Comparison of the responsiveness of the Brazilian version of the Western Ontario Rotator Cuff Index (WORC) with DASH, UCLA and SF-36 in patients with rotator cuff disorders

A. Diniz Lopes[1], R.M. Ciconelli[2], E.F. Carrera[1], S. Griffin[3], F. Faloppa[1], F. Baldy dos Reis[1]

[1]Department of Orthopedics and Traumatology, and [2]Rheumatology Division, Department of Medicine, Universidade Federal de São Paulo, São Paulo, Brazil; [3]Fowler Kennedy Sport Medicine Clinic, 3M Center, University of Western Ontario, London, Ontario, Canada.

Abstract

Objective

To investigate the responsiveness of the Brazilian version of the Western Ontario Rotator Cuff Index (WORC) and compare it with the Disabilities of Arm, Shoulder and Hand questionnaire (DASH), the University of California Los Angeles Shoulder Rating Scale (UCLA), and the Short-Form 36 questionnaire (SF-36) in patients with rotator cuff disorders.

Methods

The four questionnaires were administered to 30 patients at baseline and 3 months after treatment (physiotherapy or surgery). The patients were divided into two groups: those who improved after treatment (n=20) and those who did not (n=10) based on an anchor-based strategy to distinguish between the two groups and assess responsiveness. The t-test, the t-value of the paired t-test, the effect size (ES), and the standardized response mean (SRM) were calculated.

Results

All four questionnaires registered statistically significant changes ($p<0.05$) in the "improved" group between baseline and 3 months after treatment, and no changes in patients who did not improve. All four instruments showed higher ES and SRM values for the patients who improved than those who did not. WORC registered moderate to high ES and SRM values for the "improved" group, as did the UCLA and DASH. The ES and SRM values measured by the SF-36 ranged from small to large, the physical subscales being more responsive than the other subscales.

Conclusion

The Brazilian version of the WORC (like UCLA, DASH and SF-36 physical subscales) proved responsive to change and suitable for use in the short-term follow-up of patients after rotator cuff interventions.

Key words

Rotator cuff, questionnaires, quality of life, outcome measures.

Andréa Diniz Lopes, PT, MS
Rozana Mesquita Ciconelli, MD, PhD
Eduardo F. Carrera, MD, PhD
Sharon Griffin, CSS
Flávio Faloppa, MD, PhD
Fernando Baldy dos Reis, MD, PhD

Please address correspondence to:
Andréa Diniz Lopes, PT, MS,
Department of Orthopedics and Traumatology,
Universidade Federal de São Paulo.
Rua Borges Lagoa 783, 5o andar,
Vila Clementino, São Paulo,
SP 04038-031, Brazil.
E-mail: adinizlopes@uol.com.br

Received on December 4, 2008; accepted in revised form on March 12, 2009.

© Copyright CLINICAL AND EXPERIMENTAL RHEUMATOLOGY 2009.

Permission to reproduce the WORC is routinely granted by the authors to individuals and organizations for their own use. Requests for permission to reproduce the WORC should be sent to: Sharon Griffin, Coordinator, Fowler Kennedy Sport Medicine Clinic, 3M Centre, University of Western Ontario, London, Ontario, Canada N6A 3K7. E-mail: stdshg@uwo.ca

Competing interests: none declared.

Introduction

The literature supports the use of questionnaires for monitoring the health status of patients with shoulder conditions, as well for measuring outcome following treatment (1-5). Responsiveness is the ability of an outcome measure to detect changes in patient status when it has occurred (5). A responsive clinical outcome measure will reflect improvement as a patient's condition improves and deterioration as the patient's condition worsens (4, 6, 7).

As validation is an evolving property and an ongoing process, it is important for the performance of a measure to be assessed in different patient populations with similar attributes of interest (8). It has been shown that psychometric properties including responsiveness depend on the setting and the population in which they are assessed (4, 6, 7). Standard questionnaire validation methodologies have been applied in a number of countries to ensure that the new versions are equivalent to the original questionnaire, thereby facilitating the exchange of information within the international scientific community (9, 10). The availability of such validation studies in the literature is important as it allows clinicians and researchers to assess the content and quality of questionnaires and enables them to choose the most appropriate measures for different purposes (4, 9-11).

The Western Ontario Rotator Cuff Index (WORC) is a disease-specific, health-related quality of life (HRQOL) questionnaire for patients with rotator cuff conditions, originally developed in English by Kirkley *et al*., that has been proven to be reliable and valid for such patients (1, 12-15). Other versions of the WORC have been developed and validated, including the German and Turkish ones (16, 17). The WORC has also been translated and culturally adapted in Brazilian Portuguese (14), and its reliability and validity have been demonstrated (9). This last study found strong correlations between WORC and the Disabilities of Arm, Shoulder and Hand Questionnaire (DASH), the physical components of the Short-Form 36 questionnaire (SF-36), and the University of California Los Angeles Shoulder Rating Scale (UCLA) (9). The next step was to determine the responsiveness of these questionnaires in the same Brazilian population.

The aim of the present study, therefore, is to investigate the responsiveness of the Brazilian version of the WORC and to compare it with the responsiveness of the DASH, UCLA and SF-36 questionnaires in patients with rotator cuff disorders.

Materials and methods

Patients

The patients included in this study had participated in the validation study for the Brazilian Portuguese version of the WORC (9). The total sample in the validation study comprised 100 male and female patients with rotator cuff disorders (tendinopathy or rotator cuff tear) who were over 18 years of age and whose primary language was Brazilian Portuguese. They were recruited from the Physiotherapy Unit and Orthopaedics Outpatient Clinic of the Universidade Federal de São Paulo between February and December 2006.

The patients included in the present responsiveness study were those who were attending their initial clinic visit (n = 40). The final sample for the analysis of responsiveness included a total of 30 patients who completed the WORC at baseline (T0) and at the 3-month follow-up (T1). Ten patients were excluded because they did not undergo treatment (physiotherapy or surgery) within the study's follow-up period.

Diagnoses were confirmed by the appropriate and available radiological evaluations (ultrasound and/or magnetic resonance imaging). Data was recorded in the medical registry for assessment and inclusion in the present study. Patients with cognitive, neurological or rheumatic disorders or with other shoulder conditions were excluded.

The WORC was administered twice: at baseline and 3 months after the recommended treatment (physiotherapy or surgery). The DASH, SF-36 and UCLA were also administered at baseline and during follow-up (18-20). Moreover, clinically relevant outcomes of interest in patients with shoulder disorders were included in the study protocol: pain at night, pain at rest, and pain

during movement scored on visual analog scales (VAS); active range of motion (forward flexion, external rotation, and hand behind back); and strength (1-3, 21-24).

Active range of motion was measured in standard positions using a universal goniometer, as described elsewhere (23). Forward flexion was measured in the standing position, whereas external rotation was assessed in the sitting position, with the elbow bent at 90º and the arm at the patient's side. Internal rotation was also assessed in the sitting position with the patient's arm at his side and his hand behind his back. This measure was assessed by the extended thumb position at the height of the spinous process (24). Manual muscle tests were used to assess strength, graded from 0 (absent muscle contraction) to 5 (normal muscle force) for the movements of forward flexion, external rotation and internal rotation in the sitting position (23).

Western Ontario Rotator Cuff Index

The WORC is a self-reporting questionnaire with 21 items concerning five life and health domains (Physical Symptoms, Sports/Recreation, Work, Lifestyle, Emotions) (12). All items have the same weight and each has a possible score of 0 to 100 (100 mm VAS). Each domain can be scored separately and the total score can range from 0 to 2100. To make the scoring more understandable, the authors of the original version of the WORC recommend that the data be converted to a percentage score by inverting the raw score and converting it to a score out of 100. A score of 0% then becomes the worst possible score and 100% implies no reduction in HRQOL (9, 12, 14).

UCLA shoulder rating scale

The UCLA system is a 35-point scale with 10 points for pain, 10 points for function and 5 points each for motion, strength and patient satisfaction. The maximum score of 35 represents an optimal result (9, 15, 20).

DASH disabilities questionnaire

The DASH is a regional questionnaire developed to measure physical disability and symptoms in the upper limbs. It consists of 30 questions that assess physical function and symptoms, including 21 items relating to physical function, 6 items relating to symptoms, and 3 items that assess social functions. The score is calculated by applying established formulas and ranges from 0 (best) to 100 (worst) (8, 18).

Short Form-36

The Short Form-36 (SF-36) is a generic HRQOL questionnaire that evaluates eight domains: physical functioning, role limitations due to physical health, role limitations due to emotional health, bodily pain, vitality, social functioning, general health and mental health. The score for each domain ranges from 0 to 100, with lower scores reflecting greater degrees of disability. From these eight dimensions two summary scales – one for physical and one for mental health – are computed (9, 19, 25).

Responsiveness

Responsiveness refers to the ability of an instrument to detect change over time when it occurs (4, 26-28). A responsive measure distinguishes patients or groups of patients whose condition clinically improves, deteriorates or remains stable. To assess responsiveness, a criterion is needed to identify whether a patient's condition has changed over time (26, 28-30). In this study, the first step was to establish two groups of patients, one group who experienced improvement and another group who did not improve (i.e., worsened or remained stable) over 3 months of follow-up. Thus, an anchor-based approach was used to assess responsiveness (27). The selected anchors were a combination of clinical and patient-based outcomes. Since it is highly recommended to use multiple independent anchors, a total of 15 were chosen (28). These included working status; visual analog scales for pain at rest, during movement and at night; active range of motion for forward flexion, external rotation and internal rotation (hand behind back); strength of forward flexion, external rotation and internal rotation; the DASH, UCLA and SF-36 physical health and mental health summary scores; and global range of change.

A threshold was created to indicate whether an individual had improved or not, taking into consideration the 15 anchors (26, 27). The change in score between baseline and the 3-month follow-up was calculated by subtracting the baseline score from the 3-month follow-up score for each of the anchors, reflecting "improvement" or "non-improvement". A total score of 8 out of 15 was used as the threshold and to divide the patients into the two subgroups: Group 1 with "improvement" (n=20) and Group 2 with "non-improvement" (n=10).

Ethical considerations

The study protocol was approved by the University Research Ethics Com-

Table I. Baseline characteristics of the patient population, consisting of Brazilian patients with rotator cuff disorders.

Characteristics		n=30
Age (years), mean (SD)	55.07 (10.83)	
range	27-74	
	no.	%
Gender (F/M)	24/6	80/20
Treatment		
Physiotherapy	21	70
Subacromial decompression	1	3.33
Rotator cuff repair	8	26.67
Diagnosis		
Tendinopathy	14	46.66
Partial thickness rotator cuff tear	8	26.67
Full-thickness rotator cuff tear	8	26.67

SD: standard deviation.

mittee and information was collected after obtaining written informed consent from the subjects.

Statistical analysis

Descriptive statistics were compiled for the baseline characteristics of the study population. Responsiveness was evaluated using four statistical analyses: the *t*-test, the t-value of the paired *t*-test, effect size (ES), and the standardized response mean (SRM) for the two subgroups. For the statistical analysis, the level of significance was set at 5%.

The *t*-test is used to determine whether the difference in the outcome means of study groups is statistically significant (between-group comparisons). The t-value of the paired *t*-test is used to analyze data originating from a one-group repeated-measures design and concludes whether or not there is a statistically significant change in the measures over time (within-group comparisons). Here the t-value of the paired *t*-test was used to compare each group between T0 (baseline) and T1 (3-month follow-up) (31).

The ES is a standardized measure of change obtained by dividing the average change between initial and follow-up measurements (mean baseline to endpoint change) by the standard deviation (SD) of the initial measurement (at baseline) (28, 31). In the present study, the ES was calculated by dividing the mean change between T0 and T1 by the SD of T0.

$$ES = \frac{\text{Mean T0} - \text{Mean T1}}{\text{SD (T0)}}$$

For ES, the guidelines provided by Cohen for the interpretation of the magnitude – *i.e.* trivial (ES <0.2), small (ES ≥0.2 <0.5), moderate (ES ≥0.5 <0.8) or large (≥0.8) – were adopted (32). A responsive measure would require at least a small ES (0.2) in patients deemed to have improved, and would be larger than in the group who did not improve (27).

The SRM represents the mean change in scores divided by the SD of the subjects' difference scores (27, 31). Therefore, in this study the SRM was calculated by dividing the average change between T0 and T1 by the SD of the differences in score between T0 and T1.

Table II. Distribution of clinical characteristics in the patient cohort.

Characteristics (variation)	n=30		
	Mean (SD)		*p*-value
	T0	T1	
Active range of motion			
Forward flexion (0-180º)	112.53 (34.11)	115.4 (39.09)	0.626
External rotation (0-90º)	56.13 (17.43)	58.83 (19.88)	0.244
Hand behind back: T2- greater trochanter (2 to 20)	11.3 (3.85)	10.67 (3.48)	0.264
Strength (0-5)			
Forward flexion	3.53 (0.82)	3.9 (0.84)	0.005*
External rotation	4.2 (0.96)	4.3 (0.79)	0.448
Internal rotation	4.53 (0.68)	4.6 (0.56)	0.489
Pain VAS (0-100 mm)			
At rest	52.17 (33.09)	30.23 (34.04)	0.000¶
During movement	76.43 (22.82)	49.53 (33.01)	0.000¶
At night	66.47 (32.37)	51.07 (34.82)	0.018*

* $p<0.05$; ¶ $p<0.001$; T0: at baseline; T1: at 3-month follow-up.

Table III. Questionnaire scores at baseline (between-group comparisons).

Questionnaires	T0		
	Mean (SD)		*p*-value
	Group 1 n=20	Group 2 n=10	
Total WORC	29.1 (22.18)	19.72 (13.17)	0.159
Physical symptoms	35.08 (26.3)	29.37 (23.33)	0.551
Sports/recreation	23.7 (20.04)	16.37 (12.39)	0.229
Work	22.84 (18.05)	11.3 (7.68)	0.021*
Lifestyle	33.44 (30.24)	20.12 (11.6)	0.095
Emotions	26.88 (30.56)	15.57 (19.73)	0.232
DASH	55.25 (22.61)	58.67 (14.95)	0.626
UCLA	15.05 (6.19)	16.6 (6.02)	0.523
SF-36			
Physical functioning	53 (26.33)	43 (19.03)	0.247
Physical role	37.25 (33.33)	39.5 (30.07)	0.854
Bodily pain	36.3 (19.97)	38.6 (19.02)	0.762
General health	57.2 (25.67)	60.7 (19.82)	0.684
Vitality	49.55 (26.46)	53 (27.79)	0.749
Social functioning	67.75 (33.65)	72.7 (37.12)	0.727
Emotional role	62.15 (38.41)	55.1 (32.38)	0.603
Mental health	52.55 (25.81)	50.2 (22.67)	0.801
Physical health*	36.66 (7.39)	35.58 (9.07)	0.898
Mental health*	42.94 (11.76)	47.57 (13.68)	0.873

Group 1: improved; Group 2: not improved; T0: at baseline; T1: 3-month follow-up; *$p<0.05$.

$$SRM = \frac{\text{Mean T0} - \text{Mean T1}}{\text{SD (T0-T1)}}$$

The magnitude of the SRM was interpreted as trivial, small, moderate or large, depending on the derived values (31, 33).

Responsiveness statistics for the WORC were then compared with those for the three other questionnaires examined in this study: DASH, UCLA and SF-36. These additional responsiveness statistics were used to help anchor the amount of change detected on the WORC relative to these commonly used indicators (27).

Results

The baseline and clinical characteristics of the study population are shown

in Tables I and II. The mean age of the patients was 55.07 years (SD 10.83; range 27–74 years). A higher frequency of rotator cuff disorders was found in females (80%) with a diagnosis of tendinopathy (46.66%). Most of the patients (70%) were treated with physiotherapy.

Baseline scores (T0) on the questionnaires were not significantly different between patients classified as "improved" and "not improved" (Table III). However, statistically significant differences were found between the two groups at the 3-month follow-up (T1) when we compared the total WORC score; the work, lifestyle and emotions domains; DASH; UCLA; and the physical role domain of the SF-36. There was a tendency toward a difference in the Sports/Recreation domain of the WORC and the physical functioning domain of the SF-36 (Table IV). This indicates that the strategy for differentiating between improvement and non-improvement was effective (34).

Statistically significant changes between baseline and the 3-month follow-up were registered by all questionnaires for the "improved" group (except for the general health domain of the SF-36), whereas there were no significant changes in the "not improved" group (Tables V and VI). These findings support the effectiveness of the anchor-based strategy in separating groups (34).

The effect size (ES) and standardized response mean (SRM) for those judged to have improved or not improved based on the anchor-based strategy are summarized in Table VII. The total WORC and all of its domains demonstrated moderate to high ES and SRM values (0.66 to 1.1) for patients who improved (Group 1). Analysis of the UCLA and DASH revealed similar ES and SRM values. UCLA exhibited the highest responsiveness (ES=1.17 and SRM=1.66). Some variation in responsiveness occurred across the subscales of the SF-36 questionnaire in the "improved" group. The ES and SRM values ranged from small to large and the greatest responsiveness was found in the physical role subscale (ES=0.90 and SRM=1.27). Higher values were found for the SF-36 physical subscales than the other SF-36 subscales in the "improved" group.

All instruments and subscales recorded higher ES and SRM values for those who improved than those who did not improve. The UCLA and the majority of the SF-36 subscales showed changes in a negative direction in the "not improved" group.

Table IV. Questionnaire scores at 3-month follow-up (between-group comparisons).

Questionnaires	T1		
	Mean (SD)		*p*-value
	Group 1 n=20	Group 2 n=10	
Total WORC	49.61 (32.78)	25.61 (19.65)	0.019*
Physical symptoms	55.32 (31.99)	36.57 (25.54)	0.096
Sports/recreation	45.69 (34.36)	25.2 (22.59)	0.062
Work	41.4 (33.84)	14 (13.96)	0.004*
Lifestyle	53.4 (33.88)	25 (17.39)	0.005*
Emotions	49.35 (37.51)	20.53 (23.27)	0.016*
DASH	40.42 (25.77)	56.83 (14.45)	0.034*
UCLA	22.45 (7.01)	16.3 (6)	0.021*
SF-36			
Physical functioning	61.75 (27.06)	46.5 (14.15)	0.052
Physical role	67.25 (25.30)	37.5 (27.08)	0.010*
Bodily pain	49.7 (27.4)	40.9 (17.52)	0.297
General health	65.4 (17.99)	59.5 (21.94)	0.473
Vitality	61.6 (28.41)	47.7 (30.28)	0.243
Social functioning	82.05 (24.96)	64 (34.42)	0.162
Emotional role	79.5 (26.87)	54.2 (41.69)	0.105
Mental health	62 (24.94)	46 (24.92)	0.115
Physical health*	41.70 (8.8)	37.17 (7.71)	0.163
Mental health*	50.09 (11.56)	41.74 (14.55)	0.134

Group 1: improved; Group 2: not improved; T0: at baseline; T1: 3-month follow-up; *$p<0.05$.

Table V. Questionnaire scores at baseline and 3-month follow-up in the group of patients with rotator cuff disorders whose condition improved after therapy (Group 1).

Questionnaires	Group 1 (n=20)		
	Mean (SD)		*p*-value
	T0	T1	
Total WORC	29.1 (22.18)	49.61 (32.78)	0.003*
Physical symptoms	35.08 (26.3)	55.32 (31.99)	0.002*
Sports/recreation	23.7 (20.04)	45.69 (34.36)	0.005*
Work	22.84 (18.05)	41.4 (33.84)	0.018*
Lifestyle	33.44 (30.24)	53.4 (33.88)	0.005*
Emotions	26.88 (30.56)	49.35 (37.51)	0.005*
DASH	55.25 (22.61)	40.42 (25.77)	0.001*
UCLA	15.05 (6.19)	22.45 (7.01)	0.000¶
SF-36			
Physical functioning	53 (26.33)	61.75 (27.06)	0.002*
Physical role	37.25 (33.33)	67.25 (25.30)	0.000¶
Bodily pain	36.3 (19.97)	49.7 (27.4)	0.027*
General health	57.2 (25.67)	65.4 (17.99)	0.60
Vitality	49.55 (26.46)	61.6 (28.41)	0.011*
Social functioning	67.75 (33.65)	82.05 (24.96)	0.005*
Emotional role	62.15 (38.41)	79.5 (26.87)	0.005*
Mental health	52.55 (25.81)	62 (24.94)	0.023*
Physical health*	36.66 (7.39)	41.70 (8.8)	0.002*
Mental health*	42.94 (11.76)	50.09 (11.56)	0.000¶

Group 1: improved; T0: at baseline; T1: 3-month follow-up; *$p<0.05$; ¶$p<0.001$.

Table VI. Questionnaire scores at baseline and 3-month follow-up in the group of patients who did not improve after 3 months of therapy (Group 2).

Questionnaires	Group 2 (n=10)		
	Mean (SD)		*p*-value
	T0	T1	
Total WORC	19.72 (13.17)	25.61 (19.65)	0.248
Physical symptoms	29.37 (23.33)	36.57 (25.54)	0.196
Sports/recreation	16.37 (12.39)	25.2 (22.59)	0.261
Work	11.3 (7.68)	14 (13.96)	0.586
Lifestyle	20.12 (11.6)	25 (17.39)	0.373
Emotions	15.57 (19.73)	20.53 (23.27)	0.618
DASH	58.67 (14.95)	56.83 (14.45)	0.689
UCLA	16.6 (6.02)	16.3 (6)	0.849
SF-36			
Physical functioning	43 (19.03)	46.5 (14.15)	0.482
Physical role	39.5 (30.07)	37.5 (27.08)	0.669
Bodily pain	38.6 (19.02)	40.9 (17.52)	0.515
General health	60.7 (19.82)	59.5 (21.94)	0.804
Vitality	53 (27.79)	47.7 (30.28)	0.312
Social functioning	72.7 (37.12)	64 (34.42)	0.288
Emotional role	55.1 (32.38)	54.2 (41.69)	0.937
Mental health	50.2 (22.67)	46 (24.92)	0.382
Physical health*	42.94 (11.76)	37.17 (7.71)	0.499
Mental health*	47.57 (13.68)	41.74 (14.55)	0.245

Group 2: not improved; T0: at baseline; T1: 3-month follow-up.

Table VII. Effect size and standardized response mean.

Questionnaires	ES		SRM	
	Group 1	Group 2	Group 1	Group 2
Total WORC	0.92**	0.45	0.76*	0.39¶
Physical symptoms	0.77*	0.31¶	0.80**	0.44¶
Sports/recreation	1.10**	0.71*	0.71*	0.38¶
Work	1.03**	0.35¶	0.58*	0.18§
Lifestyle	0.66*	0.42¶	0.71*	0.30¶
Emotions	0.74*	0.25¶	0.71*	0.16§
DASH	0.66*	0.12§	0.85**	0.13§
UCLA	1.17**	-0.05§	1.66**	-0.06§
SF-36				
Physical functioning	0.33¶	0.18§	0.78*	0.23¶
Physical role	0.90**	-0.07§	1.27**	-0.14§
Bodily pain	0.67*	0.12§	0.54*	0.21¶
General health	0.32¶	-0.06§	0.45¶	-0.08§
Vitality	0.46¶	-0.19§	0.63*	-0.34¶
Social functioning	0.42¶	-0.23¶	0.70*	-0.36¶
Emotional role	0.45¶	-0.03§	0.72*	-0.03§
Mental health	0.37¶	-0.19§	0.55*	-0.29¶
Physical health†	0.68*	0.18§	0.41¶	0.11¶
Mental health†	0.61*	-0.43§	0.43¶	-0.29§

Group 1: improved, n=20; Group 2: not improved, n=10.
Interpretation of ES (effect size) and SRM (standardized response mean) values: trivial§; small¶; moderate*; large**.

Discussion

The patient cohort in the present study had a diverse spectrum of rotator cuff conditions and types of treatment. There was a high occurrence of tendinopathy, which was treated with physiotherapy. Two previous studies have demonstrated the responsiveness of the WORC in patients who had undergone surgery for impingement syndrome or rotator cuff tear (8, 34). These facts should be taken into account when choosing this instrument to monitor changes on these conditions.

The results of the present study reveal higher ES and SRM values for the WORC at the 3-month follow-up in the "improved" group than in the "not improved" group. The data demonstrate that this disease-specific, outcome measure-based instrument is a responsive, acceptable questionnaire for detecting changes. The WORC domains were also able to differentiate between the two groups. MacDermid *et al*. analyzed positive and negative outcome groups separately and found higher SRMs for the WORC and its domains in the group with a positive response to surgery after a 6-month follow-up (34). Holtby *et al*. also found a large SRM value for the total WORC score after rotator cuff surgery (3- and 6-month follow-up) (8). The developers of the original WORC questionnaire correlated the WORC scores of patients who reported change after 3 months of follow-up with the DASH, SF-36, UCLA, ASES and constant score and found a correlation between the changes measured, but did not report on typical responsiveness statistics such as SRM or ES (12, 34). Therefore, direct comparison with our study is not possible.

The DASH and UCLA showed moderate to high SRM and ES values in the "improved group" and lower values (trivial to small) in the "not improved" group. Thus, these instruments also proved to be responsive in detecting change after rotator cuff treatment. MacDermid *et al*. reported the responsiveness of the WORC, DASH, SST (Simply Shoulder Test) and SF-36 following rotator cuff surgery, indicating the usefulness of the WORC, DASH and SST for measuring changes after rotator cuff repair (34). Other authors have demonstrated the UCLA to be a responsive scale in the short-term follow-up of arthroscopic subacromial decompression surgery (35).

The SF-36 is the most commonly used generic tool in the orthopaedic literature (36). In the present study, the physical role subscale of the SF-36 global health measure was more responsive than the

other SF-36 subscales. MacDermid *et al*. showed the SF-36 to be the least responsive instrument when compared with region-specific scales in patients recovering from rotator cuff surgery, finding the greatest responsiveness in the bodily pain subscale (34). According to other authors, there is evidence to suggest that both the physical role and bodily pain subscales can be used to follow up musculoskeletal conditions (5, 36). Even though it provides a broad perspective on overall health and has been recommended for disease-specific or region-specific use in clinical research, the SF-36 has been shown to be less responsive than specific scales in evaluating the effects of shoulder interventions (5, 34-37).

According to Beaton *et al*., a responsive measure should record higher ES and SRM values in patients deemed to have improved than in patients who did not improve (27). This was demonstrated in the present study for all ES and SRM values. Further research on larger samples of patients is needed, however, to understand the meaning of the change in scores and to determine the minimum amount of change that should be regarded as indicating significant improvement after rotator cuff interventions (8, 30).

In conclusion, the present study supports the use of the Brazilian version of the WORC questionnaire as an outcome for measuring changes in the short-term follow-up of rotator cuff treatment as well as the UCLA, DASH and physical subscales of the SF-36.

References

1. GREEN S, BUCHBINDER R, HETRICK S: Physiotherapy interventions for shoulder pain (Cochrane Review). In *The Cochrane Library*, 2005, issue 2, Oxford, Update Software.
2. GREEN SE, BUCHBINDER R, FORBES A *et al*.: Interventions for shoulder pain (Cochrane Review). In *The Cochrane Library*, 2005, issue 2, Oxford, Update Software.
3. EJNISMAN B, ANDREOLI CV, SOARES BGO *et al*.: Interventions for tears of the rotator cuff in adults. *Cochrane Database Syst Rev* 2004; 1: CD002758.
4. BOT SDM, TERWEE CB, VAN DER WINDT DWM *et al*.: Clinimetric evaluation of shoulder disability questionnaires: a systematic review of the literature. *Ann Rheum Dis* 2004; 63: 335-41.
5. GAY RE, AMADIO PC, JOHNSON JC: Comparative responsiveness of the Disabilities of the Arm, Shoulder and Hand, the Carpal Tunnel Questionnaire, and the SF-36 to clinical change after carpal tunnel release. *J Hand Surg* (Am) 2003; 28: 250-4.
6. GADOTTI IC, VIEIRA ER, MAGEE DJ: Importance clarification of measurement properties in rehabilitation. *Rev Bras Fisio* 2006; 10: 137-46.
7. IRRGANG JJ. ANDERSON AF, BOLAND AL *et al*.: Responsiveness of the International Knee Documentation Committee Subjective Knee Form. *Am J Sports Med* 2006; 34: 1567-73.
8. HOLTBY R, RAZMJOU H: Measurement properties of the Western Ontario Rotator Outcome Measure: a preliminary report. *J Shoulder Elbow Surg* 2005; 14: 506-10.
9. LOPES AD, CICONELLI RM, CARRERA EF *et al*.: The validity and reliability of the Western Ontario Rotator Cuff Index (WORC) for use in Brazil. *Clin J Sport Med* 2008; 18: 266-72.
10. VIGATTO R, ALEXANDRE NMC, FILHO HRC: Development of a Brazilian Portuguese version of the Oswestry Disability Index. Cross-cultural, adaptation, reliability and validity. *Spine* 2007; 32: 481-6.
11. SOLOMON DH, GABRIEL SE: Quality Measures 101: What every rheumatologist should know. *Clin Exp Rheumatol* 2007; 25 (Suppl. 47): 18-21.
12. KIRKLEY A, ALVAREZ C, GRIFFIN S: The development and evaluation of a disease-specific quality-of-life questionnaire for disorders of the rotator cuff: the Western Ontario Rotator Cuff Index. *Clin J Sport Med* 2003; 13: 84-92.
13. RAZMJOU H, BEAN A, VAN OSNABRUGGE V *et al*.: Cross-sectional and longitudinal construct validity of two rotator cuff disease-specific outcome measures. *BMC Musculoskelet Disord* 2006; 7: 26.
14. LOPES AD, STADNIKY SP, MASIERO D *et al*.: Translation and cultural adaptation of the WORC: a quality of life questionnaire for rotator cuff disorders. *Rev Bras Fisioter* 2006; 10: 309-15.
15. KIRKLEY A, GRIFFIN S, DAINTY K: Scoring systems for the functional assessment of the shoulder. *Arthroscopy* 2003: 19: 1109-20.
16. EL O, BIRCAN C, GULBAHAR S *et al*.: The reliability and validity of the Turkish version of the Western Ontario Rotator Cuff Index. *Rheumatol Int* 2006; 26: 1101-8.
17. HUBER W, HOFSTAETTER JG, HANSLIK-SCHNABEL B *et al*.: Translation and psychometric testing of the Western Ontario Rotator Cuff Index (WORC) for use in Germany. *Z Orthop Ihre Grenzgeb* 2005; 143: 453-60.
18. ORFALE AG, ARAÚJO PMP, FERRAZ MB *et al*.: Translation into Brazilian Portuguese, cultural adaptation and evaluation of the reliability of the Disabilities of the arm, shoulder and hand questionnaire. *Braz J Med Biol Res* 2005; 38: 293-302.
19. CICONELLI RM, FERRAZ MB, SANTOS W *et al*.: Brazilian-Portuguese version of the SF-36. A reliable and valid quality of life outcome measure. *Rev Bras Reumatol* 1999; 39: 143-50.
20. PARK S, STADNIKY SP, RAMOS MMS *et al*.: (2006) Validation of the Brazilian version of the "Modified – University of California at Los Angeles shoulder rating scale". *Proceedings of the VI Brazilian Congress of Shoulder and Elbow*, June 1-3, 2006, Goiânia, Brazil.
21. HUSKISSON EC: Measurement of pain. *Lancet* 1974; ii: 1127-31.
22. REVILL SI, ROBINSON JO, ROSEN M *et al*.: The reliability of a linear analogue for evaluating pain. *Anaesthesia* 1976; 31: 1191-8.
23. CLARKSON HM: Musculoskeletal assessment. Joint range of motion and manual muscle strength. Guanabara Koogan, Rio de Janeiro, 2002.
24. DUTTON M: *Orthopaedic Examination, Evaluation and Intervention*. Artmed, Porto Alegre, 2007.
25. CICONELLI RM, SOÁREZ PC, KOWALSKI CC *et al*.: The Brazilian Portuguese version of the work productivity and activity impairment – General Health (WPAI-GH) questionnaire. *Sao Paulo Med J* 2006; 124: 325-32.
26. DUNKL PR, TAYLOR AG, MCCONNEL GG *et al*.: Responsiveness of fibromyalogia clinical trial outcome measures. *J Rheumatol* 2000; 27: 2683-91.
27. BEATON DE, KENNEDY CA: Beyond return to work: testing a measure of at-work disability in workers with musculoskeletal pain. *Qual Life Res* 2005; 14: 1869-79.
28. REVICKI DA, CELLA D, HAYS RD *et al*.: Responsiveness and minimal important differences for patient report outcomes. *Health Qual Life Outcomes* 2006; 4: 70.
29. MICHENER LA, MCCLURE PW, SENNETT BJ: American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form, patient self-report section: reliability, validity and responsiveness. *J Shoulder Elbow Surg* 2002; 11: 587-94.
30. BEATON DE: Understanding the relevance of measured change through studies of responsiveness. *Spine* 2000; 25: 3192-9.
31. WANG HH, LIAO HF, HSIEH CL: Reliability, sensitivity to change of the Peabody Development motor scale-second edition for children with cerebral palsy. *Phys Ther* 2006; 86: 1351-9.
32. COHEN J: *Statistical Power Analysis for the Behavioral Sciences*. Hillsdale, New Jersey, 1988.
33. KOCKER MS, STEADMAN RJ, BRIGGS KK *et al*.: Reliability, validity and responsiveness of the Lysholm knee scale for various chondral disorders of the knee. *J Bone Joint Surg* 2004; 86-A: 1139-45.
34. MACDERMID JC, DROSDOWECH D, FABER K: Responsiveness of self-report scales in patients recovering from rotator cuff surgery. *J Shoulder Elbow Surg* 2006; 15: 407-4.
35. O'CONNOR DA, CHIPCHASE LS, TOMLINSON J *et al*.: Arthroscopic subacromial decompression: responsiveness of disease-specific and health-related quality of life outcome measures. *Arthroscopy* 1999; 15: 836-40.
36. BEATON DE, SCHEMITSCH E: Measures of health-related quality of life and physical function. *Clin Orthop Relat Res* 2003; 413: 90-105.
37. BEATON DE, RICHARDS RR: Assessing the reliability and responsiveness of 5 shoulder questionnaires. *J Shoulder Elbow Surg* 1998; 7: 565-72.