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CHARACTERISING TEMPORAL PHASE RELATIONSHIPS BETWEEN CYCLICAL LIMB MOVEMENTS IN EQUINE LOCOMOTION USING INERTIAL SENSORS.

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Aims: To determine the temporal relationships between limb cycles in equine locomotion for different gaits, directions and surfaces using gyroscopic inertial movement sensors (IMS), and to investigate inter and intra horse limb cycle variation. **Methods:** Five sound horses were equipped with IMS housed in adapted brushing boots on the distal metacarpal/tarsal region of each limb. Trials were conducted unridden in walk and trot, in straight lines and left and right circles on both hard and soft surfaces. Cross-correlation of the rotation velocity around the lateromedial axis of the IMS, on a stride by stride basis, was used to calculate temporal phase-lag between respective limb cycles. Phase-lag was expressed as a percentage (%) of the stride duration of a reference limb for each limb. **Results:** Median phase-lag between limb cycles with reference to the left hind (LH) when walking straight lines on hard was left fore (LF) 32%, right hind (RH) 49%, right fore (RF) 81%, and when trotting straight lines on hard was RF 14%, RH 48%, LF 64%. There was a consistent 48-50% phase lag between contralateral limbs in both gaits. There was a significant group and individual effect of direction and surface. Significant 'between horse' variations were observed which was independent of surface and direction. **Conclusions and Practical Significance:** The results differ fundamentally from traditional temporal data based on foot strike, as the entire stride cycle is used to determine the temporal relationship. Anatomical and functional differences between fore and hind limbs likely influence the respective cycles, and explain this apparent temporal difference. This novel approach provides a more comprehensive gait evaluation, which is of clinical relevance in lameness assessment, and in the evaluation both of training responses, and locomotor performance on different surfaces. **Acknowledgements:** British Dressage for funding.