

ANALYSIS OF ELECTROMYOGRAPHIC DIFFERENCE BETWEEN CONCENTRIC AND ECCENTRIC PHASES DURING SEATED TRICEPS EXTENSION

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INTRODUCTION: Seated triceps extension is one of the most common exercises in muscle strengthening and can lead to significant improvement in triceps strength. Seated triceps extension consists of concentric (ascending) and eccentric (descending) phases. Therefore, the purpose of this study was to investigate the difference of electromyography (EMG) in triceps brachii and biceps brachii between concentric and eccentric phases during seated triceps extension.

METHOD: Ten healthy male subjects participated in this study (mean age: 21 years; mean weight: 71 kg; mean height: 171 cm). Subjects were asked to perform 10 repetitions of elbow extension (Fig 1) with 6 different dumbbell weights (0, 2, 4, 6, 8, 10 kg) in two different days. Surface EMG were recorded on biceps brachii and triceps brachii (MA411). Root mean square (RMS) values of EMG were computed and normalized by maximum voluntary contraction. Average RMS values and slope of 10 repetitions were calculated. Slope was defined as the linear change rate of RMS values during 10 repetitions. Paired t test was used to compare the difference between concentric and eccentric phases.

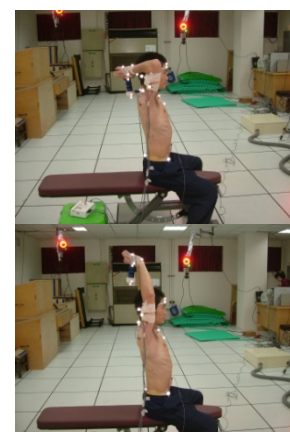


Figure 1: Seated triceps extension

RESULTS: RMS values and slopes of 10 repetitions during seated triceps extension were shown in Table 1. For average RMS values, significant differences were found in 2, 4, 6, 8 and 10-kg dumbbell for triceps ($p < .05$). For slopes, significant differences were found in all dumbbell weights for triceps and biceps ($p < .05$).

Table 1 RMS values and slopes during seated triceps extension (rep: repetition)

Dumbbell (kg)			0	2	4	6	8	10
Average	Triceps	Concentric	.217	.229*	.419*	.488*	.492*	.967*
		Eccentric	.215	.221	.336	.328	.315	.520
	Biceps	Concentric	.135	.125*	.130	.223	.137*	.276
		Eccentric	.134	.123	.130	.202	.129	.225
Slope (1/rep)	Triceps	Concentric	.214*	.217*	.219*	.284*	.251*	.448*
		Eccentric	.000	.000	.035	.033	.006	.008
	Biceps	Concentric	.136*	.120*	.123*	.208*	.125*	.210*
		Eccentric	.000	.000	.000	-.002	.000	.002

*significant difference, $p < .05$

DISCUSSION: RMS values of triceps in concentric phase were significantly greater than those in eccentric phase during seated triceps extension, except in no-loading condition (0 kg). Slopes of both muscles were significantly greater in concentric phase than in eccentric phase, indicating RMS values in concentric phase were increased during 10 repetitions while they were not obviously changed in eccentric phase. This study demonstrated that EMG signals of triceps brachii between concentric and eccentric phases were significantly different during seated triceps extension. These data suggested that with the strong dumbbell weight (10 kg), triceps brachii were activated maximally during concentric phase but submaximally during eccentric phase.