Man in a white coat watches for the inevitable;  
Tendon and ligament injuries account for nearly half of all injuries at racecourses

Horses presenting with tendon problems have historically been the nemesis to veterinarians and trainers alike. Many treatment methods have been tried; in some cases tested and mostly fallen by the way side. Possibly the reason for so many false dawns in the search for a reliable treatment for tendon trauma/pathology is that many of them do not take into account the healing and metabolic processes that occur naturally. Instead, it could be argued that human intervention causes as many, if not more, problems as solutions.
For example, it is understood by clinicians [human and animal alike] that disorganised scar tissue present in a highly organised structure such as the tendon tissue matrix will disrupt that ordered architecture to the detriment of the functional capacity of the tendon. However, treatments still appear to ignore this fact.

I am a long way from being convinced of the repeatable success of any procedure that injects any substance into the tendon structure which comprises of a complex functional architecture. The latest vogue for injecting substances such as platelet rich plasma (PRP), stems cells and even cells taken from pig bladder I believe are counter productive and may do more damage than harm.

Old fashioned treatments such as blistering and firing blatantly ignore basic science to the detriment of the horses welfare and long-term viability of it as an athlete. The explanation that it promotes an increase in blood circulation to the area to promote healing clearly does not stand up to even the flimsiest of scientific scrutiny. The fact that some horses do return to racing following these treatments does not mean that they work. Merely that in some cases it does not prevent a horse from returning to racing.

**The Tendon Structure: What does a tendon look like?**

There are two clear facts that must be considered when dealing with tendon pathology; firstly, the longitudinal arrangement of the collagen fibres that make up 90% of the structure of the tendon needs to be maintained and when disrupted through injury and pathology this can be significantly aided by regular exercise at a frequency, duration and intensity appropriate to the condition of the tendon. Secondly, disorganised fibrous tissue will be detrimental to the long-term viability of the functional capacity of the tendon, therefore opportunity for the accumulation of this should be minimised.

Tendons are physiologically and structurally complicated and often injuries have long healing times and convoluted aetiology. As a consequence, the management of injuries and rehabilitation requires the application of specialist knowledge, experience and patience. Injuries to tendons, often caused by overuse in association with chronic degenerative pathology, are a major clinical issue in the management of athletes, be they human or equine.
Tendons have a hierarchical structural arrangement and small areas of damage within the tissue architecture can remain undetected until it has reached a significant critical mass.

**The Science; How tendons are made**

Tendons and ligaments have a highly structured and ordered cellular organisation within the tissue matrix. Tendon cells are arranged in longitudinal rows between collagen based fibre bundles. Within the rows the cells are arranged in a manner so they are in contact end-to-end. Between the rows they are in contact via processes that extend around the collagen fibrils so one cell will meet up with a process from another cell.

Where tendon cell membranes meet gap junctions are found. These gap junctions are specialized areas of the cell membrane that are organized collections of protein channels that allow ions and small molecules to negotiate their way between connected cells. These channels facilitate cellular communication, which enable cells to balance their key regulatory ions and molecules. It appears that the major physiological role of the gap junction is to synchronize metabolic and electronic signals between cells enabling key functions such as cell proliferation and cell differentiation.
It is believed that different types of gap junctions occur in lateral and longitudinal planes which have different communication characteristics. Therefore, in theory will have differing capabilities to pass chemical and electrical messages longitudinally and laterally. To me this makes perfect sense as the principal line of strain in a tendon is along the longitudinal plane. It is suspected that the failure in the correct function of these gap junctions is responsible for the significant down regulation of cellular activity in tendon cells which promotes the breakdown of the tissue architecture. I believe that this is why the electrical treatment led and perfected by my research is so effective in reversing this process returning it to a more ‘normal’ condition.

Discussion; Why the Superficial Digital Flexor Tendon (SDFT) ?

In the racehorse the SDFT is the most commonly affected tendon and the suspensory ligament the most frequently affected ligament accounting for 46% of all injuries at racecourses. It is almost certain that the injury is nearly always preceded by chronic degeneration, similar to the Achilles tendon in the human. When there is a repair a type III collagen (scar type tissue) replaces the normal type I collagen. This scar tissue is less flexible than the original tissue which increases the risk of re-injury. For many of these injuries time is not the best healer; commonly left to its own devices the tendon will repair with a type III fibrous collagen with the fibrils produced being of a lesser diameter than the original tissue so compromising the functional viability of the structure.

Therefore, an optimal treatment would be one that reduces the incidence of chronic degeneration and promotes a repair with a type 1 collagen. However, there does not appear to be a consensus among clinicians about the most appropriate treatment to apply in cases of tendon injury. I do believe that the mismanagement of tendon injuries, through a lack of understanding of the basic science underpinning their existence has significant implications because even a small degree of loss of tendon strength can result in a dramatic rise in the chance of a career threatening injury.

Tendon tissue is biologically unusual in that it follows a pattern of embryonic regeneration. This means that the tissue is constantly being broken down and replaced with new tissue. Therefore, there is a constant cycle allowing for transient changes, in the balance and it will remain within a functional tolerance.
However, particularly in the SDFT in the racehorse this balance is not maintained [cellular activity is reduced after the horses reaches the age of three/four]. The reasons for this are not yet clearly understood. However, the effect of this reduced level of cellular activity is the reduced capacity of the tendon to adapt and respond to repeated levels of mechanically stress induced micro-trauma. This is why we see degenerative pathology so prevalent in the older horse. The same is also true in humans in the Achilles tendon.

It is interesting to observe that in the immature racehorse there is a considerable level of collagen synthesis in the SDFT, which tails off as the horse matures; this contrasts with the common digital extensor tendon (CDET) that maintains collagen turnover into maturity. Injury to the SDFT is a very common occurrence, which prematurely ends the careers of many competition horses whilst injury in the CDET is rare. Whether this stasis of cellular activity in one tendon and not in the other is a contributing factor to the high difference in injury rates could be considered.

As a further confounder such is the small gene pool for the thoroughbred racehorse the possibility of a defective gene influencing the premature degeneration of tendon tissue has to be considered.

**Tendon Injury: How bad is it?**

In use, tendon’s undergo constant loading and unloading, often to extremes and are only capable of minimal elastic elongation, this makes them prone to injury. Tendons contain little vasculature and as a result the blood supply is poor. This is also true of ligaments. This poor blood supply often results in long healing times.

Over strain-induced tendon and ligament injury in the racehorse is very common and presents a great burden in terms of injured horses and financial loss to the racing industry. Tendon and ligament injuries account for 30% of wastage of young thoroughbreds\(^2\). These injuries also sideline an estimated of 25-30% of National Hunt horses in registered training – or not as the case is!

An ultrasound study on National Hunt horses in training showed that almost one half of all horses (43%) had evidence of tendon pathology\(^3\). A conservative estimate based upon anecdotal evidence suggests that tendon injuries normally take 12-18 months to heal and often render the horse to a reduced functional capacity post-injury. There is very little good quality published data about injury incidence and return to full racing function.
**The Role of Exercise Rehabilitation**

There is no doubt in my opinion that a structured exercise programme can significantly improve the prognosis of a racehorse with a tendon injury. A rehabilitation programme I feel should be based upon principles used extensively in human healthcare where the general philosophy adopted in musculo-skeletal medicine is one where mobilisation is preferential to immobilisation. This is particularly important in the remodeling phase of tissue replacement.

Methods of mobilisation used can be walking in hand, under saddle and when appropriate over a variety of terrains and gradients, eccentric proprioceptive neuromuscular facilitative stretching and basic schooling work where the body is treated as a whole entity rather than concentrating on the injury in isolation. Unless an injury is very severe I would not follow a regime of sustained period of box rest. I would not advocate use a circular horse walker but in preference horses should walked in hand, preferably in a straight line or using a treadmill which will reduce the torsional stress on the developing fibrillar collagen matrix during the remodeling phase of tissue repair.

The key elements to rehabilitation programme are:
- ✔ Consistency & repetition: little and often
- ✔ Treating the body as a whole
- ✔ Ensuring that any increase in the level of exercise in terms of frequency, intensity or duration, is taken in a stepwise incremental manner
- ✔ Good shoeing, keep the toe short and use a shoe with plenty of lateral and heel support
- ✔ Avoiding aggravating external factors such as uneven surfaces for example deep sand-based surfaces, small diameter automatic horse-walkers (less than 15m)

A variety of exercises help to make up a good rehabilitation programme
Conclusion
The reader may be thinking this is all very interesting but can the incidence of tendon injury be reduced? I feel this is a more relevant question than the other obvious question, what is the best method to treat a horse with tendon problem?

I believe the information above makes it clear that in the racehorse it is probable that some horses are carrying a genetic predisposition to present with future tendon problems. Evidence suggests that this is caused by a down regulation of the regenerative phase of tendon tissue replacement. If this is the case then horses with the potential to present with tendon problems (and we do not know in advance which horses are affected) should be managed a whole lot better than they currently are. I feel one significant area that is rarely mentioned when talking about racehorse training and is a known precipitator of soft-tissue injury in human athletes is the warming up and cooling down procedure pre and post exercise.

Currently, from what I have witnessed particularly the warm up regime is not given the serious consideration it should be. I cannot believe it when I hear supposedly knowledgeable television pundits commenting that a horse is getting warm and ‘sweating up’ before a race. Without straying into a whole new area of debate, I would like to see racehorses hot and sweaty before a race because it will mean they have been warmed up adequately. Can you imagine a human athlete contemplating running a track race having only had a ten minute walk before hand? This warm up should be not only confined to racing but also to training also.

I believe tendon problems in racehorses will always be a part of horseracing and are almost certainly caused by a myriad of different factors both extrinsic (outside the horse for example ground, shoeing etc) and intrinsic (inside the horse, for example physiology, biomechanics etc) but I also think that the incidence could be considerably reduced if we adopted an approach in the widest sense that is more akin to the training and welfare of elite human athletes. Reducing the extrinsic risk factors and recognizing and managing the intrinsic ones.

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References


2. www.red-horse.biz/Hauptpunkte/tendon_injuries.html

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