A preliminary investigation of the use of inertial sensing technology for the measurement of hip rotation asymmetry in horse riders

Gandy, E.A.[1], Bondi, A.[1], Hogg, R.[1] and Pigott, T.M.C.[2]
1. University of Sunderland, 2. HP3 at Physiohaüs

Introduction:

An asymmetrical posture can have a significant effect on balance and stability, impeding performance and increasing the risk of injury to both horse and rider. The aim of this study was to investigate whether inertial sensing technology is a practical tool for the identification and measurement of asymmetries in the rider's position, using hip rotation as the marker.

Methods:

12 horse/rider combinations (experience level equivalent to a minimum standard of affiliated novice level dressage) were fitted with the Xsens™ MVN motion capture suit, calibrated according to the manufacturers instructions.

A straight 1m wide runway of approximately 30m in length was marked out in the centre of the riding arena using poles placed end-to-end. A 15m circle was also marked out, passing through gaps in the runway.

Each combination performed a traversal of the straight runway and a 15m circle, in rising trot on each rein, before resting and repeating.

Post-processing isolated frames for 2 complete stride cycles for straight line captures and 10 complete stride cycles for trot circles. Data analysis was carried out using the R statistical package.

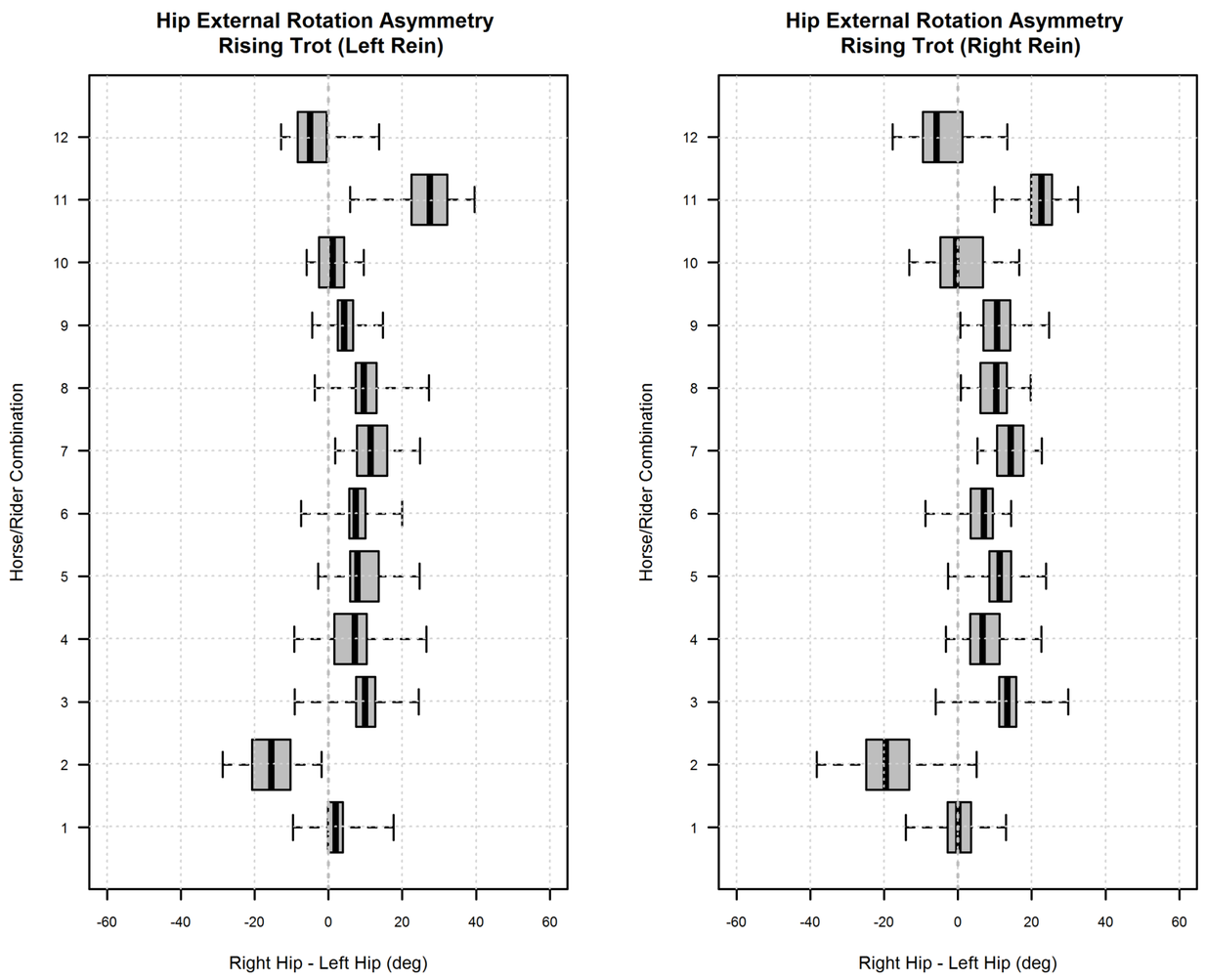

Figure 1. Variations in external hip rotation asymmetry during rising trot on a straight line.

Results:

External rotation of the hip was measured about the longitudinal axis of the femur. A larger angle indicates a greater external rotation and differences in angle between left and right hips identifies the presence of asymmetry.

Asymmetry (left v right) was revealed in mean hip external rotation of all riders, with values ranging from 1-27 degrees in a straight line and from 0-30 degrees on a circle. 83% showed greater external rotation of the right hip.

A Pearson product-moment test showed strong correlation between the two captures for both trot rising on the left rein, $r(10)=.981$, $p<.01$; and trot rising on the right rein, $r(10)=.961$, $p<.01$, indicating good intra-rater repeatability of the methodology, although a full validation study would be necessary to confirm this.

Wireless range was found to be reliable within a 20 x 40m area. The Xsens™ suit enabled quick changeover between participants and the development of R scripts automated the analysis process.

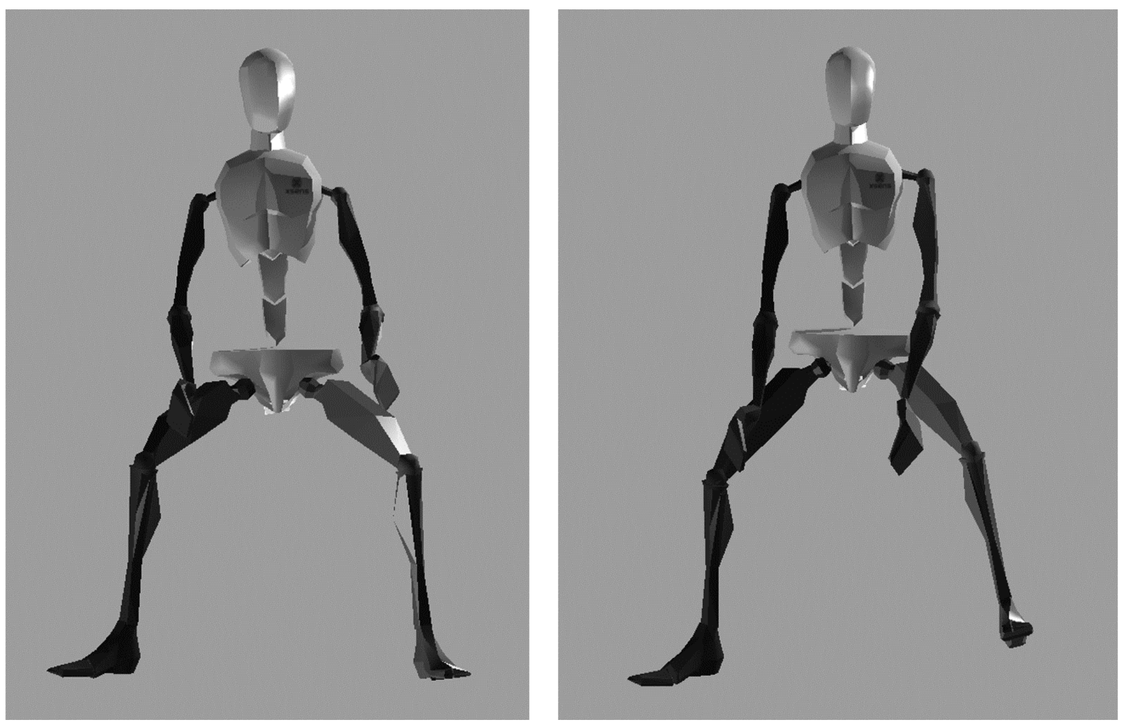

Figure 2. Comparison between the rider with the least asymmetry in hip rotation against the rider with the greatest asymmetry in hip rotation, during the sit phase of rising trot.

Conclusion:

This study represents novel use of inertial sensing technology in its application to the measurement of rider motion patterns. The technique is non-invasive and capable of recording rider hip rotation asymmetry whilst performing a range of movements unhindered. The technique goes beyond conventional optical motion analysis by providing the means of assessing the rider with greater accuracy. It was found to be efficient and practical, with potential to further advance the analysis of horse and rider interactions.

From an article by Gandy, E.A., Bondi, A., Hogg, R. and Pigott, T.M.C,. titled "A preliminary investigation of the use of inertial sensing technology for the measurement of hip rotation asymmetry in horse riders", published by Taylor & Francis Group in Sports Technology on 15/04/2014, available online: http://www.tandfonline.com/doi/full/10.1080/19346182.2014.905949.