

# **TREATMENT OF CRANIAL CRUCIATE LIGAMENT INJURIES IN DOGS**

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Cranial cruciate ligament injury is the most common traumatic orthopedic abnormality incurred by dogs. An intact cranial cruciate ligament is necessary for normal stifle function. Cranial cruciate ligament insufficiency results in chronic stifle instability, specifically abnormal cranial translation of the tibia with respect to the femur, increased internal rotation of the tibia and abnormal hyperextension of the stifle joint. This instability results in the progressive development of degenerative joint disease (noninflammatory arthritis) and limb dysfunction. While 87% of dogs under 15 kg (33lbs) treated for 3 to 6 weeks with conservative therapy (nonsteroidal anti-inflammatory drugs, exercise restriction and body weight reduction) should see an improvement in limb function, 81% of dogs weighing in excess of 15 kg had no improvement in limb function or increased lameness when managed in a similar manner.

Performance dogs, particularly obedience, hunting and field trial dogs, often sustain cranial cruciate ligament injuries. While many of these dogs sustain traumatic injuries to the cranial cruciate ligament as a result of strenuous activities associated with training, work or competition, it is well recognized that there is a subset of dogs that develop cranial cruciate ligament insufficiency, often in both stifles, at a relatively young age that is not associated with any particularly catastrophic traumatic event. There are a large number of young (less than 3 years of age) large breed dogs (particularly Rottweilers and Labrador Retrievers) that are presented with a progressive history of lameness that typically is insidious in its onset and is often bilateral. These dogs generally have moderate degenerative joint disease of both stifles indicating that this is a chronic process and in most cases a partial rupture of the cranial cruciate ligament is found at surgery. Various theories have been proposed to explain this phenomenon including a possible immune mediated process, postural affects (post or straight legged hindlimb stance) or other conformational abnormalities (genu varus, genu valgus, excessive internal torsional conformation, excessive slope of the tibial plateau, and/or malformation (narrowing) of the intercondylar notch of the femoral condyle. Most veterinary orthopedic surgeons currently subscribed to the theory that these young large breed dogs develop cranial cruciate ligament insufficiency as a result of poor stifle biomechanics which are secondary to some yet to be defined conformation abnormality.

Numerous surgical procedures have been developed to treat dogs with cranial cruciate ligament insufficiency. In the past, these procedures were grouped into two broad categories: intra- and extra-capsular techniques. Intra-capsular techniques utilized autogenous, allogenic or synthetic

“grafts” to replace the failed cranial cruciate ligament. Extra-capsular techniques utilized autogenous, or synthetic materials which were placed outside the joint capsule to restrain abnormal stifle motion. Extra-capsular procedures rely on subsequent periarticular fibrosis to limit abnormal stifle motion. Although improved limb function has been reported in dogs that had either intra- or extra-capsular stabilizations, a return to normal limb function is the exception rather than the rule and virtually all techniques are associated with a similar progression of degenerative joint disease.

For the past year and a half at the University of Florida Veterinary Medical Teaching Hospital we have been performing the tibial plateau leveling osteotomy to treat dogs with cranial cruciate ligament insufficiency weighing in excess of 40 pounds. The tibial plateau leveling osteotomy is a patented procedure which was conceived and developed by Barclay Slocum, DVM, of the Slocum Clinic, Eugene, Oregon. Dr. Slocum recognized that the cranial motion of the proximal tibia or “tibial thrust” elicited with the tibial compression test mimics the abnormal mechanics in a stifle with cranial cruciate insufficiency during forceful weight-bearing. He also realized that the caudal slope of the articular surface of the tibial plateau plays a major role in the production of this tibial thrust and that this thrust and associated tissue stress are major contributors to the pathogenesis of the pain, dysfunction and degenerative joint disease. While previously employed traditional intra- and extra-capsular techniques have attempted to re-establish a restricting functional band which mimics the restraint provided by the intact cranial cruciate ligament, the tibial plateau leveling osteotomy alters the joint mechanics to neutralize the tibial thrust by leveling the slope of the tibial plateau. The tibial plateau leveling osteotomy utilizes a patented arc shaped “biradial” saw blade and osteotomy jig to accomplish rotation of the articular surface of the proximal tibia. The osteotomy is then stabilized with a patented six hole, Synthese compatible bone plate. Training and licensing is required to perform this procedure.

The instrumentation for performing the tibial plateau leveling osteotomy is readily applicable to dogs weighing 44-132 lbs. Properly positioned preoperative radiographs must be obtained and the slope of the tibial plateau measured to determine the exact amount the plateau will be rotated during surgery. At least two people are required to perform the procedure. Once practiced as a team the technique can routinely be performed in 60 to 90 minutes. There is a substantial learning curve as several steps of the procedure require a degree of subjective assessment.

Most dogs begin bearing weight on the operated limb within a few days following surgery and are placing substantial weight on the operated limb within a month of surgery. The osteotomy generally takes approximately three months to heal and the dog’s exercise must be limited until there is radiographic union of the osteotomy. We have had several dogs develop implant complications because they have, in the early convalescence period, returned to nearly normal weight bearing on the operated limb and the dogs have not been properly restrained. The overall recommended rehabilitation period is five months. A high level return of limb function and comfort is usually evident between two and four months following surgery. Maximum limb function is usually obtained between five and nine months following surgery and the maximal return of muscle mass is usually reached between eight months and one year following surgery.

The tibial plateau leveling osteotomy appears to result in a high percentage of dogs obtaining very good or excellent limb function. We have been impressed that even dogs with moderate-to-

advanced pre-existing degenerative joint disease have obtained remarkable improvement in limb function. Dogs that have had abnormal tibial thrust neutralized with the tibial plateau leveling osteotomy do not seem to develop the extensive joint capsule fibrosis that is often seen with the more traditional intra- and extra-capsular procedures. Thickening of the patellar ligament and the parapatellar tissue is common but does not appear to be detrimental. After leveling the tibial plateau, the tibial compression test generally reveals a dramatic decrease in the tendency for the tibia to thrust. The dog will continue to have similar cranial drawer motion as was present prior to surgery, but this usually becomes more difficult to elicit as healing progresses and muscle mass increases. During activity, momentum changes mimicking drawer motion, may still occasionally occur and place the caudal horn of the medial meniscus at risk to injury. For this reason, it is recommended that a meniscal release be performed at the caudal meniscotibial ligament. Meniscal release does not seem to adversely affect a dog's prognosis following surgery and greatly decreases the incidence of subsequent meniscal injury.

Based on our limited experience with the tibial plateau leveling osteotomy at the University of Florida, discussions with other veterinary surgeons who have performed this procedure and the results reported by Dr. Slocum, we feel that this procedure consistently affords a medium-to-large breed dog, particularly a performance animal, with cranial cruciate ligament insufficiency the highest probability of obtaining the best possible limb function. There is, however, a need for clinical and experimental evaluation of the tibial plateau leveling osteotomy to document its efficacy and better understand its therapeutic mechanisms.

### **References**

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