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Inter-rater reliability of shoulder measurements in middle-aged women

A. De Groef[a,b,*], M. Van Kampen[a,b], N. Vervloesem[a,b], E. Clabau[a,b], M-R. Christiaens[c,d], P. Neven[c,e], I. Geraerts[a,b], F. Struyf[f], N. Devoogdt[a,b]

[a] *Department of Rehabilitation Sciences, KU Leuven – University of Leuven, Leuven, Belgium*
[b] *Department of Physical Medicine and Rehabilitation, University Hospitals Leuven, Leuven, Belgium*
[c] *Multidisciplinary Breast Centre, University Hospitals Leuven, Leuven, Belgium*
[d] *Department of Surgical Oncology, KU Leuven – University of Leuven, Leuven, Belgium*
[e] *Department of Obstetrics and Gynaecology, University Hospitals Leuven, Leuven, Belgium*
[f] *Department of Rehabilitation Sciences and Physiotherapy, University of Antwerp, Antwerp, Belgium*

Abstract

Objectives To investigate inter-rater reliability of a set of shoulder measurements including inclinometry [shoulder range of motion (ROM)], acromion–table distance and pectoralis minor muscle length (static scapular positioning), upward rotation with two inclinometers (scapular kinematics) and pain pressure thresholds (muscle tenderness) in middle-aged women.

Design Observational study.

Participants Thirty symptom-free middle-aged women (first cohort) were measured by two raters. All measurements with an intraclass correlation coefficient (ICC) below 0.75 were retested after an additional training period in a second cohort of 30 symptom-free middle-aged women.

Main outcome measures Inter-rater reliability of all variables was measured with the ICC (95% confidence interval) and standard error of measurement (SEM).

Results Acromion–table distance (ICC = 0.91, SEM 0.22 to 0.28% of body length), pectoralis minor muscle length (ICC = 0.91, SEM 0.16% of body length), pain pressure thresholds (ICC = 0.78 to 0.85, SEM 0.39 to 0.70 kg) and abduction ROM (ICC = 0.77, SEM 5°) showed good to excellent inter-rater reliability in the first cohort. After an additional training period, forward flexion ROM showed good inter-rater reliability (ICC = 0.83, SEM 5°), scapular upward rotation in resting position showed moderate reliability (ICC = 0.52, SEM 2°), and other scaption angles showed weak reliability (ICC = 0.26 to 0.43, SEM 3 to 8°).

Conclusions In a battery of clinical tools to evaluate factors contributing to shoulder pain, static scapular positioning and pressure pain thresholds were found to have good to excellent inter-rater reliability in middle-aged women. Additional training is recommended for measurements with a gravity inclinometer.

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Keywords: Inter-rater reliability; Inclinometry; Algometry; Static scapular positioning

Introduction

Depending on a person's age, sex and activity level, prevalence rates of shoulder problems vary between 7% and 67% [1]. Shoulder pain is a common musculoskeletal problem influenced by several factors. The most common factors contributing to the emergence or maintenance of shoulder pain are impaired shoulder mobility, altered static posture, and

* Corresponding author. Address: Department of Physical Medicine and Rehabilitation, University Hospitals Leuven, Herestraat 49, 3000 Leuven, Belgium. Tel.: +32 16 342171.
E-mail address: an.degroef@faber.kuleuven.be (A. De Groef).

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altered scapular kinematics and muscle recruitment patterns [2–5]. In addition, muscle tenderness and myofascial trigger points have been suggested as sources of shoulder pain [6,7]. However, at present, there is no consensus on the definitive relationship between these factors and painful shoulder pathologies, such as subacromial impingement syndrome [3].

During clinical examination, possible contributing factors to pain should be evaluated. In addition to visual evaluation and clinical tests, clinical measurement tools can be used, and these should be valid, reliable and easy to use. For the evaluation of static posture, several tools have been found to have good to excellent reliability [8,9]. In clinical practice, shoulder protraction can be evaluated by measuring the distance of the posterior border of the acromion to the table with a sliding caliper. A sliding caliper can also be used to measure pectoralis minor muscle length, which correlates to the acromion–table distance [8,10–12]. An inclinometer is recommended for the evaluation of shoulder mobility, as this can be applied with one hand [13]. For dynamic evaluation of the scapula, the lateral scapular slide test is less suitable and reliable than the measurement of scapular upward rotation using two inclinometers [14,15]. For the evaluation of muscle tenderness and myofascial trigger points, the pressure pain threshold (PPT) can be measured by an algometer [16]. An overview of the reliability of these clinical tools [intraclass correlation coefficient (ICC) and standard error of measurement (SEM)], characteristics of the study population and average values are given in Table 1.

Reliability has mainly been tested in symptomatic cohorts of middle-aged men and women [10,17–22]. The asymptomatic cohorts were all of a younger age, and differentiation was only made between men and women in one study [16]. However, middle-aged women are most likely to consult a general practitioner because of shoulder complaints [23]. Additionally, it is well known that total and regional fat increases with age [24], and is greater in menopausal women [25,26]. This feature may compromise palpation for bony landmarks, and therefore the accuracy of static and dynamic evaluation of the scapula. It may also complicate muscle palpation when evaluating pressure pain thresholds. To the authors' knowledge, no previous studies have investigated the reliability of a set of clinical tools to evaluate factors contributing to shoulder pain in a cohort of middle-aged women. Also, most previous studies have only investigated intrarater reliability [15,16,19,22,27]. No previous studies have investigated the reliability of a set of clinical tools in a single population. A set of tests is needed to capture the factors contributing to shoulder pain. Finally, previous studies have not determined if certain tools need a learning period before they can be applied reliably in clinical practice.

As such, the aim of this study was to test inter-rater reliability of a set of clinical assessment tools for several factors contributing to shoulder pain that are easy to use in clinical practice. This set of clinical tools consists of static scapular positioning (acromion–table distance and pectoralis minor muscle length), shoulder mobility (inclinometry), dynamic scapular evaluation (scapular upward rotation with two inclinometers) and PPTs (algometry).

Methods

The Guidelines for Reporting Reliability and Agreement Studies (GRASS) were used as a basis to report this reliability study [28]. This study was approved by the Ethical Committee of the University Hospitals Leuven (Ref. No. s54579).

Subjects

Two convenience samples of asymptomatic middle-aged women (40 to 60 years) with no history of shoulder pathologies were recruited from the Department of Physical Medicine, University Hospital of Leuven and through the families and friends of the investigators. Women had to score 0 on the visual analogue scale for shoulder pain over the past 3 months. The first cohort of 30 women was measured between December 2012 and July 2013. In order to evaluate the need for a learning period, all measurements with ICC below 0.75 were retested after an additional training period of 3 months. This second cohort consisted of 30 different women, and measurements were taken between September and December 2013.

Procedure

Measurements were taken independently by two raters, one of whom had a Masters in Physical Therapy and Rehabilitation, and the other had 1 year of clinical experience in musculoskeletal rehabilitation. Prior to the study, they underwent two types of training. First, a 4-hour training session was held for accuracy of measurements, and second, training was performed on 20 healthy subjects. Between the first and second cohort, both raters were active in clinical practice; an additional 2-hour training session was implemented, and retraining was performed on 20 healthy subjects.

Both shoulders of all women were measured within a single testing session. The order of testing (right or left shoulder and the choice of rater) was chosen at random. Both raters were blinded to the results of each other's measurements as measurements were conducted in separate rooms. The rater was alone in the room to avoid a Hawthorne effect (i.e. where individuals modify or improve an aspect of their behaviour in response to their awareness of being observed) [29].

Static scapular positioning (Fig. 1)

Static scapular positioning was evaluated using acromion–table distance and pectoralis minor muscle length. For acromion–table distance, the subject was in a supine position and was asked to adopt a natural relaxed position. The distance between the most posterior border of the acromion and the table was measured with a sliding

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