

Validity and Reliability of the Thai version of the Prosthetic Profile of the Amputee (PPA)

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ABSTRACT

Objectives: To test psychometric properties in terms of validity and reliability of the Thai version of the Prosthetic Profile of the Amputee (PPA).

Study design: Descriptive cross-sectional design.

Setting: Outpatient prosthetic service of the Department of Rehabilitation Medicine at Siriraj Hospital, Suratthani Hospital, Songklanagarind Hospital and Maharaj Nakhonratchasima Hospital.

Subjects: Three hundred and twenty-one unilateral lower-extremity amputees who used prostheses were recruited for questionnaire interview.

Methods: The original PPA questionnaire was asked for permission from the developer to be translated into Thai. A forward/backward translation was done by two different groups of one physiatrist and one translator. Both English versions were approved consistency by an American prosthetist. A group of content expert composed of one physiatrist specialized in prosthetics, two prosthetists and one amputee verified the final version. After that the amputees were enrolled and interviewed with the PPA, Thai version. The data from the PPA, Thai version were tested for construct validity, and discrimination type, in the Locomotor Capability Index (LCI) domain by comparing scores between transfemoral and transtibial groups, and comparing scores between groups in other domains. The test-retest reliability of other domains was also analyzed.

Results: The PPA-Thai version has test-retest reliability when tested in some domains such as percentage of locomotor activity, walking distance with the prostheses, walking attention, self-care activities, and acceptance to amputation. In terms of construct validity, and discrimination type, the LCI domain has ability to discriminate amputees with regard to compliance with prosthetic use, walking distance, walking attention, limitation of walking; however, the LCI domain had no evidence of discrimination between transtibial and transfemoral amputees' walking ability.

Conclusion: The Thai version of the Prosthetic Profile of the Amputee (PPA) has test-retest reliability, and the Locomotor Capability Index (LCI) domain has discrimination validity to differentiate amputees with different ambulation levels but not with levels of amputation.

Keywords: amputee, prostheses, locomotion, reliability, validity

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Introduction

Lower-extremity amputation is a common condition bringing patients to rehabilitation service. Common causes of amputation are traumatic injury and peripheral vascular disease. The rehabilitation program requires multidisciplinary approach including medical management, physical exercise and prosthetic prescription to achieve highest functionality.⁽¹⁾ The prosthetic service should start from pre-amputation period, but most of care usually begins after amputation when the wound is completely healed. Prosthetic management requires information regarding to patients' profile such as underlying medical conditions, physical conditioning, previous functional level and careers which amputees need to return to.⁽²⁾ However, we had never had collected proper database of our amputees and their prosthetic uses. In order to develop such database, information such as amputees' background, functional performance, and quality of life, should be collected.⁽³⁾

The Prosthetic Profile of the Amputee (PPA) questionnaire established in 1994 is a common measurement tool used in prosthetic service and research.⁽⁴⁾ This questionnaire could be completed in 30 minutes.⁽⁵⁾ The questionnaire consists of 44 questions divided into 6 domains: 1) physical condition, 2) prosthesis, 3) prosthetic use, 4) environment, 5) leisure activities and 6) general information. In the domain of prosthetic use, there is a subset of locomotion capability index (LCI) which consists of 14 questions^(4,5) describing mobility skills with prostheses inside and outside the house. Seven questions are basic mobility skills while the other seven questions are advanced mobility skills. Each question is rated as unable, able with help, able with supervision and able to do the activity alone. The LCI total score is 42. To test construct validity and convergence type, "prosthetic use" of the PPA questionnaire was compared with "ability to do

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daily function” of the Reintegration to Normal Living (RNL) questionnaire and found moderate convergence of these two questionnaires ($r = 0.56, p < 0.01$).⁽⁴⁾ And when comparing “perceptions of self” in the RNL to “acceptance of amputation and prosthesis” in the environment domain of the PPA, somewhat good convergence ($r = 0.64, p < 0.01$) was found. In terms of reliability testing, the PPA had excellent test-retest reliability and the intraclass coefficient was 0.92 ($p < 0.001$).⁽⁵⁾

Regarding the locomotor capability index (LCI) which is a subset of the prosthetic use domain in the PPA questionnaire, it consists of 2 groups of 7 questions measuring basic and advance mobility.⁽⁴⁾ The intraclass coefficient of the LCI was 0.80 ($p < 0.001$)^(4,5) and had good internal consistency with Cronbach alpha of 0.95.^(4,5)

In terms of concurrent validity testing, the LCI was compared to the Functional Independence Measurement (FIM) and the Amputee Activity Score (AAS), and there was concurrent validity ($X^2 = 57.28, p < 0.01$).⁽⁵⁾ Regarding test-retest reliability, the LCI had excellent reliability (intraclass coefficient = 0.80).⁽⁵⁾ It takes 5 minutes to complete the LCI subset questions.⁽⁶⁾

According to the above-mentioned, we decided to use the PPA questionnaire to provide a comprehensive database to improve our prosthetic service and to decrease cost of prosthetic management. However, this questionnaire is in English and must be translated into Thai, adapted and tested for psychometric properties. The objective of this study was to estimate test-retest reliability of the Thai version of the PPA questionnaire and to evaluate validity in the LCI domain of the PPA in terms of discrimination property.

Methods

This study was conducted at 4 outpatient amputee clinics at Siriraj Hospital, Surattani Hospital, Songklanakarind Hospital and Maharaj Nakhonratchasima Hospital. All are tertiary care hospitals providing prosthetic service to amputees. This study protocol was approved by the Ethical Committee of Faculty of Medicine Siriraj Hospital. Every participant had to complete a written-informed consent before completing the questionnaire. To be noted, this study used the same questionnaire as another study titled “Factors affecting returning to work of unilateral lower-extremity amputees who receiving prostheses”.

Participants

Unilateral lower-extremity amputees with below-knee, knee or above-knee amputation, who visited outpatient clinics for maintenance or prosthesis replacement, were invited to the study. Nurses at the clinic gave them information for a written consent. Inclusion and exclusion criteria were as follows:

Inclusion criteria: at least 18-year old, using their prostheses for at least one year, working or studying before

amputation, being able to understand and speak Thai.

Exclusion criteria: congenital limb deficiency, medical conditions causing weakness of any extremities which interfering with putting on or walking with the prostheses, other unstable medical conditions such as cancer, uncontrolled cardiac diseases that disturbing functions; active psychiatric conditions, and communication problems.

Based on the study of William C. Miller, et al,⁽⁷⁾ the mean LCI score in the transtibial amputee group was 26 and in the transfemoral amputee group was 23, the standard deviation was 8, and the difference between LCI scores was 3. Using nQuery Advisor version 7.0, a calculated sample size per group was 113 which would have 80% power to detect a difference in means of 3 assuming that the common standard deviation is 8 using a 0.05 two-sided significance level. And to prevent incomplete data collection, 30% of cases were reserved, and the total number of cases collected was 322.

For test-retest reliability, based on the aforementioned study,⁽⁷⁾ a calculated sample size was 51, when an expected intraclass correlation was 0.8 and a two-sided 95% confidence interval computed using a large sample normal approximation for an intraclass correlation based on 2 intra-raters that extended about 0.1 from the observed intraclass correlation. A total number of amputees were approximated up to 60 in total or 30 cases per group.

Study protocol

Before translation, the researchers asked for permission from the developer of the PPA questionnaire.⁽⁴⁾ Then the original PPA written in English was translated into Thai by an experienced physiatrist and a professional translator. And a back-translation into English was performed by another professional translator and a physiatrist. The back-translated version and the original English version were then compared and approved by an American native speaker prosthetist that both versions were compatible.

A committee of one physiatrist specialized in prosthetics, two prosthetists and one amputee reviewed the Thai version and provided one change in content to match with the Thai culture⁽⁸⁾ i.e., “walking for one block of building” to be “walking for a distance between two adjacent bus stops”.

The enrolled amputees were then interviewed by physiatrists, prosthetists or rehabilitation nurses to complete the PPA, Thai version. All interviewers were trained to interview with the questionnaire. For test-retest reliability, 30 amputees from each group, the transtibial and the transfemoral groups, were selected by simple randomization, and interviewed again two weeks after the first interview. Those who could not return to a hospital for a face-to-face interview would be interviewed by telephone by the same interviewer.

Statistical analysis

Descriptive data such as demographic data are presented as mean (standard deviation, SD) or median and inter-quartile

range and Cohen effect size. For discrimination test, this validity was analyzed with unpaired t-test (normality), Mann-Whitney U-test (non-normality), and analysis of covariance by using age and causes of amputation as covariate. Regarding test-retest reliability, intraclass correlation coefficient was applied for total score evaluation, while Cohen Kappa was used in case of binary data (nominal scale) and weighted Kappa was used for ordinal data (ordinal scale). P-value less than 0.05 was considered statistically significant. All data analyses were performed using SPSS Statistics version 18.0 (SPSS Inc., Chicago, IL, USA).

Results

The total numbers of amputees recruited in this study was 312 (Table 1) but 308 reported causes of amputation.

Test-retest reliability

According to incomplete data, only 11 questionnaires from each group were analyzed for test-retest reliability. Parts of the PPA questionnaire were selected for the test including

LCI domain, daily-activity questions and self-acceptance of amputation and self-acceptance of prostheses questions. The acceptance questions were 1-5 score rating which presented as numbers of participants rating in each score. For LCI domain alone, the ICC was 0.904 and the 95% CI was between 0.769-0.960. The test-retest reliability of all tested parts is shown in Table 2.

Discrimination test

The LCI subset has 14 questions with a total score of 42. This subset was selected for discrimination testing between the transfemoral (above-knee) amputees and the transtibial (below-knee) amputees. The result showed no statistical difference between both groups as shown in table 3. When considering 7 advanced mobilities (pick up an object from the floor when you are standing up with your prosthesis, get up from the floor if you fell, walk outside on uneven ground, walk outside in inclement weather, go upstairs without a hand-rail, go downstairs without a hand-rail, and walk while carrying an object), in the LCI subset, the score of these activities was evaluated for the discrimination, and there was no statistical

Table 1. Demographic data of all 312 participants

	All	AK	BK	p-value
Number ¹	312	101 (32.4)	211 (67.6)	
Mean age ²	45.8 (15.1)	42.5 (14.7)	47.4 (15.1)	0.007
Sex ¹				
Male	239 (76.6)	87 (86.1)	152 (72)	0.006
Female	73 (23.4)	14 (13.9)	59 (28)	
Onset since amputation ³	0.4 [0.25, 0.75]	0.5 [0.25, 1.0]	0.4 [0.25, 0.67]	0.329
Causes of amputation [*]	308	100	208	
Traumatic cause ¹		85 (85.0)	132 (63.5)	< 0.001
Non-traumatic cause ¹		15 (15.0)	76 (36.5)	

^{*}Total number of causes of amputation was 308

¹Number (%), ²mean (SD), ³median [P25, P75]

AK, above-knee amputation; BK, below-knee amputation

Table 2. Test-retest reliability of the PPA questionnaire of 22 participants.

	Test	Retest	reliability coefficients	p-value
LCI sum score ¹ (n=42)	40.1 (5.0)	40.9 (3.3)	0.90 ^I	< 0.001
Sitting time ≥ 50% of a day ²	9 (40.9)	10 (45.4)	0.68 ^K	< 0.001
Sitting time of a day ³ 0%/25%/50%/75%/100%	3/10/5/4/0	3/9/5/5/0	0.66 ^{KW}	< 0.001
Standing or walking time ≥ 50% of a day ²	18 (81.8)	17 (77.3)	0.74 ^K	< 0.001
Standing or walking time of a day ³ 0%/25%/50%/75%/100%	0/4/5/11/2	0/5/5/9/3	0.69 ^{KW}	< 0.001
Walking distance with prostheses ³ Unlimited/1-bus stop/less than 1-bus stop	20/2/0	18/2/2	0.63 ^K	< 0.001
Automaticity of gait ³ Automatic/attention	15/5	13/7	0.53 ^K	0.015
Activity with help score ¹ (total score = 16)	15.9 (0.3)	16.0 (0.0)	n/a	
Acceptance of amputation scores ³ (total score = 5) 1/2/3/4/5	0/0/1/1/20	0/1/3/1/17	0.40 ^{KW}	0.006
Acceptance of prostheses score ³ (total score =5) 1/2/3/4/5	0/0/0/2/20	0/0/2/4/16	0.33 ^{KW}	0.016

¹Mean (SD), ²number (%), ³number; n/a, not applicable

I, Intraclass correlation coefficient; K, Cohen kappa; KW, weighted kappa

difference between both the two groups as shown in Table 3.

Because of baseline difference between the two groups of amputees, the transtibial group had older in age and higher in numbers of non-traumatic cases. The unpaired t-test and analysis of covariance were applied by using age and causes of amputation as covariate. The mean difference between groups is shown in Table 4.

Regarding compliance, using the prostheses for 8 hours or more was considered as good compliance. There were 302 questionnaires which completed data on compliance. After analyzing the data comparing the LCI sub-score of the less-than 8-hour (poor compliance) group with that of the 8-hour or more (good compliance) group, we found the former had lower LCI score than the latter significantly as shown in Table 5.

When dividing prosthetic users into unlimited community ambulators and limited community ambulators, the group that reported unlimited walking nonstop outside had LCI total score higher than the group that reported limitation of walking distance significantly as shown in Table 6.

Table 3. Locomotion capability index (LCI) scores and levels of amputation (n=312)

	AK (n=101)	BK (n=211)	p-value
Total LCI score	38.7 (5.8)	38.7 (6.7)	0.857
Advanced capability score in the LCI	18.5 (3.9)	18.6 (4.2)	0.756

Mean (SD)

AK, above-knee (transfemoral) amputees; BK, below-knee (transtibial) amputees

When considering those who were able to walk automatically comparing with the ones walking with attention, it was found that the automatic ambulators had LCI total score higher than those walking with attention significantly as shown in Table 7.

Discussion

The Thai version of PPA was developed and tested for psychometric properties in terms of discrimination test and test-retest reliability. It revealed that the translated questionnaire has discrimination property when comparing the LCI score between those with good and those with poor prosthetic compliance. In terms of non-stop walking distance those walking without limitation had higher LCI score than those walking with limitation. In the same way the LCI score of those walking automatically was higher significantly than those walking with attention.

The LCI score is a subset of the prosthetic use domain in the PPA questionnaire. It represents walking ability of the amputees and consists of basic and advanced ambulation scores. According to our study, the LCI cannot discriminate the groups of transtibial and transfemoral amputees as both groups had comparable total scores, like a result from the study of Gauthier-Gagnon et al.; however, their study showed better in advanced mobility score in the transtibial group⁽⁹⁾ that was different from our study. Our advanced score seemed higher in the transtibial group than in the transfemoral group but was not statistically significant. This

Table 4. The advanced capability score in the locomotion capability index (LCI)

	BK	AK	Mean difference (BK-AK)	Mean difference* (BK-AK)
Advanced score in the LCI	18.65 (4.23)	18.57 (3.84)	0.06 (-0.92 to 1.030)	0.93 (-0.001 to 1.86)
p-value			0.912	0.0502*

Mean (SD); *adjusted age and causes of amputation

AK, above-knee (transfemoral) amputees; BK, below-knee (transtibial) amputee

Table 5. The locomotion capability index (LCI) score and use of prostheses of 302 participants

	Wearing < 8 hr (n=8)	Wearing ≥ 8 hr (n=254)	p-value
LCI score	33.7 (9.7)	39.8 (4.4)	< 0.001*

Mean (SD), *Independent t test

Table 6. The locomotion capability index (LCI) score and non-stop walking distance of 299 participants

LCI score	Non-stop walking distance		p-value	Effect size	p-value
	Unlimited (n=199)	Limited (n=100)			
LCI score	40.4 (4.3)	35.0 (8.3)	< 0.001*	< 0.001*	0.82

Mean (SD), *Independent t test

Table 7. The locomotion capability index (LCI) score and automaticity of gait of 293 participants

	Walk automatically (n=170)	Walk with attention (n=123)	p-value
LCI score	40.9 (2.9)	35.7 (7.9)	< 0.001*

Mean (SD), *Independent t test

might be from higher non-traumatic causes, more advanced age and female predominance in our transtibial group. For this reason, these factors had to be adjusted; however, there was no statistical significance ($p = 0.0502$). The discrimination property seemed more suitable to be tested with ambulatory functional level, not with the level of amputation. Level of amputation is a part of physical function that is usually affected by other factors such as physical health.

The PPA, Thai version had good test-retest reliability when testing the prosthetic use domain such as the LCI subset duration of activities, walking distance with prostheses, automaticity of gait, self-care activities and the significant others' acceptance of amputation. The retest had done in 2 weeks apart unlike the original version that performed in 4 weeks' duration. The 2-week duration is considered short enough to remain the same functional status and long enough to prevent the carry-over effects.⁽⁵⁾ The original version had good repeatability and enough sensitivity to change. They performed test-retest reliability testing in more aspects than our study, such as percentage of displacement indoors and outdoors, factual information, accessibility to service, donning the prostheses, automatism of walking, walking distance, walking limitation, reason for disuse, satisfaction, adaptation to amputation, and family acceptance. But our test covered only some domains of the PPA questionnaire and revealed reliability.

In conclusion, the Thai version of the prosthetic profile of the amputee (PPA) questionnaire has test-retest reliability and has discrimination validity to differentiate amputees with different locomotion abilities with the prosthesis (so called locomotion capability index, LCI); however, it has no ability to differentiate amputees in terms of levels of amputation.

Disclosure

The authors declare no conflicts of interest regarding any aspects of the study.

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