Journal of Human Kinetics volume 36/2013, 69-76
Section II- Exercise Physiology & Sports Medicine

A Reliability of Electromyographic Normalization Methods for the Infraspinatus Muscle in Healthy Subjects

by
Sung-min Ha[1], Heon-seock Cynn[2], Oh-yun Kwon[3], Kyue-nam Park[3], Gyoung-mo Kim[1],

The purpose of this study was to examine the test-retest reliability of normalization methods for the infraspinatus muscle in a group of healthy subjects. Twelve healthy subjects (male=8, female=4) performed the maximal voluntary isometric contraction (MVIC) with examiner`s resistance, MVIC with a digital tension-meter (MVIC-DT), and sub-MVIC methods. Surface electromyography (EMG) signals were recorded from the infraspinatus muscles according to normalization methods. Reliability was analyzed using the intra-class coefficient (ICC), standard error of measurement (SEM), and minimal detectable difference (MDD). The results of the present study demonstrated that the sub-MVIC method has excellent test-retest reliability (ICC=0.92) with a relatively small SEM (5.9 mV) and MDD_{95} (16.4 mV), compared to MVIC-DT (ICC=0.73; SEM=11.2 mV; MDD_{95}: 31 mV) and MVIC-E (ICC=0.5; SEM=15.7 mV; MDD_{95}: 43.6 mV). These findings provide evidence that sub-MVIC is more appropriate for comparing the EMG activity for the infraspinatus muscle as a normalization method. If MVIC for normalization is needed, MVIC-DT is more appropriate than MVIC-E.

Key words: *electromyography, infraspinatus muscle, normalization, reliability.*

Introduction

The infraspinatus muscle produces an approximation force to resist distraction during an overhead throwing motion (Ballantyne et al., 1993). Also, the infraspinatus provides the primary external rotation force (Terry and Chopp, 2000). Because of its critical role in providing dynamic stability and producing external rotation torque at shoulder joint, many authors have advocated emphasis on infraspinatus muscle strengthening during rehabilitation or athletic conditioning programs in order to enhance muscular strength and endurance (Blackburn et al., 1990; Brewster and Schwab, 1993; Reinold et al., 2004; Townsend et al., 1991).

Previous studies were conducted using surface electromyography (EMG) to measure the muscle activity of infraspinatus through EMG studies in a variety of exercises (Ballantyne et al., 1993; Reinold et al., 2004). A major limitation of kinesiologic EMG research is the difficulty in making comparisons between EMG values obtained from identical muscles in different subjects, different muscles from the same subject, or even the same muscle from the same subject on different days. These difficulties may be due to subtle differences in muscle architecture, electrode placement, and electrode construction (Giroux and Lamontagne, 1990; Jonsson and Komi, 1973; Kadaba et al., 1985). To overcome these shortcomings of

[1] - *Department of Physical Therapy, Division of Health Science, Baekseok University, Cheon-an, Republic of Korea.*

[2] - *Applied Kinesiology and Ergonomic Technology Laboratory, Department of Physical Therapy, College of Health Science, Yonsei University, Won-ju, Republic of Korea.*

[3] - *Laboratory of Kinetic Ergocise Based on Movement Analysis, Department of Physical Therapy, College of Health Science, Yonsei University, Won-ju, Republic of Korea.*

Authors submitted their contribution of the article to the editorial board.
Accepted for printing in Journal of Human Kinetics vol. 36/2013 on March 2013.