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Research article

## Effect of Training with Neuromuscular Electrical Stimulation on Elbow Flexion Strength

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### ABSTRACT

Neuromuscular electrical stimulation (NMES) may be used to prevent strength loss associated with post-surgical immobilization. Most studies testing the effectiveness of NMES have trained the knee extensors. The purpose of this investigation was to test the effectiveness of NMES when training the elbow flexors. Twenty-four students were randomly assigned to one of three groups: NMES training, isometric training or control. Testing and training were completed using a Biodex™ dynamometer. After a standard warm-up, subjects were positioned on the Biodex™ with left shoulder in anatomical neutral, elbow flexed to 90° and forearm supinated. Subjects performed three maximum isometric contractions of 5 seconds duration, with 1 min rest between repetitions. Average peak torque during three repetitions was calculated. Subjects trained on three days per week for four weeks. Training included 15 maximum contractions of 15 seconds duration with 45 seconds recovery between repetitions. Russian current was delivered by a Forte™ 400 Combo via electrodes placed over ends of biceps brachii. A maximum tolerable ramped intensity was delivered with frequency of 90 bps and duty cycle of 15:45. After training, subjects were post-tested in a manner identical to pretest. Mean normalized strength data were analyzed using a 3 (Group) x 2 (Test) ANOVA. The Group x Test interaction was significant. Post-hoc analyses revealed that the voluntary training group (normalized means of 0.49 to 0.71 for the pretest and post-test, respectively) had a significantly greater increase

than the other two groups, which were not significantly different from each other. The lack of significant strength gains with NMES was likely due to low average training intensity, which was only 20.4% of MVIC. Based on these results, NMES training may not be an effective alternative to voluntary training in healthy subjects.

**Key words:** Electrical stimulation, upper extremity, biceps, torque

#### Key Points

- Training the elbow flexors with voluntary isometric contractions produced significantly greater strength gains than did training with NMES.
- Strength gains when training with NMES were no greater than with no training.
- The lack of strength gains with NMES was likely due to a low average training torque of 20.4% of MVIC.

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