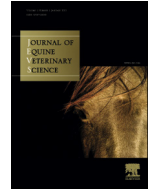




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Review Article

The Use of Treadmills Within the Rehabilitation of Horses

Kathryn J. Nankervis^{a,*}, Elizabeth J. Launder^b, Rachel C. Murray^c^a Performance in Equestrian Sport Group, Hartpury University Centre, Hartpury, Gloucestershire, UK^b Osteopathy for Horse and Rider, Welshpool, Powys, UK^c Centre for Equine Studies, Animal Health Trust, Newmarket, Suffolk, UK

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ABSTRACT

Treadmills and water treadmills are found in research centers, therapy centers, and are becoming increasingly common in private competition yards, yet little evidence exists which informs their use for rehabilitation of injury. The control that they afford in terms of speed, intensity, and duration of exercise is attractive, but guidance regarding any possible benefits and/or contraindications for treadmill exercise in any given scenario is limited. In this review, the evidence pertaining to the physiology and biomechanics of treadmill exercise in horses is examined and combined with our experiences of using treadmills for rehabilitation over 15 years to offer some basic guidelines as to their use. Evidence is presented to support the use of a land treadmill in the rehabilitation of horses following various distal limb conditions and back pain. The effects of water treadmill exercise on limb and back kinematics are considered and suggestions made as to how to select the most appropriate water depth for various conditions. Successful rehabilitation depends as much on avoidance of unsuitable exercise as selection of beneficial exercise. In time, more evidence regarding the use of treadmills for specific conditions will accrue; but as horses commonly suffer from multiple conditions (e.g., hindlimb lameness and back pain), it is likely that a rationale devised on a case by case basis will always be necessary, with regular monitoring of the gait pattern throughout rehabilitation.

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1. Introduction

Treadmills and water treadmills are found in research centers, therapy centers, and are becoming increasingly common in private competition yards, yet little evidence exists which informs their use for rehabilitation of injury. The control that they afford in terms of speed, intensity, and duration of exercise is attractive, but guidance regarding any possible benefits and/or contraindications for treadmill exercise in any given scenario is limited. Within this review, we shall examine the evidence pertaining to the physiology and biomechanics of treadmill exercise in horses and combine this with our experiences of using treadmills for

rehabilitation over 15 years to offer some basic guidelines as to their use (see [Table 1](#)). Successful rehabilitation depends as much on avoidance of unsuitable exercise as selection of beneficial exercise. In time, more evidence regarding the use of treadmills for specific conditions will accrue; but as horses commonly suffer from multiple conditions (e.g., hindlimb lameness and back pain), it is likely that a rationale devised on a case by case basis will always be necessary, and to develop this rationale requires a full understanding of the exercise being undertaken and its likely effects on limb loading, stride kinematics, posture, and muscle development.

1.1. Type of Treadmills Available

For the purpose of this review, a “land/high-speed/dry” treadmill will be referred to as a land treadmill, as distinct from a “water treadmill.” Land treadmills offer variable

* Corresponding author at: Kathryn J. Nankervis, Performance in Equestrian Sport Group, Hartpury University Centre, Hartpury, Gloucestershire GL19 3BE, UK.

E-mail address: kathryn.nankervis@hartpury.ac.uk (K.J. Nankervis).

Table 1
Recommendations and contraindications for the use of treadmill exercise in rehabilitation.

Yes	No
Land treadmill exercise	
Acute SDFT injury	Acute DDFT injury
Post-treatment for impinging or over-riding dorsal spinous processes on flat and inclines < 3%	DIP joint pain
Sacroiliac region pain	
Suspensory desmitis (fore- and hindlimb; but not inclines > 3% for hindlimb cases)	Horses with hindlimb suspensory desmitis and particularly straight hindlimb conformation (in combination)
Upward fixation of the patella (including incline)	Unilateral upward fixation with marked muscle asymmetry (avoid incline)
Water treadmill exercise	
SDFT injury post ~ 1 mo	Acute SDFT or DDFT tendonitis
Post-treatment for impinging or over-riding dorsal spinous processes (avoiding high water for cases affected in midthoracic region)	Hock joint pain
Sacroiliac region pain (postacute phase)	Wounds
Proximal suspensory desmitis (fore)	
Proximal suspensory desmitis (hind) use with care	
Distal limb chip fracture rehabilitation	Skin conditions

Abbreviations: DDFT, deep digital flexor tendon; DIP, distal interphalangeal; SDFT, superficial digital flexor tendon.

speed (often from 1.4 m/second to up to 16 m/second) and often a variable incline (0%–10% or 6°). Fans are required even for low speed exercise on a land treadmill as heat loss due to convection and evaporation are reduced when a horse exercises in a closed air space. Water treadmill speeds range from 0.1 to 5.5 m/second and do not normally have the ability to incline. Water depth can be increased up to 1.50 m, and although the literature reports use up to 80% of wither height [1], most users do not work horses in much more than stifle depth water. The comfortable walking speed for a horse on a water treadmill is generally slower than walking overground or on a land treadmill.

1.2. Preparation of the Horse

Several studies have considered habituation to exercise on a land treadmill [2,3] and a water treadmill [4,5]. The vast majority of horses present no problems and quickly habituate to both types of exercise. Once habituated, horses show a high constancy (or low intra-horse variability) in stride variables [3]. The movement of the belt makes it difficult for an exuberant horse to buck or rear and so the horse is more constrained than during in-hand walking or when on a horsewalker. In our experience, protective boots are unnecessary for low speed work and are problematic in water, as they tend to slip or become loose. For water treadmill exercise, the horse should be clean with the feet picked out and the tail wrapped up to minimize water contamination. Within our center, sedation is used for the

first session of water treadmill exercise. A study comparing the heart rates of horses over the course of the first four water treadmill sessions showed that horses that were started without sedation exhibited higher peak heart rates (over the course of the first four sessions) than horses that were started with sedation for the first session only [4].

1.2.1. Risk Associated With High-Speed Treadmill Exercise

In many centers, a safety harness is used for canter and gallop exercise on a high-speed treadmill and will immediately stop the belt in the event of a horse stumbling. For either low or high-speed exercise, it should always be the handlers responsibility to ensure that the horse maintains its position on the belt. Contrary to the popular misconception that land treadmill exercise is somehow more damaging to limbs than overground exercise, Franklin et al [6] found that the incidence of major injuries sustained while exercising on high-speed treadmill for the purpose of treadmill endoscopy is comparable with that reported during competition. This evidence, coupled with knowledge of rapid physiological habituation (i.e., after two exposures) [2] provides a certain reassurance as to the relative level of risk of this type of exercise and to its suitability for a wide range of horses.

1.3. Aspects of Land Treadmill Exercise Related to Rehabilitation

1.3.1. Control

One of the major benefits of land treadmill exercise over in-hand walking for the rehabilitation of distal soft tissue injury, for example, tendinopathy of the superficial digital flexor tendon (SDFT) is that the speed and the surface is controlled. The duration of walking is adjusted in response to changes in heat/swelling of the limb in the early stages of injury and the speed of walking is more easily standardized than in hand walking. As a result of increased standardization of exercise, it is easier to ensure that the limb is progressively loaded using suitable small increments in duration and intensity. During in-hand walking, horses with a long stride length in particular are often restricted by the handler, which leads to crookedness (usually left bend toward the handler on the left side of the horse) and/or loss of control. Exercising on a land treadmill reduces this problem to some extent, but to ensure that the horse moves in a straight line, the horse should be held from both sides. Treadmill exercise is thus not a labor saving option.

1.3.2. Nonridden Exercise (Weight Reduction)

Land treadmill exercise has the advantage over ridden exercise of allowing movement without increased load on the back or limbs. The weight of a rider increases peak vertical ground reaction forces (GRFs) in both forelimbs and hindlimbs, but relatively more (50%–100%) in the forelimbs than the hindlimbs [7,8]. Although the actual magnitudes of the increases in peak vertical GRFs are small (1%–5%), the weight of a rider has been shown to have significant effects on back posture [9]. In this study, a saddle loaded to 75 kg altered thoracolumbar posture in horses in walk, trot, and canter by decreasing maximal flexion and increasing extension of the back without changing the overall range of

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