Bandages, boots and tendon damage

Superficial digital flexor tendon (SDFT) injuries are among the most common causes of lameness in performance horses, especially polo ponies. It is thought that tissue damage chiefly occurs due to chronic (i.e. long-standing) overheating of tendons during and after exercise rather than an acute injury.

There is debate as to the relative merits of boots and bandages in protecting tendons and preventing build-up of heat during and after exercise. Dr Hannah Anderson BS, BVM&S, MRCVS of Waterlane Equine Vets in Gloucestershire has studied these effects and reports her findings in this article.

As a tendon stretches it stores energy that is subsequently released as heat when it recoils to the rest position. In one study it was shown that, with 5 minutes of galloping, the core of SDFTs heats to 45°C and this is sufficient to damage cells that make up the tendon.[1] Importantly heat accumulates and is retained for a period after exercise stops, with the result that tendons progressively degenerate over time.

Heat is believed to accumulate in tendons because of their lack of blood vessels and this makes them particularly susceptible to changes in temperature. Additionally, once damaged, the SDFT is shown to repair itself with tissue that is even less vascular than before[2] - leading to a higher likelihood of re-injury.

Heat produced from tendons during exercise is transferred to the skin via blood vessels so that it can be lost by either radiation, convection, conduction or evaporation. The effectiveness of these four methods of heat loss are altered when we place bandages or boots on the distal limbs. Anecdotally polo bandages are chosen over boots because fleece is widely used as a moisture wicking material to allow for greater heat evaporation than other materials.

---

[1] Wilson, A.M. and Goodship, A.E. (1994). Exercise-induced hyperthermia is a possible mechanism for tendon degeneration. *Journal of Biomechanics*. 27(7): 899 – 905.

[2]Stromberg, B. (1973). Morphologic, thermographic and 133 Xe clearance studies on normal and diseased superficial digital flexor tendons in race horses. *Equine Veterinary Journal.* 5(4):156 – 161.

Modern boot designs are, however, focused on increasing air flow to allow for higher convection and more effective cooling of the lower leg. To better understand the effectiveness of such boots and appreciate whether fleece bandages are detrimental, Hannah used thermal imaging to compare skin temperature in the region of the SDFT in polo ponies (Figure 1).

For one summer season, thermal images were taken using a FLiR One camera from Thermavet of 27 polo ponies before and immediately after they played a full chukka. The study was organised such that data were recorded from the same ponies when wearing fleece bandages or boots. Temperature differences before and after exercise were recorded for each pony and analysed statistically.

The results showed that fleece polo bandages caused a statistically significant greater increase in temperature than boots, suggesting that modern day boot designs are superior to polo bandages in regulating the extent to which heat accumulates in the lower limb (Figure 2). On average wearing boots led to a 2°C lower temperature, which could be critical in terms of the effects on tendon cells.

While Hannah did not specifically measure the core temperature of tendons, other research has shown skin temperature parallels that of the tendon,[3] and so it is reasonable to suggest that the core temperature would be higher when using fleece bandages.

The study also highlighted the importance of ensuring horses' tendons are cooled as quickly as possible after strenuous exercise in order to prevention of heat accumulating. This can be done by removing the bandages or boots immediately after exercise and applying cold water, ice or cold therapy boots.

Hannah concluded that it may be beneficial to use modern boots designed for increased airflow instead of bandages to keep the distal limb as cool as possible, prevent heat build-up and protect against tendon damage.

---

3 Petrov R., MacDonald M.H., Tesch A.M., Van Hoogmoed L.M. (2003). Influence of topically applied cold treatment on core temperature and cell viability in equine superficial digital flexor tendons. *American Journal of Veterinary Research*. 64(7): 835 – 844.

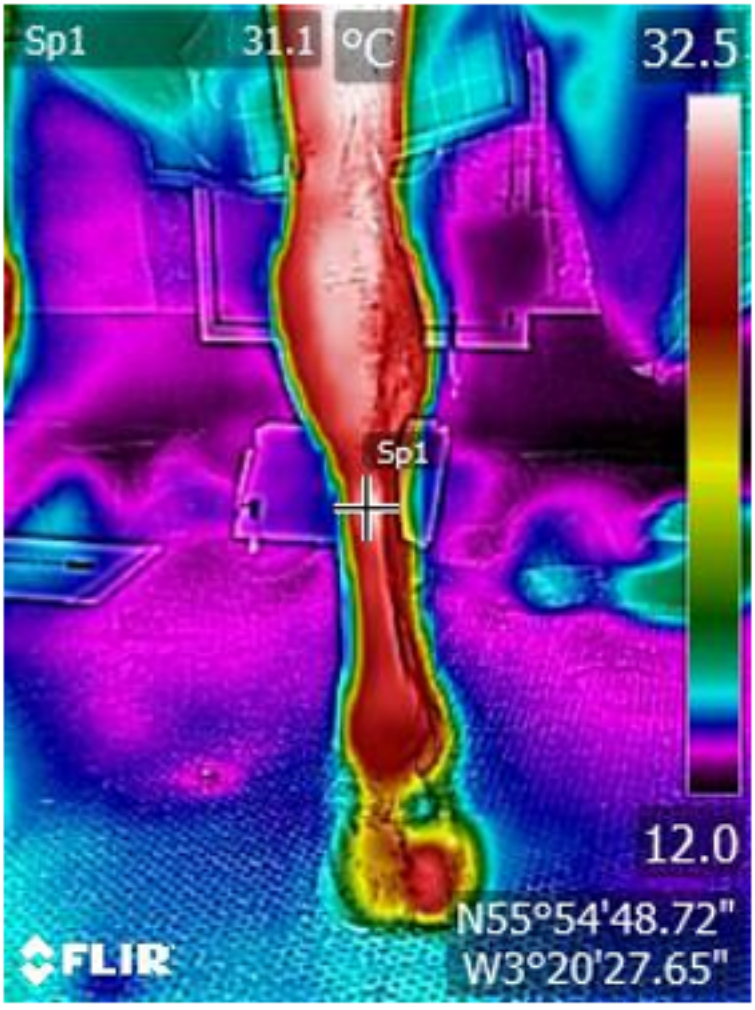

Figure 1. Post chukka thermal image of the right forelimb from behind with a temperature gradient on the right hand side (black being cold, white being hottest). Sp1 is placed at a clipped patch and gives the highest temperature reading from that area (31.1°C in this case).

Temperature change ('after' minus 'before') during a period of exercise (chukka)

	Polo Bandages	Boots
	Mean (°C)	*Mean (°C)*
Averages of All horses	+6.73	+4.58

Figure 2. Mean values from statistical analysis measuring skin temperature difference between pre- and post-chukka from 27 polo ponies.