REFLEX MODULATION AFTER LONG TERM PASSIVE REPEATED PLYOMETRIC TRAINING

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INTRODUCTION

Resistance training results in improved strength by increasing muscle size and by altering the pattern of nervous drive (Sale, 1988). Resistance training changes the functional properties of spinal cord circuitry in humans, but does not substantially affect the motor cortex (Carroll et al, 2002). Hoffman reflex (H-reflex) was evoked by an electrical stimulus applied on peripheral nerve. It reflects the excitability of motorneuron pool in spinal cord (Schieppati, 1987). Almeida-Silveira et al (1996) monitored the H-reflex and found a decrease in reflex excitability after repeat Stretch-Shortening-Cycle training in rats. Passive Repeated Plyometric training (PRP training), a new training method for strength and power, was developed based on the concepts of Stretch-Shortening-Cycle training (Chen & Shiang, 1996). Several researches have found that PRP training significantly improved strength and power in elite athletes (e.g. Liu *et al*, 2001). However, how neuro-muscular system contributes to the gain of strength and power after PRP training is still not well understand. Therefore, the purpose of this study was to investigate the excitability of the reflex arc and the presynaptic inhibition (PSI) could be modulated by the PRP training.

METHODS

Ten male collegiate (aged 20.30± 0.82 yr; weight 68.87±10.26 kg; height 171.70±3.53 cm) voluntary participated in the study. The subjects participated in a 10-wk PRP training program with three sessions per week (see Figure 1). In each of the training sessions, five sets of PRP training were carried out with a 2min break between sets. Each set lasted for 20 sec and the movement frequency was at 2.5Hz. The assessment of H-reflex and M-wave amplitudes were conducted before 1st, 15th, and 30th training session. The subjects were positioned on a leg extension machine with ankle and knee joints fixed. The surface EMG was recorded from the soleus muscle of non-dominant leg by using bipolar surface electrode with 2k Hz sampling frequency. The maximum H-reflex was elicited by stimulating the posterior tibial nerve with a constant-current stimulator (DS7H, Digitimer, UK) at 0.2 Hz to detect motorneuron excitability and at 2 Hz to detect PSI. The intensity of the stimulation was gradually intensified to elicit the maximal M-wave. Ten peak-to-peak amplitude of the H-reflexes at each frequency and ten M-waves were recorded. The $H_{max}$to-M_{max} ratio (H/M) at 0.2 Hz was calculated for indicating the excitability of alpha neuron pool. The averaged amplitude of 2nd to 10th H-reflex at 2 Hz was divided by first H-reflex (PSI ratio= Σ H2-H10/H1) for indicating PSI changed.

Figure1: *PRP training*

RESULTS AND DISCUSSION

A Repeated Measures of ANOVA revealed that the H/M ratio significantly depressed at 30th training session (p=0.015) (Figure 2), indicating about 23.5% decrease of motorneuron pool excitability after 10-wk PRP training. This result was consistent with the findings of previous studies (Almeida-Silveira et al, 1996; Scaglioni et al, 2002). Almeida-Silveira et al (1996) found that H-reflex decreases were accompanied by relative increases in the number of type II fibres after SSC training, suggesting the decrease of motorneuron pool excitability after long term PRP training might relate to the change of fiber type composition. In Figure 2, there was significantly increased in PSI ratio after 10-wk PRP training (p=0.037). The PSI mechanisms are considered mainly responsible for depression of the H-reflex (Zehr, 2002), which might relate to the function of Ia inhibitory interneurons. The long term PRP training induced PSI ratio increase about 9.7% indicating the PRP training might be able to inhibit effect of Ia inhibitory interneuron and decrease presynaptic inhibition in spinal circuitry.

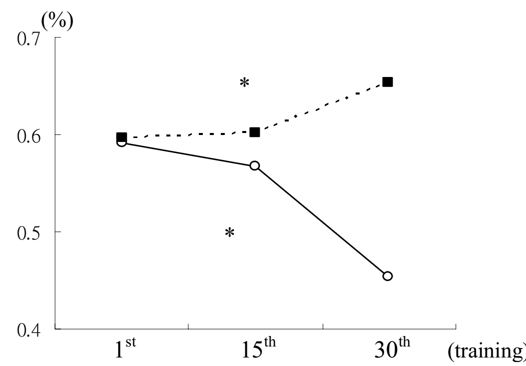

Figure 2: Variety of H/M ratio (○) and PSI ratio (■) via the PRP training for ten weeks. (*means significant difference between 1st and 30th, p<.05).

CONCLUSIONS

The findings revealed that excitability of motorneuron pool significant decreased and PSI significant increased by the long term PRP training. The PRP training affected reflex modulation of spinal cord and induced plasticity change of spinal circuitry.

REFERENCES

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