Research Paper: The Psychometric Features of the Patient-Rated Wrist Evaluation in Iranians With Scaphoid or Distal Radius Fracture

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ABSTRACT

Objectives: It is essential to have a suitable instrument for the accurate assessments of pain and disability outcomes during interventions; such tools also help to guide hand surgery and rehabilitation programs in distal radius or scaphoid fracture. This study aimed to evaluate the psychometric features of the Patient-rated Wrist Evaluation (PRWE) questionnaire in Iranians with a history of scaphoid and distal radius fractures.

Methods: One hundred and fifty subjects with a history of scaphoid and distal radius fractures were recruited from hospital-based outpatient hand clinics and completed the PRWE, 2 and 7 days after the occurrence of fracture. Additionally, the Quick-Disabilities of Arm, Shoulder, and Hand (Quick-DASH), the percentage of Wrist Range of Motion (%ROM), Visual Analog Scale Pain/Disability (VAS-P, VAS-D), Short-form Health Survey (SF-36) questionnaires, and pinch and grip strength (%) were conducted in the study participants. Cronbach's alpha (α) coefficient and Intraclass Correlation Coefficient (ICC) were used to evaluate the internal consistency and test-retest reliability of the scale, respectively. Pearson or Spearman correlation coefficient was calculated for assessing the test's construct validity.

Results: No floor or ceiling effect was found. A very high test-retest reliability was obtained for the PRWE's total score and subscores (ICC≥0.92). Cronbach's α coefficient was obtained as ≥0.78 for the PRWE and its subscales. The PRWE total score presented a weak to strong (0.24-0.74) correlation with the average values of %ROM, %power grip, %pinch strength, VAS-P, VAS-D, SF-36, and Quick-DASH. The standard error of the measurement of PRWE total score equaled 3.93; its smallest real difference was 10.86.

Discussion: The PRWE presented acceptable validity and excellent reliability for measuring disability and pain in individuals with the scaphoid and distal radius fractures in Iran.

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Highlights

- Patient-Rated Wrist Evaluation (PRWE) is a suitable test for evaluating wrist pain.

- PRWE presented acceptable validity and excellent reliability for assessing pain and disablement in Iranians with the scaphoid and distal radius fractures.

Plain Language Summary

Wrist pain and its induced disability can limit daily living, work-related, and leisure activities. Before or after treating the wrist problem, assessing the level of pain and extent of difficulty in specific and usual activities (function) must be assessed. It can determine the outcome of surgical or conservative treatment (e.g., hand therapy, occupational therapy, physiotherapy). This test is an appropriate psychometric tool for these goals.

1. Introduction

Pain and functional disability following distal radius and scaphoid fractures are among the major reasons for referral to hand rehabilitation clinics. Pain and disability can interfere with the Activities of Daily Living (ADL), leisure, and work. To guide hand therapeutic and rehabilitation programs after fracture, assessing pain and disability outcomes is necessary [1]. Considering the problems of clinician-based instruments and their probable errors in assessing pain and disability due to wrist injury, examinations are focused on using patient-based instruments [2].

In 1996, MacDermid developed a 15-item Patient-Rated Wrist Evaluation (PRWE) tool for assessing function and pain in patients with wrist disability while performing ADLs. The PRWE questionnaire assesses the presence/absence of pain as well as the intensity of pain and disability in different contexts. The administration of PRWE is easy and takes a short time (approximately 3 minutes) [3]. The PRWE questionnaire provided acceptable reliability, validity, and responsiveness to detect post-intervention changes [4, 5]. The PRWE has been translated into various languages [6-21].

The previous studies evaluated the psychometric features of the PRWE in different populations, such as those with carpal tunnel syndrome, De Quervain's tenosynovitis, Kienbock's disease, carpometacarpal osteoarthritis, and wrist ganglion [5-21]. However, validating the PRWE for use in the subjects with Distal Radius Fracture (DRF) and Scaphoid Fracture (SF) remains unexplored. Without evidence of reliability and validity, a scale cannot be recommended and used in a particular patient population. Therefore, the current study aimed to examine the reliability, Standard Error of Measurement (SEM), Smallest Real Difference (SRD), construct validity, as well as the ceiling and floor effect of the PRWE in individuals with DRF and SF in Iran.

2. Methods

One hundred and fifty subjects diagnosed with SF or DRF were recruited from hospital-based outpatient hand clinics using a simple non-probability sampling method. The inclusion criteria of the study included the following: the age of >18 years, literacy, passing at least two months from a wrist injury, and no use of plaster or orthosis a week before the evaluation. Patients who had wrist injury with a neurological or rheumatologic background, or were unwilling to cooperate in the testing process, or failed to refer for timely reassessments were excluded from the research. All study patients were evaluated in the morning at orthopedic clinics.

Patient-Rated Wrist Evaluation (PRWE) has 15 questions and two subscales, as follows: Pain subscale (PRWE-P) (including 4 questions about pain severity and 1 question about pain frequency) and Function subscale (PRWE-F) [including 6 questions about performing specific functions (PRWE-SF) and 4 questions about performing the usual functions (PRWE-UF)]. The study participants were requested to answer all questions of the PRWE concerning their pain and ability to perform specific and usual functional activities during the last week on a scale from 0 (without pain/without disability in performing activities) to 10 (the worst pain/worst disability while conducting activities). The explored patients were requested to complete the questionnaire considering the best estimate of their performance level or pain. The PRWE-P subscores are determined by summing up the scores of 5 pain items; the total score ranges between

0 (no pain) and 50 (worst pain). The PRWE-F consists of two components, as follows: specific activity component, the total score of which (0-60) is determined by summing up the scores of 6 items; usual activity component, the total score of which (0-40) is calculated by summing up the scores of 4 items. The PRWE-F subscores [0-50 (without disability to worst disability by dividing)], are determined by dividing the scores of the above-mentioned 10 items by two. The PRWE total score is computed by summing up the PRWE-P and PRWE-F subscores; it ranges from 0 (no pain/no disability while performing specific & usual activities) to 100 (severe continuous pain/full disability while performing specific & usual functions) [4, 5]. Excellent reliability (test-retest ICC=0.95, Cronbach's α coefficient=0.93) was reported for the Persian version of the PRWE [21].

The Quick-Disabilities of the Arm, Shoulder, and Hand Questionnaire (Quick-DASH): This 11-item self-report questionnaire evaluates the total functional capability of the entire upper extremity (score range for each question=1-5). The total score of Quick-DASH was used in this study, which ranges from 0 (no functional disability) to 100 (the highest severity of functional disability) [22]. The Quick-DASH has a shorter duration of completion (approximately 3 minutes) and relative responsiveness. Besides, it is more efficient than the 30-item DASH scale. The Quick-DASH has a very high reliability (test-retest ICC=0.89, Cronbach's α coefficient=0.90) [23].

The 36-Item Short-Form Health Survey (SF-36): The SF-36 is a comprehensive standard tool for measuring health outcomes. The SF-36 includes two general domains; Physical Component Summary (SF-36-PCS), which consists of 4 subscales, including Physical Function (SF-36-PF), Physical Role (SF-36-RP), Bodily Pain (SF-36-BP), and General Health (SF-36-GH); and Mental Component Summary (SF-36-MCS) with 4 subscales of social function, mental health, energy, and vitality, as well as emotional role. The score of each subscale of SF36 ranges from 0 to100, with greater scores revealing higher function. The SF36's total score also ranges from 0 to 100. Accordingly, a better quality of life is indicated by greater scores. The reliability of the Persian version of SF-36 ranges from 0.77 to 0.9 [24].

The Visual Analog Scale-Pain (VAS-P): VAS-P is an 11-point Likert-type scale [zero (without pain) to ten (severe pain)]. It is highly reliable for acute pain (ICC=0.97) [25].

The Visual Analog Scale-Disability (VAS-D): VAS-D is an 11-point Likert-type scale, with a score range of zero (without disability) to 10 (worst disability) [26].

The Wrist Joint Range of Motion (ROM): A 180-degree stainless steel goniometer caliber was used to examine the ROM of different movements in an injured wrist. The study patient was seated on a chair while the forearm supported and shoulders in 0° of abduction, flexion, and rotation. For measuring wrist flexion and extension ROM, the forearm was placed in mid-position, while the forearm and hand resting on a table on the ulnar border. The goniometer axis was located on the lateral border of the wrist, distal to the radial styloid. The stationary and movable bars were aligned with the radius and index metacarpal bones, respectively. For wrist extension, fingers were flexed. For measuring wrist ulnar or radial deviation ROM, the forearm was pronated; the wrist was placed at the neutral position; the fingers were relaxed in extensions, and the palm was resting flat on the table surface. The goniometer axis was located on the dorsum of the wrist at the basis of the third metacarpal bone, over the capitate. The movable bar was parallel to the third metacarpal, and the stationary bar was in line with the midline of the dorsal aspect of the forearm. For forearm supination or pronation, the start position was the humeral adduction, forearm mid-position, and 90° elbow flexion. The goniometer axis was located on the ulnar border of the wrist volar/dorsal aspect, proximal to the ulnar styloid. The movable bar was resting against the wrist volar/dorsal aspect. Furthermore, the stationary bar was perpendicular to the floor [27]. The observed patient was requested to move the wrist and forearms actively in all the above-mentioned movements. When the study patient stopped moving, the angle was recorded. The ROM ratio of the injured to the uninjured side was calculated. The goniometric technique has provided high reliability for assessing the wrist ROM in patients with or without pathology (ICC>0.8) [28].

Power grip: Grip strength was evaluated by handgrip Jamar Hydraulic dynamometer caliber (Preston, Bolingbrook, Illinois, USA). The study patient was seated on a chair, with the neutral rotation and adduction of the shoulder, 90° flexion of the arm, and neutral positions of the forearm and wrist. The research participant was instructed to press the dynamometer's second handle with minimal pain. The average value of 3 trials was documented in kilograms. The grip strength of the injured side was expressed as a percentage of the uninjured side. Prior research indicated that the grip strength test, using a dynamometer in healthy subjects or those with a hand/wrist injury, has high reliability (ICC>0.9) [29].

Pinch strength: The pinch strength was measured by the standard pinch gauge in the modes of thumb pinch with the index finger and thumb pinch with the middle finger. The explored patient was seated on the chair, with adduction and neutral rotation of the shoulder, 90° of arm flexion, and neutral position of the forearm and wrist. The study participant was requested to press the pinch gauge using the index finger and thumb as well as middle finger and thumb, with a minimum pain (3 trails for each mode). The average score of 3 trials was recorded in kilograms. The pinch strength of the injured side was expressed as a percentage of the uninjured side [30].

In the first assessment session, the explored patients completed the PRWE scale, along with other questionnaires, including the Quick-DASH, VAS-P, VAS-D, and SF-36 (to assess the construct validity of the test). After about 10 minutes of resting, the wrist ROM, as well as pinch and grip strength were measured by an experienced occupational therapist with a 5-year hand therapy experience. All investigated patients re-completed the PRWE questionnaire after 2 to 7 days to examine its test-retest reliability. This period was short enough to suppose the explored participants remained stable [16].

The Kolmogorov-Smirnov test revealed that the obtained data had a normal distribution. The test-retest reliability of PRWE-P and PRWE-F subscores and the PRWE's total score was calculated using ICC (type 2, 1). According to Fleiss classification, the ICC values of >0.75 and 0.40-0.75 reflect excellent and moderate reliability, respectively [29-31]. The scale's precision was explored by measuring the Standard Error of Measurement (SEM) and the Smallest Real Difference (SRD); the change, i.e., beyond the measurement error was calculated at a (95%) confidence interval [32]. The SEM and SRD were determined for the PRWE subscores and the total score using the following formulas, where SD is the total standard deviation of test and re-test [33]:

$$SEM=SD\sqrt{1\text{-ICC}}\,,\ SRD_{95}=SEM\times\sqrt{2}\times 1.96$$

The SEM value of <10% of the maximum score of the scale or subscales indicated acceptable absolute reliability [34]. The scale's internal consistency was examined using Cronbach's α coefficient; its values of >0.70, 0.8-0.9, and >0.90 indicate acceptable, good, and excellent internal consistency, respectively [35].

The PRWE's construct validity was assessed by determining its correlations with Quick-DASH, VAS-P, VAS-D, SF-36, wrist ROM, as well as grip and pinch strength using Spearman or Pearson correlation coefficient. The correlations were detected to be very strong, strong, moderate, and weak, when the correlation coefficients were ≥0.9, 0.68-0.89, 0.36-0.68, and ≤0.35, respectively [36].

According to the literature, ceiling and floor effects exist if a considerable number of respondents obtain scores in both scale extremes [37]. Ceiling and floor effects were calculated for the PRWE's subscores and total score. The ceiling and floor effects of <15% are acceptable [38].

To assess the discriminative validity of the PRWE, the research participants were classified into two groups of with and without wrist pain. For this purpose, the explored patients were asked if they had wrist pain (using a yes or no question) [39]. Moreover, the PRWE's total score and subscores were compared between the groups with and without wrist pain using the Independent Samples t-test. P≤0.05 was considered significant.

3. Results

The majority of study participants (58.7%) were male with the Mean±SD age of 39.30±12.65 years. The injury caused in 101 (67.4%) patients were falling. Moreover, 118 (78.7%) patients presented DRF and others had an SF. Besides, 146 (97.3%) patients experienced injury occurring <6 months ago. The Mean±SD of the PRWE total score was measured as 54.29±17.55 and 50.04±16.33 at test and retest phases, respectively.

Table 1 presents the demographic data of the study patients. No data were excluded from the dataset.

Reproducibility reliability: An excellent test-retest reliability was found for the PRWE's total score ($ICC_{2,1}$=0.95, P<0.0001, $CI_{95\%}$=0.05-0.15). The range of ICC per PRWE item fell between 0.86 and 0.98, indicating excellent reliability for each item (Table 2). The SEM value for PRWE's total score and its subscores was computed to be <10% (Table 2). The SRD value for PRWE's total score, as well as PRWE-P and PRWE-F subscores, was equal to10.86, 6.94, and 4.95, respectively. The range of item-total correlation was from 0.41 to 0.77, indicating its moderate to strong correlation. The range of inter-item correlation was calculated as 0.1-0.44 (mean=0.44).

Internal consistency: An excellent internal consistency (Cronbach's α coefficient=0.92) was found for the PRWE's total score. The relevant results provided Cronbach's α coefficient of 0.78 and 0.91 for PRWE-P and PRWE-F subscales, respectively; thus, the obtained data

Table 1. The descriptive features of the study participants (N=150)

Variables		No. (%)/ Mean±SD
Gender	Male	88 (58.7
	Female	62 (41.3)
Occupational status	Employee	96 (64.0)
	Housekeeper	40 (26.7)
	Unemployed	8 (5.3)
	Student	6 (4.0)
Hand dominance	Right	140 (93.3)
	Left	10 (6.7)
Affected hand	Right	81 (54.0)
	Left	69 (46.0)
Diagnosis	DRF	118 (78.7)
	SF	32 (21.3)
Treatment method	Conservation	10 (6.7)
	Surgery	140 (93.3)
Age, y	Total	39.30±12.65
PRWE-total score	Test	54.29±17.55
	Retest	50.04±16.33
PRWE-Pain subscore	Test	29.25±8.79
	Retest	26.53±8.06
PRWE-Function subscore	Test	25.2±10.24
	Retest	23.2±9.53
PRWE-Specific Function	First assessment	30.95±12.89
	Second assessment	28.54±11.98
PRWE-Usual Function	First assessment	19.48±8.54
	Second assessment	17.85±8.06

Table 2. The reliability results of the PRWE scale

Variables	Test-Retest				Internal Consistency	
	$ICC_{2,1}$	Power	SEM	SRD	Cronbach's α	Power
PRWE-total	0.95	Excellent	3.93	10.86	0.92	excellent
PRWE-P	0.92	Excellent	2.51	6.94	0.78	acceptable
PRWE-F	0.97	Excellent	2.25	4.95	0.91	excellent
PRWE-SF	0.97	Excellent	1.5	6.25	0.86	acceptable
PRWE-UF	0.97	Excellent	1.79	4.15	0.80	acceptable

Abbreviations: PRWE-P: Pain subscale; PRWE-F: Function subscale; PRWE-SF: Specific Function; PRWE-UF: Usual Function; SEM: Standard Error of Measurement; SRD: Smallest Real Difference; ICC: Intraclass Correlation Coefficient

indicated acceptable and excellent internal consistency, respectively (Table 2). The range of Cronbach's α coefficient was 0.40-0.86 after removing each item, which reflected a weak to moderate correlation.

Construct validity: The PRWE's total score was directly and strongly related to the Quick-DASH's total score (rho=0.74, P<0.001). The relationship between the total score and each subscore of the PRWE and SF-36, VAS (pain/disability), wrist ROM, as well as grip and pinch strength are presented in Table 3. Based on the obtained results, a negative and moderate relationship existed between the PRWE's total score and subscores and SF-36-PCS domain (rho=-0.29 to -0.36, P<0.001). The total score and subscores of PRWE revealed a negative weak relationship with the SF-36-MCS domain (rho=-0.23 to -0.29, P<0.001). A moderate relationship was observed between the total score and subscores of PRWE and SF-36 subscales (rho=0.36-0.66, P<0.001). The PRWE-P subscore also demonstrated a positive and moderate correlation with VAS-P as well as SF-36-BP. A positive and moderate relationship was found between the PRWE-F, PRWE-SF, and PRWE-UF subscores and the VAS-D score. Additionally, the PRWE's total score and subscores reflected a negative and poor correlation with the average percentage of wrist ROM (%Total ROM) (rho=-0.17, P=0.039); the percentage of grip strength (rho=-0.18 to -0.32, P<0.001), and the percentage of pinch strength (rho=-0.22 to -0.35, P<0.001) (Table 3).

The ceiling and floor effects of the PRWE's total score and PRWE-P, PRWE-F, PRWE-SF, and PRWE-UF subscales were obtained as 0.67%, 1.33%, 1.33%, 2.67%, 6.67% & 2%, 2.67%, 4.67%, 3.33%, and 1.33%, respectively.

Discriminative validity: The PRWE questionnaire presented a good ability (ES=0.94) to distinguish between two groups of with and without wrist pain.

4. Discussion

The current study evaluated the psychometric properties of the PRWE questionnaire in Iranians with SF and DRF. The obtained results revealed the excellent test-retest reliability and acceptable validity of PRWE for use in individuals with SF and DRF.

Similar to the previous studies [5, 8, 10-13, 15, 17, 20], the obtained results suggested an excellent test-retest reliability of the PRWE's total score as well as PRWE-P and PRWE-F subscores. Such data consistency could be because the retest interval (2-7 days) was similar in all of these studies. This time interval between the test and retest was selected to reduce the odds of a change in the patient's health status or recalling previous responses [16, 19]. The current study results demonstrated high reliability for each item of the PRWE; however, Hemelaers et al. [8] reported a moderate to a high level of reliability for items (ICC=0.60 to 0.92), and this difference may be due to the sample size (44 patients with acute DRF). Our study found that the PRWE's total score and PRWE-P and PRWE-F subscores had acceptable absolute reliability in subjects with DRF and SF. In other words, the SEM score was <10% of the total score and subscores of the questionnaire. The current study presented the SRD value of 10.86 for the PRWE's total score; thus, the changes of ≥10.86% indicated the real improvement rather than measurement error. MacDermid [4] and Mehta et al. [12] also reported the SRD values of 12.2 and 12.5 in the subjects with DRF and SF, respectively.

Table 3. The relationship between the PRWE and outcome measures (N=150)

Variables	SF-36 PCS[e]	SF-36 MCS[f]	VAS-P[g]	VAS-D[h]	% Flex	% Ext	% RD[i]
PRWE -P[a]	-0.34 (0.003)*	-0.23 (0.005)*	0.52 (0.000)*	0.60 (0.000)*	-0.03 (0.684)	-0.074 (0.368)	-0.091(0.270)
PRWE- SF[b]	-0.34 (0.004)*	-0.23 (0.004)*	0.47 (0.000)*	0.53 (0.000)*	-0.09 (0.289)	-0.126 (0.125)	-0.19 (0.018)*
PRWE- UF[c]	-0.32 (0.000)*	-0.28 (0.001)*	0.44 (0.000)*	0.54 (0.000)*	-0.62 (0.453)	-0.113 (0.168)	-0.20 (0.014)*
PRWE- F[d]	-0.29 (0.001)*	-0.25 (0.001)*	0.47 (0.000)*	0.56 (0.000)*	-0.09 (0.263)	-0.131(0. 110)	-0.22 (0.007)*
PRWE- total score	-0.36 (0.000)*	-0.29 (0.000)*	0.55 (0.000)*	0.61 (0.000)*	-0.07 (0.368)	-0.116 (0.156)	-0.18 (0.033)*

Variables	% UD[j]	% Sup[k]	% Pron[l]	% Power grip	% Pinch	% Pinch TI [m]	% Pinch TM[n]	%ROM[o]
PRWE -P[a]	-0.14 (0.089)	-0.07 (0.379)	0.06 (0.507)	-0.18 (0.032)*	-0.28 (0.000)*	-0.24 (0.003)*	-0.27 (0.001)*	-0.096 (0.244)
PRWE- SF[b]	-0.12)0.138)	-0.27 (0.001)	-0.09 (0.290)	-0.32 (0.000)*	-0.34 (0.000)*	-0.29 (0.000)*	-0.35 (0.000)*	-0.17 (0.039)*
PRWE- UF[c]	-0.08 (0.345)	-0.16 (0.049)	-0.06 (0.494)	-0.21 (0.010)*	-0.26 (0.001)*	-0.22 (0.007)*	-0.26 (0.001)*	-0.17 (0.039)*
PRWE- F[d]	-0.12 (0.154)	-0.23 (0.005)*	-0.08 (0.362)	-0.30 (0.000)*	-0.32 (0.000)*	-0.27 (0.001)*	-0.33 (0.000)*	-0.12 (0.135)
PRWE- total score	-0.14 (0.089)	-0.17 (0.036)*	-0.02 (0.830)	-0.24 (0.003)*	-0.33 (0.000)*	-0.29 (0.000)*	-0.34 (0.000)*	-0.148 (0.070)

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[a]Pain subscale of PRWE-Persian; [b]Specific function subscale of PRWE-Persian; [c]Usual function subscale of PRWE-Persian; [d]Function subscale of PRWE-Persian; [e]Physical Component Summary; [f]Mental Component Summary; [g]Visual Analogue Scale-Pain; [h]Visual Analog Scale-Disability; [i]Radial-Deviation; [j]Ulnar- Deviation; [k]Supination; [l]Pronation; [m]Thumb Index, [n]Thumb Middle, [o]Range of Motion. *Significant relationship: P≤0.05

Internal consistency measures the relationship between items on a scale [37]. An excellent internal consistency was determined for the PRWE's total score in this study. These results suggested that the PRWE precisely measures the pain and function concept. This result was consistent with those of the previous studies, which reported Cronbach's α coefficient of 0.78-0.98 [7, 8, 10-13, 15, 17, 20].

In agreement with previous studies [6, 11, 13, 16-20], a positive and strong relationship was detected between the PRWE and the Quick-DASH's total score. This positive relationship demonstrated that increased pain and disability led to higher impairment in the upper limb function. This strong correlation can be explained by the similarity of items in these questionnaires; both of which included questions concerning the severity of pain and the level of upper limb function. In line with the previous studies [4, 7, 8], the present study revealed that the PRWE's total score and its subscores were negatively and moderately correlated with the SF-36-PCS domain and SF-36-PF and SF-36-RP subscales. The SF-36 generally assesses the pain and disability constructs; however, the PRWE specifically addressed the pain and disability of the wrists. Therefore, this moderate correlation was justifiable.

Additionally, consistent with previous studies [4, 7, 8], the PRWE's total score and subscores presented a negative and poor correlation with the SF-36-MCS domain; thus, this finding indicated the divergent validity of the PRWE. Contrary to the present study, Da Silva Rodrigues et al. found a close relationship between the PRWE's total score and SF-36-PF [16]; this may be due to different participants in the two studies.

Similar to previous studies [8, 10, 13, 16], the current study revealed that PRWE-P had a moderate relationship with the physical pain of the SF-36 and VAS-P. These data may be attributed to the different structures of the questions raised in these scales. For example, the questions about the physical pain of the SF-36 and VAS-P probed their general understanding of the severity of the pain; however, the PRWE-P subscale includes separate questions on the severity and frequency of pain in the wrist region. This finding was inconsistent with those of Kim and Kong's study who reported a high correlation between these scales [13]. This finding may be due to the selected samples and different sample sizes in the two studies.

Similar to the previous studies [12, 13], the present research findings indicated that the PRWE-F had a posi-

tive and moderate correlation with the VAS-D score. This moderate correlation may be due to various factors affecting the level of disability and function of patients with SF and DRF.

In accordance with previous studies [4, 12, 13], the present study data revealed a negative and poor correlation between the PRWE's total score and its subscores and wrist ROM, as well as pinch and grip strength. The type of wrist ROM and power measures are objectives, while the PRWE questionnaire is a subjective measure [40] that may explain this poor correlation.

In the current study, the PRWE's total score and subscores indicated no floor or ceiling effect, i.e., consistent with previous studies [12, 15, 16]. Therefore, the PRWE seems to be appropriate in examining the level of changes in the clinics. The current study also demonstrated the good discriminative validity of the PRWE for separating different groups concerning wrist pain.

5. Conclusion

The PRWE is a reliable and valid tool for evaluating disability and pain in Iranians with SF and DRF.

Ethical Considerations

Compliance with ethical guidelines

The Ethics Committee of Iran University of Medical Sciences approved the current study (Code: IR.IUMS.REC.1394.9311355008). All study participants signed written informed consent forms. A code number was placed on each study participant's names to observe information confidentiality.

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Authors' contributions

Conceptualization: Akram Azad, Mahsa Fadavi-Ghaffari; Methodology: Akram Azad, Ghorban Tagizade; Investigation: Mahsa Fadavi-Ghaffari, Hooman Shariatzadeh, Sina Aminzadeh; Data Analysis: Ghorban Taghizade, Mahsa Fadavi-Ghaffari; Writting - original draft: Akram Azad, Noureddin Nakhostin-Ansari, Mahsa Fadavi-Ghaffari; Writting - review and editing: Akram Azad, Ghorban Taghizade, Mahsa Fadavi-Ghaffari; Supervision: Akram Azad.

Conflict of interest

The authors declared no conflicts of interest.

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