

# ESVOT CONGRESS 2006

**PROCEEDINGS**

**MUNICH, Germany**

**7<sup>th</sup>-10<sup>th</sup> September**

**“The Cutting Edge in Veterinary Orthopaedics”**



European Society of Veterinary  
Orthopaedics and Traumatology

## Shock wave therapy - more shock than wave?

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Extracorporeal shock wave therapy (ESWT) has been used for the past three decades to successfully treat urolithiasis in people in a non-invasive fashion.<sup>1</sup> Shock wave therapy has also become popular for orthopedic applications, including plantar fasciitis, lateral humeral epicondylitis, calcifying tendonitis of the shoulder and patellar tendonitis in man, superficial digital flexor tendonitis and navicular disease in the horse, and calcifying supraspinatus tendinopathy in dogs.<sup>2-15</sup>

Shock wave therapy has been advocated to stimulate osteogenesis in fractures undergoing non-union.<sup>9</sup> Recently, shock wave therapy has also been suggested as a modality to treat osteoarthritis in canine and equine patients.<sup>10,11</sup> Although use of ESWT in orthopedic patients has been reported to be beneficial, others have shown no effect.<sup>12</sup>

### MECHANISM OF ACTION

High energy shock waves mechanically disrupt urinary tract stones during lithotripsy. The mechanism of action of shock wave therapy in orthopedic applications is less clear. One theory as to why ESWT may be beneficial to treatment of tendinopathy is stimulation of neovasularization, collagen synthesis and collagen crosslink formation during the early healing process.<sup>4</sup> ESWT has been reported to promote healing of a segmental bone defect via stimulation of mesenchymal stem cell recruitment and differentiation into bone forming cells.<sup>7</sup> The mechanism of action of ESWT remains unclear, but present evidence suggests that it influences biological factors at the site of injured tissues.

### TREATMENT PROTOCOLS

Treatment protocols have been established for various animals, indications and severity of disease. Many of these protocols are anecdotal. In general, most protocols call for 2-3 applications of ESWT at 3 week intervals. The patient requires heavy sedation or general anesthesia due to the intensity of the shockwave. Total dose of shockwaves are measured as number of pulses times energy (mj/mm<sup>2</sup>). Pulses are delivered at a measured frequency. Many treatment protocols are available from manufacturers of ESWT machines and clinical and experimental studies, however, there is a great need for further research to confirm the validity and improve on the results of the present protocols.

### TREATMENT OF TENDON AND LIGAMENT INJURY

ESWT has been used extensively in man and the horse for treatment of various injuries and calcification of tendons. In one study, eight racing Thoroughbreds receiving ESWT for superficial digital flexor tendonitis showed clinical and ultrasonographic improvement in tendon morphology.<sup>8</sup>

Five of the treated horses returned to race, two reinjured the tendon and one was retired following treatment. Ultrasonographic evaluation did not reveal any increased damage to the tendon following treatment. ESWT has also been used routinely to treat for suspensory desmitis.<sup>13</sup>

Shockwave therapy has also been reported to decrease pain and lameness associated with injury to the supraspinatus tendon in dogs.<sup>7</sup>

### TREATMENT OF OSTEOARTHRITIS

ESWT has been advocated for treatment of osteoarthritis in the dog and horse.<sup>10,11,14</sup> Canine patients with osteoarthritis of the stifle had higher peak vertical forces and increased range of motion as compared to control dogs.<sup>10</sup> ESWT decreased lameness in 80% of horses treated for osteoarthritis of the tarsometatarsal and distal intertarsal joints.<sup>11</sup> Shockwaves do not appear to slow the progression of OA, but it does appear to decrease the pain. This may be accomplished by decreasing synovitis or by reduction of sensory nerve conduction.<sup>10,15</sup>

### TREATMENT OF NONUNION AND BONE DEFECTS

Shock waves have been shown to stimulate bone. Shock wave may prove beneficial as an adjunct to speed healing of routine fractures and healing of delayed or nonunions. Initial studies showed shock waves to have an osteogenic effect on the near cortex of the equine metacarpus and metatarsus, while sparing soft tissues of any damage.<sup>16</sup> ESWT delivered at appropriate doses did not affect the material properties of equine bone or bone-tendon junction.<sup>17,18</sup>

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