An Electromyographic Assessment of the "Bear Hug": An Examination for the Evaluation of the Subscapularis Muscle

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Purpose: The lift-off and belly-press tests are common tests for evaluation of the subscapularis. We compared these tests with the recently developed bear-hug test by assessing electromyographic (EMG) activity of the shoulder internal rotators during examination. **Methods:** Twenty-one healthy male volunteers (mean age, 22.95 ± 3.71 years; mean weight, 73.48 ± 6.93 kg; mean height, 68.76 ± 2.26 cm) with no previous history of shoulder surgery or injury participated in the study. Fine-wire and surface EMG activity of the glenohumeral joint internal rotators (i.e., upper and lower subscapularis, pectoralis major, and latissimus dorsi) was recorded while 5 subscapularis tests were being performed (bear hug at 0°, 45°, and 90°; lift off; and belly press). Peak EMG values were normalized to the maximum voluntary isometric contraction (MVIC) for each muscle. A 4 (muscle) × 5 (test) analysis of variance with repeated measures on test was used to analyze peak EMG activity (percentage of maximum voluntary isometric contraction). Follow-up univariate analysis of variance and Tukey post hoc analyses were performed for each of the 5 tests. **Results:** The bear-hug test performed at 45° of shoulder flexion showed significantly greater peak EMG activity in the upper subscapularis (107.64% ± 63.52%) and lower subscapularis (85.75% ± 64.69%) compared with the pectoralis major (41.43% ± 25.42%) and latissimus dorsi (20.32% ± 15.70%) ($P < .05$). The bear-hug test performed at 90° of shoulder flexion showed significantly greater peak EMG activity in the lower subscapularis (166.0% ± 132.71%) compared with the upper subscapularis (97.23% ± 70.78%), pectoralis major (50.63% ± 29.60%), and latissimus dorsi (17.56% ± 13.64%) ($P < .05$). The belly-press test showed significantly greater peak EMG activity in the upper subscapularis (77.88% ± 53.23%) and lower subscapularis (71.82% ± 46.49%) compared with the pectoralis major (18.49% ± 14.85%) and latissimus dorsi (34.85% ± 27.73%) ($P < .05$). **Conclusions:** The bear-hug examination performed at 45° of shoulder flexion and the belly-press test may be valuable diagnostic tools in the clinical evaluation of the upper subscapularis muscle. In addition, the bear-hug test at 90° of shoulder flexion may be a valuable diagnostic tool in assessing the clinical function of the lower subscapularis. **Clinical Relevance:** The bear-hug examination performed at specific degrees of shoulder flexion may be a valuable way to assess the function of the subscapularis muscle.
Key Words: Rotator cuff—Shoulder examination—Subscapularis.

Few clinical tests are currently used to evaluate the integrity of the musculotendinous unit of the subscapularis muscle. Gerber et al.[1,2] described the lift-off test and belly-press test as reliable maneuvers to detect subscapularis injury. The lift-off test is performed by placing the dorsum of the patient's hand on his or her

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back at the lower lumbar level, and inability of the patient to actively lift the involved hand off the back constitutes a positive test. The belly-press test requires the patient to place the palm of the affected extremity on the abdomen, just below the xiphoid process. The patient is asked to press on the abdomen while maintaining the elbow in the coronal plane. Subscapularis weakness is indicated by any compensatory wrist flexion or inability to maintain elbow position in the coronal plane. The "belly-off" sign has recently been evaluated by Scheibel et al.[3] The individual's affected extremity is brought into internal rotation and flexion with the elbow flexed to 90°. The individual's elbow is supported by the examiner's hand while the examiner's other hand places the examinee's palm onto the abdomen. The patient is asked to keep the wrist straight while actively maintaining the position of internal rotation as the examiner releases the wrist. Lag occurs if the patient cannot maintain this position and the hand lifts off the abdomen, resulting in the belly-off sign. The authors found the belly-off sign to be more reliable than the belly-press and lift-off tests to detect subtle lesions of the upper subscapularis tendon.

An electromyographic (EMG) study reported by Tokish et al.[4] showed that the belly-press test selectively activated the upper subscapularis muscle significantly more than the lift-off test and the lift-off test activated the lower subscapularis muscle more than the belly-press test. However, despite the current evidence validating these clinical tests, they may be of limited value in patients who cannot bring the affected arm into the starting position required to perform each test because of restricted range of motion and/or pain.

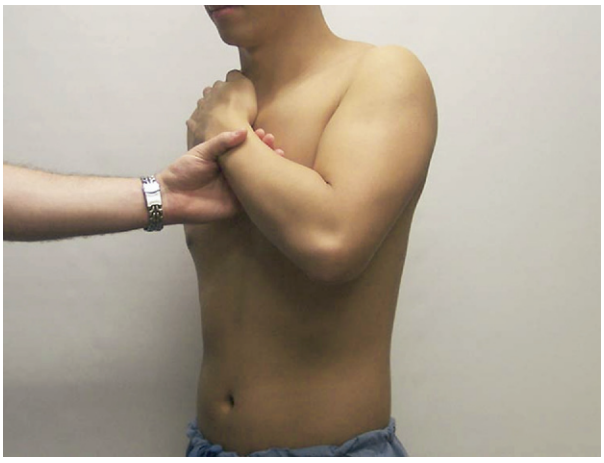

Figure 1. Bear-hug test at 0°: examiner with a hand on patient's wrist, as patient's elbow is held at 0° of forward flexion. The examiner applies an external rotation force perpendicular to the forearm at the wrist of the affected arm, as the patient attempts to hold the starting position through resisted internal rotation.

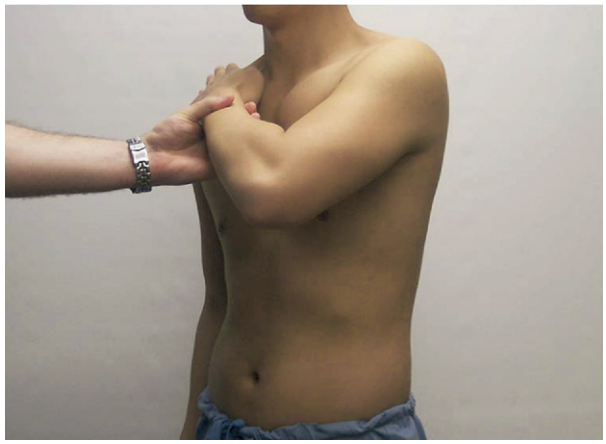

Figure 2. Bear-hug test at 45°: examiner with a hand on patient's wrist, as patient's elbow is held at 45° of forward flexion.

Burkhart and colleagues[5] recently described the "bear-hug test" in an attempt to detect relatively small tears of the upper subscapularis. The test is performed with the palm of the affected arm held on the opposite shoulder while the elbow is held in a position of maximal anterior translation. The examiner applies an external rotation force perpendicular to the forearm at the wrist of the affected arm, as the subject attempts to hold the starting position through resisted internal rotation (Figs 1-3). A positive test results when the patient shows difficulty in holding the hand on the shoulder with the applied external rotation force of the examiner or weakness when compared with the contralateral side. According to the authors, this test

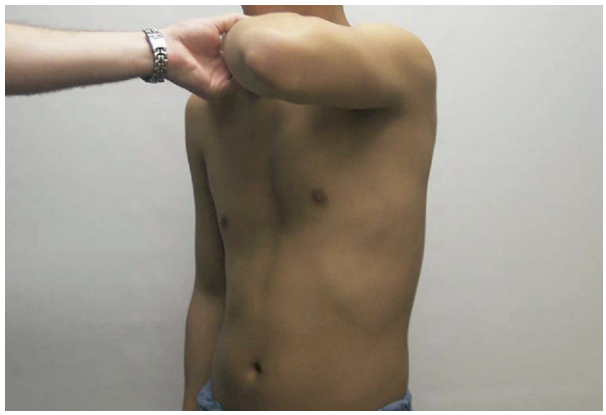

Figure 3. Bear-hug test at 90°: examiner with a hand on patient's wrist, as patient's elbow is held at 90° of forward flexion.