316 Journal of Manipulative and Physiological Therapeutics
Volume 22 • Number 5 • June 1999
0161-4754/99/$8.00 + 0 **76/1/98564** © 1999 JMPT

JMPT

Introduction of a New Physical Examination Procedure for the Differentiation of Acromioclavicular Joint Lesions and Subacromial Impingement

Dale J. Buchberger, DC[a]

ABSTRACT

Objective: To present a new physical examination procedure that may assist in differentiating acromioclavicular joint lesions from subacromial impingement lesions.

Discussion: The acromioclavicular joint differential test is performed by applying downward pressure over the lateral one third of the clavicle while passively inducing slight adduction, external rotation, and forced forward flexion to the humerus while the patient is in the seated position. Although similar mechanisms have been described, the acromioclavicular joint differential test is a new, previously unreported examination procedure.

Conclusion: This article describes a new test to differentiate between acromioclavicular joint lesions and subacromial impingement. On the basis of its mechanism, the acromioclavicular joint differential test may provide the examiner with an additional tool in the differential diagnosis of acromioclavicular joint lesions and subacromial impingement in the patient with shoulder pain. Although this test has been used by the author in a clinical setting, validation data are not yet available. (J Manipulative Physiol Ther 1999;22:316-21)

Key Indexing Terms: Shoulder; Acromioclavicular Joint; Examination; Impingement

INTRODUCTION

In spite of advancements regarding the function and management of acromioclavicular joint injuries, the physical examination for this region has failed to keep up.[1] The classic examination for suspected nontraumatic acromioclavicular joint lesions has been limited. The examination and decision making has been dependent on the patient interview, visual inspection, a limited orthopedic examination, and predominantly perceived objective information in the form of stress radiographs (Table 1). This article illustrates a new physical examination procedure that assists in differentiating acromioclavicular joint lesions from subacromial impingement lesions. Although similar mechanisms have been described,[2] the acromioclavicular joint differential test is a new, previously unreported, physical examination procedure.

DISCUSSION

Anatomy

The acromioclavicular joint is the main stabilizing point for the shoulder girdle. It is also the main site for translation of forces from the clavicle to the scapulae. Osseously, the acromioclavicular joint is comprised of the medial acromial facet (of the scapula) and the distal facet of the clavicle. Between the osseous components resides a fibrocartilaginous disc. However, anatomic studies performed by Salter et al[3] revealed only one complete disc of 53 cadaver acromioclavicular joints. The disc was either meniscoid, partial, or absent in the remaining 52 specimens (Table 2).

The fibrocartilaginous disc is enclosed by a relatively weak fibrous joint capsule. The joint capsule is supported above by the stronger superior acromioclavicular ligament and below by the weaker inferior acromioclavicular ligament. The superior acromioclavicular ligaments receive secondary musculotendinous support from a blending in of the deltotrapezial fascia.[1,4]

The coracoclavicular ligaments connect the clavicle to the coracoid portion of the scapula. These consist of the anterolateral trapezoid portion and the posteromedial conoid portion (Fig 1).

The acromioclavicular ligaments contribute two thirds of the constraining force against superior displacement. In cases of greater displacement and greater induced loads, the conoid ligament is the major constraint.[4] Additionally, scapular motion on the chest wall is limited by available motion at the acromioclavicular and sternoclavicular joints.[5] With its attachments at the superior aspect of the first rib medially and the conoid ligament laterally, the subclavius muscle can have a profound effect on functional motion at the acromioclavicular and sternoclavicular joints. Its function is to depress and stabilize the clavicle.[6,7] Fibrosis of the subclavius muscle can lead to contracture and shortening, resulting in faulty clavicular rotation and elevation.[8] This dysfunctional acromioclavicular and sternoclavicular joint

[a]Assistant Professor, New York Chiropractic College, Seneca Falls, New York.

Submit reprint requests to: Dale Buchberger, DC, New York Chiropractic College, 2368 Route 89, Seneca Falls, NY 13148-0800.

Paper submitted August 24, 1998; in revised form September 15, 1998.

No author or related institution has received financial benefit from research in this study.

Table 1. *Standard examination of the acromioclavicular joint*

1. Visual inspection for deformity	3. AROM
2. Palpation of the acromioclavicular joint	Limited abduction
Palpable tenderness	Adduction: pain on crossover
Palpable deformity	4. Radiographic examination
Palpable crepitus	Plain film radiographs
	Stress views

AROM, Active range of motion.

Table 2. *Salter classification of the intraarticular disc of the acromioclavicular joint*[3]

1. Complete disc: A circular fibrocartilaginous structure that divides the joint cavity into two compartments.
2. Meniscal disc: A projection of organized fibrocartilaginous tissue that attaches to the joint capsule.
3. Remnant disc: Projecting but poorly organized fibrocartilaginous structures randomly spaced.
4. No disc: No recognizable structure within the joint.

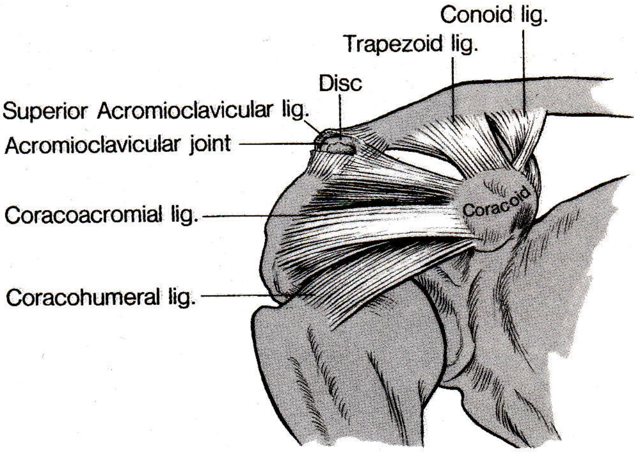

Fig 1. *Anterior-posterior view of exposed acromioclavicular joint and its supporting ligaments. Note Y-shaped insertion of coracoacromial ligament onto the acromion. Reprinted with permission from Salter EG, Nasca RJ, Shelley BS. Anatomical observations on the acromioclavicular joint and supporting ligaments. Am J Sports Med 1987;15:199-206.*

motion will therefore result in inadequate scapular rotation and subsequent glenohumeral dysfunction.

Function

The acromioclavicular joint plays an integral role in the functional mechanics of the shoulder girdle. Along with the sternoclavicular joint, the acromioclavicular joint contributes 60 degrees to the total 180 degrees of abduction.[9] When the humerus is positioned at 30 degrees of abduction, the distal clavicle is elevated to 12 to 15 degrees without rotation relative to its start point. The spinoclavicular angle (SCA; angle created by the clavicle and the spine of the scapula) has reached 10 degrees at this point in the range of motion. As the humerus approaches 90 degrees of abduction (60 degrees of glenohumeral motion and 30 degrees of scapular motion), the clavicle reaches its final position at 30 degrees of elevation without rotation. At this point, all motion has taken place at the sternoclavicular joint, and there is no additional change in the SCA.

After reaching a completed 180 degrees of abduction (120 degrees of glenohumeral motion and 60 degrees of scapular motion) the SCA has reached 20 degrees because of acromioclavicular rotation.[10] According to Rockwood and Young,[11] acromioclavicular rotation is approximately 5 to 8 degrees. Before this phase of movement the primary site of clavicular motion had been the sternoclavicular joint.

Tasks that emphasize excessive abduction and external rotation cause repetitive axial clavicular rotation, resulting in abnormal sheer stress at the acromioclavicular joint. Pain appearing at the acromioclavicular joint on active or passive abduction, beginning at approximately 90 degrees of elevation and continuing to the 180-degree end range may indicate an acromioclavicular joint lesion. The classic painful arc syndrome would occur between 70 and 120 degrees of abduction, with resolution of pain between 120 and 180 degrees of abduction.[2] Pain occurs as a result of the acromioclavicular joint stress that is provided by the close-packed position and long-axis rotation. Horizontal adduction is another acromioclavicular close-packed position that creates pain when the joint is involved.[12] It is this sequence of events that has led me to introduce a new physical examination procedure for evaluation of the acromioclavicular joint.

Acromioclavicular Joint Differential Test

There is a significantly large base of published material regarding trauma of the acromioclavicular joint and grading of the various types of dislocations associated with the joint.[1-4,9-11] Although the literature has expanded regarding the radiographic and advanced imaging procedures for the diagnosis of acromioclavicular joint lesions,[13] little has changed regarding the physical examination of the acromioclavicular joint, specifically with regard to repetitive or nonimpact trauma to it.

The hallmark test for acromioclavicular joint lesions is the adduction stress or crossover test (Fig 2).[2,9,10,14] This test uses a mechanism of humeral adduction from a forward flexed position of 90 degrees, resulting in compression of the medial acromial facet against the distal clavicle to provoke symptoms at the acromioclavicular joint.

I propose a new physical examination procedure to assist in differentiating acromioclavicular joint lesions from subacromial impingement. The new procedure uses a mechanism of shear with positional compression based on acromioclavicular joint mechanics.

Initially the "impingement sign of Neer"[15] (Fig 3) is performed with the patient seated. The humerus is passively forward flexed and internally rotated while the scapula is stabilized with a downward force on the acromion, preventing scapular rotation.[2,16] This produces the mechanism of subacromial impingement by approximating the greater tuberosity to the subacromial surface. The examiner now relaxes the patient's arm, returning to the start or neutral position. The indifferent hand contact of the examiner is now shifted to the lateral one third of the clavicle. The humerus is externally ro-

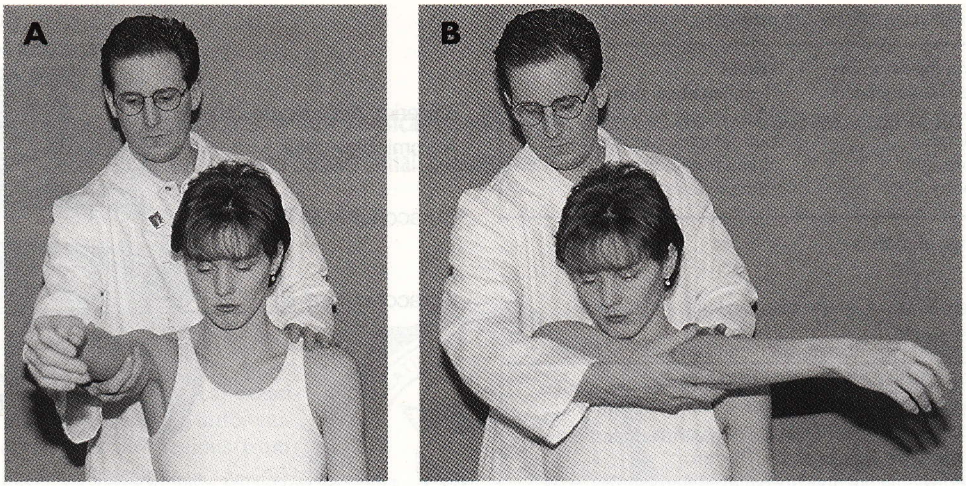

Fig 2. *A, Adduction stress/compression test starting position.* ***B,*** *Adduction stress/compression test finish position.*

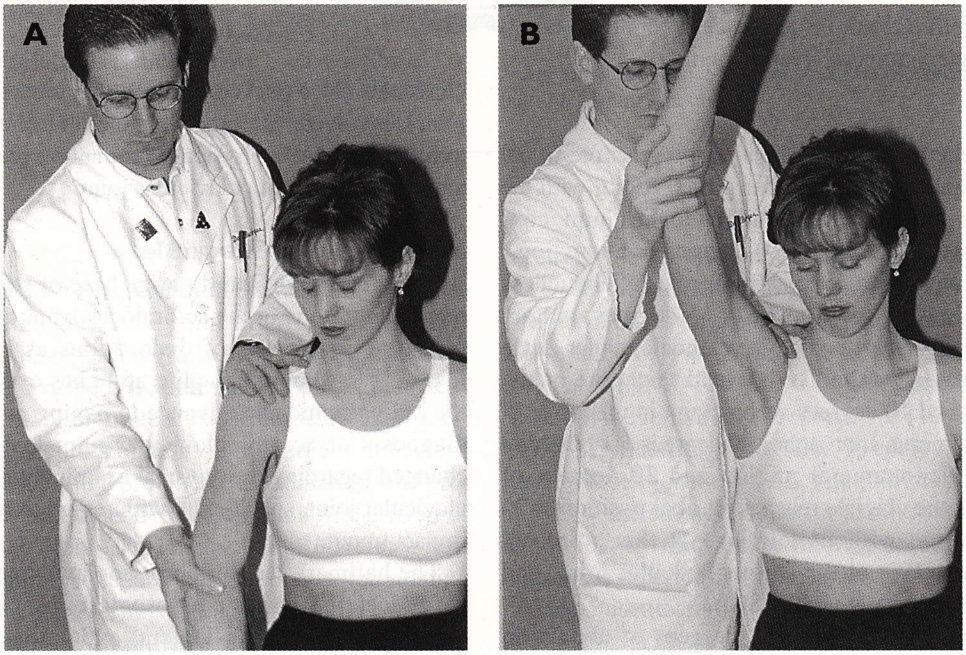

Fig 3. *A, Impingement sign of Neer starting position.* ***B,*** *Impingement sign of Neer finish position.*

tated (the elbow is extended and the hand is supinated), adducted approximately 10 to 15 degrees, and passively forward flexed while a stabilizing force is placed on the distal one third of the clavicle. The slightly adducted position provides compression to the joint surfaces, taking advantage of the close-packed position of the joint. External rotation of the humerus minimizes subacromial impingement of the glenohumeral joint by increasing clearance for the supraspinatus and biceps tendons. It also reduces capsular tension to minimize confusion with other presenting entities.[16,17] Forward flexion creates shear on the capsuloligamentous structures of the acromioclavicular joint (Fig 4).

To reduce joint compression and place the emphasis on the capsuloligamentous structures, position the humerus to 90 degrees of forward flexion while maintaining the stabilizing force to the clavicle. Then passively forward flex the humerus more than 90 degrees. This takes advantage of the sheering mechanism between the acromion and distal clavicle, created by clavicular stabilization and scapular rotation during forward flexion of the humerus.

A positive acromioclavicular joint differential test would either display a negative impingement sign with a painful acromioclavicular joint differential test or pain during the impingement sign with intensification and localization of pain to the acromioclavicular joint during the acromioclavicular joint differential test. The examiner would also feel for a shift, movement, or palpable crepitus in the acromioclavicular joint in a patient with a history of grade 2 or higher injury.[1]

The acromioclavicular joint differential test merely identifies the acromioclavicular joint as the area of lesion. This

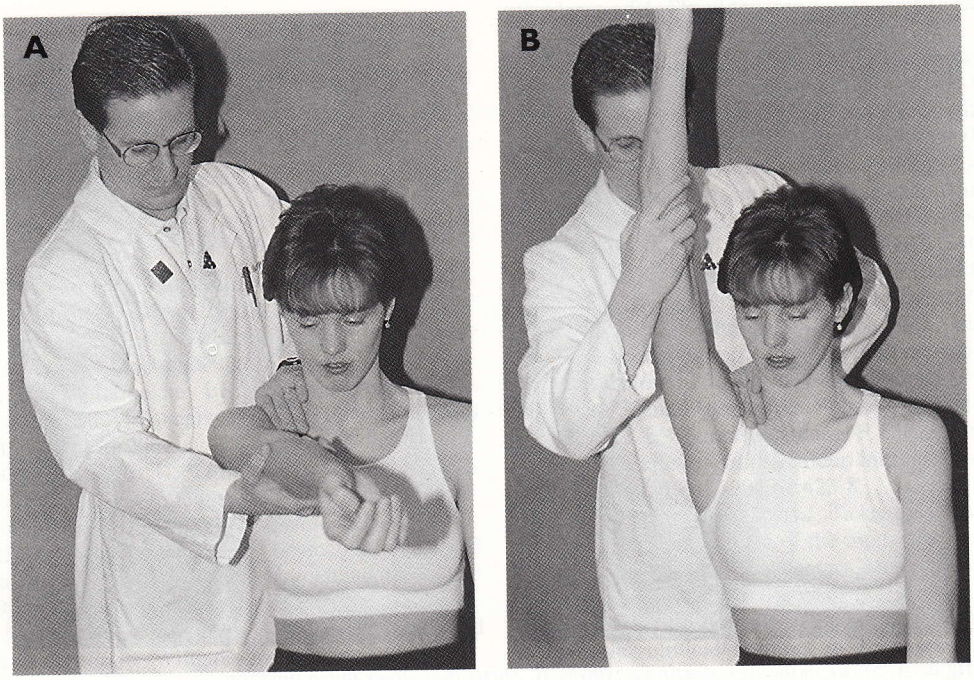

Fig 4. *A, Acromioclavicular joint differential test starting position. B, Acromioclavicular joint differential test finish position.*

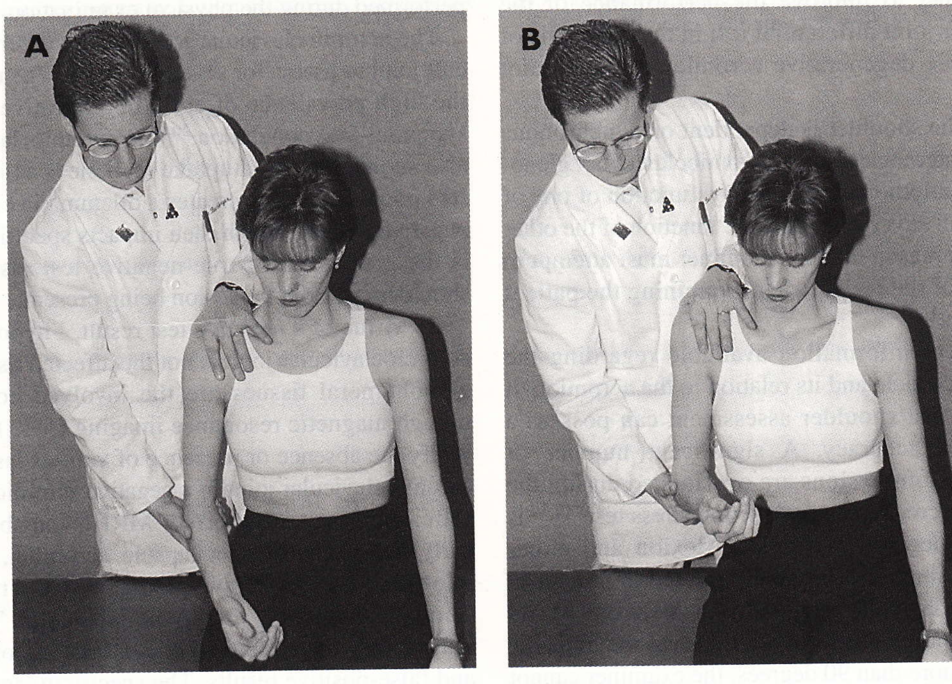

Fig 5. *A, Schultz's test starting position. B, Schultz's test finish position.*

should help to either differentiate the cause of shoulder pain from subacromial impingement or identify the acromioclavicular joint as the primary lesion. This is especially helpful in patients who suffer from repetitive stress of the shoulder, such as athletes who perform overhead throwing and striking movements (baseball players, swimmers, weight lifters, tennis players, etc), as well as patients in occupations that require them to use their shoulders in a repetitive stress manner (mechanics, chiropractors, manual laborers, etc).

The remainder of the examination should be used to confirm the suspected diagnosis. Additional diagnostic aids such as the crossover test,[2,10,14] Schultz's test[2,10] (Fig 5), Shrug test (Fig 6), and plain film should solidify suspicion of an acromioclavicular joint lesion. This test should also assist in pointing the examiner in the correct direction should it display a nonacromioclavicular joint lesion. This should allow the examiner to formulate a diagnosis with a higher level of accuracy. With experience in the examination

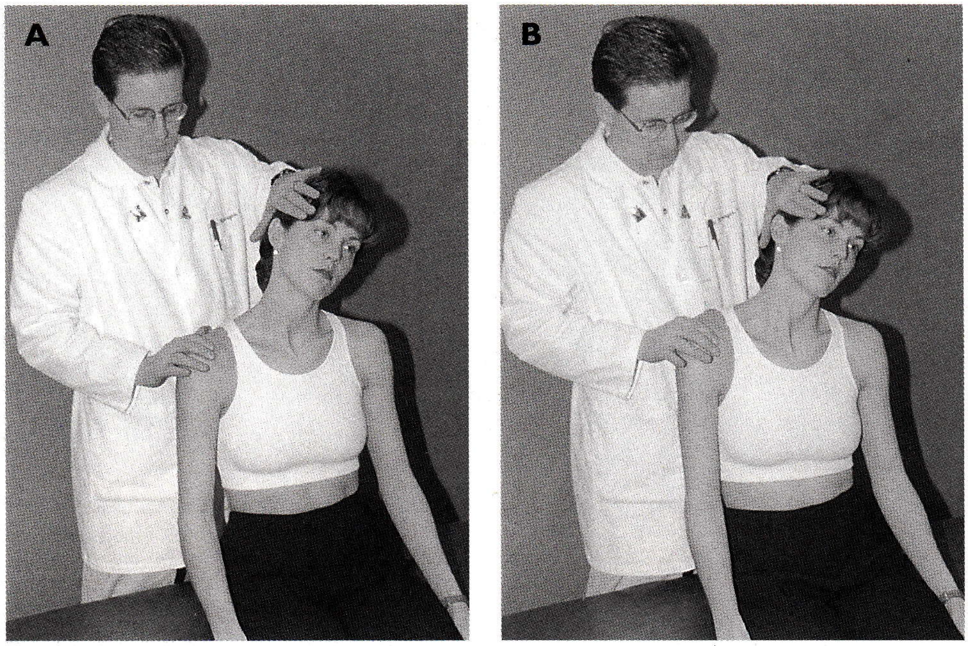

Fig 6. *A, Shrug maneuver starting position. B, Shrug maneuver finish position.*

of the shoulder, the recognition of these differences may allow the examiner to improve the performance of the acromioclavicular joint differential test in the diagnosis of overuse or chronic degenerative acromioclavicular joint lesions.

Movement at the shoulder is dependent on synchronous movement of the sternoclavicular, acromioclavicular, glenohumeral, and scapulothoracic joints. Dysfunction of one of these segments will adversely affect the function of the other three. It is for this reason that the examiner must attempt to pinpoint the site of the lesion when examining the patient with shoulder pain.[1]

By using current information available regarding the mechanics of the clavicle and its relation to the acromion, it can be theorized that shoulder assessment can possess a greater degree of accuracy. A significant number of acromioclavicular joint lesions are overlooked during the crossover test. The crossover or adduction stress test[2,10,14] is performed at 90 degrees of forward flexion and either adduction with the humerus internally rotated or in neutral external rotation. Clavicular rotation occurs between 90 and 180 degrees of scapulohumeral motion. Unless the humerus is forward flexed more than 90 degrees, the examiner cannot take advantage of this mechanism to reproduce the patient's symptoms.[10] Although this test has been used by me in a clinical setting, data on sensitivity, specificity, as well as positive and negative predictive values are not yet available.

There are several problems with assessing diagnostic accuracy of a provocative test for lesions associated with the acromioclavicular joint. The most pressing is the low practicality of performing in vivo verification of the lesion both visually and histologically. Rotator cuff tears, tendinopathy, glenohumeral instability, and labrum tears, for example, can be assessed during surgical repair to validate positive and negative findings associated with the provocative maneuvers performed during the physical examination.[18,19]

The acromioclavicular joint, on the other hand, is a difficult joint to assess for several reasons. The most dramatic is the high prevalence of early degenerative changes in the symptom-free population.[20] The acromioclavicular joint has also shown increased uptake on bone scan in the symptom-free population. This creates a dilemma in establishing true-negative results, which then impacts specificity. Specificity is the proportion of true-negative test results among the shoulders without the lesion being present.

By virtue of a negative test result, I hypothesize that the acromioclavicular joint is not the affected tissue and that the glenohumeral tissues are the involved components. Although magnetic resonance imaging (MRI) can be used to verify the absence or presence of various lesions within the acromioclavicular joint, if a negative acromioclavicular joint differential test is reported, MRI is capable of detecting early changes in the joint capsule, acromion, and distal clavicle that may not be symptomatic at the time of testing. These findings may merely be incidental. Therefore MRI may or may not assist in the identification of false-negative and false-positive results. The specificity component of the validation process remains a question mark with regard to provocative testing in the acromioclavicular joint.

The method of sensitivity validation I am currently considering is to use intraarticular injection of a lidocaine preparation into the acromioclavicular joint. After a positive acromioclavicular joint differential test result, an injection of lidocaine would be placed into the acromioclavicular joint. Resolution of localized acromioclavicular joint pain would be confirmatory for the acromioclavicular joint as the primary lesion site. This procedure would provide data useful in establishing sensitivity of the test in question.

CONCLUSION

The acromioclavicular joint differential test through its mechanism could provide the examiner with an additional tool to increase the accuracy of differential diagnosis between acromioclavicular joint lesions and subacromial impingement in the patient with shoulder pain.

REFERENCES

1. Lemos MJ. The evaluation and treatment of the injured acromioclavicular joint in athletes. Am J Sports Med 1998;26:137-44.
2. Nicholas JA, Hershman EB. The upper extremity in sports medicine. St Louis: CV Mosby; 1990.
3. Salter EG Jr, Nasca RJ, Shekkey BS. Anatomical observation on the acromioclavicular joint and supporting ligaments. Am J Sports Med 1987;15:199-206.
4. Fukuda K, Craig EV, An K, Cofield RH, Chao EY. Biomechanical study of the ligamentous system of the acromioclavicular joint. J Bone Joint Surg 1986;68A:434-9.
5. Matsen FA III, Lippitt SB, Sidles JA, Harryman DT. Practical evaluation and management of the shoulder. Philadelphia: WB Saunders; 1994.
6. Kendall FP, McCreary EK, Provance PG. Muscle testing and function. 4th ed. Baltimore: Williams and Wilkins, 1993.
7. Netter FH, Woodburne RT. The ciba collection of medical illustrations: musculoskeletal system part 1; anatomy, physiology and metabolic disorders. Summit: Ciba-Geigy; 1996;8:25.
8. Leahy PM. Active release techniques soft tissue management system for the upper extremity. Colorado Springs (CO): Active Release Techniques, LLP; 1996:57.
9. Marone PJ. Shoulder injuries in sports. Gaithersburg, MD: Aspen; 1992.
10. Souza TA. Sports injuries of the shoulder: conservative management. New York: Churchill Livingstone; 1994.
11. Rockwood CA Jr, Young DC. Disorders of the acromioclavicular joint. In: Rockwood CA Jr, Matsen FA III, eds. The shoulder. Philadelphia: WB Saunders; 1990;1:413-76.
12. Hammer W. Functional soft tissue examination and treatment by manual methods. Gaithersburg, MD: Aspen; 1991.
13. Raffii M. Shoulder. In: Firooznia HF, Golimbu C, Rafii M, Rauschning W, Weinreb J, eds. MRI and CT of the musculoskeletal system. St Louis: CV Mosby; 1992:505-63.
14. Lozman PR, Hechtman KS, Uribe JW. Combined arthroscopic management of impingement syndrome and acromioclavicular joint arthritis. J So Ortho Assoc 1995;4:177-81.
15. Neer CS. Impingement lesions. Clin Orthop 1983;173:70-7.
16. Leroux J-L, Thomas E, Bonnel F, Blotman F. Diagnostic value of clinical tests for shoulder impingement syndrome. Rev Rhum [Engl Ed] 1995;62:423-8.
17. Flatow EL, Soslowskey LJ, Ticker JB, Pawluk RJ, Hepler M, Ark J, et al. Excursion of the rotator cuff under the acromion: patterns of subacromial contact. Am J Sports Med 1994;22:779-88.
18. Gerber C, Krushell RJ. Isolated rupture of the subscapularis muscle: clinical features in 16 cases. J Bone Joint Surg 1991;73B:389-94.
19. Liu SH, Henry MH, Nuccion SL. A prospective evaluation of a new physical examination in predicting glenoid labral tears. Am J Sports Med 1996;24:721-5.
20. Yochum TR, Rowe LJ. Essentials of skeletal radiology, volume two. Baltimore: Williams and Wilkins; 1987.