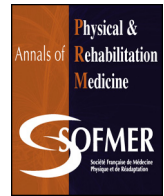




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Original article

Role of pain in measuring shoulder strength abduction and flexion with the Constant–Murley score

Cyrille Burrus^{a,b,*}, Olivier Deriaz^b, François Luthi^{a,b}, Michel Konzelmann^a

^a Department of Musculoskeletal Rehabilitation, Clinique romande de réadaptation Suvacare, 1950 Sion, Switzerland

^b Institut de recherche en réadaptation-réinsertion, 1950 Sion, Switzerland

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ABSTRACT

Objectives: The Constant–Murley score (CS) has been used for more than 25 years to assess shoulder function. Strength by itself accounts for 25% of the total score. The measurement at 90° abduction seems to be sometimes limited by pain, particularly with tendinopathy or subacromial impingement. We compared the assessment of isometric strength in anterior forward flexion and abduction and its effect on pain and total CS.

Methods: Strength was assessed by CS at both 90° forward flexion and abduction in the scapular plane by using an Isobex dynamometer, the first position tested being randomized. Pain was assessed on a 100-mm visual analog scale (VAS) and total CS was assessed.

Results: We included 54 patients with unilateral shoulder problems; 50% had rotator cuff injury. Mean strength on the affected side was 4.7 ± 2.5 kg in forward flexion and 4.6 ± 2.8 kg in abduction. Induced pain and total CS did not differ between the 2 positions tested.

Conclusions: Strength can be measured by the CS in forward flexion or abduction, because the measurement does not affect strength, pain intensity or total score. The choice of direction for measurement should be based on the underlying pathology, related contraindications and patient preference.

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1. Introduction

The Constant–Murley score (CS) has been used for more than 25 years to measure the function of the shoulder [1]. The score is divided into 2 parts: a subjective part assessing pain and activities of daily living, and a second part measuring strength and mobility of the shoulder. Strength by itself accounts for 25% of the total score.

The original method for evaluating strength was described by Moseley [2], who used an unsecured cable tensiometer or a spring balance in both 90° forward flexion and 90° abduction in the coronal plane. The use of a dynamometer was proposed by Gerber [3], with well-defined methodology [4], and normalized scores have been published [5–7]. Strength is assessed by measuring the maximal isometric strength at 90° abduction. Abduction was

chosen because it was thought that the supraspinatus and deltoid (middle fasciculus) muscles were responsible for the greatest part of the shoulder power [2].

For a long time, whether the score should be assessed in the scapular or coronal plane was not specified. Bankes et al. proposed a standardized method in 1998 [4], but until recently, we had no precise description of the exact position to measure strength, which should be recorded at 90° abduction in the scapular plane, with the strap linked to the device and placed at the level of a pronated wrist [8].

The CS is routinely used in our hospital to assess shoulder function and helps determine improvement. The measurement at 90° abduction appears to be sometimes limited by pain, particularly with tendinopathy or subacromial impingement. Moreover, abduction is not the most common movement in everyday life as compared with forward flexion, which seems more functional. This latter position may induce less pain and is a usual movement in some early rehabilitation protocols [9].

Here we aimed to evaluate a modified CS by assessing isometric strength at 90° forward flexion (in the sagittal plane) and the usual measure at 90° abduction in the scapular plane. We aimed to assess

* Corresponding author at: Clinique romande de réadaptation Suvacare, CH-1950 Sion, Switzerland.

E-mail addresses: cyrille.burrus@crr-suva.ch (C. Burrus), olivier.deriaz@netplus.ch (O. Deriaz), francois.luthi@crr-suva.ch (F. Luthi), michel.konzelmann@crr-suva.ch (M. Konzelmann).

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whether strength in forward flexion induces less pain and if so, whether the measurement results in higher CS values and reliability than those measured in abduction in the scapular plane.

2. Material and methods

2.1. Context

The study took place between August 2008 and November 2009 at the “Clinique romande de réadaptation Suvacare” belonging to the Swiss accident insurance fund (SUVA), the main injury insurance fund in Switzerland. Patients are sent to our rehabilitation hospital when they exhibit persistent pain and functional limitations (median 9 months after an accident). The aim of the therapeutic program is care by a multidisciplinary approach (somatic and psychological) to improve quality of life, functional status and the chance to return to work. Most of our patients are blue collar workers and come to our clinic after work accidents or traffic accidents. At the end of the hospitalization (median duration 29 days), a program is defined to plan a return to the workplace, which may sometimes be adapted to the disability. If necessary, other care strategies (e.g., new surgery) are decided. If disabilities appear to limit a return to work, the goal of hospitalization is to determine functional limitations and engage vocational rehabilitation.

2.2. Population

Any patient 18–65 years old who was referred to our hospital for a shoulder problem was eligible for the study. Exclusion criteria were bilateral shoulder problems, associated elbow or wrist injury, central or peripheral neurological injury limiting the measurement of strength, unable to understand visual pain evaluation, somatoform disorder, and <3-month-old rotator cuff repair. Patients signed an informed consent form before entering the study. The protocol was approved by the ethics committee of the Canton of Valais local medical association (CCVEM No. 009/08).

2.3. Outcomes

The main outcome criteria were the CS and strength measurements. Secondary outcomes were pain before and after each measurement of strength, assessed by a 100-mm visual analog scale (VAS). Sociodemographic data were obtained at admission. At that time, patients completed the Disabilities of the Arm Shoulder and Hand (DASH) questionnaire in their native language [10], which was used as a measure of self-rated upper-extremity disability and symptoms.

2.4. Intervention

The CS was measured during the hospital stay. Pain was assessed by the mean score of the sum of the verbal scale evaluation followed by a VAS evaluation, with a maximum of 15 points. Activities of daily living were assessed by a 5-point Likert scale (from 0 to 4) asking patients how much they were limited by their shoulder problem at work or during activities of daily living; the total score was 20 points. The same scale was used for evaluating leisure or sports limitations. The presence of pain at night was assessed on a 3-point scale (0 to 2), and the ability to functionally use the arm up to a given level was assessed on a 0 to 10 scale.

Movement was assessed by measuring pain-free, active forward flexion, abduction in the scapula plane, and functional external and internal rotation; the total score was 40 points.

Strength was measured with use of an Isobex dynamometer (CURSOR AG, Bern, Switzerland) with the patient in a seated position, both in forward flexion and in abduction in the scapular plane, elbow in extension, forearm in pronation, with the device placed at the wrist. Patients were asked to give their maximal effort, without further encouragement. They were seated on the corner of a therapy table with the dynamometer placed on the floor, with a vertical vector, and the hand of the untested arm resting on the omolateral knee. The sequence of the measurement in forward flexion or abduction in the scapular plane was randomly determined. Strength was measured on both sides, first the healthy side, then the affected side. It was measured sequentially for each position (e.g., 2 measures in forward flexion followed by 2 measures in abduction) and the score was calculated following recommendations of the French version of the test [11]. Results of strength are in kilograms (kg).

We controlled intra- and inter-observer reliability of the measurements for 24 patients who were assessed twice (with an interval of 1–3 days) by the same 3 physiotherapists who conducted the study.

2.5. Statistical methods

Unless specified, results are presented as mean \pm SD. Data not normally distributed are presented as median with interquartile range (IQR). Paired *t* test was used to compare measurements in abduction and forward flexion for normally distributed data and Wilcoxon signed-rank test for nonparametric data. The intraclass correlation coefficient (ICC) was calculated to assess reliability. ICC > 0.91 was considered very good and 0.71–0.9 good [12]. Agreement was assessed by the Bland–Altman method. We used Systat 13 for Windows (Cranes Software International, Bangalore, India, 2009) for analysis. Bland Altman plots were created with MedCalc for Windows, v14.12.0 (MedCalc Software, Ostend, Belgium). *P* < 0.05 was considered statistically significant.

3. Results

In total, 130 patients were eligible. After exclusions (Fig. 1), 54 patients had followed the correct protocol (measurements, randomization, etc.).

Except for the DASH score, which was available for 41 patients, other variables of interest were available for all 54 subjects tested. The mean age was 44 ± 10 years, with 91% males, who were blue collar workers. Median interval time from trauma was 309 days (IQR 91–2749). Half of the patients had a rotator cuff injury (24% underwent surgery and 26% not), 19% proximal humerus fracture, 9% adhesive capsulitis, 9% shoulder instability and 7% degenerative disease. Mean DASH score was $43 \pm 21\%$ for the 41 patients with data.

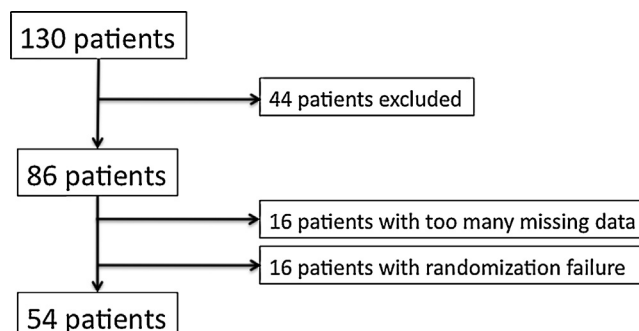


Fig. 1. Flow of patients in the trial.

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