

# Clinical Experiences with Radial Shock Wave Therapy in Performance Horses

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## Abstract

Radial Extracorporeal Shock Wave Therapy was used to treat 70 performance horses (of which 68 were Standardbreds), with 11 different lameness conditions (primarily tendon and ligament soft tissue injuries). Most injuries had a guarded prognosis for future athletic use, many were chronic, recurrent and unresponsive to other forms of treatment. Using a detailed scoring system, the overall success rate was 66% (46/70) while the failure rate was 34% (24/70).

## Introduction

Extracorporeal Shock Wave Therapy (ESWT) is a relatively new treatment for musculoskeletal injury in performance horses. Both high energy focused and low energy radial shock wave devices are becoming popular in Europe and North America. However, there is still a need for documentation of the effects of shockwaves on equine tissue or the efficacy of treatments.<sup>1-3</sup>

Extracorporeal Shock Wave Therapy has been used in human medicine for the past 17 years.<sup>4</sup> Known as lithotripsy, this therapeutic instrument is used primarily for non-surgical disintegration of kidney stones, gall bladder stones and stones in salivary glands. The FDA is currently evaluating the use of ESWT in the United States for orthopedic conditions.<sup>5</sup> A growing body of research supports success with heel spurs, calcific tendinitis, lateral epicondylitis (tennis elbow), plantar fasciitis and non-union fractures.<sup>4</sup>

Many soft tissue and bone injuries in performance horses carry guarded to unfavorable prognoses for future athletic endeavors. Many are slow healers, have a high reoccurrence and are poorly responsive to other forms of medical or surgical treatments. Eleven different conditions (Figure 2), on primarily Standardbred race horses were treated with Radial Shock Wave Therapy (RSWT) using a Swiss DolorClast Vet system (EMS Electro Medical Systems, Dallas, TX, USA) unit, which generates a pressure pulse pneumatically, through the use of an air compressor. The pulse converts a mechanical impulse through a focused tip on a hand held probe in to equine tissue.

The conditions treated were superficial digital flexor (SDF) tendinitis, suspensory desmitis, fractures, sesamoiditis, distal sesamoidean ligament desmitis, inferior check ligament desmitis, exostoses or splints, plantar ligament desmitis, dorsal metacarpal disease (DMD), proliferative synovitis and joint synovitis /degenerative joint disease. The purpose of this retrospective study, was to evaluate the effectiveness of Radial Shock Wave Therapy as a viable treatment option for such lameness problems in 70 performance horses.

## Materials and Methods

Seventy performance horses, comprising 68 Standardbreds, 1 Thoroughbred and 1 Arabian, were all included in this study. Ninety five limbs had 98 different conditions involving 11 different problems (diagnoses). Many of these horses therefore, had multiple problems on one leg or multiple problems on multiple legs, which is not an uncommon finding in Standardbred racehorses. All horses were presented for a lameness evaluation of varying degrees (AAEP grades 1 to 5) and many conditions were chronic and recurrent. Over 50% of these horses all had previous treatments, ranging from moderate to extensive rest periods (conservative therapy), cryosurgery, pinfiring, sarapin, steroid or snake venom injections, electromagnetic therapy, and cold laser therapy.

A complete lameness evaluation was performed upon presentation using a combination of history (hx.), physical exam (px.), clinical exam (cx.), plus or minus diagnostic anesthesia, thermography, ultrasonography, radiology and nuclear scintigraphy. A diagnosis and prognosis was determined for each horse and Radial Shock Wave Therapy was recommended as a potentially viable treatment. Various forms of suspensory desmitis involved 47% of the cases (33/70). Differing forms of superficial digital flexor tendinitis comprised 30% of horses treated (21/70). Fractures, either non-union or non surgical (e.g P3 fracture, C3 saggital,etc.), accounted for 8.5% of the case load. Other conditions comprised the rest including, inferior check ligament desmitis (4% or 3/70), distal sesamoidean ligament desmitis (4% or 3/70) and 6 others equating for 6.5% (4/70). These included dorsal metacarpal disease, plantar ligament desmitis, exostoses or splints, joint synovitis or degenerative joint disease, proliferative synovitis and sesamoiditis type 2 (Figure 2). Besides evaluating each of 70 lame horses, each single condition was classified separately and followed through to success or failure.

All horses were treated in the standing position with mild sedation using 2.5-5 mg. Detomidine and 2.5-5 mg. Butorphanol given intravenously just prior to treatment. The treatment area was shaved and additional physical restraint was provided by application of a nose twitch. A Swiss DolarClast Vet (EMS Electro Medical Systems) radial shock wave unit was used for all cases.

Contact gel<sup>a</sup> was placed on the treatment area and 2,000 impulses, on average (range 1,000-3,000) depending on the size of and the condition treated, were applied. Air pressure of 2.5-3.0 bar using a 6 or 15 mm probe with medium to strong pressure, generated these impulses. An impulse frequency of 8 - 10 -12 Hz was used in increasing increments during the treatment phase. Positioning of limbs up or down depended on the condition being treated, and most protocols followed the treatment -summary sheets provided by EMS Electro Medical Systems with the system. Soft tissue injuries received 3 RSWT treatments at 7-10 day intervals while bone conditions received 5 treatments using the same intervals. Hand walking was prescribed for most during treatments and during the recovery phase, unless sufficient lameness required stall rest. Alcohol bandages were used for most horses after treatment, and repeat treatments were not necessary to maintain soundness if success occurred with the case. The recovery phase ranged from 10 - 28 days post the final treatment, with the average at 14 days for most problems.

Follow up telephone calls, physical and clinical exams, plus or minus thermography, ultrasonography, radiology and nuclear scintigraphy were used on all cases treated with RSWT. A scoring system heavily weighted on lameness grades and performance, was devised to determine success or failure related to the shock wave therapy (Figure 1). Current racing statistics were obtained from Standardbred Canada's Information Technology Division. Each of the 11 conditions treated were analyzed separately (Tables 1-7 ) as well as collectively (Figures 2-4).

## Results

Seventy performance horses (68 Standardbreds, 1 Thoroughbred, 1 Arabian, 52 males, 18 females), were included in this study. Many horses had multiple problems on one leg or on multiple legs and most were chronic recurrent soft tissue injuries. Many horses already had previous forms of treatment and most had guarded prognoses with a high reoccurrence rate and poor response to other medical or surgical treatments. Eleven different lameness conditions (Figure 2) were evaluated including suspensory desmitis (33), superficial digital flexor tendinitis (21), fractures (8), sesamoiditis type 2 (4), distal sesamoidean ligament desmitis (3), inferior check ligament desmitis (3), exostoses or splints(3), dorsal metacarpal disease (1), joint synovitis/degenerative joint disease (9), proliferative synovitis (1), and plantar ligament desmitis (1). Suspensory desmitis and superficial digital flexor tendonitis comprised 77% of cases treated. Lameness grades varied from grade 1-5 (AAEP 1-5 scale).

Individual conditions compared had higher success rates (Table 7), but because of a frequent combination of lameness conditions or multiple limb involvement, the overall comparisons gave slightly lower success rates. Overall success rates for treatments with RSWT (Figure 3), as defined by clinically assigned scores, yielded 66% success rate (46/70) and a 34% failure rate (24/70). In order to be a successful case, a clinical score of 12 or higher (maximum 16) had to be achieved. There were 46 horses rated as successful recording an average score of 13.04 (range 12-16). The 24 failure rated horses had an average score of 7.70 (range 4-11). The percentage of total failure rate (TFR) (Figure 4) showed superficial digital flexor tendinitis accounting for 50% of failed cases (12/24), while suspensory desmitis stood at 29% (7/24), fractures at 13% (3/24) and all others at 8% (2/24).

There were no clinically significant complications seen after treatment of all horses with RSWT. In all horses, the skin surface was warm immediately after treatment and a mild transient swelling developed in some. Subperiosteal and endosteal hemorrhage at the application site was possible on occasion, and rarely, hematoma formation occurred. All horses did return to some level of athletic work for some period of time (short in some cases as lameness persisted or reoccurred).

## Discussion

When combined with an appropriate rest and rehabilitation period, Radial Shock Wave Therapy appears to be a safe and effective non invasive treatment for many subacute and chronic lameness conditions in performance horses (especially Standardbreds), with 46 of 70 horses (66%) returning to racing at the same or higher levels after treatment. Most of these conditions were soft tissue injuries and insertional desmopathies, that carried guarded prognoses, had high reoccurrence rates, were slow healers, or did not respond to other types of treatments.

Many of these horses were lame (grade 1-5 / 5 on the AAEP scale) during exercise at the time of presentation. Although lameness grades and clinical appearance of lesions were improved in almost all cases, success or failure was often determined by whether or not a horse raced or performed for at least 6 starts or 3 months duration post treatment and recuperation time, as evidenced on the clinical scoring system used in the study. Comparison of race records and performance of the 68 Standardbreds, before and after RSWT treatments, was used to evaluate return to racing or not, plus the level of performance. All horses in the study had clinical follow ups, while most (over 90%) had radiographic or ultrasonic follow ups as indicated to assess the healing or improvement of lesions. One complicating factor, was that many horses had multiple problems on one leg or on multiple legs giving, sometimes giving combined diagnoses. This was accounted for in the individual condition summaries, which showed higher levels of success than overall rates. For example, suspensory desmitis conditions came in at 79% successful and several other soft tissue injuries, like inferior check ligament desmitis injuries proved to be 100% success rates.

The suspensory desmitis success rate attained here, plus that of other equine practitioners<sup>6,7</sup> mirrors that found in human medicine with insertional tendon/ligament injuries, where many papers report 80% or higher success rates post ESWT treatments.<sup>8-10</sup> This does indeed imply that shock wave therapy has its greatest potential effect on soft tissue interfaces like tendon or ligament origin and insertion sites, and also has healing effects on these often chronic injuries, in both human and equine medicine.

Fifty per cent of the failures, not surprisingly, involved superficial digital flexor tendinitis problems, the bulk of which were chronic, recurrent, and had other forms of treatment performed. The successful tendon problems were all detected early, had ultrasonic evidence of mild to moderate injuries, and all had sufficient rest periods (walking only), followed by a period of controlled exercise (jogging or small paddock turn out). Superficial digital flexor tendinitis conditions were labeled as low, mid or high, yet many were combinations of more extensive tendon injury, as is often the case. However, the 43% success rate achieved was perhaps higher than other forms of treatment, and one noticeable trait seen, was that the recovered horses had long term success on the track with no evidence of reoccurrence and all performed at the same or higher levels.

A good proportion of the horses in this study had Radial Shock Wave Therapy and appropriate rest periods as a sole form of treatment, but many had previous unsuccessful treatments as well, including extended rest periods. This fact alone says that they could not achieve success prior to RSWT treatments, which would seem to indicate that the therapy is a very useful treatment modality, even if it attains only a 50% level of success in these difficult and often disappointing performance horse injuries. Future research and refined techniques will improve success rates even more than they are today.

## References and Footnotes

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a - EMS Contact Gel (Ref. No. DV-033). EMS Electro Medical Systems

## Acknowledgments

1. Camille Prange  
Information Technology  
Standardbred Canada  
2150 Meadowvale Blvd.  
Mississauga, Ont. L5N 6R6

Supplying race records for 68 project horses

2. Tammy Lawson, R.V.T.  
Ambulatory Equine Service  
Atlantic Veterinary College

Treatment, follow ups and after care of all cases

TABLE 1 - SUSPENSORY DESMITIS (36)

Limb	HSD	Low Susp.	Mid Body	Med. Br.	Lat. Br.	Rupture
Total	15	4	2	9	4	2
LF	2	1	1	1	3	1
RF	2	1	1	3	0	0
LH	3	1	0	3	1	1
RH	8	1	0	2	0	0
Failure	4	0	0	2	0	1
RH	2			1		
LH	2			1		
LF						1

Total Suspensory Desmitis = 36 limbs/33 horses

Successful = 26/33 or 79%

Failure = 7/33 or 21%

% of Total Failure Rate (24/70) = 7/24 or 29%

Abbreviations = HSD= high suspensory desmitis

Low susp.=low suspensory desmitis

Mid body = mid body suspensory desmitis

Med.Br.= medial branch suspensory desmitis

Lat.Br.= lateral branch suspensory desmitis

Rupture = suspensory rupture/dropped suspensory

TABLE 2 - SUPERFICIAL DIGITAL FLEXOR TENDINITIS(25)

Limb	Mid Body SDF	High SDF	Low SDF
Total	22	2	1
LF	14	1	1
RF	5	0	0
RH	2	1	0
LH	1	0	0
Failure	10	1	1
LF	8	1	1
RF	1	0	0
RH	1	0	0

Total Superficial Digital Flexor Tendinitis (SDF) = 25 limbs/21 horses

Successful = 9/21 or 43%

Failure = 12/21 or 57%

% Total failure Rate (24/70) = 12/24 or 50%

TABLE 3 - FRACTURES (8)

Limb	SesMidBo	SesBasal	C3 Slab	C3Saggital	MC3 Avul	P3 Lat.
Total	1	1	2	1	2	1
LF	1	1	2	1	0	1
RF	0	0	0	0	2	0
Failure	1	0	2	0	0	0
LF	1	0	2	0	0	0

Total Fractures = 8 limbs/8 horses /2 combined diagnosis(MC3 avulsion fractures)

Successful = 5/8 horses or 63%

Failure = 3/8 horses or 37%

% of Total Failure Rate(24/70) = 3/24 or 13%

Abbreviations- SesMidBo=sesamoid fracture mid body/ SesBasal=sesamoid basal fracture/C3 Slab= 3<sup>rd</sup> carpal bone slab fracture/C3 Sag= 3<sup>rd</sup> carpal bone saggital fracture/ MC3 Avul= 3rd metacarpal bone avulsion fracture/ P3 Lat= 3<sup>rd</sup> phalynx(coffin bone) fracture lateral

TABLE 4 - SESAMOIDITIS(5)/ DISTAL SESAMOIDEAN LIGAMENT DESMITIS(4)/  
INFERIOR CHECK LIGAMENT DESMITIS(3)

Limb	Sesamoiditis	DistalSesLigDesmitis	Check lig.Desmitis
Total	5	4	3
RF	4	2	1
LF	1	2	2
Failure	2	2	0
RF	1	1	0
LF	1	1	0

Total Type 2 sesamoiditis = 5 limbs/4horses/3 combined diagnoses  
Successful = 3/4 horses or 75%      Failure = 1/4 horses or 25%      %of TFR(24/70)=1/24 or 4%

Total distal sesamoidean ligament desmitis = 4 limbs/3 horses  
Successful = 2/3 horses or 67%      Failure = 1/3 horses or 33%      %of TFR(24/70)=1/24 or 4%

Total inferior check ligament desmitis = 3 limbs/ 3 horses  
Successful = 3/3 horses or 100%      Failure = 0/3 or 0%      %of TFR(24/70)=0/24 or 0%

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TABLE 5 - Exostoses/Splints(3)/ Plantar Ligament Desmitis(1)/Dorsal Metacarpal Disease(1)

Limb	Exostoses/Splints	Plantar LigamentDes.	DMD(bucked Shins)
Total	3	1	1
LF	2	0	1
RH	0	1	0
LH	1	0	0
Failure	0	0	0

Total Exostoses/Splints = 3 limbs/3 horses/2 combined diagnosis  
Successful = 3/3 horses or 100%      Failure = 0/3 or 0%      % TFR (24/70)= 0%

Total Plantar Ligament Desmitis (curb) = 1 limb/1 horse  
Successful = 1/1 horse or 100%      Failure = 0/1 or 0%      % TFR (24/70) = 0%

Total DMD(bucked shins) = 1 limb/ 1horse  
Successful = 1/1 horse or 100%      Failure = 0/1 or 0%      % TFR (24/70) = 0%

TABLE 6 - Joint Synovitis / Degenerative Joint Disease(11)/ Proliferative Synovitis(1)

Limb	Joint Synovitis / DJD	Proliferative Synovitis
Total	11	1
LF	7	0
RF	4	1
Failure	5	0
LF	4	0
RF	1	0

Total Joint Synovitis/Degenerative Joint Disease = 11 limbs/9 horses/all combined diagnoses  
 Successful = 6/11 horses or 55%                      Failure = 5/11 or 45%                      % TFR = Combined

Total Proliferative Synovitis = 1 limb/1 horse/combined diagnosis  
 Successful = 1/1 horse or 100%                      Failure = 0/1 or 0%                      % TFR= Combined

TABLE 7 - INDIVIDUAL CONDITION SUCCESS/FAILURE RATE/HORSE

Condition/Diagnosis(Total #)	Success Rate % / #	Failure Rate % / #
Suspensory Desmitis (33)	79% or 26/33	21% or 7/33
SDF Tendonitis (21)	43% or 9/21	57% or 12/21
Fractures (8)	63% or 5/8	37% or 3/8
Sesamoiditis Type 2 (4)	75% or 3/4	25% or 1/4
Distal SesamoideanLigDes(3)	67% or 2/3	33% or 1/3
Check Ligament Desmitis(3)	100% or 3/3	0% or 0/3
Exostoses/Splints (3)	100% or 3/3	0% or 0/3
DMD/Bucked Shins (1)	100% or 1/1	0% or 0/1
Joint Synovitis/DJD(9)	55% or 6/11	45% or 5/11
Prolioferative Synovits(1)	100% or 1/1	0% or 0/1
Plantar Ligament Desmitis(1)	100% or 1/1	0% or 0/1

Total # horses treated with RSWT listed/Some with multiple limb or combined problems

FIGURE 1 - CLINICAL SCORING SYSTEM FOR SUCCESS OR FAILURE

Clinical Improvement In:		(Score= Successful or Failure)
¬Appearance Of Lesion	Max.	0 = no change
a) clinically (px.)	_____ (3)	1 = improved
b) ultrasonographically or radiographically	_____ (3)	2 = much improved/>50%
		3 = healed/clinically non- apparent
∧ Lameness Grade(cx.+ px.)	_____ (6)	1 = grade 5/5 lame AAEP
		2 = grade 4/5 lame
		3 = grade 3/5 lame
		4 = grade 2/5 lame
		5 = grade 1/5 lame
		6 = not lame clinically
∨ Racing / Athletic Performance		0 = no race/ no performance
a) 6 race starts or 3 mos. performance	_____ (1)	1 = raced/performed
b) racing level or performance	_____ (3)	2 = raced/performed at same level
		3 = raced/performed at higher or improved level

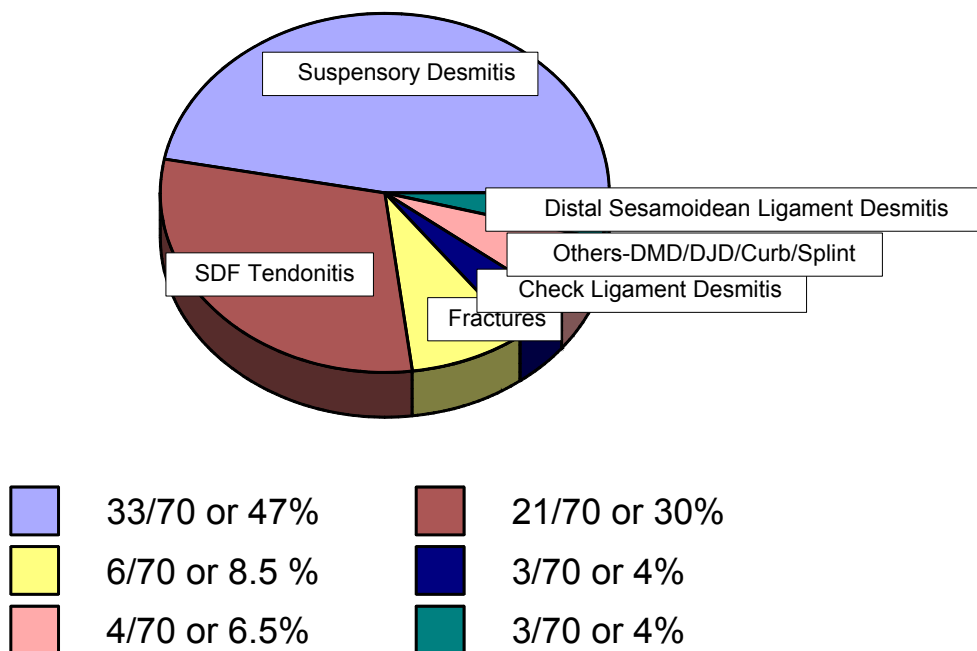
\*\*\* Maximum Score = 16

Successful = ∃ 12

Failure = # 12

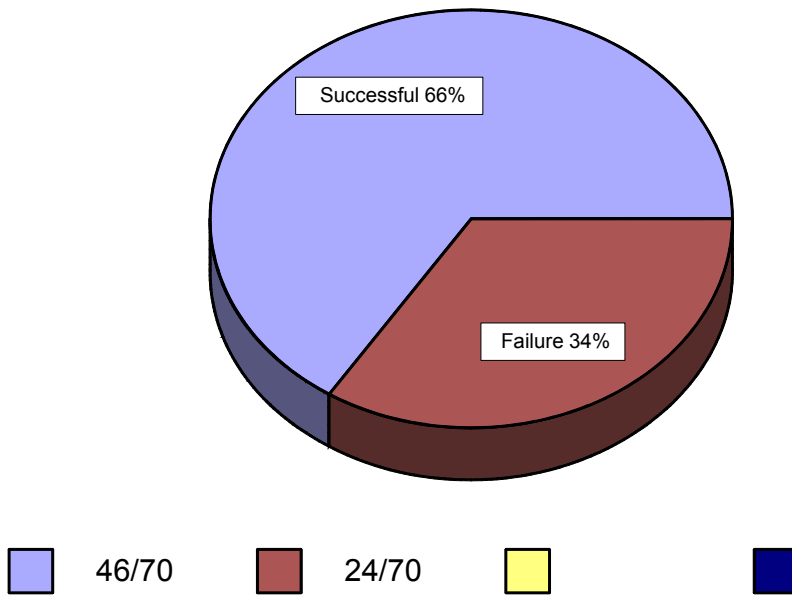
## Conditions Treated With RSWT

Figure 2



**Overall Success/Failure Rate In 70 Performance Horses Treated With RSWT**

**Figure 3**



**% Of Total Failure Rate (TFR) 24/70 Horses**

**Figure 4**

