



How STEM CELLS could help your horse

It is an unfortunate fact that equine athletes may suffer tendon and ligament injuries as a result of stresses and strains endured in training and competition. The superficial digital flexor tendon (SDFT) is most commonly injured and results in the characteristic 'bowed tendon' appearance.

SDFT injury has traditionally been associated with racehorses, event horses and hunters, but it can occur in any type of horse or pony, of any breed and age. Many people believe that such an injury will mean the end of the horse's athletic career, as there is a high risk of re-injury with traditional treatments.

However, in recent years stem cells have provided an alternative treatment, with a greater chance of returning the tendon to its normal structure. It has been proven that stem cell therapy halves the rate of re-injury when compared with traditional treatments. There are various companies, such as VetCell, which offer stem cell treatment. Horses in a variety of disciplines are back competing successfully after VetCell's treatment for tendon injuries, known as StemRegen, including a number of high profile elite athletes in racing and eventing (see case studies overleaf). All-round riding club horses have benefitted, too.

It's not just horses that gallop and jump that can benefit from stem cell therapy. International Grand Prix dressage rider and former Team GB member Wayne Channon has used stem cell therapy for tendon and ligament injuries. He firmly believes in the technology. "A tendon injury for a dressage horse used to be the end of the road," he says. "Now we're getting elastic repairs and

We find out how the regenerative power of stem cell therapy is helping to heal tendon injuries in riding club horses, as well as top sports horses

that means most horses can return to full competition work. It's a life saver."

The cause of injury

The SDFT is most frequently injured in the mid-cannon region. Tendon and ligament damage can occur due to a repetitive strain injury (RSI) or from direct trauma, such as an overreach or cut.

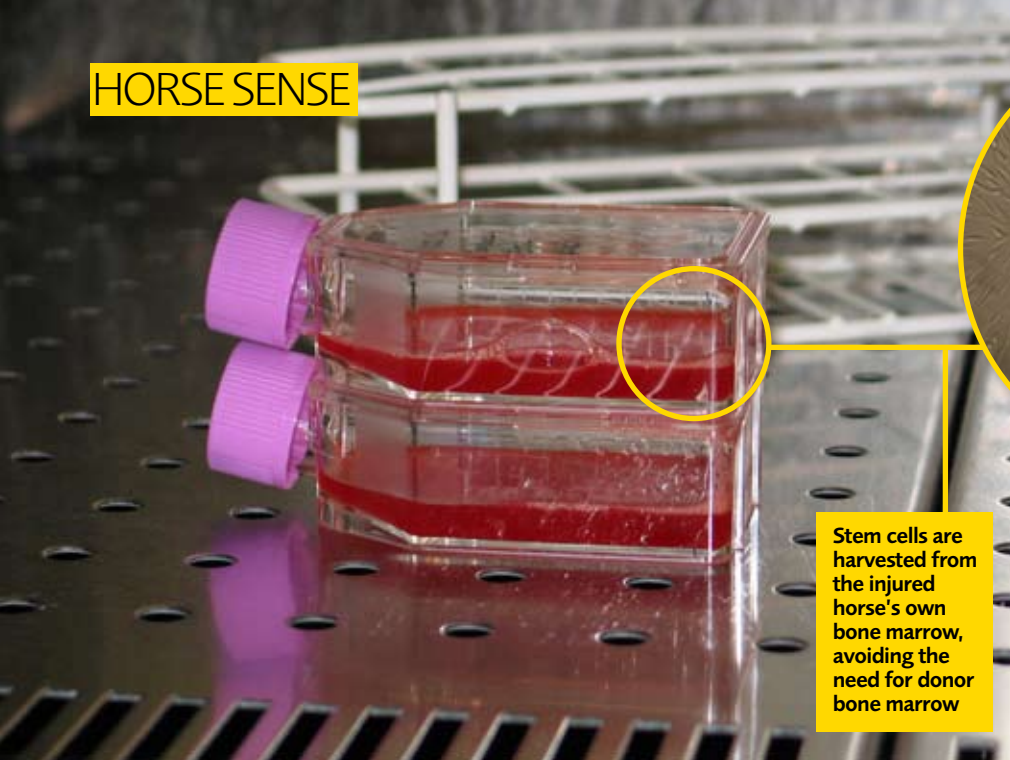
When you consider the extent to which a tendon stretches during galloping and during take-off and landing over a fence, you can understand how an RSI type problem can occur. Under normal circumstances, the horse's hind and front

fetlock joints will virtually touch the ground at the point of take off over a fence, as the horse pushes down with the front end, lifts his shoulders and transfers his weight onto the hind end to push off the ground. The same is true on landing, when the forelimbs take the strain.

This force on the tendon has been measured at one tonne per square centimetre of tendon, both when jumping and also when at a full gallop. The SDFT is actually just over one square centimetre (1.2cm²) in cross-sectional area. It has also been shown, under lab conditions, that the SDFT breaks when **H**



The forelimbs take the strain when landing over a jump, putting a high level of force on the tendons



Stem cells are harvested from the injured horse's own bone marrow, avoiding the need for donor bone marrow

hyaluronic acid or polysulphated glycosaminoglycans (PSGAGs).

The stem cell

Regenerative medicine offers the prospect of restoring normal, or very close to normal, structure and function to injured tissue and a successful return to work with a much reduced risk of re-injury. Mesenchymal stem cells are an ideal source for regenerative medicine because they are capable of differentiating into different cell types and forming new structures that are very close to normal.

These stem cells are thought to be present in small numbers in most types of tissue. For the purposes of stem cell therapy, they are harvested from the bone marrow because of ease of recovery and minimal donor site complications. Because the bone marrow can be harvested from adult tissue you can use the horse's own (autologous) stem cells to heal the tendon, which avoids the need for donor animals or for venturing into the controversial territory of using embryonic stem cells. It has also been proven that bone marrow derived mesenchymal stem cells tend to out-perform stem cells taken from other areas (such as fat tissue) when comparing their ability to differentiate into new tissue.

The stem cell therapy process

Bone marrow is harvested from the horse's sternum (where a martingale strap would attach to the girth) or the tuber coxae (hip bone) under standing sedation and with a

one tonne of stretching force is applied to it. This means that the tendon is close to breaking point whenever the horse is galloping or jumping.

Traditional treatments

In the past, many people would just put their horse in the field for a year to heal after a tendon injury, to allow the formation of scar tissue in the lesion. But as the scar tissue has different mechanical properties to the normal tendon – it isn't as stretchy, for example – this means that the areas above and below the scar tissue are put under increased strain as they have to stretch even more than normal to compensate. In addition, when turned out, the horse's exercise level is not controlled so he can put too much strain on the tendon before it is strong enough, which may result in further damage. Re-injury to the same leg is common in these circumstances.

Firing was a traditional tendon treatment, but it is controversial due to welfare implications and lack of scientific evidence to prove its efficacy. Under sedation and local anaesthetic, the horse had a hot firing iron placed against the skin of the lower leg either to burn

lines around the leg (line or bar firing) or to penetrate the tendon, known as pin firing. The theory is that this causes counter irritation, which supposedly encourages the repair of the tendon damage. Professor Silver at the University of Bristol performed a five-year study comparing ponies with tendon injuries treated with firing versus those who were just left to rest for a year. He found no evidence that it was an effective treatment for tendon injury.

Recent research into stem cell therapy (by Professor Roger Smith and his colleagues at the Royal Veterinary College) has shown that using stem cells reduces the rate of re-injury by a half (re-injury rate 27 per cent) when compared with the results of Dr Sue Dyson's 2004 research of more conventional treatments (re-injury rate 56 per cent). These two studies used similar populations of horses and analysed them in the same way. Conventional therapy, with which the stem cell therapy was compared, included controlled exercise alone, or controlled exercise combined with intra-lesional tendon treatments with



Firing tendons is a controversial practice

CASE STUDY: the racehorse

National Hunt racehorse Dream Alliance suffered severe tendon damage during the 2008 Grand National. He was treated by his own vet and then referred to Professor Roger Smith at the Royal Veterinary College Equine Referral Hospital for stem cell therapy. Following rehabilitation by his trainer he made a successful return to the track and went on to win the Welsh Grand National in December 2009, and is still racing.



Photograph: Bill Sellwyn

CASE STUDY: the riding club horse



Riding club all-rounder and Novice eventer Zoe had only been in her new home for six weeks when she suffered a 30 per cent tear to her deep digital flexor tendon while playing in the field. Her owner Gail explains: "We were given several options of treatment. The vet felt that as it was such a new injury and so large a tear that stem cell therapy would be the best treatment option to give her a good chance of returning to full work and staying sound. After stem cell implantation and a year-long rehabilitation programme, she came back to full fitness and won her first two-day event. Her scan results showed that the tendon had healed and there was no sign of damage."

local anaesthetic, using a specially designed needle. This usually needs to happen within one month of the horse sustaining the injury so the lesion has not yet filled with scar tissue.

The bone marrow is then sent to a laboratory, which must be approved to culture equine stem cells by the Veterinary Medicines Directorate, which is part of Defra. At the lab, the stem cells are cultured over a period of two to three weeks until

they have grown in sufficient numbers to be implanted into the horse's tendon (usually about 10 million). Occasionally the stem cells of certain horses grow very slowly and a second bone marrow aspirate is required. In rare instances, the cells are still not good enough in quality or quantity to be any use. This is more common in older horses.

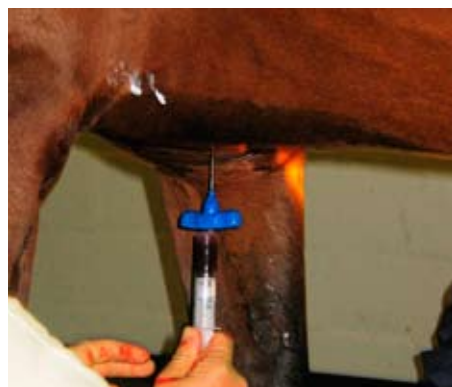
Once grown, the stem cells are then re-suspended in bone marrow fluid and returned to the vet for implantation into the tendon within 24 hours of leaving the lab. The vet uses an ultrasound scanner to guide the needle while stem cells are injected into the tendon lesion, again under standing sedation and with a local anaesthetic. There is no need for a general anaesthetic at any point in the stem cell therapy process.

A bandage is placed on the limb and the horse then undergoes a few days of box rest before beginning a year of a custom-designed controlled exercise programme to rehabilitate him to full fitness. The aim of this is to encourage the stem cells to grow into tendon cells by subjecting them to the stresses that a

CASE STUDY: the eventer



International eventer Oingy Boingy won a silver medal at the Young Rider Europeans in 2007, which was his first season back after stem cell therapy in 2005 for a tendon injury. He is still going strong and completed a double clear at Burghley Horse Trials at the end of 2010. Owner and rider Nicola Wilson says: "I am so pleased that we went ahead with the treatment. His recovery has been incredible and his performance feels as good as ever."




Bone marrow is taken from the horse's sternum using a specially designed needle



Recent research has shown that stem cell therapy is more successful than more conventional treatments

tendon would normally be exposed to. Regular ultrasound examinations are used to monitor healing progress and to evaluate when the horse's workload can be increased. A final scan is also recommended before the horse returns to competition.

The bone marrow harvesting, stem cell culture and implantation into the tendon costs approximately £1,500-2,000, but is covered by most insurance companies. If your horse is ever unfortunate enough to sustain a tendon injury then it is worth discussing the option of stem cell therapy with your vet. 



Processing the bone marrow to establish the culture of stem cells



The cultured stem cells are then injected into the injured tendon under standing sedation

Following Professor Smith's latest research, VetCell are now offering the VetCell Plus Promise – a money-back guarantee (visit www.vetcell.com for details).