DIFFERENCES BETWEEN CONCENTRIC AND ECCENTRIC CONTRACTION INDUCED MUSCLE FATIGUE

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INTRODUCTION: Studies of neuromuscular activation often evaluated through isometric contractions. However, this type of contraction may not truly represent muscle actions during activities. EMG analysis is not only used to determine motor unit activations, but also used to determine muscle conduction velocity by transforming signals into frequency spectrum. Studies have shown that fatigue mucles produced a relativly slower conduction velocity measured by mean power frequency (MPF). Therefore, the purpose of this study was to compare the effects of muscle fatigue generated by two different types of contraction. We hypothesized that muscle fatigue generated by concentric contractions (CC) would cause gretaer muscle contraction frequency reduction than eccentric contractions (EC).

METHODS: Seventeen healthy male subjects (aged 18-31 y/o) were recruited for this study. Each subject required to attend two test sessions (CC/EC) that were separated by one week. During each test section, subjects were seated and right forearms were fixed onto an isokinetic dynamometer (BIODEX Medicine System). Each test section included two measurments (pre and post fatigue test) and one fatigue protocol (CC or EC). For each test, measurements were taken before (pre) and immediately after (post) the fatigue protocol. At the pre-test, isometric MVC torque of elbow flexor and biceps EMG signals at 90° of elbow flexion were be collected simotaneously. During the fatigue protocol, subjects were asked to execute elbow flexors concentricaly or eccentricaly throught 30-120° of elbow flexion at angular velocity of 45°/s. The definition of muscle fatigue was joint torque reduced to 50% of MVC torque. All data were synchonized and collected by BIOPAC MP150 system. EMG signals were digitally filtered (bandwidth 10–450 Hz) and transferred to power spectrum to calculate mean power frequency (MPF). Paired *t*-test was used for statistical analysis.

RESULTS: Elbow flexion torque of EC had a siginificant greater reduction than CC. However, CC had a significant greater reduction of bicpes brachii MPF than EC(Table 1).

Table 1 Joint torque (Nm) and MPF (Hz) at pre and post test of CC and EC protocol. △: represents difference between pre and post test

	CC			EC		
	pre	post	△Pre-post	pre	post	△Pre-post
Torque	55.4±10.1	39.8 ± 8.9	15.6±2.9	53.7 ±10.0	33.8 ± 8.5	19.9 ± 5.7*
MPF	111.9±11.4	87.6 ± 9.1	24.3±8.9*	112.2 ±12.9	100.7 ± 11.6	11.4 ±13.6

DISCUSSION: EC fatigue protocol could cause more torque reduction than CC, which would possibly explain that fatigue muscle strained more frequently during eccentric contraction. The greater reduction of MPF caused by CC fatigue protocol could possibly result from reduction of neuromuscular conduction velocity (Kay, D., et al., 2000).

CONCLUSION: Muscle fatigue generated by CC or EC demonstrated two different effects on torque production and muscle contraction frequency measured by MPF. Both torque reduction and slower MPF were often used to be the indicator of muscle fatigue. However, data from the current study revealed that different types of muscle contractions could cause different results of muscle fatigue indicators.

REFERENCES:

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