EFFECTS OF SINGLE ANGULAR VELOCITY ECCENTRIC TRAINING ON MUSCLE STRENGTH AND NEUROMUSCULAR ACTIVATION DURING DIFFERENT TYPES OF CONTRACTIONS

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INTRODUCTION

It is generally accepted that isokinetic muscle strength training protocol could maintain the maximal muscle contraction through range of motion and stimulate more motor units recruitments when performing both concentric and eccentric contractions [1]. Isokinetic eccentric training has a significant effect on gaining muscle strength than concentric training [2] [3]. However, the effects of isokinetic eccentric training on lower extremity muscle strength and neuromuscular activation when contracting at different angular velocities are not clear. The purpose of this study was to determine the effects of isokinetic eccentric training on muscle strength and neuromuscular activation when testing at different angular velocities.

METHODS

Eight healthy subjects (mean age 23.3 ± 2.9 years, height 161.0 ± 5.2 cm, weight 55.5 ± 8.1 kg) were recruited for isokinetic eccentric right knee extensor training at 120 deg/sec, 3 sets of 10 reps at 80% maximal efforts, 3 days a week for 6 weeks. EMG electrode was placed on right rectus femoris of each subject. Isokinetic dynamometer (Biodex systems 3) and surface electromyography (EMG, MP150) were used to collect data simultaneously. Before and after 6 weeks training period, maximum isometric knee extension torque was obtained at 60° knee flexion. Also, knee extensor torques and surface EMG signals were collected from 10°-100° of knee flexion, and analyzed data from 30° to 70° during maximal voluntary concentric and eccentric contraction at 60, 120, 180 deg/sec. Torque data were normalized by body weight and EMG data were normalized by EMG signals during MVC. Pair T test was used to examine the significance between pre-test and post-test torque and normalized EMG values. The significant level was set at α=.05.

RESULTS AND DISCUSSION

After 6 weeks isokinetic eccentric contraction training, post training torques were significantly higher than pre training torques for both concentric and eccentric contraction at 60, 120, 180 deg/sec (Figure 1). The results indicated that 6 weeks single angular velocity isokinetic eccentric training increased muscle strength at different contraction velocities and types. Normalized EMG data between pre and post training tests had no significant effects through different angles and contraction types (Figure 2). Results from this study indicated that motor units recruitments were not affected by 6 weeks single velocity eccentric contraction training. After 6 weeks eccentric contraction training, the same amount of motor units recruitments could produce greater joint torques. The efficiency of torque generation was better after eccentric training

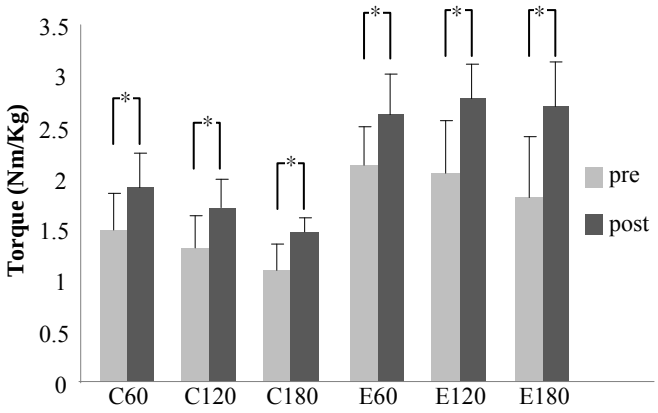

Figure 1: Average torque at pre and post test for concentric (C) and eccentric (E) contraction at 60, 120, 180 deg/sec. Values are means ± SD. * significantly different compared with pre and post test value ($p < .05$)

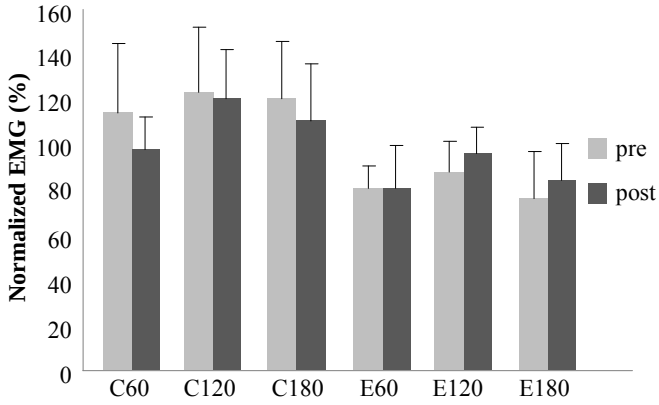

Figure 2: Average normalized electromyography activity at pre and post test for concentric (C) and eccentric (E) contraction at 60, 120, 180 deg/sec. Values are means ± SD. * Significantly different compared with pre and post test value ($p < .05$)

CONCLUSIONS

The effects of single velocity isokinetic eccentric training could have positive impacts on both concentric and eccentric contraction torque generations and at different angular velocities. However, there was no significant effect on motor units recruitment.

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