EFFECTS OF CONCENTRIC VERSUS ECCENTRIC TRAINING ON MUSCLE STRENGTH AND NEUROMUSCULAR ACTIVATION

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INTRODUCTION: Eccentric contraction (EC) involves fewer motor units but produces more tension than concentric contraction (CC) (Kay, 2000). Both EC and CC training can stimulate strength gain (Miller, 2006). However, it is not clear whether one method is more effective than the other and the effect of each training on motor units recruited after training. The purpose of this study was to compare the effects of EC and CC isokinetic training exercises on quadriceps muscle strength and neuromuscular activations.

METHODS: Sixteen healthy subjects (8 males/8 females) were randomly divided into two groups: EC training group (ECTG, mean age 23.3 ± 2.9 yrs) and CC training group (CCTG, mean age 22.8 ± 3.0 yrs). Isokinetic muscle strength training was performed on right knee at 120°/s, 3 sets of 10 reps at 80% maximal efforts, 3 days a week for 6 weeks. Surface EMG electrodes were placed on rectus femoris of each subject. Isokinetic dynamometer (Biodex systems 3) and surface EMG system (MP150) were used to collect data simultaneously at 1000 Hz. Before and after 6 weeks training period, maximum voluntary isometric knee extension torque was obtained at 60° of knee flexion, and maximum isokinetic CC/EC torque was obtained at 120°/s. Knee extension torque and EMG signals were collected total range of motion from 10°-100° of knee flexion (0° = full extension). Data were analyzed from 30°-70° range during maximal isokinetic contraction. EMG signals were digitally filtered (bandwidth 10–450 Hz) and full wave rectified. Torque data were normalized by body weight and EMG data were normalized by EMG signals collected during MVC. Two way ANOVA was used to compare torques and EMG data between groups, and between pre and post-test. (α=.05).

RESULTS: Significant differences were found for both contraction types after CCTG and ECTG except EC after CTG (Table 1). Normalized EMG data demonstrated no significant results through different training modes and contraction types.

Table 1 : Normalized Torque (Nm/kg) of CCTG and ECTG at Pre/Post Test for CC and EC Test Modes; △%: represents reduction rate between pre and post

Group	CC			EC		
	pre	post	△%	pre	post	△%
CCTG	1.32 ± 0.39	1.77 ± 0.43*	44%	2.37 ± 0.37	2.63 ± 0.53	11%
ECTG	1.30 ± 0.33	1.70 ± 0.28*	36%	2.03 ± 0.53	2.76 ± 0.35*	42%

DISCUSSION: The difference between CCTG and ECTG only occurred during EC. For CCTG, it only demonstrated greater torque production when contracted at the same training type. The reason for no significant difference in EMG data might be that both groups adopted the same amount of motor units recruitment, and therefore the efficiency of producing force was better after training (Seger & Thorstensson, 2005).

CONCLUSION: The level of motor units recruited was not increased after 6 weeks isokinetic training. Muscle strength increased significantly after both training modes, but concentric muscle strength was only enhanced in CCTG.

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