Role of stifle and tarsal joint angles and calcaneal tendon tension in cranial tibial translation during limb loading in cranial cruciate ligament-deficient dogs

Olivia Winson, SVM, UC Class of 2014, STAR STUDENT
University of California, Davis

Hypothesis:

We hypothesized that the gastrocnemius muscle and common calcaneal tendon complex play a major role in generating cranial tibial thrust (evidenced by cranial tibial translation in the CrCL-deficient stifle) and that the effect of the tendon complex is modified by tarsal and stifle joint angles because the complex has large moment arms about both of these joints.

Proposed research to accomplish:

The relationships of common calcanean tendon strain and CrCL integrity on cranial tibial translation with different stifle and tarsal joint angle configurations were determined in an in vitro biomechanical testing experiment using canine cadavers. At specific, incremental stifle joint angles, the tarsus was flexed while measuring common calcaneal tendon strain and bone and joint positions using an extensometer and kinematic markers. The experiment was performed before, and after transection of the CrCL. The relationships between tendon strain, joint angles, and cranial tibial translation were assessed using regression and repeated measures ANOVA statistical techniques.

Preliminary Results:

Data reduction for the project is still in progress. Thus far we have been able to show that there is greater cranial tibial translation when the CrCL is transected, demonstrating that our model approximates the behavior of a true stifle. Gastrocnemius tendon tension appears to be linearly correlated with tarsal torque (data not shown), and appears directly related to the magnitude of tibial translation, as expected, since the gastrocnemius is helping to generate cranial tibial thrust. The degree of tibial translation is greatest when the CrCL is transected at both extreme angles of stifle extension and flexion, however the greatest net translation occurs with the stifle in extension. These data support our hypothesis that the maximal strain on the common calcaneal tendon, and thus its point of peak contribution to cranial tibial thrust, will be greatest when the stifle is in extension and the tarsus is in flexion, as this creates the most elongation of the gastrocnemius muscle-tendon unit itself.