

Topical Review

Why Owners Choose an Orthosis Over Stifle Surgery for Canine Cranial Cruciate Ligament Deficiency

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The objective of this study was to describe the patient population of dogs with cranial cruciate ligament (CrCL) deficiency that were prescribed a stifle orthosis. A total of 215 client-owned dogs with previously diagnosed CrCL deficiency were prescribed a stifle orthosis at a veterinary pain management and mobility clinic. Patient intake data collected included dog signalment, chief medical complaint, home environment and activity description, medical and surgical history, and diagnosing veterinarian. An orthopedic examination was conducted to assess pelvic limb function and determine pelvic limb morphologic measures. Spayed females (57.2%) were most common in our sample. Median age, body weight, and body condition score were 9.00 ± 3.23 years, 32.98 ± 13.37 kg, and 6.00 ± 1.04 , respectively. Most common breeds prescribed stifle orthoses included Labrador Retriever, Golden Retriever, and German Shepherd. Right and left limbs were equally affected, and 19.5% of dogs previously had stifle stabilization surgery. Primary reasons for seeking a stifle orthosis consultation were surgical concerns, advanced age, and surgery cost. Most common chief complaints included altered gait, decreased weight bearing, and pain following activity. Reduced stifle extension, increased cranial drawer score, and decreased 3-leg stance time characterized the CrCL-deficient stifle. Stifle orthosis represents an alternative approach to surgical stabilization and management of CrCL deficiency. CrCL-deficient dogs prescribed stifle orthoses were generally large breeds of advanced age with above ideal body condition score. Owners commonly sought a stifle orthosis for CrCL deficiency due to reservations regarding surgical management.

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Orthotic and prosthetic devices are an emerging veterinary technology that can potentially promote an active lifestyle and high quality of life for patients with orthopedic and neurologic impairments.^{1–7} An orthosis provides biomechanical stability to a compromised joint through rest, immobilization, and protection, as well as guided or corrected joint motion.^{1,8} Orthoses can offer an alternative to surgical correction of unstable joints and may also reduce the need for preventative amputation associated with impeded limb use, chronic injury, self-inflicted injury, and disease progression.^{1,4,5,9} Patient-specific orthoses can be custom-fabricated to address specific needs,^{5,6,8} such as biomechanical support during healing, rehabilitation, or concurrent therapies while preventing further injury given that orthoses typically limit and guide functional movement without completely immobilizing a joint.^{2,3} Orthosis efficacy depends on both design and owner diligence to restore function, improve patient acclimation, and maintain tissue integrity.⁸ Orthoses are well-suited in cases where advanced age, anesthesia safety, significant comorbidities, or more costly surgery are significant concerns,⁵ and use may be discontinued in cases where sufficient improvement is achieved.⁷

Orthoses have been used successfully in dogs with sciatic neuropathy,⁴ gastrocnemius tendon strain,² distal extremity pad wounds,³ carpal ligament instability,⁷ and other thoracic and pelvic limb pathologies.^{6,8} Canine orthoses have also been developed to stabilize the stifle joint⁶ following cranial cruciate ligament (CrCL) rupture given that the CrCL limits internal rotation, hyperextension, and cranial translation of the tibia relative to the femur.^{10–12} CrCL deficiency is one of the most commonly diagnosed canine orthopedic conditions, often leading to

inflammation, pain, lameness, and osteoarthritis.^{10,11,13–17} Management costs for CrCL deficiency are substantial,¹⁸ with surgical stabilization being the standard of care in large dogs.¹⁹ As an alternative to surgical stabilization, canine stifle orthoses may provide sufficient stability to the CrCL-deficient joint by limiting internal tibial rotation and cranial tibial translation,^{6,20} but long-term recovery of function following removal of the orthosis is not likely without physical rehabilitation and gait retraining.⁸ Stifle orthoses are typically designed to guide joint articulation using a combination of rigid cuff and flexible strap constraints enveloping the (1) quadriceps and hamstrings, (2) the tibial tuberosity, (3) the proximal gastrocnemius, and (4) the calcaneal tendon. Orthoses mechanical hinges align with the stifle joint flexion–extension axis of rotation.⁶

Canine CrCL deficiency prevalence has previously been described in detail.^{17,21} However, the canine population using stifle orthoses for CrCL deficiency management has not been described. The goals of this study were (1) to describe the population of dogs with CrCL deficiency that were prescribed a stifle orthosis, and (2) to investigate chief complaints leading to owners seeking orthosis evaluation.

Materials and Methods*Subjects*

Owners presenting with their dogs to a veterinary pain management and mobility clinic² for stifle orthosis evaluation

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Table 1
Criteria Used to Determine Canine Activity Score

Activity Score	Description
5 (Athlete)	Walking/playing for > 7 h/wk or running ≥4 h/wk
4 (Very active)	Walking/playing for 5.25-7 h/wk or running < 4 and ≥3 h/wk
3 (Moderately active)	Walking/playing for 3.5-5 h/wk or running < 3 and ≥2 h/wk
2 (Somewhat active)	Walking/playing for 1.75-3.25 h/wk or running < 2 and ≥1 h/wk
1 (Sedentary)	Walking/playing for 0-1.5 h/wk

between January 2013 and December 2014 were invited to participate in this study. This clinic is the largest in the region that prescribes orthoses. Inclusion criteria included diagnosed CrCL deficiency. Exclusion criteria included amputation of a pelvic limb. Owner informed consent was obtained for all participants.

Intake Data

Intake data for patients enrolled in this study was collected by one of two DVMs, both with Certificate in Canine Rehabilitation Therapy (CCRT) credentials and one board-certified in Sports Medicine and Rehabilitation. Data collection included patient breed, age, weight, body condition score ranging from 1 (emaciated) to 9 (severely obese) with 5 representing an ideal body condition,³ sex, and reproductive status. Activity score (range 1-5, where 1 = sedentary and 5 = athlete; Table 1) was determined through owner response. In this study, we defined the affected limb(s) as the limb evaluated for an orthosis that was either a CrCL-deficient stifle not stabilized surgically or an unsuccessfully surgically managed CrCL-deficient limb. The affected, CrCL-deficient limb (right, left, or both), CrCL deficiency type (complete, partial, or unknown), clinician diagnosing CrCL deficiency (general practitioner, surgical or rehabilitation specialist, or unknown), whether stifle stabilization surgery was previously performed (yes or no), type of previous stifle stabilization surgery (tibial plateau leveling osteotomy, tibial tuberosity advancement, extracapsular, modified fiber tape extracapsular,⁴ or other), and any complications associated with stifle stabilization surgery were recorded. Other prior surgeries, concurrent medical conditions, and current medications were also recorded.

Owner Questionnaire

A questionnaire was administered (Table 2) querying owners to select all chief medical complaints, and identify home environment characteristics (e.g., large yard vs. small yard), primary reasons for seeking an orthosis consultation, whether there has been previous use of a stifle orthosis, if professional canine rehabilitation was available near their residence, and whether professional rehabilitation would be pursued.

Orthopedic Examination

An orthopedic examination was conducted for the left and right pelvic limbs to obtain lameness scores based on a previously defined scoring system²² with a range of 0-5, where 0 = no lameness and 5 = minimal to no weight-bearing (Table 3). Thigh circumference at mid-femur and stifle circumference at the joint center (level mid medial buttress) while standing were measured

Table 2
Owner Questionnaire Response Choices

Questionnaire Category	Response Choices
Chief complaint characteristics (select all that apply)	Pain Difficulty sitting Difficulty rising from sitting Difficulty standing Difficulty walking Limps during walking Difficulty running Sore to touch stifle/pelvic limb Decreased weight bearing on affected limb Toe touches on affected limb Nonweight bearing on affected limb Painful or lame following exercise Other (please indicate)
Owner home environment characteristics (select all that apply)	Other animals Primarily carpet in home Primarily tile/hardwood/linoleum in home Sleeps on owner's bed Jumps onto bed or sofa Free access to house at night Small yard Large yard > 50% of time outdoors in yard each day Short flight of stairs Long flight of stairs Access to dog door during day Access to dog door during night Young children in home
Primary reasons for seeking an orthosis consultation (select 2 max)	Cost of surgery Other health concerns Previous bad experience with surgery Age of dog Anesthesia safety concerns Concurrent medications (immune suppression) Unable to restrict activity post-op Have heard/read the surgery does not work well Previous stifle surgery and do not want to do again Dislike the idea of the surgery/invasive Other (please indicate)
Previous use of a stifle orthosis	Yes No
Is professional canine rehabilitation available near your residence?	Yes No
Will professional rehabilitation be pursued?	Yes No Maybe

using a constant tension tape measure.⁵ Maximum stifle extension and maximum stifle flexion was obtained using a plastic goniometer,²³ three-leg stance time score (0 second [score = 0], < 5 seconds [score = 1], 5-10 seconds [score = 2], or > 10 seconds [score = 3]) in which the contralateral pelvic limb is elevated and prevented from bearing weight was determined, and cranial drawer score (none [score = 0], minimal [score = 1], moderate [score = 2], and severe [score = 3]) was assessed.²⁴ Condition of the meniscus was examined using the McMurray technique²⁵ and checking for meniscal click; meniscus condition was categorized

³Body condition score chart, Nestlé Purina PetCare Company, St Louis, MO.

⁴TightRope CCL, Arthrex Vet Systems, Naples, FL.

⁵Gulick II Tape Measure (Model 67020), Country Technology, Inc., Gays Mills, WI.

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