



Shortly after National Hunt racehorse Nomecheki (Fr) was brought from France, it was discovered that he had damage to his SDFT. The horse's owner was keen to use stem cell therapy and his veterinarian, Dr. Tim Beauregard, advised that it would be the best course of treatment. "Cheki" was soon back to work following VetCell's rehabilitation program to get to full fitness again. He made a winning return to the racetrack at Plumpton in England in November 2009 in heavy going and since then has had another win, two seconds, two thirds and a fourth from 14 runs. This picture above shows him at Cheltenham in November 2011, clearly loving his job having led the field for the majority of the race.

Grossick Photography

Stemming the Risk of Re-Injury

FROM MUCH-LOVED PONIES TO MILLION-DOLLAR RACEHORSES,
STEM CELL THERAPY IS AMONG THE MOST ADVANCED
TREATMENTS FOR EQUINE TENDON AND LIGAMENT INJURIES

• By Lucy Graham •

The most commonly injured tendon in horses is the superficial digital flexor tendon (SDFT), which is most frequently injured in the mid-cannon region. Tendon and ligament injury can occur due to a repetitive strain injury (RSI) or from direct trauma. When you see the extent to which a tendon stretches during galloping, racing or during take-off and landing over a fence, you can understand how an RSI-type problem can occur. Under normal circumstances, the horse's fetlock joints, both front and hind, will virtually touch the ground at the point of take-off over a fence, as the horse pushes down with its front end, lifts its shoulders and transfers its weight onto the hind end to push of the ground. The same is true on landing as the forelimbs take the strain. Racing and training on the flat exerts similar strains and pressures on these joints.

This force on the tendon has been measured at about 5,000 pounds per square inch of tendon, both when jumping and also when at a full gallop (bear in mind that the SDFT is actually only about four-tenths of an inch in cross-sectional area). It has also been shown under lab conditions that the SDFT breaks when approximately one ton of stretching force is applied to it. This, therefore, means that the tendon is close to the breaking point whenever the horse is galloping or jumping. It's easy to see why these injuries are common and have a high chance of re-injury after treatment or rest.

Stem cell therapy has now become the treatment of choice for many veterinarians when faced with equine tendon and ligament injuries. Stem cells have the ability to self-renew and become specialized cells within the body. These cells are essentially the

body's own repair kit and allow the body to naturally regenerate tissue that has been damaged. Unfortunately in some cases of tissue injury, naturally occurring levels of stem cells cannot cope with the level of damage that they face. In these instances, stem cell therapy can be

used to multiply the stem cells and implant them into the damaged region.

Some stem cell technologies, such as those described in this article, use bone marrow-derived mesenchymal stem cells that are taken from the injured horse's own bone marrow. This provides the best chance of regeneration. The improved quality of repair and the reduced chance of re-injury mean that horses treated in this way are more likely to return to their previous performance level and are also far less likely to suffer further injury to the leg. This is because the stem cells encourage the tendon or ligament to heal in a more normalized fashion, which has far better functionality than the scar tissue that would develop if the stem cells were not there.

Knowing the Basics

So what does stem cell treatment involve? Once the veterinarian and owner have agreed that stem cell therapy is the way they want to proceed, the horse undergoes a bone marrow aspiration procedure. This is done under standing sedation and using local anaesthetic. A sample of bone marrow is taken from the horse's sternum or tuber coxa (hip

bone) using a specially designed needle.

Dr. Kristi Underwood, who is the coordinator of regenerative medicine at Elgin Veterinary Hospital outside of Austin, Texas, says that she prefers to harvest bone marrow from the sternum, although the tuber coxa is a good alternative site.

How is stem cell therapy done?



Bone marrow is taken from the sternum or tuber coxa (hip bone) of the injured horse



Stem cells are separated from other cells within the marrow and encouraged to multiply.



2-3 weeks later they are re-suspended in fluid from the bone marrow sample and returned to the veterinary surgeon.

All stem cell products are checked for sterility, viability and quantity prior to dispatch.



The veterinary surgeon implants the cells into the injury using an ultrasound machine to guide the needle.

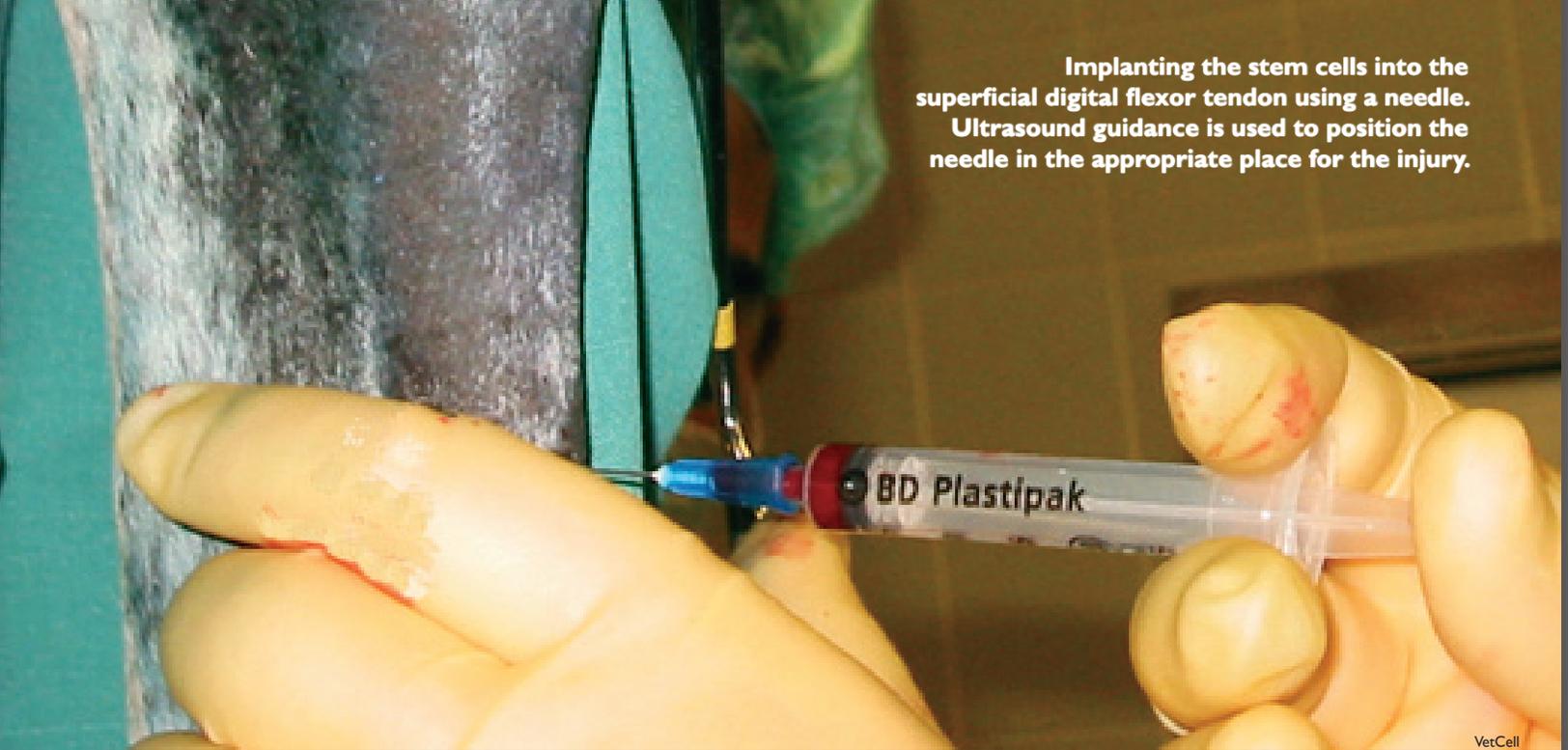


The horse begins a careful rehabilitation programme to get back to full fitness.



12 months after stem cell implantation the horse should be able to return to the racetrack or competition arena.

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Implanting the stem cells into the superficial digital flexor tendon using a needle. Ultrasound guidance is used to position the needle in the appropriate place for the injury.

“While harvesting from the sternum is technically more difficult and potentially risky if you do not have experience, I feel that this method is the quickest and least painful for the horse,” she said.

Dr. Underwood went on to say that she always uses an ultrasound examination of the sternum to find the correct site for aspiration.

“The ultrasound exam allows visualization of each of the sternbrae, and measurements can be taken to know exactly how deep the needle needs to be inserted to obtain the bone marrow sample,” she said.

A horse undergoing stem cell therapy need not visit the veterinary clinic at all. If your veterinarian has a mobile scanner, everything can be done in a clean stable at any farm or location using good aseptic technique.

The bone marrow is sent off to the laboratory (in a specially insulated container) so that the stem cells can be separated and then cultured to increase their numbers. After two to three weeks, the cells will have multiplied up to a quantity of 10 million (sometimes the culture takes longer if the veterinarian has requested more than 10 million for a larger lesion). They are then returned to the veterinarian so that he or she can implant them into the injured horse. Like the aspiration, this implantation procedure is done under standing sedation so there is no need for any general anaesthetic and the associated risks that would bring. Occasionally there can be an inflammatory response following the injection, which Dr. Underwood says is the only complication she has encountered.

“This may happen in approximately three to five percent of cases and can usually be managed with NSAIDs (e.g. Banamine),” she said, adding that inflammation such as this shouldn’t cause any long-term problems for the horse.

Following implantation, the horse has a couple of days of stall rest and then starts a gradual rehabilitation program with the aim of

being back to the racetrack, competition arena or riding trail within one year of stem cell implantation.

“The rehab protocol will depend on the extent of the injury that we are treating,” Dr. Underwood elaborated. “Most horses that have an injury that justifies stem cell use will have six to 12 months off before returning to full work.”

The principles behind stem cell treatment mean that the rehab time will not be shortened, but stem cell therapy offers a better fix rather than a quick fix.

“We want complete healing of the injury with minimal scar tissue and a lower re-injury rate once the horse is back in full work,” Dr. Underwood explained. “In most cases, we start rehabbing immediately with walking and slowly increase the duration and intensity of work based on repeat examinations every two to three months to assess healing.”

Ten Years and Running

The patented VetCell stem cell techniques were developed more than 10 years ago by a team at the Royal Veterinary College in London headed by Professor Roger Smith. Their first stem cell case was treated in August 2002, so 2012 marked the 10-year anniversary. In that time, the procedures have been honed and the quantity of cells has increased from two million up to 10 million, which is now the standard dose. The latest research (taken from VetCell’s database of treated horses) has shown that there is a clear dose response (horses treated with 20 million cells or more have a much lower chance of re-injury than those treated with 1-19 million cells). For this reason, the company is now recommending that veterinarians use at least 20 million cells. In some cases, this is done as a two-stage implantation – 10 million followed by another 10 million a month or so later.

At the Elgin Veterinary Hospital, Dr. Underwood and her team may recommend multiple injections depending on the severity of the injury.

“VetCell offers packages for one injection, two injections or more, or cryopreservation of stem cells,” she said. “Prices will vary based on the above criteria, but generally treatment ranges from \$2,000 to \$5,000.”

Stem cell therapy, as with most other tendon and ligament treatments, is often covered by insurance policies as part of the veterinarian’s fees.

VetCell’s database feedback has also shown that there is a relationship between time delay and the chance of re-injury. Non-racing sport horses treated within one month of injury showed just a 13% chance of re-injury. This increased to 23% for those treated one to two months after injury and 29% for those treated over two months after injury.

So far this relationship has not been clearly shown in racehorses, but there is an advantage to early treatment before too much scar tissue develops to fill the lesion.

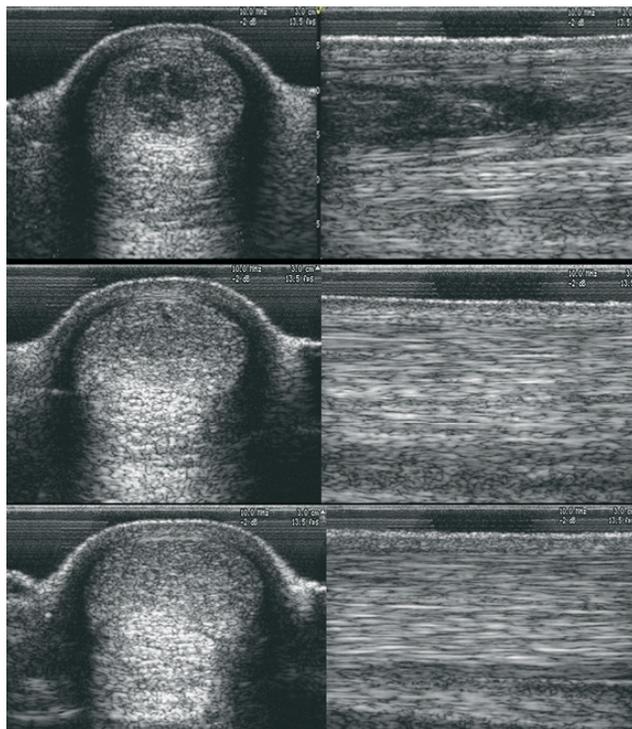
Dr. Underwood has found that quick treatment is often important with the horses she sees.

“Best case scenario, the horse is diagnosed within a week of the injury, the bone marrow is collected, and the first stem cell injection occurs within one month of injury,” she said. “However, there are plenty of horses that have been treated by other means unsuccessfully, and then have stem cell injections months after the original injury and do just as well.”

In addition to investigating the effect of time delay on treatment success, VetCell has also recently made direct comparisons between their data and that collected by B. O’Meara, et al., in his 2010 paper looking at stem cells versus more conventional SDFT treatments. This research has shown that although the return to racing and the racing records of stem cell treated racehorses are very similar to those of O’Meara’s conventionally treated horses, the overall re-injury rate of stem cell treated horses is just 29% compared with 53% found by O’Meara. This data will be published soon, but so far O’Meara has

checked it against his own data and given his approval.

Although stem cell therapy was initially developed to treat tendon and ligament injuries, veterinarians around the world are starting to use stem cells to treat a wide range of injuries and ailments. In Elgin, they currently use stem cells for musculoskeletal injuries, however, as Dr. Underwood explained, “There are new advances everyday, and we have even treated one spinal cord injury with success. The most common musculoskeletal injuries that we treat are suspensory ligament tears, deep and superficial digital flexor tendon bows and



Just before the stem cells are implanted, the scan shows a clear core lesion in the center of the superficial digital flexor tendon.



One month after stem cell implantation, there is some infilling of the lesion and a less defined lesion border.



Three months after stem cell implantation, the scan shows almost no noticeable difference between the healthy tendon and the area of injury.

meniscal tears in the stifle.”

Horses treated with VetCell’s technique have gone on to win the Welsh Grand National, European silver medals in eventing, races at Cheltenham, Pony Club two-day events and one even finished with an excellent placing at the London 2012 Olympics. As well as eventing and racing, VetCell has also treated stars of show jumping, dressage, reining, showing, polo, barrel racing and even cutting horses, plus many much loved family pets that have returned to full soundness and gone on for many more years of giving their owners lots of fun at riding or pony club level, hacking or hunting.

It really does make perfect sense that the body’s own building blocks should be used to help healing. Stem cells are frequently in the news in human medicine, but the equine world is already ahead of the game as far as tendons and ligaments are concerned; VetCell has treated more than 2,000 horses in Europe, the U.S. and Canada. Without a doubt, stem cells will become increasingly common in both veterinary and human medicine over the next few years and will provide cures for many illnesses and injuries that are currently proving difficult to treat. It’s remarkable really, for something so tiny. ★



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A leading distributor of VetCell, Pall (E-Pet), and RenovoCyte products & services, Equine Partners America is dedicated to providing the most progressive regenerative medicine products to assist horses' recovery from injury and to promote optimum health. To that end, we offer a broad array of cutting edge, scientifically proven products designed to maximize equine performance and capabilities.

Equine Partners continually monitors and participates in ongoing research to stay abreast of breakthrough scientific findings that will assist us in our efforts. We know: early treatment improves outcomes; there is no discernible outcome difference among types of work or performance; and outcomes appear to be dose-related (a 20M cell dose reduces reinjury rate), 2,000 horses in treatment with VetCell protocol included in data spanning 10 years.

We are proud of the professional collaborations we have made to continue to develop the science of equine regenerative medicine. The VetCell stem cell protocol has treated more than 2,000 horses through their courses of therapy and rehabilitation, producing a reliable and peer-reviewed database of treatment outcomes. RenovoCyte has developed less invasive protocols to harvest mesenchymal stem cells from skin and other sources. Pall Corporation used its expertise in developing filtration products to manufacture a unique, stall-side equine platelet enhanced therapy (E-PET). These partnerships ensure that we can offer our clients comprehensive veterinary platforms for horses not found anywhere else.

Most importantly, we are firmly committed to distributing our products in the most direct, cost-effective and transparent manner possible. It is our pledge to those who utilize our products for the betterment of their horses.

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