DRY VS GEL ELECTRODES IN CANINE SURFACE ELECTROMYOGAPHY: A STEP TOWARDS MORE PRACTICAL VETERINARY ELECTROMYOGRAPHY?

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INTRODUCTION

Surface electromyography (sEMG) is **a non-invasive diagnostic tool** that records the electrical activity of muscles.[1,2,3,4] It can be used research, clinical diagnostics, sports medicine and rehabilitation, and has proven to be a valuable technique for assessing neuromuscular disorders, monitoring treatment progress and evaluating therapeutic interventions, **allowing clinicians to evaluate muscle function** in dynamic activities.[4,5,6,7] In Veterinary Medicine, sEMG has emerged as a promising tool for the non-invasive measurement of muscular function **in conscious patients**, mostly in biomechanics and locomotion where research output has increased in recent years.[8,9]

AIMS

- **MOTIVATION?** The lack non invasive, objective tools to assess neuromuscular function in animals with myelopathies, undergoing rehabilitation medicine treatments.
- **HOWEVER?** In small animals, broader use has been limited by trichotomy, signal instability, and the need for specialised training in signal analysis.
- **OBJECTIVE?** Evaluate the feasibility of dry electrodes, never used before in veterinary applications, comparatively to conventional gel-based electrode, in canine subjects.

MATERIALS AND METHODS

ANIMALS

- 12 healthy Dachshund dogs (8 males and 4 females, mean of 3.6 years old).
- All underwent a complete orthopaedic and neurological exam.

PROCEDURE

- sEMG Dry electrodes (SoftPulse Flex, Datwyler®, Switzerland) (Fig.1) placed 2 cm apart on the erector spinae muscles (T12-L2 right side), same process for conventional gel-based electrodes (Kendall™H124SG, UK) (Fig. 2).
- Subjects walked on a veterinary treadmill (FitFurLife® Professional Treadmill, UK) for 1 min, at 1.2 mph (Fig. 3).

SIGNAL PROCESSING

- Muscle activity recorded with BITalino® EMG device.
- Signal collection was achieved with OpenSignals® software (Fig. 4).
- Signal Processing based on band-pass filter (25-480 Hz), notch filter (50 Hz), rectification, envelope calculation (low-pass at 6 Hz)[10] and frequency band division (25-150 Hz/ 150-300 Hz / 25-480 Hz).[11]

DATA ANALYSIS

- Statistical measures (mean, standard deviation, maxima, Root mean square error).
- Fast Fourier Transform (FFT) to obtain PSDmax (Maximum Power Spectral Density), PSDmean, PSDmedian and compare noise and signal characteristics.[11]

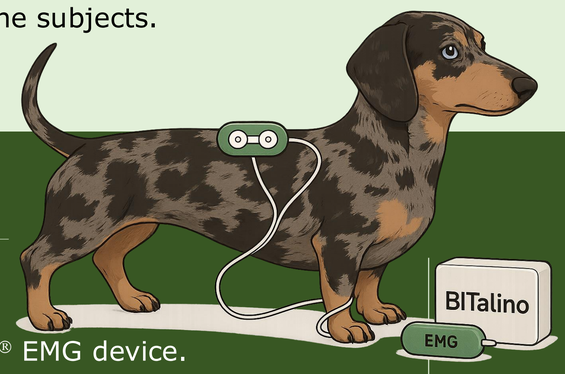

Figure 1. sEMG setup - BITalino® EMG, Portugal.

Figure 2. A: Dry electrodes. **B:** Conventional gel-based electrodes.

Figure 3. Electrode placement in the dog and treadmill usage during signal acquisition.

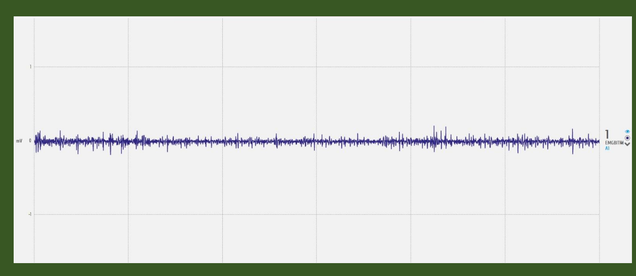

Figure 4. Signal acquisition on OpenSignals ® software.

RESULTS & CONCLUSIONS

Dry electrode configuration consistently produced higher amplitude and RMSE (Fig. 5), while in PSDmedian and PSDmax values, **both electrode configurations were broadly comparable** (Fig. 6), with a slight tendency towards higher spectral power in the pre-gelled configuration. Although it is advisable to use pre-gelled electrodes whenever possible, our observations suggest that **dry electrodes may offer practical advantages** in terms of easier use and reduced preparation time, without compromising signal integrity, they are also **more envairomental friendly**, as they can be reused several times, unlike the pre-gel, which are single use.

Given the limited body of knowledge and lack of standardised protocols for of sEMG in the veterinary field, **further investigation into the use of dry electrodes is required**, studying in greater detail the susceptibility of dry electrodes to noise and motion artefacts is of utmost importance.

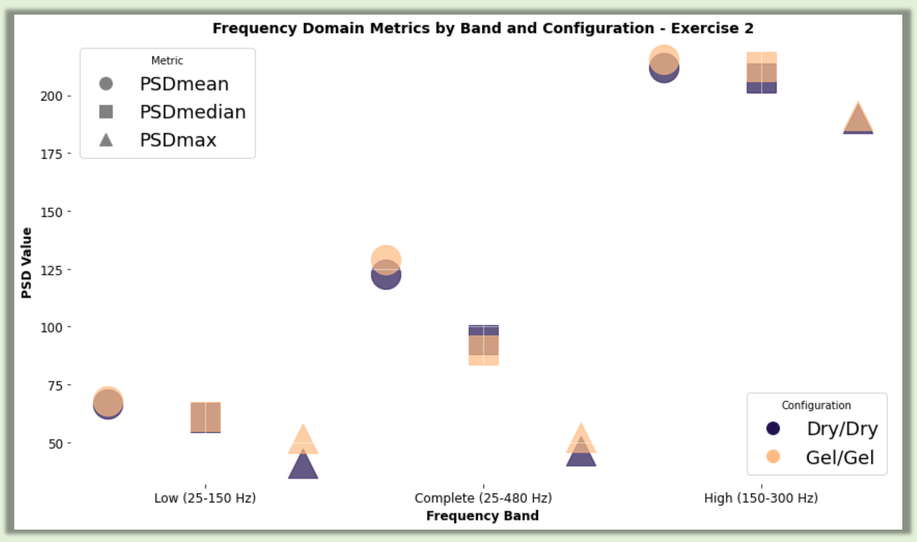

Figure 5. Experimental results on amplitude comparation between pre-gelled configuration and dry electrodes.

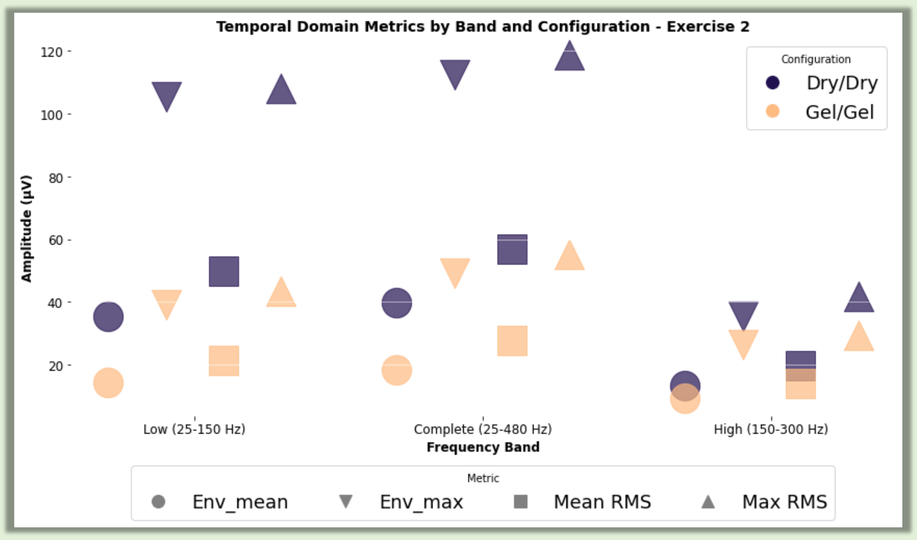

Figure 6. Experimental results on frequency comparation between pre-gelled configuration and dry electrodes.

REFERENCES

ACKNOWLEDGMENTS

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