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EXTRACORPOREAL SHOCK WAVE THERAPY

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The use of extracoporeal shock waves (ESW) originally developed for human urology, is a new orthopedic treatment method. Extracorporeal shock wave therapy (ESWT) has a good healing effect in insertion demits/tendentious. lt is successfully used to disintegrate calcific deposits in tendons and ligaments. This study shows indication, technical requirements and an up to 12 months follow-up for 209 horses treated with ESW.

Treated by ESWT were 124 horses with fore- or hindlimb high suspensory desmitis (HSD) and 85 horses with other forms of desmitis. ESWT was performed on the standing deeply sedated horse under ultrasonographic guidance (7.5 MHz). The shock frequency applied was 2000 shocks/treatment and the effective energy for threshold ranged between 0.07 - 0.17 mJ/mm². The treatment was performed one to three times in one to three week intervals.

104 (83%) out of 124 horses with HSD were sound for more than 6 months or showed an improvement of their lameness. 20 horses (17%) did not improve or did slightly improve. 48 (56%) out of 85 horses with other desmitis became sound, 12 horses (14%) showed an improvement and 25 horses (30%) did not improve. ESWT, a minimally invasive, cosmetic, low-risk method in the treatment of insertion tendopathiae, is tolerated by horses very well. Side effects such as hematoma or inflammation were rare. After ESWT no clinical hospitalization and box rest was required. All horses were walked the day after ESWT.

The study proves that ESWT is an alternative therapy for insertion desmitis, especially in chronic cases, which did not respond to conservative treatment, but showed very good results after ESWT.

SHOCK WAVE THERAPY

A PROMISING AND GENTLE THERAPY METHOD FOR THE TREATMENT OF ORTHOPAEDIC DISORDERS

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A new therapy form has recently gained increasing importance in the treatment of horses suffering from orthopaedic disorders. This therapy form is referred to as extracorporeal shock wave therapy or simply ESWT. The first reports dealing with extracorporeal shock wave therapy used in human medicine date back to 20 years ago when shock waves were first employed for the disintegration of kidney stones. Since then, ESWT has grown to become an invaluable treatment method in human medicine. Since the early 1990s, a modified form of extracorporeal shock wave therapy has been successfully employed to treat patients suffering from orthopaedic disorders such as heel spurs or shoulder calcification. Now, extracorporeal shock wave therapy is also making its entry into veterinary medicine.

Depending on the selected energy level, shock waves can be used in the treatment of bone tissue (stimulation of bone formation or removal of calcifications), of soft tissue sited close to bones (transition from bone/periosteum to tendon/fascia etc.) and in the therapy of chronic/acute pain (Table 1).

But what is the secret behind the success of extracorporeal shock wave therapy?
Physically speaking, shock waves are highly intensive acoustic waves of very short duration. They are characterised by an abrupt pressure increase, an exponential pressure drop and a prolonged flat negative pressure period. These features distinguish them from the continuous waves employed in thermotherapy and from diagnostic ultrasound waves.

The therapeutic effect of shock waves can be attributed to the mechanical pressure and tension the wave exerts on the tissue. However, detailed knowledge on the (side) effects of shock waves on different types of tissue is not yet available.

Shock waves can be generated with various systems. These shock wave generators include spark gap systems, piezoelectric systems and the most frequently used electromagnetic shock wave systems.

The spark gap system, which works just like the spark plug of a vehicle, was the first shock wave generator used in human medicine and was employed for the disintegration of kidney stones as early as 20 years ago. Owing to the gradual wear of the shock wave source, however, this method of shock wave generation exhibits major pressure variations in the course of the therapy and involves substantial difficulties concerning a precise localisation of the target area.

The development of electromagnetic shock wave systems has opened up new fields of application for extracorporeal shock wave therapy. Electromagnetic shock wave systems are characterised by the fact that the energy set free by an electromagnetic energy source is converted into shock waves by an acoustic converter.

The shock wave is directly introduced into the body through a coupling cushion and focused on a specific point, the so-called focal point. The position of the focus is variable. In fact, it can be located in the tissue at a depth of up to 50 mm. It is only in the approximately 3x5 mm focus that the energy level of the shock waves is high enough to produce the desired therapeutic effect. The tissue surrounding the focus will not be damaged. In order to ensure precise focussing of the shock waves, it is crucial for the target area to be continuously monitored by means of an ultrasound unit throughout the therapy. This is due to the fact that even the slightest movement of the horse requires the direction in which the shock waves are triggered to be corrected. To this end, the cross hairs on the ultrasound monitor continuously indicate the position of the focus in the tissue to allow corrections to be made immediately, when necessary.

In equine medicine, extracorporeal shock wave therapy has so far been used to treat limb disorders. The best results have been achieved when using shock waves on therapy-resistant horses. In fact, pastern tendon lesions, in particular lesions affecting the tendon origin and tendon attachment, as well as lesions of the flexor tendon and sesamoid bone ligaments, tendon calcifications, arthrosis, osteoporosis of sesamoid bones and massive scar formation have all been treated successfully (Table 1). Obviously, the success of shock wave therapy is always conditional on a precise clinical, radiological and ultrasonographic diagnosis by the veterinary.

Depending on the type and severity of the disorder, one to three shock wave treatment sessions are performed at intervals of seven to 21 days. In order to achieve optimum therapy results, the equine patient is shaved in the therapy region and sedated. In-patient treatment is not required so that the horse can generally leave the clinic after the effect of the sedative injection has worn off. Also, strict rest in the box is generally not necessary. After completion of shock wave treatment, the horses undergo movement therapy tailored to their individual requirements.

To sum it up, it can be said that extracorporeal shock wave therapy is a promising new treatment method in equine medicine (Table 2).

Treatment of bone tissue / soft tissue sited close to bones
• Insertion desmopathy (pastern tendon attachment) • Adhesions in the area of the joint capsule/tendon/ligament attachment • Calcifications of tendons/ligaments • Arthrosis • Osteoporosis of sesamoid bones • etc.

Table 1: Fields of application of shock wave therapy on horses/ponies

Benefits of shock wave therapy:	Drawbacks of shock wave therapy:
• Proven success, even when treating animals with unfavourable prognosis • Old animals can be treated without having to go through severe strain • Outpatient treatment • Treatment can be performed with the horse standing • No surgery required • Cosmetic treatment	• Costs • Only recent results available (shock waves have been used on horses for only a year) • No panacea (only suitable for the treatment of specific disorders)

Table 2: Benefits and drawbacks of shock wave therapy

SHOCK WAVE

During the last few months, a new therapy form has gained increasing importance in the treatment of horses suffering from orthopaedic disorders.
This therapy form is referred to as "extracorporeal shock wave therapy" or simply ESWT.
Physically speaking, shock waves are highly intensive acoustic waves of very short duration. These features distinguish them from the continuous waves employed in thermotherapy and from diagnostic ultrasound waves.
The therapeutic effect of shock waves can be attributed to the mechanical pressure and tension the wave exerts on the tissue.
High-energy shock waves can be generated with various systems. These shock wave generators include spark gap systems, which work just like the spark plug of a vehicle, piezoelectric systems and the most frequently used electromagnetic shock wave systems.
The spark gap system was the first shock wave generator used in human medicine and was employed for the disintegration of kidney stones as early as 20 years ago. Owing to the gradual wear of the shock wave source, however, this method of shock wave generation exhibits major pressure variations in the course of the therapy and involves substantial difficulties concerning a precise localisation of the target area.
The development of electromagnetic shock wave systems, which are characterised by the fact that the energy set free by an electromagnetic energy source is converted into shock waves by an acoustic converter, has opened up new fields of application for extracorporeal shock wave therapy. A targeting unit combined with an ultrasound monitoring system allows the target area to be precisely localised.
The shock wave is directly introduced into the body through a coupling cushion and focused on a specific point, the so-called focal point. This ensures that the tissue surrounding the focus cannot be damaged as individual waves are not strong enough to cause any harm. In fact, it is only in the focus – which can be located in the tissue at a depth of up to 50 mm and has a size of about 3x5 mm – that the energy level of the shock waves is high enough to produce the desired therapeutic effect.
The energy level can be set to up to 0.5 mJ/mm², which equals a force of about 800 bar per fraction of a second.
Such shock wave systems have been used in human medicine during the last few years to treat orthopaedic disorders such as heel spurs or shoulder calcification.
As far as equine medicine is concerned, this relatively new type of therapy has so far been employed in the treatment of lesions of the lower limbs and has rapidly proved its worth when used on therapy-resistant horses.
In fact, pastern tendon lesions, in particular lesions affecting the tendon origin and tendon attachment, as well as lesions of the flexor tendon and sesamoid bone ligaments, tendon calcifications, osteoarthritis, osteoporosis of sesamoid bones up to

enthesopathy of navicular joints and massive scar formation have all been treated successfully.
Depending on the type and severity of the disorder, one to three shock wave treatment sessions are performed. The energy level to be selected varies according to the specific requirements. During each session, about 2000 shock waves are applied to the target area. Since shock wave therapy is somewhat painful and requires the horse to be standing still during shock wave triggering, the animal is slightly sedated before treatment is started. However, the equine patient can leave the clinic about 30 minutes after completion of the therapy session and undergo gradual movement therapy.
The animal is re-examined two weeks after the first treatment session. Depending on the results of this examination, the horse can either be subjected to increased exercise or may have to undergo further shock wave therapy.
Based on the total number of about 400 horses treated with shock waves to date, an approximately 80% success rate has been achieved.
However, detailed knowledge on the precise mode of action of the mechanical waves in body tissue is not yet available.
What we do know for certain is that strong pressure and tensile forces lead to substantially improved blood circulation. This is crucial to increase the O^2 content in the blood and to reduce the amount of carbon dioxide which is responsible for calcification and damage to tendons.
Moreover, shock waves ensure an alignment of newly formed fibres. High-energy shock waves allow damaged tissue to be decomposed whereas low energy waves enhance tissue regeneration by activating the individual cells.
Shock waves can thus be employed to allow the periosteum to re-establish a firm connection with the pastern tendon or to render tendon calcifications flexible.
Some horses have been found to experience an improvement of their disorders only after three days while initially suffering a slight deterioration. This clearly refutes the theory that shock waves destroy nerve fibres.
Shock wave therapy is bound to gain a firm foothold as an invaluable treatment method in equine medicine.