Clinical evaluation of a powder of quality elk velvet antler for the treatment of osteoarthrosis in dogs

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Abstract — A powder of quality elk velvet antler (QEVA) was evaluated on client-owned dogs with osteoarthrosis (OA) in a clinical, double-blind, and placebo-controlled study. Thirteen dogs received a placebo for 30 days and then QEVA for 60 days. Twenty-five other dogs received QEVA for 60 days. Gait analysis measured with a force plate, clinical signs assessed by an orthopedic surgeon, performances in daily life activities and vitality assessed by the owners, and complete blood analyses were obtained at days 0, after 30 days of placebo and/or 60 days of QEVA. On placebo, the 13 dogs did not show significant improvement ($P < 0.05$); however, their gait, their performances in daily life activities, and their vitality were significantly improved on QEVA, based on changes in values exceeding those observed when placebo was administered. The 25 dogs on QEVA for 60 days showed similar improvements. No clinical changes were revealed on blood analyses. Administration of QEVA was effective in alleviating the condition in arthritic dogs.

Résumé — Évaluation clinique de l'utilisation d'une poudre faite à partir de bois de velours de cerf de bonne qualité dans le traitement d'ostéoarthrose chez le chien. Une poudre faite à partir de bois de velours de cerf de qualité a été évaluée chez des chiens ayant de l'ostéoarthrose lors d'une étude clinique à double insu. Trente chiens ont reçu un placebo pendant 30 jours et, par la suite, de la poudre de bois de velours pendant 60 jours. Vingt-cinq autres chiens ont reçu de la poudre de bois de velours pendant 60 jours. L'analyse de la démarche a été faite à l'aide d'une plate-forme. Les signes cliniques ont été évalués par un chirurgien orthopédiste. Les performances et l'entrain dans les activités quotidiennes ont été évalués par les propriétaires. Des analyses sanguines complètes ont été faites au jour 0, après 30 jours de placebo ou 60 jours de poudre de bois de velours. Les 13 chiens ayant reçu le placebo n'ont pas montré d'amélioration significative ($P < 0,05$); cependant, leur démarche, leurs performances lors d'activités quotidiennes et leur vitalité se sont améliorées considérablement après qu'ils eurent reçu de la poudre de bois de velours, cette conclusion repose sur les écarts de valeurs plus important que ceux observés chez les chiens ayant reçu le placebo. Les 25 chiens qui ont reçu la poudre de bois de velours pendant 60 jours ont connu des améliorations similaires. Les analyses sanguines n'ont révélé aucun changement clinique. L'administration de la poudre de bois de velours s'est avérée efficace pour améliorer l'état des chiens arthritiques.

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Introduction

Osteoarthrosis (OA) is a painful musculoskeletal condition in dogs, often being secondary to structural abnormalities, such as hip or elbow dysplasia or ligament injury. Disturbance in the normal homeostasis of joint tissue between degradation and synthesis is involved in this degenerative process, visually characterized by articular surface erosion, bone sclerosis, and osteophyte production, leading to pain, joint stiffness, and muscular atrophy (1–4).

Research has led to the development of a broad range of pharmaceutical approaches to alleviate clinical signs by acting on the degenerative process, the associated inflammatory process, or both (5–8). Elk velvet antler is a well-known Chinese materia medica, which has been used clinically in East Asia for thousands of years in the treatment of various diseases and as a tonic (9). This traditional Chinese medicine is a nutritional supplement made from the inner core of elk antler in the velvet stage of growth. Observations from in vivo studies demonstrated an antiinflammatory effect of a peptide (pilose antler peptide) isolated from velvet antler in a rodent model of inflammation (9,10). These studies, combined with the knowledge that chondroitin sulfate is found in velvet antler, suggested that this material could be useful in the treatment of OA (11,12).

The purpose of this study was to evaluate scientifically the health benefits of a powder of quality elk velvet antler, referred here to QEVA, by administering it at the manufacturer's recommended dosage to a pool of client-owned dogs afflicted with OA.

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Materials and methods

Dog selection

Dogs weighing more than 20 kg and older than 18 mo were included in the study. All dogs had radiographic evidence of OA in 1 or more joints. The OA had to have been determined to be the cause of the clinical

signs, including an algetic gait, by a complete orthopedic examination performed by an orthopedic surgeon (JD or NHB). The algetic gait reported by the owner had to be chronic and stable. Dogs with rupture of the cranial cruciate ligament were admitted, if the rupture had been surgically repaired more than 1 y previously. Dogs were also included if a complete cranial cruciate ligament rupture had been diagnosed more than 1 y previously and had not been surgically corrected at that time and if they were without evidence of gross instability (drawer movement) at the time they were presented for the study. Concurrent treatment for OA was not permitted during the course of the study. If dogs had previously received treatment, the following predetermined withdrawal periods were observed: 2 wk for oral nonsteroidal antiinflammatory drugs, 3 wk for oral corticosteroids, and 12 wk for injectable corticosteroids. A 4-week withdrawal period was required following oral administration of glucosamine, chondroitin sulphate, or both, while a 24-week withdrawal period was required following injectable polysulfated polysaccharide. Pregnant bitches and dogs suffering from neurologic or other musculoskeletal lesions were excluded. Dogs that had undergone orthopedic surgery within the past year were also excluded. Recruitment was done through telephone calls to clients selected from the medical files of the Veterinary Teaching Hospital of the Université de Montréal and advertisements in newspapers. Dog owners involved in the study were required to sign a consent form.

Study protocol

The experimental protocol was approved by the Animal Care and Use Committee of the Université de Montréal and was in accordance with the Guidelines of the Canadian Council for Animal Care (13). On day 0, owners and dogs attended the Veterinary Teaching Hospital for the first visit. Owners were asked to score performances in daily life activities by using an owner's assessment form (Appendix 1). Scores for each activity were then summated to generate a score for activity performances. Dogs were weighed and their gait was analyzed by using ground reaction forces (GRF) obtained by a biomechanical force plate (Model OR6-6; Advanced Mechanical Technology, Watertown, USA). Visual examination of the gait and complete orthopedic and neurologic examinations were then carried out by 1 of 2 surgeons. After the examination, the surgeon attributed scores for the clinical signs of the most severely affected joint by using a surgeon's assessment form (Appendix 2). In both assessment forms, higher scores meant severe clinical signs. Radiographic evaluations of elbows, hips, and stifles were performed under routine sedation in all dogs; if necessary, additional radiographs were obtained for specific joints. A radiographic score of OA was attributed to each joint only on day 0 (Appendix 3). Blood samples were obtained by jugular venipuncture for hematological and biochemical analyses to detect any pre-study abnormalities and to obtain basal values. Owners were informed that dogs selected for the study would receive either a placebo or an OA medication over 2 or 3 visits. Orthopedic examinations were successively conducted during a period of 6 mo and included between clinical cases, thus confounding observation on day 0 and at re-evaluations. All owners were unaware of the study design, to which group their dog had been assigned, and about the contents of the capsules administered to their dog. Surgeons were unaware of the GRF, had no communication with the owners, and did not know about the assigned group. Dogs meeting all enrolment criteria were randomly assigned to 1 of these 2 experimental groups.

Placebo-QEVA group

Dogs weighing between 20 and 39.9 kg, 40 and 59.9 kg, and 60 and 79.9 kg received 2, 3, and 4 capsules of placebo, respectively, PO, q12h for 30 d, starting on day 0. Following this, dogs weighing between 20 and 39.9 kg, 40 and 59.9 kg, and 60 and 79.9 kg received 2, 3, and 4 capsules of QEVA, respectively, PO, q12h for 60 d, from days 31 to 90. Each capsule of placebo contained a mixture of flour (unbleached and organic romano bean), powder (arrowroot, roaster carob, and cocoa), salt, and allspice. Each capsule of QEVA contained 280 mg of a pure powder of elk (*Cornu cervi*) velvet antler (Cartiplex; Qeva Velvet Products, Calgary, Alberta). The placebo was used to determine if the OA condition of dogs that received a treatment for a period of 30 d had changed. The following 60 d were used to evaluate the effects of QEVA.

Quality elk velvet antler group

Dogs between 20 and 39.9 kg, 40 and 59.9 kg, and 60 to 79.9 kg received 2, 3, and 4 capsules of QEVA, respectively, PO, q12h for 60 d, starting on day 0. Each capsule contained 280 mg of QEVA.

Owners and dogs included in the placebo-QEVA group returned to the Veterinary Teaching Hospital for 2nd and 3rd visits on days 30 and 90, respectively. Owners and dogs included in the QEVA group returned to the Veterinary Teaching Hospital for a 2nd visit on day 60. At the time of these visits, owners were asked again to complete the owner's assessment form (Appendix 1) with an assessment of increasing vitality by using a dichotomous key (yes or no) and to report side effects related to treatment. Dogs were weighed, their gait was analyzed, and an orthopedic examination was carried out. Owners were asked to return any unused medication, so that it could be verified that it had been given as prescribed.

Equipment and gait analysis protocol

Ground reaction forces were obtained by using a permanently mounted biomechanical force plate that had been levelled with the floor in a 10-m runway and interfaced with a dedicated computer and software (Vetforce; Sharon Software, Michigan, USA) specially designed for the acquisition, numerical conversion, and storage of values. Trot was maintained at a constant velocity between 1.9 and 2.2 m/s. A chronometer was used to ensure that the dogs crossed the 10-m runway in between 4.5 and 5.2 s. The objective gait analysis focused on the worst limb, the one with the most severely affected joint, responsible for most of the clinical signs and algetic gait, as determined by the orthopedic examination. In the vertical axis, GRF obtained for the evaluated limb were the peak (maximal force) and impulse (force integrated over time). In the craniocaudal axis, the peak and impulse for the braking (cranial) and propulsive (caudal) portions of this GRF were also obtained. At least 5 valid trials with a stance time

Table 1. Mean and standard error ($s_{\bar{x}}$) of the mean changes from pretreatment for ground reaction forces and surgeon and owners' assessments in 13 dogs with osteoarthrosis after 30 d of treatment with placebo and then 60 d of treatment with a powder of quality elk velvet antler (QEVA)

A

	Changes from pretreatment	
Ground reaction forces	30 d of placebo	60 d of QEVA
Vertical		
peak	0.047, $s_{\bar{x}}$ = 1.500	4.102, $s_{\bar{x}}$ = 1.000[a]
impulse	−0.094, $s_{\bar{x}}$ = 0.214	0.091, $s_{\bar{x}}$ = 0.163
Craniocaudal braking portion		
peak	−0.151, $s_{\bar{x}}$ = 0.202	0.870, $s_{\bar{x}}$ = 0.555[a]
impulse	−0.009, $s_{\bar{x}}$ = 0.017	0.052, $s_{\bar{x}}$ = 0.057
Propulsive portion		
peak	−0.412, $s_{\bar{x}}$ = 0.330	0.313, $s_{\bar{x}}$ = 0.356
impulse	−0.056, $s_{\bar{x}}$ = 0.039	0.020, $s_{\bar{x}}$ = 0.033

B

	Changes from pretreatment	
Assessments (scores)	30 d of placebo	60 d of QEVA
Surgeon		
clinical signs	0.00, $s_{\bar{x}}$ = 0.43	0.15, $s_{\bar{x}}$ = 0.49
visual appreciation	4.30, $s_{\bar{x}}$ = 5.70	−6.38, $s_{\bar{x}}$ = 5.56
Owner		
activity performances	−1.00, $s_{\bar{x}}$ = 0.63	−6.92, $s_{\bar{x}}$ = 1.45[a]

[a]Pretreatment values significantly different from posttreatment values with changes significantly different from those of placebo ($P < 0.05$)

determined by the software of 0.650 s were retained; invalid trials were rejected, as previously described (14). Normalized values in percentage of body weight for the evaluated limb were averaged and analyzed from the first 5 valid trials. Vertical GRF peak was designated as the primary outcome measurement of the study.

Dogs

Forty-five (45) dogs afflicted with OA were included in the study; 5 (11%), 22 (49%), 13 (28%), 1 (2%), and 4 (9%) dogs with clinical and radiographic evidence of OA of the elbow, hip, stifle, shoulder and tarsus, respectively. There were 33 purebred and 12 mixed breed dogs with ages ranging from 21 to 148 mo, with an average of 82 mo. Their weight ranged from 25 to 71 kg, with an average of 42 kg.

Statistical analysis

The Wilcoxon rank-sum test was used to evaluate the homogeneity between groups. Posttreatment GRF and assessment scores were compared with pretreatment (day 0 or 30) scores by using the Wilcoxon signed-rank test for paired data. Changes from pretreatment for QEVA-treated dogs were calculated and compared with similar changes for placebo-treated dogs by using the Wilcoxon signed-rank test for paired data in the placebo-QEVA group and the Wilcoxon rank-sum test in the QEVA group. An improvement was defined as an increase in GRF and a decrease in assessment scores. The proportion of dogs with an increased vitality in the QEVA-treated group was compared with that of dogs in the placebo-treated group by using a chi-square test. Probability (P) values less than 0.05 were considered significant.

Results

Age, weight, GRF, duration of clinical signs, radiographic findings, and assessment scores were not significantly different between groups, and the weights of dogs obtained at each visit did not differ significantly. Table 1 presents the changes from pretreatment observed in the placebo-QEVA group for GRF and assessments after 30 d of treatment with placebo and then after 60 d of treatment with QEVA.

In response to 30 d of treatment with placebo, GRF and assessments obtained for the 13 dogs in this group were not significantly different from those obtained before treatment (day 0). Only 1 owner reported an increased vitality after treatment with placebo (1/13). Following 60 d of treatment with QEVA, the vertical GRF peak and the craniocaudal GRF peak for the braking portion for these same 13 dogs were significantly improved compared with pretreatment (day 30) results, and changes observed from pretreatment scores significantly exceeded the changes observed after these dogs received the placebo. According to owners' assessment, dogs improved their performances, as indicated by a significant reduction, compared with pre-treatment (day 30) in activity performance scores. Changes in activity performances significantly exceeded those observed after these dogs received the placebo. In these 13 dogs, 9 owners reported an increasing vitality

Table 2. Mean and standard error ($s_{\bar{x}}$) a of the mean changes from pretreatment for ground reaction forces and surgeon and owners' assessments in dogs with osteoarthrosis after 60 d of treatment with a powder of quality elk velvet antler (QEVA)

A

	Changes from pretreatment			
Ground reaction forces	QEVA group (25)	Pooled group (38)	Hips subset (19)	Stifles subset (12)
Vertical force				
peak	2.381, $s_{\bar{x}} = 0.717$[b]	2.970, $s_{\bar{x}} = 0.590$[b]	2.514, $s_{\bar{x}} = 0.726$[b]	3.149, $s_{\bar{x}} = 0.588$[b]
impulse	0.160, $s_{\bar{x}} = 0.145$	0.136, $s_{\bar{x}} = 0.109$	0.130, $s_{\bar{x}} = 0.153$	0.209, $s_{\bar{x}} = 0.132$
Craniocaudal force braking portion				
peak	0.529, $s_{\bar{x}} = 0.257$[a]	0.646, $s_{\bar{x}} = 0.251$[a]	0.726, $s_{\bar{x}} = 0.310$[a]	0.267, $s_{\bar{x}} = 0.224$
impulse	0.042, $s_{\bar{x}} = 0.021$[a]	0.046, $s_{\bar{x}} = 0.023$[b]	0.051, $s_{\bar{x}} = 0.025$[a]	0.011, $s_{\bar{x}} = 0.021$
Propulsive portion				
peak	−0.060, $s_{\bar{x}} = 0.230$	0.066, $s_{\bar{x}} = 0.193$	−0.124, $s_{\bar{x}} = 0.304$	0.515, $s_{\bar{x}} = 0.305$
impulse	−0.024, $s_{\bar{x}} = 0.028$	0.009, $s_{\bar{x}} = 0.022$	−0.033, $s_{\bar{x}} = 0.033$	0.045, $s_{\bar{x}} = 0.035$

B

	Changes from pretreatment			
Assessments (scores)	QEVA group (25)	Pooled group (38)	Hips subset (19)	Stifles subset (12)
Surgeon				
clinical signs	−0.68, $s_{\bar{x}} = 0.51$	−0.39, $s_{\bar{x}} = 0.37$	0.21, $s_{\bar{x}} = 0.53$	−0.75, $s_{\bar{x}} = 0.68$
visual appreciation	−5.40, $s_{\bar{x}} = 4.36$	−5.73, $s_{\bar{x}} = 3.40$	−5.68, $s_{\bar{x}} = 5.10$	−8.00, $s_{\bar{x}} = 5.48$
Owner				
activity performances	−8.00, $s_{\bar{x}} = 1.26$[a]	−7.63, $s_{\bar{x}} = 0.96$[a]	−8.63, $s_{\bar{x}} = 1.62$[a]	−6.25, $s_{\bar{x}} = 1.16$[a]

[a]Pretreatment values significantly different from posttreatment values with changes significantly different from those of placebo ($P < 0.05$)
[b]Pretreatment values significantly different from posttreatment values ($P < 0.05$)

after 60 d of treatment with QEVA. This proportion (9/13) was significantly higher compared with the proportion observed after treatment with placebo (1/13).

Table 2 presents the changes from pretreatment scores for GRF and assessments after 60 d of treatment with QEVA. Ground reaction forces and assessments were recorded for the QEVA group of dogs and the dogs pooled from the placebo-QEVA and QEVA groups. Subsets for stifles and hips were created from this pool of 38 dogs to provide distinction in treatment effects according to evaluated joints.

The vertical GRF peak observed after 60 d of treatment with QEVA was significantly improved in the QEVA group, pooled group, and in the hips and stifles subsets compared with the pretreatment peak. Also, the craniocaudal GRF peak and impulse for the braking portion were significantly improved in the QEVA group, pooled group, and hips subset, but not in the stifles subset. Except for the braking impulse in the pooled group, these changes significantly exceeded those observed in the 13 dogs that received the placebo only. According to owners' assessment, activity performances were significantly improved in dogs in the QEVA group, the pooled group, and in the hips and stifles subsets, as indicated by a significant reduction in activity performances scores compared with pretreatment (day 0) evaluations. Changes from pretreatment scores significantly exceeded the changes observed after the 13 dogs had received the placebo. Assessments by the surgeon did not note significant differences from pretreatment scores. Eighteen, 27, 14, and 6 owners reported an increased vitality in the QEVA group, pooled group, hips, and stifle subsets, respectively. Compared with placebo (1/13), proportions of dogs with an increased vitality were significantly higher in the QEVA group (18/25), pooled group (27/38), and hips subset (14/19), but not in the stifles subset (6/12).

Side effects and sample exclusion

The hematological and biochemical parameters that were monitored revealed no evidence of abnormalities of any clinical relevance following administration of placebo or QEVA, and the owners reported no side effects related to their administration.

Seven dogs did not complete the study. In the placebo-QEVA group, a pregnant bitch was withdrawn from the study, and another dog was withdrawn when the owner decided to stop the study for reasons unrelated to the experimental context. Also in this group, a 4-year-old Great Pyrenees died after 30 d of QEVA, following a history of anorexia, lethargy, and vomiting. On necropsy, macroscopic examination revealed bilateral reduction in size of the adrenal glands, which was confirmed by microscopic examination. The final diagnosis was chronic adrenal atrophy with degeneration and fibrosis of the cortical region of the adrenal glands. In the QEVA group, a 10-year-old dog died after 38 d of QEVA. At necropsy, hemorrhagic nodules were observed protruding from the surface of the right atrium and on the spleen. A final diagnosis of hemangiosarcoma of the right atrium was given. A 4-year-old American bulldog developed diarrhea after 2 d of QEVA. Based on owner information and a medical history that this dog had previously demonstrated enteric problems with susceptibility to diarrhea associated with dietary changes, the owner decided to withdraw his dog. Following a history of

diarrhea and 40 d of QEVA, a 5-year-old bobtail died; its alkaline phosphatase prior to treatment was 531 U/L. Macroscopic examination revealed pulmonary congestion and bilateral atrophy of the adrenal glands with a thin cortical region. The liver was pale and friable. Bilateral atrophy of the cortical region of the adrenal glands with mild lymphoid adrenalitis and vacuolar hepatopathy was diagnosed. Finally, to avoid concomitant medication, the investigators decided to withdraw a dog with a prior history of dermatological problems that required corticosteroid therapy during the course of the study.

Discussion

Kinetic measurement of musculoskeletal limb function has been used in different ways to comparatively evaluate response to different treatments (15–17), impact of acute synovitis (14), and surgical procedures (18). The biomechanical force plate used in this study allows a noninvasive and objective quantification of the forces transmitted through a single limb to the ground. Concerning the limb with the most severely affected joint, the vertical and craniocaudal GRF were obtained pretreatment to create an arthritic pattern that could be compared with the GRF obtained posttreatment. The difference in GRF and in assessments scores pre- and posttreatment represents the effect of the treatment on the arthritic condition.

The efficacy of QEVA was evaluated objectively on dogs afflicted with OA by using a description of the gait. Although some GRF were obtained and analyzed, vertical GRF peak was chosen as a primary outcome measure of improvement, thus limiting the probability of getting an improvement by chance alone. The GRF generated by the musculoskeletal system and transmitted to the affected limb were increased in QEVA-treated dogs, thereby indicating an improvement. The vertical GRF peak reflects the maximal weight bearing of the dog. Dogs treated with QEVA applied a greater magnitude of weight on their worst limb during the stance phase. This improvement in weight support may be related to an increase in muscular strength, a decrease in joint inflammation, or both. Indeed, when muscular mass is able to adequately support limb loading, reduction in joint loading occurs. This myotropic effect can improve the arthritic gait by limiting the deleterious action of joint loading. Also, when the inflammatory process in a joint is reduced, relief of pain related to hyperalgesia occurs (19). This reduction in joint inflammation can improve the arthritic gait by limiting the pain related to biochemical mediators released from OA cartilage, synovial membrane, and nerve fibers from the surrounding articular tissues (20–22).

The craniocaudal GRF generated during the stance phase is divided into a braking and a propulsive portion. At the beginning of the stance phase, dogs decrease their momentum; then they propel their body forward before lifting the limb from the ground to increase their momentum (23). Dogs treated with QEVA were able to increase their maximal braking force and also increase their total applied braking force. Based on gait analysis, QEVA-treated dogs improved their weight bearing, accepted an algetic portion of the stance phase, and executed the stride in a comfortable manner.

According to the owners' assessment, QEVA-treated dogs demonstrated a beneficial response. At home, arthritic dogs improved their physical performances, accompanied by an increasing vitality. Based on this appreciation, QEVA prevented or decreased the deleterious effect of inactivity by providing vigor and favoring resumption of normal activities of daily life. Although no improvements were observed by the surgeon in QEVA-treated dogs, visual appreciation showed a decrease in score, while an increase in score was observed in placebo-treated dogs. Whether adjustment in dose to provide a greater amount of QEVA or longer therapy might result in better improvement in orthopedic examination needs further investigation.

The effects of QEVA were described by using subsets to determine if a distinction existed between treatment of dogs with hip and stifle as their most severely afflicted joints. Results showed that a difference in response was in fact present, with less improvement of GRF and vitality for dogs with arthritic stifles. Based on a previous study on the marked effect of a nonsteroidal antiinflammatory drug on canine stifles, we speculated that this joint may differ in etiopathogenesis, resulting possibly in a more pronounced inflammatory process associated with an injury to the cruciate ligament (15). According to this speculation, the distinction in improvement could be related to the major inflammatory process associated with cruciate disease and a less effective treatment with QEVA when pronounced inflammation is present. This hypothesis was suggested by clinical observations, thus it is limited in scope.

There was no alteration in the biochemical and hematological parameters obtained for all QEVA-treated dogs, but 3 deaths occurred. One of these deaths was related to a hemangiosarcoma; however, the 2 other cases showed similar postmortem lesions on microscopic examination: atrophy of the cortical region of the adrenal glands. In one case, the degree of fibrosis observed suggested that the lesions were secondary to cortical necrosis. The severe hyperkalemia, obtained from postmortem analysis of vitreous humor, supports the hypothesis of cardiogenic and circulatory shock following adrenocortical insufficiency. In the other case, pulmonary and hepatic congestion suggested that death was caused by a vascular shock.

Evaluating the safety of QEVA was one of the purposes of this study, with 2 deaths with similar lesions, safety of this medication needed to be demonstrated further: Oral toxicity of QEVA for 7 d at daily doses of 500, 1000, and 2000 mg/kg body weight (BW) and also at a daily dose of 250 mg/kg BW for 90 d has been evaluated previously in rodents (Cartiplex; Qeva Velvet Products, personal communication). Lethality, clinical signs, and clinical and gross pathologic examination revealed no evidence of toxicity. Adrenocortical insufficiency may occur as a result of a rapid withdrawal of exogenous corticosteroids (24). However, in both of the QEVA-treated dogs in this study, corticosteroid therapies had never been used previously. Organochlorine compounds, such as dichloro-diphenyl-trichloroethane (DDT) and its derivatives, can produce acute adrenal insufficiency with shock and death (25,26). In order to determine the presence of noxious substances in the QEVA capsules, investigators submitted the medication used in both of these dogs to an independent

laboratory (Bodycote-Envirolab, Ste-Foy, Quebec) to screen for 20 potential pesticides, including DDT and its derivatives. Results obtained by gas chromatographic analyses showed no detectable traces of any pesticides. Also, in order to document the adrenocortical function of QEVA-treated dogs, adrenal response following synthetic adrenocorticotropin hormone (ACTH) injection was evaluated. Five dogs receiving QEVA during 16, 20, 22, 60, and 60 d were tested: Basal and stimulated cortisol concentrations were all within the normal range values, indicating a normal adrenal function. Based on these findings and with the fact that in both cases the pathologist could not rule out shock following naturally occurring adrenocortical insufficiency, these deaths were determined to be unrelated to QEVA treatment. However, a laboratory work-up must be considered for QEVA-treated dogs showing clinical signs similar to those reported here.

Elk are farmed to produce velvet antler teas, extracts, or capsules of raw material for human and animal health benefits. It is well established that velvet antler contains collagen as a major protein; a small amount of glycosaminoglycans, primarily as chondroitin sulfate (11,12); a peptide of 68 amino acids called pilose antler peptide (9,10), and an alcohol extract known as pantocrin or rantarin (27,28). Chondroitin sulfate possesses documented antiarthritic effects and is the major glycosaminoglycans present in velvet antler (29). We consider that its presence in QEVA was not associated with the beneficial effects observed in this study, since, in another study performed by our group (15), administration of a nutraceutical providing chondroitin sulfate in greater amounts than the raw material administered in this study failed to demonstrate significant gait improvement. The beneficial effects of QEVA could be associated, in part with the antiinflammatory action of pilose antler peptide and with the action of pantocrin. Therapeutic claims reported for pantocrin include increased work capacity, increased recovery from training, decreased skeletal muscle fatigue (adaptogenic properties), and a stimulating effect (30). To reinforce our hypothesis of a myotropic effect provided by QEVA, clinical signs were analyzed separately to evaluate the effect on muscular mass in the QEVA and pooled groups. Although the cumulative score for clinical signs did not show significant improvement, palpation of muscle mass revealed a significant reduction of atrophy, suggesting a myotropic effect (data not shown).

The beneficial effects of QEVA on arthritic dogs were objectively and subjectively demonstrated in this study. Based on the improvements observed here, consideration should be given to a powder of quality elk velvet antler in the treatment of canine OA. Further fundamental investigation in OA cartilage explants to evaluate the capacity of QEVA to reduce or inhibit the degenerative process would be interesting. Also, the long-term safety of administering QEVA needs to be investigated, as does the magnitude of improvement with a well defined and frequently prescribed OA medication on dogs afflicted with osteoarthrosis.

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Appendix 1. Owner's assessment

Daily life activities
- Walking approximately 15 minutes
- Gait after 15 minutes of walking
- Running approximately 10 minutes
- Gait after 10 minutes of running
- Climbing stairs
- Going down stairs
- Getting up after a long rest
- Sitting down
- Climbing in the car, over objects

Scoring system
0 — No difficulty in performing this activity
1 — Slight and occasional difficulty in performing this activity
2 — Slight and constant difficulty in performing this activity
3 — Evident difficulty in performing this activity
4 — Can no longer execute this activity

Did you notice an increasing vitality in your dog? YES/ NO
Please report side effects related to treatment
Score for each activities were added to generate a score for activity performances

Appendix 2. Surgeon's assessment

Clinical signs	Scoring system
Walking gait	0 — Normal 1 — Perceivable algetic gait 2 — Evident algetic gait
Posture	0 — Normal 1 — Abnormal (perceivable relief) 2 — Abnormal (obvious relief)
Mobility	0 — No limit of motion 1 — Reduction of 10° to 20° of motion 2 — Reduction of 20° to 50° of motion 3 — Reduction of more than 50° of motion
Muscular atrophy[a]	0 — No 1 — Perceptible muscular atrophy 2 — Evident muscular atrophy
Joint pain	0 — No 1 — Slight (complete movement with reluctance) 2 — Moderate (incomplete movement with reluctance) 3 — Severe (no movement allowed)
Visual appreciation[b]	0 mm Normal 100 mm Severe algetic gait

[a]Muscular mass atrophy was assessed by palpation.
[b]On a 100-mm line, the surgeon identified his own appreciation of the algetic gait, the resulting numeral length (score) was further analyzed.
Score for walking gait, trotting gait, posture, mobility, muscular atrophy, and joint pain were added to generate a score for clinical signs.

Appendix 3. Scoring system for radiographic evidence of osteoarthrosis

Joints	Scoring system
Hip	0 — Osteophytes and sclerosis absent. 1 — Acetabular remodeling, Morgan line, slight neck remodeling and slight femoral head sclerosis. 2 — Acetabular remodeling and osteophytosis, neck remodeling, enthesiophytosis, and femoral head sclerosis. 3 — Advanced acetabular and neck remodeling, severe osteophytosis and advanced femoral head sclerosis.
Stifle	0 — Osteophytes absent. 1 — Osteophytes present on patella and proximal aspect of femoral trochlear groove. 2 — Osteophytes present on patella, femoral trochlear groove, medial and lateral femoral condyles, and tibial plateau. 3 — Severe osteophytes on patella, femoral trochlear groove, medial and lateral femoral condyles, and tibial plateau: subchondral sclerosis of femoral condyles and tibial plateau.
Elbow	0 — Osteophytes absent. 1 — Osteophytes < 2 mm on the anconeal process of ulna. 3 — Osteophytes 2 to 5 mm on the anconeal process of ulna, osteophytes on the head of radius < 2 mm, and on the humeral crest < 2 mm.
Tarsus and shoulder	0 — Osteophytes absent 1 — Osteophytes < 2 mm 2 — Osteophytes 2 to 5 mm 3 — Osteophytes > 5 mm