

## The reliability and validity of the Turkish version of the Western Ontario Rotator Cuff Index

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**Abstract** To adapt the Western Ontario Rotator Cuff (WORC) index for use in Turkey and to investigate its reliability and validity; the Turkish version of the WORC was developed according to the guidelines in the literature. Seventy-two patients with rotator cuff disease were administered the questionnaire and were also evaluated by using the University of California Los Angeles (UCLA) shoulder rating scale, Constant score, and Short Form (SF)-36 to test validity. The WORC questionnaire was repeated in 35 patients after a mean interval of 2.9 days (range 2–7 days) to evaluate test–retest reliability. Cronbach’s alpha was calculated as 0.92 for the total questionnaire. The intraclass correlation coefficients were very high and ranged between 0.96 and 0.98 for each section. There was a significant negative correlation between the Turkish version of WORC and UCLA ( $r = -0.598$ ,  $P < 0.01$ ), Constant score ( $r = -0.630$ ,  $P < 0.01$ ), and all subscales of SF-36 ( $P < 0.01$ ). The Turkish version of the WORC index is a reliable and valid instrument for use in clinical trials in patients with rotator cuff disorders.

**Keywords** Quality of life · Rotator cuff · WORC · Adaptation · Validity

### Introduction

Most of the musculoskeletal diseases that physicians treat each day influence a patient’s quality of life rather than the length or quantity of life. Standardized validated questionnaires that measure treatment outcomes and health-related quality of life have become important in clinical research [1–3]. Generic instruments such as the Short Form (SF)-36 [4] and its shorter version, the SF-12 [5], have been used as health-related quality of life measures in various musculoskeletal disorders. Because generic instruments may not be able to detect small but important changes related to specific disorders, disease—or joint—specific instruments have been developed [2, 3].

Shoulder pain is the third most common musculoskeletal symptom encountered in medical practice after back and neck pain [6] and rotator cuff disease is the most common cause of shoulder pain [7]. Pain and reduced mobility of the shoulder can affect the patient’s functional status and quality of life. The major therapeutic goals for patients with rotator cuff disease are to control pain and restore pain-free function, thereby maintaining and improving quality of life. There are a number of measurement tools in existence to determine the treatment outcome in patients with shoulder problems. These include the University of California Los Angeles (UCLA) shoulder rating scale [8], the American Shoulder and Elbow Surgeons Standardized Shoulder Assessment form [9], the Disabilities of the Arm, Shoulder, and Hand outcome measure (DASH)

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[10], the Constant score [11], the Shoulder Pain and Disability Index [12], the Shoulder Rating Questionnaire [13], Simple Shoulder Test [14], and Western Ontario Shoulder Tools (Western Ontario Shoulder Instability Index—WOSI, Western Ontario Osteoarthritis of the Shoulder Index—WOOS, Western Ontario Rotator Cuff Index—WORC) [15–17].

The WORC index was developed by Kirkley et al. to evaluate the disease-specific quality of life of patients with rotator cuff disease. The WORC has been shown to be reliable and valid in these patients [17]. At present, no disease-specific quality of life measurement tools are available for Turkish patients with rotator cuff disease. Cross-cultural adaptation of validated outcome instruments has been advocated in order to facilitate their use in international studies [18]. To be used internationally, these questionnaires must be translated into the respective local languages and must also be culturally adapted.

The aim of this study was to adapt the WORC index for use in Turkey and to test the new version's reliability and validity.

## Materials and methods

### Translation

After the authors of the original version of the WORC index were contacted for permission, it was translated and adapted according to the guidelines in the literature [19]. First, the English version of the WORC was translated into Turkish by three bilingual physiatrists and an English teacher with Turkish as mother tongue. The translators worked independent of one another. The translations were compared and inconsistencies in the translation were resolved by consensus. Next, this version was independently translated back into English both by a native English-speaking translator and an English teacher. At this stage, one of the authors of the original version (SG) reviewed the back-translated version. The translation was reviewed by members of a committee comprising the forward translators, a public health specialist, and other translators who were contacted as needed and a consensus was met for the final Turkish translation. The final version was pretested on 15 patients and volunteers with and without shoulder problems to test comprehensibility. No further changes were required.

### Patients

Seventy-two patients with rotator cuff disease (impingement syndrome, partial or full-thickness

rotator cuff tears) were included in the study. All patients were recruited between December 2004 and June 2005 at the Department of Physical Medicine and Rehabilitation in Dokuz Eylul University Hospital. Demographic and clinical characteristics of the study population are given in Table 1. The diagnosis was confirmed in each patient by history, physical examination, and appropriate radiological evaluations. Patients with chronic inflammatory diseases and patients with impairments in the cervical spine, elbow, and/or hand affecting the shoulder function were excluded.

After obtaining informed consent, patients were administered the Turkish version of the WORC, the UCLA shoulder rating scale, Constant score, and SF-36 to test validity. The WORC questionnaire was repeated in a group of stable patients after a mean interval of 2.9 days (range 2–7 days) to evaluate test-retest reliability.

### Western Ontario Rotator Cuff Index

The WORC index is a self-assessment instrument that has been developed to measure the quality of life of patients with rotator cuff disease. It has 21 items representing the five domains which encompass all aspects of health as defined by the World Health Organization [20]. There are six questions in the physical symptoms domain, four in the sports and recreation domain, four in the work domain, four in the lifestyle domain, and three in the emotions domain. Each question is answered on a 100-mm visual analog scale. The scores of 21 items are added to give a total score from 0 to 2,100. A score of 0 implies no reduction in HRQL, and a score of 2,100 is the worst score possible [17].

### 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 [8].

**Table 1** Demographic and clinical characteristics of study population

Sex (F/M)	54/18
Age (years) <sup>a</sup>	54.9 ± 9.9
Duration of symptoms (months) <sup>a</sup>	9.8 ± 15.7
Diagnosis	
Impingement syndrome without rotator cuff tear	51
Partial thickness rotator cuff tears	11
Full-thickness rotator cuff tears	10

<sup>a</sup>Mean ± SD

Constant score

The Constant score is based on subjective and objective assessments. The subjective assessments of pain and activities of daily living are allocated 15 and 20 points, respectively. A maximum of 40 points is assigned for active range of motion, and 25 points for quantitative measurement of abduction strength. The maximum score of 100 corresponds to optimal health state [11].

Short Form-36

Short Form-36 is a generic measure of quality of life addressing eight health concepts: physical functioning, physical role, bodily pain, vitality, role emotional, social functioning, mental health, and general health. Scores for each dimension range from 0 (poor health) to 100 (good health). From these eight dimensions, two summary scales, one for physical and one for mental health, can be computed [4].

Analysis

SPSS (version 11.0) was used for the statistical analysis. Reliability was tested by internal consistency and test-retest reliability. Cronbach’s alpha coefficient was calculated to assess internal consistency. Intraclass correlation coefficients were computed to investigate test-retest reliability. Validity was assessed by calculating the Pearson correlation coefficients between the WORC and the other scales.

Results

A total of 72 patients fulfilled the selection criteria and participated in the study. All patients filled in the questionnaires and were investigated clinically. The absolute values of all scores are given in Table 2.

Reliability

The internal consistency of the Turkish version of WORC tested by the Cronbach’s alpha was 0.92 for the total questionnaire. The results for each domain are shown in Table 3. Thirty-five patients filled in the questionnaire twice for testing of test–retest reliability. The intraclass correlation coefficients were very high and ranged between 0.96 and 0.98 for each section (Table 4).

**Table 2** Absolute values of all scores (*n* = 72)

Scores	Mean ± SD	Minimum	Maximum
Constant score	47.2 ± 11.7	21	78
UCLA shoulder rating scale	16.9 ± 3.7	11	26
WORC index	1,236.4 ± 361.5	439	1,902
SF-36			
Physical functioning	63.7 ± 18.5	16.7	100
Physical role	25.3 ± 37.4	0	100
Bodily pain	36.4 ± 21.0	0	84
Vitality	48.8 ± 20.5	0	85
Emotional role	46.5 ± 43.5	0	100
Social functioning	65.1 ± 26.3	12.5	100
Mental health	58.7 ± 18.0	12	96
General health	56.3 ± 23.6	0	92
Physical health summary score	38.2 ± 7.8	19.4	56.5
Mental health summary score	40.6 ± 9.4	19.1	61.9

UCLA University of California Los Angeles, WORC Western Ontario Rotator Cuff Index

Validity

There was a significant negative correlation between the WORC and UCLA ( $r = -0.615, P < 0.01$ ), Constant score ( $r = -0.571, P < 0.01$ ), and all subscales of SF-36 ( $P < 0.01$ ) (Table 5). The correlations were stronger with the physical health summary scale than with the mental health summary scale of the SF-36. When the correlations between the WORC and individual domains of the UCLA were investigated sepa-

**Table 3** Reliability scores for the total WORC score and the domains

Domain	<i>r</i> at 2–7 days
Total WORC	0.92
Physical function	0.70
Sports/recreation	0.69
WORC	0.79
Lifestyle	0.77
Emotions	0.92

**Table 4** Test–retest scores of the Turkish version of WORC to evaluate reliability in patients with rotator cuff disease (*n* = 35)

	First visit (mean ± SD)	Second visit (mean ± SD)	ICC (95% CI)
Total score	1,220.8 ± 341.0	1,208.9 ± 353.8	0.98 (0.96–0.99)
Physical symptoms	282.9 ± 100.0	289.9 ± 105.5	0.97 (0.94–0.98)
Sports/recreation	258.2 ± 69.3	254.9 ± 72.4	0.96 (0.92–0.98)
Work	199.3 ± 56.9	198.0 ± 60.7	0.96 (0.93–0.98)
Life style	249.9 ± 78.7	244.0 ± 78.3	0.97 (0.94–0.98)
Emotions	165.5 ± 83.6	158.5 ± 81.0	0.98 (0.97–0.99)

ICC Intraclass correlation coefficient

**Table 5** Correlations between WORC and Constant score, UCLA shoulder rating scale, and SF-36

	Correlation coefficients ( <i>r</i> ) with WORC	<i>P</i>
Constant score	-0.57	<0.001
UCLA shoulder rating scale	-0.61	<0.001
SF-36		
Physical functioning	-0.53	<0.001
Physical role	-0.47	<0.001
Bodily pain	-0.67	<0.001
Vitality	-0.61	<0.001
Emotional role	-0.38	0.001
Social functioning	-0.56	<0.001
Mental health	-0.36	0.002
General health	-0.35	0.003
Physical health summary score	-0.62	<0.001
Mental health summary score	-0.53	<0.001

*UCLA* University of California Los Angeles, *WORC* Western Ontario Rotator Cuff Index

rately, significant negative correlations were observed [pain ( $r = -0.510$ ,  $P < 0.01$ ), function ( $r = -0.432$ ,  $P < 0.01$ ), range of motion ( $r = -0.350$ ,  $P < 0.01$ ), strength ( $r = -0.265$ ,  $P < 0.05$ )].

## Discussion

In this study, the Turkish adaptation of the WORC was performed following a systemic standardized approach [19]. Similar approaches have been used in the translation of other health instruments into Turkish, such as SF-36 and Nottingham Health Profile [21, 22].

Since rotator cuff disease is the most common cause of shoulder pain [7] and the third most common musculoskeletal symptom, there is need for a measuring instrument in order to provide subjective evaluation on the condition of Turkish patients. Only the DASH exists in a Turkish version but no reliability and validity study has been published. Furthermore, the application of the DASH is to evaluate the total upper limb and, consequently, its use for certain types of pain and syndromes, or specific joints is a matter of controversy in the literature [14, 23–25]. Disease-specific instruments can be very sensitive for evaluating health changes related to specific upper extremity diseases [26]. The WORC has been published as a measurement tool for use as the primary outcome in clinical trials evaluating treatments in patients with diseases of the rotator cuff. The WORC index was selected to be translated and validated into Turkish because the authors report that it can be used not only in the research setting but also in the clinical setting for monitoring an individual patient's progress and for decision-making

about treatment on an individual basis [17]. Also, WORC is a self-administered, user friendly questionnaire that takes a short time to complete and also reflects the patients' own perception of change in health status. Another advantage of the WORC is its comprehensiveness. It was designed to include the five domains of health as defined by World Health Organization [20] and may provide information that is unavailable in other measures. This is especially true of the sports/recreation, work, lifestyle, and emotion domains, which are not common in other shoulder questionnaires. These domains refer to important elements of a patient's life that may be relevant to the overall quality of life. This index includes specific instructions to the patient to be read prior to completion. A supplement to the index includes an explanation for each question, which can be referred to if the patient is unsure of the meaning of a question. This property also helps the patient to fill in the questionnaire correctly and facilitates the translation and adaptation to other languages.

In this study, it was shown that translation and adaptation of the WORC into the Turkish language was successful. There were however two idioms in one item regarding lifestyle "roughhousing and horsing around" for which an equivalent in Turkish does not exist. After consultation with the author, these idioms were translated as "jogging and playing (wrestling, rolling on the floor type activities) with family or friends."

The properties of the translated version regarding internal consistency, test–retest reliability, and validity for rotator cuff disease were good and compared to the properties of the original version.

Examination of internal consistency resulted in a Cronbach's coefficient alpha of  $r = 0.92$ , an excellent value. Testing of reproducibility was done within a short time in order to minimize changes in the clinical status of the patients. Test–retest reliability was very high (ICC = 0.98). The correlation coefficients between the absolute values of Turkish WORC, Constant score, UCLA scale, and the physical health summary scales of SF-36 were generally high ( $r > 0.5$ ). Similar results were achieved when compared with the original English version [17]. The WORC scores correlated negatively with all SF-36 subscales and the correlations were stronger with the physical health summary scale than with the mental health summary scale. The strongest correlation was observed with pain. When we compared the WORC with the two conventional shoulder scores, Constant and UCLA, strong correlations were observed ( $r > 0.5$ ). There was modest correlation with the mo-

tion and function, and lower correlation with the strength items of the UCLA whereas strong correlation was observed with the pain item. Also, the correlation with UCLA was higher than that with the Constant score. These results were also similar to the original version. This might be due to the larger portion of objective criteria such as motion and strength in the Constant score as compared to the UCLA score. Range of motion has been shown to correlate poorly with shoulder function [27]. This points to the typical problem with the conventional scores. These conventional shoulder scores may still be important in assessing the results of treatment in terms of improvement of joint motion and strength; however, these do not cover the different dimensions of health-related quality of life, which is central to

patients. The patient's own perception of change in health status is the most important indicator of the success of a treatment; so, the WORC is an appropriate measurement tool for evaluating the treatment outcome in patients with rotator cuff disease.

In conclusion, our data showed that the WORC index was successfully translated and adapted into the Turkish language. The Turkish version of the WORC index is a reliable and valid instrument for use in clinical trials in patients with rotator cuff disorders.

## Appendix

### WESTERN ONTARIO ROTATOR KAF ÖLÇEĞİ

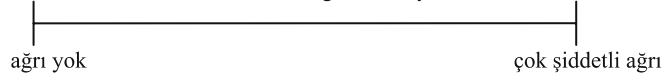
#### BÖLÜM A: FİZİKSEL BELİRTİLER

##### Hasta için açıklamalar:

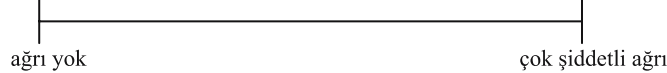
Aşağıdaki sorular omuz probleminize bağlı yaşadığınız fiziksel belirtilerle ilgilidir. Tanımlanan tüm durumlarda geçen hafta içindeki belirtilerinizin derecesini aşağıdaki çizgi üzerinde işaretleyiniz.

Lütfen yanıtlarınızı “/” ile işaretleyiniz.

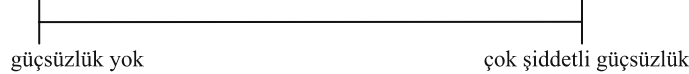
1- Omzunuzda ne kadar keskin ağrı hissediyorsunuz?



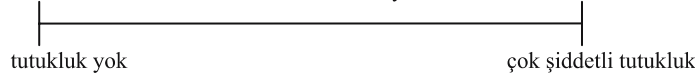
2- Omzunuzda hissettiğiniz sürekli, rahatsız edici ağrının şiddeti ne kadardır?



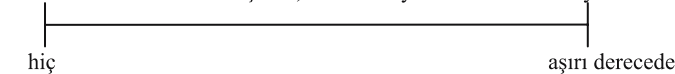
3- Omzunuzda (kolunuzda) ne kadar güçsüzlük hissediyorsunuz?



4- Omzunuzda ne kadar tutukluk hissediyorsunuz?



5- Omzunuzda ne kadar çıtırtı, kütürtü veya sürtünme hissediyorsunuz?



6- Omzunuz nedeniyle boynunuzda ne kadar rahatsızlık hissediyorsunuz?



**Appendix** continued**BÖLÜM B: SPOR/BOŞ ZAMAN AKTİVİTELERİ****Hasta için açıklamalar:**

Bu bölüm geçen hafta içinde omuz probleminizin spor veya boş zaman aktivitelerinizi ne kadar etkilediğini içermektedir.

Lütfen her soru için yanıtlarınızı “/” ile işaretleyiniz.

7- Omuz probleminiz form düzeyinizi (kondüsyon, zindelik) ne kadar etkiledi?

hiç etkilemedi |-----| aşırı derecede etkiledi

8- Omzunuz bir şeyi güçlü veya uzağa fırlatma yeteneğinizi ne kadar etkiledi?

hiç etkilemedi |-----| aşırı derecede etkiledi

9- Birisi veya herhangi bir şey etkilenmiş omzunuza çarptığında ne kadar güçlük çekiyorsunuz?

hiç |-----| aşırı derecede

10- Şınav çekmek ya da diğer zorlayıcı egzersizleri yaparken omzunuz nedeniyle ne kadar güçlük çekiyorsunuz?

hiç |-----| aşırı derecede

**BÖLÜM C: İŞ****Hasta için açıklamalar:**

Bu bölüm omuz probleminizin ev civarındaki veya dışındaki işinizi ne kadar etkilediğiyle ilgilidir. Geçen hafta içindeki uygun dereceyi “/” ile belirtiniz.

11- Ev ya da bahçeyle ilgili günlük aktivitelerinizde ne kadar zorluk çekiyorsunuz?

hiç |-----| aşırı derecede

12- Kolunuzu başınızın üzerine kaldırmanızı gerektiren işlerde ne kadar zorlanıyorsunuz?

hiç |-----| aşırı derecede

13- Etkilenen kolunuzu telafi etmek için diğer kolunuzu ne kadar kullanıyorsunuz?

hiç |-----| sürekli

14- Ağır cisimleri yerden veya omuz seviyesinin aşağısından (altından) kaldırmakta ne kadar zorluk çekiyorsunuz?

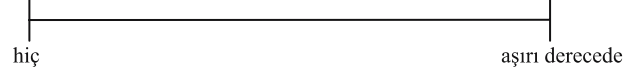
hiç |-----| aşırı derecede



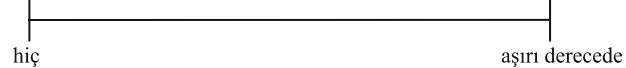
**Appendix** continued**BÖLÜM D: YAŞAM TARZI****Hasta için açıklamalar:**

Bu bölüm omuz probleminizin yaşam tarzınızı ne kadar etkilediği veya değiştirdiğiyle ilgilidir. Yine, geçen hafta içindeki uygun miktarı lütfen “/” ile belirtiniz.

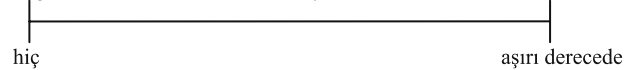
15- Omzunuz nedeniyle uyumakta ne kadar zorluk çekiyorsunuz?



16- Omzunuz nedeniyle saçınıza şekil vermekte ne kadar zorluk çekiyorsunuz?



17- Aile bireylerinizle veya arkadaşlarınızla şakalaşıp oynamada (yerde yuvarlanmak, güreşmek) ne kadar zorluk çekiyorsunuz?

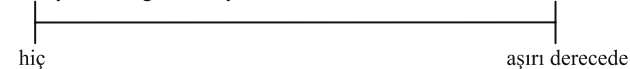


18- Giyinirken veya soyunurken ne kadar zorluk çekiyorsunuz?

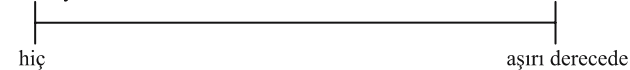
**BÖLÜM E: DUYGULAR****Hasta için açıklamalar:**

Aşağıdaki sorular omuz probleminize bağlı olarak geçen hafta nasıl hissettiğinizle ilgilidir. Lütfen yanıtlarınızı “/” ile belirtiniz.)

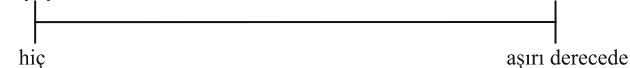
19- Yapmaya çalışıp da omzunuz nedeniyle yapamadığınız şeyler ile ilgili olarak ne kadar hayal kırıklığı hissediyorsunuz?



20- Omzunuz nedeniyle kendinizi ne kadar üzüntülü veya moralsiz (keyifsiz) hissediyorsunuz?



21- Omzunuzun mesleğiniz veya işiniz üzerindeki etkisi hakkında ne kadar endişe duyuyorsunuz?

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