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**RADIAL SHOCK WAVE THERAPY
AS PALLIATIVE TREATMENT FOR CHRONIC PAIN IN TARSOMETATARSAL DEGENERATIVE ARTICULAR DISEASE IN THE SPORT HORSE.
(Translation from Spanish abstract)**

SUMMARY

Radial shock wave therapy was used in 10 animals affected by articular degeneration of the tarsometatarsal joint of the sport horse, with grade 2 lameness and a clinical course x 9 months. The diagnosis was made clinically (with intra-articular anaesthesia) and radiologically. All the patients had received medical treatment, with variable results (relapses in 20 to 30 days). The treatment consisted of the application of 2,000 pulses, at a frequency of 10 Hz and a pressure of 3.0 bar, into the periphery of the anatomical region in question, in 5 sessions with a 10-day interval between treatments. The lameness disappeared in 70% of cases and a notable improvement was obtained in the remaining 30%. Forced flexion became negative in 30% of cases and improved in the remainder. The lameness did not reappear for 60 days after the completion of the final application. As no significant radiological changes were recorded, the effect of the treatment can be deduced to be fundamentally analgesic.

INTRODUCTION

Radial shock wave therapy (RSWT) was first used in surgery in the 1980s as a non-invasive technique that avoided the use of conventional procedures in the treatment of urinary calculi (urolithiasis), as a typical example. It is known as acoustic bistoury because of its particular mechanism of action. In the case of urolithiasis, a shock wave generated by a special device and directed by the use of imaging strikes the stone and destroys it.

It has now been observed, in the light of the preliminary results of separate studies in human and veterinary medicine, that it is also of great benefit in the treatment of particular orthopaedic conditions such as enthesiopathy, fractures, etc. Its value in the treatment of pain in the soft tissues adjacent to bony structures has also been noted.

So far, shock wave therapy has been used with good results in proximal suspensory ligament desmitis, enthesiopathy, flexor tendinitis, deep bursitis, chronic myalgia of the longissimus dorsi, superposition of dorsal spinous processes, and podotrochlear syndrome of the horse; however, it has not been used very much in the treatment of arthrotic processes.

The mechanism of action is explained by the principle of the well-known "metal bearings model" (see Figure No. 1): the transmission head in the handpiece (which corresponds to the left-hand bearing) emits the shock wave by accelerating a high velocity air flow. This flow is guided with micrometric precision in the hand-piece, converting the impact of the kinetic energy into mechanical force.

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Radial shock waves are defined as mechanical pressure pulses that radiate in a gaseous or liquid medium. The front wave can exceed 1,000 bar within an extremely short space of time, followed by a phase of tensile stress equivalent to 100 bar. The shock waves used hitherto in medical technology are short pressure pulses generated in water. The theory behind the mechanism of action of the shock waves is believed to be related to:

1- Chemical changes that trigger the release of pain-inhibiting substances.
2- The destruction of cell membranes on the pain receptors where the pain is generated, thus inhibiting its transmission.
3- The stimulation of pain receptors, triggering the emission of nerve impulses that eliminate the perception of pain (gate theory).
4- The release of endorphins, which bring about local inhibition of pain.

All of these theories are undergoing evaluation in separate clinical trials. It seems that two or more of these theories might co-exist. One of the parameters used to measure the effects of shock waves is Energy Flow Density, which refers to the amount of energy that flows per unit of area (mJ/mm2). The cells are able to regenerate after treatment (repair potential), but this ability diminishes as the energy flow increases. If the energy level is very high, the cell nuclei are destroyed. In fractures in which the anatomical conditions and type of bone affected are such that healing is delayed due to poor blood irrigation, the osteogenic effect can be enhanced by means of the increase in metabolism induced by the shock waves. Furthermore, tissue destruction is an unwanted side effect of pain treatments. For this reason, the energy flow should be varied according to the desired result.

MATERIALS AND METHODS

The study population was 10 show-jumping horses of ∅ 12 years of age (SD10 to 14 years), 50% mares, 50% geldings, with a confirmed diagnosis of degenerative articular disease of the tarsometatarsal joint.

All of the cases had a mean clinical course of 10 months, and had undergone medical treatment with injections of hyaluronic acid and corticoids, with positive but short-lived results (x 30 days).

The patients were evaluated at the trot on hard and soft ground, in a straight line and circling, with forced flexions of the hind limb before each treatment in order to evaluate their course. The evaluation parameters were as follows:

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a) Observation of lameness (classified into 5 grades):

- 1/5 lameness detectable by the rider. Barely visible to the veterinary surgeon.
- 2/5 lameness not detectable in a straight line, but detectable when circling.
- 3/5 lameness detectable in a straight line and circling.
- 4/5 lameness very obvious, with a large movement of the croup.
- 5/5 weight-bearing impossible

b) Positive results of forced flexion (classified into 5 grades):

- 1/5: after 1 minute of flexion, the horse remains lame for the first 10 gaits at the trot, then improves.
- 2/5: after 1 minute of forced flexion, the horse makes its lameness worse by slight lifting of the croup and slight abduction of the limb, and remains lame for over 20 gaits at the trot.
- 3/5: after 1 minute of forced flexion, the horse makes its lameness worse by considerable lifting of the croup and obvious abduction of the limb, dragging the toe and remaining lame for over 20 gaits at the trot.
- 4/5: after 1 minute of forced flexion, the horse carries its weight on the toe for the first few strides, avoids weight-bearing, then makes its lameness worse by substantial lifting of the croup and substantial abduction of the limb, dragging the toe and remaining lame for over 20 gaits at the trot.
- 5/5: after 1 minute of forced flexion, the horse avoids weight-bearing, with the limb remaining in the air for the first few strides, and then tries to carry weight only on the toe.

The diagnostic protocol used to select the cases was as follows:

- Examination: grade 3/5 lameness, with slight abduction of the limb and a shortening of the lifting phase
- Hind limb flexion test: positive
- Tarsal pressure test: positive
- Tarsometatarsal anaesthesia: positive (with 2% lidocaine)
- Radiology: marginal osteophytosis

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Figure No. 1 presents the baseline clinical status of the study horses.

HORSE - AGE - SEX - RACE	BASELINE CLINICAL STATUS	
	Lameness	Forced flexion
A) 11 years, half-bred, mare	Yes 3/5	Pos. 3/5
B) 14 years, Argentinean saddlebred, gelding	Yes 3/5	Pos. 3/5
C) 12 years, Argentinean saddlebred, gelding	Yes 2/5	Pos. 2/5
D) 10 years, half-bred, jumper, mare	Yes 3/5	Pos. 3/5
E) 15 years, Argentinean saddlebred, mare	Yes. 2/5	Pos. 2/5
F) 12 years, thoroughbred, gelding	Yes 3/5	Pos. 3/5
G) 14 years, half-bred, gelding	Yes 3/5	Pos. 3/5
H) 15 years, half-bred, mare	Yes 3/5	Pos. 3/5
I) 14 years, thoroughbred, mare	Yes 2/5	Pos. 2/5
j) 12 years, Argentinean saddlebred, mare	Yes 3/5	Pos. 2/5

EQUIPMENT AND APPLICATION TECHNIQUE

Before each treatment, the horses were evaluated at the trot in a straight line and circling, on both soft and hard ground, and were then sedated with xylacine because the treatment is painful at first.

A radial shock wave device **(Swiss DolorClast® Vet - registered trademark of EMS-Electro Medical Systems**) was used in sessions that took place every 7 days (6 sessions in total) at a pressure of 3.0 bar, 2,000 pulses, and a frequency of 10 Hz, using the medium-size applicator. The shock waves were applied to the periphery of the distal tarsometatarsal and intertarsal joint, encircling it, using carboxymethylcelullose gel as the contact medium. During the treatment, the animals were not worked, and were walked in the morning and evening. On completion of the final treatment, control radiographs were taken.

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RESULTS

Figure No. 2 presents the results of the treatment evaluations:

CASE No.	CONTROL 1		CONTROL 2		CONTROL 3		CONTROL 4		CONTROL 5	
	Lame	F. flex.	Lame	F. flex.	Lame	F. flex..	Lame	F. flex.	Lame.	F. flex.
1	Yes 3/5	Pos. 3/5	Yes 2/5	Pos. 3/5	Yes 2/5	Pos. 3/5	Yes. 1/5	Pos. 2/5	No	Pos. 1/5
2	Yes 3/5	Pos. 3/5	Yes. 2/5	Pos. 3/5	No.	Pos. 1/5	Yes. 1/5	Pos. 1/5	No	Neg.
3	Yes 2/5	Pos. 2/5	Yes. 2/5	Pos. 2/5	Yes. 1/5	Pos. 1/5	No.	Pos. 1/5	No.	Neg.
4	Yes. 3/5	Pos. 3/5	Yes. 3/5	Pos. 3/5	Yes. 1/5	Pos. 2/5	Yes 1/5	Pos. 1/5	Yes. 1/5	Pos. 1/5
5	Yes. 2/5	Pos. 2/5	Yes. 2/5	Pos. 2/5	Yes. 1/5	Pos. 2/5	No.	Pos. 1/5	No.	Pos. 1/5
6	Yes 3/5	Pos. 3/5	Yes. 2/5	Pos. 3/5	Yes 1/5	Pos. 2/5	Yes. 1/5	Pos. 1/5	Yes. 1/5	Pos. 1/5
7	Yes. 3/5	Pos. 3/5	Yes. 2/5	Pos. 3/5	Yes. 1/5	Pos. 2/5	Yes. 1/5.	Pos. 2/5	Yes. 1/5.	Pos. 1/5
8	Yes. 3/5	Pos. 3/5	Yes. 2/5	Pos. 3/5	Yes. 2/5	Pos. 2/5	Yes. 1/5.	Pos. 2/5	No.	Pos. 1/5
9	Yes. 2/5	Pos. 2/5	Yes. 2/5	Pos. 2/5	Yes. 2/5	Pos. 1/5	Yes. 1/5	Pos. 1/5	No.	Pos. 1/5
10	Yes. 3/5	Pos. 2/5	Yes. 2/5	Pos. 2/5	Yes. 1/5.	Pos. 1/5	No.	Pos. 1/5.	No.	Neg.

As Figure No. 2 shows, improvements were apparent from the second control (50% of cases of lameness), and the forced flexion test became negative at the fourth control (10%). At the fifth control, the lameness had already disappeared in 70% of cases, with a notable improvement apparent in the remaining 30%, while the forced flexion test was negative in 30% and had improved in the remainder.

Although the subsequent radiological studies did not show any significant changes, considering the remission in the clinical signs, it can be concluded that Radial Shock Wave Therapy is effective and encouraging in the symptomatic treatment of articular degeneration of the tarsometatarsal joint in the horse.

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DISCUSSION

Articular degeneration of the tarsometatarsal joint in the horse is characterised clinically by a chronic, insidious clinical picture, the treatment of which is fundamentally palliative by means of periodic injections or even surgery (arthrodesis). Therefore, and adhering to this objective in view of the degenerative nature of the disease, any therapy that brings about beneficial effects with minimal invasiveness and side effects must be regarded as progress.

Even the horses who remained lame underwent a very notable improvement (the lameness decreased from grade 3/5 to grade 1/5), to a point at which they were able to undertake low-performance sport activity.

It should be borne in mind that the treatment is somewhat painful at first, and that there are horses who tend to resist it at the 2nd and 3rd application, which is why sedation is important. This pain is related to the proximity of the bony structures in the area in which the impact is primarily absorbed. When the treatment area has more muscle or connective tissue bulk, better tolerance of the treatment is usually observed.

Although no significant radiological changes were detected at the end of the study, monitoring will be continued, as the induction of arthrodesis in these joints using this mechanism is proposed as a protocol.

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