INTRA- AND INTER-SESSION RELIABILITY OF SCAPULOTHORACIC NEUROMUSCULAR ACTIVITY

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Background: Alterations in scapular muscle activity, including excess activation of the upper trapezius (UT), and onset latencies of the lower trapezius (LT) and serratus anterior (SA) muscles, are suggested to be related to abnormal scapular motion and shoulder impingement. Furthermore, interventions to normalize scapular neuromuscular activity are advocated in shoulder rehabilitation and prevention programs. Scapulothoracic motion is evaluated while an individual performs humeral elevation, frequently holding weights. However, the reproducibility of scapular muscle activity during this task has not been well studied.

Purpose: To characterize the reproducibility of scapular muscle activity (mean activity, relative onset timing) during a weighted bilateral humeral elevation task and determine the stability of these measures over time.

Design and Setting: Reliability design. Controlled laboratory study

Participants: Sixteen healthy adults (mean age=28.0 ± 5.9 years; 8 males)

Methods: Surface electromyography (sEMG) of the UT, LT, SA and anterior deltoid (AD) muscles of one shoulder (9 Dominant;7 Non-Dominant) were captured during 10-repetitions of weighted bilateral humeral elevation approximately one week apart (mean=6.5 ± 1.9 days). All sEMG data were normalized to peak activity during a maximum voluntary isometric contraction (MVIC). Normalized scapular muscle activity during concentric and eccentric phases and the relative onset of the scapular muscles compared to the AD were calculated. Data from the middle 5 trials were used for analysis. Intraclass correlation coefficient (ICC) and the minimal detectable change (MDC) were used to determine intra and inter-session reliability.

Results: Intra-session reliability of scapular muscle activity during both phases of elevation was very good (ICC=0.96-0.99) as were relative onset times (ICC=0.88-0.97). Inter-session reliability of the LT and SA were very good (ICC=0.82-0.86) and good for the UT (ICC=0.66-0.79). MDC of muscle activity amplitudes during both phases of elevation were less than 5% except for SA (10.4-12.7%). Intersession reliability of relative onset timing was poor to moderate (ICC=0.43-0.73). MDC values for relative onset timing ranged between 46-132 milliseconds.

Conclusion: Mean scapulothoracic muscle activity as measured with sEMG was reliable both within and between testing sessions. With regard to muscle onset timing, within session reliability was good but more variability was found between sessions.

Clinical Relevance: The minimal difference necessary to infer a meaningful change in neuromuscular activity of the scapulothoracic musculature using sEMG was determined. Relatively small changes in the amplitude of mean scapular muscle sEMG activity (5-12%) can be interpreted as change that exceeds error of the measure. Relative muscle onset is more variable between sessions, thus the ability to detect change in scapular muscle latencies over time remains a challenge. Changes in amplitudes rather than onset of scapular muscular activity appear to yield more stable values in order to measure neuromuscular changes over time. The effectiveness of interventions to alter scapular muscle activity requires further study.