

NEUROMUSCULAR ADAPTIONS FOLLOWING A DAILY STRENGTHENING EXERCISE IN INDIVIDUALS WITH ROTATOR CUFF RELATED SHOULDER PAIN: A PILOT CASE-CONTROL STUDY

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ABSTRACT

Background: The goal of therapeutic exercise is to facilitate a neuromuscular response by increasing or decreasing muscular activity in order to reduce pain and improve function. It is not clear what dosage of exercise will create a neuromuscular response.

Purpose: The purpose of this study was to assess the effects following a three-week home program of a daily single exercise, the prone horizontal abduction exercise (PHA), on neuromuscular impairments of motor control as measured by scapular muscle EMG amplitudes, strength, and secondarily outcomes of self-reported pain and function between individuals with and without subacromial pain syndrome.

Study Design: Prospective Case-Control, Pilot Study

Methods: Twenty-five individuals participated; eleven with shoulder pain during active and resistive motions (Penn Shoulder Score: 77 ± 11) and 14 matched healthy controls (Penn Shoulder Score: 99 ± 27) ($p < 0.001$). Participants underwent baseline and follow up testing at three weeks including surface electromyography (EMG) of the serratus anterior, upper, and lower trapezius of the involved (painful group) or matched shoulder (control group) during an elevation task and maximal isometric shoulder strength testing. All participants were instructed in a PHA exercise to be performed daily (3 sets; 10 reps). Subjects logged daily exercise adherence. Neuromuscular adaptations were defined by changes in EMG amplitudes (normalized to MVIC) of serratus anterior, upper trapezius, and lower trapezius and strength. Secondary outcomes of self-reported pain and function were also compared between groups following the three-week intervention.

Results: After three weeks of a daily PHA exercise, the painful group demonstrated a greater decrease in baseline-elevated EMG amplitudes in the lower trapezius by 7% (95%CI 2.6-11%) during the concentric phase of the overhead lifting task ($p = 0.006$). EMG amplitudes of the healthy control group did not change at three-week follow-up. Additionally, the change in serratus anterior mean EMG amplitude in the painful group -1.6% (IQR -22.9 to 0.8%) was significantly greater ($p = 0.033$) than the healthy group change score, 2.5% (IQR -2.3 to 5.7%) during the eccentric phase ($p = 0.034$). While the painful group was weaker in abduction and flexion at baseline and at follow up, both groups had a significant increase in all strength measures ($p \leq 0.014$). Concurrent with increased strength and normalizing EMG amplitudes, the painful group significantly improved on the Penn Shoulder Score with a mean change 9.8 points (95%CI=7.0, 12.6) ($p < 0.001$).

Conclusion: In this pilot case-control study, a single home exercise performed daily for three weeks demonstrated neuromuscular adaptations with improvements in muscle activity and strength. These were concurrent with modest, yet significant improvements pain and function in individuals with mild rotator cuff related shoulder pain.

Level of Evidence: 3

Key words: Electromyography, impingement, muscle strength, rehabilitation, subacromial pain,

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