



## **Tibial Plateau Leveling Osteotomy (TPLO) For Repair of Cranial Cruciate Ligament Rupture**

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Tibial Plateau Leveling Osteotomy (TPLO) has become one of the most recognized techniques for management of cruciate ligament tears in dogs. Although new to many surgeons, its founder Barclay Slocum and Theresa Devine Slocum, started perfecting this techniques since the early 1980s. Historically, the technique has been the object of much criticism and scrutiny. Criticism was based upon a lack of understanding in addition to complaints about the ethics of patenting a surgical procedure. Currently, TPLOs are performed all over the country and are changing the way people think about cruciate rupture.

The traditional model of cranial cruciate ligament (CCL) injury considered the mechanism of failure to be from trauma or from chronic degeneration of the ligament. In this model, the end result of damage to the CCL is instability. The instability leads to pain, progressive osteoarthritis, meniscal damage and lameness. The traditional methods to remedy these problems are to re-stabilize the joint. Multiple different extra-articular (fibular head transposition, extracapsular sutures) and intra-articular (fascial grafts, patella tendon transposition, allografts, autografts, arthroscopic repair) techniques have been described that attempt to re-stabilize the stifle. All of these techniques have similar results. Instability returns to the joint 2-4 months post operatively. The common denominator to all of these procedures may be the enhancement of periarticular fibrosis (scar tissue), with stabilization coming at the expense of range of motion. Despite the instability, dogs seem to improve and many (approximately 80-85%) have a tolerable outcome with happy owners. Most of these dogs will have progressive radiographic and clinical osteoarthritis and many will fail to return to their pre-injury status.<sup>1</sup>

Further concern for application of traditional repair techniques arises when considering partial cruciate tears. Partial cruciate ruptures may be present in 30-40% of dogs with cruciate ruptures. Many of these dogs have minimal to no instability on orthopedic examination. How do “stabilization” procedures benefit these patients?

The poor recovery of many dogs repaired with conventional techniques inspired the development of the TPLO. The technique is based on a active model of the stifle. This model is centered around the concept of cranial tibial thrust. Dr. Slocum described this natural force in the dog’s stifle as the one responsible for rupture of the CCL and damage to the caudal horn of the medial meniscus. (Figure 1) Cranial tibial thrust is the cranial translation of the tibia with weight bearing. Due to the fixed length of the Achilles mechanism, all of the forces of the foot are transmitted through the tibia. The proximal portion of the tibia is sloped. The slope causes the tibia to slide forward unless

it is restrained from doing so by the CCL. The magnitude of tibial thrust is dependent not only on the amount of compression (weight bearing ) but on the degree of slope of the tibial plateau. The goal of TPLO is to overcome the effects of cranial tibial thrust by leveling the tibial plateau. Once the cranial tibial thrust has been neutralized by TPLO, the passive restraints of the stifle (CCL and medial meniscus) are no longer important. (Figure 2,3)

The technique of TPLO involves application of a jig to the medial tibia to guide the osteotomy. A curved saw blade is used to create a cylindrical cut in the proximal tibia. The fragment is rotated until the desired tibial slope is achieved (3-7 degrees) and a TPLO plate is used to hold the fragments in apposition. The meniscus is evaluated through a caudal approach or arthroscopically and either partially removed or a meniscal release is performed to prevent further damage.

Ideal candidates for TPLO are dogs greater than 15bs with either partial or complete CCL tears. There is no upper end weight restriction. Dogs as great as 200 pounds have been repaired. Contraindications are neoplastic or infectious processes. Immune mediated disease with secondary CCL rupture is not an absolute contraindication, but these dogs have longer healing times.

Complications following TPLO are uncommon but can include screw or plate failure, limb swelling, infection, patellar tendonitis, caudal cruciate rupture, or gait abnormalities.

Research in the field of tibial plateau leveling is on going. In a 1999 prospective clinical study by Dr. Peter Schwarz, TPLO was compared to an extracapsular imbrication technique (ECIT). The study evaluated dogs over 50 pounds with CCL tear treated by either TPLO or ECIT and followed for 6 months post-operatively. Parameters evaluated included tibial plateau slope, time until initial weight bearing, time to maximum recovery, range of motion, owner satisfaction, owners willingness to recommend procedure and complications. TPLO was equal or superior to ECIT in all parameters evaluated. This study was repeated by Conzemius et al and presented at the 2002 ACVS scientific abstracts session comparing TPLO to ECIT in Labrador retrievers. In this study dogs with TPLO performed similarly to dogs with ECIT at 6 months post operatively.

Further documentation of the efficacy of TPLO was demonstrated at the 1999 ACVS scientific abstracts session where C Warzee, SP Arnoczky et all (Michigan St.) evaluated the effect of TPLO in CCL deficient stifles. This *in vitro* analysis found that cranial tibial translation was eliminated in all CCL deficient stifles following TPLO. The study suggested that TPLO converts cranial tibial thrust into caudal tibial thrust and that the caudal cruciate ligament acts as the prime static stabilizer of the joint.

Morris and Lipowitz reported a significant difference in tibial plateau angles in dogs with cruciate ligament tears compared to dogs without tears. Dogs with tears had a mean tibial plateau angle of 24.7 degrees vs. 18.1 degrees in dogs without cruciate disease.

TPLO is a proven technique for management of CCL tears in dogs that results in improved post-operative function, decreased osteoarthritis, more rapid return to function and higher client satisfaction than with more conventional techniques of repair.

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