Hobbs S.J. *University of Central Lancashire, Centre for Applied Sport and Exercise Sciences, Preston, UK*

Bertram J.E.A. *The University of Calgary, Department of Cell Biology and Anatomy, Alberta, Canada*

Clayton H.M. *Sport Horse Science, 3145 Sandhill Road, Mason, MI 48854, USA*

Email: SJHobbs1@uclan.ac.uk

Reasons for performing study: Although the trot is described as a diagonal gait, movements of the limb pairs are not usually perfectly synchronised. Subtle alterations in dissociation timing between contacts of each diagonal pair could have consequences on gait dynamics and provide insight into related functional strategies.

Objectives: To explore the mechanical effects of different diagonal dissociation patterns between individuals. It was hypothesised that diagonal dissociation at contact could reduce collision-based energy losses and preferred dissociation patterns would be evident.

Study design: Observational.

Methods: Seventeen horses of mixed breed with (mean ± SD) height 1.50 ± 0.06 m and mass 465 ± 34 kg trotted in hand on a loose rope over four force platforms recording at 960 Hz. Kinematic data were captured at 120 Hz by a 10 camera motion analysis system. A full body marker set was used to calculate temporal, speed, GRF, postural, mass distribution, moment, and collision dynamics parameters. One successful, speed-matched trial per horse was selected that provided a comparable number of hind-first (n = 12; 3.28 ± 0.11 ms^{-1}), synchronous (n = 11; 3.26 ± 0.15 ms^{-1}) and fore-first (n = 11; 3.24 ± 0.20 ms^{-1}) dissociations for each diagonal. ANOVA was used to determine differences between dissociations and diagonal pairs for each variable separately.

Results: The COP moved systematically and significantly (P = 0.001) from more caudally in hind-first dissociation (mean location = 0.41 ± 0.04) through synchronous (0.36 ± 0.02) to more cranially in fore-first dissociation (0.32 ± 0.02). Other important differences, including functional, postural and balance parameters, were found when either synchronous or fore-first were compared to hind-first dissociation. Notably, hindlimb peak forces and mean collision angle were greater ($P<0.05$) for synchronous compared to hind-first dissociation.

Conclusions: The results indicate that dissociation assists in stabilising trunk pitch through management of the location of the centre of pressure COP.

Ethical animal research: Study was approved by the Institutional Animal Care and Use Committee, Michigan State University, USA under protocol number 02/08-020-00. **Sources of funding:** University of Central Lancashire, the McPhail endowment at Michigan State University and the University of Calgary. **Competing interests:** None declared.