# Postural asymmetry of the rider whilst static and in sitting trot

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## INTRODUCTION:

Results from a preliminary study by Symes and Ellis (2009) quantified asymmetry of the riders (n=17) and evaluated leg length discrepancies as a possible predisposing factor. However the study used a range of horses and the affect of the horses motion on the asymmetry observed was not established and a number of significant variables within the study were not controlled. The aims of this study were therefore to identify rider asymmetry, with fewer influencing variables, within a static position and during sitting trot and to establish any correlations with leg length discrepancies.

Postural asymmetry is commonly seen in horse riders and can be associated with poor performance, however, the prevalence and manifestation of asymmetry has received minimal attention within literature and has yet to be quantified sufficiently. Kinetic research demonstrates that asymmetric positioning of the rider can significantly alter the forces acting on the horses back (Cocq et al 2009); however the affect on the horses kinematics has also yet to be quantified. Consequently, establishing both the manifestation and cause of rider asymmetry could act as a forerunner to understanding the influence on the horses kinematics and aid in improving rider performance.

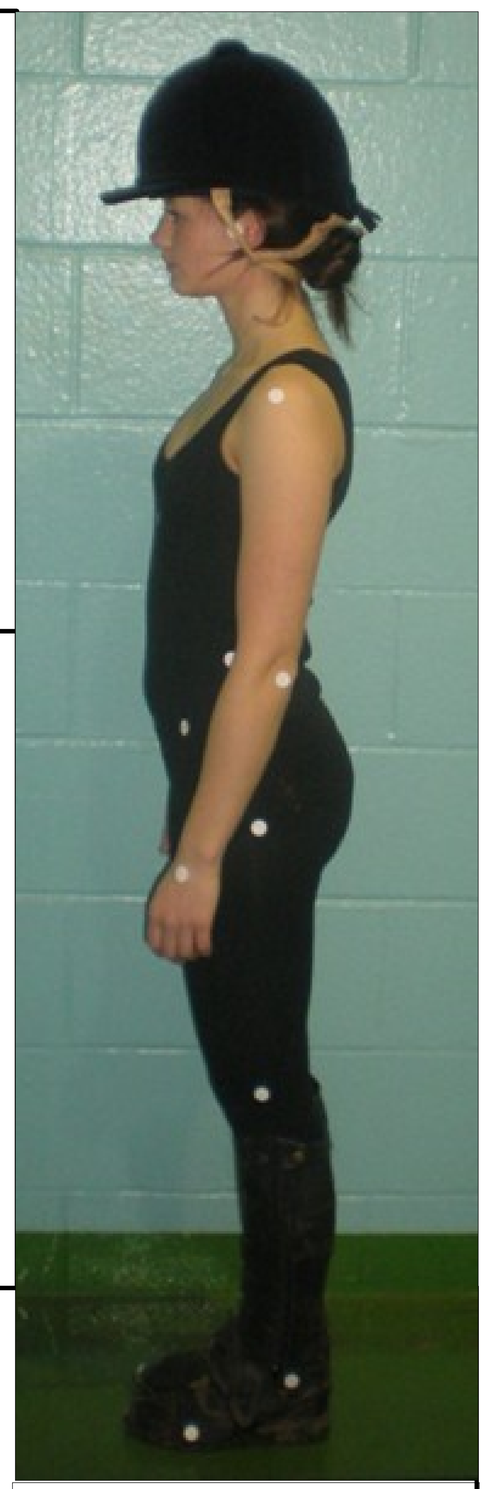

**Figure 1:** Marker position

## METHOD:

Fifteen female riders, aged 18 to 22 years (21.5±0.71, mean body mass 67kg± 9.42kg, mean height 169.9cm± 5.5cm) all with a competitive record within a range of disciplines, and riding at least five times a week took part in the study. Although not a variable for this study, the handedness of the riders were recorded; all were right handed. Video analysis was used to measure eight joint angles of the upper limbs, lower limbs and trunk of the rider during the lowest (frame 1) and highest (frame 2) point of the simulated trot stride cycle within sitting trot, and also within the static position (frame 3) to quantify the effect of motion on the degree of asymmetry observed. Reflective markers were placed on the approximate instantaneous centre of rotation of the joint (Figure 1), to enable accurate calculation of the joint angles. Leg length discrepancies (LLD) were measured to identify correlations between LLD and angle discrepancies. Marker placement and LLD measurements were undertaken by a qualified physiotherapist to ensure accuracy. Two cameras situated perpendicularly to the axis of the mechanical horse captured the static and dynamic data. Dartfish Connect 5.5 was used to analyse the films. Related samples T-tests were used to established bilateral differences in joint angles and for differences between the angles in each of the three frames. Spearman rank correlation coefficient was used to determine if a relationship existed between LLD and the calculated difference of the left and right angles.

## RESULTS:

Absolute angles of the upper arm expressed larger tendencies on the right (p≤0.001) indicating a more vertical upper arm position leading to a subsequent retraction of the hand. During motion the lower legs demonstrated significant asymmetries with larger angles on the left (p≤0.05) indicating a straighter limb. Significant differences were also seen between the two points of motion for the absolute angles on the right side for the trunk (p≤0.001) and thigh (p≤0.05), whereby angles increased during the highest point in the cycle. Together, these results suggest a rotational movement of the rider within which the left lower leg was positioned further forwards in relation to the right and the rider's right shoulder and hip were posteriorly rotated in relation to the left. No significant correlations were observed between the asymmetry of joint angles and LLD (P≥0.05), however conclusions suggest that lateral dominance of the rider may be an influencing factor. absolute angle.

**Table 1:** Distribution of sides showing largest absolute & relative angles

| Angle | Frame 1 | | | Frame 2 | | | Frame 3 | | |
|---|---|---|---|---|---|---|---|---|---|
| | P value | Distribution | | P value | Distribution | | P value | Distribution | |
| | | L | R | | L | R | | L | R |
| ***Absolute Angles*** | | | | | | | | | |
| Upper arm | 0.000 | 0 | 14 | 0.005 | 2 | 12 | 0.000 | 1 | 13 |
| Trunk | 0.218 | 8 | 6 | 0.007 | 3 | 11 | 0.716 | 6 | 8 |
| Thigh | 0.808 | 5 | 9 | 0.098 | 2 | 12 | 0.180 | 4 | 10 |
| Lower Leg | 0.012 | 11 | 3 | 0.015 | 10 | 4 | 0.077 | 7 | 7 |
| ***Relative Angles*** | | | | | | | | | |
| Shoulder | 0.234 | 11 | 3 | 0.022 | 12 | 2 | 0.069 | 5 | 9 |
| Elbow | 0.920 | 7 | 7 | 0.856 | 6 | 8 | 0.117 | 11 | 3 |
| Hip | 0.816 | 7 | 7 | 0.684 | 6 | 8 | 0.141 | 5 | 9 |
| Knee | 0.136 | 8 | 6 | 0.515 | 7 | 7 | 0.603 | 6 | 8 |

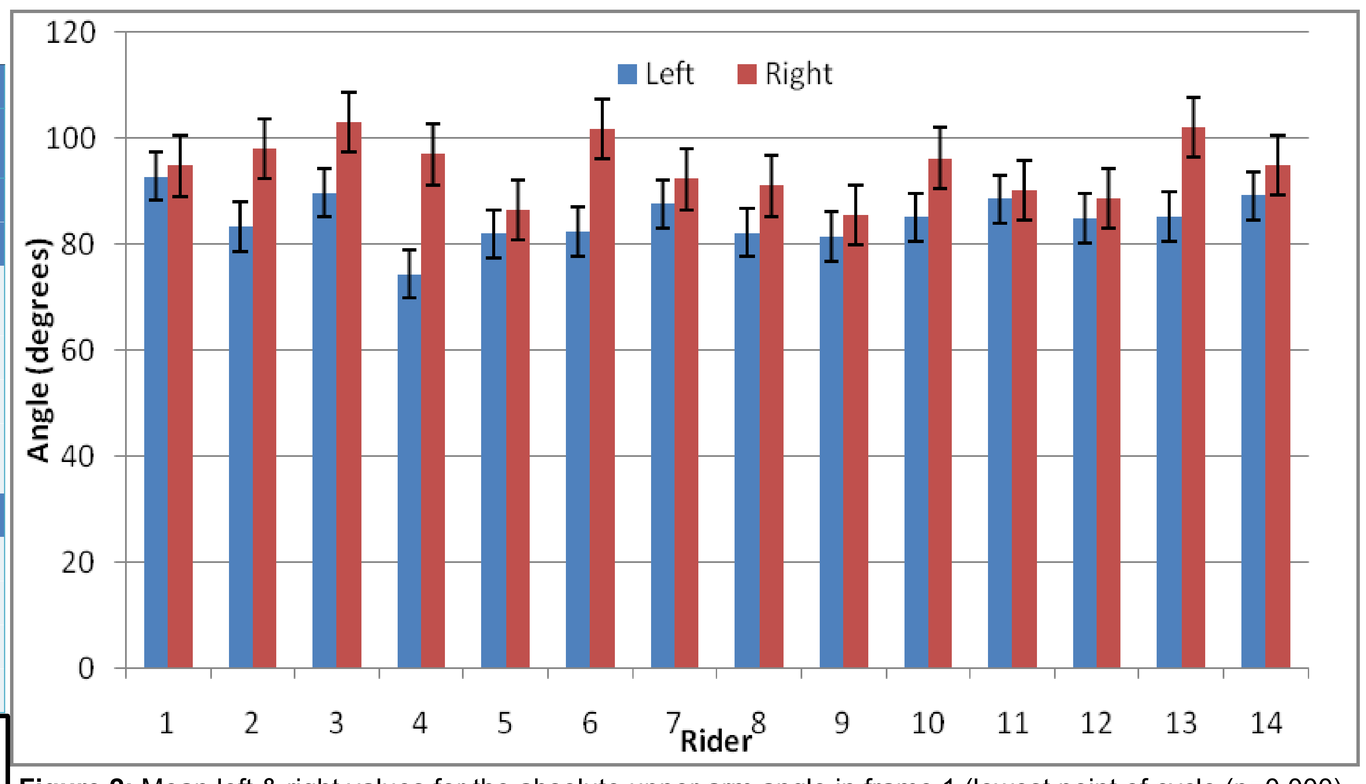


**Figure 2:** Mean left & right values for the absolute upper arm angle in frame 1 (lowest point of cycle (p=0.000)

## CONCLUSIONS:

The present study suggests some commonly asymmetrical postures may be adopted by riders; the degree and type of asymmetry observed appears to be exaggerated during motion of the mechanical horse. Typically, alterations in posture occur within the upper limbs of the rider through a greater retraction of the dominant upper limb. However, despite the theoretical basis, LLD's did not show any significant correlation with the postural asymmetry observed, therefore the underlying cause of the rider asymmetry requires further research. Potentially, as suggested by the results of this study, laterality factors should be considered as a predisposing factor.

## INDUSTRY APPLICATIONS:

The study suggests that there are commonalities in rider posture faults. Awareness of these, and identification of predisposing factors could assist riders and trainers in developing compensatory strategies within training to enhance rider performance.

**REFERENCES:**

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