

Effects of Lower Trapezius Muscle Strengthening Exercises

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Abstract. The lower trapezius (LT) muscle is important for normal shoulder function. Evidence for optimal strengthening exercises and dosage for a weak LT muscle does not exist. Our goal was to determine if purported LT strengthening exercises are effective. Shoulder external rotation, prone elevation in the scapular plane, and scapular retraction were used in this study. Fifty-five healthy participants (33 experimental; 22 control) between the ages of 20-30 participated. Strength was assessed with hand held dynamometer pre-training and post-training at 4, 8, and 12 weeks. A mixed 2-way ANOVA assessed differences between experimental and control LT strength at the various time frames. Results found no difference between experimental and control groups LT strength pre-training and post-training 4, 8, and 12 weeks.

1. Introduction:

This study was designed to determine if exercises deemed to be effective for strengthening the lower trapezius muscle do indeed create strength gains. One goal of shoulder rehabilitation is to regain lower trapezius muscle strength to reestablish normal scapulohumeral rhythm. Limited knowledge exists on exercises to prescribe for a weak lower trapezius muscle. Previous research has determined by electromyographic (EMG) analysis, which exercises illicit the highest amount of lower trapezius muscle activity [1]. The three exercises selected for this study (shoulder external rotation, prone elevation in the scapular plane, and scapular retraction) were chosen based on these EMG analyses [1,2]. *See Figure 1.* Previous studies focus only on EMG activity of the scapular muscles rather than actual exercises and strengthening of these muscles, thus establishing the basis of this study. Our study used a hand held dynamometer to assess the force of lower trapezius force production. A handheld dynamometer can be used to quantify muscle performance to address EMG limitations [3].

2. Experiment, Results, Discussion, and Significance:

A sample of convenience was used of normal male and female college age students (ages 20-30) whom have had no recent shoulder injury. Each subject was randomly placed into either a control or exercise group. Subjects in the exercise group had an exercised extremity determined randomly with hand dominance taken into account. Subjects drew from a hat to determine if dominant or non-dominant upper extremity would be exercised. The control group was not instructed in any exercises and they were instructed not to change their present exercise routine. The exercise group subjects were asked to perform the three previously mentioned exercises, for three sets of ten repetitions, progressing to three sets of fifteen repetitions, three to four times per week, for eight weeks. Subjects were tested at 12 weeks to determine if any carry over occurred of cessation of exercise. Subjects were assumed to perform the exercises correctly at least three times a week and assumed to give maximal effort during strength testing with the hand held dynamometer (HHD). Each participant had their lower trapezius strength assessed with HHD pre-training and again post-training at 4, 8, and 12 weeks. Subjects' were measured in prone on a plinth. The HHD was securely fastened under a plinth which was adjusted to the appropriate height. The subjects were positioned so that the HHD was correctly positioned on the distal forearm. Subjects then gave maximal effort elevating arm in the scapular plane against the HHD. After three trials the average score was recorded.

Following statistical analysis using a mixed 2-way ANOVA, results found no significant difference between experimental group and control group. More specifically, statistical analysis investigated and found no significant strength gains in the experimental group from pre-test to 4 weeks and pre-test to 8 weeks. No significant carry over was noted from 8 weeks to 12 weeks in the experimental group.

The intention of this study to determine a relationship between lower trapezius exercises and strength gains. It was hypothesized that strength gains would be established from pre-test to 8 weeks in the experimental group. There are numerous factors that could have affected the results of this study. Factors include; lack of control of compliance

within the experimental group, participation of each subject throughout the course of this study, and subject familiarization of testing procedure.

3. Conclusions:

This study found no significant strength gains in the lower trapezius muscle after an eight week program of exercises determined by EMG analysis to have high lower trapezius activity. Further research would be beneficial to physical therapists for treatment protocols for shoulder pathologies involving weakness of the lower trapezius muscle.

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[1] Ballantyne BT, O'Hare SJ, Paschall JL, et al. Electromyographic activity of selected shoulder muscles in commonly used therapeutic exercises. *Phys Ther.* 1993; 73:668-677.

[2] Giannakopoulos K, Beneka A, Malliou P, Godolias G. Isolated vs. complex exercise in strengthening the rotator cuff muscle group. *J Strength Cond Res.* 2004; 18:144-148.

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Fig. 1- Exercises



Scapular Retraction



Shoulder External Rotation



Prone Elevation in Scapular Plane