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Repeatability and reproducibility of a novel smart sensor system in boots to assess locomotion in horses

Stéphane JUBAN, Morgane GEROUT-JUBAN, François BAGAÏNI, Fanny HONTOIR, Jean-Michel VANDEWEERD



Figure 1 : The connected boots Tendiboots put in place on a horse

REASONS FOR PERFORMING STUDY

In order for changes in lameness to be detected with accuracy and recorded during diagnostic investigations and clinical follow-up, an objective measure of lameness is required. A novel smart sensor system in boots has been developed to detect asymmetry of locomotion in front limbs in horses (Figure 1). The system provides a measure in Newtons.

Objectives of the study : To assess repeatability and reproducibility of the system fixed in protecting boots in healthy horses.

MATERIAL AND METHODS

Nine healthy horses were video recorded (Figure 2) under twelve standardized conditions (Table 1). Videos were assessed blindly by two veterinarians who confirmed that no lameness was visible. Observations were conducted in triplicates. The signal recorded by the boots was expressed in Newtons. To measure concordance between measures, the intraclass correlation coefficient (ICC) was used. ICC values less than 0.5 are indicative of poor reliability, values between 0.5 and 0.75 indicate moderate reliability, values between 0.75 and 0.9 indicate good reliability, and values greater than 0.90 indicate excellent reliability.



Figure 2 : Observations under standardized conditions

Table 1 : Observations performed on the nine horses

- | | |
|--|---|
| 1. Trot from left to right on straight line / slow | 7. Trot on circle right rein / slow |
| 2. Trot from left to right on straight line / fast | 8. Trot on circle right rein / fast |
| 3. Trot from right to left on straight line / slow | 9. Walk on circle right rein |
| 4. Trot from right to left on straight line / fast | 10. Walk on circle left rein |
| 5. Trot on circle left rein / slow | 11. Walk from left to right straight line |
| 6. Trot on circle left rein / fast | 12. Walk from right to left straight line |

RESULTS

Measures are repeatable when they are conducted in the same way (ICC 0.92)

Measures are reproducible :

- when boots are placed by different persons (ICC 0.93)
- when moving from left to right or right to left on the straight line at the trot (ICC 0.91) and at walk (ICC 0.98)
- when moving on the left or right rein on the circle at the trot (ICC 0.92) and at walk (0.94)
- independently of the speed of the trot on the straight line and the circle

Measures are significantly different between trot and walk

In this series of healthy horses, overall the 12 observations, there was a mean difference of 2.17 Newtons between the signals recorded on the left and the right limb, with a mean signal per limb of 16.34 Newtons.

CONCLUSION

Repeatability and reproducibility of the smart sensor system in boots is excellent. Measures must be compared within a same pace (e.g. trot). The system should now be assessed for validity in a standardized model of induced lameness.