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Clinical Results of the Use of an Extracorporeal Shock Wave Therapy Device for the Treatment of Chronic Lameness Conditions In Horses.

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Summary

This paper represents the results of the clinical application of a shock wave therapy device for the treatment of chronic lameness disorders in horses. Radial Shock Wave Therapy (RSWT) was applied to 36 horses representing a cumulative total of forty-seven (47) applications. Upon re-evaluation sixty (60) to one hundred eighty (180) days after completion of the treatment protocol, 85% (40/47) of the conditions treated demonstrated an improvement in the lameness or had become sound.

Introduction

Lameness is the major cause of economic loss in the equine industry today. Chronic lameness syndromes present a therapeutic challenge to the equine practitioner to provide relief of pain and return athletic use of the horse while operating within the ethical and regulatory constraints of modern competition. Ideally, the practitioner would be able to employ a treatment modality or regimen that would relieve pain and promote healing as fast as possible without the patient experiencing any negative side effects. Initial reports of the effects of RSWT on laboratory animals, humans, and horses indicate that this modality may offer the treatment ideals indicated above.

In a joint effort between The Equine Center in San Luis Obispo, California, and the Rochester Equine Clinic in Rochester, New Hampshire, thirty-six (36) horses were used in an ongoing study to assess the efficacy of a Radial Shock Wave Therapy (RSWT) device on a variety of musculoskeletal pathologies.† All cases were chronic in nature, meaning that the horses had been lame for at least two (2) months with minimal clinical/structural improvement occurring during that time.

It was hypothesized that by using this extracorporeal shock wave therapy system at pre-established levels of frequency (in Hz), pneumatic pressure (in BAR, where 1 BAR = 14.503 psi), and impulse count, the veterinarian would be able to deliver a relatively painless pneumatically generated shock wave to the injury site. This then produced a transient period of analgesia (pain relief) and more importantly, stimulated the healing process by returning the injury to an acute state thus signaling cells responsible for bone growth and soft tissue formation to “think” that a new injury had occurred.

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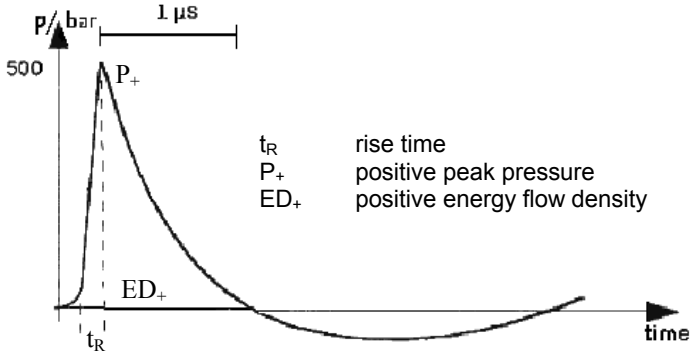
† Both equine clinics utilized a Swiss DolorClast® Vet system. EMS Electro Medical Systems, Dallas, Texas (www.ems-medicalamerica.com).

Prior to entering the study, many of the subjects demonstrated easily discernible lameness (evaluated by a veterinarian based on the American Association of Equine Practitioners (AAEP) lameness scale). Subjects ranged in age from 4 -17 years, exhibited an initial grade of lameness ranging from 0.5/5 to 3/5 and were used for pleasure, endurance, flat racing, dressage, eventing and jumping. When treatment was completed, the majority of the horses showed improvement by at least one full grade of lameness in their level of soundness, with some showing no lameness at all. A small percentage of horses showed improvement initially after treatment but later regressed in their soundness.

Based on our experience and the results of this study, we believe that this technology shows great promise as a non-invasive, economic, and relatively pain-free alternative and/or adjunct to other treatment methods for equine lameness. In certain cases RSWT offers a treatment solution where no other treatment option has previously existed for a specific condition or injury. The idea that veterinarians can now treat these types of injuries at a relatively low cost to the client makes RSWT an interesting and attractive treatment option to equine practitioner and client alike.

Radial Shock Waves are generated outside of the animal's body and are, therefore, also described as extracorporeal shock waves. These acoustic waves are transmitted through the skin into deeper anatomical structures. Shock waves are characterized by a high and very rapid rise in pressure, followed by a rapid decrease in pressure to a negative level (see graph below).



This energy is transmitted easily through the skin and underlying soft tissues (which possess low density and high water content) with no significant structural damage. The impact of the energy of the waves is predominately within bone and certain soft tissues.[1] Shock waves have their greatest impact when they meet an interface of different impedance, with compression and shear loads developing. This is perhaps why shock wave therapy seems to be effective in treating insertion desmopathies.

The history of shock wave therapy began in human medicine as a treatment for kidney stones. In 1980, the first patient with renal calculi was successfully treated with extracorporeal shock wave lithotripsy. Using high intensity focused shock waves these "interoliths" were broken down to a level that the body was able to remove and/or reabsorb naturally. Since then the application of this form of energy has extended into orthopedics[2], as well as other disciplines of human medicine.

In later studies, researchers began to study the effects of pressure waves on surrounding tissues such as blood vessels, kidney cells, and the bone of the pelvis. The first experiments on the effects of shock waves were carried out on the pelvic bones of rabbits. Researchers discovered small ruptures in the bone tissue. Bleeding and micro damage to the bone cells resembled, on a

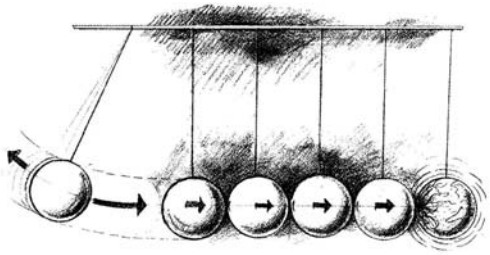
cellular level, what would occur in a fresh fracture. Initially, there was concern that the problems associated with the cure would be as bad as the original condition, but researchers following the progress of the damage to the bone tissue found that after the shock wave trauma occurred, the osteocytes and osteoblasts of the affected bone showed increased activity.[3]

In subsequent human orthopedic applications, RSWT was used successfully to treat not only bony conditions, but also those involving chronic soft tissue problems – so called insertion tendopathies such as tennis elbow, plantar fasciitis (with or without heel spur), Achilles and patella tendonitis as well as calcified shoulders. The effectiveness of RSWT has been proven in a multicentric, randomized, placebo-controlled, single-blind study by Lohrer, et al, with more than 200 patients who suffered from chronic pain associated with radial epicondylitis (tennis elbow) or plantar fasciitis (with or without heel spur). On a twelve (12) month follow-up, an overall success rate of 81% for the heel spur patients, and 83% for the tennis elbow patients was achieved in this study group.

Materials and Methods

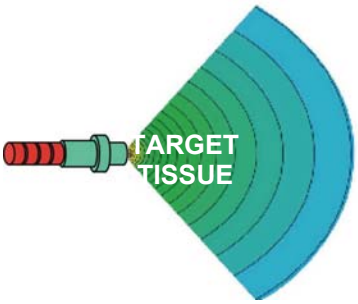
For this study, the pre-treatment protocol depended largely on the individual temperament of the horse undergoing treatment. As a general rule, the horse would be treated either in a typical stocks restraint or in a treatment room with a handler at its head, and then further controlled by one of two methods. If the horse expressed any discomfort with the radial shock wave application, it was sedated using Detomidine Hydrochloride[‡] 0.01 mg/kg and Butorphanol Tartrate[§] 0.01 mg/kg or further restrained by use of a nose twitch. Cotton ear plugs were also utilized on horses that were reactive to the sound of the RSWT device On rare occasions some patients required local anesthesia as well. The treatment area was clipped to remove hair and a coupling gel was applied over this zone allowing a maximum energy transmission to the target tissue. Once these initial steps were taken, treatment would proceed. The RSWT system used for this study consisted of a control unit with a hand piece, two (2) different applicator sizes (6 and 15 mm), and a medical air compressor mounted on a cart. While most treatments utilized the 15 mm head, suspensory origin areas of injury were more easily accessed with the smaller applicator head. The medical air compressor created the pneumatic energy used to accelerate the projectile located in the handpiece. Once the projectile hit the applicator, an extracorporeal shock wave was created and subsequently distributed in a radial (spherical) fashion throughout the treatment area. Illustrations 1 and 2 show this energy transfer relationship.

Illustration 1.



Pneumatic Driven Piston > Applicator Head > Target Tissue

Illustration 2.



[‡] Dormosedan® 10 mg/mL, Pfizer Animal Health®
[§] Torbugesic® 10 mg/mL, Fort Dodge®

Depending on the specific type and location of injury, pre-established parameters for treatment pressure, frequency, and impulse count were set at the control unit. Standard settings for a Radial Shock Wave treatment was 2,000 impulses per treatment area with a frequency of 8-10 Hertz and a pressure of 2.5 up to 3.0 bar. Following the recommendations cited in a previous study[4], our patients were treated 3-5 times, at intervals ranging from 7–30 days. This protocol offers the treated tissue time to respond both between individual treatment sessions and cumulatively. A recovery phase lasting two (2) to four (4) weeks followed the last treatment session. Horses received some controlled exercise on firm ground during the course of treatment.

During the course of treatment, horses were hand walked starting at fifteen (15) minutes twice daily and slowly increased over several weeks to the point of 60 minutes daily. In the first 10 days of the recovery phase, horses started a training program under saddle, beginning with 30 minutes walk interrupted by short periods of trot for two weeks. After this period, trotting was successively extended and horses started canter work, which was also gradually increased over time. Conditions of turn out for these horses varied widely, depending mainly on the facilities available to the horse owner and the temperament of the individual horse.

Upon completion of the RSWT treatment program, the horse owners were interviewed to determine and quantify the improvement/deterioration of their animal, as well as to observe any clinically relevant side effects. Furthermore, interviewing served to enable the authors to study treatment success/failure on a long-term (horse back to full work and/or competition) basis. This subjective feedback from the horse owner was combined with post treatment lameness evaluation by a veterinarian sixty (60) - ninety (90) days after the last treatment session. A group of the horses were also re-evaluated six (6) months or more post therapy. Diagnostic imaging including nuclear scintigraphy, ultrasonography, and radiography were used to objectively assess the horse's improvement or deterioration.

In this study we enrolled thirty-six (36) horses suffering from chronic orthopedic conditions where at least two other conservative treatment approaches have failed in a minimum period of two (2) months prior to shock wave therapy. It should be noted that some of these horses were treated for multiple conditions.

Within this group of 36 patients with 47 chronic lameness conditions, there were fifteen (15) horses treated for Proximal Suspensory Ligament Desmopathy (PSD), seven (7) patients for Degenerative Joint Disease (DJD), four (4) animals for an Exostosis, four (4) horses for Palmar Heel Pain Syndrome, two (2) for lesions of the Dorsal Spinous Processes (DSP), six (6) for Ringbone of the pastern, five (5) patients for calcified Tendonopathies as well as four (4) horses for dorsal metacarpal disease (DMD).

Results and Observations

Condition	Marked Improvement or Sound	Some Improvement	No Improvement or Regression
PSD-	10/15 (67%)	3/15 (20%)	2/15 (13%)
DJD-	6/7 (86%)	1/7 (14%)	
Exostosis-	3/4 (75%)		1/4 (25%)
Palmar heel pain syndrome-	1/4 (25%)		3/4 (75%)
DSP-	2/2 (100%)		
Ringbone-	5/6 (83%)		1/6 (17%)
Tendonopathies-	2/5 (40%)	3/5 (60%)	
DMD-	4/4 (100%)		

Conclusion

As a result of treatment by Radial Shock Wave Therapy, the horses in the study demonstrated results ranging from no improvement to a complete return to normal function. Long term (6+ months post treatment) follow up observations showed that while many of the horses treated in the study have continued to perform at previous levels and remain sound while doing so, a few cases have shown some regression in their condition. There was, however, no observable deterioration in performance or any other adverse effect as a direct result of using this treatment method.

Although further study is needed to establish, with certainty, a comprehensive list of indications for RSWT, we conclude that, based on both short term and long term results of this study, RSWT is both a safe and effective treatment for certain chronic lameness conditions in the horse.

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