

# TTA (Tibial Tuberosity Advancement) for the treatment of cranial cruciate ligament injuries in the dog

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## INTRODUCTION

Rupture of the cranial cruciate ligament (CrCL) in the stifle of the dog is probably the most common cause of hindlimb lameness seen in the general practice setting. Injury to the CrCL is thought to be due to a hyperextension injury of the knee with an internal rotation of the tibia. CrCL tears may be partial initially, complicating the diagnosis, but eventually most end up in complete tear due to the imbalance of forces that act on the joint resulting in cranial tibial thrust. This abnormal translation of the tibia relative to the femur may also result in additional injury to the medial meniscus, necessitating a partial or complete meniscectomy during surgery, further prolonging postoperative morbidity. Most practitioners opt for the modified retinacular imbrication technique utilizing heavy monofilament nylon as a repair method, or refer to surgeons capable of performing tibial plateau leveling osteotomy (TPLO), which is in a broad consensus, considered state of the art.



## NEUTRALIZATION OF CRANIAL TIBIAL THRUST

Without neutralizing the cranial tibial thrust, any attempted reconstruction of the CrCL would simply fail as a result of the biomechanics of the knee. Slocum's 1993 proposal was to modify the anatomy of the knee, i.e., eliminate the tibial plateau slope in such a way that all loading forces on the knee are transmitted perpendicularly from the femoral condyle to the tibial plateau, along the long axis of the tibia.

In 2000, Tepic and Montavon realized that the total joint force of the stifle is nearly parallel to the patellar ligament. They proposed that advancing the tibial tuberosity cranially would achieve the same results. Cranial advancement of the tibial tuberosity until the patellar ligament becomes perpendicular to the tibial plateau eliminates the shearing force produced in the CrCL deficient stifle.

## RATIONALE FOR TTA

First, the total joint force of the stifle is approximately parallel to the patellar ligament. If the patellar ligament is perpendicular to the tibial plateau, there is no shear component of the total joint force, and the cruciate ligaments are not loaded. The angle between the patellar ligament and the tibial plateau changes with flexion

and extension, and in fact the two are 90 degrees to each other when the stifle is in 90 degrees of flexion, the cross-over point. So, when the CrCL is ruptured, the stifle can be stabilized by shifting the cross-over point to full extension of the joint. This can be performed by either TPLO, or TTA.

### **THE PROCEDURE**

The amount of advancement required to move the tibial tuberosity is determined from a preoperative standing angle lateral radiograph of the stifle. The stifle is approached medially, and a frontal plane osteotomy is performed. The tibial tuberosity and cranial border are held in advancement by (1) a titanium cage, (2) a titanium fork, and a (3) titanium tension band plate. The cage transfers the compression component of the patellar ligament force from the tuberosity to the proximal tibia. The tension band plate transfers the axial component of the patellar ligament force from the tibial tuberosity to the proximal diaphysis of the tibia. The open-wedge osteotomy may be grafted by cancellous bone or a commercially available product.

### **CLINICAL EXPERIENCE**

Having performed both procedures, the author finds the TTA to be technically easier to perform than the TPLO. Now having performed over 200 procedures around the United States since early 2004, the complication rate seems to be related to technique. Thorough examination of the joint, either by arthroscopy or arthrotomy, is a must to evaluate medial meniscus health. Placement of the osteotomy is forgiving, but the fork and tension band plate must be placed accurately to avoid fragmentation of the bone postoperatively.



**INTERESTED IN MORE?** Contact the author for more details concerning instructional classes, in-hospital surgeries, and implant availability. Hardware is available to perform the procedure on any sized patient. Although the implants are proprietary, the hardware to install them and the procedure itself is not.