THE VARIABILITY OF A HORSE'S MOVEMENT AT WALK IN HIPPOTHERAPY

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Abstract:

The impulses emitted from the back of a horse during hippotherapy stimulate the rider's postural reflex mechanisms, resulting in balance and coordination training. The objectives of this study were to evaluate the movement variability of the horse's back and limbs and to determine significant relationships between the movement of the selected body points on the horse. Two English thoroughbreds and twelve female riders participated in six sessions of hippotherapy. Three-dimensional (3-D) videography was used to assess movement of the selected points on the horse's back and limbs. The spatiotemporal parameters of the horse's walk showed no significant changes throughout the entire measuring process. Horse movement within a given session was stable, and overall, inter-individual (between-horse) variability was greater than intra-individual variability. The maximum differences in the vertical displacement of the horse's back across individual sessions were significant. With respect to the range of movement of the caudal part of the horse's back, it is necessary to consider the instability of movements during longitudinally repeated sessions.

Key words: *equine-assisted therapy, 3-D videography, biomechanics*

Introduction

Hippotherapy (a proprio-neuromuscular-facilitation method) is one of the basic components of hipporehabilitation (Rothaupt, Laser, & Ziegler, 1998), in which a horse is an integral part of a patient's therapy. The walk of a horse (a four-beat gait) is used in hippotherapy as a movement to which the patient/rider adjusts his or her body (Wheeler, 2003), resulting in balance and coordination training. Each horse has its own genetically given performance of gait, which becomes a source of individual and characteristic movement impulses. In the walk, the horse's body position periodically changes and physical stimuli are transmitted to the rider as a rhythm of movement (Matsuura, et al., 2003).

In hippotherapy, the walk is preferred to other gaits of locomotion as it more readily allows for impulses to be transmitted to the rider because changes in the horse's trunk shape are larger during the walk than the trot, a two-beat gait (Nauwelaerts & Clayton, 2009).

There is a specific variability of horses' and other mammals' ("natural" variability in the "physiological" range as a part of healthy biological systems) because it helps individuals adapt to unique constraints (Davids, Glazier, Araujo, & Bartlett, 2003). Large variability in movement, however, can indicate movement system instability (Hamill, Haddad, Heiderscheit, Van Emmerik, & Li, 2006). Consideration of system variability is necessary for reporting and interpreting data and for subsequent data application to practice (Chiari, Della Croce, Leardini, & Cappozzo, 2005).

Utilizing the stability of horse's movement at the walk as a "therapeutic tool" is a basic notion for transferring related impulses from the horse's body to that of the patient. A greater variability of movement across multiple lessons, however, is associated with decreased therapeutic effect and may be counter-productive to therapeutic goals (Dvořáková, 2009).

The aims of this study were to evaluate the movement variability of the horse's back and limbs in an over-ground walk within one session and in repeated sessions of hippotherapy, and to determine the significant relationships between movement of the selected points on the horse's body.

Materials and methods

Measurements took place over five weeks (six sessions of therapy, ten rounds in each session), always in the third, sixth, and ninth round of a given therapy session. Two English thoroughbreds (ages 19 and 14 years), with a long-term experience in hippotherapy (eight and nine years), were observed. Twelve healthy women, aged (mean±SD) 23.2±3.01 years, body mass 59.1±5.47 kg, and body height of 1.67±0.04 m, without any previous horse riding experience volunteered to participate in the study.

3-D videography was used to collect data (four cameras, 50 Hz). For labeling points on the horse's back and right body side (sacral tuber, root of the tail, greater trochanter, talus, distal metatarsus, hoof at the coronary band of the hind and front hoof), contrast hemispheric markers (of four cm in diameter) were used. The horses were taken to walk for fifteen minutes before being subjected to measurement. The filming took place on a 20-meter flat piece of land in an environment to which the horses were accustomed. A gait cycle was defined as the time between the touchdown of the right hind hoof and the subsequent touchdown of the same hoof. Fifteen walking cycles were analyzed for each horse in each of the six therapy sessions, making a total of ninety cycles for each horse. The basic spatialtemporal and angle parameters were determined by APAS software® (Ariel Dynamics Inc., Trabuco Canyon, CA, USA).

Table 1. Basic spatiotemporal parameters for the horse walking

Parameters	Horse H1 Mean±SD	Horse H2 Mean±SD
Speed ($m \cdot s^{-1}$)	1.46±0.061	1.38±0.059
Step length (m)	1.76±0.040	1.79±0.030
Frequency (Hz)	0.83±0.030	0.77±0.020

A one-way analysis of variance (ANOVA) with repeated measures with a Fisher's Least Significance Difference *post hoc* test and correlation analysis (Pearson's correlation coefficient) were performed using STATISTICA (Version 8.0, StatSoft, Inc.®, Tulsa, OK, USA). P-values of less than .05 were deemed significant throughout. Effect size was assessed by using eta-squared (large effect .14) (Pierce, Block, & Aguinis, 2004; Cohen, 1988).

Results

The average values of the spatiotemporal parameters of the walk in the observed horses are presented in Table 1. In these variables, there were no significant differences between individual trials in a given session throughout the whole measuring process.

Stability of movement in a given session of hippotherapy

Horse H1: The average vertical displacement of the front hoof (FH) in various rounds of all sessions of hippotherapy was in the range of 0.071–0.076 meters, whereas vertical displacement of the hind hoof (HH) was 0.096 meters and the same in all rounds. This also had a connection with the minimum difference in the vertical movement of the distal metatarsus (DM) and talus (TA). For the movement of selected points in the rear part of the back, the difference between the average values was 0.01 meters for the sacral tuber (ST) and 0.02 meters for the root of the tail (RT). None of the presented differences between the individual rounds were statistically significant.

Horse H2: The average vertical displacement of the FH during the walk in various rounds of all sessions of hippotherapy was between 0.064–0.067 meters. For the HH, this parameter was between 0.090–0.093 meters. The differences were smaller between individual rounds for the TA (range of movement 0.130–0.132 meters) than for the movement of the DM (0.126–0.130 meters). The average vertical displacement of the ST and the rear part of the back was 0.057 meters and 0.058 meters, respectively. For the RT, the difference was greater (0.068–0.071 meters). However, it was statistically nonsignificant.

Differences in vertical displacement of the observed limb and back points during a given hippotherapy session were not statistically significant. The size of inter-individual (between-horses) differences was greater than that of intra-individual differences.

Table 2. The displacement of the observed points of the bodies of horses H1 and H2 in six sessions of hippotherapy

Horse H1						
Session	1	2	3	4	5	6
Point	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD
FHv (m)*	0.076±0.016	0.086±0.017	0.068±0.013	0.076±0.018	0.074±0.019	0.062±0.014
HHv (m)*	0.101±0.023	0.105±0.017	0.079±0.019	0.105±0.018	0.092±0.019	0.096±0.014
DMv (m)*	0.125±0.015	0.146±0.015	0.123±0.017	0.125±0.014	0.121±0.017	0.129±0.010
TAv (m)*	0.147±0.014	0.165±0.017	0.160±0.028	0.152±0.020	0.153±0.016	0.168±0.016
GT (m)*	0.077±0.012	0.083±0.010	0.084±0.005	0.074±0.014	0.095±0.016	0.091±0.011
STv (m)*	0.055±0.006	0.055±0.008	0.063±0.013	0.058±0.007	0.064±0.008	0.063±0.007
RTv (m)*	0.070±0.008	0.070±0.010	0.077±0.007	0.074±0.009	0.080±0.010	0.080±0.008
STml (m)	0.062±0.019	0.065±0.020	0.055±0.012	0.058±0.025	0.068±0.015	0.051±0.013
RTml (m)	0.130±0.078	0.143±0.056	0.146±0.091	0.121±0.057	0.085±0.034	0.111±0.053
Hock (°)*	38.5±4.37	46.5±5.21	38.3±5.43	33.6±6.95	41.1±9.20	37.0±6.78
Horse H2						
Session	1	2	3	4	5	6
Point	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD
FHv (m)*	0.057±0.013	0.064±0.012	0.059±0.013	0.076±0.017	0.072±0.010	0.066±0.013
HHv (m)	0.089±0.012	0.087±0.013	0.089±0.014	0.091±0.015	0.093±0.013	0.096±0.015
DMv (m)	0.125±0.011	0.125±0.012	0.133±0.010	0.124±0.012	0.127±0.010	0.131±0.010
TAv (m)*	0.121±0.008	0.138±0.011	0.121±0.014	0.130±0.013	0.133±0.009	0.141±0.009
GT (m)*	0.068±0.011	0.081±0.011	0.069±0.009	0.071±0.012	0.073±0.011	0.070±0.010
STv (m)*	0.058±0.008	0.066±0.007	0.052±0.007	0.052±0.006	0.062±0.008	0.055±0.006
RTv (m)*	0.065±0.006	0.078±0.008	0.067±0.007	0.065±0.005	0.071±0.008	0.070±0.008
STml (m)	0.056±0.021	0.061±0.024	0.051±0.025	0.063±0.025	0.046±0.018	0.048±0.015
RTml (m)	0.131±0.064	0.117±0.073	0.133±0.081	0.166±0.072	0.111±0.046	0.156±0.071
Hock (°)*	38.9±3.09	32.5±3.62	33.4±3.92	33.8±3.14	29.7±3.64	31.6±3.72

Legend: * – eta squared > .14; FH – coronary band of the front hoof; HH – coronary band of the hind hoof; DM – distal metatarsus; TA – talus, GT – greater trochanter; ST – sacral tuber; RT – root of the tail; Hock – the range in the hock joint; v – vertical; ml – mediolateral

The stability of movement across multiple sessions of hippotherapy (six sessions over five weeks)

As there were no statistically significant differences among the parameters within a given session, we used the average values of three rounds in each session to compare multiple sessions (Table 2).

The influence of different sessions of hippotherapy on the vertical displacement of the measured points was significant. The size of the eta-squared for H1 varied from .142 to .316. For the mediolateral movement of points ST and RT on the back of horse H1, these values were lower (.093, .108). For horse H2, the lowest values of the eta-squared were found for the vertical displacement of points HH and DM (.055, .081) and for the movement of points ST and RT in the mediolateral directions (.087, .079). For the other body points, these values varied from .207 to .628.

When comparing values from multiple sessions of hippotherapy, absolute differences in the range of movement of limb points were greater than those for the horse's back points. The maximum differences in the vertical movement of the back across individual sessions (0.013 meters) were significant ($p<.01$). The spatiotemporal parameters in the horse's walking did not show any significant changes throughout the entire measuring process.

The relationship between the movement of the selected points on the body of the horse

Significant relationships existed between the movement of the selected body points on the horse, especially the adjacent points. For horse H1, a significant relationship was found for the movement of points FH and HH in the vertical direction ($r=.549$, $p<.01$). There were also significant relationships ($p<.01$) in the vertical movement of points HH and DM ($r=.536$), as well as of points DM and TA ($r=.368$). On the hind limb and on the back of the horse, significant relationships were found for the points of greater trochanter (GT) and ST ($r=.379$, $p<.01$) and GT and RT ($r=.424$, $p<.01$). On the horse's back, there was a significant relationship between the movement of points ST and RT in the vertical direction only ($r=.553$, $p<.01$).

For horse H2, significant relationships ($p<.01$) were found for the movement in the vertical direction of points HH and DM ($r=.700$), HH and TA ($r=.469$), and DM and TA ($r=.423$). Analogous to the measurement of horse H1, there was a significant relationship between the movement of points GT and ST ($r=.484$, $p<.01$), GT and RT ($r=.470$, $p<.01$), and for ST and RT (on the horse's back) in the vertical direction ($r=.601$, $p<.01$).

Discussion and conclusions

The internal sources (central nervous system [CNS] status, natural temporal dynamics of neuromotor control, the fitness level of the musculoskeletal system, quality of proprioreception, level of metabolic processes, etc.) contribute to the total variability of the movement system as do the external conditions (light, type of surface, marker positioning during movement analysis, etc.) (Chau, Young, & Redekop, 2005; Schwartz, Trost, & Wervey, 2004). Movement variability has traditionally been viewed as dysfunctional and a reflection of "noise" in the CNS (Newell & Corcos, 1993). However, mature motor skills and healthy states are associated with an optimal amount of movement variability (Stergiou, Harbourne, & Cavanaugh, 2006). For the movement of a horse to be useful as a "therapeutic tool", it must be stable (Pauw, 2000).

The displacement of chosen points on the horse's back and limbs is often used to evaluate stability in movement and to diagnose movement disorders in horses (Clayton, 1986; Buchner, Savelberg, Schanhardt, & Barneveld, 1996). This method could also be used for selecting horses suitable for use in hippotherapy.

Stability of the movement of the horse – a short-term point of view

From these results we can conclude that the changes in the movement of the observed body points did not show any significant differences within one session (third, sixth and ninth round) of hippotherapy for a given horse. It is possible to say that there were no significant changes in the size of impulses generated from the movement of the horse's back within a given session of hippotherapy. The mechanical effect of the horse on the patient remained consistent.

The movement of points on the limbs showed a greater range than did the ones on the horse back. This is defined as a proximal-to-distal linkage system through which energy is transferred, achieving maximum magnitude in the terminal segment (Fleisig, et al., 1996). The movement of the back was characterized by two periods of extension and flexion during each stride cycle (Faber, et al., 2000).

For stability in the execution of the horse's movement, it is necessary to ensure that the horse is relaxed for the purposes of therapy. This relaxation is recommended for the practical use of horses in other fields of measurement (Kotschwar, Baltacis, & Peham, 2010; Meschan, Peham, Schobesberger, & Licka, 2007).

There were differences in the observed parameters between the horses. The effect of an individual horse on the difference in amplitude was significant. For the range of motion values of the horses at walk, the between-horse coefficient of variability was up to four times higher than the between-day coefficient of variability of individual horses (Faber, et al., 2002).

Stability of the movement of the horse – a long-term point of view

In terms of the individual choice of horse for a given client, it is necessary to evaluate whether the horse appears to be a "stable means of rehabilitation" in a long-term sense rather than during just one therapeutical session. Logically speaking, it is sufficient that the horse does not change any basic morphological parameters (weight, state of health, etc.) over the entire therapy time span.

We can conclude from these results that six sets of measurements showed no significant differences in the speed of movement or length of step. This should create a standard for the stable execution of the movement. Khumsap, Clayton, Lanovaz, and Bouchey (2002) state that an increase in walking velocity correlates with an increase in stride length and a decrease in stride and stance duration, and increased velocity also increases peak vertical, braking, and propulsive ground reaction forces.

The absolute values of the differences measured in the area of the horse's limbs reached a maximum of two centimeters. For the horse's back, the differences in individual measurements were about one centimeter. We do not consider these differences to be important for practice. We can also assume there is less back-movement deviation in the areas closer to the horse's head. On a horse without a rider, the vertical amplitude is greater in the caudal parts than in the cranial parts of the trunk (Matsuura, et al., 2003).

The strengths and limitations of the study – factors influencing parameter values

This research was conducted in over-ground conditions, thus in conditions typical for the implementation of hippotherapy. The stability of horse movement described in previous literature was not validated in the real conditions of hippotherapy, thus limiting the value of data comparisons between current and earlier data (Alvarez, Rhodin, Bystrom, Back, & van Werren, 2009). The horse "followed" the speed of the treadmill, which influences the stability of its movement (Peham, Licka, Schobesberger, & Meschan, 2004). There also exists an additional coupling between treadmill and horse (Peham, Licka, Kapaun, & Scheidl, 2001).

In comparison to analyses of movement on a treadmill, in over-ground conditions it is more difficult to ensure stable conditions, which leads to the evaluation of a smaller number of movement cycles than is possible during a laboratory measurement. We believe that conducting our study in conditions of hippotherapy (a total of 90 cycles for each horse), however, will more accurately elucidate the physical effects of the horse on the patient.

When evaluating study results, it is necessary to examine the quality of data entries and the possibility of mistakes caused by the movement of the markers on the body of the horse. In this study, measurement resolution in the periodical study was estimated to be one centimeter for the linear position and less than or equal to one degree for the angular position (pitch rotation), based on the length of the shortest segment (head) (Dunbar, Macpherson, Simmons, & Zarcades, 2008). The movement or displacement of skin, in relation to underlying bone, has a large effect on the analysis of skeletal kinematics (Reinschmidt, van den Bogert, Nigg, Lundberg, & Murphy, 1997). Usually the largest displacements are along the segment axes (Sha, Mullineaux, & Clayton, 2004).

The impact of six horse leaders who participated in the measurements must also be considered. These leaders were acquainted with the aim of the measurements and regularly lead horses during hippotherapy sessions. Despite this, we can presume that their manner of leading the horses could affect the performance of the movement.

It is also necessary to consider the effects of weather conditions that occurred during data collection. These fluctuated and spanned hot, sunny weather, with temperatures of around 25°C, to windy weather with rain, at a temperature of 15°C.

For each individual horse, the basic spatiotemporal parameters of movement (length and frequency of step, speed of movement) did not differ significantly from each other either within a given session or across multiple sessions of hippotherapy. The movement of the horse in a given session was stable and the differences in the vertical displacement of the observed points on the limbs and back of the horse were not significant. The differences increased over repeated sessions of hippotherapy (long-term point of view of stability) and were greater for the horse's limbs than for its back. The maximum difference in the rear part of the horse's back was close to the border of significance from the practical point of view (0.01 meters).

References

Alvarez, C.B.G., Rhodin, M., Bystrom, A., Back, W., & van Werren, P.R. (2009). Back kinematics of healthy trotting horses during treadmill versus over ground locomotion. *Equine Veterinary Journal*, *41*(3), 297–300.

Buchner, H.H., Savelberg, H.H., Schanhardt, H.C., & Barneveld, A. (1996). Head and trunk movement adaptation in horses with experimentally induced fore- or hindlimb lameness. *Equine Veterinary Journal*, *28*(1), 71–76.

Chau, T., Young, S., & Redekop, S. (2005). Managing variability in the summary and comparison of gait data. *Journal of NeuroEngineering and Rehabilitation*, *2*, 22.

Chiari, L., Della Croce, U., Leardini, A., & Cappozzo, A. (2005). Human movement analysis using stereophotogrammetry. Part 2: Instrumental errors. *Gait and Posture*, *21*(2), 197–211.

Clayton, H.M. (1986). Cinematographic analysis of the gait of lame horses. *Journal of Equine Veterinary Science*, *6*(2), 70–78.

Cohen, J. (1988). *Statistical power analysis for the behavior sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Davids, K.W., Glazier, P., Araujo, D., & Bartlett, R. (2003). Movement systems as dynamical systems: The functional role of variability and its implications for sports medicine. *Sports Medicine*, *33*(4), 245–260.

Dunbar, D.C., Macpherson, J.M., Simmons R.W., & Zarcades, A. (2008). Stabilization and mobility of the head, neck and trunk in horses during overground locomotion: Comparisons with humans and other primates. *Journal of Experimental Biology*, *211*(24), 3889–3907.

Dvořáková, T. (2009). *Sledování vlivu vybraných parametrů kroku koně na chování balanční plochy hřbetu a na motorickou odpověď jezdce při hipoterapii*. [Following the influence of the chosen parameters of a horse's walk on the movement of the horse's back and the movement response of the rider in hippotherapy. In Czech]. (Unpublished doctoral dissertation, Palacký University in Olomouc). Olomouc: Fakulta tělesné kultury.

Faber, M., Johnston, C., van Weeren, P.R., & Barneveld, A. (2002). Repeatability of back kinematics in horses during treadmill locomotion. *Equine Veterinary Journal*, *34*(3), 235–241.

Faber, M., Schamhardt, H., van Weeren, R., Johnston, C., Roepstorff, L., & Barneveld, A. (2000). Basic three-dimensional kinematics of the vertebral column of horses walking on a treadmill. *American Journal of Veterinary Research*, *61*(4), 399–406.

Fleisig, G.S., Escamilla, R.F., Andrews, J.R., Matsuo, T., Satterwhite, Y., & Barentine, S.W. (1996). Kinematic and kinetic comparison between baseball pitching and football passing. *Journal of Applied Biomechanics*, *12*(2), 207–224.

Hamill, J., Haddad, J.M., Heiderscheit, B.C., Van Emmerik, R.E.A., & Li, L. (2006). Clinical relevance of variability in coordination. In K. Davids, S. Bennett & K.M. Newell (Eds.), *Movement system variability* (pp. 153–166). Champaign, IL: Human Kinetics.

Khumsap, S., Clayton, H.M., Lanovaz, J.L., & Bouchey, M. (2002). Effect of walking velocity on forelimb kinematics and kinetics. *Equine Veterinary Journal. Supplement*, (34), 325–329.

Kotschwar, A.B., Baltacis, A., & Peham, C. (2010). The effects of different saddle pads on forces and pressure distribution beneath a fitting saddle. *Equine Veterinary Journal*, *42*(2), 114–118.

Matsuura, A., Takita, N., Shingu, Y., Kondo, S., Matsui, A., Hiraga, A., Asai, Y., Hiroshi, H., & Okubo, M. (2003). Rhythm analysis for movements of horse and rider on a treadmill by sequential still VTR pictures. *Journal of Equine Science*, *14*(4), 125–131.

Meschan, E.M., Peham, C., Schobesberger, H., & Licka, T.F. (2007). The influence of the width of the saddle tree on the forces and the pressure distribution under the saddle. *The Veterinary Journal*, *173*(3), 578–584.

Nauwelaerts, S., & Clayton, H. (2009). Trunk deformation in the trotting horse. *Equine Veterinary Journal*, *41*(3), 203–206.

Newell, K.M., & Corcos, D.M. (1993). *Variability and motor control*. Champaign, IL: Human Kinetics.

Pauw, J. (2000). Therapeutic horseback riding studies: Problems experienced by researchers. *Physiotherapy*, *86*(10), 523–527.

Peham, C., Licka, T., Kapaun, M., & Scheidl, M. (2001). A new method to quantify harmony of the horse–rider system in dressage. *Sports Engineering*, *4*(4), 95–101.

Peham, C., Licka, T., Schobesberger, H., & Meschan, E. (2004). Influence of the rider on the variability of the equine gait. *Human Movement Science*, *23*(5), 663–671.

Pierce, C.A., Block, C.A. & Aguinis, H. (2004). Cautionary note on reporting eta-squared values from multifactor ANOVA designs. *Educational and Psychological Measurement*, *64*(6), 916–924.

Reinschmidt, C., van den Bogert, A.J., Nigg, B.M., Lundberg, A., & Murphy, N. (1997). Effect of skin movement on the analysis of skeletal knee joint motion during running. *Journal of Biomechanics*, *30*(7), 729–732.

Rothaupt, D., Laser, T., & Ziegler, H. (1998). Hippoterapia a jej miesto v rehabilitácii. [Hippotherapy and its place in rehabilitation. In Slovak.] *Rehabilitácia*, *31*(1), 34–37.

Schwartz, M.H., Trost, J.P., & Wervey, R.A. (2004). Measurement and management of errors in quantitative gait data. *Gait & Posture*, *20*(2), 196–203.

Sha, D.H., Mullineaux, D.R., & Clayton, H.M. (2004). Three-dimensional analysis of patterns of skin displacement over the equine radius. *Equine Veterinary Journal*, *36*(8), 665–670.

Stergiou, N., Harbourne, R., & Cavanaugh, J. (2006). Optimal movement variability: A new theoretical perspective for neurologic physical therapy. *Journal of Neurologic Physical Therapy*, *30*(3), 120–129.

Wheeler, A. (2003). Hippotherapy as a specific treatment: A review of current literature. In B.T. Engel (Ed.), *Therapeutic Riding II: Strategies for Rehabilitation"* (3rd ed.). (pp. 25–30). Durango, CO: Barbara Engel Therapy Services.

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VARIJABILNOST GIBANJA KONJA U HODU TIJEKOM HIPOTERAPIJSKOG JAHANJA

Impulsi s leđa konja za vrijeme hipoterapijskog jahanja podražuju jahačeve posturalne refleksne mehanizme, što rezultira treningom ravnoteže i koordinacije. Ciljevi ovog istraživanja bili su vrednovati varijabilnosti gibanja leđa i udova konja i utvrditi značajnost veza između gibanja odabranih točaka na tijelu konja. Dva čistokrvna engleska konja i dvanaest jahačica sudjelovalo je u šest hipoterapijskih sesija. Trodimenzionalna videografija se koristila za utvrđivanje gibanja izabranih točaka na konjskim leđima i udovima. Kinematički parametri konjskog hoda nisu se značajno mijenjali tijekom cijelog procesa mjerenja. Gibanje konja tijekom jedne sesije bilo je stabilno i, generalno, inter-individualna varijabilnost kinematičkih parametara između konja bila je veća nego intra-individualna varijabilnost između mjerenja u svih 6 sesija. Maksimalne razlike u okomitim pomacima leđa konja između pojedinačnih sesija bile su značajne. Promatra li se donji dio leđa konja, potrebno je u obzir uzeti nestabilnost gibanja tijekom ponovljenih jahačkih sesija.

Ključne riječi: *terapija uz pomoć konja, 3D videografija, biomehanika*

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