Shock wave therapy for lameness

Musculoskeletal problems, soft-tissue and bone injuries show signs of abatement without recurrence

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By: Dr. Ed Kane
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Extracorporeal shock wave therapy (ESWT) has become an emerging new technology for treating musculoskeletal problems, soft-tissue injuries and bone injuries in horses. ESWT is non-invasive, used to stimulate healing to return horses to a level of fully sound, useful activity without recurrence of disease.

From outside the body (extracorporeal), the machine generates high-intensity shock or pressure waves, which pulse to a specific site within the injured tissue. Though its actual mode of action is still in dispute, it stimulates and accelerates the healing process, essentially combining an immediate analgesic effect with a reduction in inflammation, neovascularization in soft tissue and osteogenesis in bone. According to Dr. Scott McClure, DVM, Iowa State University, a leading researcher in the field, it can be used to treat various conditions, such as suspensory ligament desmitis, navicular disease, saucer fractures, bucked shins, bowed tendon, sesamoid fractures, stress fractures and vertebral spinal pain (kissing spine lesions).

The technique

Though some of its initial use came with the need for general anesthesia, the most common units today are portable and able for use with a standing horse in the barn or at the racetrack.

The handheld wand of the unit attaches to an energy source. For the simplest shock wave procedure, the horse is lightly sedated; the area to be treated is shaved to provide for good contact; a contact gel is placed on the horse's skin, and the hand unit is applied to the horse to deliver the shock wave pulses. The treatment takes minutes. The horse does not experience pain. Sedation is recommended so the horse remains still so the treatment is applied accurately, targeted to the specific treatment location, and if fractious, the veterinarian is protected.

Dr. Scott McClure of Iowa State's School of Veterinary Medicine reports ESWT can be used in the treatment of various bone injuries. For the simplest procedure, the horse is lightly sedated; the area for treatment is shaved to provide good contact; a contact gel is placed on the horse's skin, and the hand unit is applied to the horse to deliver shock wave pulses.

Electrical energy is used to initiate the pressure wave. The energy settings and the number of pulses are important. Too low energy or too few pulses might not create the desired therapeutic effect. Excessive energy or pulses may result in tendon damage. The pressure waves penetrate fluid and soft tissue, and their effects occur at sites at the bone/soft tissue interface.

The mechanism by which shock waves stimulate healing is unknown. Theoretically, shock waves can increase cellular membrane permeability, cellular division, and stimulate cytokine production by bone marrow, neovascularization of soft tissue and osteogenesis in bone. Pressure waves might help physically break down or move a hematoma or fluid from the lesion to allow the fibroblasts to more rapidly fill the defect. At this time, the effect of ESWT on disease recurrence and future ligament strength has not been evaluated.

Today, the units have flexible therapy heads — similar to an ultrasound wand on a long chord — to be applied across the horse's body to any anatomical site.

Though the horse is sedated, it can tolerate the pain, similar to hitting the funny bone, and there is some numbing effect as the shock waves are applied. Depending on the site and injury depth, the usage is usually 1,500 to 2,500 impulses. A small, defined area requires fewer impulses than a larger surface area. The more shallow and softer the tissue, fewer and milder impulses are required; the deeper and harder the tissue, the greater the number of impulses and energy required. Though shock wave therapy works with good results, there is need to define the procedural protocols, including how to treat, at what intensity, at what energy level and the proper number of impulses.

"During the procedure, we do sedate the horses and either use a twitch or sometimes use local anesthetic at the site," says David McCarroll, DVM with Interstate Equine Hospital in Goldsby, Okla.

Early adopter

A lot of improvements have occurred since McCarroll started to do these treatments in the late 1990s. As the first veterinarian to use the procedure, he didn't have a machine that would allow him to apply the treatment to a standing horse. They had to anesthetize the horse to get him in the proper position to deliver the treatment. The fact that there is miniaturization of the equipment now allows veterinarians to be more flexible.

"The machine that I use generates a charge with an electrode," says Van Snow, DVM for Santa Lucia Farm in Santa Ynez, Calif. "The wave is very powerful and the procedure very painful, so we have to use general anesthesia when we use it with the horses in lateral recumbency."

If Snow is treating the navicular bone, it requires that the frog be paired down to near bleeding so there is enough moisture in the foot to conduct the wave well. He treats with 2,000 impulses (on a power setting of "7") through a window in the frog, in the area where one would do a "street-nail" procedure. He also treats through the bulb of the heel, as if to inject the navicular bursa, at 1,000 impulses. He commonly treats both feet.

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"Treatment is critical to the proper location, target specific," McCarroll says. "The more accurate you can be locating exactly where the pain is originating, the more successful it can be. Second, you need to use a very high-energy level of shock wave, and you need to use enough of it to make a difference."

His usual treatment regimen is to use the high end of the treatment level, which is normally 1-1.1 millijoules per mm, delivered at about 2,000-3,000 times per site.

"Using high energy levels at one time is better than repeating smaller energy levels at a lower frequency," McCarroll suggests. "I think you can do a lot better by doing one great big treatment."

Horses do better post treatment when rested. According to McCarroll, after ESWT, the pain subsides, and the horses heal usually within one to four weeks, depending a lot on the chronicity of the problem and area of involvement.

"I don't think you need to retreat, to treat them frequently. I don't think that is a good idea," McCarroll cautions. By giving enough of them to stimulate a dramatic healing response, I think the horses do better."

Though the mechanism of action is unsubstantiated, McCarroll says shock wave therapy might promote production of proteins and enzymes that are involved in the stimulation of bone healing. Shock wave therapy is most beneficial at the soft tissue/bone interface, such as a tendon insertion or a ligamentous attachment to bone.

Uses and Results

"It is a fairly safe technique, I'm using it to try to stimulate healing," says Duane Rodgerson, DVM, Hagyard-Davidson-McGee in Lexington, Ky.

He's tried it on various conditions, including bone cysts, pasterns, fetlocks, the distal cannon bone, some tendons and suspensories.

"I have seen much luck with it," he states. "Right now I use it more for bucked shin and shin fractures," he says. "I have used it on shins because I rather do that than pin fire these horses. I'm a big skeptic. As far as success, I think we are too early to determine how successful we'll be as far as stimulating the healing. We are blocking some pain, but are we actually getting some benefits from it I'm not sure. Following with some radiographs we have seen some evidence of healing, but these horses are also getting quite a bit of time away from training. For me, the jury is still out as to whether I am getting any benefit from it or not."

Doug Herthel, DVM, Alamo Pintado Equine Clinic in Los Olivos, Calif., says shock wave therapy seems to be efficient in improving suspensory ligament damage, specific sesamoid lesions and bone spurs located between the sesamoid bones.

"We use it for a multitude of problems," says Keith Merritt, DVM, Wauconda, Ill. "We use it for tendonitis, whether its superficial flexor tendon or deep digital flexor tendon (DDFT), for suspensory desmitis (front or hind leg), for collateral ligament problems, distal sesamoid ligaments, cortical bone fracture (cracks), DJD of the fetlock, knee, and hock, for the cranial horn meniscus problems in the stifle, chronic sore backs and sacroiliac problems and DJD of the cervical spine."

But despite the success of therapy, it has its pitfalls, too. Merritt has considered the failures as well as the successes. Most of the failures he has experienced with tendons occurred with at least a six-week-old tear within the tendon before he initiated treatment. The best tendon responses were the ones he treated immediately after the injury, and he did not begin ESWT until 10 days to two weeks after the incident. At that time, after the tendon had been torn and after he got some sort of medication to it, started shock wave therapy yielded a very high percentage of improvement.

"On front-leg suspensory desmitis, it's phenomenal, the best thing since sliced bread," Merritt says. "For hind-leg suspensory desmitis, I don't think there is any great treatment for that because it works on some, and some it does not. For navicular disease, 50 percent of the horses will respond. For DDFT at the insertion to P3, 100 percent of those cases we've got are sound, and they've stayed sound for at least a year and half."

Navicular disease

The youngest case that McCarroll treated was a 4-year-old Quarter Horse that was used for reining. He came up lame a month before a reining futurity. He attempted a treatment on him, but it did not work. However, within three months he was at another futurity. He showed successfully and was sound. He had radiographic evidence of the dissolution, improvement of cyst of the medial-femoral condyle.

"In navicular disease, I really think a lot of caudal heal pain is associated with the ligamentous attachment to the navicular, the coffin bone, and 2nd phalanx, McCarroll says. "A lot of the tearing occurs, which leads to pain. The attachment of the entire ligament along the polar plantar border is apparently compromised. If we can improve the strength of the attachment at that area, I think we can get the horse feeling a lot more comfortable. On the wings of the navicular bone, medially and laterally where you see spur formation, a lot of times that means there is damage to the navicular collateral ligament or suspensory ligament up the leg. If you treat those areas, they seem to improve."

Snow says in the navicular cases, horses that seem to respond well had moderate changes, without any gross flexor cortex abnormalities or osteophytes in the navicular ligament, any spurs on the wings. Horses with an increased number and size of vascular channels — but did not have palmar cortex or spurs — seemed to respond well. About 79 percent (of 110 head) returned to full range of previous use, he says.

Snow used shock wave therapy on horses with insertional desmopathies at the proximal suspensory ligament with good results, too. But animals with tarso-metarsal and distal inter-tarsal osteoarthritic problems showed poor results.

After treatment, the horses with navicular disease get 30 days stall rest, and then they are shod appropriately. Snow usually observes them at 30 days post procedure to see the response, then they can do light work. He examines them another 30 days later to further judge the response and to determine whether it's OK to increase the workload.

Snow gives the horses one ESWT treatment; it either works the first time or not at all, he says.

On the suspensories, the layoff time is usually the same, about 30-45 days, then they can resume light work. He likes to use the aquatic treadmill if possible. Most of his cases are in a farm setting, so people are fine with the extended (30-day) rest period. With the racehorses, he suggests to hand walk them in addition to the stall rest.

According to some research, ESWT is an effective method of decreasing clinical signs of lameness associated with osteoarthritis. In a study comparing horses treated with a common non-steroidal anti-inflammatory drug, ESWT performed better, promoting improvement in clinical lameness and increased synovial fluid total protein, and increased amount of glycosaminoglycan released into the bloodstream. ESWT treatment reduced the clinical signs of pain measured by lameness evaluation 42 days after the final treatment. The results of the study suggested that ESWT is an effective method of reducing clinical lameness and synovitis, but it does not improve gross or histologic progression of arthritis significantly; thus, it would be best considered in combination with a chondroprotective agent.

Effects and concerns

Among possible concerns of ESWT for horses is potential local analgesia after treatment, and for bone micro-lesions, micro-fractures. McClure and colleagues studied these possible effects and found slight cutaneous analgesia for three to five days, but no bone lesions were present. Data indicated that a horse should not be subjected to strenuous activities where local analgesia pre-disposes the horse to injury for at least four days after ESWT.

"I think the analgesic effect is definitely there," Rodgerson says. "I think we are getting some initial tissue damage from the shock wave and therefore the inflammation assists in the healing phase, similar to cryotherapy or pin firing for bucked shins or shin splints, which somewhat traumatizes the area which stimulates inflammation which helps in the healing phase."

Snow says effects sometimes can be observed rather quickly.

"I'm fairly sure that there is some analgesia associated with the treatment because with the navicular disease, for example, pre-treatment they are pretty lame, and the day following the treatment, they feel pretty good and seem much better," he says. "It's just an empirical feeling, but I think it certainly seems to occur post treatment."