INVESTMENTS IN EDUCATION DEVELOPMENT

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DOES RIDER INFLUENCE HORSE'S MOVEMENT IN HIPPOTHERAPY?

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Introduction

The physiologic basis of hippotherapy is the three-dimensional transmission of the horse's motion over to the patient's body (Schwesig et al. 2009). Hippotherapy can be used for patients with various levels of physical handicap (McGee & Reese 2009; Lechner et al. 2007). In some cases, a ride in hippotherapy can be described as asymmetrical loading of the horse caused by the patient with, for example, cerebral palsy, amputation, balance disorders etc. Variability of horse's back movement (L4) is influenced by the rider or fit of the saddle. In the ridden horse the variability in velocity and acceleration in forward direction was significantly lower than in the unridden horse (Peham 2004).

In equitation the rider is the key factor that controls horse's rhythmical movement. In hippotherapy it is assumed that the rider is a passive element which is only stimulated by mechanical impulses produced by the moving horse's back. The patient sitting on the walking horse only maintains his or her balance in a position matching his reached vertical level, while the movement of the horse is controlled by the leader.

Aim

The aim of the study was to determine influence of the rider on horse's movement in hippotherapy.

Materials and Methods

Observed groups

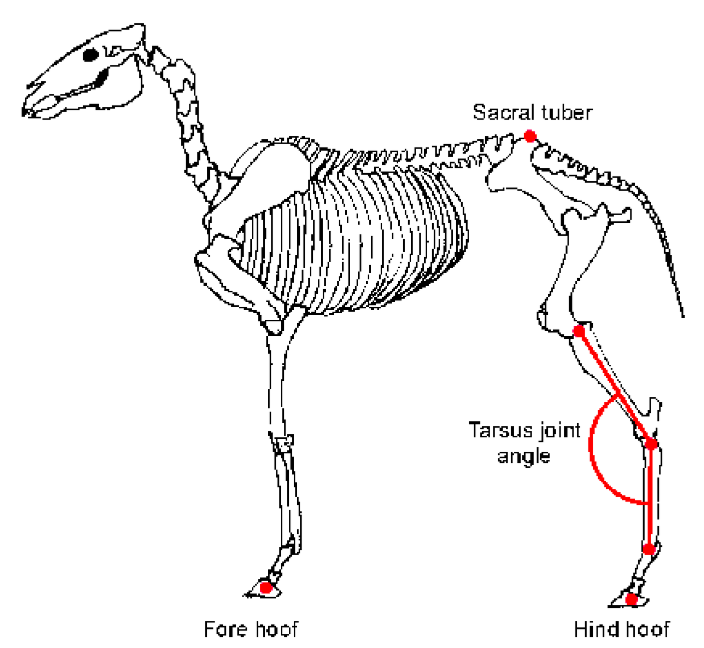
- Two sound thoroughbreds with a similar body shape and size (age: 19 and 14 years, withers height: 165 cm both, weight: 548 and 500 kg).
- Twelve healthy women (age: 23.3±2.8 years, height: 167.3±4.2 cm, weight: 59.2±5.3 kg) without any previous horse riding experience.

Experimental set-up and data collection

- The experiment was carried out in over-ground conditions natural for hippotherapy. The horses were given an initial warm-up (walking in hand) of 15 minutes prior to the start of the experiment.
- 6 contrast hemispheric markers (4 cm in diameter) were attached on a horse (Figure 1).
- For each rider 36 trials in total (6 stride cycles in 6 hippotherapy sessions held during five weeks) were recorded (4 videocameras, 50 Hz) and evaluated.

Data analysis

- Stride duration [s], stride length [m], walking velocity [m.s-1], vertical displacement of hoof of the fore limb (fore hoof), hoof of the hind limb (hind hoof), the sacral tuber on the horse's back [m] and angular range of movement (ROM) of tarsus joint [°] were obtained from video images analyzed with APAS software.
- Comparisons among riders were made using one way ANOVA for each horse (Statistica version 8.0).



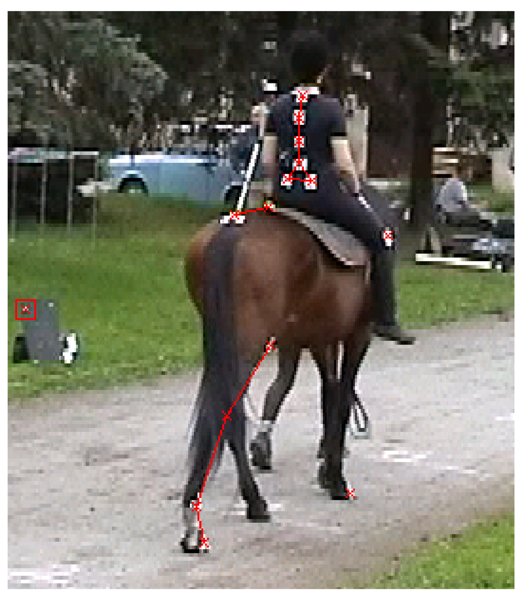


Figure 1 Location of markers on the skin

Horse A

	Rider						F
	A1	A2	A3	A4	A5	A6	
Stride duration [s]	1.20±0.043	1.22±0.023	1.22±0.035	1.20±0.038	1.22±0.044	1.21±0.030	0.71
Stride length [m]	1.76±0.061	1.78±0.053	1.73±0.055	1.74±0.058	1.77±0.066	1.75±0.086	1.20
Walking speed [$m.s^{-1}$]	1.47±0.094	1.47±0.056	1.42±0.043	1.45±0.071	1.46±0.093	1.45±0.082	0.65
Fore hoof [m]	0.075±0.018	0.075±0.022	0.068±0.013	0.074±0.019	0.069±0.011	0.075±0.019	1.06
Hind hoof [m]	0.095±0.012	0.103±0.024	0.091±0.019	0.092±0.019	0.088±0.021	0.105±0.023	3.59**
Sacral tuber [m]	0.056±0.008	0.065±0.006	0.064±0.010	0.059±0.008	0.060±0.009	0.056±0.011	5.43**
Tarsus joint ROM [°]	38.3±7.57	42.5±8.89	37.2±7.40	41.4±9.13	39.1±8.40	49.2±12.97	6.62**

Horse B

	Rider						F
	B1	B2	B3	B4	B5	B6	
Stride duration [s]	1.31±0.056	1.29±0.048	1.34±0.062	1.31±0.058	1.31±0.043	1.31±0.056	1.59
Stride length [m]	1.78±0.111	1.82±0.207	1.79±0.104	1.78±0.104	1.77±0.099	1.77±0.054	0.53
Walking speed [$m.s^{-1}$]	1.36±0.124	1.41±0.164	1.34±0.118	1.37±0.131	1.35±0.100	1.35±0.078	0.74
Fore hoof [m]	0.069±0.019	0.064±0.013	0.070±0.012	0.061±0.014	0.062±0.011	0.069±0.015	2.42*
Hind hoof [m]	0.087±0.017	0.093±0.015	0.094±0.011	0.089±0.014	0.090±0.011	0.095±0.013	1.46
Sacral tuber [m]	0.060±0.010	0.059±0.008	0.056±0.009	0.057±0.006	0.059±0.010	0.056±0.005	1.32
Tarsus joint ROM [°]	41.9±7.27	42.6±6.85	41.2±7.96	41.6±7.36	43.9±7.89	44.9±5.38	1.23

*Legend: F – test score, * – p<0.05, ** – p<0.01*

Table 1 Variables (mean±SD) measured on two horses with different riders

Results

We did not find any statistically significant differences (p<0.05) for stride duration, stride length and horse's walking velocity among different riders in either horse (Table 1).

Horse A: A statistically significant difference (p<0.01) was found in vertical displacement of hind hoof and sacral tuber as well as in angular ROM of tarsus joint (Figure 2).

Horse B: Statistically significant influence of the rider on the movement of the horse was not found with the exception of fore hoof (p<0.05).

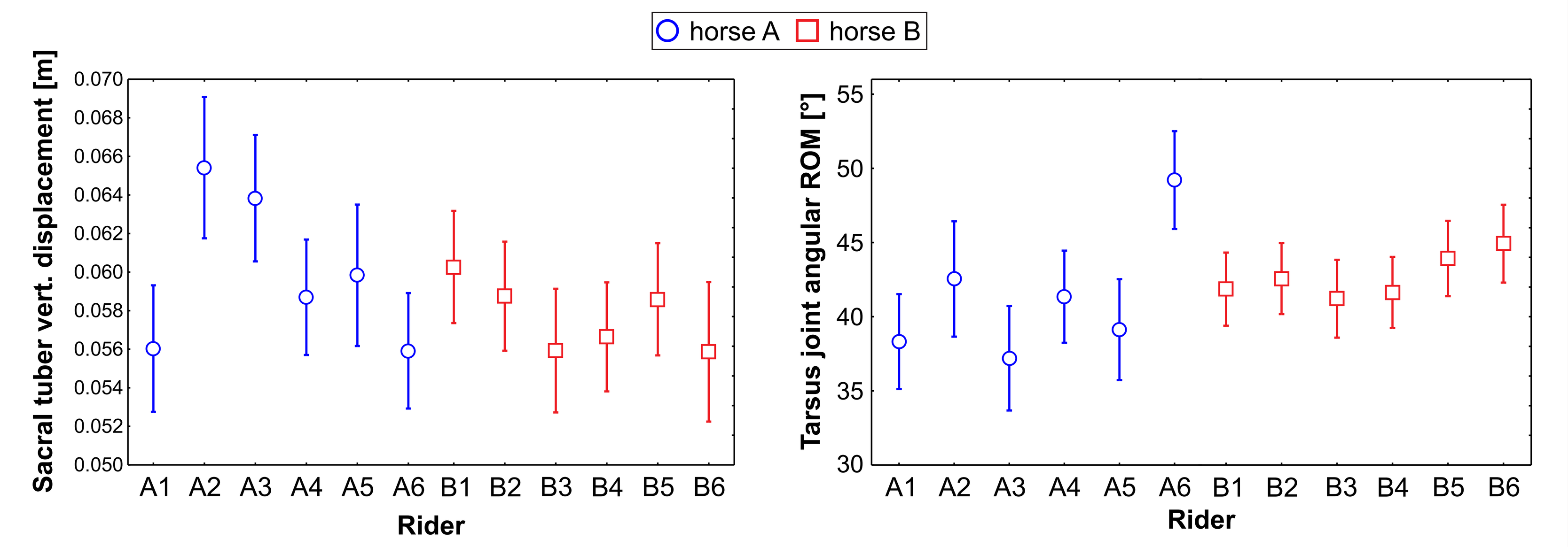


Figure 2 Vertical displacement of sacral tuber and angular ROM of tarsus joint during stride cycle

Discussion

Horse kinematics is influenced by a horse's breed (Cano et al. 2001). For these reasons two thoroughbreds with a similar age and conformation were chosen for our study.
Values of mean stride length (1.76 and 1.79 m) were similar to those in the study of Faber et al. (2002) (1.83 and 1.81 m). Walking velocity and stride duration differed because horses in our study were measured in natural walking while horses in study of Faber et al. (2002) moved on a treadmill. Minimal differences can be caused among others due to the fact that in our study, the horses were led by leaders.

Differences in spatiotemporal variables influenced by the rider were not found for either observed horse. Thus, influence of the rider on complex spatiotemporal variables in hippotherapy is negligible. With regard to kinematics variables, results are not explicit.

The movement of the horse's back is the most important factor for effect of hippotherapy. Licka et al. (2001) indicated that back movement during the walk is driven by the motion of the limbs. Horse's limbs act as springs. The stretching process stores mechanical energy, which is later released during recoil to provide propulsion (Clayton 2004). The influence of riders is significant but the difference does not have practical significance.

Conclusions

In hippotherapy, spatiotemporal variables of horse's walk (stride duration, stride length, walking speed) are not influenced by the rider. With regard to vertical displacement of points on the limbs and horse's back, the results are not explicit.

There are many questions for further research. The interaction between the rider and the horse can depend on a horse breed, horse conformation and other factors such as external conditions or the horse leader.

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