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

Juliette L. Hart DVM
Kimberly D. May DVM
Nina R. Kieves DVM
Patrice M. Mich DVM, MS
Clara S. S. Goh BVSc, MS
Ross H. Palmer DVM, MS
Felix M. Duerr DVM, MS

From the Department of Clinical Sciences, College of Veterinary Medicine and Biomedical Sciences, Colorado State University, Fort Collins, CO 80523 (Hart, Goh, Palmer, Duerr); Animal Care Centers of Cincinnati, 11440 Winton Rd, Cincinnati, OH 45242 (May); Department of Veterinary Clinical Sciences, College of Veterinary Medicine, The Ohio State University, Columbus, OH 43210 (Kieves); and Wheat Ridge Animal Hospital, 3695 Kipling St, Wheat Ridge, CO 80033 (Mich).

Address correspondence to Dr. Duerr (Felix.Duerr@colostate.edu).

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, ≥ 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. (*J Am Vet Med Assoc* 2016;249:391–398)

In dogs, injury to the cranial cruciate ligament is a common cause of hind limb lameness and the development of stifle joint osteoarthritis and associated signs of pain.[1–4] Despite the high prevalence of CCLD in dogs, the best overall course of treatment for affected dogs remains controversial.[4–7] Surgical treatment is frequently advocated and is effective for the restoration of limb function.[5–10] The veterinary literature through September 2013 provides strong support for the use of TPLO for the treatment of dogs with CCLD, as that procedure frequently results in a return to normal function; however, the literature contains insufficient data for the evaluation of other procedures for the treatment of CCLD aside from extracapsular repair.[5] Results of 2 large case-series reports[11,12] that collectively evaluated > 2,000 dogs following TPLO indicate that the postsurgical major complication rate for that procedure is < 7%, and most of those complications resolved with secondary treatment. Nonsurgical management of dogs with CCLD has been investigated and is most commonly recommended for dogs that weigh < 15 to 20 kg (33 to 44 lb),[13,14] although improvement of lameness with nonsurgical management of CCLD has been reported for dogs that weigh > 20 kg.[15,16]

Nonsurgical management of CCLD has changed with the introduction of canine rehabilitation therapy and other novel management options such as

ABBREVIATIONS

ACL	Anterior cruciate ligament
CCLD	Cranial cruciate ligament disease
TPLO	Tibial plateau leveling osteotomy

stifle joint orthoses.[17,18] Orthoses (also referred to as braces, orthotics, or orthotic devices) are medical devices used to support or protect an injured leg[18] and are frequently defined as any medical device added to the body to support, align, position, immobilize, assist weak muscles, prevent or correct deformity, or improve function.[19,20] The use of custom-made orthoses has been reported for the treatment of dogs with carpal and gastrocnemius tendon injuries.[21,22] Anecdotally, stifle joint orthoses are occasionally used for the nonsurgical management of dogs with CCLD.[20] However, to our knowledge, there have not been any peer-reviewed reports of the clinical outcomes for dogs with CCLD that were managed with stifle joint orthoses. The objective of the study reported here was to compare owner satisfaction between custom-made stifle joint orthoses and TPLO for the management of medium- and large-breed dogs with CCLD.

Materials and Methods

Study design

A survey was developed and administered to the owners of medium- and large-breed dogs with CCLD that were managed with either a custom-made stifle joint orthosis or TPLO. Potential survey participants were identified by searching the client databases of an orthotic and prosthetic device company[a] (orthosis group) and the Colorado State University Veterinary Teaching Hospital (TPLO group). The orthosis group consisted of owners of medium- and large-breed dogs that received a custom-made stifle joint orthosis for the treatment of CCLD from the orthotic and prosthetic device company from 2008 through 2013. Only owners of dogs that had not undergone previous surgical intervention for CCLD were included in the study. Owners of dogs that were managed with an orthosis in addition to surgical intervention were excluded from the study. All orthotic devices were manufactured by the company in-house after the dog was confirmed to have CCLD by a veterinarian. Typically, the veterinarian provided a stifle joint mold from the patient to the company, and the mold was used to manufacture a custom-made orthosis. The veterinarian instructed the owner on the use and wearing schedule of the device and performed the fitting, adjustment, and aftercare associated with the device. Complications were addressed by the veterinarian with support from the manufacturer, and any necessary revisions to the device were completed by sending the device back to the manufacturer.

The TPLO group consisted of owners of medium- and large-breed dogs that underwent TPLO for the treatment of CCLD at the veterinary teaching hospital between 2002 and 2013. For both the orthosis and TPLO groups, only owners who had provided an email address for the respective databases were included in the study. The study procedures were reviewed by the Colorado State University Institutional Review Board.

Survey

The survey was administered by use of an online survey tool.[b] A request for survey participation was emailed to the members of the orthosis group in October 2013 and to the members of TPLO group in May 2014. The survey (**Supplemental Appendix S1**, available at http://avmajournals.avma.org/doi/suppl/10.2460/javma.249.4.391) had 6 categories that included demographic information (age, sex, weight, breed, and affected limb), treatments performed, aftercare, complications, extent of client compliance and satisfaction, and considerations that affected treatment choice. Minor changes to the wording of the survey were made to tailor it for the target group. For example, the survey for the orthosis group included questions about the owner's satisfaction with the dog's activity level after full acclimation to the orthosis, whereas the survey for the TPLO group included questions about the owner's satisfaction with the dog's activity after full recovery from the surgery. Also, questions that were only applicable for the survey administered to the orthosis group (eg, wearing schedule for the orthosis and skin issues associated with the orthosis) were removed from the survey administered to the TPLO group. Consequently, the survey administered to the TPLO group consisted of up to 26 questions, whereas that administered to the orthosis group consisted of up to 41 questions. For the orthosis group, complications were identified on the basis of comments respondents made when asked about specific outcomes such as "Why is the device no longer used?" and "Were there any skin issues associated with wearing the brace?" For the TPLO group, complications were identified on the basis of survey responses and a formal medical record review for dogs of respondents who provided identifying information on the survey and did not rate the intervention as excellent.

Statistical analysis

Continuous variables such as patient age and weight were compared between the 2 groups by the use of *t* tests. For categorical variables, the frequency of responses for each group was compared by the use of χ^2 tests or Fisher exact tests when individual cell counts were < 5. Responses for some variables were compressed so that χ^2 tests could be performed. For example, responses for lameness severity (moderate-severe lameness and mild-no lameness), outcome (excellent-very good-good and poor), and decision factors (cost-convenience-personal preference and veterinarian recommendation) were collapsed into 2 categories. All analyses were performed with commercially available software,[c] and values of $P \leq 0.05$ were considered significant.

Results

Survey response

Two hundred three of 819 (25%) owners in the orthosis group and 76 of 203 (37%) owners in the TPLO group responded to the respective surveys.

The response rate for the TPLO group was significantly (P = 0.003) greater than that for the orthosis group. Respondents were not required to answer all survey questions, and multiple answers were allowed for some questions; therefore, the number of responses varied among questions.

Demographics of dogs

All dogs represented in the study were medium- or large-breed dogs. The mean weight of dogs in the TPLO group (31.4 ± 10.5 kg [69.1 ± 23.1 lb]) did not differ significantly (P = 0.10) from that for dogs in the

Table 1—Number (percentage) of responses to various questions on a survey administered to owners of medium- and large-breed dogs with CCLD that were managed with a custom-made stifle joint orthosis or TPLO to assess their satisfaction with the chosen treatment.

Question	Orthosis group	TPLO group	*P* value
Dog's preintervention activity level	—	—	0.43
Low	23 (17)	7 (11)	—
Moderate	68 (50)	30 (48)	—
High	45 (33)	26 (41)	—
Interval between CCLD diagnosis and intervention	—	—	< 0.001
0–4 mo	102 (75)	31 (49)	—
5–8 mo	23 (17)	17 (27)	—
9–12 mo	6 (4)	5 (8)	—
> 1 y	6 (4)	10 (16)	—
Most important factor that affected treatment decision	—	—	< 0.001
Cost, convenience, or personal preference	162 (81)	17 (25)	—
Veterinarian's recommendation	37 (19)	50 (75)	—
Was physical therapy implemented?	—	—	0.14
Yes	72 (44)	23 (37)	—
No	90 (56)	40 (63)	—
If physical therapy was not implemented, why?	—	—	0.06
Cost, too time-consuming, or not interested	45 (49)	9 (26)	—
Not advised of necessity	30 (33)	16 (46)	—
Not available in my area	17 (18)	10 (29)	—
If physical therapy was implemented, how often?	—	—	0.74
1–3 times/wk	60 (82)	19 (79)	—
≥ 4 times/wk	13 (18)	5 (21)	—
How well did you adhere to exercise restrictions?	—	—	0.10
Very well	113 (74)	53 (84)	—
Somewhat or not at all	40 (26)	10 (16)	—
Changes in dog's behavior following the intervention	—	—	0.27
Positive	80 (59)	43 (68)	—
Negative	18 (13)	4 (6)	—
No changes noticed	38 (28)	16 (25)	—
Changes in dog's ability to sit following the intervention	—	—	< 0.001
Positive	23 (17)	26 (41)	—
Negative	71 (52)	5 (8)	—
No changes noticed	43 (31)	32 (51)	—
Changes in dog's ability to stand following the intervention	—	—	0.25
Positive	68 (48)	35 (56)	—
Negative	13 (9)	2 (3)	—
No changes noticed	62 (43)	25 (40)	—
Satisfaction with the chosen intervention	—	—	< 0.001
Excellent	60 (39)	43 (68)	—
Very good	48 (32)	9 (14)	—
Good	23 (15)	10 (16)	—
Poor	21 (14)	1 (2)	—
Would you choose that intervention again?	—	—	0.27
Yes	129 (85)	57 (90)	—
No	23 (15)	6 (10)	—
Extent of lameness before the intervention	—	—	0.43
Severe or moderate	134 (99)	61 (97)	—
Mild or none	2 (1)	2 (3)	—
Extent of lameness after the intervention	—	—	0.01
Severe or moderate	18 (12)	1 (2)	—
Mild or none	128 (88)	62 (98)	—

Two hundred three of 819 (25%) owners in the orthosis group and 76 of 203 (37%) owners in the TPLO group responded to the survey. Respondents were not required to answer all questions, and multiple answers were allowed for some questions; therefore, the number of responses varied among questions. Values of $P \leq 0.05$ indicate a significant difference in the frequency distribution of responses between the 2 groups.

— = Not applicable.

orthosis group (34.1 ± 13.4 kg [75.0 ± 29.5 lb]). Likewise, the side distribution of the affected limb did not differ significantly ($P = 0.68$) between the 2 groups. The mean age at which clinical signs of lameness developed for dogs in the TPLO group (5.5 ± 2.6 years) was significantly ($P < 0.001$) less than that for dogs in the orthosis group (7.8 ± 3.6 years).

Treatment decision factors

The most important factor that influenced the treatment decision was cost, convenience, or personal preference for 162 of 199 (81%) respondents from the orthosis group and 17 of 67 (25%) respondents from the TPLO group. Conversely, veterinarian recommendation was reported as the most important factor in the treatment decision for the remaining 50 (75%) respondents in the TPLO group and 37 (19%) respondents in the orthosis group. Thus, the factors that affected the treatment decision differed significantly ($P < 0.001$) between the orthosis and TPLO groups **(Table 1)**.

Aftercare

The proportion of respondents who did not take their dogs for physical therapy in the TPLO group (40/63 [63%]) did not differ significantly ($P = 0.14$) from that for the orthosis group (90/162 [56%]; Table 1). When asked why they did not pursue physical therapy, 46% (16/35) and 33% (30/92) of respondents in the TPLO and orthosis groups, respectively, cited that they were not advised of the necessity of physical therapy.

Owner satisfaction with treatment outcome

The proportion of respondents who stated that they would choose the same treatment again if given the chance did not differ significantly ($P = 0.27$) between the orthosis (129/152 [85%]) and TPLO (90% [57/63]) groups. However, the proportion of respondents who rated the treatment as excellent, very good, or good for the TPLO group (62/63 [98%]) was significantly ($P < 0.001$) greater than that for the orthosis group (131/152 [86%]). Likewise, the proportion of respondents who reported that their dogs had either mild or no lameness after the intervention for the TPLO group (62/63 [98%]) was significantly ($P = 0.01$) greater than that for the orthosis group (128/146 [88%]; Table 1).

Complications

Seventy of 151 (46%) respondents from the orthosis group reported that their dogs developed skin problems while wearing the orthosis, and 22 of 69 (32%) respondents from that group reported that their dogs required medical attention for complications associated with the orthosis or multiple adjustments to the orthosis. In comparison, only 4 of 76 (5%) respondents from the TPLO group reported complications subsequent to the intervention; 2 dogs developed suspected patellar tendinopathy, 1 dog developed a draining fistula that required removal of the TPLO plate, and 1 dog developed acute NSAID toxicosis. No additional complications were identified for dogs represented in the TPLO group during review of medical records.

It took the majority (91/151 [60%]) of dogs that were managed with an orthosis 1 to 2 weeks to adjust to wearing the device. One hundred thirty-four of 151 (89%) respondents reported that the dog continued to wear the orthosis after the initial adjustment period. Of those 151 respondents, 65 (43%) reported that the dog wore the orthosis every day, 23 (15%) reported that the dog wore the orthosis 3 to 6 d/wk, and 52 (34%) reported that the dog wore the orthosis < 3 d/wk. Fifty-eight of those 151 (38%) respondents reported that their dogs tolerated the orthosis "very well—my dog actually seems to like wearing the device," whereas 50 (33%) reported that their dog tolerated the orthosis "well—my dog seems reluctant to have the device applied but seems to like wearing the device" and 28 (19%) reported that their dog tolerated the orthosis "fair—my dog seems reluctant to have the device applied and does not seem to like wearing it but will tolerate it." Seventeen of 151 (11%) respondents reported that their dog did not wear the orthosis at all because the device did not fit well or caused skin problems (n = 10), because the lameness had resolved and the dog did not need the device anymore (3), or because of other reasons (4). Of 151 respondents from the orthosis group, 10 (7%) reported that their dog never tolerated the orthosis because of fit issues or skin problems, and 16 (11%) reported that their dog subsequently underwent a surgical procedure on the orthosis-managed limb (TPLO, n = 7; meniscal removal only, 4; tibial tuberosity advancement, 2; tightrope procedure, 2; and procedure not specified, 1).

Discussion

To our knowledge, the present study was the first to describe owner satisfaction with the use of custom-made stifle joint orthoses to manage CCLD in medium- and large-breed dogs. In the present study, we compared owner-reported outcome measures between dogs with CCLD that were managed with a stifle joint orthosis and similar dogs that were managed with TPLO. Although the satisfaction rate was high for both interventions, the proportions of respondents who rated the intervention outcome as excellent and the extent of lameness after the intervention as mild or none for the TPLO group were greater than those for the orthosis group.

Surgical treatment is frequently advised for the management of dogs with CCLD, especially large-breed dogs. The high satisfaction rate for owners in the TPLO group (98% [62/63]) of the present study was consistent with findings of other studies[7,16,23] that assessed objective outcomes for dogs that underwent TPLO. In another study,[24] owner satisfaction (rated on a scale of 1 to 10 where 1 is low and 10 is high) was

≥ 9 for 37 of 40 (93%) dogs 12 months after TPLO. In the human medical literature, there is insufficient evidence to clearly support surgical treatment for patients with ACL injuries (the equivalent of CCLD), and nonsurgical management of those patients frequently results in acceptable function.[25,26] However, results of some studies[12,27–29] that involved either human patients with ACL deficiency or dogs with CCLD suggest that stabilization of the stifle joint soon after injury may be beneficial. Wilke et al[2] reported that approximately 11% and 30% of dogs with CCLD that were examined by a board-certified veterinary surgeon or a primary care veterinarian, respectively, were managed without surgery.

Despite the large number of dogs with CCLD that are managed without surgery, information regarding the outcomes for those dogs is lacking, and unfortunately, the various nonsurgical interventions and outcomes assessed in the few studies[13,15,16,30] that are available make it difficult to draw definitive conclusions. In 1972, Pond and Campbell[30] reported that 14 of 18 (78%) large-breed dogs with CCLD that were nonsurgically managed with administration of NSAIDs for 10 to 14 days and 4 to 8 weeks of strict rest had no detectable lameness as assessed by the owner, compared with 28 of 31 (90%) dogs with CCLD that had no detectable lameness following surgical intervention. However, in 1984, Vasseur[13] reported that nonsurgical management of large-breed dogs (> 15 kg) with CCLD in a manner similar to that of the Pond and Campbell study[30] resulted in functional improvement as assessed by a veterinarian in only 11 of 57 (19%) dogs, and the majority (n = 7) of those 11 dogs still had detectable lameness. In a 1996 study,[15] only 3 of 10 dogs with CCLD that were managed without surgery were subsequently assessed as having excellent function by both the owner and veterinarian. None of those studies[13,15,30] compared contemporary surgical interventions with nonsurgical management. In 2013, a study by Wucherer et al[16] was published in which 40 overweight large-breed dogs with unilateral CCLD were randomly assigned to receive nonsurgical management (weight control, physical rehabilitation, and NSAID administration for 12 weeks; n = 20 dogs) or surgical intervention (TPLO; 20 dogs). At 52 weeks after initiation of treatment, 36 of 40 (90%) owners felt that their dog had a good to excellent quality of life; however, 23 of those dogs underwent a force platform analysis, and dogs that underwent TPLO had superior force platform analysis data and a better overall success rate (as determined on the basis of the combined results of force platform analysis and owner questionnaire), compared with dogs that did not undergo surgery.[16] Unfortunately, the statistical power in that study[16] was limited because a large number of dogs developed CCLD in the contralateral leg during the 52-week observation period and had to be dropped from the study.

In human medicine, the use of functional knee braces for the management of ACL injuries is controversial because orthoses are unable to completely restore knee stability.[31–34] The application of bracing to an ACL-deficient knee decreases anteroposterior laxity when an anteroposterior load is applied to the joint.[31,32] Subjectively, human patients with ACL injuries benefit from functional knee braces; however, objective outcome measures do not completely support that assessment.[33] Nevertheless, it has been suggested that custom-made braces provide greater support than off-the-shelf products.[34] Human knee orthoses prevent tibial translation during mild activity but not during high loads, and muscle contraction and proprioception are important contributors to knee stability.[31,33] The veterinary medical literature contains no objective data regarding the biomechanics of stifle joint orthoses in dogs, and further evaluation is necessary, especially given the differences among breeds in terms of the anatomy of cruciate ligaments,[35] tibial plateau angles, and limb conformation. In humans, a tibial plateau angle of approximately 7° to 13° is considered physiologic,[35] and that fairly narrow range may minimize translational tibial forces and make functional knee bracing more effective in patients with ACL injuries. Additionally, functional bracing of the knee in human patients might be more feasible than bracing the stifle joint in dogs because the thigh region of humans is longer and more uniform in diameter than that in dogs.

The availability of viable nonsurgical interventions for dogs with CCLD is important because of various patient and owner considerations such as advanced patient age, comorbidities, and high surgical or anesthetic risk; financial constraints; inability to adequately control the patient's activity during the postoperative period; and unavailability of surgical treatment options. On the basis of the results of the owner satisfaction survey of the present study, nonsurgical management of dogs with CCLD by use of a custom-made stifle joint orthosis as the primary intervention may be a viable option. However, the results of the present study did not allow us to draw any conclusions regarding the effectiveness of the stifle joint orthoses alone because most dogs received additional interventions such as analgesics and physical therapy. This is important because many owners cited financial constraints as the reason they chose the orthosis over surgery, and the orthosis represents a large portion of the expense for dogs managed with nonsurgical interventions. Physical therapy is also costly but accelerates recovery for both human patients with ACL injuries and dogs with CCLD.[36,37]

In the present study, although respondents were generally satisfied with the outcome for dogs that were managed with a stifle joint orthosis, that intervention was not without complications. Almost half (70/151 [46%]) of the respondents reported that their dogs developed skin lesions as a result of wearing the orthosis. Although the survey did not provide respondents an opportunity to rate the severity of those lesions, 32% (22/69) reported that the skin lesions were severe enough to require veterinary intervention. In another study,[38] > 60% of dogs and cats with orthopedic injuries of the distal portion of a limb that were

managed with some type of external coaptation developed soft tissue injuries, and only 20% of owners detected or were aware of those soft tissue injuries. Unlike most external coaptations, stifle joint orthoses can be removed by the owner at home, which should enable the owner to identify skin lesions as they develop. Thus, severe skin lesions associated with orthoses should be avoidable with appropriate owner education. Nevertheless, owners should be informed that an orthosis may cause skin complications, which might result in additional costs associated with veterinary care and adjustment to the device. Sixteen of 151 (11%) respondents from the orthosis group reported that their dog subsequently underwent some type of surgery such as surgical joint stabilization or meniscectomy alone. Unfortunately, the survey of the present study did not allow us to determine the status of the menisci in the affected stifle joints at the time CCLD was diagnosed; therefore, we do not know whether dogs managed with an orthosis developed meniscal injuries while wearing the device. It is possible that meniscal injury contributed to the poor patient response reported by some owners in the orthosis group. Dogs with meniscal tears at the time of CCLD diagnosis may be poor candidates for nonsurgical management because the meniscal injury represents an ongoing source of irritation in the joint.[16]

Data obtained from the survey of the present study indicated that 131 of 152 (86%) respondents from the orthosis group and 62 of 63 (98%) of respondents from the TPLO group rated their satisfaction with the chosen intervention as good, very good, or excellent. Likewise, 129 of 152 (85%) respondents from the orthosis group and 57 of 63 (90%) respondents from the TPLO group reported that they would select the chosen treatment again. The facts that the proportion of respondents who reported that they would select the same intervention again was similar between the 2 groups and that the overall satisfaction with the chosen intervention was higher for the TPLO group than for the orthosis group were most likely a reflection of owner expectations. Owners in the orthosis group may have been advised that surgery was the preferred treatment for CCLD but use of a functional stifle joint orthosis was a nonsurgical alternative that could improve, but not return, full limb function. It is also possible that patient age may have influenced owner satisfaction with the orthosis intervention given that the mean age at CCLD diagnosis for dogs represented in the orthosis group was significantly greater than that for dogs represented in the TPLO group.

On the basis of the collective results of the previous studies and the present survey, we concluded that nonsurgical management of CCLD is a viable option for dogs that cannot undergo surgery. When nonsurgical management includes use of an orthotic device, owners should be advised about potential complications associated with the device such as skin lesions and the dog's unwillingness to wear the orthosis, as well as the potential for the subsequent requirement of surgical intervention. Owners should also be advised that most dogs with CCLD that are managed with an orthosis will remain dependent on the device for life, and long-term data on the development of osteoarthritis in those dogs are currently unavailable.

The limitations of the present study were similar to those that are inherent to any retrospective study that involves collection of owner-reported data. The data collected in this study were dependent on the owners' ability to recall decisions and events that happened in the past. Also, the survey respondents were not selected in a random manner; therefore, response bias was likely. Owner experience and the extent of follow-up they received during the treatment intervention likely varied among veterinary practices. Although several of the factors assessed in the survey such as incidence of subsequent surgery, the dog's unwillingness to adjust to the orthosis, and the development skin lesions could be readily assessed by owners, the data were not verified. Given the low response rate for the orthosis group (25% [203/819]), the results may not be representative of all dogs with CCLD managed with an orthotic device.[39] In human medicine, results of patient satisfaction surveys tend to overestimate the level of satisfaction, and the extent of that overestimation increases as patient outcome worsens.[39] Thus, the data of the present study should be interpreted with caution, and further comparison of outcomes between dogs with CCLD that are managed with and without surgery is warranted and should involve assessment of objective outcomes in a prospective clinical trial. For the orthosis group, the responses to the question about the patient's wearing schedule of the device varied. Most respondents reported that the dog wore the orthosis regularly for at least 8 weeks and that use of the orthosis then decreased and the dog wore it for only 1 to > 10 h/d. It is possible that inconsistency in the use of the orthosis within individual dogs and among dogs might have affected the results of the present study. Finally, the responses for some questions were arbitrarily grouped. For example, the responses for extent of lameness before and after the intervention (moderate-severe and mild-no lameness) and overall owner satisfaction (excellent-very good-good and poor) with the intervention were compressed into 2 groups. Although we feel that those groupings were clinically relevant, grouping the responses in another manner might have provided different results.

Our goal for conducting the present study was to obtain basic outcome information for medium- and large-breed dogs with CCLD that were managed with a custom-made stifle joint orthosis or TPLO so client education regarding surgical and nonsurgical interventions for CCLD could be improved and enhanced. The surgical intervention for which we chose to evaluate owner satisfaction was TPLO because a recent systematic review[5] of surgical treatments for CCLD indicates that it is the method most strongly supported by the scientific literature. The TPLO group consisted of owners of dogs with CCLD that underwent

surgery at only 1 institution, and most of the owners in both groups were from the same geographic area. Although limiting the sampling frame for the TPLO group to 1 institution resulted in a fairly small number of potential respondents being invited to complete the survey, it allowed us to compare dogs managed with orthotic devices with dogs that were surgically treated with the current gold standard, and because that surgery was performed at only 1 institution, the treatment should have been fairly standard among dogs, which eliminated potential confounding that would be associated with multiple surgical procedures performed at multiple institutions. Future research should initially focus on the elucidation of the biomechanical capabilities of canine orthoses. That research may then lead to prospective clinical studies that use objective outcomes to evaluate the efficacy of orthoses for the management of CCLD. Those studies should include multiple control groups so that the respective roles of physical therapy, analgesia, and orthoses in the nonsurgical management of dogs with CCLD can be identified. Ideally, those studies will also include long-term follow-up of patients to evaluate the incidence of osteoarthritis and meniscal injuries. Results of the present study provided subjective information that can be used to counsel dog owners who are considering a custom-made stifle joint orthosis for the management of CCLD in their pet until more objective information is available.

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Footnotes

a. OrthoPets, Denver, Colo.
b. SurveyMonkey, Palo Alto, Calif.
c. Excel 2010, Microsoft Corp, Redmond, Wash.

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From this month's *AJVR*

Pharmacokinetic modeling of penciclovir and BRL42359 in the plasma and tears of healthy cats to optimize dosage recommendations for oral administration of famciclovir

Lionel Sebbag et al

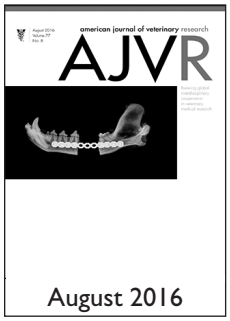
OBJECTIVES
To determine, following oral administration of famciclovir, pharmacokinetic (PK) parameters for 2 of its metabolites (penciclovir and BRL42359) in plasma and tears of healthy cats so that famciclovir dosage recommendations for the treatment of herpetic disease can be optimized.

ANIMALS
7 male domestic shorthair cats.

PROCEDURES
In a crossover study, each of 3 doses of famciclovir (30, 40, or 90 mg/kg) was administered every 8 or 12 hours for 3 days. Six cats were randomly assigned to each dosage regimen. Plasma and tear samples were obtained at predetermined times after famciclovir administration. Pharmacokinetic parameters were determined for BRL42359 and penciclovir by compartmental and noncompartmental methods. Pharmacokinetic-pharmacodynamic (PK-PD) indices were determined for penciclovir and compared among all dosage regimens.

RESULTS
Compared with penciclovir concentrations, BRL42359 concentrations were 5- to 11-fold greater in plasma and 4- to 7-fold greater in tears. Pharmaco-kinetic parameters and PK-PD indices for the 90 mg/kg regimens were superior to those for the 30 and 40 mg/kg regimens, regardless of dosing frequency. Penciclovir concentrations in tears ranged from 18% to 25% of those in plasma. Administration of 30 or 40 mg/kg every 8 hours achieved penciclovir concentrations likely to be therapeutic in plasma but not in tears. Penciclovir concentrations likely to be therapeutic in tears were achieved only with the two 90 mg/kg regimens.

CONCLUSIONS AND CLINICAL RELEVANCE
In cats, famciclovir absorption is variable and its metabolism saturable. Conversion of BRL42359 to penciclovir is rate limiting. The recommended dosage of famciclovir is 90 mg/kg every 12 hours for cats infected with feline herpesvirus. (*Am J Vet Res* 2016;77:833–845)



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