

Putting Humpty Dumpty Back Together Again

Progress in rehabilitative therapy makes it easier to rehabilitate horses after injury

BY NATALIE VOSS

The most dreaded call for owners or trainers can be the one informing them that a star race prospect has come up with an injury. Whether it's a dramatic breakdown, a persistent lameness, or a nagging stiffness, owners have a wide range of treatment options available to them thanks to modern veterinary medicine. Many issues that would have permanently sidelined a horse several decades ago can be treated or corrected using today's technology.

The rehabilitative therapy used depends on the type and severity of injury the horse sustained, but most importantly the root cause for injury needs to be identified before treatment may begin, according to lameness expert Dr. Larry Bramlage.

Tendon injuries, for example, are often the result of secondary lesions and indicative of another problem.

"They're an overload injury because the horse is avoiding some other problem," said Bramlage. "Many times all the owners can tell is, 'Something is wrong; I don't know what.' That's why it's important to get the lameness exam, so you can tell what."

According to Dr. Bramlage, updates in ultrasound technologies have granted veterinarians a better understanding of lameness, and ultimately allows them to find its original cause. The most important starting point is always the lameness exam, in which a veterinarian will examine the horse at a walk and a trot, usually over an even, tough surface, and flex areas of concern. From there, he or she may recommend targeted radiographs or ultrasounds



Nuclear scintigraphy, or bone scan, is an effective tool in pinpointing the cause of lameness

COURTESY DR. MATHIEU SPIRET

to check for abnormalities.

Additional high-tech diagnostic procedures may include magnetic resonance imaging (MRI) or nuclear scintigraphy. As in human medicine, MRI works by using magnetic fields and energy pulses to generate layers of detailed pictures that depict the finest details of bone and tissue from one surface of a limb to the other. MRI may reveal abnormalities not easily detected by radiograph or ultrasound. Nuclear scintigraphy, or bone scan, examines levels of metabolic activity through the entire body. Horses are injected with a marker, which spreads throughout the body, remaining concentrated in areas with highest activity such as healing injuries. Bone scan may reveal injuries to ligaments as well as to bone, and is especially useful for cases in which the root cause of lameness remains elusive.

No magic bullet

Once the primary cause of the problem is identified, a combination of rehabilitation therapies is often used. Experts are quick to point out that no one treatment by itself will restore a horse to 100%, and that not all horses or injuries respond the same way to the same treatment.

“It’s important to have a complete diagnosis and to understand the proper therapies at the appropriate time to best suit each individual. There is no magic bullet for each injury or horse; it takes a combination of therapies to help a horse return to a high level of performance,” said Kirsten Johnson, owner of Kentucky Equine Sports Medicine and Rehabilitation Center in Kentucky.

In the hospital

Surgery and rest have historically been paramount fixes for many bone fractures, but high-tech rehabilitative therapies have begun tackling the slow, uncertain healing process for injuries to tendons and ligaments. These types of injuries can often keep horses out of training for months, and may prevent athletes from returning at their full strength.

Tendon splitting

One of the most cutting-edge treatments for bowed tendons is called tendon splitting. A normal equine tendon is comprised of a cable of tiny elastic fibers that stretch and contract during movement. When the tendon bows, a hole rips somewhere along the cable, and becomes inflamed and filled with fluid.

Bowed tendons can cost a horse as many as 10-12 months of recovery and rehabilitation before returning to the races because the fibers must heal completely. Unfortunately, although tendons regain

full strength upon recovery, they do not often regain full elasticity, which can increase the chance for re-injury.

Tendon splitting was originally developed in Sweden as an alternative to pin-firing. Veterinarians noticed that tendons recovered better after incision than after the burning and subsequent scar tissue formation resulting from pin firing.

In a tendon-splitting procedure, a veterinarian will cut the fibers in the bow, draining the fluid and collapsing the gap in the tendon, similar to draining a hematoma. This allows the tendon fibers on the edge of the bow to touch, giving them a jumpstart in growing back together. This boost to healing also reduces the chance for scar tissue to grow inside the

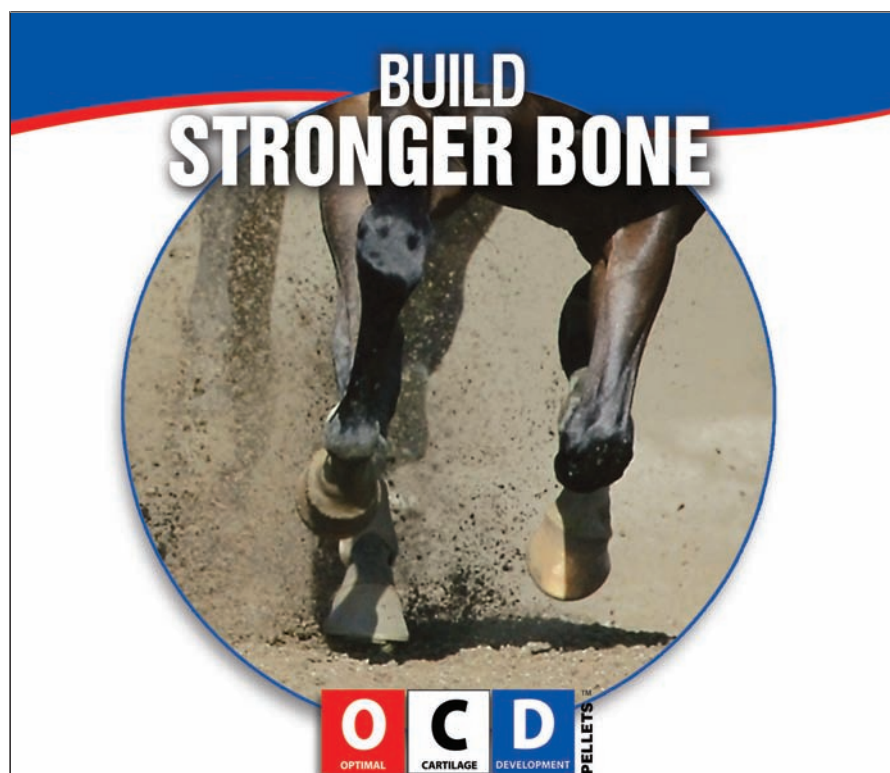
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bow, which has a negative impact on the tendon's ability to stretch upon recovery.

Tendon splitting is performed with the horse standing and sedated while the area is blocked. The procedure may only run a few hundred dollars, depending on the specific needs of the horse. The technique has been found to shorten healing time by as much as eight weeks when compared with lay-up alone.

Tendon splitting is a beneficial treatment only when there is a clearly isolated pocket of fluid, indicating a hole in the

tendon, seen on ultrasound. A similar, simple injury to a ligament may also benefit from the procedure. Complex bows, and those involving more prolific injuries such as lacerations, etc. will not necessarily respond well to splitting.

For tendon bows in back legs and extensors, Bramlage says recovery is almost guaranteed due to the physical makeup of the leg. Flexor tendon injuries on front legs however, are almost never the same upon healing due to the superior check ligament.

The superior check ligament runs between the knee and the superficial digital flexor tendon, which is the thickest group of cables farthest behind the cannon bone on the front leg. Bramlage explains that the check ligament limits the amount to which the flexor tendon can stretch in recovery, so that unlike other injured tendons, it cannot be stretched at one end to allow it to continue to be elastic throughout. The horse is the only known domestic species to have a structure like this limiting tendon flexibility in the front leg.

A superior check ligament desmotomy can lengthen the tendon slightly, but only about $\frac{3}{4}$ of an inch, which may or may not restore the needed elasticity. As with many rehabilitative therapies, superior check ligament desmotomies and tendon-splitting procedures are often done in complement.

"The thing that's probably done most

commonly is to split the tendon and do a superior check ligament desmotomy," aid Dr. Scott Hopper of Rood and Riddle Equine Hospital.

Bramlage emphasizes that tendon injuries in racehorses are most commonly caused by the horse attempting to avoid stressing another injury or defect, resulting in "asymmetric loading" of a tendon. By contrast, sport horse tendon issues are most often a result of wear, when the tendon becomes old and loses elasticity. Use of modern imaging technologies allows veterinarians to detect issues such as cannon bone bruising that can lead to bowed tendons, and he says that he has seen a relative decrease in tendon bows for this reason in recent years.

"The incidence has declined over the last 20 years...and it's because we have a better imaging technology...we find more lamenesses from other causes earlier, and we don't train them to the point where they injure a tendon as often," said Bramlage.

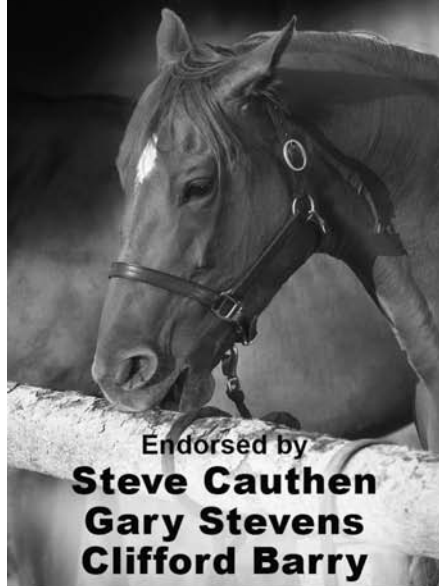
Stem cells and other regenerative medicine

One of the treatments often used in conjunction with tendon splitting is stem cell therapy. The world of stem cells and similar therapies is still very new but is already proving extremely popular for a variety of injuries. Regenerative therapies in which the healing material is collected from the horse itself are favored because

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Bone marrow collection is one source of stem cells

THE HORSE STAFF

there is less likelihood the horse will reject the material before it has a chance to work.

Stem cells are non-differentiated cells that may replicate into more stem cells, or differentiate to become bone, muscle, tendon, ligament, or any other type of tissue found in the horse's body. They are the mechanisms of growth in a young horse, and of healing in an injured horse of any age, as replacement tissue at an injury site originates as stem cells.

Stem cells are found throughout the body, but in horses the easiest sites for collection are from umbilical cord tissue or blood upon birth of a foal, or from adipose (fat) tissue, or from bone marrow of an adult. Less commonly, fetal stem cells may be obtained from companies that harvest them from growing fetuses. Cord blood collection may be done on the farm by a night watchman or manager with the appropriate instructions and collection kit, and the cord blood may be frozen for later use. Stem cells can be collected from bone marrow, usually via the sternum, or adipose tissue at any time. Veterinarians usually have their own preference as to which source is best for a given situation.

Dr. Joseph Yocum, Lexington veterinarian and founder of the Centre for Regenerative Medicine, prefers adipose-derived cells.

"They finally found a use for fat," he joked.

Adipose usually yields a higher concentration of cells that are available the same day of collection, (as many as 75 million cells per gram of fat from a single collection, according to Yocum). Not all of these are true stem cells however, as collection from adipose tissue may contain other types of cells. Yocum believes that these other types of cells such as cytokines and growth factors contained in the harvest may also aid healing, creating a "cocktail of healing."

"Nobody knows what that number [concentration of true stem cells] is. We've seen everything from 8-40% in the literature," said Yocum.

Bone marrow-derived samples are processed to produce a purer sample of cells that are multiplied and compounded into

a "super-dose," which contains a much higher concentration of stem cells than most tissues in the body. This process can take several weeks. After concentration, the cells are injected into the injured area, which may be a joint, ligament, tendon or wound.

Stem cells are commonly inserted into a bowed tendon during a tendon-splitting procedure but are not appropriate in all cases. Swelling can occur upon stem cell injection, as the cells cause a rush of cytokines, the mechanisms in blood that cause swelling, to speed more blood to the area in order to heal the injury, so it is used carefully in situations where increased swelling could cause further damage to the limb.

"(Swelling) is not uncommon at all," said Yocum. "When we inject these horses and get a flare, we're obviously concerned about that, but...it usually goes down in a day or two. Many vets feel that the joint flare may be a component of the healing process. It would be similar to the inflammatory response from an injury that helps initiate healing in the body."

In addition to encouraging healing by providing the needed tissue building blocks to close a lesion, stem cells are believed to help the horse create replacement tissue for a damaged area before it can form scar tissue, which limits motion and reduces elasticity in ligaments and tendons. Research is currently underway to examine the use of stem cells in cases of laminitis, neurologic conditions, eye disease, and airway illnesses.

According to Hopper, much is still unknown about stem cell therapy. He says that veterinarians have lots of anecdotal evidence indicating that it can be used on a variety of problems, but even though the treatment comes from their own bodies, not all horses benefit the same way from stem cells. For some, it may make the difference between a more complete recovery and permanent disability, while others may show more limited response



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to the injection, depending on the animal and the injury.

The therapy is costly, often ranging in the thousands of dollars depending on the number of treatments. Despite the expense, Hopper says it is growing in popularity as owners try to give their horses a leg up to recovery.

A related precursor to stem cell injection is bone marrow aspirate, or BMA. BMA is formed by processed blood from a bone marrow sample, which essentially contains a lower concentration of stem cells and healing agents than the current therapies.

Platelet-rich plasma, or PRP, is another material derived from the horse's own blood that may speed healing. It is in the early stages of development even compared to stem cell treatments.

"Almost all the papers that have come out are general and anecdotal. There's been enough in stem cells in bowed tendons in horses, but there's been almost nothing on PRP," said Hopper.

For PRP treatment, blood is collected from a horse and spun on a centrifuge to separate and concentrate the plasma. It is then introduced into an injured area, sometimes in conjunction with stem cells. PRP appears to act as an anti-inflammatory, and several studies have suggested it boosts growth factor. These qualities allow PRP to aid the injury site in the use and differentiation of stem cells, helping a horse to make the most out of a costly therapy.

Shockwave

Another therapy available to an injured horse is shockwave treatment. Once used for a wide range of conditions, shockwave treatment is now better understood and only appropriate for certain cases.

During shockwave treatment, waves of energy are aimed at a concentrated area on the horse and dissipate at the intersection of soft tissue and bone, over-stimulating nerves until they eventually become worn out, producing a temporary pain-relieving effect. This therapy is useful for horses with chronic, non-catastrophic aches such as oclelets and some other types of joint problems in which the horse is not expected to increase his likelihood of injury because of the issue. In these cases, Bramlage says it is beneficial for the horse to get non-chemical pain relief and continue performing, as long as it is not masking a larger issue.

For some injuries such as bucked shins, which occur on the shin surface, extreme caution must be used in case there is an underlying fracture that will worsen with the application of the energy waves.

"You have to treat the lesion that you've got," said Bramlage. He stresses that not all horses and not all injuries will react the same way to shockwave therapy and it should only be applied when the underlying cause of injury is diagnosed.

After the hospital

The most successful lay-up and rehabilitation centers have become increasingly complex in recent years, offering a variety of post-surgical or post-injury treatments administered under a veterinarian's watch outside the hospital. While exercise therapy such as swimming, aqua-tred, and automatic walkers are becoming more common, some facilities have access to higher-tech recovery aids as well.

Hyperbaric chambers

Hyperbaric Oxygen Therapy (HBOT) chambers are another tool rising in popularity for everything from "dummy" foals to pneumonia to laceration treatment.

Treatment with HBOT requires placing the horse in an airtight chamber, which is then pressurized with 100% oxygen. Treatment times range from 30-60 minutes depending on the injury or illness. Normal air contains roughly 21% oxygen, which is normally adequate to allow healing and support life. However in some instances ischemic tissue, infection, or swell-



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tion, or swelling requires an increase in oxygen concentration to promote healing. This increased oxygen saturation is the principle behind HBOT and helps reduce swelling, stimulate collagen production in wounds, and kill anaerobic bacteria. HBOT also potentiates the effect of some antibiotics and increases the production of stem cells, as proven by studies conducted at The Gluck Center and The University of Tennessee.

KESMARC began operating the world's second HBOT chamber for equines in 2000. Johnson is also a part owner of Veterinary Hyperbaric Oxygen (formerly Equine Oxygen Therapy), a company that manufactures and distributes veterinary hyperbaric chambers worldwide. At KESMARC and other facilities utilizing hyperbaric chambers, HBOT has also proved successful in treating bone infections, cellulitis, wounds, respiratory issues, and post-race recovery as well as many other conditions.

HBOT has been so successful in human medicine that there are 15 "approved" conditions for which it is covered by most insurance providers as a reasonable treatment.

Johnson believes that the therapy will soon become the equivalent standard of care in equine medicine.

"Hyperbarics is an important tool in the recovery of many athletes. Although not a replacement for any one therapy, it can be used as an adjunct at different stages of the healing process," said Johnson. "Equine hyperbarics has risen in popularity among rehabilitation professionals and veterinarians because of the dramatic results seen in a variety of cases."

Whole-body vibration plates

Perhaps the newest therapy on the market, EquiVibe has introduced whole-body vibration plates to the world of equine rehabilitation. The 40-by-80-inch platforms create slight tremors of high frequency vibration throughout the horse's body, mimicking the vibrations experienced during exercise. The vibrations increase circulation and are intended to restore flexibility, ultimately improving balance, muscle coordination, and stability, particularly for old or injured horses.

While EquiVibe has seen considerable popularity in the sport horse world, WinStar Farm is one of the first Thoroughbred operations to begin using the plates both on its horses in training and as a rehabilitative therapy.

Bill Casner, former co-owner of WinStar, has been watching the developing technology since 2001 when he heard about the first clinical trials of vibration plates performed with sheep. The back legs of the sheep were placed on vibration



Hyperbaric chambers help speed healing

plates for 20 minutes a day and at the end of the trial, had a 34% increase in bone density. Subsequent studies also found it to stimulate vasodilation and strengthen bone.

Once the technology was proved safe for growing animals, Casner installed two plates at WinStar.


"Horses that are in rehabilitation, it's well-documented that ... they will lose significant bone. The system adapts very quickly to the loads that are presented. If a horse is not loading that bone, it's going to diminish the density," said Casner.

Casner says he puts weanlings, yearlings, and horses in training on the plates to increase bone density and strength before the track as a form of preventative therapy, but he has also seen results with bucked

shins. He believes the same benefits would likely be seen in cases of soft tissue injury but says more research needs to be done before that can be known for sure.

"One thing categorically that it'll do is make a foot grow," he said, due to stimulation of vasodilators. Casner recalls putting Well Armed on the EquiVibe before any other horse on the farm and marking the length of his hoof, only to see an inch of growth six weeks later.

Racing into the future

The world of rehabilitative therapy is rapidly evolving. As more research is conducted and new therapies are tried in the field, veterinarians hope to have more solutions to allow horses to run longer and more comfortably. 

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