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Contribution of selected scapulothoracic muscle forces to the control of accessory scapular motions

P M. Ludewig

Thomas M. Cook

University of Iowa
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INTER-RATER RELIABILITY OF THE LATERAL SCAPULAR SLIDE TEST

Edon Johnson, SPT
Sueann Jeon, MA, PT
Department of Physical Therapy, University of North Dakota, Grand Forks, ND

Purpose:
Recent research indicates that altered scapular positioning during elevation of the upper extremities can lead to shoulder pathology. However, there are very few quantifiable methods for measuring scapular position at this time. The lateral scapular slide test (LSST) was proposed by Kibler to aid in the identification of individuals with functional scapular instability. The purpose of this study was to determine the inter-rater reliability of the LSST.

Methods:
Subjects. Thirty healthy volunteers, age 20-35, served as subjects for this study. Subjects had no prior history of scapulothoracic injury or pathology. Materials. A standard tape measure was used to measure the linear distance from the medial aspect of the inferior angle of the scapula to the most lateral aspect of the nearest adjacent spinous process in each test position. Procedure. Each subject was tested in an isolated environment with the scapula completely visible. From a position of static, upright posture with the front approximately shoulder width apart, each subject performed the following test movements: 1) arms relaxed at sides with zero degrees of humeral abduction, 2) hands on iliac crests with thumbs pointed posteriorly approximating 45 degrees of humeral abduction, 3) arms abducted to 90 degrees with full internal rotation and elbow extension. Subjects were randomly assigned to be measured by each of the three raters. The instructions were standardized for consistency. Data Analysis. Means, standard deviations and ranges were computed for each position for each tester. The data was then subjected to the intraclass correlation coefficient test.

Results:
The intraclass correlation coefficients ranged from 0.89 to 0.94 and showed a progressive decrease from position one to position three. The standard error of measurement (SEM) ranged from 0.23 to 0.27 cm, with the highest SEM observed for test position one. Probability vs. increased progressive from position one to position three showing no significant differences occurred among the measurements of the three raters. Conclusions and Clinical Relevance. The results of this study indicate that the lateral scapular slide test has very good intertester reliability and may be used clinically with consistent results when used among several therapists as long as standardization is maintained. The results also indicate that for this population, the LSST is a reliable tool for quantifying scapular instability.

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CONTRIBUTION OF SELECTED SCAPULOThorACIC MUSCLES TO THE CONTROL OF ACCESSORY SCAPULAR MOTIONS

Ludwig PM, Cook TM
Physical Therapy Graduate Program, The University of Iowa, Iowa City, IA 52242

Purpose: Increased emphasis is being directed to selective control of accessory scapular motions created and maintained in older rehabilitation programs. However, the majority of previous biomechanical descriptions of scapulothoracic muscle actions have been limited to two-dimensional models describing scapular upward and downward rotation. The purpose of this project was to model and describe the potential three-dimensional (3-D) moment contributions of selected scapulothoracic muscle forces to scapular internal/external rotation and anterior/posterior tipping. Subjects: Kinematic data were derived from 25 healthy subjects 19-37 years old (mean height = 1.7 meters +/- 0.1, mean weight = 66.9 kg +/- 11.4). Methods and Materials: An electromyographic digitizer was used to record the coordinate locations of anatomical landmarks on the scapula and trunk. Three-dimensional scapular orientation relative to the trunk was expressed as ordered Cardan angles representing upward/downward rotation, internal/external rotation, and anterior/posterior tipping. Data were collected at static arm positions of 90°, 90°, and 140° of humeral elevation in the scapular plane. Additional model parameters (scapular axes of rotation, and origins and insertions of the scapular portions of the trapezius, rhomboids, and levator scapula) were based on cadaver dissection and previous data available in the literature. Analyses: The mean 3-D orientation of the scapula was determined at each arm position. Muscle lines of action relative to the scapula were then described for the trapezius, rhomboids, and levator scapula, and the potential moment created by each muscle was computed for each of the three arm positions. Summary Results: Of the muscles studied, contributors to scapular tipping moments included the rhomboid major (posterior tipping) at 90° of arm elevation, the lower trapezius (posterior tipping) at 90° of arm elevation, and the rhomboid major (anterior tipping) at 140° of arm elevation. Contributors to internal/external rotation moments included the upper and middle trapezius (internal rotation) at the 0° arm position, the lower trapezius, rhomboids, and levator (external rotation) at the 90° arm position, and the lower trapezius and levator (external rotation) at the 140° arm position. Conclusions: The results of this study highlight the role of selected scapulothoracic muscles in contributing to the control of accessory scapular motions. Clinical Relevance: Knowledge of the potential contribution of scapular muscles to accessory scapular motions can assist in the refinement of shoulder therapeutic exercise programs.