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Reliability and validity of the Turkish version of patient-rated ulnar nerve evaluation scale

Meliha Kasapoglu Aksoy[1], Alper Aksoy[2], Ilker Ercan[3], Lale Altan[4]

ABSTRACT

Objectives: The aim of this study was to investigate the validity and reliability of the Turkish version of the 'Patient-Rated Ulnar Nerve Evaluation'(PRUNE-T) scale.

Patients and Method: 51 patients diagnosed with cubital tunnel syndrome were included to this study. PRUNE scale was translated into Turkish by using cross-cultural adaptation process which can be used for the follow-up. All patients filled PRUNE-T, Q-DASH, SF-12 forms. HGS were measured. Two hours after the evaluation, the PRUNE-T scale was refilled. The internal consistency reliability of the scale and its subscales were examined by Cronbach Alpha coefficient. The reliability of the scale was evaluated with test-retest reliability method. The compliance validity of the scale was evaluated by examining its relationship with Q-DASH and SF-12. The construct validity was evaluated according to the variables of the HGS. The relationships between variables were evaluated by Spearman's rho coefficient. Intergroup comparisons were performed using Wilcoxon signed-rank test.

Results: Cronbach's alpha coefficient was calculated as 0.919 in the overall total reliability analysis of the PRUNE-T. In test-retest reliability, the correlation coefficient was 1 for the total score ($p < 0.001$). No statistically significant difference was observed between the scores of test-retest measurements ($p > 0.05$). There was significant correlation between Q-DASH score and SF-12 score with PRUNE-T ($p < 0.001$). There was a significant relationship between the HGS and the scores of usual activities subscale and total score of PRUNE-T ($p < 0.001$).

Conclusion: The results of our study showed that the PRUNE-T questionnaire which can be used for the follow-up of the clinical condition and treatment outcomes was valid and reliable in ulnar nerve entrapment. PRUNE-T scale is an easy-to-perform scale with a short completion time, which can be used for the follow-up of the clinical condition and treatment outcomes.

Key words: *Ulnar nerve evaluation, reliability, validity, patient-rated*

Introduction

Due to its anatomical course, the ulnar nerve may suffer damage and entrapment due to various factors [1]. Cubital tunnel syndrome develops as a result of trapping of the ulnar nerve in the elbow region, where it is most often exposed to local compression and trauma. Cubital tunnel syndrome is the second most common entrapment neuropathy of the upper extremity after

Author affiliations : *[1] Department of Physical Medicine and Rehabilitation, University of Health Sciences Bursa Yüksek İhtisas Training and Research Hospital, [2] Department of Plastic Reconstructive and Aesthetic Surgery, Bursa Konur Hospital, [3] Department of Biostatistics, Uludağ University Medicine Faculty, [4] Department of Physical Medicine and Rehabilitation, Uludağ University Medicine Faculty, Bursa, Turkey*

Correspondence : *Meliha Kasapoglu Aksoy, MD, Department of Physical Medicine and Rehabilitation, University of Health Sciences Bursa Yüksek İhtisas Training and Research Hospital, Bursa, Turkey. e-mail: melihakasapoglu@hotmail.com*

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entrapment of the median nerve [2,3]. Motor deficits, sensory deficits or autonomic changes may be seen after nerve entrapment. Trapping of the ulnar nerve in the elbow can also lead to disability due to pain and motor loss. There is pain in the ulnar side of the forearm and hand, and sensory loss in the fourth and fifth fingers in patients with mild compression, whereas in patients with more severe compression, weakness, muscle atrophy, and clawing of the fingers may occur. The persistence of symptoms creates a significant limitation of the functions of the upper extremity [1,3].

Many conservative and surgical modalities are used in the treatment of cubital tunnel syndrome. Conservative treatment modalities include overnight use of elbow extension splints, use of non-steroidal anti-inflammatory drugs and modification of activities [4,5]. Surgical treatments is performed when conservative treatment fails or in the presence of chronic compression or atrophy of intrinsic muscles of the hand. Surgical treatment options include in situ decompression, endoscopic in situ decompression, anterior transposition (subcutaneous, intramuscular, submuscular) and medial epicondylectomy [6-8]. An appropriate scale is important and necessary to monitor the outcome of these treatment modalities and to determine the severity of cubital tunnel syndrome [8,9].

In a review evaluating follow-up parameters for the treatment of ulnar neuropathy, it was observed that neurophysiologic evaluations or the parameters used for the evaluation of hand and upper extremities were more frequently used [10]. However, these surveys have limitations in assessing functional status and daily living activities in patients with ulnar nerve injury. Based on these limitations, Mac-Dermid and Grewal developed a scale called 'Patient-Rated Ulnar Nerve Evaluation (PRUNE)', which has been proposed as a valid and safe scale that can be used in both clinical practice and scientific studies to assess daily living activities and symptoms experienced by patients with ulnar nerve injury. The PRUNE scale, which was published in English, was found to be valid, sensitive and reproducible [11]. The Polish version of PRUNE was found valid and reliable also [12].

The literature review did not show a comprehensive assessment scale in the Turkish language evaluating of the ulnar nerve neuropathy. The aim of this study was to investigate the validity and reliability of the Turkish version of the PRUNE scale.

Patients and Methods

This study included patients aged 18 to 65 years who were diagnosed with cubital tunnel syndrome confirmed by clinical evaluations (tinel's sign, ulnar nerve sensorial loss, muscle weakness and elbow flexion were evaluated on their physical exam before) and Electroneuromyography (ENMG). We excluded patients with carpal tunnel syndrome, cervical radiculopathy, endocrinological disease such as DM and hypothyroidism that could cause polyneuropathy, inflammatory rheumatic disease, and malignancy.

Translation of the Turkish PRUNE

After obtaining written permission from the original developer (Dr JC MacDermid) of the PRUNE scale the survey, written in English, was translated into Turkish by two independent senior interpreters (one physiatrist, one hand surgeon), both of who were native Turkish speakers and fluent in English. Physiatrist was not informed about the study concept. In this study we used Beaton's guideline for the cross cultural adaptation process [13]. Both translations were evaluated in a session attended by researchers and translators, and a common form was created. Afterwards, this common form was translated back into English by two separate non-physician (English teacher, professional translator) people who were native English speakers to assess compliance with the original form. All translations were compared by the committee, which consisted of translators (one physiatrist, one hand surgeon, English teacher, professional translator), and researchers and the final version of the PRUNE Turkish (PRUNE-T) scale was created. PRUNE-T was tested on 5 patients with cubital tunnel

syndrome, all of whom were native Turkish speakers. Those patients asked to indicate any ambiguous questions. After this step, final version of the questionnaire was produced and used throughout the study.

Measurements

The demographic data of the patients were recorded and the PRUNE-T scale was filled in. In PRUNE, the questions were divided into four groups: the first six questions in the first section assess pain-related symptoms, the four questions in the second section sensory / motor symptoms, the six questions in the third section evaluate specific activity, and the four questions in the fourth section evaluate usual activities (personal care, household, work and recreation). Each question is scored between 0 and 10 points: 0 points are considered as no pain or difficulty, whereas 10 points are considered as the worst possible pain and complete inability. Scoring system was created to collect the scores given by the patients to the questions. (Pain 60 points, sensory / motor 40 points, specific activity 60 points, and usual activity 40 points). The overall assessment score ranges from 0 (no symptoms or no difficulty) to 100 (excessive difficulty or pain in functional activities). The total score is obtained by dividing the sum of the 10 questions used to evaluate symptoms and the 10 questions used for functional evaluation by two (0-100) [11].

The disability of arm, shoulder and hand (DASH) questionnaire, is a standardized questionnaire which evaluates impairments and activity limitations, as well as participation restrictions for both leisure activities and work [14,15]. Quick-DASH (Q-DASH) is a shortened version of the DASH scoring system. It consists of 11 items to measure physical function and symptoms in people with any or multiple musculoskeletal disorders of the upper limb. At least 10 of the 11 items must be answered in order to calculate the score of this scale [14]. Each item was scored between 1 and 5, where the high score indicates an increase in the severity of symptoms or the level of difficulty. The total score collected from the sub-parameters ranged from 0 (no difficulty or symptoms) to 100 (unable to perform activity or very severe symptoms) [15,16]. All patients filled the Q-DASH scale.

SF-12 form was used to evaluate daily living activities. The 12-Item Short-Form Health Survey (SF-12) was developed by taking 12 different items from 8 different subtitles of SF-36 [17]. In a study developed by The Institute of Health in 1994 and published in the journal Medical Care, SF-12 was compared to SF-36 and reported to be more advantageous in terms of ease of administration and shorter completion time [17,18]. The SF-12 has a physical and a mental component (PCS-12 and MCS-12) that have been applied in the general population and subjected to regression analysis [19].

Hand grip strength (HGS) was evaluated in all patients. Standard Jamar dynamometer (Jamar® Plus+ Digital Hand Dynamometer from Patterson Medical by Sammons Preston) was used to measure grip strength of the hand (HGS). Jamar Dynamometer has been accepted as the gold standard for the evaluation of grip strength as it has a high level of validity and reliability. Measurements were performed in sitting position, with an adducted shoulder, a 90-degree flexed elbow, and a forearm positioned in a neutral position between supination and pronation [20-22]. Grip strengths were measured 3 times with 1-minute resting intervals and their averages were calculated. The grip strength was measured in kilogram-force [Kgf].

Two hours after the evaluation, the PRUNE-T scale was refilled by the patients.

The study was approved by the local ethics committee (2011-KAEK-25 2018/05-12) and the patients were informed about the study and signed an informed consent form.

Statistical analysis

The normality of distribution of data was tested by Shapiro-Wilk test. The internal consistency reliability of the scale and its subscales were examined by Cronbach Alpha coefficient. The items in the scale and sub-

scales were evaluated with the reliability coefficient and the whole correlation coefficient when one item was removed. The compliance validity of the scale was evaluated by examining its relationship with Q-DASH and SF-12. The construct validity was evaluated according to the variables of the hand grip strength. The relationships between the normally distributed variables were evaluated by Pearson correlation analysis, whereas the relationship between non-normally distributed variables were evaluated by Spearman's rho coefficient. Intergroup comparisons were performed using T-test for normally distributed variables, whereas Wilcoxon signed-rank test was used for non-normally distributed variables. Descriptive statistics were given as mean ± SD when parametric test was applied and median (min-max) when non-parametric test was applied. An alpha = 0.05 was considered as the level of statistical significance. In addition, the reliability of the scale was evaluated with test-retest reliability method in addition to Cronbach's alpha coefficient.

Results

The study was completed with 51 patients diagnosed with cubital tunnel syndrome. Of the patients, median age was 48 (21-65) years, 32 (63%) were female, 19 (37%) were male, 25 had right arm involvement, 26 had left arm involvement, and the mean duration of complaints was 12 months (2-98 months). The BMI of the patients was 29,46 (25,59-35,20). The median PRUNE score of patients were 100 (32-165). With dividing sum by 2 the median value were 50 (16.00-82.50) (Table 1).

Internal consistency

Cronbach's alpha coefficient was calculated as 0.919 in the overall total reliability analysis of the PRUNE-T (Table 2). In the internal consistency assessment of the sub-scales of the PRUNE-T scale, the Cronbach's alpha coefficient was found to be 0.851 for the pain subscale, 0.834 for the sensory/motor subscale, 0.908 for specific activities, and 0.848 for usual activities (Table 3).

Table 1. The demographic characteristics of the participants.

	N=51
Age (year)	48 (21-65)
Gender (female/male)	32 (%63) /19 (37)
BMI	29,46 (25,59-35,20)
Effected side (right/left)	25 (%49) /26(%51)
Duration of complaints (month)	12 (2-98)
PRUNE-T	100 (32-165)

BMI: Body Mass Index, PRUNE-T: Turkish version of the 'Patient-Rated Ulnar Nerve Evaluation', The values were given as median (minimum:maximum) and percentages (%).

Table 2. Internal consistency reliability of PRUNE-T for individual item.

Item number	Item-Total correlation	Cronbach's Alpha if item deleted	Cronbach Alpha
1	0.692	0.912	0,919
2	0.608	0.914	
3	0.515	0.916	
4	0.453	0.917	
5	0.424	0.919	
6	0.479	0.917	
7	0.129	0.925	
8	0.492	0.916	
9	0.478	0.917	
10	0.637	0.913	
11	0.700	0.912	
12	0.595	0.914	
13	0.703	0.912	
14	0.854	0.908	
15	0.686	0.913	
16	0.673	0.912	
17	0.523	0.916	
18	0.734	0.911	
19	0.710	0.912	
20	0.637	0.914	

PRUNE-T: Patient-Rated Ulnar Nerve Evaluation – Turkish

Test/retest reliability

Test-retest reliability was demonstrated for all items and sub-scales. In test-retest reliability, the correlation coefficient was 0.998 for pain, 0.999 for sensory/motor, 0.999 for specific activity, 0.996 for usual activi-

Table 3. Internal consistency reliability of PRUNE-T for subscales.

PRUNE-T	Question number	Item-total corelation	Cronbach's Alpha if item deleted	Cronbach Alpha
Pain subscale	1	0.788	0.802	0,851
	2	0.751	0.803	
	3	0.643	0.825	
	4	0.511	0.848	
	5	0.562	0.843	
	6	0.597	0.834	
Sensory/ motor subscale	7	0.459	0.879	0.834
	8	0.688	0.781	
	9	0.814	0.716	
	10	0.724	0.763	
Spesific activity subscale	11	0.664	0.902	0.908
	12	0.699	0.898	
	13	0.781	0.887	
	14	0.825	0.879	
	15	0.822	0.882	
	16	0.704	0.899	
Usual activity subscale	17	0.476	0.894	0.848
	18	0.769	0.770	
	19	0.783	0.764	
	20	0.757	0.785	

PRUNE-T: Patient-Rated Ulnar Nerve Evaluation – Turkish

Table 4. The test-retest reliability for subscales of PRUNE-T.

	r	p value
Pain subscale	0.998	<0.001
Sensory/Motor subscale	0.999	<0.001
Spesific activity subscale	0.999	<0.001
Usual activity subscale	0.996	<0.001
Total score	1	<0.001

PRUNE-T: Patient-Rated Ulnar Nerve Evaluation – Turkish

ty, and 1 for the total score (p <0.001) (Table 4).

No statistically significant difference was observed between the scores of test-retest measurements (p> 0.05) (Table 5).

Criterion/construct validity

There was a significant correlation between Q-DASH scale and pain, sensory/motor, specific activity and usual activity subscales and total scale of the PRUNE-T (p <0.001). There was a significant negative correlation between the physical component of SF-12 and the total scale and all subscales, whereas a significant negative correlation was found between the mental component and total scale and all subscales except for the sensory/motor subscale (p <0.001). There was a significant negative relationship between the hand grip strength and the scores of usual activities subscale and total scale (p <0.001) (Table 6).

Table 5. The test-retest reliability for all the individual items of PRUNE-T.

Item number	Test median (min-max)	Retest median (min-max)	p value
1	8 (0-10)	8 (1-10)	1,000
2	4 (0-10)	4 (0-10)	0,564
3	5 (0-10)	5 (0-10)	0,083
4	9 (3-10)	9 (4-10)	0.655
5	5 (0-10)	6 (0-10)	0.564
6	9 (0-10)	9 (1-10)	0.317
7	7 (0-10)	7 (1-10)	0.317
8	5 (0-10)	5 (1-10)	0.157
9	4 (0-10)	4 (0-9)	1,000
10	5 (0-9)	5 (0-9)	1,000
11	2 (0-10)	2 (0-9)	0.317
12	5 (0-10)	5 (0-9)	0.317
13	5 (0-10)	5 (1-10)	0.157
14	5 (0-10)	5 (0-9)	1,000
15	6 (0-10)	6 (0-10)	0.317
16	3 (0-10)	3 (0-9)	0.564
17	3 (0-7)	3 (0-7)	0.564
18	5 (0-10)	5 (0-9)	0.180
19	5 (0-9)	5 (0-8)	0.564
20	5 (0-8)	5 (0-8)	1,000

PRUNE-T: Patient-Rated Ulnar Nerve Evaluation – Turkish

Discussion

Our study revealed that the Turkish version of the Patient-Rated Ulnar Nerve Evaluation Scale was valid and reliable.

Developers of the scale should perform reliabili-

Table 6. Criterion and construct validity of PRUNE-T against Q-DASH, SF-12 and the Hand Grip Strength.

PRUNE-T	Pain subscale		Sensory/motor subscale		Spesific activity subscale		Usual activity subscale		Total score	
	r	p	r	p	r	p	r	p	r	p
Q-DASH	0.585	<0.001	0.439	0.001	0.769	<0.001	0.849	<0.001	0.841	<0.001
Hand grip strength	-0.208	0.144	-0.206	0.148	-0,163	0.253	-0.441	0.001	-0.288	0.041
SF-12 PCS	-0.392	0.004	-0.369	0.008	-0.537	<0.001	-0.559	<0.001	-0.567	<0.001
SF-12 MCS	-0.412	0.003	-0.251	0.075	-0.372	0.007	-0.483	<0.001	-0.475	<0.001

SF-12 PCS: Short form-12 physical state assessment, SF-12 MCS: Short form-12 mental state assessment, Q-DASH: The quick disability of arm, shoulder and hand questionnaire, PRUNE-T: Patient-Rated Ulnar Nerve Evaluation – Turkish

ty and validity studies and those who apply the scale should question whether the reliability and validity studies of the scale would be performed. If there are significant differences between the society in which the reliability and validity of the scale is examined and the societies that are considered to be applied later, the reliability and validity of the scale may need to be re-examined [23].

Outcome measurements are required using appropriate assessment scales to document progress in the treatment process after nerve repairs, provide feedback to the treatment team and the patient, and determine the level of disability after injury. In addition, scales are of great importance in evaluating the effectiveness of both surgical and rehabilitation methods and demonstrating the superiority of these methods. The standardization of management and scoring of test instruments and protocols is of paramount importance in order to allow comparison of different treatment methods, and different centers treatment outcomes [24,25]. In clinical use, it is also important that the evaluation method should be practical and not require additional costs [26].

The tools and methods used to assess nerve function during the follow-up period should provide significant information about recovery, be repeated over time, and show small but significant changes in recovery. These characteristics are defined as validity, reliability and responsiveness in the measurement theory and determine the degree of confidence in the data obtained [26,27]. The validity of a scale should be shown statistically before it can be used for patient evaluation and follow-up. Validity analysis should be performed with appropriate validity coefficients.

The scales are considered to be highly reliable when the Cronbach's alpha coefficient is greater than 0.81 [28]. In our study, Cronbach's alpha coefficient for the scale was found to be 0.919. This ratio shows a high level of internal consistency. The Cronbach's alpha coefficient was found to be 0.851 for the pain subscale, 0.834 for the sensory/motor subscale, 0.908 for specific activities, and 0.848 for daily activities. It can be stated that the PRUNE-T is a highly reliable scale in terms of the scale as a whole and its subscales. The reliability of the scale increases as the number of items in the sample of scales. In this respect, even if the number of items in the subscales of the scale decreases, reliability levels are not affected much [29]. Number of items in PRUNE-T scale is enough for high reliability.

The test-retest method is to apply a measuring instrument twice to the same group of subjects under the same conditions at a time interval that is long enough to prevent significant recalls, but is short enough not to allow significant changes in the properties to be measured [30,31]. Studies of test-retest reliability for health-related quality of life instruments have used varying intervals between test administrations. The interval has ranged from 10 minutes to 1 month. In our study, the retest time was 2 hours because a longer in-

terval could have led to changes in the symptoms of the patients whereas a shorter interval could allow the patients to recall the answers given to the questions of the firsth scale clearly [32,33].

It is necessary to be confident that the information provided with the scale is stable and free of errors and that the same results will be obtained in the second measurement for the same purpose. In test-retest reliability, the correlation coefficient was 0.998 for pain, 0.999 for sensory/motor, 0.999 for specific activity, 0.996 for daily activity, and 1 for the total score. The validity and reliability study for PRUNE in Poland determined the re-evaluation period as 24 to 48 hours, and the correlation coefficient was 0.92 for pain, 0.79 for numbness and motor symptoms, 0.87 for specific activities, 0.92 for daily activities and 0.93 for total score.

Although outcome measures after nerve injuries generally focus on the improvement of sensory and motor functions, it is observed that the activity and participation levels of the patients have recently taken an important place in the evaluation programs. This patient-oriented approach is closely related to the main goal of treatment approaches, which aim to optimize health-related quality of life and activity and participation levels of individuals with injuries. Because none of the physical assessment methods can fully assess the impact of injury and treatment on the patient's daily living activities and quality of life [34,35].

General surveys evaluate the general health by considering the different aspects of an individual's life without regarding any particular disease. Short Form-36 is the most valid and well-known questionnaire in this group. A shorter alternative to this form is the Short Form-12 [36,37].

In our study, Q-DASH and SF-12 were used for compliance validity and HGS was used for construct validity. Kozeij et al. [12] used Michigan Hand Outcome Questionnaire, VAS and DASH for compliance validity, and HGS and finger pinch strength test for compliance validity. Kozeij et al. [12] showed a significant correlation between DASH and PRUNE scales. In our study, we also found a significant correlation between Q-DASH and PRUNE. We also observed a significant correlation between PRUNE and SF-12 (PCS) and SF-12 (MCS). Szekeres et al. [38] found a moderately significant negative correlation between PRUNE and HGS, whereas Kozeij et al. [12] found a low correlation between HGS and PRUNE-T total score. In our study, we also found a low negative correlation between HGS and PRUNE-T total score.

In a study investigating the effectiveness of endoscopic neurolysis of the ulnar nerve in cubital tunnel syndrome, the preoperative median PRUNE score were found to be 103,1 (25-181) and the postoperative median PRUNE score were 26,3 (0-135) [38]. They did not divided the total score by 2. In our study the median PRUNE score in cubital tunnel syndrome patients were 100 (32-165). Kozeic et al. [12] found total mean PRUNE score in cubital tunnel syndrome patients 44.4±20.4 with dividing total score by 2. In our study similar to Poland version the mean PRUNE score was 49.11±15,71 with dividing total score by 2.

The results of our study showed that the Turkish version of the PRUNE questionnaire was valid and reliable. The patient-rated ulnar nerve evaluation scale is an easy-to-perform scale with a short completion time (5 minutes), which can be used for the follow-up of the clinical condition and treatment outcomes.

Conflict of interest statement

The authors have no conflicts of interest to declare.

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