

Original Article

The accuracy of “subacromial grind test” in diagnosis of supraspinatus rotator cuff tears

Seif Sawalha, Jochen Fischer¹

ABSTRACT

Purpose: The aim of this study is to assess the accuracy of a simple clinical test (subacromial grind test) in diagnosing supraspinatus tendon tears.

Patients and Methods: The test is considered positive if palpable crepitus or grinding is detected on passive internal and external rotation of the shoulder while abducted in the scapular plane. Data were collected prospectively on 47 patients undergoing shoulder arthroscopy, and the results of the test and arthroscopy compared.

Results: During arthroscopy, 17 patients had full thickness (FT) tears of supraspinatus tendon and 10 had partial thickness tears. For any supraspinatus tear, the sensitivity of the test was 63%, specificity 95%, positive predictive value 94%, negative predictive value 66% and overall accuracy 79%. For FT tears, the sensitivity was 82%, specificity 87%, positive predictive value 78%, negative predictive value 90% and overall accuracy 85%.

Conclusion: We found that this is a useful single test for diagnosing FT supraspinatus tears.

Level of Evidence: Level IV diagnostic study.

Key words: Grind, physical examination, shoulder, supraspinatus tendon, tear

INTRODUCTION

Rotator cuff pathology is a common problem with rising incidence and increasing volume of surgical repair.^[1] Despite advances in imaging modalities, the role of physical examination in diagnosing rotator cuff tears remains important. Degenerative cuff tears commonly start in supraspinatus tendon. Many physical examination tests have been described for diagnosing supraspinatus tears. Frequently used tests include empty can test (Jobe test), full can test and drop arm test. The diagnostic accuracy of these tests in the literature is highly variable.^[2,3]

Codman described direct palpation of rotator cuff tears in 1934. He also described “soft crepitus” palpable with the “tip of finger pressing on sulcus and eminence” as one of the signs of complete rupture of supraspinatus tendon.^[4] The accuracy of trans-deltoid palpation of the defect in the tendon described

by Codman (rent test) in the diagnosis of rotator cuff tears has been assessed.^[5,6] However, the usefulness of palpable crepitus in diagnosis of rotator cuff tears has not been studied.

The aim of the study is to assess the accuracy of the subacromial grind test in diagnosing supraspinatus tendon tears using shoulder arthroscopy as reference.

PATIENTS AND METHODS

Previous papers that studied similar patient population to ours reported approximately 42% prevalence of full thickness (FT) rotator cuff tears at arthroscopy.^[6] We anticipated a 90% specificity of the test with 0.1 precision and 95% confidence level (i.e., specificity between 80% and 100%). Using a simple nomogram designed for sample size calculation in diagnostic studies, the required number of subjects is approximately 50.^[7]

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We prospectively collected data on 50 consecutive patients who underwent shoulder arthroscopy between February and August 2013. We included 47 patients (31 male and 16 female, mean age 58 years (range 27-76 years)). Three patients could not tolerate the test due to pain and therefore, were excluded. All patients presented with a shoulder complaint and had already been fully assessed in shoulder clinics. The patients were assessed on the day of their operations, several weeks after their clinic appointments, by the authors. At the time of performing the subacromial grind test, the authors were blinded to patients' clinical and radiological findings in clinics and the proposed arthroscopic procedures. The result of the subacromial grind test recorded as positive or negative. The intraoperative findings (presence of supraspinatus tendon tear and the degree of tear; FT or partial thickness [PT]) were recorded.

Statistical analysis

A 2×2 table was designed, and sensitivity, specificity, positive and negative predictive values were calculated. Receiver operating characteristic (ROC) curve analysis was performed using SPSS version 20 statistics software (IBM, Armonk, NY, USA) and the area under the curve (AUC) value calculated. A $P < 0.05$ was considered as statistically significant.

The subacromial grind test description

With the patient standing and examiner standing facing the patient, the examiner grasps the patient's flexed elbow. The shoulder is passively abducted in the scapular plane to 90° (Hawkins-Kennedy test position).^[8] The examiner's other hand is placed over the patient's shoulder overlying the anterior acromion and greater tuberosity. The examiner passively internally and externally rotates the shoulder detecting the presence of palpable crepitus [Figure 1a and b]. The test was considered positive if resulted in palpable crepitus.

The anatomic basis for Hawkins-Kennedy test position was studied previously. Pappas *et al.* demonstrated subacromial narrowing and contact with supraspinatus in most cases during open magnetic resonance imaging (MRI).^[9] Roberts *et al.*

showed using MRI scans that the rotator cuff insertion appeared to be in closest proximity to the anteroinferior acromion at 90° of flexion.^[10]

RESULTS

Table 1 summarizes the findings of the test and arthroscopy, and sensitivity analysis. During arthroscopy, 17 patients had FT tears of supraspinatus tendon, and 10 had PT tears. Three patients had false negative tests; two of them had massive cuff tears involving all tendons. Four patients had false positive tests; three of them had PT tears (two bursal side tears and one joint surface tear), and one had no tears. None of the patients had other pathologies.

Results of sensitivity and specificity analysis are shown in Table 1. The test was more sensitive for detection of FT tears. ROC curve analysis showed that for FT tears $AUC = 0.85$ (95% confidence interval [CI] 0.72-0.97) ($P < 0.0005$) indicating a good test while for any tear, the $AUC = 0.79$ (95% CI 0.66-0.92) ($P = 0.001$) indicating a fair test.

DISCUSSION

The study shows that the subacromial grind test has a very good accuracy and differentiates well between patients with and without FT tears. The test was well-tolerated by most patients. We found the subacromial grind test to be simple and could be easily incorporated into the shoulder physical

Table 1: Results of subacromial grind test and sensitivity analysis

Tear type	True positive	True negative	False positive	False negative
Any tear	17	19	1	10
FT tear	14	26	4	3
	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Any tear	63	95	94	66
FT tear	82	87	78	90

FT = Full thickness; PPV = Positive predictive value; NPV = Negative predictive value



Figure 1a: Starting position for subacromial grind test



Figure 1b: Shoulder passively moved by examiner to detect crepitus

examination sequence. It relies on an objective sign (crepitus) and therefore, is not affected by patient factors like poor effort and secondary gain. We assessed the test's accuracy against shoulder arthroscopy as the gold standard for diagnosis. The results show that it is mostly useful for detecting FT supraspinatus tears.

Several papers and systematic reviews have investigated the usefulness of clinical examination tests for diagnosis of rotator cuff tears. While external rotation lag sign is a very sensitive and specific test for diagnosis of infraspinatus and teres minor tears, the tests for detecting supraspinatus tears are less useful.^[2,3] The sensitivities and specificities of empty can test (Jobe test) and full can test in the literature is very variable.^[11-13] Several factors could explain this wide variability; the grade of cuff tears, how the test is performed (pain, weakness or both), the reference gold standard (arthroscopy, MRI or ultrasound) and the patient population being studied.

Compared to the subacromial grind test, the Jobe test (with weakness as a response) has 52% sensitivity and 82% specificity for FT tears.^[14] When the Jobe test was compared against MRI scans, sensitivities ranging from 60% to 77% and specificities from 68% to 89% were reported. Considering the pain and/or weakness as a response improves the sensitivity of the test but the specificity drops. The full can test has a largely similar accuracy to the Jobe test.^[12,13] The Codman's drop arm sign has a higher reported specificity than the subacromial grind test, but its sensitivity is much lower.^[14,15]

Impingement tests, like Neer's and Hawkins-Kennedy signs, were also assessed for their usefulness in detecting cuff tears, but their diagnostic accuracy were low.^[11,14,16] A recently described test, the lateral Jobe test, is reported to have high sensitivity and specificity, but it has not been independently assessed and is not widely used.^[17]

Two previous studies assessed trans-deltoid palpation of rotator cuff tears (rent test). Lyons and Tomlinson reported 91% sensitivity and 75% specificity, but they also assessed supraspinatus and infraspinatus muscle strengths and not the rent test in isolation.^[5] Wolf and Agrawal reported a diagnostic accuracy of 96.3% for rent test. The rent test involves direct palpation of the defect in the cuff tendon, which requires experience and could be painful and difficult especially in obese patients with thick fatty layer over the shoulder.^[6]

Our study has limitations. First, our group of patients was preselected for arthroscopy. We do not know if the same sensitivity and specificity will be reproduced in a different group of patients. Every possible measure was taken to avoid bias by blinding the assessors to patients' clinical and radiologic records in addition to the long-time interval between clinic and operation dates. The study population included patients with different shoulder problems in addition to impingement and cuff tears (e.g., instability, superior labral anterior-posterior

tears, acromioclavicular joint osteoarthritis) and therefore, we think it is representative of a shoulder clinic patient population. Second, inter-or intra-observer reliability of the new test is not available as the study included a single assessor. Third, the study is possibly underpowered as three patients who could not tolerate the test were excluded. The subacromial grind test had good but not excellent accuracy in our study (85%). Some studies suggested that other structures also impinge in the Hawkins-Kennedy test position, which could explain why the test did not have higher sensitivity and specificity.^[18,19]

There are other shoulder pathologies, not found in our study population that are associated with crepitus and could result in a false positive test. Advanced glenohumeral arthritis is associated with coarse bony crepitus. Scapulothoracic disorders like bursitis or osteochondroma often present with crepitus but this is usually audible and reproduced by active rather than passive movement.^[20]

Despite the limitations, we conclude that the subacromial grind test is useful as a single test for diagnosis of FT supraspinatus tears. It is simple and easy to perform, requires minimal effort by the patient and can be easily included in the physical examination sequence.

Declaration of Patient Consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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