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Publication date:
2024

Document version
Peer reviewed version

Citation for published version (APA):
Muscle function assessments in a dog with cranial cruciate ligament disease using acoustic myography

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Introduction
Skeletal muscles are involved in multiple orthopaedic disorders in dogs, such as cranial cruciate ligament disease. This disease is critical in veterinary medicine, but clinicians lack tools to evaluate the functional capacity of their patients perioperatively. Acoustic myography could meet this clinical need.¹, ²

Objectives
To evaluate bilateral hindlimb muscle function pre- and postoperatively in a dog with right-sided cranial cruciate ligament disease.

Materials and methods
Hindlimb muscle function was assessed using video recordings, visual lameness grading, pressure-sensitive walkway gait analysis, stifle and tarsal goniometry, limb circumference, and acoustic myography. Measurements were performed pre-operatively and at eight postoperative time points within six months of Tibial Plateau Levelling Osteotomy.

Results
Initial lameness and muscle atrophy were reflected in asymmetric limb loading on gait analysis. Lameness gradually resolved with normalized loading from 14 weeks, based on left/right symmetry indices for peak vertical force and vertical impulse of 1.04 and 1.07, respectively. However, acoustic myography revealed quantitative and qualitative asymmetry for a longer period, indicating increased muscular activation and better coordination in the contralateral limb compared with the operated limb at 14- and 15.5-weeks post-surgery. Vastus lateralis left/right symmetry indices for S-scores and T-scores were 0.49 and 0.82 at 14 weeks, 0.73 and 0.94 at 15.5 weeks, and 1.06 and 1.08 at 17.5 weeks, respectively. Mean symmetry indices for acoustic myography in healthy dogs are 1.03 (S-score) and 1.04 (T-score) for this muscle.

Temporospatial measures (symmetry indices for swing time and stance time) revealed asymmetry for a longer period, while the M-shaped loading graphs from the pressure sensitive walkway gradually improved for the right hindlimb.

Figure: Data are shown for one pre-operative (week -10.5) and three post-operative (week 14, 15.5 and 17.5) time points. Symmetry indices of the pressure sensitive walkway data are shown in the top row. Acoustic myography recordings from the vastus lateralis in the middle row (with less distinct pressure waves on the right vastus lateralis). Loading graphs from the pressure sensitive walkway in the bottom row. L: Left, R: Right.

Discussion and conclusions
Identification of altered muscle activity patterns in dogs with cranial cruciate ligament disease may provide clinicians with novel insights into management of affected dogs compared to visual assessments or gait analysis, and potentially identify targets for focused post-operative rehabilitation. Further investigations are needed to establish individual vs. population-wide applicability of these measurements.

Conflicts of interest:
One of the first author’s supervisors is commercializing acoustic myography equipment but was not involved in the data analysis.

References