

Evaluation of Extracorporeal Shock Wave Therapy for Osteoarthritis

David D. Frisbie, DVM, PhD, Diplomate ACVS;
Chris E. Kawcak, DVM, PhD, Diplomate ACVS; and
C. Wayne McIlwraith, BVSc, PhD, Diplomate ACVS*

Extracorporeal shock wave therapy (ESWT) is an effective method of decreasing clinical signs of lameness associated with osteoarthritis (OA). In this model, ESWT performed better than intramuscular polysulfated glycosaminoglycans. Authors' address: Equine Orthopaedic Research Center, Colorado State University, 2503 Bay Farm Road, Fort Collins, CO 80523. © 2004 AAEP. *Presenting author.

1. Introduction

Lameness, and more specifically, joint disease, causes significant loss of use of athletic horses and has a large economic impact on the horse industry. Despite numerous medical treatments, novel treatments are needed. Recent experimental evidence and anecdotal clinical impressions of extracorporeal shockwave therapy (ESWT) for the treatment of osteoarthritis (OA) have been reported.¹⁻³ Unpublished clinical studies in dogs have shown promising results, as have anecdotal reports on treating shoulder, pastern, and coffin joint OA in horses. This information led to the completion of the current study comparing ESWT to Adequan^{®a} and sham treatments in horses.

2. Materials and Methods

This study was a blinded, experimentally controlled randomized block design that used 24 horses in an established model of OA.⁴ On day 0 of the study, arthroscopic surgery was performed on both midcarpal joints of all horses, and OA was induced in one of

the midcarpal joints. On day 14, horses were divided into three treatment groups: sham control, positive control, and shockwave treated (Fig. 1). The sham control group was treated similarly to the shockwave treated group in all respects, except that bubble wrap was applied to the probe end to absorb all of the energy. The positive control group received intramuscular Adequan^{®a} administered every 4 days for 28 days. The shockwave-treated horses received ESWT on days 14 and 28 using a VersaTron^{®b} 12-mm probe. Specifically, the ESWT protocol was 2000 shock waves at the E4 energy level on study day 14 and 1500 shock waves at the E6 level on study day 28. The energy was delivered mainly to the intercarpal joint capsule attachment, but some energy was delivered to the area of fragmentation (~20% of the shocks).

On day 14, the horses began a strenuous exercise regimen 5 days/wk for the remaining 8 wk of the study. Synovial fluid and serum were assessed every other week for total protein concentration, white blood cell count (WBC), and level of the inflammatory

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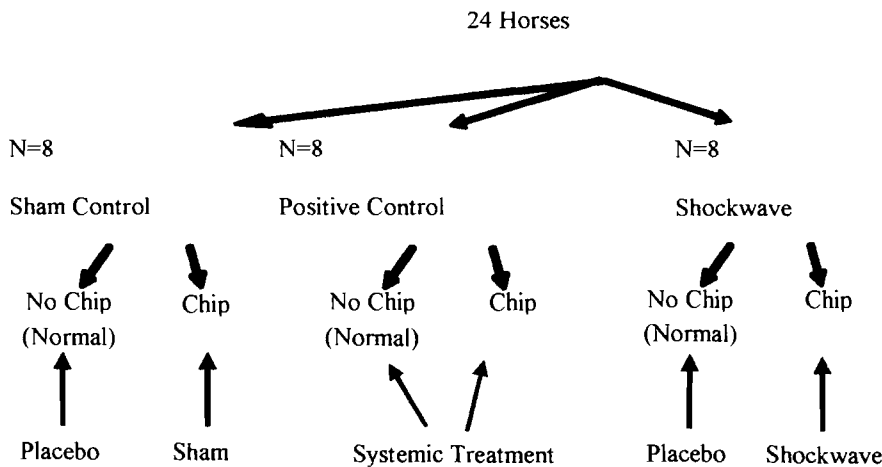


Fig. 1. Experimental design of the study. Overall horse numbers, treatment groups, and treatment applied to specific carpal joints are indicated.

marker, prostaglandin E_2 (PGE_2). Additionally, biomarkers for aggrecan synthesis (CS-846), proteoglycan release (sGAG), type II collagen synthesis (CPII) and type I and II collagen degradation (COL2-3/4C_{short}), and bone synthesis (osteocalcin) were estimated. Horses were assessed for lameness using the AAEP grading scale every 2 wk. At the termination of the study, operated joints were evaluated grossly, and tissues were harvested for biochemical and routine histologic examinations.

Statistical analysis used both a mixed model analysis of variance and discriminate analysis, with p values <0.05 considered significant.

3. Results

Induction of OA resulted in a significant increase in lameness in the corresponding limbs. Significant improvement in clinical lameness (1.7-fold) was noted at the first evaluation time point post-treatment (14 days) in the ESWT-treated horses compared with both the sham and positive control groups. This significant improvement was also noted for all subsequent evaluation periods (days 42, 56, and 70). No significant difference was noted between the sham and positive control horses when compared at similar time points. However, the positive control group had significantly improved in lameness by day 70 compared with day 14, whereas the sham control group had no significant improvement in lameness.

Both the positive control and ESWT horses had significant improvement in synovial fluid total protein levels (up to 1.3-fold) within 14 days of treatment, indicating less synovitis compared with the sham control horses. Improvement with Adequan^{®a} and ESWT treatment was also noted in the amount of glycosaminoglycan released into the bloodstream 14 days post-treatment.

No significant differences were noted in the gross and histologic examinations of the tissue comparing any of the treatment groups.

4. Discussion

This study used an established model of OA that has been used to test various medical treatments for arthritis, such as intra-articular corticosteroids, intravenous hyaluronan, and intramuscular pentosan polysulfate. Furthermore, the induction of arthritis has been shown to result in clinical lameness and histologic and biochemical alterations. These changes are noted in both the soft tissue and in the articular cartilage. Treatment with ESWT reduced the clinical signs of pain measured by lameness evaluations; Pain was even reduced 42 days after the last treatment, the longest time point measured. There was, however, no significant improvement in response to flexion of the carpus. This suggests that the improvement in lameness was not caused by local desensitization of the region or more specifically, the joint capsule. Concurrently, a parameter of synovitis, synovial fluid total protein, was significantly reduced, suggesting a possible mechanism for the treatment effect of ESWT. At the gross or histologic level, improvement was not seen with either ESWT or Adequan^{®a} treatment and thus, would not be considered chondroprotective in this model. These findings would suggest more of an effect on the soft tissues surrounding the joints compared with the articular cartilage. Computer tomography and bone rate formation studies are being analyzed on these horses and may yield more information on whether or not ESWT improved the treated horses.

The results of this study suggest that ESWT is an effective method of reducing clinical lameness and synovitis but does not significantly improve gross or histologic progression of arthritis. Therefore, it would be best considered in combination with a chondroprotective agent. Also, further work evaluating ESWT in clinical cases of joint disease is definitively warranted.

References and Footnotes

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^aAdequan®, Luitpold Pharmaceuticals, Inc., Shirley, NY 11967.

^bVersaTron®, High Medical Technologies, Inc., Kenesaw, GA 30144.