Abstract

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Biomechanics of an orthosis-managed cranial cruciate ligament-deficient canine stifle joint predicted by use of a computer model

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OBJECTIVE To evaluate effects of an orthosis on biomechanics of a cranial cruciate ligament (CrCL)-deficient canine stifle joint by use of a 3-D quasistatic rigid-body pelvic limb computer model simulating the stance phase of gait and to investigate influences of orthosis hinge stiffness (durometer).

SAMPLE A previously developed computer simulation model for a healthy 33-kg 5-year-old neutered Golden Retriever.

PROCEDURES A custom stifle joint orthosis was implemented in the CrCL-deficient pelvic limb computer simulation model. Ligament loads, relative tibial translation, and relative tibial rotation in the orthosis-stabilized stifle joint (baseline scenario; high-durometer hinge]) were determined and compared with values for CrCL-intact and CrCL-deficient stifle joints. Sensitivity analysis was conducted to evaluate the influence of orthosis hinge stiffness on model outcome measures.

RESULTS The orthosis decreased loads placed on the caudal cruciate and lateral collateral ligaments and increased load placed on the medial collateral ligament, compared with loads for the CrCL-intact stifle joint. Ligament loads were decreased in the orthosis-managed CrCL-deficient stifle joint, compared with loads for the CrCL-deficient stifle joint. Relative tibial translation and rotation decreased but were not eliminated after orthosis management. Increased orthosis hinge stiffness reduced tibial translation and rotation, whereas decreased hinge stiffness increased internal tibial rotation, compared with values for the baseline scenario.

CONCLUSIONS AND CLINICAL RELEVANCE Stifle joint biomechanics were improved following orthosis implementation, compared with biomechanics of the CrCL-deficient stifle joint. Orthosis hinge stiffness influenced stifle joint biomechanics. An orthosis may be a viable option to stabilize a CrCL-deficient canine stifle joint.

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