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Validity and reliability of the Thai Shortened Token Test

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ABSTRACT

Background: The Token Test (TT) helps evaluate language comprehension in individuals with aphasia. This test can detect comprehension difficulties, even in mild aphasia cases. In Thailand, the other language tests for aphasia focused primarily on multiple aspects of language, which took a long time to evaluate. The Shortened TT, which has fewer commands, has been chosen to be translated for this study. Previously, the Shortened TT was translated into Thai using only forward translation and had not yet been evaluated for its psychometric properties. Thus, this study focuses on translating the Shortened TT into Thai using a forward and backward translation process and determining its validity and reliability.

Objective: To translate, validate, and determine the reliability of the Thai Shortened TT.

Materials and methods: The Shortened TT was translated using forward and backward translation. Following the completion of the translation process, five expert speech-language pathologists (SLPs) evaluated its content validity using the Content Validity Index (CVI), the Content Validity Index for Items (I-CVI), and the Content Validity Index for Scales (S-CVI). Then, it was administered to 12 normal participants and 12 aphasia participants to determine the test-retest, intra-, and inter-rater reliability using the Intraclass Correlation Coefficient (ICC).

Results: The Thai Shortened TT's content validity was satisfied at CVI=0.920, I-CVI=0.800-1, and S-CVI=0.983. The test-retest, intra-, and inter-rater reliability were excellent. In the normal group, they were 0.943, 0.985, and 0.974, respectively; in the aphasia group, they were 0.985, 0.999, and 0.999, respectively.

Conclusion: This study indicated that the Thai Shortened TT can be utilized and is suitable for clinical evaluation regarding its content validity and reliability.

Introduction

Auditory comprehension deficiency is one of the symptoms in patients with aphasia. The loss of language and ability to comprehend others impacts the patient's quality of life.[1,2]Aphasia may result from cerebrovascular disease, Traumatic Brain Injury (TBI), brain tumor, infection, dementia, or other neurodegenerative medical conditions. However, the most common cause of aphasia is cerebrovascular disease.[3] In Thailand, the prevalence of cerebrovascular disease in populations over 45 is 1.88%.[4] According to data, aphasia is the consequence of approximately 25-50% of all individuals with cerebrovascular disease.[3]

The Token Test (TT) is one of the assessments used to evaluate language comprehension in individuals with

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aphasia. This test can detect language comprehension difficulties in individuals with mild aphasia.[5] The TT was developed by De Renzi and Vignolo in 1962.[6] The test included 61 commands divided into five subtests, each containing instructions that increased in difficulty. The commands for subtest parts 1 through 4 comprised identical forms of verbs, nouns, and adjectives. Every subtest consisted of ten commands that were gradually extended. The final part of the test contained twenty-one commands with a more complex grammatical structure. Subjects must listen to the commands and execute tasks using tokens as responses. Ten circle tokens and ten rectangle tokens were present, each in two sizes (large and small) and five colors (red, blue, green, yellow, and white). As a result of the token usage, the test commands lacked any supplementary words that would aid understanding, including situation, object nature, or verbal context. The developers found that subjects with mild aphasia who demonstrated good language comprehension during communication struggled to respond to commands on the TT. They determined that TT can detect language comprehension deficiencies in patients with aphasia.[6]

The TT has been developed into various formats, such as the TT for Children (TTFC), the Revised TT (RTT), the Five-item RTT, and the Shortened TT.[7-10]

De Renzi and Faglioni subsequently developed the Shortened TT in 1978.[7] In this version, the number of commands has decreased from 61 to 36. In the first through fourth parts, the number of orders decreased from 10 to 4, and in the final part, from 21 to 13. Furthermore, the developer designed a simple subtest comprising seven commands, all of which the subjects could accurately respond to on the condition that they understood the tokens' sizes, shapes, or colors. For example, once participants understood the definition of "circle," they could follow with the command "touch a circle." The tokens were converted from rectangles to squares due to their frequent usage. In addition, the blue tokens have been recolored to black because ordinary people and those with certain brain disorders would have difficulty distinguishing between green and blue.[7] The Shortened TT, comprising 36 commands, was determined to be a sufficient tool for assessing language comprehension impairments in individuals with aphasia. This version of the TT was more frequently used in clinical settings.[11]

The TT was translated into Thai using forward translation by Akamanon in 1989.[12] The Shortened TT was translated into 40 languages, including Thai, using forward translation for the application by Bastiaanse *et al*. in 2016.[13] These two versions of the Thai-translated TT were translated only through forward translation and were not assessed for the test's psychometric properties. Gorecki *et al*. proposed using both forward and backward translation in an instrument translation process. Additionally, researchers must evaluate the test for its psychometric properties before using it.[14] In 2016, Alkhamra and Al-Jazi translated TTFC into Arabic, utilizing forward and backward translation, and determined its validity and reliability.[8]

The study of the validity of the TT was conducted by Orgass and Poeck in 1966. This study determined the TT's criterion validity in healthy, non-aphasia brain-damaged, and aphasia participants. The results indicated that the validity of the test was not impacted by disorders resulting from brain injury, except aphasia. Healthy participants and those with non-aphasic brain injury scored significantly higher on the TT than participants with aphasia. To evaluate the test's efficacy, the researchers evaluated its discriminatory potential. They found that 84% of aphasic participants were accurately diagnosed with aphasia, while only 4% of non-aphasic participants were diagnosed with aphasia.[15]

In 2016, Alkhamra and Al-Jazi determined the construct and concurrent validity of the Arabic TTFC in Jordanian Arabic-native and bilingual children. The construct validity of the A-TTFC was evaluated using factor analysis. In accordance with the factor analysis findings, the A-TTFC items were comparable to the English version items. A two-factor mixed-effects model was employed to investigate concurrent validity. The ICCs between E-TFC and A-TTFC were more significant than 0.8.[8]

In 2000, Park *et al*. determined the test-retest, intra-, and inter-rater reliability of the Five-item RTT in aphasia participants.[10] The study of the reliability of the Shortened TT was conducted by Paci *et al*. in 2015. This study determined the Shortened TT's intra- and inter-rater reliability in aphasia participants.[16]

The Shortened TT can detect language comprehension deficiencies in patients with aphasia, requiring less equipment, documentation, and time.[7] The test must be translated using both forward and backward translation and be proven reliable and valid before it is used in clinics and research in the future.[14] The aims of this current study were (a) to translate the Shortened TT into Thai by using forward and backward translation, (b) to determine its content validity, and (c) to examine its test-retest, intra-, and inter-rater reliability.

Materials and methods

This study was experimental research. Data were collected between May 2021 and December 2022 after approval from the Ramathibodi Hospital's ethical committee.

Procedures

The current study was divided into three steps: the test translation, the validity testing, and the reliability testing processes. The details are as follows:

Test translation

The Elsevier Copyright Clearance Center was contacted for authorization of the Shortened version of the TT translation because the author and corresponding author of the original study could not be reached. In this study, the Shortened TT was translated into Thai using forward and backward translation methods adapted from the guidelines of Gorecki *et al*.[14] The translation steps consisted of (a) forward translation, (b) review of

the forward translation, (c) backward translation, and (d) review of the backward translation.

(a) Forward translation

The researcher and a certified speech-language pathologist (SLP) with at least three years of experience evaluating and training patients with aphasia carried out the forward translation from English to Thai. This step produced two sets of the Thai-translated test (the Thai Shortened TT version A and version B).

(b) Review of the forward translation

The review committee consisted of the two forward translators and another researcher. They compared two versions of the Thai-translated test to determine the meaning and usage of words. The forward translation phase was reviewed based on the following criteria: the language used in the test had to be natural and acceptable in Thai, and the test items had to maintain the original test's purpose.

(c) Backward translation

A professional translator in this step was a person with expertise in both languages from the Center for Translation and Language Services, Research Institute for Languages and Cultures of Asia (RILCA) at Mahidol University. The translator had no prior knowledge of the instrument. This step produced the backward-translated test (in English).

(d) Review of the backward translation

The review committee was comprised of two researchers and a backward translator from RILCA. The backward translated and original versions of the test were compared by identifying word meanings and usages that were consistent with the original version's concept. At this stage, the Thai Shortened TT was established.

This study could not conduct a pretesting phase in the test translation process due to the restrictions imposed by the coronavirus disease 2019 (COVID-19) on the number of patients, caregivers, and visitors at Ramathibodi Hospital who could participate in data collection.

Validity testing

Five experts, certified SLPs with at least 10 years of professional experience in assessing or training patients with aphasia, evaluated the content validity of the Thai Shortened TT. This study conducted the assessment of content validity using the Content Validity Index (CVI), the Content Validity Index for Item (I-CVI), and the Content Validity Index for Scale (S-CVI). The Thai Shortened TT was examined and compared to the original test's principles, including suggestions by the experts. Next, the Thai Shortened TT was revised.

Reliability testing

Participants

The participants in this study were recruited for the reliability testing process. They included patients, caregivers, and individuals who visited Ramathibodi Hospital. They were adults who spoke Thai as their primary language and were at least 18 years old. The researcher would inform the participants of the research's purpose and explain the procedures. All participants signed or imprinted their fingerprints on the consent form to indicate their agreement to participate in this study.

The number of participants in this study was determined using the sample size requirement for an Intraclass Correlation formula.[17] This formula considers the desired significance level (alpha=0.05), statistical power (80%), and number of observations per subject set at 2, with R_0=0 and R_1=0.7. The calculation indicated a requirement of 10 participants per group. To account for potential withdrawals, the total number of participants increased by 20%, resulting in 24 participants divided into two groups: 12 participants with aphasia and 12 normal participants.

For aphasia participants, the inclusion criteria included: (a) having a history of cerebrovascular disease that a neurologist has diagnosed; (b) being evaluated and diagnosed with mild or moderate aphasia based on their aphasia quotient (AQ) score from the Thai Adaptation of the Western Aphasia Battery (T-WAB), which ranged from 40 points or above[18,19] due to the subject that is considered severe if the score is less than this. The exclusion criteria were as follows: (a) had no correct responses in five consecutive items of the first part of the Thai Shortened TT, which resulted in the test's discontinuation; (b) they were unable to move their bodies in response to the test instructions due to restrictions on body movement.

For normal participants, the inclusion criteria were to have no history of cerebrovascular disease or communication disorders. The exclusion criteria included: (a) failure to meet the Mini-Mental State Examination-Thai 2002 (MMSE-Thai 2002) criteria, which is the subject that is illiterate and scored less than or equal to 14 points; the subject completed elementary school and scored less than or equal to 17 points; and the subject studied beyond elementary school and scored less than or equal to 22 points.[20] (b) had no correct responses in five consecutive items of the first part of the Thai Shortened TT. All participants had to have sufficient hearing to communicate, no visual or color blindness that could have restricted the assessment, and no previous history of mental health conditions.

The Thai Shortened TT was administered to the participants to determine the reliability of the test. Two raters participated in this procedure. The researcher served as the first rater, while a certified SLP with at least three years of experience in assessing and training individuals with aphasia served as the second rater. Before evaluating the participants, two raters were required to review the manual detailing assessment procedures and ratings. The first rater assessed the participants twice to determine the test-retest reliability. There were at least two weeks between each examination. The first rater assessed and recorded the video simultaneously during the initial assessment. These video recordings were later used to determine intra- and inter-rater reliability. After

the first rater assessed all the participants twice, the video records from the initial evaluation were randomized by another SLP to blind the groups of participants. The first rater reassessed the participants via video recording to determine the intra-rater reliability by comparing the scores from the initial evaluation with the scores rated via video recording. The second rater assessed the participants via the recorded video to determine inter-rater reliability by comparing the scores from the initial evaluation by the first rater. To avoid bias, the first rater did not participate in the scoring process when the second rater assigned the score.

Results

Validity testing

The content validity of the Thai Shortened TT was assessed by five expert SLPs, including CVI, I-CVI, and S-CVI. The CVI, I-CVI, and S-SCI had the following defined criteria: (1) CVI>0.815[21] or (2) I-CVI>0.78 and S-CVI>0.9.[22]

The results revealed that the CVI=0.920, the I-CVI ranged from 0.800 to 1, and the S-CVI=0.983. These values met the criteria, and the test had a good validity result.

Reliability testing

Participants' characteristics

To determine the reliability of the Thai Shortened TT, this study included 12 aphasia participants and 12 normal participants. The participants' demographic information and scores on the MMSE-Thai 2002 and T-WAB were analyzed using descriptive statistics and presented as numbers of participants (percentages) or averages (standard deviation; SD). Table 1 presents the characteristics of the participants and the scores from T-WAB and MMSE-Thai 2002.

Table 1. Participants' characteristics.

	Number of participants (%)		
	Normal (N=12)	**Aphasia (N=12)**	**Overall (N=24)**
Gender			
Male	4 (33.3)	8 (66.7)	12 (50)
Female	8 (66.7)	4 (33.3)	12 (50)
Age			
Mean (SD)	57.8 (8.8)	58.8 (10.6)	58.3 (9.5)
Range	43-70	39-76	39-76
Education			
Elementary school	1 (8.3)	1 (8.3)	2 (8.3)
Junior high school	-	3 (25)	3 (12.5)
High school	2 (16.7)	-	2 (8.3)
Vocational certificate	1 (8.3)	-	1 (4.2)
Bachelor's degree	7 (58.3)	7 (58.3)	14 (58.3)
Postgraduate degree	1 (8.3)	1 (8.3)	2 (8.3)
AQ scores (T-WAB test)			
Mean (SD)	-	83.4 (14.2)	-
Range	-	61.8-99.6	-
Aphasia types			
Anomic aphasia	-	8 (66.7)	-
Transcortical sensory aphasia	-	2 (16.7)	-
Wernicke's aphasia	-	2 (16.7)	-
Duration of illness (month)			
Mean (SD)	-	51.4 (63.5)	-
Range	-	6-204	-
6-12 months		4 (33.3)	
13-24 months		3 (25)	
25-36 months		-	
37-48 months		1 (8.3)	
49-60 months		-	
61+ months		4 (33.3)	
MMSE-Thai 2002 scores			
Mean (SD)	27.5 (1.1)	-	-
Range	26-29	-	-

The test comprises 36 commands: 7 in part 1, 4 in parts 2 through 5, and 13 in part 6. The scoring procedure for parts 1-5 is as follows: 1 point is given if the subject performs the correct action during the first representation, 0.5 points if the subject performs the correct action after repeating the command, and 0 points if the subject fails to respond or responds incorrectly. The test is terminated if no correct answer is provided in parts 1-5 of the five sequential items. In part 6, the subject receives 1 point if they offer the correct response and 0 points if they do not provide the proper response; the commands are not repeated in this part.[7] The duration of the assessment is approximately 5 to 15 minutes.

This study conducted two assessments on-site and two via video recording to determine reliability. Table 2 displays the performance scores of each evaluation.

Table 2. The performance scores from the Thai Shortened TT in normal and aphasia groups.

	Normal group	Aphasia group
First assessment		
Mean (SD)	33.0 (1.9)	21.9 (10.0)
Range	28-35	5-33
Second assessment		
Mean (SD)	33.9 (1.9)	23.5 (10.6)
Range	30-36	8-35
Video assessment (Rater 1)		
Mean (SD)	32.9 (1.9)	22.1 (9.9)
Range	28-35	6-33
Video assessment (Rater 2)		
Mean (SD)	33.0 (2.0)	22.2 (9.9)
Range	28-35	5-33

The test-retest, intra-, and inter-rater reliability of the Thai Shortened TT was analyzed using intraclass correlation coefficients (ICCs) with a two-way mixed effects model. The ICC values were translated as follows: (1) The ICC value for which the instrument's reliability score was more significant than 0.90 indicated that it had excellent reliability; (2) between 0.75 and 0.90 was good reliability; (3) between 0.50 and 0.75 was moderate reliability; and (4) less than 0.5 was poor reliability.[23]

The test demonstrated excellent test-retest reliability, with ICC values ranging from 0.920 to 1 when compared to the criteria.[23] However, subtest part 1 in aphasia participants and all participants showed ICC=0.652 and 0.710, respectively, indicating moderate test-retest reliability and subtest part 5 in normal participants showed ICC=0.485, indicating poor test-retest reliability (Table 3).

Table 3. Test-retest reliability of the Thai Shortened TT.

	Normal		Aphasia		All	
	ICC (average)	95% CI	ICC (average)	95% CI	ICC (average)	95% CI
Overall	0.943	0.800-0.983	0.985	0.947-0.996	0.989	0.975-0.995
Part 1	1	-	0.652	-0.210-0.900	0.710	0.329-0.874
Part 2	1	-	0.920	0.723-0.977	0.926	0.825-0.967
Part 3	1	-	0.990	0.670-0.997	0.992	0.981-0.997
Part 4	1	-	0.980	0.931-0.994	0.986	0.969-0.994
Part 5	0.485	-0.789-0.852	0.937	0.781-0.981	0.957	0.900-0.981
Part 6	0.963	0.871-0.989	0.958	0.854-0.988	0.974	0.939-0.989

The test showed excellent intra-rater reliability, with ICC values ranging from 0.946-1 compared to the criteria (Table 4).[23]

The test displayed excellent inter-rater reliability, with ICC values ranging from 0.966-1 when compared to the criteria (Table 5).[23]

Table 4. Intra-rater reliability of the Thai Shortened TT.

	Normal		Aphasia		All	
	ICC (Average)	95% CI	ICC (Average)	95% CI	ICC (Average)	95% CI
Overall	0.985	0.948-0.996	0.999	0.998-0.999	0.999	0.998-0.999
Part 1	1	-	0.946	0.812-0.984	0.955	0.895-0.980
Part 2	1	-	0.995	0.982-0.998	0.995	0.988-0.998
Part 3	1	-	0.994	0.979-0.998	0.995	0.988-0.998
Part 4	1	-	1	-	1	-
Part 5	1	-	1	-	1	-
Part 6	0.980	0.932-0.994	0.998	0.993-0.999	0.997	0.993-0.999

Table 5. Inter-rater reliability of the Thai Shortened TT.

	Normal		Aphasia		All	
	ICC (Average)	95% CI	ICC (Average)	95% CI	ICC (Average)	95% CI
Overall	0.974	0.911-0.993	0.999	0.996-0.999	0.999	0.997-0.999
Part 1	1	-	1	-	1	-
Part 2	1	-	0.995	0.982-0.998	0.995	0.988-0.998
Part 3	1	-	0.993	0.976-0.998	0.994	0.987-0.998
Part 4	1	-	0.969	0.892-0.991	0.979	0.951-0.991
Part 5	1	-	1	-	1	-
Part 6	0.966	0.883-0.990	0.996	0.985-0.999	0.996	0.990-0.998

Discussion

Validity

This study examined the content validity of the Thai Shortened TT. Nevertheless, it did not examine the same type of validity as other studies.[8,15] Its content validity analysis revealed that the CVI, I-CVI, and S-CVI values met the criteria.[21,22] The Thai Shortened TT items were modified based on the experts' recommendations. In this phase, the adjustments were made while maintaining the contents of the original test and its appropriateness for the characteristics of the Thai language. For example, the instructions for items 24, 28, 30, and 32 were changed from "place" to "pick up and place" by adding the word "หยิบ" (meaning "pick up") to clarify the actions in the instructions. These modifications were aimed at making the instructions more explicit and more precise.

Reliability

The test-retest reliability result of this study, ICC=0.974, was comparable to the study of Park *et al*.,[10] showing excellent test-retest reliability. The study also demonstrated excellent test-retest reliability with the five-item RTT, with ICC=0.96.[10] However, the test-retest reliability of the fifth subtest of the Thai Shortened TT was low among normal participants, with ICC=0.485. Although the details of these two tests varied, the format of some subtest items was similar. The items in the fifth subtest of the Thai Shortened TT were grammatically equivalent to those in the fourth subtest of the five-item RTT, which had moderate test-retest reliability, ICC=0.73.[10] Variations in the methodology details could explain the difference in test-retest reliability. The participants and the time intervals between the two examinations in this study and of Park *et al*. were different. Park et al.'s study only included participants with aphasia,[10] while this study included both aphasia and normal participants. The interval between the two examinations in this study was two weeks, while Park et al.'s study was three days.[10] Park et al. suggest that the participants' learning or changes in individual ability may cause this low test-retest reliability.[10] Additionally, low test-retest reliability may be associated with the duration of the two assessments,[24] the lack of variability among the sampled subjects, and the small number of subjects.[23]

The Thai Shortened TT's intra- and inter-rater reliability were excellent, ICC=0.997 and 0.996, compared to the study of Park *et al*., which showed that the five-item RTT also demonstrated excellent intra- and inter-rater reliability, ICC=0.98 and 0.95.[10] Like the study of Park *et al*., the video recordings of the initial assessment were used in this phase. Additionally, the Park *et al*. study raters received training in assessment and rating before the participant assessments.[10] This study also gave the raters a manual defining the assessment procedures and scoring details. The methodology of this study was like that of Park

et al., which could explain why its results were comparable to theirs.

On the other hand, this study's intra- and inter-rater reliability results differ from those of Paci *et al*.[16] In that study, the Shortened TT showed good intra-rater reliability, ICC=0.889, and moderate inter-rater reliability, ICC=0.588. Two evaluations were conducted on their participants, with a minimum of two days between each evaluation. Their raters weren't provided training or a manual for evaluating and scoring. In their conclusion, Paci *et al*. suggested that the minimal reliability values may be associated with participants' learning or changes in individual competence. They also indicated that explicit scoring guidelines and instructions on conducting the testing procedure could enhance the test's reliability.[16]

Conclusion

This study aimed to translate, validate, and assess the reliability of the Thai Shortened TT. Begin by translating the Shortened TT into Thai using both forward and backward translation processes. Five expert SLPs assessed the Thai Shortened TT's content validity. Based on the results, this test's content validity met the criteria. This test's intra-, inter-rater, and test-retest reliability were evaluated in normal and aphasia participants using ICCs. According to the results, this test showed excellent intra-, inter-rater, and test-retest reliability. Consequently, this test is suitable for clinical evaluation and future research.

Limitations

During the backward translation phase, the translator had to be proficient in the target language and use the original language as their mother tongue. Due to difficulties in finding the required translator, the translator was a professional translator with expertise in both languages from the Center for Translation and Language Services, RILCA, Mahidol University, Nakhon Pathom, Thailand.

The backward translation phase review committee was required to consist of the test's developer and forward translators. However, the original study's author and corresponding author could not be contacted. Therefore, the review committee for this study consisted of two researchers and the backward translator from RILCA.

This study did not conduct the pretesting phase of the translation procedure due to the COVID-19 pandemic during data collection.

Recommendations

The English version has cut-point data, which is a score of less than 29 points; the subject has an auditory comprehension deficit.[7] Future research should establish normative or cut-point data for the Thai version, which is necessary to make this test suitable for screening the Thai population.

If sufficient individuals are available to participate in the study that translates to other tests, a pretesting phase should be conducted. If possible, the backward translator should be a native speaker of the test's original language, have experience in the target language, and live in a country that uses it; furthermore, if they could be contacted, the translation would need to be returned to the original test developer for review.

Conflict of interest

The authors declare that there is no conflict of interest.

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Ethics approval

The present study received approval from the Ethical Committee of the Ramathibodi Hospital, COA. No. MURA2021/455.

References

[1] Hallowell B. Aphasia and other acquired neurogenic language disorders: a guide for clinical excellence. San Diego, CA: Plural Publishing, Inc; 2017.

[2] Babkair LA, Chyun D, Dickson VV, Almekhlafi MA. The effect of psychosocial factors and functional independence on poststroke depressive symptoms: a cross-sectional study. J Nurs Res. 2022; 30(1). doi: 10.1097/JNR.0000000000000464.

[3] American Speech-Language-Hearing Association. Aphasia [cited 2024 Sep 9]. Available from: https://www.asha.org/practice-portal/clinical-topics/aphasia.

[4] Suwanwela NC. Stroke epidemiology in Thailand. J Stroke. 2014;16(1):1-7. doi: 10.5853/jos.2014.16.1.1.

[5] Spreen O, Risser AH. Assessment of aphasia. New York: Oxford University Press; 2003.

[6] De Renzi E, Vignolo LA. The token test: a sensitive test to detect receptive disturbances in aphasics. Brain. 1962; 85(4): 665-78. doi: 10.1093/brain/85.4.665.

[7] De Renzi E, Faglioni P. Normative data and screening power of a shortened version of the token test. Cortex. 1978; 14(1): 41-9. doi: 10.1016/s0010-9452(78)80006-9.

[8] Alkhamra RA, Al-Jazi AB. Validity and reliability of the Arabic Token Test for children. Int J Lang Commun Disord. 2016;51(2):183-91. doi: 10.1111/1460-6984.12198.

[9] Arvedson J, McNeil M, West TL. Prediction of revised token test overall, subtest, and linguistic unit scores by two shortened versions. Proceedings of 15th Clinical Aphasiology Conference; 1985 Jun 2-6; Ashland, Oregon, 1985. Available from: http://aphasiology.pitt.edu/838.

[10] Park GH, McNeil MR, Tompkins CA. Reliability of the five-item revised token test for individuals with aphasia. Aphasiology. 2000;14(5-6): 527-35. doi: 10.1080/026870300401298.

[11] Hall J, O'Carroll RE, Frith CD. Neuropsychology. In: Johnstone EC, Owens DC, Lawrie SM, McIntosh AM, Sharpe M, editors. Companion to psychiatric studies.

8th Ed. St. Louis: Churchill Livingstone; 2010.
[12] Akamanon C. The assessment of auditory comprehension ability with a Thai adaptation of the token test. Rama Med J. 1989; 12: 104-8. (in Thai).
[13] Bastiaanse R, Raaijmakers S, Satoer D, Visch-Brink E. The multilingual token test. Aphasiology. 2016;30(4):508. doi: 10.1080/02687038.2015.1121710.
[14] Gorecki C, Brown JM, Briggs M, Coleman S, Dealey C, McGinnis E, *et al*. The Pressure ulcer quality of life (PU-QOL) questionnaire, Language translation & cross-cultural adaptation guideline. [e-book] Leeds: University of Leeds; 2014 [cited 2021 Apr 16]. Available from: https://ctru.leeds.ac.uk/wp- content/uploads/2019/01/Translation_Guidelines_10JAN14_finalv1.0.pdf
[15] Orgass B, Poeck K. Clinical validation of a new test for aphasia: an experimental study on the token test. Cortex. 1966; 2(2): 222-43. doi: 10.1016/S0010-9452(66)80005-9.
[16] Paci M, Lorenzini C, Fioravanti E, Poli C, Lombardi B. Reliability of the 36-item version of the token test in patients with poststroke aphasia. Top Stroke Rehabil. 2015; 22(5): 374-6. doi: 10.1179/1074935714Z.0000000049.
[17] Bujang MA. A simplified guide to determination of sample size requirements for estimating the value of intraclass correlation coefficient: a review. Arch Orofac Sci. 2017; 12: 1-11.
[18] Teerapong W. The comparison of language abilities of Thai aphasic patients and Thai normal subjects by using Thai adaptation of western aphasia battery [MA Thesis]. Bangkok: Mahidol University. 2000.
[19] Kauhanen M-L, Korpelainen JT, Hiltunen P, Määttä R, Mononen H, Brusin E, et al. Aphasia, depression, and non-verbal cognitive impairment in ischaemic stroke. Cerebrovasc Dis. 2000; 10(6): 455-61. doi: 10.1159/000016107. PMID: 11070376.
[20] The Committee prepared the Preliminary Brain Test-Thai version. Mini mental examination Thai-2002, MMSE-2002. Bangkok: Institute of Geriatric Medicine, Department of Medical Services, Ministry of Public Health, Thailand; 2002. (in Thai).
[21] Srisatidnarakul B. Development and validation of research instruments: Psychometric properties. Chulalongkorn University Printing House: Bangkok; 2012. (in Thai).
[22] Polit DF, Beck CT. The content validity index: are you sure you know what's being reported? Critique and recommendations. Res Nurs Health. 2006; 29(5): 489-97. doi: 10.1002/nur.20147.
[23] Koo TK, Li MY. A guideline of selecting and reporting intraclass correlation coefficients for reliability research. J Chiropr Med. 2016; 15(2): 155-63. doi: 10.1016/ j.jcm.2016.02.012.
[24] Meehanpong P, Boonsin S. The development of nursing research instruments. Journal of The Royal Thai Army Nurses. 2021; 22(1): 10-9. (in Thai). https://he01.tci-thaijo.org/index.php/JRTAN/article/view/242019.

Appendix

A sample of the commands in the Thai Shortened Token Test

Part 1
1. แตะวงกลมอันหนึ่ง
2. แตะสี่เหลี่ยมอันหนึ่ง

Part 2
1. แตะสี่เหลี่ยมเหลือง
2. แตะวงกลมดำ

Part 3
1. แตะวงกลมเล็กขาว
2. แตะสี่เหลี่ยมใหญ่เหลือง

Part 4
1. แตะวงกลมแดงและสี่เหลี่ยมเขียว
2. แตะสี่เหลี่ยมเหลืองและสี่เหลี่ยมดำ

Part 5
1. แตะวงกลมใหญ่ขาวและสี่เหลี่ยมเล็กเขียว
2. แตะวงกลมเล็กดำและสี่เหลี่ยมใหญ่เหลือง

Part 6
1. หยิบวงกลมแดงวางไว้บนสี่เหลี่ยมเขียว
2. แตะวงกลมดำด้วยสี่เหลี่ยมแดง

Note: This test is part of the Mahidol University thesis. To obtain authorization to use the test, please contact Mahidol University or the first author by this email: ntrisakdipol@gmail.com for more information.