THE EXAMINATION OF POST-ACTIVATION POTENTIATION OF THE H-REFLEX FOLLOWING ECCENTRIC AND CONCENTRIC CONTRACTIONS

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INTRODUCTION

The H-reflex indicates the excitability of the spinal motoneuron pool [2]. Post-activation potentiation (PAP) of the H-reflex in human soleus muscle was reported following the cycling movements consisting of voluntary concentric contraction (CON) and voluntary eccentric contraction (ECC) after the depression for 1 to 3 minutes [3]. Trimble and Harp [3] explained that the muscle activation recruited high-threshold motor units induced PAP similarly to tetanic electrical stimulation.

From the view point of neural control, however, CON and ECC are qualitatively different motor task [2]. Thereby, it is conceivable that aftereffects of ECC and CON may be different. In addition, the H-reflex was affected by the background muscle activity [4]. Trimble and Harp did not report the muscle activity levels of both contractions. Hence, it is doubtful that PAP was induced by ECC and CON cycling movements itself.

The purpose of this study was to investigate that motor task consisting of ECC and CON with similar muscle activity levels in both phases can induce PAP.

METHODS

Six healthy male subjects (24.0 ± 1.9 yr, 173.1 ± 5.3 cm, 71.4 ± 8.0 kg) with no history of neurological disorders participated in this study. The subjects were assumed a kneeling position on a rubber surface with both the hip and knee joint angles at 90°, and ankle angle at 110° respectively. The right foot was strapped to the metal plate fix to the biomechanical and training system (Con-Trex MJ, CMV AG).

The subjects were instructed to rotate the foot about the ankle joint at a constant angular velocity (60°/s) from 100° to 130° matching the movement of the metal plate. They were required to keep SOL activity levels about 30 % of Maximal isometric voluntary contraction (MVC). They performed motor task for 6 sets of 10 repetitions with 20 s rest between each set.

Electromyographic (EMG) activity was recorded from the SOL of the right leg using bipolar Ag/AgCl surface electrodes. The H-reflex and M-response were evoked by stimulating the posterior tibial nerve with single pulses of 1 ms duration. The test reflex stimulus intensity was determined to the intensity which evokes the H-response corresponding to the amplitude of 20-25 % of the maximal M-response (M-max). The EMG signals were amplified and filtered about 10 Hz-2 kHz (MEB-2200, Nihon Kohden) analog to digital converted at sampling rate of 4 kHz (Mac lab/16s, AD Instruments) and recorded.

10 control H-reflexes were evoked before motor task. Post-condition value was recorded for 10 min following motor task. The time-course after motor task was divided into 6 stages (ST1 - ST6) and ten responses corresponding to each stage were averaged. The statistical difference of control and post-condition H-reflex was tested by Dunnet’s post hoc test. Paired t-test was used to compare the muscle activity level of CON with ECC. Statistical significance was set at P < 0.05.

RESULTS AND DISCUSSION

There were no significant differences between CON and ECC in the muscle activation level. Hence, it was conceivable that muscle activation levels in both phases were similarly. Figure.1 shows time course of the post condition value. The depression at ST1 was probably considered post-activation depression (PAD) caused by depletion of neurotransmitter substance [1]. Significant PAP did not occur in each stage. During ECC, inhibitory component of corticospinal volley were relatively increased compared with CON [2]. The excitability of the motoneuron pool was lower during ECC then during CON [2]. Thereby, CON & ECC cycling movement itself did not have aftereffect to potentiate the H-reflex and both contractions may have different aftereffect on the H-reflex because both motor controls were qualitatively different. ** P < 0.01

CONCLUSIONS

PAP did not occur after CON & ECC cycling movements with similar muscle activity level in both contractions. Present study suggested that CON and ECC may have different aftereffect on the H-reflex.

REFERENCES