I love working with working dogs because they represent the most noble spirit I can imagine, that is, they perform beyond human capabilities with grace and ease, yet they are in service to man with loyalty and charm. Even though they test me, and push me to my limits, I come back for more because the experience enriches me. When a patient comes to me with a ruptured cranial cruciate ligament, I eagerly wait for the patient to return to the field and training. This sense of satisfaction comes from a new understanding of how the stifle works.

In 1978, a new test for identifying rupture of the cranial cruciate ligament was described.\(^1\) After using the test for several years, I began to understand how the stifle really works. In 1982, I described the cranial tibial thrust\(^2\) which is a natural force created in the dogs stifle. The cranial tibial thrust is responsible for rupture of the cranial cruciate ligament. Understanding how this force is created, led to the design of a surgical procedure\(^3\) for controlling this force and its destructive side effects. Although that surgery neutralized the effects of the cranial tibial thrust, a new version of the procedure, called Tibial Plateau Leveling Osteotomy,\(^4\) has proven effective in returning dogs to full function.

![Figure 1: Normal Canine Tibia](image)

<table>
<thead>
<tr>
<th>A. Femur</th>
</tr>
</thead>
<tbody>
<tr>
<td>B. Meniscus</td>
</tr>
<tr>
<td>C. Tibia</td>
</tr>
<tr>
<td>D. Tarsus</td>
</tr>
<tr>
<td>E. Achilles Tendon</td>
</tr>
<tr>
<td>F. Tibial Plateau</td>
</tr>
</tbody>
</table>
The key to understanding lameness is understanding the forces generated in the stifle. Since the tarsal tendon within the Achilles tendon (Fig. 1-E) of the dog is a fixed length, all the forces of the foot are transmitted through the tibia (1-C). The proximal portion of the tibia, the tibial plateau (1-F) is sloped. This slope causes the tibia to slide forward unless it is restrained from doing so by the cranial cruciate ligament. The single force between the tibia and the femur (Fig. 2-A) can be thought of as having a component for compression (2-D) and a component for slippage (2-F). The compressive force is composed of weight bearing and muscular forces for propulsion.

On the other hand, the cranial tibial thrust (2-C) is opposed only by the cranial cruciate ligament. When the cranial tibial thrust is too great, it ruptures the cranial cruciate ligament. Ruptures come in several varieties. There are singular incidents which cause a sudden complete rupture with a lot of pain and a non-weight bearing lameness. Other ruptures occur in small increments or a little bit at a time. These are known as partial rupture of the cranial cruciate ligament which cause a small amount of pain and a mild lameness with poor performance. When partial rupture proceed to complete rupture, the transition is often gradual.

The diagnosis of a rupture of a cranial cruciate ligament is made by eliciting forward motion of the tibia (cranial drawer sign). This is easy in an acute rupture, but subtle in partial ruptures or chronic ruptures of the cranial cruciate ligament. Secondary to rupture of the cruciate ligament, the medial meniscus (the football player’s cartilage) is injured. This is constantly painful and will soon be followed by the inability to sit with the stifle in a fully flexed position. A crooked sit may represent a mild to severe form of stifle injury.
For years I used traditional surgical techniques which were designed to stabilize the stifle by replacing the cranial cruciate ligament with a synthetic or natural ligament. The material was supposed to be as strong or stronger than the original ligament and be able to heal without stretching in the fluid environment of the stifle joint. The ligament would stretch, the cranial tibial thrust would be unopposed, and arthritis would follow. I noticed incomplete return of thigh diameter, incomplete flexion of the stifle, and poor athletic performance. This is failure as far as a working dog is concerned, so another method was devised.

Today, the Tibial Plateau Leveling Osteotomy is used to overcome the effects of the cranial tibial thrust. Thus, the need for the cranial cruciate ligament is eliminated as a restraint to the cranial tibial thrust. The medial meniscus is also removed if the cruciate ligament tear is complete. If there is
a partial rupture of the cranial cruciate ligament, the medial meniscus is left intact.

Healing takes about two months for the bone and slightly longer for the soft tissues to calm down. The cranial drawer sign will remain positive since there is no cranial cruciate ligament. The tibial compression test will be slightly positive initially and usually be absent by three months post-operatively.

![Figure 5: Tibial Plateau Leveling Osteotomy](image)

Because the plateau leveling permits the joint pain to subside, the major problem in this surgery has been related to excessive patient activity before bone healing is complete. Owners are advised that absolute restriction of activity is mandatory during the healing process. Most patients return to very light yard work at 2-3 months, full training at 5-6 months, and are functioning normally under field trail conditions at 6 months. Complete return of thigh diameter, complete flexion of the stifle, and good athletic performance usually results from this surgery. This is success as far as a working dog is concerned.

The surgery results over the past ten years have been excellent. Even patients that have had ruptured ligaments for periods of up to five years have made marked improvement. Many of these cases have a longer period of regaining flexibility in the stifle. Dogs that have had previous surgery (up to seven previous surgeries on the same stifle) still show improvement. Dogs with poor conformation may not respond well to this surgery but those patients can also have their conformation corrected at the time of surgery. This surgery is not size dependent; it works on all stifles of all breeds from the Chihuahua to the Great Dane with the described mechanism of injury.

The Tibial Plateau Leveling Osteotomy is a patented procedure which is performed in Eugene, Oregon. Preparations are being made to develop specialized instrumentation and teach other surgeons the technique. The learning, discovery, analysis, diagnosis, treatment, and results are all part of the excitement I feel in developing the best for our four legged friends.
It should be noted that some dogs have a twisted or bent leg or both and in some cases to get the best results with TPLO it is necessary to correct these problems at the same surgery.

An analogy is helpful to understand the process of tibial plateau leveling osteotomy. Consider a wagon parked on a hill. A. The weight of the wagon (C, axial compression), pulls downward because of gravity and creates a force (D) because of the slope. If a rope (F, cranial cruciate ligament), is tied from the wagon to a fire hydrant and a chock (E, meniscus), is placed behind the tyre (condyle), then the wagon is prevented from rolling down hill (cranial tibial translation). If the rope breaks, the wagon rolls down hill and crushes the chock B. Force (D) can be eliminated by parking the wagon on a level surface and the rope (F) and chock (E) are not needed. The joint compression force is reduced to the weight of the wagon (C). Although the weight of the wagon (C) is not eliminated, it's destructive effects are overcome.

Questions to Ask About the Knee

Does the dog bear full weight on the leg or does the dog limp?
Does the dog go into a full sit or sit crooked?
Does the dog flex the knee or is the knee straight?
Is the knee of the affected leg the same size or smaller than the other?
Is there swelling to the inside of the knee?
Is there swelling on the hock (ankle) or is it smooth?
When did the most recent episode occur?
Was the dog sore in the past and then improve with rest or did the dog become sore and stay sore?
Was the dog ever sore in one or both legs after getting up from rest?
Has the leg always pointed straight or is the leg crooked?
How long has the dog been actively jumping?

5 Barclay Slocum, DVM, Slocum Clinic, 621 River Avenue, Eugene, OR 97404, Phone (503) 689-9393

The above article is copyright Barclay Slocum and is used with permission.