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Assessment of Equine Gait Abnormalities Using Wireless Inertial Sensors: A Step towards Objective Lameness Detection

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Introduction

Equine lameness is a prevalent and clinically significant issue that affects the athletic performance, welfare, and overall health of horses. Traditionally, lameness assessment has relied on subjective visual and tactile evaluation by veterinarians. However, these methods can be influenced by individual judgment and experience, leading to potential inaccuracies and variability in diagnosing and monitoring lameness. Objective and quantitative assessment techniques are needed to enhance the accuracy and consistency of lameness detection. Wireless inertial sensors have emerged as a promising technology for objective gait analysis, enabling continuous and real-time monitoring of equine movement. This study aims to explore the utility of wireless inertial sensors in assessing equine gait abnormalities, thereby advancing the field of objective lameness detection.

Description

In this pioneering study, a diverse group of horses with a spectrum of lameness severity levels were outfitted with state-of-the-art wireless inertial sensors. These lightweight and unobtrusive sensors were strategically attached to various limbs, allowing for comprehensive data collection during the horses' natural locomotion. The utilization of wireless inertial sensors offered the advantage of unencumbered movement, ensuring that the data captured were authentic representations of the horses' gait patterns across different gaits and terrains. A meticulously designed data collection protocol was implemented to capture a holistic range of equine movements. Horses were observed both in controlled environments, such as straight paths, as well as under more challenging conditions like turns and uneven surfaces. This comprehensive approach aimed to encompass the complex and multifaceted nature of equine locomotion, accounting for potential variations that arise during different activities.

During the data acquisition phase, the wireless inertial sensors continuously recorded triaxial accelerations and angular velocities, generating a rich dataset for each horse's movement. These data streams were then subjected to advanced signal processing techniques to extract vital gait parameters. Parameters of interest included stride length, a fundamental indicator of gait dynamics; stance duration, reflecting the time a hoof remains in contact with the ground; and asymmetry indices, indicating any imbalances between the limbs. To establish a robust foundation for analysis, parallel to the sensor-based measurements, experienced veterinarians conducted thorough clinical assessments to ascertain traditional lameness scores. These clinical evaluations were based on visual observation, palpation, and established lameness grading systems. By correlating these traditional scores with the sensor-derived parameters, the researchers aimed to establish a meaningful bridge between the novel technology and the existing clinical framework.

In-depth statistical analyses were performed to evaluate the data collected from both the wireless inertial sensors and the clinical evaluations. Comparisons were drawn between sound and lame horses, allowing the researchers to identify patterns and trends associated with different levels of lameness severity. This multidimensional approach provided a comprehensive understanding of how equine gait abnormalities manifest across various measures [1-5].

Conclusion

The integration of wireless inertial sensors into equine lameness assessment holds tremendous promise for transforming the field of objective gait analysis. The study's thorough data collection methodology, involving a diverse set of horses and a wide range of movements, facilitated a holistic understanding of the potential applications of this technology. By employing advanced signal processing techniques and statistical analyses, the study illuminated the substantial differences in gait parameters between sound and lame horses. This suggests that the data obtained from wireless inertial sensors could serve as robust indicators of lameness. The ability to capture intricate variations in gait dynamics in real time provides a unique opportunity for early detection and continuous monitoring, enhancing the precision of clinical interventions.

Furthermore, the observed correlations between sensor-based measurements and traditional lameness scores underscore the relevance and validity of the wireless inertial sensor data. This alignment between cutting-edge technology and established clinical practices holds the promise of a more standardized and quantifiable approach to equine lameness diagnosis and management.

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