Shockwave Therapy for Horses

Stephen B. Adams, DVM, MS, DACVS

Extracorporeal shockwave therapy is a relatively new method of treatment for horses suffering from lameness. Shockwaves have been used in humans for over 20 years for the disintegration of kidney stones, and, since 1991, for the treatment of select orthopedic diseases such as stress fractures, tennis elbow, plantar fasciitis, and non-union fractures. Shockwaves are high-energy sound waves, which are transmitted to the afflicted body part. There, they trigger natural repair mechanisms. Shockwaves have been shown to stimulate bone formation and produce marked analgesia. Shockwave therapy constitutes a new modality for treating lameness of horses.

Shockwave therapy is useful for a number of conditions causing lameness in the horse. These conditions include:

- Suspensory ligament disease
- Bowed tendons
- Ringbone
- Bone spavin
- Backed shins
- Splints
- Fractured splint bones
- Navicular syndrome
- Fractures not healing properly
- Also known as delayed unions

(continued on page 2)

Some Facts About Equine Sports Medicine

This article is adapted from the interview of Professor David Evans published in issue No 1, 2001 of the rural industries research and development corporation (RIRDC) Equine Research News.

David Evans, BVSc, PhD is currently an Associate Professor in the Faculty of Veterinary Science, University of Sydney and his current interests include: new methods of evaluating respiratory and cardiovascular function in performance horses and the epidemiology of lameness in Thoroughbreds.

Q: You have worked in the area of exercise physiology for many years, can you tell us what has been learnt in the area of fitness assessment of performance horses?

A: Research from many international studies has confirmed the importance of fitness assessments based on measurements of the aerobic capacity (capacity to use oxygen) of the horse. This can be done directly, using special respiratory masks worn during treadmill exercise, or can be inferred from measurements of heart rate during exercise. Measurement of the blood lactate response to slow and medium pace exercise has also proven useful for measuring changes in fitness, for example, during training and detraining. We know that Standardbred and Thoroughbred horses with a higher aerobic capacity or an ability to run fast without accumulating high concentrations of lactate in blood do race more successfully.

Note—Lactate is another term for lactic acid, which is produced during exercise in working muscle. During fast exercise, large quantities of lactic acid are produced in muscle, which move from muscle into the blood and can be easily measured by taking a blood sample from the jugular vein.
Q: Have there been any advances in measurements to determine the athletic ability of horses prior to the investment of large sums of money in training?
A: That’s an important question, especially in view of a recent finding that only 10% of purchased horses pay their way. There have been very few studies that have looked at this question. As you can imagine, such studies require measurements on very large numbers of yearlings, with follow up studies of racing performances. Unfortunately, there seems little basis for relying on heart evaluations in yearlings, with either heart score or ultrasound examination. I suspect that reliable estimates of future athletic ability cannot be obtained without measurements obtained during exercise tests. Unfortunately, this research question has not been addressed and would need a very large investment.

Q: We all hope that the horse can run faster or jump higher as a result of a training program, but what do we actually know about how the horse’s body system adapts as a result of training?
A: Almost every body system adapts to the exercise stimulus with a response that enables the horse to cope with the demands of the specific stimulus. Muscles, bone, tendons, blood components, heart, blood vessels all adapt. Most of the adaptations that have been described promote use of oxygen to support energy supply during exercise. However, some adaptations that support anaerobic (without oxygen) energy supply have also been described. The respiratory system seems to be an exception to this general adaptive response. Current evidence suggests that the airways and lungs do not adapt to training, although much more research is needed on breathing in horses and its responses during exercise. The current view is that the lungs do not change their structure or function after training.

Q: So if a horse’s performance improves with training, will this improvement continue indefinitely or will a point be reached where the horse can no longer improve, and can a horse get too much training?
A: Most of the improvements in aerobic capacity occur over a 6-8 week period after the start of training. However, studies of prolonged training showed that there were still small increases in maximal aerobic capacity (VO2 Max) occurring after 30 weeks of continuous training. This study used interval training to promote continuous adaptation and increased fitness. Fitness then decreases immediately when training ceases, although the longer the horse has been in training, the longer the fitness is maintained after training stops. Of course if the training has been inappropriate or inappropriate for an individual horse’s current fitness, then there can be breakdown (e.g., leg injury), overreaching or overtraining syndrome. Overreaching is likened to chronic fatigue. It is characterized by weight loss and poor performance that is not quickly reversed by rest. If the training speeds and intensities are inappropriate for an individual horse’s current fitness, then there can be breakdown (e.g., leg injury), or will a point be reached where the horse can no longer improve, and can a horse get too much training?

Q: There are still important areas that need more research in the future? That treadmills will be used more commonly in veterinary practice?
A: Treadmill laboratories and studies of equine exercise physiology have sometimes been seen as somewhat remote from mainstream veterinary practice. However, several veterinary practices now have or are now building treadmill laboratories. Most interest centres on their use for endurance of the upper airways during exercise. However, provision of new services such as pulmonary function and fitness measurements will be provided by some veterinary practices in the future. It could be a real growth area for some practices. There is no doubt that owners and trainers are interested in the new techniques available.

Q: Considering what we already know about fitness and health of performance horses, do you think there are still important areas that need more research in the future?
A: Some important issues include use of exercise tests in young horses to estimate athletic potential. We also need to develop techniques that enable reliable and accurate studies in the field, to reduce reliance on treadmill exercise tests. Finally, we need techniques that we have developed for measuring exercise function and breathing in horses should help us to better understand how airways and lung diseases limit performance, and to better treat respiratory disorders.

Suzanne Bishard, DVM student (Class of 2003)

The equine sarcoid is a locally aggressive tumor and is one of the most common skin tumors found in horses. Sarcoids usually occur at sites of previous trauma, so they are most often located on the head, legs, and ventral abdomen. A study found that Appaloosa, Arabian, and Quarter Horses were at higher risk of developing sarcoids (Mohamed, 1992). Similarly, geldings appear to be more commonly affected and the risk of developing sarcoid increases with age up to 15 years and then declines. In addition, some horses or family of horses may be genetically susceptible. Brusine papilloma virus (BPV) has been isolated from sarcoids on several occasions (in some studies up to 100%), so the virus has obviously been implicated in the etiology. The number of sarcoids that can affect an individual horse is extremely variable, ranging from single and static to numerous and rapidly multiplying. Sarcoids have most of the features of a true tumor, having a high capacity for local tissue invasion into the skin, but true cancerous spread doesn’t occur. It is also important to realize that small, non-aggressive types can quickly become aggressive, particularly if traumatized. Also, some sarcoids can regress spontaneously after several years.

There is currently six recognized forms: occult (hairless, roughened, flat lesion with scales and/or crusts), verrucous (wart-like), nodular (firm, well-defined, spherical nodules), fibroblastic (proud flesh appearance), mixed (verrucous, nodular and fibroblastic) and malevolent (infiltrating cords), which are classified on the basis of general appearance. In most cases, a presumptive diagnosis is made based on appearance; treatment can be started immediately. Biopsy will confirm the diagnosis, however biopsy of that small or verrucous tumors should be avoided because the surgical procedure may promote aggressive growth of the remaining lesions. It is important for owners to understand that the prognosis for all sarcoid cases is guarded because recurrence is so likely, which usually calls for prolonged or repeated treatments. However, there are several factors that may affect which treatment method is chosen. These include the value of the animal and the cost of the treatment, previous treatments and history, prognosis, results of biopsy, possible treatment complications, facilitations and practicability. A few therapy options are mentioned below to make veterinarians and horse owners aware of the more current and effective means of treatment, not necessarily the most cost effective.

The first treatment option is complete surgical removal. This sounds quite appealing, but incomplete elimination can transform a small sarcoid into a rapidly proliferative tumor, which can become difficult, if not impossible to successfully treat. The removal of appropriate tissue margins while conserving adequate skin for closure also makes surgery difficult. Autotransplantation of the tumor is another problem, which increases the risk for post-surgical recurrence. Ideally surgery is chosen to debulk the sarcoid and then combined with other forms of therapy, the most effective of which will be discussed below.

Another very effective therapy for sarcoid removal is cryotherapy, which is controlled freezing using, most commonly liquid nitrogen. This method is believed to produce more consistent therapy results than surgical excision and is usually used on areas where surgical closure of the skin isn’t possible. With cryotherapy, the tissue will be frozen twice (freeze, thaw, freeze); it will die, slough and heal in several weeks. The primary disadvantage of cryotherapy is that only a limited number of tumors can be treated at one time. It is also important to realize that anything that promotes cell growth, including infection, will cause recurrence. Therefore, the tumor should first be removed and then treated with cryotherapy to help prevent recurrence.

Several surgical and nonsurgical treatment options are available, but therapy is usually reserved for the more aggressive fibroblastic forms. In most instances, neglect is the best treatment for static sarcoids. There are several factors that may affect which treatment method is chosen. These include the value of the animal and the cost of the treatment, previous treatments and history, prognosis, results of biopsy, possible treatment complications, facilitations and practicability. A few therapy options are mentioned below to make veterinarians and horse owners aware of the more current and effective means of treatment, not necessarily the most cost effective.

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Horses Like Drinking from Buckets

This article is reprinted from issue No 4, 2001 of the rural industries research and development corporation (RIRDC) Equine Research News.

A recent study investigated 3 different methods of water supply on drinking preference and behavior in a group of horses (S Nyman and K Dahlborn; Effects of Water Supply Method and Flow Rate on Drinking Behavior and Fluid Balance in Horses; Physiol Behav 2001 May;71(1-2):1-8). The water sources were buckets, pressure valve bowl (where the horse has to push on the apparatus to receive water) and float valve bowl (the waterer is refilled when it gets below a certain level). All methods were of the type recommended for horses. The horses were fully accustomed to drinking from all three methods before the testing period commenced. In an initial test of the pressure valve bowl, it was found that horses drank more at a flow rate of 0.8 l/min than the other two methods due to technical problems. Horses showed a clear preference for drinking from the bucket and there was no significant difference between the 2 automatic bowls. According to the researchers, some possible reasons for this are the ease of getting water from the bucket, the greater diameter and depth of water suitable to the horses’ natural drinking habit. Further studies may be warranted to improve these characteristics in automatic watering systems for horses.

The researchers also measured the fluid balance and behavior of the horses for all 3 watering methods. Each horse spent a week with each of the different water delivery methods. The horses drank more each day from the buckets than from the pressure valve bowl and the float valve bowl. Two of the horses experienced an overall loss of body water when drinking from the float valve bowl even though they spent more total time drinking than for the other 2 systems. The researchers suggest that this situation could be improved with a higher flow rate for the float valve system, which would allow them to consume more water in the time they spent drinking. The horses also spent more time drinking from the pressure valve bowl than from buckets although they consumed less water in the time they spent drinking, again a higher flow rate may improve this. The horses in this study were at rest throughout the study period and the authors note that the differences in water consumption between the different delivery methods may be highly significant for horses in athletic competition or for lactating mares. If a horse is normally watered using an automatic system it could be useful to supplement with water from a bucket after intense exercise to ensure the horse is adequately rehydrated.

Further studies may be warranted to improve these characteristics in automatic watering systems for horses.

Subsolar (Hoof) Abscesses: A Common Problem

Hoof abscesses are typically acute and severe lamenesses and bear minimal to no weight on the affected limb. The hoof may feel warm to the touch, and the digital pulses felt over the back of the fetlock (adjacent to the sesamoid bones) may be stronger than in any other area. The point of penetration is often difficult to see in the untrimmed foot. Therefore a subsolar abscess cannot be ruled out even if a site of penetration cannot be readily identified. In some cases abscesses are forced along the hoof wall to drain at the coronary band. However, sharp objects can penetrate deeper structures, which can lead to serious, or even life-threatening complications. Structures within the hoof capsule that can be affected include the coffin bone, nucular bone, coffin joint, nucular horn, and deep digital flexor tendon. In severely affected horses infection can affect the soft tissues of the lower leg. Occasionally untreated superficial abscesses can spread to deeper structures in the hoof (e.g., sensitive lamina and coffin bone) even if those structures were not originally affected. Lastly, leaving superficial abscesses untreated can contribute to extensive undermining of the sole, leading to a prolonged and expensive recovery period.

Bowed Tendons (continued from pg 3)

Surgical treatments include superior check desmotomy and tendon splitting. Superior check desmotomy has been shown to be a successful treatment of tendinitis in Standardbred racehorses but not Thoroughbred racehorses. The most common complication associated with the Thoroughbred racehorse is the development of suspensory desmitis following surgical transection of the check ligament. Tendon splitting involves surgical incision into the affected portions of the bowed tendon. The goal of tendon splitting is to aid in decompression of the torn tendon and to enhance blood flow to the area(s) of fiber tearing.

Despite the multitude of available treatments for bowed tendons no one treatment has been proven to be superior for all cases. Treatments must be chosen on a case-by-case basis and following discussion with your veterinarian as to what options are available. Tendon injuries are a serious complication for the horse and many require intensive and prolonged treatment from 6 months to 1 year. However, some horses with mild injuries may return to work after adequate rest and healing. Horses that are unable to return to peak performance usually can return to some degree of soundness and may find usefulness in a less strenuous occupation. Consultation with a veterinarian experienced in tendon injuries will help insure that your horse will have the best opportunity to recover from a bowed tendon.
What to Do About Warts
Amy Smith, DVM student (Class of 2003)

"Doc, what can I do about these warts?" When a prized yearling begins to look like a long-legged toad, owners become concerned. But never fear, equine warts can be a natural part of growing up for a horse just like acne or awkwardness in a teenager. Equine warts are small, gray-pink, cauliflower-like growths that are usually concentrated on the muzzle. They are commonly found on young horses less than three years of age and can range in number from a few to a few dozen. They grow over a course of one to two months and often regress on their own after anywhere from two months to two years.

Warts are caused by an equine papillomavirus similar to the one found in cattle. The virus is contagious and can be transmitted via contact between flies and abraded or traumatized skin. Because most warts will regress on their own, treatment is usually not necessary. However, the owner may want to consider eliminating any flies that are present on the farm to prevent spread of the virus. Insecticides can be used to reduce skin trauma, which permits infection by the virus. Marking pens may be used to darken lesions in show horses.

Prevention of the spread of warts on a farm is important to limit the number of animals involved. Isolation of affected from non-affected horses and not sharing brushes, combs or any other equipment is recommended. Disinfection of brushes, combs, water basins, and other fomites with lye, formaldehyde, or povidone-iodine solution can minimize spread of the virus. Mowing pastures and controlling biting flies can reduce skin trauma, which permits infection by the virus. Warts are often removed surgically by a veterinarian.

Horse owners and veterinarians alike will agree that a "bowed tendon" is a common cause of lameness in horses. A "bowed tendon" develops following excessive strain of the superficial digital flexor tendon (SDFT). The application of excessive strain to the tendon results in tearing of the tendon fibers. The end result of fiber tearing is pain and lameness. The forelimbs are more commonly affected than the hind limbs. The predominant sign of a bowed tendon is a warm, painful swelling associated with the SDFT (figure 1). Tendon injuries are usually unilateral but bilateral injuries are not uncommon. The most common breeds affected include the racing Thoroughbred and Standardbred. Ambulans is used for endoscopic rating and horses used for dressage, three-day event, and combined training. The injury can be performance limiting and in some instances can result in the end of an athletic career.

The SDFT is made of fiber bundles that can be stretched or torn by trauma or overloaded in a single episode or following repeated damage (cyclic fatigue). Tendon fibers are usually torn in the mid-cannon bone region because the SDFT has the smallest cross-sectional diameter at this point. Once the natural arrangement of the tendon fibers is disrupted, inflammation, edema and hemorrhage further disrupt the tendons. At this point, the horse may be lame. On the other hand, some horses may only show tendon swelling without signs of lameness.

Pulmonary and ultrasonography (US) are two common methods of tendon assessment. Following palpation of the flexor tendons pain and focal swelling may be the only consistent finding. It is important to understand that considerable damage can be present within the tendon even though external palpation of the tendon is unremarkable. Ultrasonography will display the normal SDFT as hyperchoic (bright white) and areas of fiber tearing are typically noted as anechoic (black). When ultrasonating the tendon, a core lesion is noted as an anechoic (black) area near the origin of the SDFT (figure 2).

Horses should not return to training until the tendon has healed ultrasonographically. In acute cases the goal of treatment is to control inflammation associated with the tendon. Treatments for acute cases include application of cold to the tendon (ice packs, ice slams or cold hosing), rest, pressure bandages and administration of anti-inflammatory drugs such as phenylbutazone and DMSO. Following treatment of the acute injury your veterinarian may recommend other therapies. Ultrason should be performed as soon as possible following resolution of the acute signs of inflammation. Ultrason will determine how severe the area of tendon injury is and help determine when the horse is likely to recover. Treatment of tendon injuries can be successful following conservative and surgical treatments. The most common conservative treatments include controlled exercise and intratendinous or peritendinous injections. All acutely affected horses diagnosed with a "bowed tendon" will benefit from conservative treatment of at least one-month stall rest later combined with several months controlled exercise. These horses should not be turned out under any circumstances because of the risk of further tendon strain. One example of an effective controlled exercise program is provided in table 1. In addition to controlled exercise other treatments are available. A variety of medications have been injected into tendons but no medication has met with consistent success. However, the injection of growth factors such as insulin-like growth factor-1 may become the wave of the future for the treatment of tendon injuries. A newer treatment, which has met with consistent success. However, the injection of growth factors such as insulin-like growth factor-1 may become the wave of the future for the treatment of tendon injuries. A newer treatment, which currently available at Purdue University, is "shock wave". The application of shock waves to injured tendons and ligaments may aid in the healing process following tendon or ligament injury. Further research will delineate the future of shock wave treatments for the management of bowed tendons in the horse.

TABLE 1

| Controlled Exercise Program used in “Bowed Tendons” | Day 0 - 45 | Walk 15 minutes, twice daily. |
| Day 46 - 60 | Walk 30 minutes, once daily. |
| Day 60 - 90 | Walk 30 minutes, twice daily. |
| Day 90 - 120 | Trot 15 minutes, once daily. |
| Day 120 - 150 | Trot 15 minutes, twice daily. |

(continued on pg 6)