

Serratus Anterior Dysfunction Examination: Wall Push-up or Shoulder Flexion Resistance Test?

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Background:

Wall push-up is the most common exam used for the diagnosis of scapular winging secondary to serratus anterior dysfunction. The wall push-up test (WPUT) however, may not be able to differentiate causes of scapulothoracic abnormal motion (STAM) or winging. We introduce a novel physical examination maneuver; the shoulder flexion resistance test (SFRT), and we propose that this test is more specific and accurate in determining serratus anterior dysfunction as the cause of STAM. Secondly, we sought to determine the accuracy of electromyographic (EMG) testing to diagnosis STAM secondary to serratus anterior paralysis.

Methods

Fifty patients with STAM are included in this study. All patients underwent clinical scapular examination using both WPUT and SFRT. The SFRT is performed by resisting shoulder flexion while the elbow is fully extended at 30°, 60° and 100°. All patients additionally received preoperative electromyography (EMG). All patients underwent exploration and intraoperative stimulation of the distal serratus anterior to characterize colour, thickness, and contractility at the time of their arthroscopic pectoralis minor release and open scapulopexy, or pectoralis major tendon transfer if the serratus was paralyzed. The preoperative clinical examination and EMG findings were then correlated with intraoperative findings.

Results

Abnormal distal serratus anterior was seen intraoperatively in 5/50 patients (10%) with marked alterations in colour, thickness, and contractility. All (n=50) patients had positive WPUT manifested by increased winging of the scapula off the chest wall (STAM) with 45 false positive tests. The WPUT was 100% (95% CI 47.82-100%) sensitive but 0% (95% CI 0-7.87%) specific for lower serratus anterior deficiency. The SFRT was 100% sensitive (95% CI 47.82-100%) and 100% specific (95% CI 92.13-100%) for serratus anterior dysfunction as the cause of STAM. Using area under the curve (AUC) of receiver operating characteristic (ROC) curves for WPUT and SFRT tests, WPUT had clinically insignificant accuracy (AUC 0.5) compared to the excellent accuracy (AUC 1.0) of SFRT. EMG testing had a 100% (95% CI 48.82-100%) sensitivity, 31.1% (95% CI 18.17-46.65%) specificity, positive likelihood ratio of 1.45 (95% CI 1.19-1.77), a PPV of 13.9% (11.70-16.41%), and a NPV of 100%.

Conclusion

Shoulder flexion resistance test (SFRT) is specific and accurate in determining serratus anterior dysfunction as a cause of STAM. Based on this study, the SFRT should replace the wall push up

test (WPUT) as the physical exam of choice to determine dysfunction of the serratus anterior muscle and guide operative management of STAM. Electromyography has poor specificity to diagnose serratus anterior paralysis as the cause of STAM and caution should be taken in relying on this examination alone to determine treatment.

Keywords: scapula; scapulothoracic abnormal motion; physical examination; winging; serratus anterior; scapulopexy

Level of Evidence: II