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Intra- and interexaminer reliability of four manual shoulder maneuvers used to identify subacromial pain

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ABSTRACT

Introduction: Shoulder pain is a diagnostic challenge and the physical clinical examination of the shoulder is crucial. It is important that the diagnostic tests used are valid as well as reliable.

Objective: The objective of the study was to assess intra- and interexaminer reliability for four manual shoulder maneuvers; the Neer impingement sign, the Hawkins-Kennedy impingement test, the Patte maneuver, the Jobe supraspinatus test. These maneuvers are frequently used in clinical practice to examine patients with shoulder complaints in which subacromial pain is highly suspected.

Methods: Thirty-three participants with shoulder pain were included consecutively. Within a week from inclusion, the four maneuvers were performed by a physiotherapist. The procedure was standardized in order to increase reproducibility. After a week, the maneuvers were performed again by the same physical therapist (test-retest) and by another physical therapist (test for interexaminer reliability).

Results: All four maneuvers have an almost perfect agreement (Kappa coefficients 0.91-1.00), if performed with suggested standardizations.

Conclusion: Neer impingement sign, Hawkins-Kennedy impingement test, Patte maneuver as well as Jobe supraspinatus test, are highly reproducible and therefore reliable to use in clinical practice to identify patients with subacromial pain with an impingement phenomenon, but the maneuvers are limited as structural discriminators.

Keywords:

Shoulder impingement syndrome, physical examination, diagnostic tests, reliability

1. INTRODUCTION

Patients with shoulder pain, especially subacromial pain with impingement phenomenon, are commonly seen in clinical practice and present a diagnostic challenge (Van der Windt et al., 1996). The physical clinical examination is crucial and it is important that the diagnostic tests used are valid as well as reliable (Krebs 1987; Fritz & Wainner 2001). Several tests or maneuvers are used in clinical practice to diagnose shoulder patients thought to have a subacromial origin. The theory of several of these is to stress the tissues thought to be involved in the pain-generating mechanism, for example; Neer impingement sign (Neer 1972; Neer 1983), Hawkins-Kennedy impingement test (Hawkins & Kennedy 1980), the Patte maneuver (Leroux et al., 1995) and Jobe supraspinatus test (Jobe & Moynes 1982). Their different ability to produce pain by provoking subacromial structures has been validated in several earlier studies (Sigholm & Styf 1988; Leroux et al., 1995; Çaliş et al., 2000; MacDonald et al., 2000; Valadie et al., 2000; Holtby & Razmjou 2004; Park et al., 2005) and appropriate sensitivity was reported, but less specificity which affects their structural discriminating ability. However, the knowledge about their reliability aspects is limited. Earlier studies have reported an unclear picture for Hawkins impingement test. De Wilde et al. (2003) reported high intra- and interexaminer reliability on shoulders in healthy subjects. Only acceptable interexaminer reliability was reported by Nørregaard et al. (2002) in patients with longstanding shoulder pain. For Neer impingement sign, good interexaminer reliability was reported when patients with hemiplegic shoulder pain were evaluated (Dromerick et al., 2006). No studies were found evaluating the Patte maneuver or Jobe supraspinatus test. The objective of this study was to assess intra- and interexaminer reliability for four manual shoulder maneuvers; Neer impingement sign, Hawkins-Kennedy impingement test, Patte maneuver and Jobe supraspinatus test.

2. METHODS

2.1 Subjects

Patients with shoulder pain, attending primary health care in the Swedish city of Linköping during August 2004 to March 2005, were offered participation. The family physicians and physical therapist (PT) had received information about the study and recruited participants with a probable subacromial impingement syndrome. Those who gave their informed consent to participate were referred to the research PT. Participants were consecutively recruited according to the following inclusion criteria; age 18-50 and duration of symptoms for less than 16 weeks. Those with a known rheumatic- or neurological disease were excluded, as well as those with neck problems or former surgery in the neck- and/or shoulder region. This study was performed after approval of the regional Ethics Committee at the Faculty of Health Sciences, Linköping University, Sweden (no. M177-04).

2.2 Procedure

Within a week from inclusion, each participant was examined by the research PT using the four maneuvers; Neers impingement sign (Neer 1972; Neer 1983), Hawkins-Kennedy impingement test (Hawkins & Kennedy 1980), Patte maneuver (Leroux et al., 1995) and Jobe supraspinatus test (Jobe & Moynes 1982). The testing procedure was standardized in order to increase reproducibility. After a week, the four maneuvers were performed again by the same PT (test-retest) and by another physical therapist (test for interexaminer reliability). Before start of the study, five subjects were pilot-tested in order to standardize the test procedure of the four maneuvers as well as the order; (1) the Neer impingement sign, (2) the Hawkins-Kennedy impingement test, (3) the Patte maneuver and (4) the Jobe supraspinatus test. A detailed description of all tests is presented in the electronic version with matching pictures.

(Http-address?)

The two PTs performing the maneuvers differed in post graduate education. One had a level III-certificate in orthopedic manual therapy (OMT) and 18 years of experience working in the field of musculo-skeletal disorders. The other had five years experience and a level I OMT-certificate.

The participants were not informed about the response noted by the PTs until all maneuvers at the second occasion had been performed. Further, each participant was instructed not to give the research PT any information about their complaint except for the response of each maneuver expressed in terms of reproduction of their shoulder pain or not. A positive response to each maneuver was defined as a reproduction of shoulder pain familiar to the patient as well as the pain localization; around the shoulder and especially in the lateral aspect of the upper arm (the C5 dermatome).

At the second test occasion, the participant rested for one hour in-between the two test sessions; retest for intraexaminer reliability and the test of interexaminer reliability. The PT that performed the test-session first was randomized. Each maneuver was repeated twice to secure a consistent response.

Stability of the current shoulder complaint and pain-levels in between test occasions as well as in-between sessions at the second occasion due to the maneuvers was controlled by using a Visual Analogue Scale (VAS) before start of each test session.

2.3 Statistical analyses

Descriptive statistics was used to present characteristics of participants. For analysis of intra- and inter examiner reliability (two examiners and two category nominal scale) Kappa Statistics were used (Streiner & Norman 1998). All analyses were undertaken using the Statistical Package for the Social Sciences (SPSS, version 10.1 for Windows). The Kappa

coefficients (κ) derived from 2 x 2 contingency tables (SPSS crosstabs). To interpret levels of agreement, κ of >0.81 was considered almost perfect, 0.61-0.80 as substantial, 0.41-0.60 as moderate, 0.21-0.40 as fair and 0.0-0.20 was considered as a slight agreement (Landis & Koch 1977).

3. RESULTS

Thirty-three participants with shoulder pain were included and all completed their participation in the study. The mean age was 32 years old (SD 10) and ranging from 18 to 50. The mean duration of symptoms was 7.5 weeks (SD 4.0), ranging from 2 to 14 weeks. The arm affected was equally distributed between the left and right side among the participants and only four of them reported pain at rest. However, no one reported a VAS above 3.0. In mean, their experienced shoulder disability was 2.2 on VAS (SD 2.0).

There was a perfect agreement between the two test occasions, when the same examiner repeated the maneuvers, intra-examiner reliability. Each and every one of the maneuvers had a κ of 1.0. For inter-examiner reliability, when both PTs examined the same patient independently from each other, there was a perfect agreement for the Neer impingement sign and the Patte maneuver ($\kappa = 1.0$ respectively) and the Hawkins-Kennedy impingement test and the Jobe supraspinatus test had an almost perfect agreement ($\kappa = 0.91$ and 0.94 respectively). These results are based on the figures in table 1 and each test response is plotted in figure 1-8.

None of the maneuvers generated prolonged elevated pain. In case of a positive response to a maneuver, the provoked pain returned to pre-test level within the hour.

Table 1: The number of positive and negative responses for the respective examiner in relation to each maneuver (n=33)

	Examiner A		Examiner A		Examiner B	
	First test occasion		Second test occasion (Re-test)		Second test occasion	
	Pos	Neg	Pos	Neg	Pos	Neg
Neers impingement sign	26	7	26	7	26	7
Hawkins-Kennedy impingement test	25	8	25	8	26	7
Patte maneuver	31	2	31	2	31	2
Jobe supraspinatus test.	15	18	15	18	16	17

Figure 1 Neer impingement sign. Patient (n=33) responses at test-retest.

Figure 2 Neer impingement sign. Patients (n=33) responses from examiner A and B.

Figure 3 Hawkins-Kennedy impingement test. Patient (n=33) responses at test-retest.

Figure 4 Hawkins-Kennedy impingement test. Patients (n=33) responses from examiner A and B.

Figure 5 Patte maneuver. Patient (n=33) responses at test-retest.

Figure 6 Patte maneuver. Patients (n=33) responses from examiner A and B.

Figure 7 Jobe supraspinatus test. Patient (n=33) responses at test-retest.

Figure 8 Jobe supraspinatus test. Patients (n=33) responses from examiner A and B.

4. DISCUSSION

The impingement phenomenon is a clinical syndrome. A pathological process in the subacromial structures is indicated when maneuvers that change the distance between the roof and the floor in the subacromial space and/or demands rotator cuff activation in a position whereas the space is narrowed reproduce pain. The objective of this study was to assess intra- and interexaminer reliability for four of these manual shoulder maneuvers; the Neer impingement sign, the Hawkins-Kennedy impingement test, the Patte maneuver, the Jobe supraspinatus test. All of them had a high level of agreement, both for intra- and interexaminer reliability. To our knowledge, there are only a limited number of reliability studies in the field of diagnosing subacromial pain. De Wilde et al. (2003) reported high levels of intra- and interexaminer reliability (ICC 0.93-0.97) of a modified Hawkins-Kennedy impingement test. Five examiners performed three measurements each on five shoulders in healthy subjects and used a supine position. In the study by Nørregaard et al., (2002), impingement provocations referred to as Neer impingement sign and the Hawkins-Kennedy impingement test were evaluated. The first resulted in poor inter examiner agreement and the later reached moderate interexaminer agreement ($\kappa > 0.4$) when an orthopedic surgeon and a rheumatologist performed the test in consecutive patients with shoulder problems. Dromerick et al. (2006) evaluated the Neer impingement sign, among other tests, assigning patients from an academic inpatient stroke rehabilitation service. They reported good interexaminer reliability ($\kappa = 0.78$) using two examiners who evaluated patients with hemiplegic shoulder pain. These researchers present various conclusions about reliability for some of the maneuvers in focus. Results based upon more or less divergent materials which make comparisons difficult and could explain the variation in levels of agreement.

When interpreting the perfect to almost perfect levels of agreement in the current study, some methodological aspects must be taken into consideration. Only two examiners were included

in this study which limited the source of variation and influenced the levels of agreement. This is partly compensated by the reasonable number of participating patients, but should be accounted for in aspects of extrapolations. Further, the evaluated maneuvers had a dichotomous response, a positive or negative finding. This also has a limitative effect on the possibility of measurement variation and consequently on the levels of agreement, both for intra- and interexaminer reliability. However, a dichotomous response is the reality of how these tests are used in clinical practice. At the second test-occasion, re-test, there was a risk of patients remembering their responses from the first test occasion and a possibility that the patients tried to be helpful when responding. On the contrary, the clinical experience is that these responses are distinctly expressed both verbally and in body language supporting a true test response. Agreement levels could further be biased by the fact that the examiner remembered the test-response from the first test occasion that influenced the interpretation of the second. A pre-selection of participants with suspected subacromial pain were enrolled in this study. This limits the amount of negative responses, but in the actual clinical encounter these maneuvers are chosen especially when subacromial soft tissue involvement is suspected. The results of this study present both negative and positive responses (table 1), but most prevalent are the positive responses for three of four maneuvers. Only Jobe supraspinatus test had a more even distribution (table 1). The patients also reported limited duration of symptoms and no one reported extensive pain or disability. Patients with higher pain ratings or more disabled shoulders, probably due to increased involvement of surrounding tissues, could make the test response more difficult to interpret and thereby increase variability. But since these tests have been reported as highly sensitive (Park et al., 2005), inclusion of patients with more disabled shoulders would probably increase the number of positive test and not diminish reliability. In summary, all these aspects could influence the κ -coefficients (Sim & Wright 2005).

The standardization used (appendix) emphasizes the importance of locking the thoraco-scapular movement. This is crucial in order to provoke the subacromial structures as well as to obtain this high degree of reproducibility. This is supported in the study by De Wilde et al. (2003).

The Jobe supraspinatus test was performed unilaterally, a conscious choice in order to secure a correct performance. Jobe and Moynes (1982) recommended the Jobe supraspinatus test as useful both when examining strength in the supraspinatus muscle and when strengthening it. This test, as well as the Patte maneuver (Lerouxet al., 1995), was in the current study interpreted in relation to pain provocation not only muscle force, which differs from the original description. When these maneuvers are performed by for example the PT in patients with suspected subacromial impingement, no pain or pain combined with varying degree of muscular weakness is the main response. The muscular weakness could be a result of muscular-tendonal changes and/or probably due to neuro-muscular inhibition in the presence of pain (Farina D et al., 2004). Accordingly, pain or no pain as test response seems more relevant, since muscle force is hard to evaluate in the presence of pain.

Intra- and interexaminer reliability is affected of different sources of variation that could influence reproducibility. The examiners experience of the used maneuvers could probably be of importance, but the results in the current study where experience differed indicates that equal experience is not necessary to reach almost perfect intra- and interexaminer reliability. In this study, variation was limited by standardizing the maneuvers. Further the within-subject variation was monitored. The stability of the current shoulder complaint was assessed by VAS for pain at rest as well as VAS for functional disability, before each test occasion. Further, the duration of pain in case of a positive response was monitored by using VAS. The pain always returned to pre-test level before start of the test by the second examiner. Since these factors were stable, the examiner(s) seems to be the main source of variation. All together, these

procedures can often be controlled in the actual clinical encounter to support reliability when using these maneuvers in daily practice.

5 . CONCLUSION

The Neer impingement sign, the Hawkins-Kennedy impingement test, the Patte maneuver as well as the Jobe supraspinatus test, are all highly reliable. In combination with earlier research about their validity, these four maneuvers seem suitable for use in clinical practice to identify patients with subacromial pain with impingement phenomena. However, their ability to discriminate between structures in the area is limited. Their high level of intra- and interexaminer reliability, together with validity aspects, are the clinicians' tool in the diagnostic procedure. A homogenous diagnostic classification is a prerequisite for relevant choice of treatment and necessary when implementing research results into clinical practice.

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APPENDIX

All maneuvers were performed with the patient in a seated position.

The Neer impingement sign

The patient's arm was forward flexed combined with medial rotation in the gleno-humeral joint. The examiner prevented the thoraco-scapular movement fixating the acromion with a depressive force.

The Hawkins-Kennedy impingement test

The patient's arm was positioned in 90° flexion in the gleno-humeral joint as well as in the elbow. Then the gleno-humeral joint was forcibly rotated medially by lowering the forearm while supporting the elbow. The examiner prevented the thoraco-scapular movement fixating the acromion with a depressive force.

Patte maneuver

The patient's arm was positioned in 90° flexion in the gleno-humeral joint with the elbow in 90° flexion and then medially rotated by lowering the forearm. The patient was then instructed to activate lateral rotation against the examiners resistance. The examiner prevented the thoraco-scapular movement fixating the acromion with a depressive force.

Jobe supraspinatus test

The patient's arm was extended and medially rotated and elevated to 90° abduction in the scapular plane (90° abduction and then 30° horizontal adduction). The examiner instructed the patient to maintain position and resist a downward pressure.