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Exploring movement-related cortical potentials, reaction time and force production during the sprint block start of expert and novice sprinters: A case series

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INTRODUCTION:
Research have identified reaction time and force production as the most important factors for a successful sprint start, which accounts for 5% of the 100 m running time. Additionally, executive functions, sensory integration and motor programming are required to carry out the actions of the sprint start. Relating to cognitive processes, the neural efficiency hypothesis states that those with more experience require less cortical activation to execute a well-trained skill, when compared to someone with less experience. This hypothesis has been extended to athletes, but these brain-body connections have not been investigated in sprinters. This pilot study set out to describe MRCP (movement-related cortical potentials) of novice and expert sprinters before and during the sprint block start to understand movement-related brain activity changes during the movement preparation stage of the sprint block start. Secondary aims were to describe the reaction time, relative force production, speed and acceleration of multiple novice and expert sprint cases during a sprint block start.
METHODS:
A case series design was used and four cases (two novice and two expert sprinters) were recruited. Cases completed ten sprint block start trials on an indoor track, while MRCP were recorded via 64-channel EEG. Additionally, reaction time, relative force, speed and acceleration were measured by the FAST start blocks.
RESULTS:
The prefrontal cortex and the parietal lobe were identified as hubs of brain activity during the sprint block start, with statistically significant differences found across conditions in the parietal lobe. Lower prefrontal theta, alpha 1, alpha 2 and beta power were observed for the expert sprinter case. Parietal theta, alpha 1, alpha 2 and beta power of all cases appear to be quite similar, but this is inconclusive.
CONCLUSION:
The statistically significant differences in parietal alpha and theta power, found across conditions, possibly indicate an increase in working memory and focused attention from the initial rest period until the response to the starting signal. Whereas the lower prefrontal power of the expert sprinter case potentially reflects a decrease in the reliance on executive functions and supports the neural efficiency hypothesis. The similar parietal power of the four cases may be because, regardless of skill level, all cases still had to anticipate the starting signal, integrate the sensory information and prepare the appropriate motor response.

These observations show that MRCP recording during the sprint block start is possible, and contributes new information to the novel field of applied mobile-EEG in cue-based closed-skill sport performance. Currently EEG cannot be used as a tool in the everyday sprint training setup due to the many factors affecting the EEG response and the expertise required to process and interpret the data. In future, with development, EEG may possibly be used as a load monitoring tool to screen for fatigue and impaired performance.

Topic: Motor Learning and Motor control

Presentation Poster