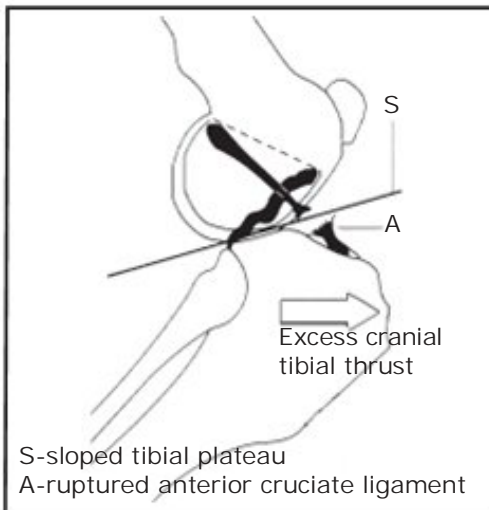


Figure 5. Ruptured anterior cruciate ligament

Diagnosis

Diagnosis is made upon eliciting forward motion of the tibia (cranial drawer sign). This is easy in acute, complete ruptures but may be more subtle in chronic or partial tears. Mild sedation to allow muscle relaxation and radiographs (x-rays) to demonstrate arthritic changes and swelling may be necessary to obtain a diagnosis.

TPLO Surgery

The tibial plateau leveling osteotomy procedure is used mostly for large, active dogs due to the stability it provides under extreme repetitive stress. Traditional surgical techniques require prolonged confinement to allow healing of the synthetic or natural anterior cruciate ligament replacements. These surgical repairs may fail due to the difficulty in confining large, active dogs for prolonged recovery periods. Any activity may lead to stretching of the artificial cruciate ligaments.

TPLO neutralizes the effect of cranial tibial thrust (see Fig. 6). The procedure levels the tibial plateau, thereby eliminating the need for the cranial cruciate ligament as a restraint against cranial tibial thrust (see Fig. 4B). In other words, rather than replacing the cable that broke in the first place, this procedure will level the surface and eliminate the need for the cable. Meniscal injuries are also corrected during the surgery in order to prevent further arthritic changes in the joint.

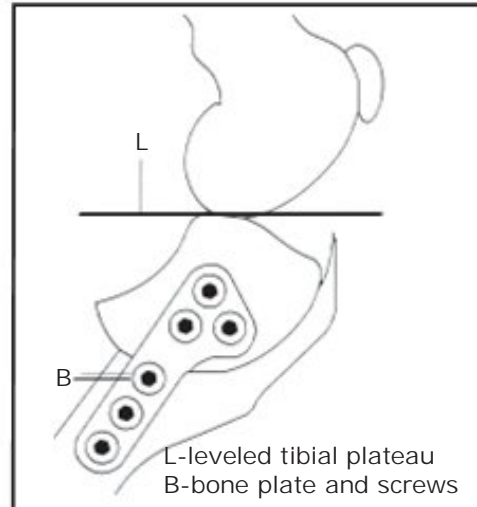


Figure 6. Tibial plateau leveling osteotomy

Postoperative Care

Postoperative care is critical to long term success. Healing takes about two months for the bone and slightly longer for the soft tissues. The most critical element during the healing process is strict confinement of the dog to a small area. Because the plateau leveling allows the joint pain to rapidly subside, the major problem during recovery is excessive patient activity prior to the completion of bone healing.

After surgery, the knee is bandaged in a stable walking configuration for one to two days. After 10-14 days, the sutures are removed and passive physical therapy is started at home. This physical therapy requires only a few minutes three to four times daily. Swimming therapy and short walks gradually increasing in length over six to eight weeks will be started several weeks after surgery. Again, complete confinement to a small room, pen, or cage when not working on physical therapy is mandatory. Avoid slick floors, jumping, running, stair climbing, and all acrobatics until recovery is complete.

Most patients return to controlled activity in two months and full activity in three to four months. Patients can usually return to athletic competition (field trial, hunting, agility trials) by six months postoperatively.

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Figure 7. Supporting ambulation with a towel

During your pet's convalescence, it may be necessary to offer assistance with ambulation (walking). Two such methods are:

Towel Walking

Place a sheet or large towel under your pet's abdomen as a means of support, holding an end in either hand. Use a towel or sheet that is large enough to enable you to stand in an upright position (Figure 7).

Support your pet so that he/she is unable to bear full weight on the affected limb(s). Over the passage of time (usually two to three weeks), you will notice that your pet will be able to accommodate a greater percentage of its actual weight, requiring less assistance from you.

In the case of a male dog, you will need to reposition the towel/sheet so as not to impede urinary function. This would be done once the dog is outside and ready to urinate. Allow him to lean against you while urinating. This will provide stability for him while urinating.

Tail Walking

You may also assist your dog with ambulation by holding its tail in an upright manner. This serves as a 'rudder' and provides the needed stability for walking.

NOTE: Not all pets will tolerate this method. You will need to decide which method of assistance will be the most effective.

The Use of Elizabethan Collars

Your pet is being discharged with a plastic cone-shaped collar called an Elizabethan or Buster Collar (Figure 8). This collar has been provided for use during the recuperation period and plays an important part in your pet's healing capabilities.

The collar is designed to restrict your pet's ability to reach his/her incision area or bandage(s). Licking at an incision area may result in open wounds (granulomas) that can be difficult to treat. This collar has been provided to protect these areas and also to insure that proper healing is allowed to take place.



Figure 8. Elizabethan collar

Although your pet may exhibit some strange behavior (such as pawing at or rubbing the collar, or walking into stationary objects), after the initial placement of the collar this behavior will usually subside after approximately one to two hours time. Contrary to what one might think, it is not beneficial to remove this collar. To do so only increases the time needed to become accustomed to wearing it.

Be assured that this collar does not constrict breathing passages when worn. The animal will be able to eat, drink, sleep and eliminate while wearing this collar.

Typically, it will only remain in place for the duration of time that the surgical site is sutured or an area is to remain bandaged. We do suggest that once your pet may have this collar removed that you keep it for future use. It may prove to be quite beneficial in the future for aid in treating minor skin irritations, "hot spots," and so forth.

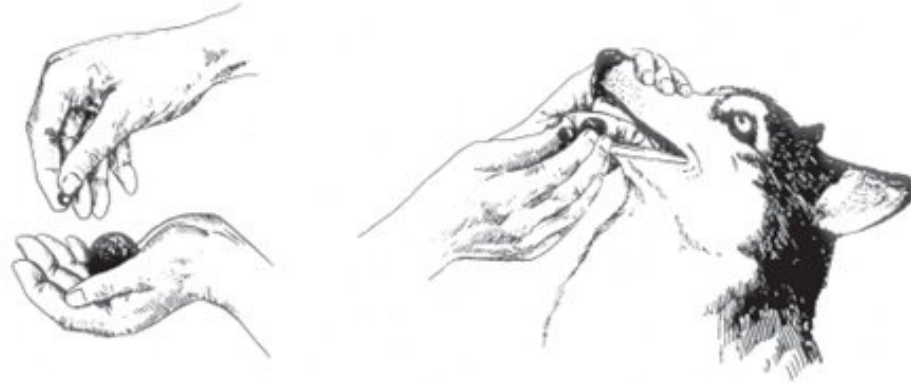


Figure 9. Administering medication to a dog

Medicating Your Dog

1. When administering medication in capsule or tablet form to your dog, you may find it much easier to simply place the medication in a small amount of food and offer it as a treat to your pet.
2. If your dog will not accept medication in the above mentioned fashion, it will be necessary for you to manually 'pill' your pet (Figure 9).

Place your hand around your pet's upper jaw and gently apply pressure by pressing the lips against the teeth. Using your other hand, gently pull the lower jaw downward and place the medication in the very back of your pet's throat. By holding his/her muzzle and gently stroking the throat, you will stimulate your pet to swallow.

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