Validity, Reliability and Responsiveness of the Thai Version of Patient-Rated Wrist Evaluation (Th-PRWE) in Distal Radius Fracture Patients

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ABSTRACT

Objective: Patient-Rated Wrist Evaluation (PRWE) is a specific tool for the assessment of wrist function and has been validated and translated into many languages. This study aimed to translate the PRWE into the Thai language and to evaluate its validity, reliability, and responsiveness in operatively treated distal radius fracture patients.

Materials and Methods: PRWE was translated into the Thai language according to a linguistic validation protocol by a forward–backward translation process. In total, 53 distal radius fracture patients who underwent volar locking plate fixation were included in the present study. However, 8 patients were excluded due to multiple injuries, leaving 45 patients who were prospectively enrolled and evaluated with the Thai version of the PRWE (Th-PRWE) and Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire within 2 weeks of their surgery. Reliability of the Th-PRWE was assessed by the test–retest reliability and internal consistency. The content, concurrent, and criterion validity of the Th-PRWE were measured. At 3 months after the operation, patients were re-assessed with Th-PRWE and DASH. The standardized response mean (SRM) and effect size (ES) were assessed to identify the responsiveness to a change of the tool.

Results: Most of the patients were female (64%) with average age of 55 years old and had sustained distal radius fractures. The intraclass correlation for the test–retest reliability of the Th-PRWE was 0.9. The internal consistency of the Th-PRWE was acceptable (Cronbach's alpha = 0.93). Th-PRWE had a high content validity (Item-objective congruence index = 0.8) and excellent correlation with DASH (Spearman's rank correlation = 0.81; $p < 0.001$). Its responsiveness was also considered excellent (SRM = 1.12, ES = 1.28).

Conclusion: Th-PRWE is valid, reliable, and responsive for the evaluation of distal radius fracture patients.

Keywords: Psychometric; patient outcome assessment; wrist injury; radius fracture (Siriraj Med J 2021; 73: 275-281)

INTRODUCTION

Distal radius fracture is a common fracture in all age groups, especially in the elderly.[1] Nowadays, there is an increasing number of elderly in the population as well as an increasing incidence of fractures. Such an injury represents not only a physical problem, but also a psychological and socioeconomic problem. Moreover, patients may have difficulty with self-care and in performing the activities of daily living after the injury. Surgical treatment tends to yield superior outcomes, in terms of

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a faster return to the pre-injury status and functional outcomes, compared to conservative treatment, especially in active, independent patients.

Operative treatment with volar locking plate fixation of the distal radius fracture is increasingly performed to allow an early range of motion of the wrist and a faster recovery toward being able to perform daily activities. There are several outcome measurements for the hand and wrist, such as the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire, Boston Carpal Tunnel Questionnaire, Jebsen-Taylor Hand Function Test, and Michigan Hand Outcomes Questionnaire.[2] However, the wrist joint has many specific functions and should be evaluated separately from other joints of the upper extremity. The Patient-Rated Wrist Evaluation (PRWE) was developed as a specific tool for assessment of the wrist functions.[2-6] PRWE is a simple self-reported outcome measurement carried out by the patients in the form of a questionnaire that can take them only a few minutes to complete. This disease-specific questionnaire had been translated into many languages.[7-14] However, the questionnaire had never been translated into Thai language before.

Consequently, this study is aimed to develop a Thai version of the PRWE (Th-PRWE) and to evaluate its validity, reliability, and responsiveness for operatively treated distal radius fracture patients.

MATERIALS AND METHODS

The study protocol was approved by the Institutional Review Board of Siriraj Hospital and registered in the Thai Clinical Trials Registry (TCTR20180930002) (www.clinicaltrials.in.th).

The original English version of PRWE was translated into the Thai language according to the linguistic validation protocol by a forward-backward translation process. In this way, the final Thai language translation of PRWE was achieved. Three orthopedic surgeons and 2 orthopedic residents evaluated the content validity of the Th-PRWE by using an item-objective congruent index. The study prospectively enrolled distal radius fracture patients aged more than 18 years old who had been operatively treated with volar locking plate at a tertiary care hospital from July 2017 to April 2019. Patients with pathological fracture, concomitant neurovascular injury, impaired cognitive function, a known history of upper extremity disability, and multiple injuries were excluded from the study.

All the eligible participants were well-informed and consented to the study protocol before their participation. Participants completed the Th-PRWE and DASH questionnaire at 2 weeks after the operation and 1 week thereafter for evaluation of the test–retest reliability. At 3 months after the operation, the participants re-evaluated the Th-PRWE and DASH questionnaire to identify the responsiveness to a change of the tool.

Ethical approval: Ethical approval for this study was obtained from the Siriraj Institutional Review Board (Si 394/2017).

Outcome Measurements

Patient-Rated Wrist Evaluation (PRWE)[3]

The PRWE was developed by MacDermid et al. to assess pain and functional difficulties in the activities of daily living resulting from injuries to the wrist joint.

The PRWE comprises a 15-item patient-reported questionnaire, subcategorized into 2 subscales; a pain subscale and function subscale. The pain subscale has 5 items related to pain of the affected wrist at rest and during specific activities. The function subscale has 10 items, which rate a patient's difficulty in performing activities, which are further divided into 6 items corresponding to specific activities and 4 items corresponding to usual activities. Each item has a numeric rating scale, ranging from 0 to 10. The pain subscale has a maximum total score of 50 and the function subscale has a maximum total score of 100. A higher score reflects more pain or greater difficulty in performing the activities. The total score for the PRWE is obtained from a summation of the total pain subscale and half of the total function subscale. Therefore, the minimum score for the total PRWE that reflects the best outcome is 0, and the maximum score that reflects the worst outcome is 100.

$$Total\ score = Pain\ subscale + \frac{Function\ subscale}{2}$$

Disabilities of the Arm, Shoulder, and Hand (DASH) Questionnaire[15]

The DASH questionnaire was developed by a joint effort by the American Academy of Orthopedic Surgeons, the Council of Musculoskeletal Specialty Societies, and the Institute for Work and Health in Toronto. The questionnaire aims to assess the region-specific disability of an upper extremity. It is widely utilized for upper extremity difficulty measurement for various disorders. The DASH questionnaire has been validated and translated into many languages, including Thai.

The DASH questionnaire is a self-administered questionnaire and is composed of 2 sections: a required

section and an optional additional section. The required section has 30 items, with the score ranging from 1 to 5 for each item, where a higher score reflects increasing difficulty in performing activities. The score for the required section is calculated by summing all the scores for the responded items and then dividing by the number of responded items, followed by subtracting 1 and multiplying by 25. The total score for the required section ranges from 0 to 100, where a higher score reflects a greater difficulty in performing activities of the upper extremity. The optional section has an additional 8 questions for specific activities, including a work module and sports/performing art module. The scoring for the optional module is calculated in the same way as for the required section and the score ranges from 0 to 100.

Statistical analysis

Data analysis was performed using SPSS version 16.0 (SPSS Inc. Released 2007. SPSS for Windows, Version 16.0. Chicago, SPSS Inc.). Demographic data are shown by the range, mean, and percentage of the outcomes. Content validity was determined by using the index of the item-objective congruence. Construct validity was evaluated by comparing Th-PRWE with the Thai version of the DASH questionnaire and by calculating the Spearman's rank correlation coefficient. To determine the test–retest reliability and internal consistency, Spearman's rank correlation and Cronbach's alpha were calculated, respectively. Floor and ceiling effects more than 15% were considered significant. The effect size (ES) and standardized response mean (SRM) were calculated to detect the responsiveness to a change of the tool. ES and SRM values of more than 0.8 were considered large.

RESULTS

In total, 53 patients were screened for eligibility, but 8 patients were excluded from the study due to having multiple injuries. Consequently, 45 patients were consecutively enrolled into the study, comprising 16 males (36%) and 29 females (64%), with an average age of 55 years old. Forty-two percent of the patients had injuries to their dominant hand. The patients' demographic data are shown in Table 1.

At 2 weeks follow-up, the total mean score of the Th-PRWE was 43.5 (SD 21.1) and the total mean score of the Thai version of DASH was 48.9 (SD 21.5); while at 3 months, the total mean scores of the Th-PRWE and of the Thai version of DASH were significantly decreased to 16.5 (SD 13.5) and 18.0 (SD 15.3), respectively. (Table 2)

Validity

All 15 items on the Th-PRWE had good content validity, as demonstrated by the item-objective congruence (IOC) index. Only 4 items (pain when doing a task with repeated wrist movement in the pain subscale, fastening buttons on my shirt, carrying a 10-pound object in my affected hand, and recreational activities in the function subscale) had an IOC index of 0.8, while the other items had an IOC index of 1.

TABLE 1. Demographic data of the study participants.

Demographic data	Statistics (n = 45)
Gender	
Male	16 (36%)
Female	29 (64%)
Age (years) *	55 (13)
Injury to the dominant hand	19 (42%)
AO Classification	
23-A	11 (24.4%)
23-B	20 (44.4%)
23-C	14 (31.1%)

*Data presented as the mean (SD)

TABLE 2. Th-PRWE and Thai version of DASH outcomes.

Outcomes	Total mean score (SD)
Th-PRWE	
Baseline at 2 weeks	43.5 (21.1)
1 week after baseline	43.1 (21.1)
3 months	16.5 (13.5)
Thai version DASH	
Baseline at 2 weeks	48.9 (21.5)
3 months	18.0 (15.3)

The construct validity of the function subscale and the total score of the Th-PRWE revealed excellent correlation with the Thai version of DASH, as shown in Table 3. The Spearman's rank correlation between the function subscale of the Th-PRWE and the Thai version of DASH was 0.87, and the correlation between the total score of the Th-PRWE and of the Thai version of DASH was 0.81; $p < 0.001$. However, the pain subscale of Th-PRWE had only a moderate correlation with the total score of the Thai version of DASH (Spearman's rank correlation 0.39; $p = 0.008$).

Reliability

The reliability results for Th-PRWE are presented in Table 4. The intraclass correlation for the test-retest reliability of the total score for Th-PRWE was 0.90. Each item in the pain subscale had a high intraclass correlation (ICC) ranging from 0.64 to 0.85. Similarly, the function subscale also had an excellent ICC, ranging from 0.64 to 0.95. The internal consistency for Th-PRWE was considered excellent, as indicated by its Cronbach's alpha of 0.93. The questionnaire also had an acceptable floor and ceiling effect at 2 weeks follow-up. Only 2.2% of the patients had a floor effect on the pain subscale and 4.4% of the patients had a ceiling effect on the function subscale. None of the patients had a ceiling and floor effect on the total score.

Responsiveness to change

The standardized response mean (SRM) and effect size (ES) of Th-PRWE were considered to be high, as shown in Table 5. The standardized response mean of the pain subscale was 0.78, while it was 1.1 for the function subscale and 1.12 for the total score. The effect size of the pain subscale was 0.89, while it was 1.26 for the function subscale and 1.28 for the total score. These data demonstrated the significant clinical improvement of the patients from 2 weeks to 3 months after the operation.

DISCUSSION

Specific-disease functional outcomes are becoming increasingly important for monitoring a patient's recovery. PRWE is one of the outcome measurements for the evaluation of pain and function of the wrist. We translated this tool from English language into Thai language for use in Thailand. All the items in the questionnaire could be easily understood and it took about 5 to 10 minutes to complete the questionnaire. We converted the unit of measurement from 10 pounds to 5 kilograms in the "carrying an object" item, due to kilograms being more commonly used in Thailand than pounds. This modified item has also been applied and validated in other countries that use the International System of Units for measurements.

The study results revealed that Th-PRWE had excellent construct validity. However, only the pain subscale of Th-PRWE had a moderate correlation with the Thai version of the DASH questionnaire. The pain subscale contributed to a half of the PRWE score, while DASH, which specifically focuses on the disability of the upper extremity, has only 2 pain-related questions. Thus, the correlation between the pain subscale and the DASH was lower compared to for the function subscale.

The internal consistency and test–retest reliability of the Th-PRWE were excellent and comparable to other versions, suggesting that the Th-PRWE is easy to understand. However, two of the five items in the pain subscale demonstrated a moderate ICC (0.64–0.66). The moderate reliability of the pain subscale reflects the typical course of pain, which tends to be more responsive in the early period after distal radius fracture fixation. The one-week-apart period before testing the reliability

TABLE 3. Construct validity of the Th-PRWE relative to the Thai version of DASH.

Th-PRWE	Thai version of DASH Spearman's rank correlation	95% CI	p-value
Pain subscale	0.39	0.06–0.64	0.008
Function subscale	0.87	0.77–0.92	< 0.001
Total score	0.81	0.67–0.87	< 0.001

TABLE 4. Reliability test of the Th-PRWE.

Th-PRWE items	Test–retest ICC	95% CI
Pain at rest	0.78	0.64–0.88
Pain during repeated wrist movement	0.66	0.45–0.80
Pain during lifting a heavy object	0.64	0.43–0.79
Pain at its worst	0.84	0.73–0.91
Pain frequency	0.85	0.74–0.91
Turning a doorknob	0.90	0.83–0.94
Using a knife	0.64	0.43–0.78
Fastening buttons	0.89	0.80–0.94
Pushing up from a chair	0.82	0.69–0.90
Carrying a 5 kg object	0.95	0.92–0.97
Using bathroom tissue	0.91	0.84–0.98
Personal care activities	0.84	0.73–0.91
Household work	0.85	0.73–0.91
Usual everyday work	0.80	0.66–0.89
Recreational activities	0.87	0.78–0.93
Total score	**0.90**	**0.83–0.95**

TABLE 5. Responsiveness to change of the Th-PRWE.

Th-PRWE	SRM	ES
Pain subscale	0.78	0.89
Function subscale	1.10	1.26
Total score	1.12	1.28

Abbreviations: SRM = standardized response mean; ES = effect size.

of the tool might have affected the clinical difference in these patients. Some patients were externally immobilized with a slab for 2 weeks after fracture fixation, while others were allowed to move their wrist immediately. The rehabilitation program for the wrist is generally initiated after removal of any external immobilization, which might affect the pain during the third week. At 2 weeks after the operation, some of the patients were externally immobilized; therefore, they might have experienced only mild pain compared to a week later, at which time a range of motion exercises was advocated. Additionally, we observed a discrepancy in one item in the function section of the PRWE, namely, "cut meat using a knife with my affected hand", as reflected by its lower ICC (0.64) compared to the other items. This was possibly due to cultural differences in that most Thai people rarely use a knife to eat food. This discrepancy has also been demonstrated in other Asian versions of the PRWE, some of which modified the question; for instance, into "cut food using knife with my affected hand" in the Korean version[10] and "cut vegetables using knife with my affected hand" in the Hindi version.[11]

The responsiveness to change of the Th-PRWE between 2 weeks follow-up and 3 months follow-up were large (SRM = 1.12). We observed a higher minimum detectable change (MDC = 15.5) than the Korean version of the PRWE. They reported an MDC of 4.4 at 3 and 6 months in 63 patients with distal radius fractures treated by open reduction and locking plate fixation.[10] This difference could partly explain the higher ICC in their study and the different timing of the responsiveness evaluation. In a previous study by MacDermid et al., the highest responsive of the PRWE in distal radius cases was during the 0- to 3-months period. A lower responsiveness was found during the recovery period at 3- to 6-months, as the SRM in the first 3 months was 2.27 and then decreased to 0.74 in the next 3 months.[4] The SRM of our study was 1.12, suggesting that the Th-PRWE has a large responsiveness to change for distal radius fracture evaluation. Although, our study found an MDC of 15.5, indicating that the score must change by 15.5% to ensure the recovery of the patients. The change of Th-PRWE mean score between postoperative 2 weeks and 3 months was more than 20%; therefore, the Th-PRWE is an appropriate and effective tool to detect responsiveness after distal end radius fracture treatment.

There were some limitations to note, such as the study was performed in a short-term period for distal radius fracture; therefore, longer-term evaluation should be performed to identify any possibility of floor and ceiling effects in longer follow-up periods. The study showed that this tool has excellent responsiveness to change. Thus, it can monitor a patient's outcome and detect unfavorable results after the treatment. Another limitation is that the outcomes in this study only apply to operatively treated distal radius fracture patients. Future studies should be performed on other wrist disorders for assessing the generalizability of the tool.

CONCLUSION

The Th-PRWE provided excellent validity, reliability, and responsiveness to change. This disease-specific measurement can effectively be used for the outcome measurement of operatively treated distal radius fracture patients.

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