Journal of Veterinary Behavior xxx (2014) 1–5

Contents lists available at ScienceDirect

Journal of Veterinary Behavior

journal homepage: www.journalvetbehavior.com

Research

Riders' application of rein tension for walk-to-halt transitions on a model horse

Lesley A. Hawson [a,*], Hannah E. Salvin [a], Andrew N. McLean [b], Paul D. McGreevy [a]

[a] Faculty of Veterinary Science, University of Sydney, New South Wales, Australia
[b] Australian Equine Behaviour Centre, Broadford, Victoria, Australia

ARTICLE INFO

Article history:
Received 6 October 2013
Received in revised form
27 March 2014
Accepted 1 April 2014
Available online xxx

Keywords:
horse
rein tension
rider
deceleration cue
learning theory
equitation

ABSTRACT

Rein cues have been used for millennia when controlling horses. Recent research has quantified the range of tensions exerted on the horse's mouth by bit and rein apparatus under a variety of conditions and investigating the tension horses will freely tolerate. Given the importance of rein tension in terms of controlling horses and the potential for welfare issues arising from use of apparatus in the horse's mouth, this study the tensions created by riders ($n = 12$) performing walk to halt gait transitions on a model horse. The mean tension when applying the deceleration cue of the left rein (mean tension, 8.58 N; standard deviation = 5.15; range = 3.14-28.92 N) was greater than the right rein (mean tension, 6.24 N; standard deviation = 4.1; range = 2.27-16.17 N). Little correlation was found between rider morphometry and rein tension. Although the deceleration cue was significantly higher than the resting tension by 51% for the right rein ($P < 0.001$) and by 59% for the left rein ($P < 0.001$), there was large variation between and within riders. These findings suggest the need for greater awareness of the potential for rein tensions to vary from principles of good horse welfare and training principles.

Introduction

Humans use a variety of cues to control the ridden horse. Tension in the reins creates pressure through the bit within the horse's mouth to provide deceleration and directional cues (McGreevy and McLean, 2010). Effective deceleration cues are fundamental for safe equitation.

Evidence of riders using bits and reins to control horses dates from circa 4000 BC (Anthony, 2007). In most equestrian disciplines, increased bilateral tension on the reins cues the horse to decelerate. Careful shaping to lighter bit pressures and cues associated with bracing motions of the rider's seat or closing of the knees permit the development of less invasive classically conditioned cues. Regardless of these refinements, increased pressure on the mouth through the reins and release on the deceleration response form the core operant–conditioning mechanism for deceleration (McGreevy and McLean, 2010).

Learning theory dictates that, for optimal training, any signal used as a cue should not be neutral. Dressage requires that the reins must be straight, thus necessitating a baseline tension in the reins (termed contact). Furthermore, the contact must be steady and soft (FEI, 2007). The horse must learn to discriminate between baseline bit pressure and pressures that are cues (McGreevy and McLean, 2010). Riders escalate tension in the reins to provide sufficient discrimination between neutral tension and tension associated with cueing a response. The need for baseline contact also means that the horse is never totally free of pressure within its mouth. This could lead to habituation (and therefore dulling of responses to cues) or learned helplessness (Hall et al., 2008).

Several published studies have investigated the range of tensions exerted in the reins connected to the horse's mouth while under saddle and on the lunge. These studies used strain gauge technology integrated into custom-built reins or between the reins and the bit via a clip. Mean tensions recorded at walk have ranged from 1.28 to 7.5 N (Clayton et al., 2005; Warren-Smith et al., 2007; Kuhnke et al., 2010). Mean tensions at trot have ranged between 3.41 and 35 N (Clayton et al., 2003, 2005; Clayton et al., 2011; Randle et al., 2011). The reported range of mean tension at canter is 16.18-62.5 N (Clayton et al., 2003, 2005; Kuhnke et al., 2010).

* Address for reprint requests and correspondence: Lesley A. Hawson, BSc, BVSc, Faculty of Veterinary Science, University of Sydney, New South Wales 2006, Australia. Tel: +61422558001.
E-mail address: lhawson@gmail.com (L.A. Hawson).

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http://dx.doi.org/10.1016/j.jveb.2014.04.001

Kuhnke et al. (2010) reported a mean tension of 15.89 N for giving the cue for a transition to halt.

Other studies have tried separating horse and rider to ascertain the tensions either party exerts on the reins separately. Clayton et al. (2011) demonstrated that the characteristic cyclic peaks and troughs seen in rein tension measurements originate with changes in the horse's head position during each gait cycle. This study also showed that fixed inelastic reins can develop tension levels greater (>25 N) than those that induced unusual lingual behaviors such as bulging of the tongue over the bit in the fluoroscopy study by Manfredi et al. (2009). Randle et al. (2011) used a static horse model to concentrate on rider tension perception. They demonstrated that the selected rein tension not only shows considerable variability between individual riders but also is subject to change depending on the construction material of the reins (Randle et al., 2011). Christensen et al. (2011) described the tension that naive horses will freely tolerate to reach a valued food reward. Horses initially applied a rein tension of up to 40 N (mean tensions 10.5 ± 1.4 and 9.9 ± 1.1 N for the left and right reins, respectively) to obtain the food reward but did not habituate to this pressure on subsequent tests (mean tension 6.0 N, day 2; mean tension 5.7 N, day 3). They demonstrated increasing conflict behaviors, such as mouth gaping, pulling at the feed bucket, and backing away from the feed bucket on subsequent testing days. These horses did not habituate to higher tensions and were not willing to maintain the peak tensions demonstrated on the first day. Given the importance of rein tension in terms of controlling horses and the potential for injury to both horse and rider should the instruments of bit and reins be misused, it is critical that riders' application of rein tension be understood.

This study aimed to determine the mean tensions produced when riders perform a putative walk–halt cue while mounted on a model horse and identify thoracic limb attributes associated with these tensions.

Materials and methods

Subjects

Twelve subjects, 9 females and 3 males, were recruited from the staff and working pupils of the Australian Equine Behaviour Centre. Two of the subjects reported that they were professional trainers of young horses, and 2 subjects nominated training as their main horse activity. Six subjects reported that they were dressage riders. One subject nominated himself or herself as a trail rider, and 1 subject was a beginner rider receiving lessons. Average age was 36.8 years (±13.6 years). The average period subjects had been riding horses was 15.8 years (±10.1 years). Two subjects reported riding at state level, 3 subjects rode at interclub level, 2 subjects rode at club level, and 6 of the subjects did not ride competitively.

Riders were asked to report their preferred handedness. The following measurements were taken using a measuring tape, with the subject sitting in riding position: exterior angle of the elbow; the distance from the greater tuberosity of the head of the humerus to the lateral epicondyle of the humerus (cm); the distance between the lateral epicondyle of the humerus to the ventral aspect of the proximal metacarpophalangeal joint (cm); the width of the shoulders from each anterior aspect of the greater tuberosity of the head of the humerus coming across the back (cm); and the circumference of the widest part of each arm (cm). The angle of the elbow was measured using a goniometer (Jinnaka Type; Spirit Medical, New Taipei City, Taiwan, ROC) placed against the lateral epicondyle of the humerus aligned with the greater tuberosity of the head of the humerus and the second arm parallel with the center of the radius toward the wrist.

Equipment

A fiberglass model horse torso that had been molded from a horse approximately155 cm high was used as a mount for the riders. It was fitted with a Bates Wintec Dressage Pro saddle (Bates Australia, Perth, Western Australia). Measurements of the model horse revealed it to be asymmetrical; therefore, a wooden brace was created to reduce the asymmetry. A wooden pillar used to simulate the horse "head" was set up in front of the torso. Reins fitted with load cells (Signal Scribe; Crafted Technology, Sydney, Australia) were attached to a stainless steel eggbutt snaffle bit (weight 327 g, 130-mm width, and 90-mm diameter across the thickest part of the shank). The bit was inserted in a foam casing (Armacell LLC, Mebane, NC), 13-cm long and 3.1-cm thick, to replicate the soft tissues of the mouth (Figure 1). This was positioned in a metal bracket with 2 curved arms, each 11.5-cm long and 1.5-cm wide. The space between each arm was 4 cm, which corresponds to the reported width between the left and right mandibles at the interdental diastema (Engelke and Gasse, 2003). The bit was 26 cm lower than the highest point of the wither and 94 cm distant from the artificial torso. This position corresponded to that of the mouth position of a horse, the same size as the artificial torso (estimated to be 155 cm high at the withers) while in walk (Clayton et al., 2005).

Calibration

Each rein was calibrated in accordance with the manufacturer's recommendations before the beginning of each recording.

Procedure

The participant was seated comfortably in his or her normal riding position with stirrups set at the length he or she would use for regular riding. For riders unsure of regular riding length, the stirrup was adjusted so that the tread of the stirrup was level with the medial malleolus of the rider's tibia (Myers, 2005). The rider was required to hold the reins at the length necessary to create the feel of mouth contact with the horse they rode most regularly. The rider was instructed to apply a halt cue as if from walk every 20 seconds. This was repeated 10 times within the recording for each rider. The rider was cued by an audio signal every 20 signals

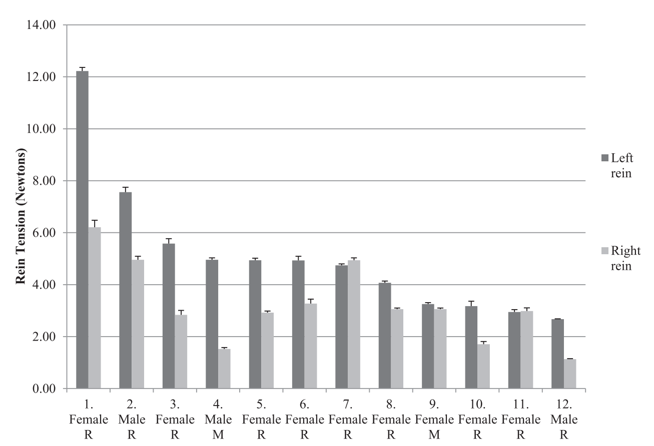

Figure 1. Graph of mean tensions for each rider when applying deceleration cue. Data are sorted in descending value on the left rein. Gender (male/female) and preferred hand are detailed. R = right hand, M = mixed, that is, uses either hand depending on task.