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ORTHOPAEDICS

THE USE OF SURFACE ELECTROMYOGRAPHY FOR QUANTIFICATION OF CHANGES IN BICEPS FEMORIS AND TRICEPS BRACHII MUSCLE ACTIVITY DURING INDUCED FORELIMB AND HINDLIMB LAMENESS

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Background: Movement asymmetry during lameness has been extensively studied using quantitative gait analysis, but limited information exists about adaptive muscle activity occurring during lameness.

Objectives: To investigate whether asymmetric muscle activity occurs in superficial pelvic and thoracic limb muscles before and after induced forelimb (FL) and hindlimb (HL) lameness using surface electromyography (sEMG).

Study design: Experimental.

Methods: sEMG sensors were attached bilaterally above biceps femoris (BF) and triceps brachii (TB) in a preliminary sample of five clinically non-lame horses. sEMG and 3D-kinematic data were collected during in-hand trot. FL and HL lameness (2–3/5 AAEP) were induced on separate days using a modified horseshoe, with baseline data initially collected each day. To quantify lameness, MinDiff was calculated from poll (HDMin) and pelvis (PDMin) vertical displacement for FL and HL lameness, respectively. Raw sEMG signals were DC-offset removed, high-pass filtered, and full-wave rectified. Integrated EMG (iEMG) was calculated using stride duration as the temporal domain. iEMG from each horse were normalised to the maximum observed value of individual muscles in the baseline condition. The difference between right and left iEMG values for each muscle were calculated for each stride to quantify muscle asymmetry ($iEMG_{Diff}$). Repeated measures ANOVA compared $iEMG_{Diff}$ data for each muscle between conditions (baseline, induced FL and HL lameness).

Results: Absolute mean ± s.d. for HDMin (61.6 ± 27.1) and PDMin (16.0 ± 9.1) were congruent with the degree of induced lameness. Mean ± s.d. baseline $iEMG_{Diff}$ was 14.2 ± 5.7 across both muscles. $BFiEMG_{Diff}$ was significantly greater than baseline (15.2 ± 6.9 vs. 80.9 ± 46.1, $P < 0.05$, $pn^2 = 0.704$) during HL lameness and $TBiEMG_{Diff}$ during FL lameness (10.0 ± 1.7 vs. 40.7 ± 18.7, $P < 0.05$, $pn^2 = 0.754$).

Main limitations: Clinical lameness cases must confirm findings.

Conclusions: FL and HL lameness cause differential increases in iEMG asymmetry in TB and BF. sEMG symmetry parameters could help understand neuromuscular adaptations to lameness and could complement kinematic methods for objective lameness evaluation.

Competing interests: None declared.

Ethical animal research: This study was approved by the Ethical Committee of Utrecht University (CCD: AVD108002015307).

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