

Double-Blind Study of the Effects of an Oral Supplement Intended to Support Joint Health in Horses with Tarsal Degenerative Joint Disease

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Horses with tarsal degenerative joint disease showed a significant reduction in gait asymmetry after receiving oral supplements that are intended to support joint health^a orally for 2 wk compared with a placebo treatment. Authors' address: Mary Anne McPhail Equine Performance Center, College of Veterinary Medicine, Michigan State University, East Lansing, MI 48824. © 2002 AAEP.

1. Introduction

In recent years, the use of oral supplements that are intended to support joint health has become very popular for relief of the symptoms of degenerative joint disease (DJD) in people and animals. There is considerable anecdotal evidence to support the use of these products, together with experimental evidence of their efficacy in treating DJD in horses.¹

DJD is the most common form of joint disease in horses. Therapy is directed towards providing analgesia, controlling inflammation (if present), limiting damage to articular tissues, and promoting healing of damaged cartilage. Medical treatment is usually based on non-steroidal anti-inflammatory drugs and/or corticosteroids to relieve pain, reduce lameness, and suppress inflammation. Long-term use of these medications, however, may suppress chondrocyte metabolism and inhibit normal collagen and proteoglycan synthesis, leading to further degradation of the cartilage matrix. Disease-modifying drugs, which include polysulphated glycosaminogly-

can and hyaluronan, also have anti-inflammatory and analgesic effects. Oral supplements designed to support joint health may also be disease-modifying, although there have been limited studies to support or refute their efficacy in treating DJD.

Traditionally, lameness is evaluated subjectively and graded on a five-point scale.² Gait analysis is an objective tool for measuring gait. It uses kinematic variables to describe the movements (angulations) of the segments and joints and kinetic variables to describe the forces associated with locomotion. Ground reaction forces, which are usually resolved into vertical and horizontal (shear) components, measure the forces between the hoof and the ground. Summation of the ground reaction force throughout the stance phase is the impulse. Kinematic and force variables are used to calculate the torque (turning force) around each joint and the bursts of mechanical energy absorption and generation. Energy absorption is indicative of the function of the joint in absorbing concussion; energy

NOTES

Table 1. History and Lameness Diagnoses in Horses Used in Study

Number	Age (years)	Occupation	Lameness
1	8	Dressage training (1 h/d, 5 d/wk)	LH tarsal DJD Bilateral tarsal DJD Bone chip LH fetlock
2	12	Dressage training (1 h/d, 6 d/wk)	Bilateral navicular changes
3	Aged	School horse (4 h/d, 2 d/wk)	Bilateral tarsal DJD LH tarsal DJD
4	20	School horse (2 h/d, 4 d/wk)	Bilateral fore fetlock DJD Bilateral tarsal DJD
5	19	School horse (2 h/d, 5 d/wk)	Bilateral fore fetlock DJD
6	19	School horse (3 h/d, 5 d/wk)	LH tarsal DJD
7	11	Dressage training (1 h/d, 5 d/wk)	LH tarsal DJD
8	Aged	School horse (3 h/d, 5 d/wk)	Bilateral tarsal DJD

LH, left hind; RH, right hind; DJD, degenerative joint disease.

generation is indicative of the provision of propulsion.

Even for experienced clinicians, subjective scoring of mild-to-moderate lameness is not very repeatable in comparison with kinematic analysis.³ Therefore, objective gait analysis is the preferred technique for evaluating changes in the degree of lameness over time. However, it is important to select a set of variables that are consistent with the objectives of the study. Vertical ground reaction force (GRF) represents the weight-bearing function of the limb, with peak vertical GRF and vertical impulse being the most useful measurements. Redistribution of the vertical GRF between the four limbs is indicative of changes in the willingness to bear weight on different limbs, which is a relevant consideration in supporting limb lameness.⁴ Joint kinematics have been described in horses with various lamenesses.⁵ Net joint torques and mechanical energy generation and absorption across a joint have received less attention to date, but may prove to be more sensitive to changes in the degree of lameness than the kinematic or GRF variables.⁶

Velocity affects the gait variables, and lame horses tend to decrease velocity as a means of reducing pain by decreasing the GRFs.⁷ Therefore, it is important to control velocity if the objective is to compare signs of lameness at different times. In this study, trials were analyzed in which the horse moved at a pre-selected velocity that was scaled to the horse's height and weight.⁸

The objective of this study was to objectively assess changes in gait variables in horses with tarsal DJD after administration of a joint supplement in a double-blind placebo-controlled trial.

2. Materials and Methods

The study was a double-blind placebo-controlled study designed to test the effects of an oral supplement that supports joint health on gait symmetry of lame horses. The active solution and a placebo were supplied in bottles identified numerically. The active solution contained the following

guaranteed levels: manganese, 1100 ppm; copper, 401 ppm; sulphur, 0.03%; vitamin B6, 504 mg/lb; ascorbic acid, 480 mg/lb; glutamine, 1.00%; proline, 0.31%; glutamic acid, 0.30%; glycine, 1.00%; and glucuronic acid, 0.05%. In addition, the active solution was fortified with animal protein products, glucuronic acid, methionine, alanine, arginine, aspartic acid, tyrosine, serine, valine, phenylalanine, histidine, threonine, and isoleucine. Both the active solution and the placebo solution contained xanthan gum as a thickening agent, sodium benzoate as a preservative, and yucca as a natural flavoring agent in an aqueous base containing dextrose, corn syrup, and sorbitol. The placebo solution was indistinguishable from the active solution in taste, smell, color, and consistency.

The eight subjects were riding horses that were in regular use. All horses were mildly lame (grade 1 or 2) in one or more limbs. All were diagnosed as having DJD of the distal intertarsal and/or tarsometatarsal joints of one or both hind limbs (Table 1) on the basis of physical examination, diagnostic anesthesia, and radiography. Some of the horses also had DJD in other joints.

Horses were admitted into the study in pairs and were numbered sequentially so there was an odd- and an even-numbered horse in each pair. Odd-numbered horses received the odd-numbered treatment solution first, and even-numbered horses received the even-numbered treatment solution first.

All dietary supplements and medications were withheld for 2 wk before the start of the study and until after the study was completed. Horses received the first treatment orally for 2 wk, followed by 2 wk without treatment, and then the alternative treatment was administered orally for 2 wk. During each treatment period, the horses received a loading dose of 60 ml/d for 5 days, followed by a maintenance dose of 30 ml/d for 9 days. Treatments were administered orally using a dosing syringe.

LAMENESS

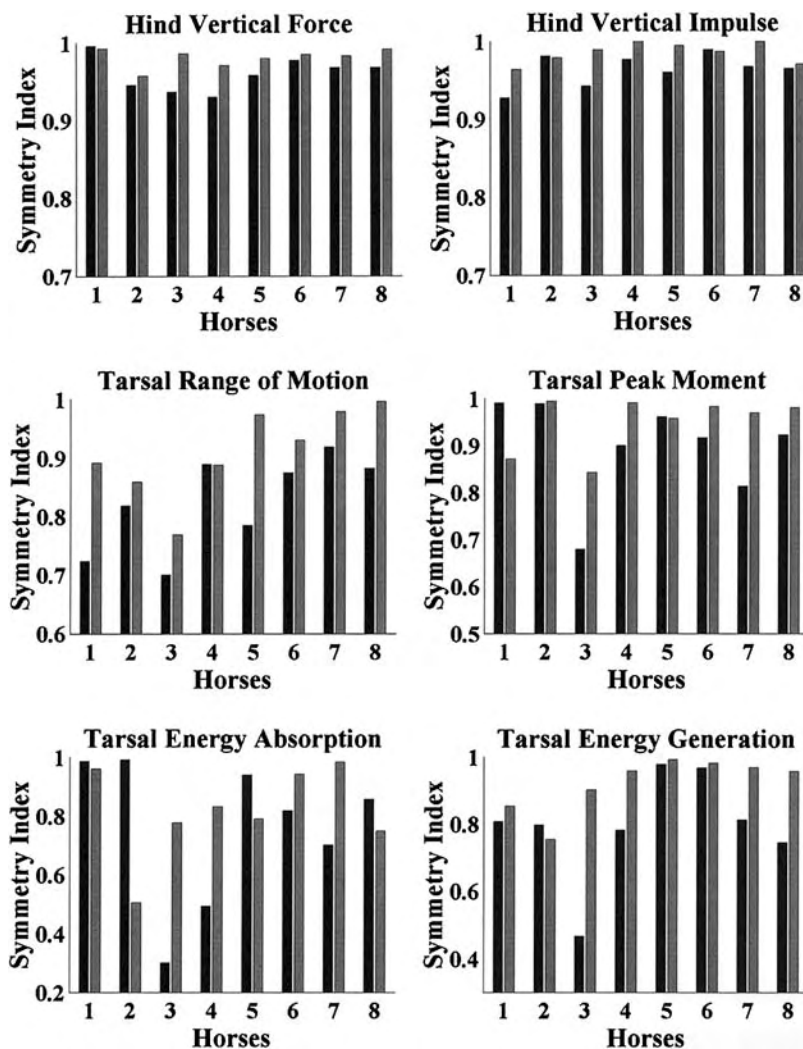


Fig. 1. Symmetry indices for gait variables after treatment with placebo solution (dark bars) or an active joint supplement solution^a represented by the light bars.

Gait analysis was performed using standard methods. Briefly, reflective spheres were attached over the centers of rotation of the hip, stifle, tarsal, fetlock, and coffin joints and the distal hoof wall at the toe and heel. These markers were tracked automatically by a six-camera Expert Vision Real Time System^b as the horses trotted in hand along a rubberized runway. The marker locations were used to determine joint angles during the stance phase of the stride. GRFs were collected synchronously with the kinematic data using a $60 \times 120\text{-cm}^2$ force plate.^c Gait analysis was performed at the completion of each 2-wk treatment period, with the horses moving at constant velocity and the appropriate velocity for each horse being determined according to its height and weight.⁸

The following variables were measured for the left and right hind limbs during the stance phase of the trot: peak vertical GRF, vertical impulse, range of tarsal joint motion, peak torque around the tarsal

joint during stance, and mechanical energy absorption and generation across the tarsus during stance. A symmetry index was constructed for each variable using the values measured for the left and right limbs: the lower value was divided by the higher value, so the index was always less than one. This index provided an indication of contralateral limb symmetry without differentiating between the left and right limbs. The higher the value (closer to unity), the greater the left-right symmetry for the variable under study. The treatment code was broken after completion of the data reduction.

Comparisons between the symmetry indices for each variable after treatment with the active solution versus the placebo solution were made using paired samples t tests with a probability level of $p < 0.05$.

3. Results

The velocities did not differ between groups (placebo solution, 3.28 ± 0.12 m/s; active solution, $3.27 \pm$

0.15 m/s). Compared with the placebo, treatment with the active solution resulted in significant increases in left-right symmetry of peak vertical GRF ($p = 0.01$), vertical impulse ($p = 0.02$), tarsal joint range of motion ($p = 0.01$), and tarsal joint energy generation during stance ($p = 0.05$). The direction of the changes was quite consistent across horses (Fig. 1). The tarsal net joint moment peak and tarsal net energy absorption did not change significantly. The results of this study are specific to the oral supplement used in this study and would not necessarily apply to other similar products.

4. Discussion

Visual assessment of lameness is based on observation of a complex array of clinical signs that are indicative of asymmetrical or abnormal movement patterns. Gait analysis of lame horses offers a means of quantifying the movements and associated forces in a repeatable and objective manner. The use of left-right asymmetries as a means of assessing the severity of lameness is well recognized, and various symmetry indices have been developed. Symmetry indices have been applied in analysis of kinematic variables⁹ and GRFs.¹⁰

In the study reported here, every effort was made to ensure an objective and quantitative evaluation by using a placebo control, blinding the researchers and the owners to the order of treatment, and using objective measurements of gait analysis. The treatment period of 2 wk was quite short, but there is evidence of a rapid improvement in clinical signs after the administration of oral supplements that support joint health. A previous study of the effects of a glucosamine-chondroitin sulfate compound in horses with DJD showed that lameness grade, flexion test grade, and stride length improved rapidly during the first 2 wk of administration and then more slowly during the following 2 wk.¹

DJD is a common pathology in older working horses, and the majority of affected horses show changes in more than one joint. The horses used in this study were lame in multiple sites, leading to complex patterns of gait abnormalities and compensations, which are typical of the older working horse. However, the presence of multiple pathologies complicates the clinical evaluation. The gait variables chosen for analysis represented the weight-bearing function of the hind limbs and the movements and functions of the tarsal joint. The results clearly indicated that the product used as a

dietary supplement in this study produced a more symmetrical gait pattern, which was interpreted as being indicative of an improvement in locomotor function. It is unrealistic to expect that an oral supplement of this type will restore complete soundness, but an effective product might be expected to improve the lameness so that the horse's gait pattern more closely approaches left-right symmetry.

It is concluded that the gait pattern at the trot became more symmetrical in horses with DJD after they received an oral supplement designed to aid joint health compared with administration of a placebo.

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References and Footnotes

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^aCorta-Flx®, Nature's Own, Inc., Aiken, SC 29801.

^bMotion Analysis Corp., Santa Rosa, CA 95403.

^cAdvanced Medical Technology Inc., Watertown, MA 02472.