Title: The potential effect of equine brachiocephalicus muscle tenderness on forelimb kinematics.

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Introduction: Knowledge of effects of specific muscle tenderness on the equine gait may expand understanding of causes of equine gait abnormalities and lameness. Within this study muscle tenderness refers to an increased sensitivity to pain quantified by pressure algometry, an established method for the measurement of mechanical nociceptive thresholds (MNTs) (Hausler & Erb, 2006). The aim of this study was to investigate if differences in left and right equine brachiocephalicus (EBc) MNTs alter respective forelimb (FL) kinematics.

Material & Methods: A single-blinded, controlled, randomised study with 14 privately owned horses assessed unridden in trot was conducted. Skin markers, 3cm in diameter, were applied bilaterally to four anatomical forelimb landmarks; dorsal aspect of scapula cartilage (in line with scapula spine), cranial, ventral aspect of the head of the humerus (point of shoulder), caudal aspect of the olecranon tuberosity of the ulna (point of elbow) and the lateral aspect of the hoof wall approximately central to the pedal bone (Clayton, 2013). Stride length (SL) and maximum shoulder extension angles (MAXANGLE) measurements were collected via 2D video analysis (Kinovea) in trot on a straight 20m track. Each horse was trotted three times on each rein at working trot. Using a pressure algometer, a single examiner measured MNTs three times at the origin (wing of atlas), belly (between C6 & C7) and insertion (deltoid tuberosity (DT)) sites on the left and right EBc (Payne et al, 2006). Symmetry Indices (SI) were calculated from MNT and FL data sets. Data were tested for normality (Kolmogorov-Smirnov test). Student's t-test compared MNTs between left and right sides. Pearson's correlation coefficient evaluated correlation between MNTs and kinematic data.

Results: There was no significant difference between left and right MNTs for all EBc sites. There was a negative correlation between the EBc insertion site MNT SI and SL SI ($r=-0.56$, $p= 0.04$). There was no correlation between origin and belly MNT SI's, SL SI's and MAXANGLE.

Discussion and Conclusions: The results show that asymmetrical muscle tenderness in a FL protractor muscle (EBc) may influence forelimb kinematics. Further research is recommended with a larger population and a defined trot speed to establish the full extent of its influence. The insertion of the EBc was the only MNT site to correlate with forelimb kinematics. The caudal portion of the EBc passes over the scapula-humeral joint to insert into the DT. When a muscle is stretched over a joint it becomes predisposed to strain which could explain why this site showed a correlation when the other sites did not. This suggests when evaluating muscle tenderness by PA, that site within the muscle is important.

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