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ORIGINAL ARTICLE

Responsiveness of the Japanese version of the patient-rated wrist evaluation (PRWE-J) and physical impairment measurements in evaluating recovery after treatment of ulnocarpal abutment syndrome

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Abstract
Background We evaluated the responsiveness of patient-derived questionnaires and physical findings in evaluating recovery after treatment of ulnocarpal abutment syndrome.
Methods Patients were assessed at their initial visit to our clinic and again 3 months after the treatment. At each visit, patients completed a Short Form-36, the Japanese Society for Surgery of the Hand version of Disability of the Arm, Shoulder, and Hand questionnaire (DASH-JSSH), and the Japanese version of patient-rated wrist evaluation (PRWE-J). Grip strength, range of motion, and visual analogue scale for wrist pain were also examined at each visit. Satisfaction with treatment was questioned after 3 months using a Likert scale. Standardized response means (SRM) and effect sizes were calculated to evaluate the responsiveness.
Results The PRWE-J (SRM, 1.35) was the most responsive questionnaire, followed by the DASH-JSSH (SRM, 0.81) and the Short Form-36 (SRM, −0.38 to −1.19). Of the physical tests, grip strength (SRM, 0.81) was more responsive than range of motion (SRM, 0.01 to −0.29). The visual analogue pain scale (SRM, 1.56) was highly responsive. Changes in the PRWE score were correlated with the satisfaction rating for the treatment.
Conclusions Responsive patient-derived scales can assist in the outcome evaluation of patients with ulnocarpal abutment syndrome.

Introduction

After treatment of musculoskeletal disorders, the outcome has conventionally been measured by the range of motion, muscle strength, radiographic appearance, and the subjective judgment of the examiner. These conventional outcome measurements are not clearly correlated with how

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the patient assesses the clinical result. Over recent decades, patient-based instruments have been introduced to evaluate function and disability after disorders of different parts of the musculoskeletal system [1]. Some of these are generic instruments, such as the Short Form (SF)-36 [2] and sickness impact profile [3]. These generic measures assess the impact of musculoskeletal problems on the overall health and well-being of patients, and they were designed for broad use with a variety of disorders. In the field of upper-limb injuries and diseases, the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire has evolved as an important self-reported instrument [4–7].

The patient-rated wrist evaluation (PRWE) was specifically designed to reflect the function of the wrist, while the DASH takes the whole upper extremity into account. Previous studies have found the PRWE to be a valid and responsive questionnaire with regard to wrist function [8, 9]. Imaeda et al. [10] investigated the reliability, validity, and responsiveness of the Japanese version of the PRWE (PRWE-J) and concluded that the evaluation capacity of the PRWE-J was equivalent to that of the original PRWE.

In the present study, we aimed to investigate the responsiveness of the PRWE-J questionnaire and physical testing in evaluating recovery after treatment of ulnocarpal abutment syndrome.

Materials and methods

Thirty-two patients agreed to be included in the study. All patients were asked to complete the PRWE-J, the Japanese Society for Surgery of the Hand version of the DASH (DASH-JSSH), and SF-36 questionnaires, and the visual analogue scale (VAS) for wrist pain was evaluated at the initial visit and 3 months after treatment of ulnocarpal abutment syndrome (UAS). SF-36 Japanese version 2.0 was used, and norm-based scoring was adopted for the analysis. The mean age of the patients was 56 years, with a range of 21–89 years. There were 14 males and 18 females, and the dominant wrists were affected in 20 patients. The duration of symptoms prior to the initial visit averaged 17 months (range, 3–82 months). Diagnosis of the disease was determined by physical examination and standard X-ray findings; it was confirmed by MRI or arthroscopic findings. Treatment consisted of conservative treatment, such as brace and/or medication, in six patients and surgical treatment of ulnar shortening osteotomy in 26 patients.

Grip strength was measured using a Jamar dynamometer (Sammons Preston Rolyan, IL, USA), and the percentage of grip strength (%GS) was determined as the relative grip strength of the affected wrist compared with the contralateral side. The range of the wrist and forearm motions was measured using a standard goniometer. The angles tested were those of radial and ulnar deviation, flexion and extension, and pronation and supination. A standard dorsal technique was used for the wrist flexion and extension [11]. A standard dorsal alignment along the third metacarpal and forearm, with the wrist as fulcrum, was used for the wrist deviations [12]. Forearm rotation was measured using a perpendicular axis, and either the proximal wrist crease or just proximal to the ulnar head were the landmarks for placing the moving arm of the goniometer [13]. The range of motion of the affected wrist was evaluated as a proportion of the active range of forearm and wrist movement (%ROM) compared with the contralateral side. The percentage of flexion–extension movement (%FEM) was defined as the proportion of the range of active flexion–extension motion of the wrist joint compared with the contralateral hand. The percentage of radial and ulnar deviation movement (%RUM) was determined as that of active radial and ulnar deviation motion; the percentage of supination and pronation movement (%SPM) was similarly derived from supination and pronation motion. Three months after treatment, patient satisfaction with the treatment was assessed using a four-point Likert scale (very satisfied, satisfied, neutral, dissatisfied).

The responsiveness of all the instruments was examined by calculating the standardized response mean (SRM; mean change/SD) and effect size (ES; mean change/SD of the baseline value). An SRM >0.8 indicated a large change; 0.5–0.8 indicated moderate change; and <0.5 indicated a small change [14].

As an additional indicator of responsiveness, the correlation between patient satisfaction with the results of treatment and the improvement in each score was calculated. Good correlation suggested that the score was sensitive to changes in the clinical picture in the patients with UAS. The study design was approved by the institutional review board of the hospital. All subjects were informed that the data from their cases would be submitted for publication, and they gave their written consent to participate in the study.

Statistical analysis

A comparison was made between the first and second measurements to assess the clinical change in each patient-rated questionnaire and objective findings. A paired t test and Wilcoxon signed-rank test were used for comparative analysis. The correlations were calculated between changes in each score of the PRWE-J, DASH-JSSH, and SF-36, and changes in objective findings, such as %GS and %ROM, were assessed by means of Spearman's correlation coefficient. The correlations of changes in each subscale of the PRWE-J with changes in %GS and %ROM were analyzed

using Spearman's coefficient. Correlations between changes in the PRWE-J, DASH-JSSH, SF-36, and patients' satisfaction were calculated using Spearman's coefficient. A p value of less than 0.05 was considered significant. We used the Statistical Package for Social Science (SPSS) version 16.0 J software for Windows for the statistical analysis (SPSS Inc., Chicago, IL, USA).

Results

A significant clinical change between the first and the second measurement was observed in the PRWE-J, DASH-JSSH, and VAS as well as several subscales of SF-36 and %FEM ($p < 0.01$). The mean scores improved from 55 points at baseline to 25 points at the time of follow-up for the PRWE-J, from 42 to 23 points for the DASH-JSSH score, and from 60 to 22 points for the VAS. Responsiveness was calculated for the total score of the PRWE-J as well as for the separate subscales and other measurement scales (Table 1). The standardized response means were 1.35 for the PRWE-J, 0.81 for the DASH-JSSH score, and −0.38 to −1.19 for the SF-36. The largest responsiveness of subscales was observed in the PRWE-J pain subscale (SRM/ES, 1.33/1.76), followed by the SF-36 bodily pain (−1.19/−1.83) and the PRWE-J function subscale (1.10/0.98). The SRMs of objective findings and visual analogue pain score were 1.56 in VAS, –0.36 in %GS, and 0.01 to −0.29 in %ROM (Table 2).

The change in the PRWE-J usual function subscale score had a significant correlation with changes in %SPM ($r = 0.43$, $p < 0.05$). The change in the PRWE-J score had a significant correlation with patient satisfaction ($r = 0.44$, $p < 0.05$) (Table 3). Changes in the DASH–JSSH, bodily pain, physical function, role-physical scale, mental health, and general health as assessed with the SF-36 had a significant correlation with patient satisfaction.

Discussion

The current results demonstrate that the PRWE-J, which is a specific questionnaire relating to the wrist, is highly responsive in detecting clinical changes in UAS. The PRWE-J had a greater SRM than the DASH-JSSH and the SF-36, and it was demonstrated to be the most responsive instrument in the current study. The pain and function subscale of the PRWE-J attained a high responsiveness (SRM, 0.89–1.76), whereas the SF-36 general health (SRM, –0.68), vitality (SRM, 0.54), social function

Table 1 Responsiveness of patient-derived outcome measures in ulnocarpal abutment patients

	Number	Preoperative		Postoperative		Preoperative–postoperative			Responsiveness	
		Mean	SD	Mean	SD	Mean	Median	SD	SRM	ES
PRWE-P***	32	31.38	9.43	14.75	11.36	16.63	17.50	12.53	1.33	1.76
PRWE-SF***	31	31.44	19.53	13.55	14.30	17.32	17.00	18.52	0.94	0.89
PRWE-UF***	26	18.67	11.88	8.64	7.28	11.38	11.00	11.25	1.01	0.96
PRWE-F***	26	24.52	15.35	11.11	10.28	15.12	10.75	13.70	1.10	0.98
PRWE***	26	55.45	23.42	25.32	20.44	33.38	27.75	24.81	1.35	1.43
DASH***	30	41.69	22.18	22.98	18.43	19.24	13.09	23.64	0.81	0.87
SF-36-PF***	31	39.05	12.08	46.39	10.83	−10.15	−7.04	15.59	−0.65	−0.84
SF-36-RP**	31	28.36	17.76	39.96	13.35	−14.12	−10.23	17.52	−0.81	−0.79
SF-36-BP***	31	31.52	8.26	44.32	9.26	−15.11	−13.72	12.72	−1.19	−1.83
SF-36-GH*	31	43.68	10.47	48.16	9.10	−7.08	−3.78	14.62	−0.48	−0.68
SF-36-VT	31	43.34	11.74	47.07	7.96	−6.35	−3.08	15.41	−0.41	−0.54
SF-36-SF	31	43.07	15.52	47.13	12.81	−7.08	0.00	18.66	−0.38	−0.46
SF-36-RE***	31	34.32	17.03	42.85	13.43	−11.33	−8.50	13.70	−0.83	−0.67
SF-36-MH*	31	40.34	14.51	45.60	10.14	−7.80	−2.66	16.09	−0.48	−0.54

SRM standardized response mean, *ES* effect size, *PRWE-P* pain subscale of the patient-rated wrist evaluation Japanese version, *PRWE-SF* specific function subscale of the patient-rated wrist evaluation Japanese version, *PRWE-UF* usual function subscale of the patient-rated wrist evaluation Japanese version, *PRWE-F* function subscale of the patient-rated wrist evaluation Japanese version, *DASH* disability/symptom scale of the Japanese version of DASH, *SF-36-PF* physical functioning subscale of the 36-item short-form health survey (SF-36), *SF-36-RP* role-physical subscale of SF-36, *SF-36-BP* bodily pain subscale of SF-36, *SF-36-GH* general health subscale of SF-36, *SF-36-VT* vitality subscale of SF-36, *SF-36-SF* social functioning subscale of SF-36, *SF-36-RE* role-emotional subscale of SF-36-MH, mental health subscale of SF-36

* Significant difference between preoperative and postoperative median value ($P < 0.05$)

** Significant difference between preoperative and postoperative median value ($P < 0.01$)

*** Significant difference between preoperative and postoperative median value ($P < 0.001$)

Table 2 Responsiveness of physical findings and VAS for wrist pain in ulnocarpal abutment patients

	Number	Preoperative		Postoperative		Preoperative–Postoperative			Responsiveness	
		Mean	SD	Mean	SD	Mean	Median	SD	SRM	ES
VAS pain***	32	60.31	19.12	21.88	18.57	38.44	37.00	24.62	1.56	2.01
% GS	30	71.06	32.33	78.44	24.27	−9.44	−6.70	26.12	−0.36	−0.29
% FEM*	23	84.67	22.98	92.76	12.61	−6.12	−5.72	21.29	−0.29	−0.27
% SPM	23	97.48	30.52	101.96	34.49	−1.61	0.00	22.93	−0.07	−0.05
% RUM	20	85.03	39.86	87.44	22.34	0.25	−9.81	33.39	0.01	0.01

SRM standardized response mean, *ES* effect size, *VAS pain* visual analogue scale for wrist pain, *% GS* a proportional grip strength of the affected wrist compared to the contralateral side, *% FEM* a proportion of range of active flexion–extension movement of the affected wrist compared with the contralateral hand, *% RUM* a proportional active radial and ulnar deviation motion of the affected wrist compared to the contralateral side, *% SPM* a proportional active supination and pronation motion of the affected extremity compared to the contralateral side

* Significant difference between preoperative and postoperative median value ($P < 0.05$)

*** Significant difference between preoperative and postoperative median value ($P < 0.001$)

Table 3 Correlation between change scores of each questionnaire and physical finding, satisfaction

Instrument	Correlation with				
	% GS	% FEM	% RUM	% SPM	Satisfaction
PRWE-P	−0.047	−0.030	−0.269	−0.104	**−0.435***
PRWE-SF	−0.224	−0.045	−0.406	−0.133	−0.294
PRWE-UF	−0.208	−0.268	−0.347	**−0.433***	**−0.425***
PRWE-F	−0.256	−0.222	−0.381	−0.325	**−0.663***
PRWE	−0.230	−0.164	−0.310	−0.327	**−0.447***
DASH	−0.356	−0.159	−0.290	−0.214	**−0.576****
SF-36-PF	−0.027	−0.073	−0.150	−0.100	**−0.463***
SF-36-RP	−0.274	−0.104	−0.100	−0.099	**−0.496****
SF-36-BP	−0.181	−0.128	−0.187	−0.040	**−0.672****
SF-36-GH	−0.104	−0.199	−0.224	−0.024	**−0.587****
SF-36-VT	−0.275	−0.075	−0.187	−0.139	−0.189
SF-36-SF	−0.180	−0.384	−0.271	−0.054	−0.383
SF-36-RE	−0.258	−0.132	−0.000	−0.139	−0.197
SF-36-MH	−0.379*	−0.222	−0.008	−0.059	**−0.423***

PRWE-P pain subscale of the patient-rated wrist evaluation Japanese version, *PRWE-SF* specific function subscale of the patient-rated wrist evaluation Japanese version, *PRWE-UF* usual function subscale of the patient-rated wrist evaluation Japanese version, *PRWE-F* function subscale of the patient-rated wrist evaluation Japanese version, *DASH* disability/symptom scale of the Japanese version of DASH, *SF-36-PF* physical functioning subscale of the 36-item short-form health survey (SF-36), *SF-36-RP* role-physical subscale of SF-36, *SF-36-BP* bodily pain subscale of SF-36, *SF-36-GH* general health subscale of SF-36, *SF-36-VT* vitality subscale of SF-36, *SF-36-SF* social functioning subscale of SF-36, *SF-36-RE* role-emotional subscale of SF-36-MH, mental health subscale of SF-36

* $P < 0.05$, ** $P < 0.01$; Spearman's correlations (rs) boldface results indicate a significant correlation, when $P < 0.05$ and $|r\text{s}| > 0.4$

(SRM, –0.46), role-emotional scale (SRM, –0.67), and mental health (SRM, –0.54) resulted in a statistically lower responsiveness. The responsiveness of the PRWE-J was greater than that with measurement scales of physical impairment, such as range of wrist motion and grip strength. Relatively short-term follow-up after the current treatment may have contributed to the lower responsiveness of psychosocial subscales of the SF-36 and objective measurement scales. MacDermid et al. [8] compared the responsiveness of the DASH, PRWE, and SF-36 scores in evaluating recovery after distal radius fractures. The PRWE score was the most responsive of the three in that group of patients (SRM, 2.27), followed by the DASH (SRM, 2.01) and the SF-36 (SRM, 0.92). This indicates that the PRWE score is a reasonably sensitive tool for assessing the outcome in patients with distal radius fractures. The current results are comparable with those of MacDermid et al., and the PRWE-J was found to be a sensitive measurement scale for patients with chronic ulnar wrist pain. Because of the high responsiveness, using the PRWE-J would minimize sample-size requirements for evaluating clinical trials for various wrist problems.

The result of a significant correlation between improvement in the PRWE-J and patient satisfaction indicated another aspect of the responsiveness with the PRWE-J. Although patient satisfaction generally focuses on clinical interaction with respect to a specific health-care service, achieving a painless wrist with greater functionality yielded higher satisfaction among the patients in the present study.

Improvement of normal wrist function with the PRWE-J was significantly correlated with changes in forearm supination and pronation after treatment of UAS, whereas almost no correlation was found between the function subscale of the PRWE-J and change in grip strength or flexion–extension motion. This result indicates that functioning of forearm rotation may be more important for daily living activities than wrist flexion–extension motion with powerful grip strength.

The limitation of the present study was the small number of patients with a short-term follow-up. A larger cohort

with long-term observation will elucidate the differences in responsiveness with various treatment modalities. Nevertheless, the responsiveness of the PRWE-J in evaluating patients with UAS was clearly demonstrated with the present series, probably as a result of the homogeneous population with relatively strict diagnostic criteria.

Conflict of interest None of the authors received any benefits or funds from any commercial party or company directly or indirectly related to the subjects of this article.

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