Case study: Palmar heel bulb laceration

A plethora of products and therapies are available within the equine industry, and deciphering which are 'scams' and which may be of therapeutic value can be difficult for the veterinarian let alone the owner.

Frequently (and occasionally for good reason) 'alternative' therapies are dismissed by equine vets when discussing treatment protocols with their clients. This may be because the treatment is inappropriate, however occasionally it may be due to a lack of familiarity with that product. There is still much to learn about how 'Low Level Laser Therapy' (LLLT), homeopathy, acupuncture and even many veterinary medicines and surgeries do (or don't) affect patients.

This case study demonstrates how LLLT was incorporated into the veterinary management of a severe but uncomplicated wound, resulting in an excellent outcome. The role of LLLT as well as other factors contributing to the outcome in this case is then briefly discussed. Emphasis is placed upon the importance of collaboration between veterinarian and therapist for a successful outcome.

Case History

In September 2014 a 14 month old TB x Criollo gelding sustained a deep laceration to the lateral heel bulb of the right forelimb as a result of a wire injury (pictured after cleaning):

The gelding was 5/5 lame with moderate diffuse swelling of the limb. A complete veterinary examination including sedation, analgesia, antibiotics and tetanus prophylaxis was performed.

The wound was sustained less than 24hours ago however severe contamination, tearing and contusion of surrounding soft tissues precluded primary closure (stitching). The wound was cleaned with dilute chlorhexidine, debrided and then lavaged with sterile 0.9% Sodium Chloride solution. A firm bandage with an absorbent dressing was applied and strict box rest instigated.

It was anticipated that 2 weeks of dressing changes would be required to allow the wound to debride itself and start to granulate. Following this a cast would usually be applied to immobilise the area to optimise healing and speed recovery as compared to bandaging alone (Janicek et al 2005, Ketzner et al 2009).

The dressings were changed and the wound cleaned and gently debrided every 24-48 hours for the first 5 days, until the wound was clean and less productive. An 'LLLT' protocol was instigated and provided by a trained paraprofessional every 48 hours from day 5 post-injury (see text box below for protocol). Bandages were changed at the time of LLLT therapy with topical medical grade manuka honey dressings applied directly to the wound. A dramatic response in terms of wound contracture and healing was seen from 8 days onwards and it was decided not to cast the limb.

9th September 2014 (48 hours post-injury):

15th September 2014 (1 week post injury):

17th September (10 days post-injury):

19th September 2014 (12 days post-injury):

21st September (2 weeks post-injury):

25th September 2014 (final LLLT treatment, 17 days post-injury):

29th September 2014 (3 weeks post-injury) a biofilm persists on the pastern with a small amount of exuberant granulation tissue developing. This was managed with topical antimicrobial and betamethasone ointment and silver dressings.

7th October 2014 (4 weeks post-injury). Bandaging was stopped with restricted corral turn-out.

17th October 2014 (5.5 weeks post-injury). Unrestricted turn-out was permitted at 6 weeks.

Low Level Laser Therapy (LLLT) Protocol

LLLT can be applied as a pulsed or continuous wave, and when applied to the skin surface penetration depth can be varied by altering wavelength and power. A continuous beam is often used for analgesia (pain relief) however a pulsed wave is used for treating inflammation and stimulating repair.

An MR4 Activet(TM) laser was used to apply super pulsed LLLT to the wound by a paraprofessional trained in its use.

Using both visible red (640nm) and blue (470nm) wavelengths and infrared (870nm and 905nm) wavelengths at setting #1 (pulse repetition frequency of 50Hz) LLLT was applied to the wound margins for 5 minutes followed by setting #5 (pulse repetition frequency of 1-250Hz) for a further 5 minutes around the wound margins every 48 hours from day 5 post injury to day 17 post injury.

Discussion

This case healed more rapidly and with fewer complications than was anticipated for a wound in this area managed with bandaging alone. Hypertrophic granulation tissue and cheloid scar formation is common in distal limb wounds in the horse due to difficulties in restricting movement and controlling infection, and also due to inherent properties of the tissues in this area. The usual approach for this case would be to employ a distal limb cast with an expected total recovery time of around 5 weeks (Janicek et al 2005, Ketzner et al 2009).

Multiple factors may have contributed to the successful outcome in this case; the age, breed and health status of the horse, rigorous wound management and box rest, possibly the use of manuka honey dressings (Carnwath et al 2014, Jull et al 2013), possibly photodynamic/LLLT therapy and the absence of complicating factors such as the presence of a sequestrum/foreign body or infection.

Photodynamic Therapy

LLLT has been employed as a rehabilitative therapy for nearly 40 years. Much of the research that is cited in support of its use was performed by the National Aeronautics and Space Administration (NASA) when they investigated the application of a Light-emitting Diode (LED) laser to increase cell metabolism. The benefits of this would be to reduce muscle and bone atrophy in astronauts during mission periods.

Work following on from NASA's initial studies has shown that LLLT reduces oxidative stress in cells and increases ATP production (Sommer et al 2001, Wong-Riley et al 2001, Karu 2008); and there is plenty of *in vitro* evidence to support the *theoretical* application of LLLT (Aimbre et al 2006, Ehrreigh & Furchatt 1968, Sutherland 2002). In human medicine LLLT has been used to reduce pain (Konstantinovic et al 2010), inflammation (Aimbre et al 2006) and oedema (Omar et al 2012) and has also been seen to promote wound healing (Hopkins et al 2004, Whelan et al 2001). More recently it has been proposed as a pre-conditioning tool, to prime tissues for a future insult such as surgery or strenuous activity (Agrawal et al 2014).

Unfortunately clinical trials investigating the use of LLLT cannot provide robust evidence for its efficacy due to a lack of a standardised LLLT products and protocols, and a lack of controls. Results are also inconsistent due to multiple variables in individual patients. Nonetheless LLLT is recognised in human medicine in the USA, Canada and the UK and its application usually requires

a prescription or referral. The procedure itself is usually carried out by medical paraprofessionals and therapists working closely with the physician. LLLT is not currently recognised by human medical insurance companies and the same is likely to apply for animals.

Unfortunately 'alternative therapies' are not strictly controlled in equine medicine and many commercially available lasers are marketed to the equine industry. Few of these are controlled or have robust clinical evidence to support them when applied to the equine athlete. As a result these therapies are regarded with a healthy dose of scepticism by most veterinarians in the UK partly due to lack of understanding and partly due to the plethora of 'bogus' products that they are presented with on a daily basis.

We can reasonably extrapolate from LLLT use in human medicine to other mammals however, and the fact that no adverse side-effects have been documented should allow us to proceed with confidence in the equine patient. It is up to the owner to source a safe and reputable LLLT source, and to allow the therapist to communicate with their veterinarian to enable incorporation of an LLLT protocol into an overall management strategy (i.e. coinciding with bandage changes and so on).

This case study demonstrates how LLLT has been successfully incorporated into the veterinary management strategy for a severe heel bulb laceration. In this instance, the combination of prompt veterinary management, rigorous nursing and the application of a complete LLLT protocol has, amongst other factors, resulted in a rapid and successful outcome with minimal complications.

This case study reports on a single case and its outcome; a similar management strategy may not necessarily achieve the same results in a different patient or injury. It is important to seek prompt veterinary advice for any wound on the distal limb.

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