

The Passive Distraction Test: A New Diagnostic Aid for Clinically Significant Superior Labral Pathology

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Purpose: The purpose of this report is to present a new provocative maneuver, the passive distraction test (PDT), as an examination tool to be used in the evaluation of patients thought to have a SLAP lesion and to compare its accuracy, precision, and reproducibility alone and in conjunction with previously published maneuvers. **Methods:** A retrospective analysis of 319 consecutive arthroscopies performed between May 2001 and November 2003 was performed. A total of 65 cases were excluded, 53 because of limitation of elevation to less than 150° or pain in the starting test position and 12 who had previous shoulder procedures performed by the senior author, leaving 254 cases for review. A thorough history was obtained and a thorough physical examination performed with a focus on the involved shoulder including specific provocative maneuvers for the clinical diagnosis of a SLAP lesion. The active compression test, the anterior slide test, and the PDT were used to clinically diagnose a SLAP lesion. The results from the 3 provocative maneuvers were compared with the arthroscopic findings to determine the sensitivity, specificity, negative predictive value (NPV), and positive predictive value of each test alone and in a logical combination. **Results:** Of 254 shoulder arthroscopies, 61 had a clinically significant SLAP lesion, for an incidence of 24%. The sensitivity and specificity for the PDT were 53% and 94%, respectively, with an NPV of 87% and positive predictive value of 72%. In combination, the PDT and the active compression test yielded an NPV of 90.5%. **Conclusions:** The PDT can be used alone or in combination to aid in the clinical evaluation and diagnosis of a SLAP lesion. **Level of Evidence:** Level IV, retrospective, diagnostic, sensitivity-specificity study. **Key Words:** Passive distraction test—Superior labrum anterior-posterior lesion—SLAP—Physical examination.

It has been over 20 years since Andrews et al.¹ published their review of 73 overhead-throwing athletes and their description of superior glenoid labral tears occurring at the insertion of the biceps anchor. Snyder et al.² were the first to coin the term “SLAP” lesion (superior labrum anterior-posterior), in 1990,

and in the subsequent years there have been many advancements with regard to this entity.³⁻¹⁵ The etiology, diagnosis, and pathodynamics of these lesions remain an evolving concept. Over the past 2 decades, several provocative measures have been described to aid in the clinical diagnosis of SLAP lesions, including the biceps tension test and compression rotation test,² the active compression test (ACT),¹⁶ the anterior slide test (AST),¹⁷ the biceps load test II,¹⁸ the pain provocative test of Mimori et al.,¹⁹ the resisted supination external rotation test,²⁰ the crank test,²¹ and the supine flexion resistance test.²² The diagnostic accuracy of these examinations has been reported on several occasions; however, there has been considerable variability in the measured sensitivity, specificity, and predictive values between the authors who initially described the tests and subsequent researchers^{5,20,22-27} (Table 1). No one provocative maneuver is considered to be clinically superior for the diagnosis of SLAP

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TABLE 1. *Provocative Measures for Diagnosis of SLAP Lesions*

Measure	Publication	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Active compression test	O'Brien et al. ¹⁶ (1998)	100	98.5	94.6	100
	McFarland et al. ²⁴ (2002)	47	55	10	91
	Stetson and Templin ²³ (2002)	54	31	34	50
	Parentis et al. ⁵ (2002)	62.5	50	—	—
	Guanche and Jones ²⁵ (2003)	54	47	57	45
	Myers et al. ²⁰ (2005)	78	11	70	29
	Oh et al. ²⁶ (2008)	63	53	55	61
Compression rotation test	McFarland et al. ²⁴ (2002)	24	76	9	90
	Oh et al. ²⁶ (2008)	61	54	55	61
Anterior slide test	Kibler ¹⁷ (1995)	78	92	84	87
	McFarland et al. ²⁴ (2002)	8	84	5	90
	Parentis et al. ⁵ (2002)	10	82	—	—
Biceps load test II	Kim et al. ¹⁸ (2001)	90	97	92	95.5
	Oh et al. ²⁶ (2008)	30	78	59	52
Crank test	Liu et al. ²¹ (1996)	91	93	94	90
	Stetson and Templin ²³ (2002)	46	56	41	61
	Parentis et al. ⁵ (2002)	12.5	83	—	—
	Guanche and Jones ²⁵ (2003)	39	67	59	47

lesions.^{4,6,7,17} Shoulder arthroscopy has been considered the gold standard for diagnosis of SLAP lesions; however, the reliability of arthroscopic diagnosis has been shown to vary even among experienced arthroscopists.²⁸ Clearly, technical expertise, surgical experience, and judgment integrated with the clinician's diagnostic skills can affect the interpretation and the reliability of such an examination. At this time, there does not appear to be a consistent, reliable, reproducible clinical test for the diagnosis of superior labral tears.

To augment the clinical examination of patients presenting with shoulder complaints, the senior author has used a new clinical provocative maneuver: the passive distraction test (PDT).²⁹ The PDT was first performed in the shoulder evaluation of competitive divers thought to have a SLAP lesion. The PDT mimicked the position of the arm and glenohumeral joint at the time of entry into the water and reproduced the patients' clinical symptoms. The use of this maneuver was expanded to all patients being evaluated for shoulder pathology by the senior author.

It is the purpose of this article to present the PDT as a new provocative maneuver to be used in the evaluation of patients thought to have a superior labral tear and to compare its use and outcomes alone and in conjunction with previously published maneuvers. We hypothesized that patients with superior labral pathology would have pain within the glenohumeral joint when undergoing the PDT.

METHODS

A retrospective analysis of 319 shoulder arthroscopies performed between May 2001 and November 2003 was performed. All patients had presented during the study period for evaluation of shoulder pain and/or dysfunction. A complete shoulder history was taken from all patients. This included a detailed history of the mechanism of injury or onset of symptoms, previous diagnostic tests, current symptoms, hand dominance, occupation, athletic activities, previous injuries, surgery, and response to treatment. All patients underwent shoulder examinations that included evaluation of the kinetic chain and scapular kinematics; assessment of range of motion with the scapula stabilized; provocative testing for subacromial impingement; isolated manual muscle testing of the rotator cuff and serratus anterior; biceps provocation in forward flexion and abduction; Whipple test for anterior supraspinatus pathology³⁰; provocative tests for labral pathology and instability in the sitting, supine, and lateral decubitus positions; assessment for acromioclavicular joint pathology; and anatomic palpation for tenderness.

All patients had a complete medical history taken and completed a specific shoulder questionnaire. As part of the shoulder evaluation, 3 provocative measures, the ACT, the AST, and the PDT, were performed by the senior author to attempt to clinically diagnose a clinically significant superior labral tear.

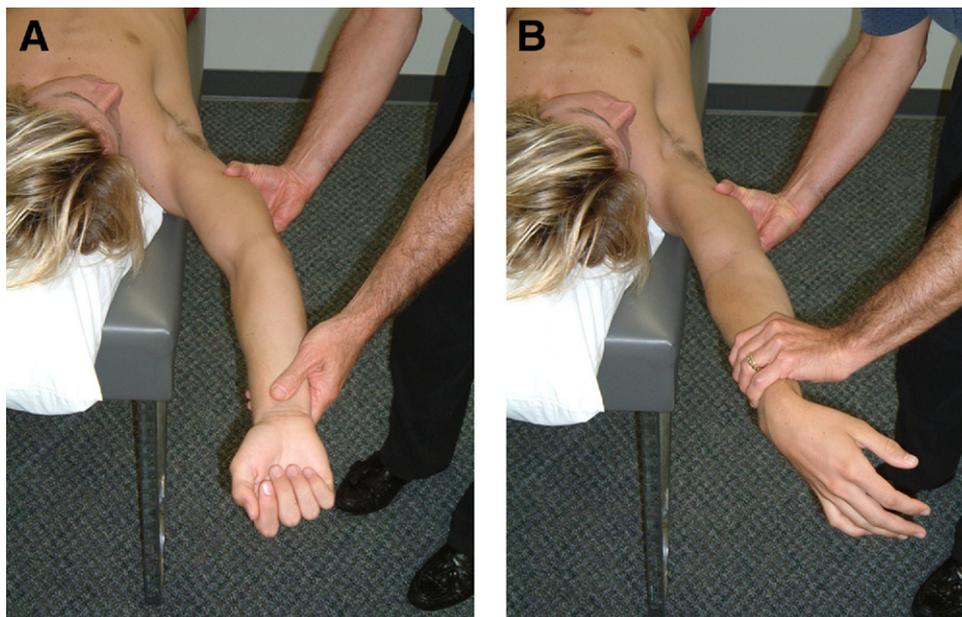


FIGURE 1. PDT. (A) The patient is positioned supine with the affected extremity elevated 150° in the coronal plane, with the elbow extended, the forearm supinated, and the upper arm stabilized to prevent humeral rotation. (B) The forearm is gently pronated from the supinated position while maintaining a steady position of the upper arm. Pain reported deep inside the glenohumeral joint either anteriorly or posteriorly is considered a positive test result.

Active Compression Test

The ACT, described by O'Brien et al.¹⁶ in 1998, was performed with the involved arm forward flexed to 90° with the elbow in full extension. The arm was then adducted approximately 10° to 15° medial to the sagittal plane of the body and internally rotated so that the thumb pointed down. A downward force was applied to the arm as the patient resisted (test position 1). The maneuver was then repeated with the palm facing up to assess whether the pain was reduced or alleviated in this position (test position 2). The test was considered positive if pain was felt “deep” within the glenohumeral joint in test position 1 and was either decreased or absent when the test was repeated with the forearm supinated in test position 2.

Anterior Slide Test

The AST, described by Kibler¹⁷ in 1995, was performed with the patient's affected arm positioned with the hand on the ipsilateral hip with the thumb pointing posteriorly. The examiner then stabilized the shoulder and acromion with one hand and used the other to place an anteriorly and superiorly directed axial load on the humerus. A positive test was described as pain and/or a click felt within the joint.

Passive Distraction Test

The provocative maneuver being investigated, the PDT,²⁹ was performed with the patient lying supine at

the edge of the examination table. The affected extremity was elevated to 150° in the coronal plane with the elbow extended with the forearm in supination (Fig 1A) and the upper arm stabilized to prevent humeral rotation. If this position was reasonably comfortable, the forearm was pronated (Fig 1B). Pain reported deep inside the glenohumeral joint either anteriorly or posteriorly was considered a positive test result and was considered to be consistent with the presence of a SLAP lesion.

Patients underwent magnetic resonance imaging with or without intra-articular gadolinium before undergoing a detailed arthroscopic shoulder evaluation by the senior author.

Of the 319 cases that were reviewed, 65 were excluded, leaving 254 shoulders in 246 patients for assessment. We excluded 53 patients from this study because of either an inability to elevate the arm to 150° or an inability to do so comfortably and 12 for having undergone a previous arthroscopy on the same shoulder. The study population consisted of 160 male patients and 86 female patients with a mean age of 44 years (range, 13 to 84 years).

The results from the 3 provocative maneuvers were compared with the arthroscopic findings to determine the sensitivity, specificity, and predictive values of each test alone and in combination with each other. A positive arthroscopic finding for a SLAP lesion was recorded if the glenoid labrum showed clinically significant type II, III, or IV changes by use of the

original classification of Snyder et al.² or if it was believed that the biceps anchor was unstable and the pathology matched the history, clinical presentation, and symptoms. Biceps anchor instability was diagnosed by applying traction to the biceps tendon with a nerve hook and observing either “fish mouthing” at the labrum-glenoid interface or significant splitting of the superior labrum. This arthroscopic finding may be considered an incomplete type II SLAP tear.

RESULTS

A total of 246 patients (254 shoulders) were evaluated and their data analyzed for inclusion in this study. Of the 254 shoulder arthroscopies, 61 (24%) had a clinically significant type II, III, or IV SLAP lesion. Arthroscopic findings occurring alone and concomitant with SLAP lesions included rotator cuff tears, Bankart lesions, subacromial impingement, and biceps tendon pathology (Tables 2 and 3). Twenty patients were found to have an isolated SLAP tear. In this population, when the PDT was used in isolation, 9 of 20 patients tested positive.

The results of the 3 provocative maneuvers used in this study are listed in Table 4, along with the respective sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) calculated.

The sensitivity, specificity, PPV, and NPV for the ACT, the AST, and the PDT were compared and the associated *P* values calculated. The difference when the PDT and the ACT were compared with regard to predictive value, sensitivity, and specificity was not statistically significant. The NPV of the PDT and the AST was 87% and 82%, respectively (*P* = .0158), and sensitivity was 53% and 21%, respectively (*P* = .0076). When the results of the ACT were compared with those of the AST, a statistically significant difference was found for NPV (*P* = .0008), sensitivity (*P* = .0002), and specificity (*P* = .0047).

TABLE 2. Arthroscopic Findings in 254 Shoulders

Arthroscopic Finding	No. of Shoulders	%
SLAP lesion	61	24
Rotator cuff tear		
Complete	79	31
Partial	66	26
Instability		
Bankart lesion	57	22
Biceps tendon pathology	48	19

TABLE 3. SLAP Lesions and Associated Pathologies

	No. of Shoulders
Arthroscopic findings	
Isolated SLAP lesion	20
SLAP and instability/Bankart	11
SLAP and rotator cuff tear	15
SLAP and biceps tendon pathology	0
SLAP, instability/Bankart, and biceps tendon pathology	1
SLAP, instability/Bankart, and rotator cuff tear	7
SLAP, biceps tendon pathology, and rotator cuff tear	6
SLAP, instability/Bankart, biceps tendon pathology, and rotator cuff tear	1
Total	61

The PDT and the ACT were analyzed as a logical combination. Clinical examination results were confirmed by shoulder arthroscopy. The ACT and the PDT were positive for the diagnosis of a SLAP lesion on clinical examination in 58 of 254 patients. Of the 58 positive results, 39 coincided with a clinically “abnormal” labrum (i.e., the presence of a type II, III, or IV SLAP lesion) on a detailed arthroscopic evaluation of the shoulder, yielding a PPV of 67.3% ± 6%. Both the ACT and the PDT were negative for the diagnosis of a SLAP lesion on clinical examination in 180 of 254 patients; of these, 163 shoulders coincided with a clinically “normal” labrum (i.e., absence of a type II, III, or IV SLAP lesion) on a detailed arthroscopic evaluation of the shoulder, yielding an NPV of 90.5% ± 2% (Table 4).

DISCUSSION

Lesions of the superior labrum have been difficult to diagnose based on clinical evaluation.^{4,6,7,17} Compar-

TABLE 4. Calculated Values of PDT, ACT, and AST, as Well as Combination of PDT and ACT

	PDT	ACT	AST	PDT and ACT
PPV (%)	72	69	71	67
NPV (%)	87	88	82	91
Sensitivity (%)	53	59	21	70
Specificity (%)	94	92	98	90

NOTE. PPV was determined as follows: PPV = Number truly positive by arthroscopy (gold standard)/Total number testing positive. NPV was determined as follows: NPV = Number truly negative by arthroscopy (gold standard)/Total number testing negative.

ison of recent reports shows great variability in the sensitivity, specificity, PPV, and NPV for the most commonly performed SLAP tests.^{20,22,26,27} Recently, we have used the PDT in the clinical evaluation for SLAP lesions.²⁹ It is postulated that this maneuver as described rotates the radial tuberosity, placing traction on the biceps, which in turn tensions the proximal long head of the biceps anchor at the superior labrum, causing a “peel back” or “fish mouthing” of the labrum. Arthroscopic observation of a “peel back,” as described by Burkhart et al.,¹³ of the superior labrum during this maneuver supports the validity of this interpretation.

The incidence of superior labral tears in this study population was 24% (61 of 254 shoulders) and is slightly higher than the SLAP incidence previously published.^{8,31} The increased incidence in this study may be attributed to the patient population of the senior author, which includes a high volume of overhead athletes, especially competitive divers, who show a higher-than-usual incidence of SLAP lesions. In addition, because of the higher age of our study population, the incidence of degenerative SLAP lesions was likely increased.

An abnormal attachment of the superior labrum can be an anatomic variation as described by Davidson and Rivenburgh³² or appear as an incomplete tear or horizontal cleavage tear. The true clinical significance of these lesions remains in question; however, when the PDT was performed during arthroscopy, in turn tensioning the biceps anchor, an increase in the visible gap, or “step off,” within either the anatomic insertion or the cleavage tear was visualized. The finding of an incomplete or horizontal cleavage tear with an unstable biceps anchor may represent a “pre-SLAP” lesion, which can be thought of as an incomplete or pending type II lesion.

A 37-year-old male weightlifter and laborer treated during this study was found on initial arthroscopy to have a pre-SLAP lesion. The lesion initially was debrided and the patient underwent rehabilitation; in the second postoperative year he progressed to have a complete type II SLAP tear that required repair. This pre-SLAP lesion clearly needs to be differentiated from the normal superior labral variant.³² When the PDT is performed and tension placed on the superior labral insertion, the pre-SLAP phenomenon may be found.

The sensitivity and specificity of the PDT are comparable to other physical examination modalities used in the clinical evaluation of SLAP lesions. When comparing the PDT with recently published tests for the diagnosis of SLAP lesions, the findings are relatively similar. Myers et al.,²⁰ in their recent report and description of the resisted supination external rotation

test, reported a sensitivity, specificity, PPV, and NPV of 83%, 82%, 92%, and 64%, respectively. The resisted supination external rotation test stresses the biceps insertion in a manner similar to the PDT by re-creating the peel-back mechanism.

Ebinger et al.²² recently evaluated 150 patients who underwent a complete shoulder examination after presenting with persisting pain and/or functional disability of the shoulder. The authors described and analyzed a new clinical examination maneuver: the supine flexion resistance test. With the patient lying supine, a resisted throwing motion of the humerus is performed. If pain is elicited deep within the glenohumeral joint, the test is considered to be positive for a SLAP lesion. When compared with the ACT and Speed’s test, the supine flexion resistance test proved to be more specific for a SLAP tear in their cohort, yielding a specificity of 69%. In contrast, in this study we found the specificity for the diagnosis of a SLAP lesion to be 92% with the ACT and 94% with the PDT.

The addition of the PDT to the clinician’s armamentarium is especially useful in combination with the ACT. Both the ACT and the PDT in combination were negative for the diagnosis of a SLAP lesion on clinical examination and arthroscopy in 163 of 254 patients studied, yielding an NPV of 90.5%. Therefore, when both the PDT and the ACT are negative, the chance of a patient having a significant SLAP tear is less than 10%.

Clearly, it is important that the PDT and all tests used to clinically diagnose a SLAP lesion be considered in the context of the history as well as the patient’s presenting complaints and other findings during the physical examination. This study showed that a negative PDT and ACT had an NPV greater than 90%. This information and the provocative maneuver described should prove useful to the surgeon when evaluating a patient with shoulder pain and suspected labral pathology.

The weaknesses of this study are a lack of a method to measure intraobserver and interobserver reliability with regard to the PDT and the other provocative maneuvers used. The sensitivity and specificity of the ACT, the AST, and the PDT reported in this study are biased because of how patients were selected for gold standard testing, which in this study was shoulder arthroscopy. To limit this bias, when the PDT and other provocative maneuvers are used, the probability of having a gold standard examination should be determined independently of the clinical test/provocative maneuver(s) outcome, which is difficult to achieve in clinical practice. In addition, the use of shoulder ar-

throscopy as a gold standard for diagnosis may also be a limitation because it has been shown to have substantial interobserver and intraobserver variability among experienced shoulder arthroscopic specialists with regard to the diagnosis of SLAP tears.²⁸ Furthermore, the starting position for the PDT requires that the patient be comfortable with the arm elevated to 150° in the coronal plane with the elbow extended and the forearm in supination. It should be noted that this test may be of little value in patients with concomitant pathologies, such as subacromial impingement, bursitis, capsulitis, and arthrosis, that make assuming the starting position for the PDT uncomfortable or perhaps impossible; thus the PDT may be most useful in the young athletic population.

CONCLUSIONS

The PDT can be used alone or in combination to aid in the clinical evaluation and diagnosis of a SLAP lesion.

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