MAKING WAVES

Is your horse in need of rehab? Therapeutic ultrasound is showing promise as a successful way to heal equine injuries.

BY JENNIFER BROOKS

Whatever your discipline, your horse can sometimes get injured. Rehabilitation is an important way to help him regain his health and performance ability. Physical rehab has long been an established therapy for humans and can encompass a variety of treatments and methods. Many of these can also be used on horses.

In the US, the world of equine rehabilitation is in its infantile stages, but in Europe, equine practitioners are applying established treatment regimes, regularly used in human practice, to horses. These include laser, heat and cold modalities, therapeutic exercises – and therapeutic ultrasound (tUS).

What is tUS?

Therapeutic ultrasound is a comforting, mild heating non-invasive modality used to promote tissue healing or before stretching tight or adhered structures. Inaudible sound waves are absorbed primarily by collagen-rich connective tissues such as ligaments, tendons, fascia and scar tissue. Ailments such as tendon or ligament injuries, muscle spasms or tearing, joint swelling, open wounds and even mild arthritis can benefit from tUS. New studies are now showing that tUS also has beneficial effects on delayed bone healing (Cordes, M., 2010). It's now an available option for riders to consider when faced with an equine injury.

How does it work?

Therapeutic ultrasound involves the conversion of electrical energy – via a piezoelectric crystal mounted within the transducer head – into high frequency sound waves of greater than 20,000 cycles per second, known as Hertz (Hz). Sound waves transmit energy by alternately

compressing and expanding material. Ultrasound has a variety of physical effects specified as either thermal or nonthermal (Cameron, 1999).

- Thermal mode (continuous setting) has the ability to increase tissue temperatures, and is ideal for pre-stretching preparation of tight tissues.
- Nonthermal (pulsed setting) effects are ideal for the promotion of tissue healing and for decreasing inflammation.

Both methods work because the sound waves cause vibration in the tissues and cells and stimulate metabolism. Increasing cell metabolism accelerates the healing process, increases circulation, relieves pain, and in a method called phonopharesis, can push medications transdermally into targeted tissues below the skin.

tUS is usually applied at 1 MHz or 3 MHz frequencies. The frequency depends on the depth of the target tissue. This therapy is thought to affect target tissues as deep as 5 cm (Michlovitz, 1996, Cameron 1999).

For proper transmission of tUS into the tissues, hair must be clipped and shaved down to the skin. Then a gel medium is applied to allow sound waves to penetrate through the skin and underlying tissues. Determining the frequency, duration and whether to use pulsed or continuous applications depends on the nature of the injury, its acuteness or chronicity, and the depth of the injured tissue (Henson, 2009). These are all important elements for the equine physical therapist to consider when treating the horse.

What are the benefits?

The benefits of tUS abound. Used correctly, it can benefit a horse in the following ways:

- Increased collagen elasticity in tendons, joint capsules and scar tissue.
- Increased motor and sensory nerve conduction velocities, helping to reduce pain.
- Altered contractive activity to skeletal muscle, reducing muscle spasm.
- Diminished muscle spindle activity, another factor in reducing muscle spasm.
- Increased blood flow, which can bring healing factors to the site of the injury and speed up local metabolism (Henson, 2009).

Specific applications

Wound healing:

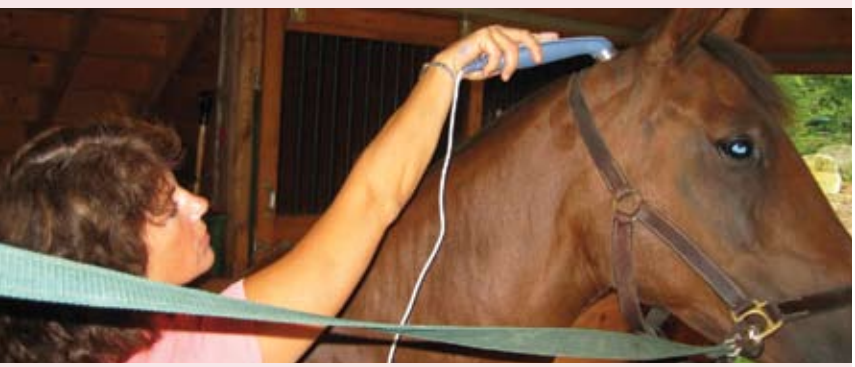
tUS works in several ways to accelerate tissue healing. It has the capacity to increase cellular metabolism and cell permeability of a tissue's membranes, change the cell's volume, and release adherences due to the detachment of collagen fibers. Work done by Moreas, et al, states: "All these properties make tUS diminish the time spent on equine wound healing. tUS modulates the inflammatory response, increasing the healing process and the epithelization of the wound. After only seven sessions, the lesions had approximately a 35% decrease of its initial measurement. Therefore, tUS is highly recommended to treat equine wounds." (Moraes, J., 2004).

Therapeutic vs. diagnostic ultrasound

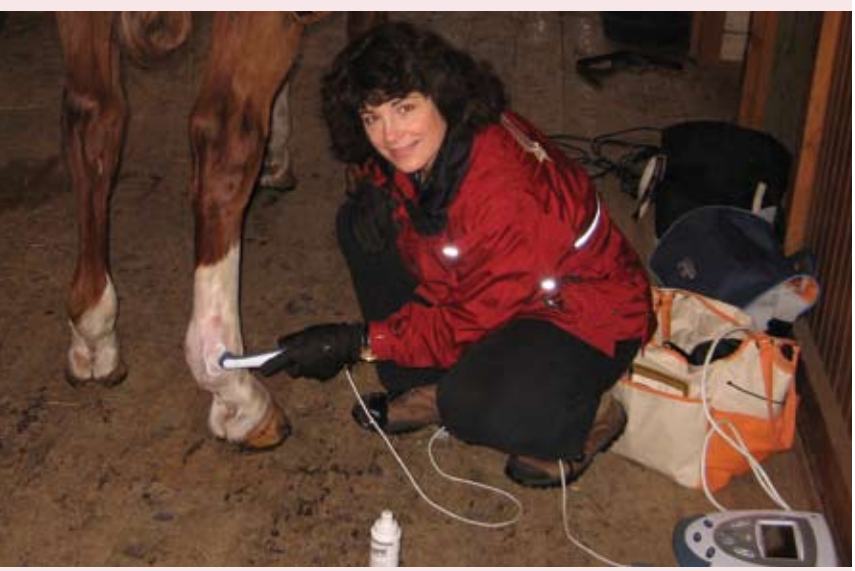
Riders have often been confused by the term "ultrasound" because of the two different kinds of ultrasound used by equine practitioners.

Therapeutic ultrasound is ideally used to assist with healing or heating tissues, and is usually applied by physical therapists.

Diagnostic ultrasound (dUS) is customarily used by veterinarians to view internal tissue integrity. dUS works in the same manner as tUS, only with higher frequencies of 3 to 7 MHz (Stashak, 2002). Echoes are generated whenever the sound beam crosses a boundary between structures of differing acoustical impedance. Returning echoes generate electrical pulses that are electronically manipulated and displayed on a monitor for vet and client viewing (Stashak, 2002).



Ultrasound to the poll for pain relief and increased extensibility of tight structures.



Author applies US to suspensory branches for promotion of healing structures.

A second study done by Moraes, et al, states that, "tUS energy is capable of producing cellular changes by mechanical effects. Its mechanism of action is correlated with activation of fibroblasts and collagen, stimulating the blood flow, anti-inflammatory properties, anti-edematous and analgesic, promoting tissue relaxation and decrease of local pain. The treatment used with the tUS was crucial for local analgesia in these horses, as no other analgesic therapy was used. The use of tUS should be included in the treatment of acute pain in horses, since it is non-invasive and effective." (Moraes, J., 2009).

Arthritis:

A study done by Singh, et al, in 1997 studied a group of eight donkeys with acute septic arthritis in their carpal joints. Four were treated with tUS for ten minutes daily for seven days, and the other four were used as control with no treatment. Later evaluation of the carpel joint capsules and cartilage in the treated donkeys showed decreased alterations of smooth cartilage and decreased synovial membrane inflammation. The gross changes in the fibrous joint capsules and synovial membranes were much milder in the treated animals. No calcium deposits were noted, reflecting joint capsule normalization. From this study, it can be concluded that treatment with tUS in the early onset of septic arthritis promotes joint tissue and articular cartilage, preventing the development of degenerative joint disease (Singh, K., et al, 1997).

Pain, muscle spasm and scars:

Therapeutic ultrasound is helpful for pain and spasm when used over the adjacent musculature of spinal dysfunction (Mitchell, R., 2009). tUS is the deepest source of heat available, penetrating to 5 cm into tissues. This therapy can be very useful for back pain, especially for large muscle spasms and scar tissue (Harman, J., 2004).

Tendon injuries:

Tendonitis is a common problem that affects a substantial number of racing and performance horses. Superficial digital flexor tendonitis is an

important cause of lameness, and tUS has been widely used to treat this injury. Guiomar, et al, have conducted several studies looking at the efficacy of tUS in healing tendons. One study evaluated the effects of tUS throughout the healing process in equine induced tendonitis. One forelimb from each horse of G2 and G3 (Groups 2 and 3) was randomly treated with tUS three times a week, until 15 days for G2 and 60 days for G3 were completed. Results suggest that the G2 tUS treatment time (three times a week for five weeks) wasn't enough to improve the process of tendon repair. However, the G3 protocol (three times a week for 60 days) was beneficial and supports the hypothesis that tUS enhances tendon healing over a longer period of time (Guiomar, A., et al, 2009).

Another study by Guiomar focused on how tUS affects the expression of growth factors. They found that "tUS accelerates tissue healing rate and promotes tendon regeneration." (Guiomar, A., 2009).

Contraindications and dangers

Although tUS is a relatively safe treatment modality, it must be applied with care to avoid periosteal burns or tissue damage. The dangers include an unacceptable temperature rise within the target area, and/or a collapse of cells leading to deep tissue necrosis (Bromiley, M., 2000). Human patients are able to tell the practitioner if they feel any discomfort or overheating. But equine practitioners don't have that luxury. They must be attuned to pain behaviors that may indicate discomfort, and therefore use the modality judiciously; for example, at lower intensities. Use of tUS is contraindicated over malignancies, pregnancy, joint cement, pacemakers, thrombophlebitis, the eyes and reproductive organs.

It's also important to use other rehabilitation therapies along with tUS. "Machine therapy, such as tUS, on its own is far from satisfactory," says Mary Bromiley, world-renowned author, lecturer and physiotherapist. "If it is possible to incorporate a rehabilitation program at the same time as the use of machines, the result will be far superior to the 'tUS machine only' cases. Unfortunately, irreversible changes can occur in the recipient, should an inappropriate therapy be selected or utilized by an untrained nonprofessional. Following a diagnosis made by a veterinary surgeon, physical therapy ought to become a useful adjunct to veterinary medicine, but this can only occur if the varied therapies are administered by a qualified person, correctly trained in the use of therapy apparatus, who also possesses an in-depth knowledge of the equine and of the demands of the individual equine disciplines." (Bromiley, M., 2000).

US can be used to accelerate wound healing.

Wounds nicely healed 6 weeks post physical therapy intervention with US.

tUS and laser

Both these modalities stimulate the development of fibroblasts and the production of collagen for tissue repair, resulting in diminished healing time and greater wound tension.

The aim of a study done by Moraes, et al, 2009 was to describe the clinical efficacy of LLLT (laser) and tUS as a treatment for septic wounds in two horses. The sessions were done twice weekly in 12 sessions during a period of 50 days. After eight sessions, there was a 64% and 76% reduction in the size of the lesions. The tUS was used to improve wound contraction after LLLT was discontinued.

After a short period of treatment, the wounds had completely healed, and without the exuberant granulation tissue, known as "proud flesh", common to horses (Moraes, J., et al, 2009).

Overall, therapeutic ultrasound has much to offer horses, but it's important to consider a qualified, credentialed and licensed professional when hiring a practitioner.

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