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Scientific/Clinical Article

What is the reliability of clinical measurement tests for humeral head position? A systematic review

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ABSTRACT

Study Design: Systematic review.
Introduction: Physiotherapists routinely assess the position of the humeral head (HH) in patients with shoulder pain.
Purpose of the Study: To conduct a systematic review to determine the quality and content of studies that evaluated the reliability of clinical measurement methods for assessing the HH position.
Methods: Five databases and gray literature were searched for studies fitting the eligibility criteria. After abstract and full-text review, the included studies were appraised using the Quality Appraisal of Reliability Studies checklist. Articles were considered of high quality if 8 was achieved on the checklist, and the overall quality of evidence was classified using prespecified criteria. Multiple raters extracted and performed quality ratings; a consensus process was used to finalize the reliability data that were synthesized and presented in a narrative synthesis. Reliability was classified as excellent if the intracorrelation coefficients or intercorrelation coefficients (ICCs) reported exceeded 0.75.
Results: Fifteen studies on the reliability of ultrasound (US) and 3 studies on palpation were included. The methodologic quality was moderate in 17 of 18 studies. The intrarater reliability for all studies was excellent (ICC, 0.76-0.99) with the exception of the 90° abduction in internal rotation position (ICC, 0.48) for palpation. The inter-rater reliability tended to be lower (ICC, 0.48-0.68) for palpation and higher (ICC, 0.66-0.99) for US. Physiotherapists demonstrated excellent intrarater reliability across different levels of training in ultrasonography.
Discussion: Our study found a moderate overall level of evidence to support the use of US for assessing HH position in symptomatic or asymptomatic subjects.
Conclusion: A moderate overall level of evidence exists for the use of US to reliably assess the HH position. Limited research supports the methods used for palpation within a clinical setting.
Level of Evidence: 2a.

Introduction

Shoulder pain and dysfunction are common in occupational and athletic activities as well as in chronic conditions. The Canadian Community Health Survey (2013/2014) by Statistics Canada found that shoulders (23%) were the most common body part affected by repetitive strain injuries.[1] Physical therapists often use palpation in clinical practice to assess the position of the humeral head (HH) as part of an overall shoulder assessment.[2] More recently and less commonly, ultrasound (US) is being introduced into physical or hand therapy practice as a diagnostic tool.

Abnormalities in the position of the HH especially superior and anterior displacement have been associated with shoulder dysfunction, including subacromial impingement,[3,4] subacromial bursitis,[4] and tendinopathy.[5] The precise centering of the HH relative to the acromion or glenoid is influenced by different aspects, including glenohumeral capsuloligamentous stability,[6] tightness,[7-10] scapular position,[11-13] glenoid version angle,[14-16] and rotator cuff muscle recruitment.[17-19] Several studies have demonstrated altered HH kinematics in symptomatic vs non-symptomatic shoulders.[3,20,21]

During their clinical examination, many therapists assess the effect of modifying the position of the scapula or HH on shoulder

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function, symptoms, and/or strength. This positional change alters the acromiohumeral relationship.[11,12] This allows the therapist to design a tailored treatment and exercise program to target the specific dysfunctions of their patient. A clinical and reliable tool is needed to precisely measure this HH position relative to the acromion, especially to assess response to treatment focused on movement retraining and specific muscle strengthening program.

Numerous studies have assessed the reliability of radiologic methods for measuring HH position including a systematic review by McCreesh et al[22] in 2013. Since then, there have been additional studies published reporting the reliability of US to measure HH position. However, no review has yet evaluated the reliability of palpation as a measurement method.

The aim of the study was to conduct a systematic review to determine the quality and content of studies that evaluated the reliability of clinical measurement methods for assessing the HH position.

Methods

We included any study reporting at least 1 type of reliability on measurement of HH, including measurement of the acromiohumeral distance (AHD), acromion-greater tuberosity distance (AGTD), and the anteroposterior HH position during static or dynamic tests. We included published original research studies written or translated in English or French, on humans older than the 12 years, with asymptomatic or symptomatic shoulders; and that provided a thorough description of the methods to measure the HH position. These methods should be applicable in a physical therapy setting.

We excluded unpublished studies, narrative discussions, reviews, or abstract-only articles. We excluded studies where the subjects had known glenohumeral instabilities, neurologic conditions (eg, stroke), a prosthetic shoulder, or if the measurement was taken during surgical interventions or on cadavers. We also excluded studies where an external force was applied to the HH, or that used X-ray, magnetic resonance imaging, 3-dimensional electromagnetic analysis, or fluoroscopy as a primary assessment tool.

We conducted a comprehensive search of the literature using PubMed, EMBASE, SCOPUS, CINAHL, and Cochrane review databases from inception to January 25, 2016. We used a building blocks search strategy for all databases.[23] The final search terms and strategy were as follows:

(positioning OR position OR translation OR static OR dynamic) AND (subacromial OR humeral OR “humeral head” OR humerus OR glenohumeral OR acromiohumeral) AND (evaluation OR evaluations OR rating OR test OR tests OR examination OR examinations OR assessment OR assessments OR measurements OR measurement OR diagnosis OR diagnostic OR clinical OR palpation) AND (reproducibility of results OR reliability OR reliable OR validity OR precision OR accuracy OR “measurement property” OR “measurement properties”).

We reviewed the reference list of each relevant article to identify any potential additional references as well as the personal files of one of the authors who is considered a physical therapy shoulder expert.

Two examiners (CG and CK) used a double-staged process for the study selection, using an inclusion and exclusion criteria checklist, which all 4 authors had agreed on. Initial screening of articles by title and abstract and full-text review were performed independently. If disagreements to include or exclude specific articles occurred, both parties discussed until a consensus was reached. A third examiner (JS) was available for consultation in cases of ongoing disagreement.

We assessed agreement of our final study selection using the unweighted kappa statistic.

Two authors (CG and CK) carried out the data extraction. We resolved disagreements by discussion, and missing data were recorded for further questions to the authors. We contacted authors for missing information after the quality appraisal was completed to avoid biasing the process.

We assessed the methodologic quality of the included studies using the Quality Appraisal of Reliability Studies (QAREL) checklist.[24] Based on the recommendations by Lucas et al,[24] all 4 authors assessed a single study independently and discussed the method of rating each item on the checklist as a calibration exercise. Once a thorough understanding of the rating tool and calibration issues was established, 2 examiners (LD and LR) independently evaluated all selected studies using the 11-item checklist. After they completed the scores, they compared results, and if disagreements were found, they discussed until a consensus was reached. A third party consultant (JS) was available in situations of ongoing disagreement. QAREL checklist items are listed in Box 1.

We rated the methodologic quality of each study according to the number of items checked *yes*: high quality for 8-11, moderate quality for 5-7, and low quality for 4 or less. Item 2 was checked as *yes* if the study described the raters’ profession or supplied information on specific training or their skill in the use of US or palpation. Items 5 and 6 were not applicable as there was no accepted reference standard for the HH position measurement and because knowledge of any background patient information would not affect the reliability of the HH measurement, respectively. Item 8 was marked as *yes* if there was some form of randomization performed. Articles, which supplied appropriate measures of agreement, ICC, and uncertainty, standard error of measurement (SEM), or confidence intervals (CIs), were checked as *yes* for item 11.

Reliability estimates of each study were categorized using the Fleiss scale.[25] Reliability was considered excellent if the intracorrelation coefficient or intercorrelation coefficient (ICC) was above 0.75, fair to good if the ICC was between 0.40 and 0.75, and poor if the ICC was below 0.4.

One of the authors (JMD) with experience in creation of critical appraisal evaluations modified the Cochrane Back Pain Group

Box 1: QAREL checklist

1. Was the test evaluated in a sample of subjects who were representative of those to whom the authors intended the results to be applied?
2. Was the test performed by raters who were representative of those to whom the authors intended the results to be applied?
3. Were raters blinded to the findings of other raters during the study?
4. Were raters blinded to their own prior findings of the test under evaluation?
5. Were raters blinded to the results of the reference standard for the target disorder?
6. Were raters blinded to clinical information that was not intended to be provided as part of the testing procedure or study design?
7. Were raters blinded to additional cues that were not part of the test?
8. Was the order of examination varied?
9. Was the time interval between repeated measurements compatible with the stability (or theoretical stability) of the variable being measured?
10. Was the test applied correctly and interpreted appropriately?
11. Were appropriate statistical measures of agreement used?