

Original Research

Survey on Knowledge, Use, and Diagnostic Applicability of Special Tests for Rotator Cuff Involvement in Clinical Practice

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Background

Recently, researchers have commented that shoulder special tests cannot identify the structure causing rotator cuff symptoms and should only be considered pain provocation tests. Others have disagreed, reporting that special tests were able to accurately detect the presence of rotator cuff involvement.

Purpose

The purpose of this study was to determine the knowledge, use, and perceived effectiveness of 15 selected special tests utilized to examine patients with possible rotator cuff dysfunction.

Study Design

Descriptive study using survey.

Methods

An electronic survey was returned by 346 members of the Academies of Orthopedic and Sports Physical Therapy through list serves. Descriptions and pictures for 15 special tests of the shoulder were included in the survey. Information regarding years of clinical experience and American Board of Physical Therapy Specialties (ABPTS) specialist certification in Sports or Orthopedics was collected. Respondents were asked if they could *identify* and *use* the special tests to evaluate dysfunction of the rotator cuff - and how confident they were in ability of the tests to *diagnose* dysfunction of the rotator cuff.

Results

The four tests most readily *known* by respondents included the empty can, drop arm, full can, and Gerber's tests, and the four tests *used* regularly by the respondents included the infraspinatus, full can, supraspinatus, and champagne toast tests. The infraspinatus, champagne toast, external rotation lag (ERLS), and the belly-off tests were found to be the most useful for establishing a *diagnosis* of the muscle-tendon complex involved. Years of experience and clinical specialization was not relevant to knowledge or use of these tests.

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Conclusions

This study will allow clinicians and educators to understand which special tests are easily identified, regularly used, and perceived as helpful for the diagnosis of muscles involved in a rotator cuff dysfunction.

Level of Evidence

3b

INTRODUCTION

Physical examination of any joint in the body is extremely important to evaluate the presence, location, and extent of problems or dysfunction that may exist in a person. One joint that may be a challenge for practitioners to examine and diagnose is the shoulder, due to the highly complex architecture of bony and soft-tissue anatomy which allows for the greatest range of motion of any joint of the body. As a result of the complexity of the shoulder joint, difficulty exists when conducting an appropriate clinical examination, especially the examination of rotator cuff involvement in the shoulder.^{1,2}

Recently, McFarland et al³ wrote a clinical commentary and stated that shoulder special tests cannot identify the structure causing rotator cuff symptoms and should only be considered pain provocation tests. The authors suggested that use of special tests to inform individuals of the specific source of their symptoms, and then recommend surgical or nonsurgical intervention for that structure is not the best practice. Furthermore, the authors suggested that a comprehensive clinical interview and physical examination *without special tests* can be used to determine a working diagnosis to implicate a rotator cuff pathology.

Salamh and Lewis⁴ wrote in an editorial that special tests do not impart diagnostic information and should not be an important part of the physical therapist examination. Requejo-Salinas et al⁵ used a group of international expert physical therapists to come to a consensus statement suggesting that resistive testing, response to overhead loading, and reported symptoms were more effective at creating a diagnostic impression than any of the special tests. Van Kampen et al⁶ stated in a systematic review, that predictive values of special tests are low. After additional systematic reviews, Gismervik et al⁷ and Hegedus et al⁸ reported no support for most special tests of the shoulder but both groups of authors found some benefit of using the Jobe's supraspinatus test with reasonable sensitivity and specificity.

Cadogan et al⁹ disagreed with the McFarland group and related research, reporting that using special tests for the shoulder allows for accurate diagnosis in identifying rotator cuff involvement. Tennent et al¹⁰ stated that "careful examination of the shoulder is an essential component in forming a diagnosis of problems in this area and special testing is an important tool in this arsenal." These authors suggested the discrepancy in the use of special testing is due to the number of tests available and the lack of knowledge of how to properly perform the tests.

Other published manuscripts reviewed the sensitivity and specificity for specific rotator cuff special tests with a

variety of results – pro and con – for including special tests for the shoulder as part of an examination. After researching sensitivity and specificity of multiple rotator cuff tests, Yuen et al¹¹ found only the Jobe (empty can) test had good sensitivity at 0.89 when compared to MRI, but found that only 37% of practitioners in their study correctly diagnosed the impairments using the gauntlet of tests available. Zou et al¹² also found that the Jobe and Hug-up tests had favorable positive likelihood values of 2.58 and 2.3 respectively. Similarly, Liu et al¹³ found the Hug-up test to have a 0.94 sensitivity and a 0.77 specificity. Bak et al¹⁴ researched the external rotation lag sign (ERLS) as a diagnostic tool compared to arthroscopic surgery findings and found sensitivity of 0.91 and specificity of 0.86 in full thickness tears of the rotator cuff. Additionally, Sgroi et al¹⁵ also found favorable diagnostic ability with the same test (ERLS) and reported resisted external rotation to have some diagnostic precision depending on the extent of the rotator cuff tear. The same authors found that the combination of resisted external rotation combined with the Patte test was the most effective in comparison with surgical findings.

Yazigi et al¹⁶ researched the use of the empty can, full can, drop arm, Patte, and infraspinatus tests in an article published in 2021 and found good sensitivity of the empty can (0.81) and good specificity of the drop arm and Patte tests (0.98). They also suggested prediction of diagnosis of injury at 58% for the empty can test. Finally, Dinnes et al¹⁷ suggest the opposite of Salamh and Lewis⁴ and stated that using rotator cuff special tests, a practitioner can rule out tears because of overall high sensitivity as indicated previously.

A problem that exists when discussing special tests of the shoulder for detecting rotator cuff involvement is that over 70 special tests have been described to examine patients with shoulder injuries.¹⁸ Because of the vast array of tests, clinicians and educators in health care curricula are challenged to decide which tests should be used and taught, respectively. Therefore, the purpose of this study was to determine the knowledge, use, and perceived effectiveness of 15 selected special tests utilized to examine patients with possible rotator cuff dysfunction.

METHODS

Following a review of the literature, 15 special tests used for the musculoskeletal examination of the shoulder complex were chosen to be included in a survey. The tests chosen were the most common found in the literature in several data searches and were described in textbooks.

ER resistance at 0 degrees abduction (Appendix- Figure 1)

- Purpose: Assess for infraspinatus muscle-tendon complex tears and dysfunction.
- Positioning: Patient seated with elbow flexed at 90 degrees and shoulder adducted to their trunk. Patient asked to externally rotate the arm while the therapist applies resistance.
- Interpreting results: Test is positive if patient reports pain or is unable resist motion.
- Sensitivity and Specificity not reported.

Hug up test¹³ (Appendix- Figure 2)

- Purpose: Assess for supraspinatus muscle-tendon complex tears and dysfunction.
- Positioning: Patient seated or standing and places hand of involved arm on opposite shoulder. Therapist applies a downward force perpendicular to elbow while patient resists the motion.
- Interpreting results: Test is positive if patient reports pain or is unable to resist motion.
- Sensitivity 94.1%, Specificity 76.6%.

Drop arm sign¹⁵ (Appendix- Figure 3)

- Purpose: Asses for full thickness rotator cuff tears, especially for supraspinatus muscle-tendon complex tears.
- Positioning: Patient seated. Therapist abducts the involved arm to 90 degrees and externally rotates the arm, while supporting the arm at the elbow. The therapist releases the arm, and the patient slowly lowers the arm down.
- Interpreting results: Test is positive if patient suddenly drops arm or struggles to maintain arm position.
- Sensitivity 73%, Specificity 77%.

Subscapularis test (Appendix- Figure 4)

- Purpose: Assess for subscapularis muscle-tendon complex tears or dysfunction.
- Positioning: Patient seated with elbow flexed at 90 degrees. Patient pushes hand into chest (contracts as internally rotates) as therapist resists.
- Interpreting results: Test is positive if patient reports pain or is unable resist motion.
- Sensitivity and Specificity not reported.

Belly press off¹⁹ (Appendix- Figure 5)

- Purpose: Assess for subscapularis muscle-tendon complex tears or dysfunction. This test is often used when a patient is unable to perform the Gerber lift off test due to pain or limited internal rotation ROM.
- Positioning: Patient seated with elbow flexed at 90 degrees with palm facing the chest (hand should be placed right below xyphoid process). Patient pushes hand into chest (contracts as internally rotates) as therapist resists.
- Interpreting results: Test is positive if patient compensates (common compensations seen are wrist flex, shoulder adduction, and shoulder extension).
- Sensitivity 34% , Specificity 92%.

Infraspinatus test (Appendix- Figure 6)

- Purpose: Assess for infraspinatus muscle-tendon complex tears and dysfunction.
- Positioning: Patient side-lying with elbow flexed at 90 degrees and shoulder adducted to their trunk. Therapist applies force to resist external rotation
- Interpreting results: Test is positive if patient reports pain or is unable resist motion.
- Sensitivity and Specificity not reported.

Patte test²⁰ (Appendix- Figure 7)

- Purpose: Assess for teres minor muscle-tendon complex dysfunction.
- Positioning: Patient either sitting or standing. The involved arm is placed in 90 degrees of shoulder abduction in the scapular plane with elbow also at 90 degrees. Patient asked to externally rotate the arm while the therapist applies resistance.
- Interpreting results: Test is positive if pain with resisted external rotation.
- Sensitivity 93%, Specificity is 72%.

Champagne toast (and pour) test²¹ (Appendix- Figure 8)

- Purpose: Assess for supraspinatus muscle-tendon complex dysfunction and injury.
- Positioning: Patient seated and puts shoulder at 30 degrees abduction, 15 degrees ER, and 30 degrees flex, with elbow flexed to approx. 90 degrees. Therapist applies downward force along elbow.
- Interpreting results: Test is positive if patient reports pain or weakness occurs during movement.
- Sensitivity and Specificity not reported.

Empty can²² (Appendix- Figure 9)

- Purpose: Assess for supraspinatus muscle-tendon complex and tendon pathology.
- Positioning: Patient can be seated or standing. Involved arm is elevated to 70 degrees. With elbow at full extension, the shoulder is held in internal rotation, and pronation (thumbs-down position). Therapist applies downward force through arm.
- Interpreting Results: Test is positive if patient reports pain or weakness with resistance.
- Sensitivity 88.6%, Specificity 58.8% for tendon tears.

Full can²² (Appendix- Figure 10)

- Purpose: Assess for dysfunction of supraspinatus muscle-tendon complex.
- Positioning: Patient standing or seated and holds involved arm at 70 degrees in scapular plane with hand in the "thumbs up" position. Therapist applies downward force at the mid-forearm.
- Interpreting Results: Test is positive if patient reports pain or weakness with resistance.
- Sensitivity 70%, Specificity 81%.

Hornblower's test²⁰ (Appendix- Figure 11)

- a. Purpose: Assess for teres minor muscle-tendon complex dysfunction.
- b. Positioning: Patient is supine with involved arm placed in 90 degrees of shoulder abduction with elbow also at 90 degrees. Patient asked to externally rotate the arm while the therapist applies resistance.
- c. Interpreting results: Test is positive if pain with resisted external rotation.
- d. Sensitivity 93%, Specificity is 72%.

Gerber lift off test²³ – Also called lift off test (Appendix- Figure 12)

- a. Purpose: Assess for rupture of the subscapularis muscle-tendon complex.
- b. Positioning: Patient standing, and places involved arm behind the back. Patient then lifts hand off the back (performs IR) while therapist applies pressure against the hand (utilizes an external rotation force).
- c. Interpreting results: Test is positive if patient cannot resist external rotation force, lift hand off the back, or compensates.
- d. Sensitivity 35%, Specificity 98%.

ER lag sign²⁴ Also called the Infraspinatus Spring Back Test. (Appendix- Figure 13)

- a. Purpose: Assess for teres minor and infraspinatus muscle-tendon complex involvement.
- b. Positioning: Patient seated with elbow flexed at 90 degrees and shoulder at 20 degrees elevation in scapular plane. Therapist externally rotates arm just short of maximal external ROM.
- c. Interpreting results: Test is positive if patient cannot maintain position or arm springs anterior.
- d. Sensitivity 97%, Specificity 93% for infraspinatus involvement. Sensitivity 100%, Specificity 93% for teres minor involvement.

Horizontal adduction²⁵ (Appendix- Figure 14)

- a. Purpose: Assess the integrity of the supraspinatus muscle-tendon complex.
- b. Positioning: Patient seated and holds arm horizontally adducted across the chest in full external rotation and with elbow extended. Subject is asked to pull the arm into horizontal abduction (away from the chest).
- c. Interpreting results: Observation is made as to whether the humeral head engages into the glenoid which can only occur when the supraspinatus is active and viable.
- d. Sensitivity and Specificity were not reported.

Bear hug test²⁶ (Appendix- Figure 15)

- a. Purpose: Assess the integrity of the supraspinatus muscle-tendon complex.
- b. Positioning: Patient seated and holds arm horizontally adducted across the chest in full external rotation and with elbow remaining extended. Subject is asked to pull the arm into horizontal abduction (away from the chest).

- c. Interpreting results: Observation is made as to whether the humeral head engages into the glenoid which can only occur when the supraspinatus is active and viable.
- d. Sensitivity and specificity were not reported.

Along with the descriptions, pictures for each test were provided in the survey so participants could identify the test visually. For each test, respondents were asked a) if they could identify each of the 15 special tests, b) regarding their use of the tests to evaluate dysfunction of the rotator cuff, and c) how confident they were in the ability of the special tests to identify the rotator cuff muscle-tendon complex involved. In addition, the survey included questions about years of clinical experience, as well as whether the participants were certified specialist by the American Board of Physical Therapy Specialties (ABPTS).

After receiving approval from the Institutional Review Board at the University of Central Arkansas, the survey was sent electronically using the list serves of both the Academy of Orthopedic Physical Therapy and the American Academy of Sports Physical Therapy. As part of the survey instructions, the respondents were notified that completing and submitting the survey was considered their informed consent.

The participant ranked each of the 15 special tests on a 7-point Likert scale. Rating possibilities ranged from 1 “strongly disagree” to 7 “strongly agree” for each of the following areas: a) knowledge of the test, b) use of the test clinically, and c) ability of the test to determine if the rotator cuff was involved.

STATISTICAL ANALYSIS

Results of the survey were tallied using the Likert score in each of the three categories for each test. To determine if years of experience made a difference as to whether the special tests were utilized clinically, the years were divided into quartiles. Quartiles were formed by review of the frequencies of the years of experience and forming four groups where natural divisions occurred. A one-way ANOVA was then performed on these rankings related to years of experience. A t-test was used to compare rankings between clinical specialists and non-specialists.

RESULTS

Three hundred forty-six surveys were returned from active members of the Academies. The average years of experience among the respondents was 15.41 (+/- 13.02) years. One hundred twenty-four were ABPTS Orthopedic or Sports Specialists and 225 respondents were not.

Results indicated that the four tests most readily **known** by respondents included the empty can test, drop arm test, full can test, and Gerber’s test. The top four tests **used regularly** by the respondents were the infraspinatus test, full can test, supraspinatus test and the champagne toast test. Finally, the infraspinatus test, champagne toast test, external rotation lag (ERLS) test, and the belly-off test were re-

ported by respondents to be the be **most useful** for establishing a diagnosis of the muscle-tendon complex involved.

Those respondents with more years of experience had significantly higher determination or diagnosis (**most useful**) using only one special test, the belly-off test. Years of experience made no difference in the **knowledge** or **used regularly** categories for any other special test. In addition, no difference existed between those who were clinical specialists and those with no specialization for any of the tests or categories.

DISCUSSION

This study attempted to discern the knowledge of and use of defined rotator cuff special tests and the perceptions regarding the use of these tests as diagnostic tools. The results suggest that several tests exist that are well known and used frequently by those that responded to the survey, but did not assist in determining the structure involved. However, other tests used by the respondents to come to clinical conclusions were used less often. No test was noted in all of the categories of interest: “known,” “used,” and “most useful in diagnosis.” For example, the infraspinatus (ER at 0° of abduction) and the champagne toast tests (a test for supraspinatus function) were both “used” and most “useful in diagnosis.” But, the full can and empty can tests were both “known” and “used” but were not the most “useful in diagnosis.”

Prior to further discussion of results of this study, a review of the concepts of sensitivity and specificity may be in order. *Sensitivity* and *Specificity* describe the accuracy of a test which reports the presence or absence of a condition. For the purposes of this study, sensitivity is the ability of a special test of the shoulder to correctly identify those with rotator cuff dysfunction (true positive rate), whereas specificity is the ability of the shoulder special test to correctly identify those without the rotator cuff problem (true negative rate). As an example, if 100 patients known to have rotator cuff problems were evaluated using a particular special test, and 43 test positive, then that special test has 43% sensitivity. If 100 with no rotator cuff involvement are assessed and 96 return a completely negative test result, then that shoulder special test has 96% specificity.²⁷ For purposes of this study, the authors have operationally defined sensitivity and specificity of 70% and greater as the determination that the special test was important in the diagnostic interpretation of rotator cuff injuries.

As indicated in the previous literature review included in this manuscript, some editorial comments and research articles suggest none of the special tests for rotator cuff pathology are helpful in the diagnosis of the rotator cuff^{4,5,7} - while others reported that using special tests for the shoulder allows a more accurate diagnosis in identifying rotator cuff involvement.^{9,10}

The present survey reinforces previous research by finding that many of the respondents believed some special tests were helpful in the clinical setting in coming to an accurate diagnosis involving the rotator cuff. In reviewing the 15 special tests used in this study, five tests (Hug-up, Patte,

Full can, Hornblowers, and ERLS) had sensitivity *and* specificity above 70%. For the other tests, sensitivity above 70% was found for one test (Empty can); and specificity above 70% was found for three tests (Belly off, Gerber lift, and the Bear hug).

Reviewing the result of this study and comparing the four tests {infraspinatus, champagne toast, ERLS, and the belly-off tests} identified in the survey as the most useful to the diagnosis of rotator cuff dysfunction, the ERLS and belly off tests were among those tests identified in the literature of being accurate test for the examination of the rotator cuff problems. Of note, two of these tests that the respondents said were helpful in the diagnosis of the rotator cuff muscles (Champagne toast and Infraspinatus tests) have had no research performed to determine their sensitivity and specificity. The suggestion by Salahm et al, and others, that special tests for the shoulder are not helpful in the diagnosis of rotator cuff injuries was disputed by the results of this study. Many of the tests reviewed for this study show substantial specificity or sensitivity and should be considered as diagnostic tools.

No information was gathered on why the responding therapists chose the special tests that were favored or why physical therapy entry-level programs chose the special tests they are teaching in their educational programs. Information regarding where the respondents learned a specific special test may provide information as to the “knowledge” of these special tests reported to be used in the survey. For instance, the Champagne Toast test for the supraspinatus is a relatively new test (described in 2016) and, therefore, may not be taught in many entry-level programs.²¹ The Champagne Toast test has been explored in some manuscripts but has not been reviewed in most systematic reviews or in comparison to other rotator cuff tests.^{21,28}

Many of the common rotator cuff tests were not known or used by a percentage of the respondents though some had support for their use in the literature. No studies were found that suggested the choice or usage of special tests in physical therapy educational programs would lead to a possible increase in the “known” category in this survey. A study was performed by Sciascia et al²⁹ that surveyed orthopedic surgeons on special tests performed to come to diagnostic conclusions for potential rotator cuff injuries or pathology. The authors suggested the choice of tests were dictated by their fellowship training and their graduate studies. Physical therapists might have a similar diversity in the training and use of certain special tests for diagnosing rotator cuff pathologies leading to a lack of usage of these same tests across the country. More studies exploring which of the rotator cuff special tests are taught in physical therapy entry-level programs are needed to understand the paucity of knowledge concerning certain special tests.

Experience and specialization might be expected to make a difference in the knowledge, use, and application of special tests for the rotator cuff. However, based on the results of this survey, no differences existed in the knowledge of, and the use of, the special tests selected for this study based on years of experience (even between the least and

most experienced therapists) or being specialized. Larger numbers of respondents may demonstrate more stratification of experience and greater statistical difference between more and less experienced physical therapists.

LIMITATION

The survey was sent to members of the Orthopedics Academy and Sports Academy of the American Physical Therapy Association and no method of recording the contact or opening rate of the survey was able to be determined. Therefore, the actual response rate could not be determined. Of the thousands of members of the Academies with the opportunity to participate, 346 surveys were received. The researchers do not know if members responding to the survey may be the most motivated by the question, or reflect the actual make-up of the physical therapy community within the Academies, or represent the responses from the licensees in Physical Therapy in the United States.

As previously indicated, the literature contains numerous tests for use in rotator cuff examination. The researchers on this study picked a group of 15 tests they reviewed reflected the most frequently used tests. A different body of researchers may have chosen a different group of rotator cuff tests or may not include tests more easily recognized or utilized. The researchers believed a survey using all the possible rotator cuff tests would be too numerous to allow an effective review.

FUTURE RESEARCH

Some of the special tests mentioned in these articles reviewed were not listed as the top four tests in the current survey for diagnostic assistance. This lack of agreement between authors could suggest that many of the practitioners surveyed were not comfortable in use of certain tests or did not perform them as frequently in evaluations. Some less-known tests (diagonal horizontal abduction, external rotation with adduction, etc) have been noted by other re-

searchers as effective at isolating specific rotator cuff musculature, and were noted by respondents as effective in diagnosis, but did not have the same weight of response as the other tests measured.²⁵ The authors behind the creation and interpretation of this survey would suggest more research needs to be added to the literature pool for all of the specific tests with validation against gold standard testing such as MRI and arthroscopy.

CONCLUSION

The results of this survey revealed the most *known* (the empty can, drop arm, full can, and Gerber's tests), *used* (the infraspinatus, full can, supraspinatus, and champagne toast tests), and *diagnostically relevant* (the infraspinatus, champagne toast, external rotation lag [ERLS], and the belly-off tests) rotator cuff tests from selected tests among a sample of physical therapists. Common knowledge of tests and use of tests did not vary by years of experience, nor by having an ABPTS Clinical Specialization. These data may allow clinicians and educators to understand which special tests are easily identified, regularly used, and helpful for the diagnosis of muscles involved in rotator cuff dysfunction.

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CONFLICTS OF INTEREST

The authors of this manuscript have no Conflicts of Interest related to reviewers, editor, editorial board member – nor any financial or personal relationships with other individuals or organizations that could inappropriately influence our actions in a way that creates bias.

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SUPPLEMENTARY MATERIALS

Appendix

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