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Recruitment properties of spinal reflex of the thigh muscle in elite sprinters

Nakagawa, K., Kakehata, G., Kaneko, N., Masugi, Y., Kanosue, K., Iso, S., Nakazawa, K.

Waseda University

INTRODUCTION:
Activation timing of thigh muscles is important in high-performance of sprint running. Especially, sharpness of switch from onset to offset of thigh muscle activation during sprint running is superior in top sprinters (Kakehata et al. 2021). These characteristics of activation pattern of thigh muscles in sprinters could be produced by specific function of central nervous system, especially neural circuits including motoneurons. The purpose of this study was to examine the recruitment properties of spinal reflex in sprinters.
METHODS:
Ten sprinters and ten control subjects participated in this experiment. We used transcutaneous spinal cord stimulation (tSCS) to evoke posterior root-muscle reflex from lower limb muscles (Courtine et al. 2007). Stimulation electrodes were attached at abdomen (anode) and the midline of the back between L1 and L2 (cathode). tSCS was applied with various stimulation intensities from subthreshold to the above intensity inducing the plateau amplitude of spinal reflex. We evaluated the recruitment curves of the reflex amplitudes in the bicep femoris and soleus muscle. From the recruitment curves, we calculated the maximal slope, plateau amplitude, and threshold (Higashihara et al. 2022).
RESULTS:
The maximal slope of the recruitment curve of the spinal reflex of the biceps femoris was significantly higher in sprinters than control subjects ($P < 0.05$). Meanwhile, there was no significant group-differences in the maximal slope of the soleus. Furthermore, the plateau amplitude and threshold did not differ between the group irrespective of muscles.
CONCLUSION:
The observed sharper slope of the recruitment curve of spinal reflex in sprinters without differences in plateau amplitudes would mean that higher motor output induced by reflex can be delivered with small changes in sensory input in sprinters. This specific recruitment property of spinal reflex of the biceps femoris in sprinter could reflect plastic change of spinal neural circuits by long-term sprint training. In conclusion, elite sprinters show the muscle-specific recruitment pattern of spinal reflex.

Topic: Motor Learning and Motor control

Presentation Poster