



Original article

PRWE application in distal radius fracture: comparison and correlation with established outcomes[☆]



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ABSTRACT

Objective: The study aimed to evaluate the correlation between the PRWE score with other measurements that are already widely used.

Methods: This was a prospective, cross-sectional, single-center study. Sixty-eight consecutive patients underwent surgical treatment for distal radius fractures (internal fixation by locked volar plate or transarticular external fixation). They were evaluated independently by PRWE, DASH, VAS range of motion, strength, and radiographic criteria, in one year of follow up. The Mann-Whitney test was used to compare continuous variables and the Spearman correlation to correlate the outcomes of interest.

Results: PRWE correlated significantly with DASH ($p < 0.001$) and VAS ($p < 0.001$). There were no significant correlations with other outcome measures.

Conclusion: PRWE presents significant moderate correlation only with DASH and VAS. Range of motion, strength, and radiographic criteria do not interfere in the PRWE outcome.

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Aplicação do PRWE na fratura da extremidade distal do rádio: comparação e correlação com desfechos consagrados

R E S U M O

Palavras-chave:

Fraturas do rádio
Avaliação de resultados
Punho

Objetivo: Este estudo teve como objetivo avaliar a correlação entre o escore PRWE com outras medidas já amplamente usadas.

Métodos: Estudo transversal prospectivo, de centro único; 68 pacientes consecutivos foram submetidos a tratamento cirúrgico para fratura da extremidade distal do rádio (fixação interna com placa volar bloqueada ou fixação externa transarticular). Foram avaliados, de forma independente, por meio da Patient-Rated Wrist Evaluation (PRWE), do Disabilities of the Arm, Shoulder and Hand (DASH), da escala visual analógica (EVA), da amplitude de movimento, da força e dos critérios radiográficos, no seguimento de um ano. Usaram-se o teste de Mann-Whitney para comparação de variáveis contínuas e a correlação de Spearman para os desfechos de interesse.

Resultados: PRWE correlacionou-se significativamente com DASH ($p < 0,001$) e EVA ($p < 0,001$). Não houve correlação significativa com as demais medidas de desfecho.

Conclusão: PRWE apresenta correlação significativa moderada apenas com DASH e EVA. As medidas de amplitude de movimento, força e os critérios radiográficos não se correlacionam com PRWE.

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Introduction

Fractures of the distal end of the radius are among the most common in adults,¹ and there are several treatment modalities.²⁻⁵ However, there is no consensus on treatment and on which outcome measures are the most suitable for research and clinical practice.⁶ To evaluate the effectiveness of any treatment, it is essential to have adequate measuring tools, because they ensure the reproducibility of the results and their external validity (generalization of the results).⁷

Initially, the outcomes of treatment of these fractures were grounded in objective aspects, such as range of motion, grip strength, and radiographic measurements,⁸ but these assessments do not take into account the performance of daily activities and, more broadly, they do not consider the subjective assessment of the patients and their expectations after treatment.⁹ Meanwhile, efforts are being made to measure outcomes focused on the subject of intervention, a paradigm shift from surgeon-centered care to patient-centered care.¹⁰

In this context, recently greater emphasis has been given to self-reported measures of symptoms and post-injury function, which assess the patient's perceived disability and consider aspects of the patient's life that may be affected as a result of the disease and treatment.^{6,8} The Disabilities of the Arm, Shoulder and Hand (DASH)¹¹ and the Patient-Rated Wrist Evaluation (PRWE)¹² are structured questionnaires that are widely used in patients with wrist diseases. The DASH has been validated for Brazilian Portuguese for some time¹³; it is the most frequently used score in studies that address wrist diseases.¹⁴ PRWE was recently translated into Brazilian Portuguese¹⁵ and is increasingly being demonstrated to be an important tool, especially in distal radius fractures.⁷

There is a lack of studies evaluating the properties of PRWE in clinical research. In this scenario, it seems reasonable to compare it with the tools that are commonly used in studies involving fractures of the distal end of the radius in order to assess its psychometric capabilities, which would validate its widespread use.

This study aimed to evaluate the correlation between the PRWE score and other objective and subjective outcome measures for the surgical treatment of distal radius fractures after one year of postoperative follow-up.

Material and methods

This study was approved by the Institution Review Board, registered in Plataforma Brasil under CAAE No. 30904214.0.0000.5505. The methods of dissemination of the results of this study followed the guidelines of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) initiative.¹⁶

This was a cross-sectional study with a sample from a prospective study (randomized controlled trial),¹⁷ conducted in a single center in a service specialized in hand and upper limb surgery.

Patients submitted to surgical treatment for unilateral fractures of the distal end of the radius, with locked volar plate or external fixator were included. Evaluation of outcomes was done after one year of follow-up, after an informed consent form was read and signed.

Patients were assessed using the following measures:

- PRWE¹⁵;
- DASH¹³;
- Visual analog scale (VAS) of pain¹⁸;

- Range of motion of the wrist and forearm (flexion, extension, pronation, supination, radial deviation, and ulnar deviation). Comparison of the operated side with the contralateral side;
- Strength (grip strength, pinch strength: pulp pinch, lateral pinch, and three-digit pinch); three measurements were made and the average value was used. Comparison of the operated side with the contralateral side;
- Radiographic measurements (radial height, ulnar variance, radial inclination and volar inclination angles, step-off, and gap between articular fragments).^{19,20} Comparison of the operated side with the contralateral side.

Patients with previous history of degenerative or traumatic disease in the affected or contralateral wrist joint, identified through clinical history, or those who had a cognitive deficit or refused to sign the informed consent form were excluded from the study.

All information collected in this research was initially presented in a descriptive way.²¹ The inferential analysis consisted of the Mann-Whitney test²² in the comparison of the PRWE score, according to gender and dominant and operated sides. The Spearman correlation coefficient²² was used to quantify the correlation between PRWE and DASH, VAS, strength, range of motion, and radiographic criteria.

For the conclusions obtained after statistical tests, an alpha significance level lower than 5% was adopted.

Results

General characteristics of patients evaluated, as well as the mean, minimum, and maximum PRWE and DASH scores, are described in Table 1.

Descriptive statistical analysis between PRWE, gender, operated side, and dominant side indicated that men had statistically lower PRWE scores when compared with women ($p=0.005$). In turn, the dominant and operated sides were not statistically correlated with the PRWE score ($p>0.05$).

Measurements of wrist range of motion and differences between the contralateral and operated sides are described in Table 2.

In the assessment of pain, measured by VAS, 49 (72%) patients reported no pain (VAS=0). Of the 19 (28%) who reported pain, mean value was 2.4, ranging from 0.3 to 7.1.

Table 3 presents the radiographic measurements made on the affected and contralateral side, as well as the difference between them.

Table 4 summarizes the results of the Spearman correlation coefficient for PRWE and other measures of outcome evaluated.

This coefficient ranges from -1.00 to $+1.00$. The closer to -1.00 or $+1.00$, the more evident is the correlation between the pair of variables involved. Thus, coefficients from 0.00 to 0.19 show very weak correlation; between 0.20 and 0.39, weak correlation; between 0.40 and 0.69, moderate correlation; between 0.70 and 0.89, strong correlation; and between 0.90 and 1.00, very strong correlation.^{21,22}

Table 1 – General characteristics of patients.

<i>Gender</i>		
Male	26	38.2%
Female	42	61.8%
<i>Fixation devices</i>		
External fixation	36	52.9%
Locked volar plate	32	47.1%
<i>Age (years)</i>		
Mean		52.0
Minimum–maximum		19–87
<i>Dominant side</i>		
Right	63	92.6%
Left	5	7.4%
<i>Operated side</i>		
Right	33	48.5%
Left	35	51.5%
<i>Dominant side was operated</i>		
Non-dominant side was operated	32	47.1%
<i>PRWE</i>		
Mean	8.2	
Minimum–maximum	0–80	
<i>DASH</i>		
Mean	3.0	
Minimum–maximum	0.0–27.5	

DASH, disabilities of the arm, shoulder and hand; PRWE, patient-rated wrist evaluation.

Discussion

The outcome of a treatment depends not only on the type of intervention, but also on the way it is measured.^{9,23} With the development of self-reported outcome measures, focus shifted to patient-centered results; this has led to the creation of valid instruments to obtain quantitative information about the everyday experience of a patient with a certain disease.²⁴ Studies directed to the measurement of the properties of these instruments are a relatively recent phenomenon, and many of the historically relevant scoring systems have not yet passed the scrutiny of rigorous evaluations.¹⁴

Studies have suggested that the DASH is an adequate instrument to assess patients with upper limb diseases, but it is not specific to the wrist.^{7,14,25} Conversely, according to Changulani et al.,⁷ the DASH has a weak correlation with the intensity of pain in the wrist; it has less validity for the specific evaluation of the wrist. We found that PRWE and DASH are significantly and directly correlated.

Most of the patients did not report pain with VAS and, at the same time, a mean PRWE score of 8.2 was obtained. Considering that half of the PRWE score corresponds to pain, the instrument used to give an objective value to pain felt by the patient showed a significant statistical correlation, as expected, evidencing that PRWE is an effective tool for pain assessment.

Mean range of motion measurements on the contralateral side were higher when compared with the operated side; the differences between the fractured side and the contralateral side for any assessed movement did not present a significant correlation with the PRWE score. Kasapinova²⁶ also failed to observe a significant correlation between these measures; however, in their study there was a significant correlation between range of motion and wrist grip strength.

Table 2 – Measures of range of motion and strength of the operated and contralateral sides.

	Operated side (n = 68)	Contralateral side (n = 68)	Difference ^a (n = 68)
<i>Flexion (degrees)</i>			
Mean	70.8	78.8	8.0
Minimum–maximum	45–90	45–95	–25 to 35
<i>Extension (degrees)</i>			
Mean	61.4	68.2	6.8
Minimum–maximum	30–80	45–90	–20 to 60
<i>Pronation (degrees)</i>			
Mean	83.2	86.6	3.4
Minimum–maximum	50–100	55–100	–5 to 20
<i>Supination (degrees)</i>			
Mean	90.1	93.3	3.2
Minimum–maximum	66–125	80–130	–15 to 25
<i>Radial bending (degrees)</i>			
Mean	21.9	24.6	2.7
Minimum–maximum	10–40	12–45	–15 to 20
<i>Ulnar bending (degrees)</i>			
Mean	39.7	42.8	3.0
Minimum–maximum	10–60	20–70	–15.0 to 25
<i>Grip strength (kgf)</i>			
Mean	24.8	28.2	3.4
Minimum–maximum	6.7–60.2	13.3–50.9	–13.2 to 20.2
<i>Pulp pinch (kgf)</i>			
Mean	3.5	4.0	0.4
Minimum–maximum	0.9–7.5	1.6–8.0	–2.8 to 4.1
<i>Lateral pinch (kgf)</i>			
Mean	5.8	5.6	–0.2
Minimum–maximum	1.8–11.4	2.5–11.0	–4.3 to 3.4
<i>Three-digit pinch (kgf)</i>			
Mean	4.5	4.8	0.3
Minimum–maximum	1.4–8.2	2.0–8.7	–3.0 to 2.7

^a Measurement of the contralateral side–measurement of the operated side.

Table 3 – Radiographic measurements of the operated and contralateral sides.

	Operated side (n = 68)	Contralateral side (n = 68)	Difference ^a (n = 68)
<i>Radial height (mm)</i>			
Mean	10.1	11.3	1.2
Minimum–maximum	0–16	4–16	–4 to 9
<i>Radial inclination (degrees)</i>			
Mean	19.9	21.2	1.3
Minimum–maximum	12–28	14–28	–6 to 10
<i>Ulnar variance (mm)</i>			
Mean	–0.4	0.8	1.1
Minimum–maximum	–8 to 4	–4 to 5	–2 to 8
<i>Volar inclination (degrees)</i>			
Mean	6.9	13.3	6.4
Minimum–maximum	–8 to 20	2–24	–6 to 24
<i>Step-off (mm)</i>			
Mean	0.2	0	–0.2
Minimum–maximum	0–3	0–0	–3 to 0
<i>Joint gap (mm)</i>			
Mean	0.3	0	–0.3
Minimum–maximum	0–5	0–0	–5 to 0

^a Measurement of the contralateral side–measurement of the operated side.

Table 4 – Spearman correlation coefficient between PRWE and other outcomes.

Pair of correlated measures	Spearman's correlation coefficient	p
PRWE and DASH	0.609	<0.001 ^a
PRWE and VAS	0.495	<0.001 ^a
PRWE and flexion	0.075	0.545
PRWE and extension	0.111	0.366
PRWE and pronation	0.033	0.788
PRWE and supination	0.066	0.595
PRWE and radial bending	0.011	0.932
PRWE and ulnar bending	0.023	0.851
PRWE and grip strength	0.095	0.440
PRWE and pulp pinch	0.144	0.240
PRWE and lateral pinch	0.124	0.315
PRWE and three-digit pinch	0.096	0.438
PRWE and radial height	-0.041	0.738
PRWE and radial inclination	-0.042	0.733
PRWE and ulnar variance	-0.106	0.389
PRWE and volar inclination	-0.161	0.189
PRWE and step-off	-0.095	0.443
PRWE and joint gap	0.063	0.610

DASH, disabilities of the arm, shoulder and hand; VAS, visual analog scale; PRWE, patient-rated wrist evaluation.

^a Statistically significant correlations ($p < 0.05$).

Taking into account the strength measurements, the contralateral side was stronger than the operated side. The only exception found was for lateral pinch strength, where the mean value on the operated side was slightly higher than that of the contralateral side. The strength differences between the fractured and the contralateral sides were not significantly correlated with the PRWE score in the present study. Conversely, Karnezis et al.²⁷ indicated that grip strength appears to be a sensitive marker of wrist function recovery. In their study, the difference between the contralateral and fractured sides, after correction of the values for the non-dominant side, was a significant predictor for PRWE.

Regarding radiographic parameters, the mean values of the contralateral side were also higher when compared with the operated side, but the differences of these measurements were not significantly correlated with the PRWE score. Kasapinova et al.²⁶ also did not observe a significant correlation between radiographic parameters and PRWE; these authors concluded that treatment and rehabilitation of distal radius fracture should not be assessed only by the follow-up radiograph.

In the present study, through inferential analysis, we observed that women presented a significantly higher PRWE score than men. Limb side, as well as dominance, did not interfere in PRWE score. No other study in the literature has performed this analysis.

The application of self-reported outcome measures, when done longitudinally, allows healthcare professionals to assess the course of treatment; furthermore, it facilitates comparison

between groups in clinical trials.²⁸ Goldhahn et al.²⁵ recommended the use of multiple instruments that have symptoms and function as separate domains for a definitive classification of the patient with distal radius fracture, since there is not yet a complete instrument for this purpose. In clinical research, instruments should be used in their most extensive and detailed form; for day-to-day medical practice, rapid instruments such as PRWE facilitate data collection.²⁵ Systematic reviews on the subject always discuss the heterogeneity of outcome measures as a barrier to draw further conclusions from the review or meta-analysis.²⁹

It is important to infer that the vast majority of the patients who attended to this service and were included in this study are users of the Brazilian Unified Health System and presented difficulties when answering the self-reported questionnaires. Another important point to consider is the possible “desire to not improve” observed in some patients who want secondary gains (retirement, indemnities, insurance, pension rights, etc.), which may have influenced the information collected.³⁰ The authors believe that, to increase the statistical power of the present study, it would be necessary to conduct a longitudinal prospective study with a larger number of patients, including treatments by non-surgical techniques and other surgical methods.

Conclusion

PRWE has a moderate statistical correlation with DASH and with VAS. Regarding gender, females presented higher PRWE values than males. Measurements of range of motion, strength, and radiographic criteria did not interfere with the PRWE result, nor did the operated side or limb dominance.

Conflicts of interest

The authors declare no conflicts of interest.

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