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Therapeutic Exercise Strategies for Topline Dysfunction in Horses

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Mini Review

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ABSTRACT

Back pain is a common cause of poor performance in horses. Veterinary practice has focused primarily on the pain aspect and has not taken into account the multifactorial aspect that is better described as "topline dysfunction". Horses with poor performance and topline dysfunction have more than just back pain, there is usually a degree of weakness and hypomobility occurring concurrently. Therefore, all three components must be addressed in order to return the horse to its full athletic potential. Therapeutic exercise programs should incorporate a variety of exercises to address these concerns. Dynamic mobilization exercises, gymnastics, ground poles, and underwater treadmill exercise have all shown to influence the topline of the horse in positive ways. Training devices require more investigation before conclusions can be made on their use for topline dysfunction.

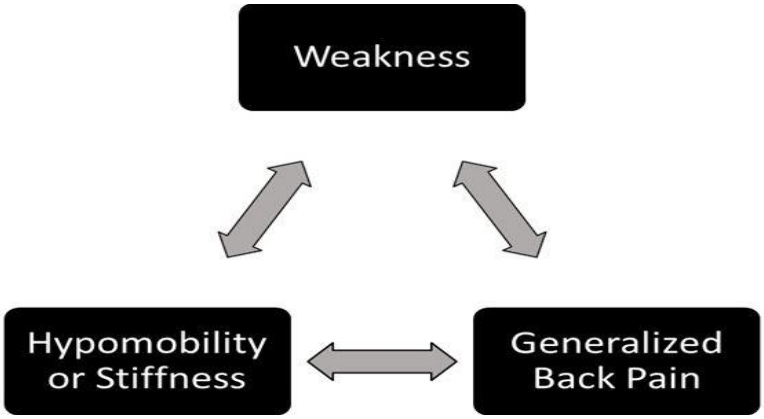
Keywords: Equine; Horse; Topline Dysfunction; Back Pain; Therapeutic Exercise; Rehabilitation

INTRODUCTION

Back pain in sport horses has been reported in up to 94% of horses that present to specialty practices and is known to be a significant cause of poor performance [1-3]. It is of this author's opinion that "back pain" does not fully describe the clinical presentation of many horses. "Topline dysfunction" is a term this author has started implementing to more accurately describe the multifactorial condition that includes hypomobility, weakness, and generalized back pain. Clinically it is vital to address all three of these

conditions to resolve the poor performance complaint. This review will focus on therapeutic exercises to improve hypomobility, weakness, and generalized back pain which as shown in Figure 1.

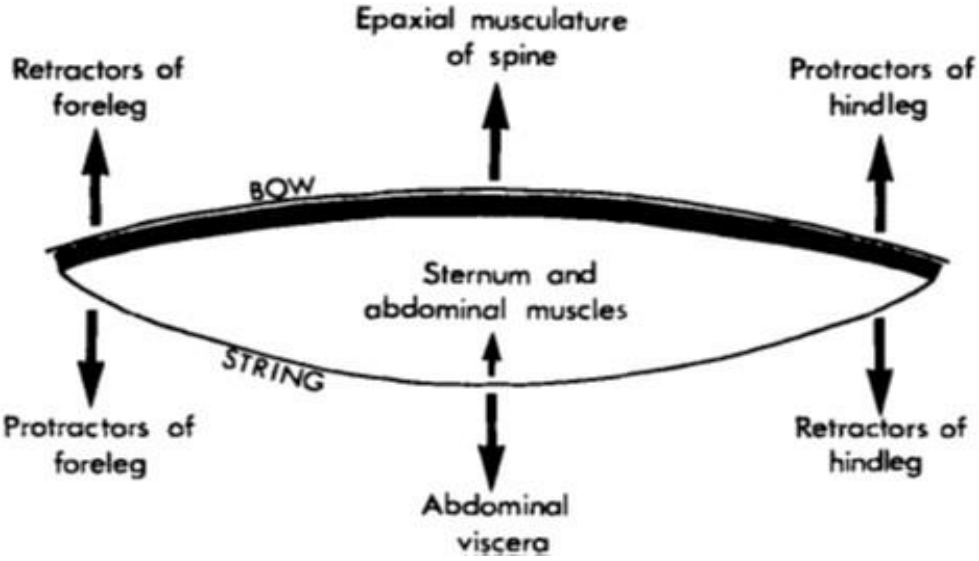
Figure 1. Schematic depicting the interconnected nature of the three main components of topline dysfunction: weakness, hypomobility or stiffness and generalized back pain.



Biomechanics and anatomy review

During daily living, the topline and core musculature of the horse is expected to counteract large vertical forces induced by abdominal viscera, protractors of the forelimb and retractors of the hindlimbs [4]. Additionally, most horses are asked to carry a rider and perform specific athletic tasks such as jump fences, gallop over varying terrain or complete fast speed turns. These activities put further stress upon the topline and core as shown in Figure 2.

Figure 2. Bow and string theory of equine spinal biomechanics. From Jeffcott, L.B., Back Problems in The Horse - Look at Past, Present and Future Progress. Equine Veterinary Journal, 1979



The thoracolumbar topline of the horse is composed of two main muscle groups: The erector spinae and multifidus. The erector spinae group can be further divided into the spinalis, longissimus dorsi, and iliocostalis muscles [5,6]. The multifidus muscle in horses has 5 distinct fascicles each arising from a single spinous process and associated laminae. Each fascicle has an independent attachment with the most superficial fascicle crossing two to four intervertebral spaces, intermediate fascicles crossing two to four spaces, and the deepest fascicle crossing one space [7].

In humans, the multifidus muscle is believed to be responsible for maintaining sagittal stability and overall spinal equilibrium [8,9]. The multifidus is believed to have a similar role in quadrupeds, but this has yet to be proven in the literature. Post-mortem studies have reported severe osseous pathological changes to be associated with asymmetry and differing cross sectional area of the multifidus muscle on either side of the spine [10]. Since cross sectional diagnostic imaging of the spine is currently impossible in the antemortem horse, transcutaneous ultrasound measurements of the multifidus muscle to detect asymmetry has become popular in identifying horses with spinal pathology. Rehabilitation strategies have become common to promote multifidus symmetry, however, the validity of repeat measurements over time has been recently shown to be poor [11].

Topline dysfunction

Topline dysfunction is defined by this author as a complex that manifests itself with hypomobility or stiffness, weakness, and generalized back pain. Therefore, in the clinical case all three components must be addressed to return the horse to peak performance potential.

Underlying and concurrent conditions

Horses presenting for poor performance should have a thorough musculoskeletal evaluation performed. Horses with hindlimb lameness have been documented to have significant changes in spinal motion immediately after diagnostic analgesia resolves the lameness [12]. Flat or negative plantar angles of the hind third phalanx are also associated with hind limb lameness and thus topline dysfunction [13,14]. Therefore, appropriate therapeutic farrier strategies and treatment of the underlying cause of hindlimb lameness should be instituted at the onset of the treatment plan for topline dysfunction.

Therapeutic exercise

Therapeutic exercise is the largest portion of the treatment for horses diagnosed with topline dysfunction. The focus of the exercise plan is to promote mobility and strength throughout full range of motion while managing the generalized back pain.

Active baited stretches promote mobility and encourage muscle activation throughout the entire range of motion. These dynamic mobilization exercises have been shown to increase the cross-sectional area of the multifidus muscle [15-]. Despite the unknown repeatability of transcutaneous ultrasound for multifidus measurement the improvement in mobility of clinical cases with hypomobility and stiffness cannot be questioned. de Oliveira et al. expanded on the initial work by Stubbs et al. and added other gymnastic exercises including, backing, walking a tight circle, pelvic tilting, and walking over a raised pole [16,17]. Using this gymnastic training they showed significantly increased cross-sectional area of the multifidus and improved stride quality [18,19].

Training devices have become popular for horse owners. One device uses ropes and pulleys to encourage a more desired posture and is marketed to increase the use of the horse's back muscles. This device reportedly increases the cross-sectional area of the multifidus and biceps femoris muscles [20]. However, the largest muscular component of the topline, the longissimus dorsi muscle, actually showed a decrease in muscle activity with the use of the training device as measured by electromyography [21].

A second training device has been designed using proprioceptive resistance bands to develop optimal core muscle function and dynamic stability. Initial evaluation showed a decrease in mediolateral and rotation motion of the thoracolumbar region after a four-week exercise program. Unfortunately, this study did not incorporate a control group, so it is unclear if the improvement in presumed dynamic stability was due to the device or exercise program in general [22]. When muscle activity was assessed, the resistance band device showed an increase in muscle activity of the rectus abdominus on the ventral core of the horse while trotting. Unfortunately, the resistance band device did not significantly affect the muscle activity of the longissimus dorsi and actually caused a decrease in longissimus muscle activity during walking or trotting [23]. The resistance band training device produced similar findings regarding the multifidus muscle with several sampling sites showing a significant decrease in muscle activity while trotting with the device as compared to trotting without the device [24].

Ground poles are commonly used in many training and rehabilitation plans [25]. Trotting over ground poles induces significant increases in joint flexion during the swing phase without increasing peak vertical force of the stanclimb [26,27]. Vertical trunk displacement was unchanged implying ground and raised poles induce to horse to recruit spinal stabilizers to clear the poles without vertical compensation. This was supported by electromyographic studies that showed trotting ground poles significantly increased the activity of the multifidus, particularly in the caudal thoracic region. Walking ground poles also induced an increase in longissimus dorsi muscle activity.

Underwater treadmill has also been used to condition and rehabilitate horses with primary or secondary topline dysfunction. Walking in water at the level of the femoropatellar joint caused thoracic extension and lumbosacral flexion as compared to walking with the water at hoof depth. According to the "bow and string" model previously described, the traction the water places on the hindlimb retractors will induce epaxial muscle activity to combat the extra force [28]. Electromyographic studies have not yet been reported regarding the underwater treadmill, however, the author has experienced a large clinical effect from the underwater treadmill on building topline musculature.

CONCLUSION

Topline dysfunction has been defined by this author as a complex syndrome characterized by hypomobility or stiffness, weakness, and generalized back pain. Concurrent conditions or underlying pathology such as hind limb lameness or negative plantar angles should be addressed as clinically appropriate, but the resulting topline dysfunction needs to also be addressed. Therapeutic exercise plays a vital role in treating and preventing topline dysfunction. There is a large number of exercises that can help treat the hypomobility, weakness and generalized back pain. These can be as simple as baited carrot stretches or as involved as underwater treadmill sessions. Training devices should be used with caution until more information can be determined.

CONFLICT OF INTEREST

The author does not have any financial or personal relationships that could inappropriately influence or bias the content of the paper.

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