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TRANSLATIONAL TENDON REHABILITATION STRATEGIES FROM HUMAN TO HORSE

All tendons connect muscle to bone to enable movement. However, some tendons additionally act as energy stores. They stretch like springs and store energy when loaded, recoiling on release to reduce the work a muscle must contribute to locomotion[1]. The primary equine energy storing tendon is the SDFT, which stretches up to 20% during the landing phase of galloping, increasing galloping efficiency up to 36%[2]. Under such extreme mechanical demands, it is not surprising the SDFT is prone to overuse injury, particularly amongst racehorses and other horses used for fast galloping disciplines. SDFT injuries are highly debilitating, requiring considerable rehabilitation periods and are often career limiting. There is little convincing evidence of efficacy for any current treatment[3], and even after extensive periods of rest and rehabilitation, re-injury rates are extremely high, with little knowledge of how best to safely reintroduce training[4].

Most studies agree that high SDFT injury rates are a function of mechanical demand. Like most natural materials no SDFT is fully elastic, losing energy during each loading/unloading cycle (hysteresis) and accumulating fatigue damage5. Building on this, we have a growing body of evidence proportionally linking SDFT elasticity with injury risk: The more efficiently the SDFT can function under stretch and recoil, the more efficient (hence potentially faster) galloping becomes, whilst a tendon with poor stretch and recoil is more injury prone. We know injury risk increases with age6, and that one of the biggest risk factors for injury, is previous injury. Tendon does not fully regenerate following injury, but in fact replaces injured tendon tissue with fibrocartilaginous scar tissue which lacks the ordered hierarchical structure of longitudinally aligned collagen fibres, organized into fascicles, which are separated by an inter-fascicular matrix which provides most of the elastic function to the SDFT7. It has been hypothesized that reinjury occurs as a consequence of the abrupt interface between the stiffer scarred fibrocartilage, and the more elastic surrounding normal tendon.

Tendon injuries in man have a very similar aetiology to those seen in horses. There is a predilection for energy storing tendons, are associated with ageing and are over-represented in sports participants. Whilst any tendon can be affected by tendonitis, it is injuries to the patellar and Achilles tendon which are most widely investigated. Pathology in the rotator cuff tendons is also an extremely prevalent condition which frequently causes profound disability.

Tendon disease in humans can present with a variety of syndromes. They can present with acute rupture, which can occur without any warning, particularly in middle-aged men taking part in recreational sport. More commonly tendon disease presents as pain and stiffness, which is classically worse in the morning, and can be exacerbated by exercise. Inflammation is a variable feature, but there is usually thickening and pain associated with the site. This is distinct from the horse, where in the case of the most prevalent SDFT pathology, pain is frequently not a feature after the initial acute stage of the injury. Thus it could be argued that many human tendinopathies are more similar to DDFT tendonitis seen in the digit of the horse, where pain is a more consistent feature.

Treatment and rehabilitation of equine tendon injury has been well documented, but the literature lacks a good evidence base, particularly relating to appropriately designed well-controlled studies. There seems to be a consensus that acute management of tendonitis in the horse should include aggressive anti-inflammatory approaches combined with some degree of rest and/or immobilization. Subsequent to the acute inflammatory phase of treatment there is a lack of consensus, and a lack of strong evidence for any therapy which is most appropriate to rehabilitate tendon injuries. Most would agree that an ascending exercise mobilization programme is key aspect to rehabilitation, and exemplar exercise regimens have been published. Whilst I am sure we are all aware of numerous interventions for tendinopathy, including PRP, ACS, Stem cells (of various types), intralesional growth factors, PSGAGs, HA, desmotomy of the superior check ligament, shock wave therapy, laser therapy, therapeutic ultrasound etc etc, no treatment has yet found universal acceptance or been shown consistently in enough well designed interventional trials to be truly beneficial.

Treatment and rehabilitation of human tendon injuries has a very similar background and evolution to that seen in veterinary medicine. There are a plethora of proposed treatments, and for many treatments there is often a lack of consistent evidence to support efficacy. In human medicine, management of tendon injury frequently falls between disciplines, with

both orthopaedic surgeons, sports medicine practitioners and rheumatologists all at times treating such injuries, and therefore bring their particular bias to decision making. Often the lead in tendon treatment is taken by physiotherapists. The nature of sports medicine means there is often pressure for individuals to return to competition quickly, and frequently there may be rapid introduction of novel therapies which have not undergone appropriate scrutiny.

The scale of human medicine means that there is often sufficient clinical activity across the world which means that it has now been possible to undertake systematic reviews and meta-analyses to provide a greater evidence base for efficacy of tendon treatments. In recent years a number of such reviews have been published relating to tendon treatments. An analysis of studies relating to conservative therapy for Achilles tendinopathy identified strong evidence for efficacy of eccentric loading exercises, and extracorporeal shock wave therapy, moderate evidence for splint/bracing, active rest, low-level laser therapy and concentric exercises, and limited evidence for in-shoe orthoses and therapeutic ultrasound8. A Cochrane review investigating injection therapies in Achilles tendinopathy concluded that there was insufficient evidence to draw conclusions on the use, or support the use for any injection therapy in treating Achilles tendinopathy9. A systematic review of surgical treatment for Achilles tendinopathy identified a large variation in surgical techniques available for its treatment. All studies included lacked non-surgical or placebo control groups. Minimally invasive procedures yielded lower complication rates but similar patient satisfaction to open procedures10. A systematic review for platelet rich therapies identified no current evidence for their use in musculoskeletal soft tissue injuries11.

There is obviously considerable overlap in the aetiology and pathogenesis of equine and human tendon injuries. There is also considerable similarities in the disparate therapies available to treat such injuries in the two species, with a similar lack of good evidence for efficacy for many therapies. It remains to be determined what is the most appropriate technique to treat tendon injury, and currently there is a lack of evidence for real benefit for interventions over most long-tried conservative approaches.

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