THE ACUTE EFFECTS OF EMG BIOFEEDBACK ON LOWER TRAPEZIUS ACTIVATION AND SCAPULAR KINEMATICS

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INTRODUCTION

Electromyography (EMG) biofeedback training has become a more useful tool with rehabilitation of subacromial impingement syndrome. Biofeedback gives patients a better sense of the activation of different muscles that are involved in the movement of the shoulder girdle through live feedback via a computer monitor [1]. With the muscle activation patterns shown on the monitor, patients are able to get a visual representation of the proper firing of the muscles [2].

The purpose of this study is to investigate changes in scapular kinematics as a result of changes in muscle activation patterns. Our hypothesis is that EMG biofeedback training will decrease the activation of the upper trapezius and increase the activation of the lower trapezius and serratus anterior. In addition, we hypothesize that the scapula will increase upward rotation, posterior tilting and external rotation.

METHODS

Five healthy male subjects were included in this study (mean age = 22.2 ± 0.5 years, height = 1.82 ± 0.1 meters, and weight = 83.9 ± 6.8 kilograms). Those who had shoulder pain within a year, were diagnosed with impingement or who had shoulder surgery were excluded.

To measure EMG, a Noraxon Telemyo DTS was utilized. Disposable, self-adhesive Ag/AgCl electrodes were placed on the upper and lower trapezius (UT, LT), serratus anterior (SA), and lumbar paraspinals (LP) bilaterally (Figure 1A). Maximal voluntary isometric contraction were performed to normalize EMG. A custom scapular tracking device was placed superior and inferior of the scapular spine, a molded humeral cuff was placed on the distal humerus of the dominant arm, and a receiver was placed on the thorax at the level of T3 to measure kinematics using a Polhemus Fastrak (Figure 1B).

Subjects underwent baseline measurements that consisted of humeral elevation in the scapular plane. Subjects were asked to elevate both arms for a duration of two seconds, and depress both arms for a count of two seconds.

Each scapular stabilization exercise (I, W, T, Y) was performed for 1 sets of 10 repetitions after practice. Subjects were told to actively try and reduce the muscle activation shown on the screen for the UT during the exercises. Kinematic testing was performed after the exercises were completed. A paired t-test was used to compare scapular kinematics before (Pre) and after (Post) the scapular stabilization exercises. The alpha level was set to 0.05.

RESULTS AND DISCUSSION

There was a statistically significant difference at 110 degrees during scapular posterior tilt (p = 0.03) (Figure 2). The mean difference for 110 degrees of humeral elevation during scapular posterior tilt was 4.76 degrees. There was no significant difference found for scapular upward rotation or external rotation at all humeral elevation angles.

CONCLUSIONS

The statistically significant difference found with posterior tilt in 90 and 110 degrees of humeral elevation indicate that there are changes in scapular kinematics with EMG biofeedback. Increase posterior tilt may increase the subacromial space which could be beneficial to patients with shoulder pain. Future studies should investigate a longer intervention study with more sessions of biofeedback in the protocol.

REFERENCES