Veterinary physiotherapy for back pain in the horse

This review presents the veterinary physiotherapist's approach to assessment and treatment of back pain in horses, while supporting veterinary care as part of the multidisciplinary team. Veterinary physiotherapists aim to restore painless optimal function using their scope of physiotherapy treatments, which are individualised to the patient, including manual therapy, the use of electro-physical and specific therapeutic exercises, as well as the prescription of a rehabilitation plan. The combination of pain relief and acquisition or maintenance of the required range of motion, along with ensuring postural stability and muscle activity, are the initial principles of treatment. A chartered physiotherapist can also assess the rider and their ability to function optimally, potentially providing interventions to ensure riders do not negatively influence their horse. Following clinically reasoned use of manual and electro-physical therapies for the horse with back pain, re-education of positive movement patterns and subsequent muscle strengthening is required. Successful physiotherapy will ensure that a horse is comfortable and capable of carrying a rider, and is thus able to perform the functional tasks required.

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The treatment of equine back pain comprises a significant part of a veterinary physiotherapist's caseload. The presence of back pain is very common in the ridden horse and has a detrimental effect on performance, as well as being a welfare concern. Behaviours in horses with back pain can be extreme, although some horses with significant spinal pathologies never display signs of pain (Zimmerman et al, 2012). It is recommended that all ridden horses should be considered at risk of having back pain, irrespective of the scale of the presenting clinical signs.

The aim of physiotherapists, alongside veterinary management, is to restore optimal function as painlessly as possible (McGowan et al, 2007). The scope of physiotherapy treatments includes manual therapy, the use of electro-physical therapies and specific therapeutic exercises, as well as the prescription of a rehabilitation plan. In the context of musculoskeletal conditions, rehabilitation is focused on building capacity in tissues, using gradual overload, progressing intensity and complexity of movement or physical activity (Cook and Docking, 2015). The application of treatments and rehabilitation techniques by a qualified veterinary physiotherapy professional should be evidence based, using the critical application of knowledge gained from an increasing number of equine-specific studies, and from research in human physiotherapy. For further reading regarding the science underlying the application of physiotherapy to horses, McGowan et al's (2007) paper provides a thorough comparative review.

In fact, 'physiotherapy' or 'physical therapy' should not be considered a technique, as it is the role of the physiotherapist to clinically reason the choice of intervention and they may use many methods or techniques of treatment (Jull and Moore, 2021).

A veterinary physiotherapist may be asked to assess a horse for potential causes of performance difficulties in the first instance, or following veterinary diagnostics and interventions. As physiotherapists may be regularly monitoring the horse as part of a routine care plan, the identification of back pain and its cause early after onset will support longer term maintenance of the horse's health. When a physiotherapist has concerns about the underlying cause of or lack of response to treatment of back pain in the horse, the horse should be referred to the veterinarian for investigation. A physiotherapist working within their scope of practice will be able to identify when a case is not appropriate for physiotherapy and thus will not solely treat the horse at that time.

Even with clinical examination and diagnostic imaging modalities, the underlying aetiology of back pain is often poorly defined (King et al, 2022). Back pain can arise from primary issues such as poor saddle fit causing muscle pain, or secondary to pathology elsewhere in the horse, causing lameness, alteration of spinal kinematics and subsequent back pain (Landman et al, 2004). However, the most common presentation in horses with back pain is over-riding spinous processes (Jeffcott, 1980), and a veterinary physiotherapist can support return to optimal function following medical or surgical treatment of this condition. It is critical that the veterinary physiotherapist is aware of the potential multifactorial aetiology and ensures that assessment, treatment and rehabilitation consider the whole horse. While treating back pain locally may relieve clinical signs in the short term, if there is an

underlying pathology, either local or distal to the spine, the treatment will not have a lasting effect. This supports the ongoing need for veterinary physiotherapists to work in partnership with veterinarians, who can provide diagnosis and allow physiotherapy input that considers holistic management of back pain.

Veterinary physiotherapy assessment

Veterinary physiotherapy assessment of the back region follows a thorough history taking from the owner or rider, during which the clinical signs of back pain during riding and when not ridden should be discussed. Expressions of certain behaviours, observed in the ridden horse, have been associated with the presence of pain and have been shown to reduce after diagnostic analgesia (Dyson and van Dijk, 2020). A study by Dyson et al (2018) provided a detailed investigation of behaviour in lame horses during riding, observing that eight or more of the 24 behaviours listed in *Table 1* that are linked to pain. While this study was limited to horses with lameness, similar behaviours displayed in horses with back pain have been reported anecdotally. Therefore, being aware that back pain can be expressed by the horse through a wide range of behaviours is important, as an owner may not link these signs to the presence of pain (Landman et al, 2004; Lesimple et al, 2013; Dyson and Pollard, 2020). Behaviours exhibited by a horse can also serve as an objective marker and be used to track the progress of any treatment protocol.

An assessment should start with an observation of the horse standing, particularly in a square standing position as well as the standing alignment self-selected by the horse. Assessing conformation of the horse and the adopted posture can give an indication of where pain, and secondary compensations to reduce and off-load the pain, are arising from. Horses with back pain can demonstrate a range of altered postures, but most often have increased extension and therefore a greater thoracolumbar lordosis (Clayton, 2016). Longer-term adaptations to pain may include muscle use changes that lead to atrophy or the overuse of compensatory movement patterns and therefore undesired hypertrophy (*Figure 1*). An imbalance of under- or overuse will then result in reinforcement of the antalgic posture. An example is atrophy of the thoracolumbar portion of the longissimus dorsalis and cranial regions of gluteus medius and overdevelopment of the caudal brachiocephalicus and sternocephalicus along with the pectoralis superficialis.

It is important to include assessment of gait in the horse with back pain, as back pain affects spinal movement (Wennerstrand et al, 2009) and therefore results in a lack of normal mobility during in-hand walk and trot, as well as during upward and downward transitions. In addition to in-hand straight line exercise, seeing the horse negotiate small circles and turns is essential to evaluate the range of lateral bend in the spinal regions. Although spinal range of motion is limited to a few degrees in the thoracolumbar region, lateral bend and rotation should be observable as the horse is asked to step the inside hindleg under the body as it moves around the turn. Although the greatest range of motion is found in the cervical regions (Clayton et al, 2012), the motion on the left and right sides can be compared. When asking the horses to rein-back, the alteration of the diagonal interlimb coordination can be a feature of horses with thoracolumbar stiffness as well as reduced flexion through the region as the weight is shifted towards the hindlimbs.

A thorough gait assessment also includes dynamic evaluation on the lunge and, in some instances, when ridden. When the horse is lunged, the assessment can include canter and transitions into and out of this gait that requires more propulsion and lum-

Table 1. Summary of the equine ridden pain behaviour ethogram

Area	Behaviour descriptor
Body: head	• Repeated changes of head position (up/down) • Head tilted or tilting repeatedly • Head in front of vertical (>30°) for ≥10 seconds • Head behind vertical for ≥10 seconds • Head position changes regularly, tossed or twisted from side to side, corrected constantly
Facial - ears, eyes, mouth	• Ears rotated back behind vertical or flat (both or one only) ≥5 seconds, repeatedly lay flat • Eyelids closed or half closed for 2–5 seconds • Sclera exposed • Intense stare for 5 seconds • Mouth opening and shutting repeatedly, for ≥10 seconds • Tongue exposed, out and/or moving in and out • Bit pulled through the mouth on one side (left or right)
Body: tail	• Tail clamped tightly to middle or held to one side • Tail swishing large movements: repeatedly up and down/ side to side/circular; during transitions
Gait	• A rushed gait (frequency of trot steps >40/15 seconds); irregular rhythm in trot or canter; repeated changes of speed in trot or canter • Gait too slow (frequency of trot steps <35/15 second) passage-like trot • Hindlimbs do not follow tracks of forelimbs but deviated to left or right; on three tracks • Spontaneous changes of gait (breaks from canter to trot) • Canter repeated leg changes: repeated strike off wrong leg; change of leg in front and/or behind; disunited • Stumbles or trips/catches toe repeatedly
Gait - obedience	• Sudden change of direction, against rider direction • Reluctance to move forward, stops spontaneously • Rearing (both forelimbs off the ground) • Bucking or kicking backwards (one or both hindlimbs)

Adapted from Dyson et al (2018)

Overdevelopment of the caudal brachiocephalicus and sternocephalicus along with the pectoralis superficialis

Atrophy of the thoracolumbar portion of longissimus dorsalis and cranial regions of gluteus medius

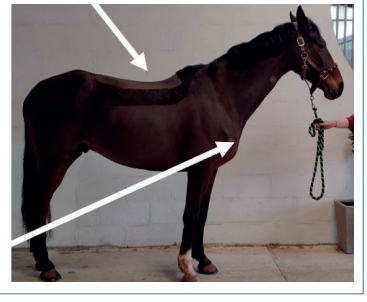

Figure 1. Two horses diagnosed with over-riding dorsal spinous processes, demonstrating antalgic posture and imbalanced muscle patterns.

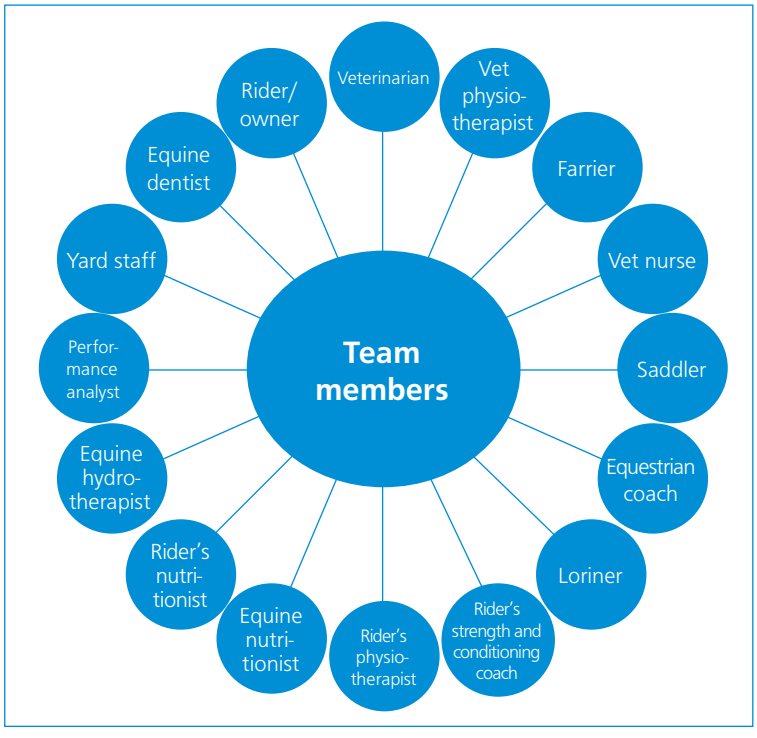

Figure 2. Examples of the professionals that may be involved in the treatment and rehabilitation of horses with back pain. Using the support of a wider professional team during treatment and rehabilitation of a horse with back pain is recommended to assist the horse's return to optimal performance.

Table 2. Categorical scoring system used to document response to palpation

Score	Description
0	Soft, low tone
1	Normal
2	Increased muscle tone but not painful
3	Increased muscle tone and/or painful (slight associated spasm on palpation, no associated movement
4	Painful (associated spasm on palpation with associated local movement, i.e. pelvic tilt, extension response),
5	Very painful (spasm plus behavioural response to palpation, i.e. ears flat back, kicking)
It is important to note the name and location within the specific muscle or region being palpated with the score.	

bosacral flexion (Johnson et al, 2009) which may be affected with thoracolumbar pain, especially in the caudal region of the spine (Barstow and Dyson, 2015). Throughout all assessments, the facial expressions (Gleerup et al, 2015) and behaviours of the horse should be evaluated for signs of pain (Dyson et al, 2018).

Although diagnosis is not within the scope of a physiotherapist's role, screening the horse for lameness is part of the assessment process. If lameness is seen and was not expected by the physiotherapist to be a part of the referral for treatment, discussion with the veterinarian should take place before physiotherapy continues. Lameness and back pain commonly present together (Landman et al, 2004) and treating the back pain could be part of the management plan. It should be noted that treating back pain may well remove the compensatory management strategy for the horse and the lameness may subsequently appear worse, although this can be useful to aid diagnosis by breaking the cycle of pain, compensation and lameness. Another element of the horse that should be evaluated, which relates to proximal pain from a more distal cause. is foot balance. Mansmann et al (2010) reported that long hind toes were related to gluteal pain, which could in turn influence the thoracolumbar region. The saddle should also be assessed by the physiotherapist to exclude back pain being caused by a poor fit (Greve and Dyson, 2015). Being thorough in assessments and communicating with the multi-disciplinary team supporting the horse with back pain (*Figure 2*), will likely contribute to a more positive outcome of physiotherapy treatment.

In the stable, assessment should continue with range of motion tests, achieved through passive mobilisation of the spinal joints and baited stretches to move the horse's head and neck through flexion and lateral bend, which induces flexion and bend in the thoracic regions at the end of range (Clayton et al, 2010, 2012). Reflex movements can be used to induce spinal movement as well (Riedler et al, 2020), although cases with acute pain and obvious muscle spasm are likely to evoke pain followed by a behavioural response, and would therefore not be a reliable test of range of motion, but can act as a marker of clinical signs.

Soft tissue palpation should also be included in the assessment, and hyperalgesia and/or hypertonicity may be displayed via changes in facial expression or aversive behaviour signs, such as withdrawal locally in the region or in the wholebody. There are published and validated scoring systems for palpation findings, such as that used in by Merrifield-Jones et al (2019) (*Table 2*), and pressure algometry can be used to provide a more objective measurement of pain threshold (Haussler and Erb, 2006).

Following assessment, a problem list can be compiled, representing the main aims of treatment in a sequential manner. Working together with the owner and the veterinarian, the physiotherapist will then be able to plan the immediate treatment and ongoing interventions required, and structure an exercise rehabilitation plan.

Veterinary physiotherapy treatment

Veterinary physiotherapy treatment may commence immediately following initial assessment, or later following veterinary intervention. Within the scope of practice of physiotherapy, there are several options for treatment and the selection of interventions must be individualised for the horse. Exactly which treatments are used may also be influenced by the equipment and facilities available, as well as the experience of the main carers who may be tasked with carrying out rehabilitation between veterinary physiotherapy treatments. The goals of treatment and the expectation of outcomes should be discussed between the members of the team involved in the horse's management, before and during the period of care. Treatment approaches include forms of manual therapy, electrophysical therapies and exercises, as well as educating and advising the owner. The success of rehabilitation relies on the continuity of

the rehabilitation plan when the physiotherapist is not present, so it is critical that the owner appreciates their role, and commits to being compliant with recommendations, to improve the chance of successful rehabilitation (Jack et al, 2010).

Manual therapy

Manual therapy, defined as 'passive or assisted active movement techniques applied by the therapist to address pain and impairment of the articular, neural and muscular systems' (Goff, 2009), has been advocated to reduce equine back pain. Inclusive of techniques such as massage and myofascial techniques (Haussler, 2009), manual therapy also refers to joint mobilisation and manipulation techniques. The main aims for manual therapy are to reduce pain and increase joint range of motion. The pressure applied by the hands mechanically stimulates the mechanoreceptors in joints and the soft tissues, resulting in neurophysiology responses within the peripheral and central nervous system. It is these effects that are responsible for pain inhibition (Bialosky et al, 2018).

The intervertebral and facet joints in the thoracolumbar region can be mobilised via pressure applied dorsally and this has been shown by Haussler et al (2010) to create intervertebral movement in the spinal regions and result in increasing mechanical nociceptive threshold. While terminology used by musculoskeletal practitioners may imply bio-anatomical effects, such as 'putting joints back in', there is no evidence for this in the literature. A manual therapy technique called 'reflex inhibition' does alter muscle tone (Wakeling et al, 2006) and therefore a secondary effect of alteration of spinal position may be a benefit if the hypertonicity is reduced. The long-term effects of manual therapy have not been studied and so it is important to follow up a hands-on treatment session with exercises to maintain the improvements gained during the session.

Electro-physical therapies

Electro-physical therapy devices such as laser, ultrasound and electrical muscle simulation are used in horses with thoracolumbar pain. Low level laser has been shown to reduce epaxial muscle hypertonicity and trunk stiffness in horses with back pain (Haussler et al, 2020). This study reported on 61 horses being treated at a competitive event, demonstrating that a combination of laser and chiropractic care had the most effect. However, there is some debate surrounding the depth of penetration of laser light through hair (Ryan and Smith, 2020) and darkly pigmented skin (Duesterdieck-Zellmer et al, 2016), therefore optimum treatment parameters such as wavelength and power need to be considered. Without adequate analysis of the factors that influence efficacy of any electro-physical therapy device, including lasers, the treatment is likely to be ineffective and therefore economically unjustified.

Therapeutic ultrasound is delivered to tissues with the aim of reducing pain and stimulating healing via thermal and non-thermal physiological effects. Adair and Levine (2019) measured the heating effect of a continuous 1.0MHz therapeutic ultrasound at 1.0W/cm² and 2.0W/cm². At depths of 1cm, 3cm and 5cm there was heating, but only the lower end of the therapeutic range of tissue heating was achieved with 2.0W/cm² at 1cm. In the UK it is more common to use lower intensity non-thermal doses, using pulse ratios such as 1:4 for the treatment of acute lesions, reducing to 1:3 as the tissue moves towards the chronic state and then to 1:2 end up with 1:1 as continuous modes (Watson, 2021). More research into the effects of pulsed ultrasound on back pain is needed.

Electrical stimulation for pain relief, such as transcutaneous electrical nerve stimulation (TENS) and functional electrical stimulation (FES) can be used. The current is passed through the tissues from electrodes placed on the skin and either the sensory nerves (for TENS) or motor nerves (for FES) can be stimulated. The FES parameters reported to reduce hypertonicity in the thoracolumbar epaxials uses a frequency of 60Hz, cycled for 2 seconds on and 2 seconds off. This induces a muscle contraction between the electrodes and with enough intensity of current, creates spinal movement. Ravara et al (2015), Schils and Turner (2014) and Schils et al (2015) have demonstrated consistent reduction in hypertonicity with increased mitochondrial density and distribution after treatment, with improving muscle function following treatment, and this is therefore indicated as part of the treatment plan. A small study using neuromuscular electrical stimulation, at low frequencies, to stimulate rhythmical muscle contraction increased mechanical nociceptive thresholds and affected skin surface temperature, also indicating its therapeutic effects (Mckinnon and Tabor, 2020).

A therapeutic technology using radiofrequency, called capacitive resistive electric transfer, showed a reduction in thoracolumbar and epaxial pain as well as improved back flexibility in horses with back pain (Argüelles et al, 2020). This is a promising modality for horses with mild to moderate thoracolumbar pain, although a more recent study showed no benefit with the same treatment for neck pain and discomfort (Parkinson et al, 2022), with the authors suggesting that further research is warranted to understand the precise mechanisms for pain relief resulting from non-thermal and thermal effects. However, a second paper by Becero et al (2020) looking into the effects of treatment in the thoracolumbar region showed improved gait parameters, providing early evidence on which to base further studies into its effects.

Pulsed electromagnetic field (PEMF) therapy has been trialled to treat equine back pain with varying results. While Biermann et al (2014) did not find any improvement to mechanical nociceptive thresholds or spinal movement after using a PEMF rug, King et al (2022) used a different form of PEMF (BEMER) and found a reduction in back pain and an increase in movement in their study of horses with back pain. This form of therapy does require further research, as this study did not have a blinded control or placebo group, and a second study into the effects of BEMER which did use a placebo group showed no difference in other markers such as haematological, biochemical blood and behavioural parameters within 1 hour after moderate exercise (Dai et al, 2022).

Exercise

With knowledge that there is a relationship between osseous pathology, muscle atrophy and asymmetry, and horses presenting with back pain having epaxial atrophy (*Figure 1*), restoration of muscle strength and mass is the key goal of physiotherapy. Pain must be treated first or concurrently, as arthrogenic inhibition (Lepley and Lepley, 2021) or the alteration of spinal kinematics as a result of pain, is going to limit the effect of exercise.

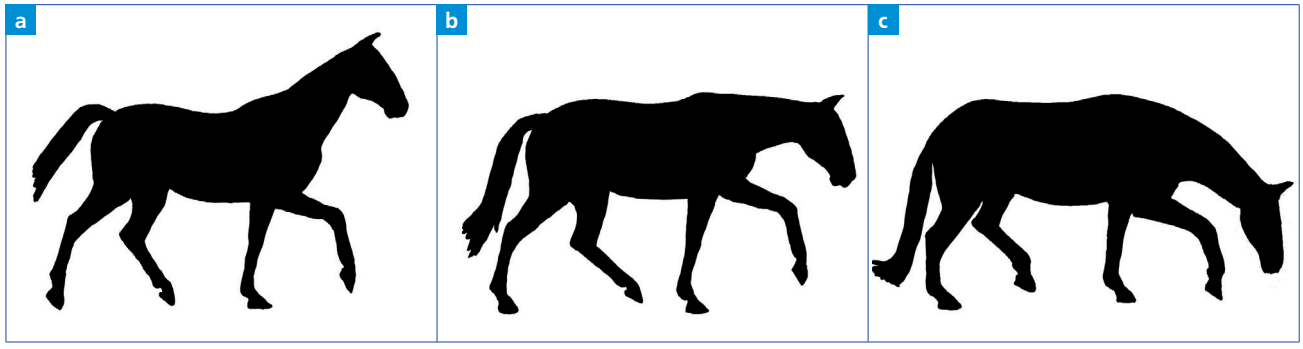

Figure 2: Head and neck positions used in rehabilitation a) raised head, b) poll level with the withers and c) nose low and close to the ground.

Atrophy and asymmetry of the deeper spinal stabiliser multifidus is not visible externally, but it has been consistently shown that exercises selected to target this supporting muscle do have hypertrophic effects (Stubbs et al, 2011; de Oliveira et al, 2015; Ellis and King, 2020). These exercises are undertaken at low intensity and high repetition, patterns of movement that take the spine through a range of motion that includes multiplanar directions. Examples are weight shift exercises and baited dynamic mobilisations in standing and in-hand exercises, with circles and turns as well as walking and trotting over poles. When used as part of a rehabilitation plan, these exercises resulted in improved postural stability and increased multifidus cross-sectional area (Ellis and King, 2020). While the horses in this study were rehabilitating from lameness, the exercises are equally applicable to an exercise plan for horses following treatment of equine back pain.

Using ground poles, in-hand or ridden, during walk or trot is an easy effective exercise, with evidence for changing kinematics without increasing loading forces through the limbs (Brown et al, 2015; Clayton et al, 2015). The joints of the thoracic and pelvic limb have increased flexion (Brown at al, 2015), and this alteration in the swing phase movement requires greater muscle activity in the trunk, increasing the activation of the rectus abdominus and longissimus dorsi (Shaw et al, 2021). Thus, while inducing limb joint range changes, the use of poles also has a beneficial effect on the hypaxial and epaxial muscles of the thoracolumbar spinal region.

Lunging, hand-walking or long-reining are all suggested for early-stage and non-ridden rehabilitation, although the exact choice will depend on upon the horse's current fitness levels and previous level of training. Lunging creates multidirectional forces (Pfau et al, 2012), and asymmetric longissimus dorsi activity (Cottriall et al, 2008), which may initially fatigue or damage weak tissue, therefore sessions must be short and gradually introduced. Long reining or hand-walking may be preferable to repetitive circling. However, as not all horses are trained to long-rein, this may not be appropriate. Also, trot work cannot be introduced in-hand unless the horse is well behaved and the handler very fit. Progressing from hand-walking to short bouts of lunging may be a good option when looking to introduce trot, although the exact timing of this should be decided under physiotherapist guidance.

An important consideration for any dynamic activity, either in-hand or ridden, is the spinal posture of the horse. If the head is raised there will be an increase in thoracolumbar extension, which is not desired as this reduces the distance between the spinous processes (Berner et al, 2012) (*Figure 2a*). Therefore, the handler needs to initially focus on maintaining a relatively low head and neck position, but without the head being behind the vertical which will also adversely affect spinal kinematics (Álvarez et al, 2006). A head and neck position that is easy to adopt and train the horse to maintain is with the poll level with the withers, and this translates to ridden work as well (*Figure 2b*). Head and neck positions with the nose very low and close to the ground (*Figure 2c*) should not be maintained for long periods, to avoid increasing the load on the forelegs excessively (Weishaupt et al, 2006).

A common theme in rehabilitation exercises for horses with back pain, based on the bow and string theory (Slijper, 1946), is core strengthening (contracting the string) to encourage flexion of the spine (stretching the bow) and separate spinous processes (Coomer et al, 2012). Although this management approach is logical, it is interesting that there is no research into flexion-focused postures vs normal protocols. Usage of a pessoa training-aid is sometimes prescribed to encourage flexion (Coomer et al, 2012). However, flexion may not always be achieved as, although the pessoa increases lumbosacral flexion, no postural change was detected in the thoracolumbar region on kinematic analysis (Walker et al, 2013). It also does not increase epaxial activity as previously thought (Cottriall et al, 2008), although strengthening of the hypaxial muscles cannot be ruled out. Álvarez et al (2006) discovered that raised or lowered rounded head and neck positions, which can result from the use of a training aid such as the pessoa, creates extension of the thoracic region, which would increase spinous process proximity where impingement is most common (Jeffcott, 1980).

An alternative training aid available uses elastic resistance bands to create a sensory stimulus to the abdominal muscles and hindquarters, with the aim of influencing proprioception and muscle recruitment. Use of this training aid for 4 weeks has been shown to increase dorsal-ventral displacement and reduce rotation of the horse's thoracolumbosacral spine, which is reported to be a sign of improved dynamic stability (Pfau et al, 2017). These suggestions to support the use of elastic resistance bands align with the goal of restoring presumed atrophied and asymmetric spinal stability musculature, and is therefore an option for influencing motion during in-hand and ridden exercise.

The rider

A chartered physiotherapist, qualified to treat humans as well and animals, will be able to consider the rider's influence on the horse

which is critical when ridden exercises are a component of the back pain rehabilitation. A horse's back pain can be made worse by a rider, from the addition of their weight (de Cocq et al, 2004) or from pre-existing injuries, such as asymmetries of the hips and pelvis, that affect how they communicate with the horse (Gandy et al, 2014; Barstow and Dyson, 2015). Therefore, where qualified to do so, being able to assess and treat the rider using physiotherapy will support the management of the horse–rider dyad to return to optimum function, without the rider impeding the horse.

Conclusions

It is critical to address the underlying cause of back pain, whether that be primarily orthopaedic causes or those secondary to poor management of equipment, feet or from the rider. This will ensure that the treatment aligns with resolution and management of the factors causing pain. Physiotherapists should work in conjunction with the veterinary surgeon and alongside other professionals such as the farrier and saddler. Fixed protocols, or 'recipes' for treatment and rehabilitation plans are likely to be limited in their effectiveness, as each horse should be treated as an individual.

The outcome of physiotherapy interventions for back pain relies on accurate and objective assessment, as well as clinical reasoning of the most appropriate manual and electrotherapy techniques. Following this, the selection of exercises that are correct for the stage of recovery and training of the horse, is imperative for ongoing progression and prevention of recurrence. Veterinary physiotherapy treatment and rehabilitation can be successful for equine back pain and thus result in restoration or improvement of function and performance, supporting the welfare of the ridden horse.

Conflicts of interest

The author has no conflicts of interest to declare.

KEY POINTS

- The treatment of equine back pain comprises a significant part of a veterinary physiotherapist's caseload and it is their role to clinically reason the choice and application of treatment and rehabilitation methods.
- Manual therapy has been advocated to reduce equine back pain, aiming to reduce pain and increase joint range of motion.
- Electro-physical therapy devices such as laser, ultrasound, electrical muscle simulation and radiofrequency are used in horses with thoracolumbar pain but optimum treatment parameters such as wavelength and power need to be considered.
- Restoration of muscle function, strength and mass is a key goal of veterinary physiotherapy and rehabilitation
- Physiotherapists should work in conjunction with the veterinary surgeon and alongside other professionals such as the farrier and saddler.

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