

# Orthosis in the Conservative Treatment of Cranial Cruciate Ligament Rupture in Dogs – Clinical Observations

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Orthoses are increasingly frequently applied orthopedic devices in veterinary medicine. Injury to the knee joint with a rupture of the cranial cruciate ligament is one of the main indications for the use of orthoses in dogs. This study aimed to present the results of treatment of 30 dogs with injured cranial cruciate ligaments using a knee orthosis and describe the reasons for the conservative treatment of cranial cruciate ligament deficiency. The study was conducted between 2017 and 2019 and involved 30 dogs of various breeds aged 7 to 15, weighing from 2.5 kg to 45 kg, diagnosed with cranial cruciate ligament rupture. In the study, a stifle knee orthosis by the Polish manufacturer Admiralf (PI) was used in 29 dogs and, in one case, an orthosis by Balto (USA) was applied. In each case, the orthosis was selected individually, based on the measurements taken. In the twelfth week of treatment using orthoses, the owners of 25 dogs were satisfied with the results of conservative treatment with the application of orthoses. The caretakers of four dogs observed difficulties in the form of slight lameness at rest after prolonged exertion on the previous day. Running difficulty was observed in one dog. In the conducted study, the knee orthosis demonstrated good therapeutic effects in dogs up to 25 kg. In the majority of dogs, a slight increase in the flexion angle of the treated knee joints was observed, X-ray examinations did not show the degenerative disease progress during the studied period.

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

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## Abstract

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  $9.00 \pm 3.23$  years,  $32.98 \pm 13.37$ kg, and  $6.00 \pm 1.04$ , 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.

# The Emerging Role of Veterinary Orthotics and Prosthetics (V-OP) in Small Animal Rehabilitation and Pain Management

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In veterinary school, we learn much about how to repair bone fractures, ligament injuries, and neuropathies. The idea, of course, is to return some level of function to a damaged appendage and decrease pain. When a limb cannot be salvaged for medical or financial reasons, we are taught that dogs and cats do “great” on 3 legs. Three legs may mean a less functional limb or outright total amputation. We espouse this doctrine to our clients. Indeed, most of us have countless stories of triped patients acclimating to their disability with aplomb. Although it is true that many patients adapt, learning to ambulate and negotiate their environment, this is functional adaptation—not necessarily the highest quality of life. As a profession, we have come to expect—even accept—that limited mobility, limb breakdown, and chronic neck or back pain are unavoidable consequences. The short- and long-term consequences of limb loss or altered limb function are not benign as once thought. Furthermore, the quality of care demanded by clients is rising and the breadth of knowledge afforded by technology and global communication spawns innovative therapies readily accessible to the computer-savvy pet owner. Recent examples of therapeutic innovations include the following: dentistry, acupuncture, chiropractic, and rehabilitation. Often there is no precedent for these new therapies in animals, and the onus rests with the veterinary community to educate itself to provide best care for patients and clients and to establish evidence-informed best practice. The newest emerging therapeutic modality is veterinary orthotics and prosthetics. Like the previously mentioned modalities, the origin lies in human health care and subsequently leaps to veterinary health care.

## Orthoses and Exoprostheses for Companion Animals

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### Abstract

Exoprostheses are devices that are secured to incomplete limbs to enable locomotion. By comparison, orthoses are devices externally applied to support or protect an injured body part. Orthoses also can be used to control, guide, protect, limit motion of, or immobilize an extremity, a joint, or a body segment. Exoprostheses and orthoses are a growing aspect of the physical rehabilitation of companion animals. They require precise design and fabrication. Patients and owners must be trained to use the devices. Exoprostheses and orthoses can have a profound beneficial impact on the mobility and the quality of life of companion animals.

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

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## Abstract

**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.

# Gastrocnemius tendon strain in a dog treated with autologous mesenchymal stem cells and a custom orthosis

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<https://pubmed.ncbi.nlm.nih.gov/23550707/>

## Abstract

**Objective:** To report clinical findings and outcome in a dog with gastrocnemius tendon strain treated with autologous mesenchymal stem cells and a custom orthosis.

**Study design:** Clinical report.

**Animal:** A 4-year-old spayed female Border Collie.

**Methods:** Bone-marrow derived, autologous mesenchymal stem cells were transplanted into the tendon core lesion. A custom, progressive, dynamic orthosis was fit to the tarsus. Serial orthopedic examinations and ultrasonography as well as long-term force-plate gait analysis were utilized for follow up.

**Results:** Lameness subjectively resolved and peak vertical force increased from 43% to 92% of the contralateral pelvic limb. Serial ultrasonographic examinations revealed improved but incomplete restoration of normal linear fiber pattern of the gastrocnemius tendon.

**Conclusions:** Findings suggest that autologous mesenchymal stem cell transplantation with custom, progressive, dynamic orthosis may be a viable, minimally invasive technique for treatment of calcaneal tendon injuries in dogs.

# Evaluation of application of a carpal brace as a treatment for carpal ligament instability in dogs: 14 cases (2008-2011)

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<https://pubmed.ncbi.nlm.nih.gov/24479458/>

## Abstract

**Objective:** To determine whether carpal brace application is a viable treatment for dogs with unilateral carpal ligament instability.

**Design:** Retrospective case series.

**Animals:** 14 client-owned athletic dogs.

**Procedures:** Medical records were reviewed to identify dogs treated with a brace for unilateral carpal valgus or varus instability between August 2008 and August 2011. Treatment included passive motion and isometric strengthening exercises during brace application.

**Results:** Of the 14 dogs, 11 were considered to have returned to normal function; 11 of 12 dogs returned to agility competition. Carpal measurements before treatment indicated the affected limb had significantly greater valgus measurements (median, 30°; range, 30° to 35°), significantly greater varus measurements (median, 15°; range, 15° to 25°), and significantly less flexion (median, 37.5°; range, 30° to 45°), compared with results for the contralateral carpus. Long-term monitoring revealed no differences in measurements between affected and contralateral limbs. Valgus measurements of the affected carpus at brace removal (median, 15°; range, 15° to 20°) and at the end of long-term monitoring (median, 15°; range, 15° to 20°) were significantly lower than measurements before treatment (median, 30°; range, 30° to 35°). Dogs had significantly lower lameness scores (assessed on a scale of 0 to 5) at brace removal (median, 0; range, 0) and at the end of monitoring (median, 0; range, 0 to 2), compared with scores before treatment (median, 3; range, 1 to 3).

**Conclusions and clinical relevance:** Application of a carpal brace resulted in improved stability and resolution or reduction in lameness in dogs with carpal ligament instability.

# The Use of Canine Stifle Orthotics for Cranial Cruciate Ligament Insufficiency

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## Abstract

**Objective:** To assess weight bearing of dogs treated for unilateral cranial cruciate ligament insufficiency with a custom stifle orthotic.

**Background:** Cranial cruciate ligament (CCL) insufficiency is the most common cause of hind limb lameness in dogs. While there are numerous options for surgical management, surgery is not always an option. Recently, the use of canine stifle orthotics has also emerged as a means to non-surgically manage patients with cranial cruciate ligament insufficiency.

**Evidentiary value:** This is a retrospective study of ten dogs treated for unilateral cranial cruciate ligament rupture with a stifle orthotic.

**Methods:** Medical records (January 2005- December 2012) of ten dogs treated for unilateral cranial cruciate ligament rupture with a stifle orthotic were reviewed. Temporospacial gait analysis was performed using a pressure sensing walkway at baseline and 90 days or greater post orthotic placement to identify weight bearing with total pressure index % (TPI%).

**Results:** TPI% improved significantly by 5.1% in the affected limb when compared to baseline ( $p = 0.0020$ ). At final gait analysis, TPI% significantly improved by 3% in the affected limb with the orthotic off when compared to the unaffected limb ( $p = 0.0020$ ).

**Conclusion:** Custom canine stifle orthotics allow for improved weight bearing in the affected limb.

**Application:** Custom canine stifle orthotics should be considered for cases with concurrent medical conditions or financial constraints that do not allow for surgical intervention.

# Orthotic Device Use in Canine Patients: Owner Perception of Quality of Life for Owners and Patients

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<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8600258/>

## Abstract

Orthotic devices are an established treatment for neuromusculoskeletal disease in the human population. Orthoses are an emerging veterinary therapy due to limited practitioner experience, availability of devices, and published data from veterinary patient outcomes. Expanding client education and veterinary expertise in the application of orthoses may allow greater access and successful utilization of these devices to treat appendicular disease. While orthoses have the potential to improve quality of life for veterinary patients, consideration needs to be made for owner related factors with device use. Owner satisfaction and experience may greatly impact compliance with treatment recommendations; therefore, it is crucial that owner expectations are met. The purpose of the present study was to evaluate owner-reported outcomes of orthosis for canine patients and their owner's subjective responses about the shared pet/owner experience utilizing a promoter score. It was hypothesized that owner's impressions of their pet's experience with the orthotic device would influence owner perceptions of quality of life for both the owner and the pet, and these factors would impact the likelihood of the owner to recommend a

veterinary orthosis to a friend. An anonymous online survey was sent to 136 clients of a single veterinary orthoses manufacturer. Fifty-six surveys were completed and included for analysis. The owner's reported quality of life was in agreement ( $P = 0.02$ ) with reported pet quality of life. There was also a higher likelihood ( $P = 0.02$ ) for the owner to recommend a veterinary orthotic device to a friend when owner perceptions of pet quality of life were positive as compared to negative or neutral. Willingness to recommend an experience to a friend is a reflection of satisfaction with the experience. The dependence of owner and pet quality of life should therefore guide therapeutic decisions for patient management and client communication to ensure that the orthosis experience is positive for both patient and owner.

## *Pelvic limb kinematics in the dog with and without a stifle orthosis*

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<https://pubmed.ncbi.nlm.nih.gov/28198549/>

### **Abstract**

**Objective:** To report a method of evaluating 3-dimensional joint motion in dogs with a stifle orthosis.

**Study design:** Experimental. **Animals:** Six healthy dogs.

**Methods:** Three-dimensional pelvic limb joint motion was recorded with and without a stifle orthosis. Kinematic data were collected from dogs at a walk and trot for the hip, stifle, and tarsus prior to, and after application of, a stifle orthosis. Data were also obtained for the orthosis alone. Comparisons were made between the braced and unbraced limb, and between the braced limb and the orthosis alone. Complete waveforms, kinematic, and temporospatial variables were compared.

**Results:** Gait waveforms differed between braced and unbraced limbs for all joints and planes of motion ( $P < .05$ ), as well as between the braced stifles and the orthosis alone at both a walk and trot. However, joint ROM was inconsistently altered. The effect of bracing on stifle ROM was limited to a reduced extension at the end of stance. Adjacent joint ROM was affected by the stifle orthosis. Temporospatial variables were predominantly affected while walking.

**Conclusions:** The restrictive motion of the stifle orthosis is not fully translated to the underlying joint, based on the limited differences between the motion of braced and unbraced stifles. This effect varies with plane of motion and phase of the gait cycle, with most changes in stifle motion being detected during the stance phase. The stifle orthosis had an equal or greater effect on the motion of adjacent joints, especially the tarsus.

# Comparison of owner satisfaction between stifle joint orthoses and tibial plateau leveling osteotomy for the management of cranial cruciate ligament disease in dogs

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## Abstract

**OBJECTIVE** To compare owner satisfaction between custom-made stifle joint orthoses and tibial plateau leveling osteotomy (TPLO) for the management of medium- and large-breed dogs with cranial cruciate ligament disease (CCLD). **DESIGN** Owner survey. **SAMPLE** 819 and 203 owners of dogs with CCLD that were managed with a custom-made stifle joint orthosis or TPLO, respectively. **PROCEDURES** Client databases of an orthosis provider and veterinary teaching hospital were reviewed to identify potential survey respondents. An online survey was developed to evaluate owner-reported outcomes, complications, and satisfaction associated with the nonsurgical (orthosis group) and surgical (TPLO group) interventions. Survey responses were compared between groups. **RESULTS** The response rate was 25% (203/819) and 37% (76/203) for the orthosis and TPLO groups, respectively. The proportion of owners who reported that their dogs had mild or no lameness and rated the intervention as excellent, very good, or good was significantly greater for the TPLO group than for the orthosis group. However,  $\geq 85\%$  of respondents in both groups reported that they would choose the selected treatment again. Of 151 respondents from the orthosis group, 70 (46%) reported skin lesions associated with the device, 16 (11%) reported that the dog subsequently underwent surgery, and 10 (7%) reported that the dog never tolerated the device. **CONCLUSIONS AND CLINICAL RELEVANCE** Results indicated high owner satisfaction rates for both interventions. Owners considering nonsurgical management with an orthosis should be advised about potential complications such as persistent lameness, skin lesions, patient intolerance of the device, and the need for subsequent surgery.