## COMPARATIVE ANALYSIS OF MUSCLE ACTIVITIES DURING RESISTANCE EXERCISES USING VARIABLE AND ELASTIC LOADS

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**KEY WORDS:** dynamic variable resistance, rubber band, surgical tubing exercise

**INTRODUCTION:** Over the last few decades, many resistance training devices and methods have been developed for the purpose of increasing strength. One of the most popular devices being used is variable resistance training (VRT) device (Baechle & Groves, 1992). This type of exercise machines has a major advantage that, by altering the shapes of cams, the resistance profiles at different joint positions can match the strength curve (maximum torque-angle curve) of a joint motion. Despite this advantage, the method has not been perfected and there are arguments against its effectiveness (Garhammer, 1989; Ward, 1993). The major disadvantages of this device are the relatively high cost and large space required. The elastic band exercise device such as elastic tubing is getting popular in recent years, especially in rehabilitation settings. To a certain extent, an elastic exercise device has characteristics similar to a variable resistance-training device. The major advantages of this device are its safety, inexpensiveness, and compact design. To evaluate the stresses placed on different upper arm muscles during a biceps curl using selected home exercise devices, it was the purpose of this study to examine the electromyographic (EMG) activities of the pectoralis major, biceps brachii, triceps brachii, and brachioradialis muscles during biceps curls using a VRT device and an elastic tubing.

**METHODS:** Ten male participants who have no injury history related to the shoulder and elbow joints were recruited as the subjects. n the week prior to the data collection session, the VRT weights and elastic tubing (Thera-band™) specifications (color and length) for 10-repetition maximum (RM) and 20-RM loads were established for each subject. monitor the muscle activity, four pairs of surface EMG electrodes with on-site pre-amplification were placed on the right side of the body. To establish the maximum EMG level of each muscle for normalization purpose, three maximum effort isometric exercises were performed. One trial was conducted for each experimental condition (2 loads × 2 devices = 4 conditions). In each trial, the subject completed five repetitions of biceps curl at a rate of 0.5 Hz (paced by a metronome). Average profile over two repetitions of the trial was used for subsequent analysis. For the purpose of this study, each repetition was divided into six phases. For each phase and peak, mean, and standard deviation values of the normalized EMG levels were computed for each experimental condition. For each load and phase, two-way ANOVA with repeated measures was performed to test for the significant difference ($p \leq 0.05$).

**RESULTS AND DISCUSSION:** From the analysis of EMG data we will expect that the two devices can place somewhat similar levels of stress on the muscles involved in different phases of a biceps curl. The curve with elastic tubing will also be expected to show relatively similar pattern to that of the VRT. If then, the elastic tubing could be one of the least expensive dynamic variable resistance exercise machines so it would be very effective as a home exercise tool for rehabilitation patients and elderly people.

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