A New Tool for Canine Rehabilitation

What is Extracorporeal Shock Wave Technology?

Extracorporeal Shock Wave Technology (ESWT) is a high-energy acoustic pressure wave technology used to treat a variety of medical conditions. A shock wave is a very strong pressure wave in any elastic medium that creates a sudden, huge change in pressure. An Extracorporeal Shock Wave (ESW) has a specific set of parameters including an extremely rapid rise time followed by a slight dip in pressure causing cavitation. Each pulse of an ESW is a broad band acoustic "blast" with approximately 1,000 times the pressure magnitude of a medical ultrasound wave. Only waves that meet the physical definition of ESWT can be expected to provide the results demonstrated in trials with ESWT.

There are several technologies that produce a shock wave, the most common of which is the electrohydraulic source (e.g., VersaTron 4 Paws). This electrohydraulic technology works by creating a spark in a liquid medium; the waves radiate out from this underwater explosion and are focused to a specific treatment area. The penetration depth into the body is modifiable. The key differentiating aspect of shock wave vs. other energy-related technologies is the strength of the device and the amount of energy deposited.

How does ESWT Work?

There are various mechanisms by which ESWT affects tissue. In soft tissue and bone, ESWT works in the body at a cellular level. The mechanical force of the compression and cavitation on the cells causes a biological response. The full mechanism of action is still being studied, however, it has been shown that ESWT positively affects tissue in a variety of ways. Several of these mechanisms of action are discussed below by tissue type.

Tendinitis: ESWT is an extremely effective treatment option for tendinitis as it not only speeds healing, but increases the quality of the healing.3 Using ultrasonographic and histological techniques, Alves, et al concluded that ESWT allowed significant improvement in the quality of tendon repair and a favorable prognosis for the equine patient, primarily due to the improved arrangement of collagen fibers in the treated tendons.3 There was indication of a higher speed of maturation of the repair process compared to the control, and ESWT increased the presence and parallelism of collagen fibers.3

Additionally, there have been several human studies focusing on ESWT effects on insertional and non-insertional Achilles tendinitis.4,5 Chen, et al reported that ESWT stimulated a significant increase in cell proliferation within 6 weeks of treatment for insertional Achilles tendinitis.5 Inflammation was resolved and an increase in tenocyte proliferation was observed. The improvement coincided with increases in TGF-,1 and IGF-I growth factor expression in addition to intensive PCNA expression, which is associated with cell division. 5 ESWT also promotes expression of various

angiogenic growth factors including eNOS, VEGF, and PCNA, leading to neovascularization, which can result in better perfusion to the injured tendon.1

Bone fractures: In addition to the neovascularization effects, ESWT-treated bone tissue increases release of BMP-2 leading to faster and better quality bone healing. In an investigation of the mechanism of action of ESWT by Wang, et al, the results showed higher bone strength and bone mass in the ESWT treatment group vs. the control group.1

Osteoarthritis (OA): ESWT has also been successful in the treatment of OA in equine and canine patients. A study at Colorado State University evaluated the efficacy of ESWT in reducing lameness associated with OA vs. no treatment (control group 1) and vs. intramuscular polysulfated glycosaminoglycans (PSGAG) (control group 2).6 In the study, ESWT performed better than both control groups in reducing lameness. Another key study outcome was that the ESWT group showed significantly reduced synovial fluid total protein relative to the two control groups, implying reduced synovitis in the ESWT group.

ESWT has been shown to alter the process of OA breakdown as it mediates a variety of pathways. OA chondrocytes express low beta ,1 Integrin and high TNF-· and IL-10 levels. In a study by Moretti, et al, ESWT down-regulated levels of TNF-· and IL-10 in OA chondrocytes to normal levels.2 It is speculated that the reduction of TNF-· as a result of ESWT can be considered a protective effect as it may prevent cartilage breakdown.2

ESWT Clinical Uses:

While ESWT is somewhat new to companion animal veterinary medicine, there is a long successful history of its use for orthopedic conditions in human and equine populations. In human medicine,

ESWT is FDA-approved for the treatment of chronic plantar fasciitis (heel pain) and lateral epicondylitis (tennis elbow). Additional publications have demonstrated its efficacy for Achilles tendinitis, calcifying tendinitis of the rotator cuff, delayed-healing and non-union fractures, avascular necrosis of the femoral head and more.4,5,7-11

In addition, SANUWAVE (Alpharetta, GA) is currently conducting an FDA-approved Investigational Device Exemption trial studying the efficacy of PACE technology, a specific proprietary type of ESWT, in diabetic foot ulcer patients.

Currently, ESWT is being used and investigated for a variety of applications for the canine patient and often is used in conjunction with other rehabilitative methods. Conditions include:

- Osteoarthritis
- Hip dysplasia
- Chronic back pain
- Osteochondrosis lesions
- Non-union and delayed-union fractures
- Sesamoiditis, tendinitis
- Lick granulomas

Two clinical trials are currently being conducted at the University of Tennessee by Drs. Darryl Millis and Marti Drum, and Gulf Coast Veterinary Specialists by Dr. Brian Beale investigating the efficacy of the VersaTron 4 Paws ESWT

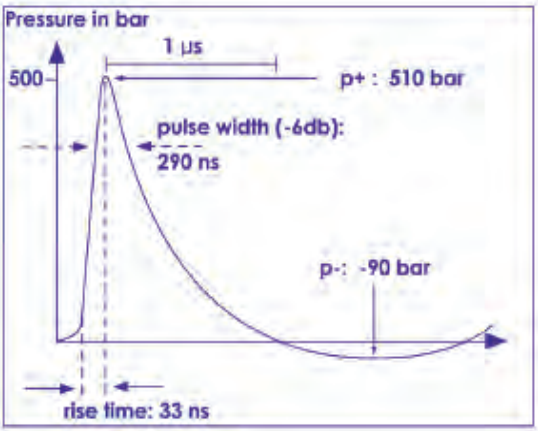
(SANUWAVE, Alpharetta, GA) for canine elbow OA and canine musculotendinous injuries of the shoulder, respectively.

ESWT is a non-invasive alternative to surgery and a more potent alternative to typical therapeutic modalities. Because it causes tissue regeneration and can interrupt degenerative processes, it is a key tool that can be extremely beneficial when used appropriately. Due to the high-energy being directed towards the body, heavy sedation or short-acting anesthesia is recommended.

VersaTron ESWT Case Study:

Andrea Looney, DVM, DiP/ACVA, pain management specialist, reported on a particularly difficult case that showed positive outcomes following shock wave treatment.

Blue, a 7 yr old male Labrador Retriever presented with arthritic inflammatory disease affecting multiple joints. Joints were tapped and fluid analysis was negative, but the right elbow was an obvious source of pain. Prior to being referred



to Dr. Looney, multiple treatments were tried including NSAIDS, gabapentin, amantadine, acupuncture, ultrasound, electrical stimulation, and hydrotherapy. None were successful. Total elbow replacement and limb amputation were also considered.

ESWT was also discussed as a possible treatment option, then pursued following owners' request. The protocol included 2 total ESWT treatments; the second treatment was conducted 2 weeks following the first treatment. Each treatment consisted of 400 shocks total (200 medial, 200 lateral) with an R05 probe at Energy Level E3.

Following the second treatment, Blue's owners stated that "he was running around like a puppy and putting full weight on the leg". Upon follow-up, Dr. Looney reported Blue to be "totally sound". Five months after the first treatment, there was no noticeable decline in function, and Dr. Looney reported that Blue was, "back to running and hunting".

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