The Thai Version of Aachen Aphasia Test (THAI-AAT)

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Abstract

The lack of a standardized Thai Language aphasia test raises difficulties not only with the assessment and treatment planning for the clinical but also with the accurate diagnosis and the realiable incidence for research on aphasiology in Thailand. This study aimed to use the Thai version of German Aachen aphasia (THAI-AAT), which is systematically adapted according to well-defined linguistic criteria and psychometric requirement, to assess the language deficit of Thai aphasic patients. The subjects participating in this study were 125 aphasia patients, 60 non-aphasic brain damaged patients and 120 normal subjects. The result revealed that the THAI-AAT is linguistically parallel in test design and fulfills the same psychometric properties as the original. The THAI-AAT obtains the goals: to differential diagnosis of aphasia distinguishing it from non-aphasic disturbance and to identify the type of aphasic syndrome.

Key word : Aphasia, Aachen Aphasia Test-Thai Version

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The approach taken in most clinics to obtain an optimal description of language deficits, is the administration of a comprehensive standardized language test. In Thailand speech and language pathologists currently use a variety of assessment procedures to evaluate the communication of

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their aphasic patients, incorporating medical and social history, information from patients, relatives and other staff, with observation and interpretation of the patients' language performance by utilizing clearly specified criteria. The usage of these non-standardized measures in clinical assessment raises difficulties with the interpretation and generalization of results obtained in Thai speech clinics. There are some modified versions of the foreign aphasia tests in Thai (Gandour J, 1981, Thammahakien S, 1982, Manochiopinig S, 1984)[1-3]. But due to the lack of normative data, these tests are not widely used.

The German Aachen Aphasia Test (AAT), the construction of which reflects the linguistic orientation is extensively standardized and uses a discriminant function analysis classification system for syndrome assignment (Benson DF, 1993)[4]. Various versions have appeared in European languages such as Italian, Dutch and English (Luzzatti C et al, 1991, Graetz P et al, 1992, Miller N et al, 1998)[5-7]. The THAI-AAT, developed to obtain the same diagnostic goals as the original helps to accomplish (1) to arrive at a differential diagnosis of aphasia distinguishing it from non-aphasic disturbances, (2) to identify the aphasic syndrome, (3) to measure the severity of the aphasic syndrome impairments, (4) to describe the quality of the aphasic disturbances in different linguistic modalities and linguistic levels and finally, (5) to evaluate changes in level of performances after therapeutic intervention (Pracharitpukdee N et al, 1998)[8].

MATERIAL AND METHOD

The Aachen Aphasia Test consists of: a test book, a test manual, a test protocol and several plastic tokens which comprise 5 color plates for the Token test, 16 alphabet plates and 16 word plates for the subtest written language. The test consists of 6 parts: 1. Spontaneous speech ratings 2.Token test 3. Repetition 4. Written language 5. Confrontation naming and 6. Comprehension. The examination time is about 60 – 90 minutes (Huber W et al, 1983)[9].

Subjects

The participating cases, including aphasics and non-aphasic patients and normal cases in this study were recruited from Sawangkaniwat Rehabilitation Center in Samutprakan province and from the speech &language Pathology Unit, King Chulalongkorn Memorial Hospital, Siriraj Hospital, the Police General Hospital and Rajavithee Hospital in Bangkok. The clinical aphasia diagnosis and syndrome classification were undertaken by three independent speech and language pathologists, who had more than 10 years experience in the differential diagnosis of neurogenic communication disorders. The patients were contacted through an appointment scheduled in conjunction with their regular therapy. The patients were administered the THAI-AAT. For normal subjects and non-aphasic patients spontaneous speech was not assessed, since the scales are designed to characterize aphasic speech and language deficits. Aspects of the test's construct validity, differential validity and reliability were examined on the basis of a sample of 125 aphasic patients, 60 brain-damaged patients and 120 normal subjects (Table 1). The grouping of item sets according to the modalities of the subtests was studied in the aphasic patient sample using a complete linkage hierarchical cluster analysis. The simi-

Table 1. Demographic sample characteristics.

		sex		education level (yrs)			occupation			age (yrs)	
group	n	male	female	4 - 10	11 - 15	16 -18	official	private	worker	md	range
Global	30	24	6	9	14	7	16	9	5	55	21 70
Wernicke's	22	14	8	11	6	5	11	7	4	61	50 -70
Broca's	30	19	11	12	7	11	13	9	8	49	20 -69
Amnesic	30	21	9	5	11	14	18	10	2	50	21 -70
Conduction	5	4	1	2	2	1	1	3	1	37	32 -57
transcortical	8	5	3	3	4	1	1	4	3	57	32 -66
All aphasia	125	87	38	42	44	39	60	42	23	53	22 -70
Diffuse.	30	25	5	10	6	14	19	5	6	49	20 - 70
Rt-hemis	30	20	10	14	9	7	16	8	5	49	22 -70
Normal	120	60	60	41	39	100	-	-	-	35	20 -70

All subjects were right-handed

larity relations among item sets were assessed for aphasic patients only with a particular method of non-metric multidimensional scaling called Smallest Space Analysis (SSA-I, Lingoes JC, 1973)[10]. The diagnostic selection and classification properties were examined by a non-parametric discriminant analysis procedure (ALLOC 80, Hermans J et al, 1982)[11].

RESULTS

All subjects were native speakers of Thai and had use of their preferred right hand. All patients were 6 weeks to 6 months post onset. The patients had predominantly suffered from a stroke, some had brain damage of traumatic origin, owing to their medical record. According to the clinical assessment, the aphasic sample comprised 30 patients with global aphasia, 22 with Wernicke's aphasia, 30 with Broca's aphasia, 30 with amnesic aphasia, 5 with conduction aphasia and 8 with transcortical aphasia. The non-aphasic patients consisted of two subgroups (n=30 each), one with focal brain damage of the non-dominant right hemisphere and the other one with diffuse brain damage causing bilateral lacunar infarctions, Parkinson's disease, etc (Table 2).

Construct validity

Construct validity was examined by means of a hierarchical cluster analysis applied to the interrelations of item group performances of all aphasic subjects. The results of the complete linkage agglomeration method combines an item group with an existing cluster only if its similarity (correlation) with all other item groups within this cluster is greater than with all other remaining item groups. The analysis was based on a correlation matrix of μ_2 coefficients measuring monotone relationships between item groups (Shye S, 1985) [12]. For three subtests the expectation as derived from the test design was fully met. These subtests were Token test, Confrontation naming and Repetition. For Written language and for Reading comprehension an unexpected regrouping was found. Reading comprehension turned out to be more similar to writing tasks than to Auditory comprehension. Furthermore, Reading aloud was more closely related to the combined clusters of Confrontation naming and the Token test than to the writing tasks (Fig. 1). Another way of looking into similarity between items groups is the application of non-metric multidimensional scaling, e.g. Smallest Space Analysis. Item groups being similar are located closely in space. The analysis tries to come up with a solution of as few spatial dimensions as possible. Overall the spatial configuration of the item groups fits the structure of a radex, i.e. a partition of the space into circular bands and wedge-like segments (Levy S, 1981)[13]. Obviously, the segments stand for the AAT subtests, with the exception of Confrontation naming labeling of objects by simple nouns and compound nouns is separated from color naming and from the description of line-drawn situations by sentences. In contrast, the circular ordering reflects processing demands of the tasks decreasing from the center to the periphery. Each item set is represented as a point in an Eucliden space and degree of relatedness is expressed with the distance between point (Fig. 2). So far, construct validity was investigated under the aspect of task similarity. Another aspect was task difficulty for each subtest. The items were selected in such a way

Table 2. Medical history of patient groups.

	etiology		hemiphegia			hemianopia		buccofacial apraxia		
group	CVD.	traumatic	no	mild	severe	no	yes	no	mild	severe
Global	30	-	-	16	14	28	2	16	5	9
Wernicke's	22	-	1	15	6	19	3	22	-	
Broca's	30	-	2	20	8	29	1	26	4	-
Amnesic	23	7	2	26	2	29	1	26	4	-
Conduction	5	-	-	2	3	5	-	5	-	-
Transcortical	6	2	-	6	2	7	1	8	-	-
All aphasia	116	9	5	85	35	117	8	103	13	9
Diffuse.	21	9	2	28	-	25	5	30	-	-
Rt-Hemis.	29	1	-	30	-	28	2	30	-	-

Post onset time : 6 weeks to 6 months

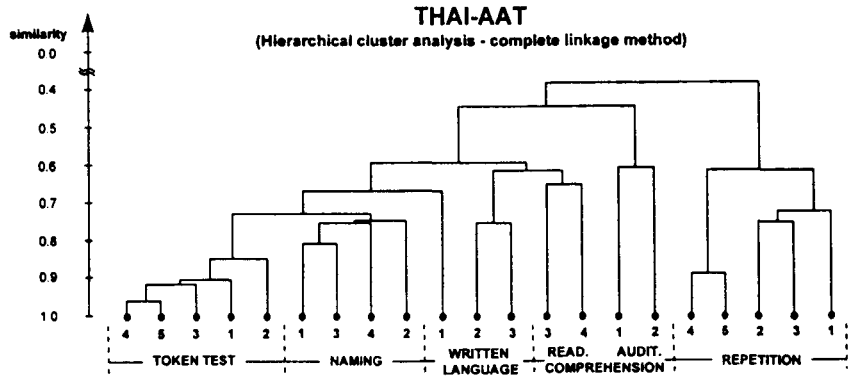

Fig. 1. THAI-AAT : Hierachical cluster analysis of item groups.

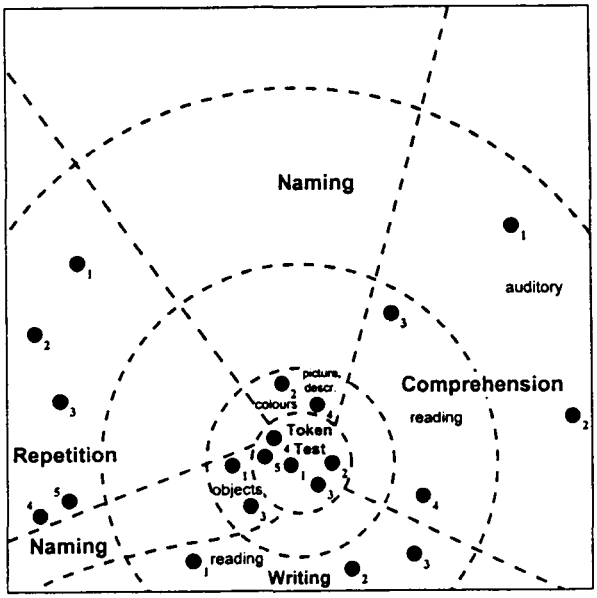

Fig. 2. THAI-AAT : Smallest space analysis of item groups.

that the linguistic difficulty was increased from item groups separately for the aphasic groups as well as for the brain damaged and the normal control groups. As expected, there was always a decreasing level of performance across item groups except for the obvious floor and ceiling effects (Fig. 3).

Differential validity

There are two aspects to be considered. First, how effectively aphasic subjects are separated from brain damaged and normal controls. Second, how well clinical syndromes can be discerned on the basis of test scores alone. The results of non-parametric group comparisons are summarized (Mann-Whitney U-Tests, type I-error level 0.01 per subtest and using the multiple testing procedure of Holm, cf, Kirk RE, 1995)[14]. Concerning Spontaneous speech rating, the scales for Communication ability and Syntactic structure revealed significant differences between all four syndrome groups. Patients with amnesic aphasia were always significantly better than the other groups except for Articulation. On this scale, patients with Wernicke's aphasia were likewise hardly affected. Wernicke's and Broca's aphasia patients can neither be distinguished with respect to Automatic speech elements nor with respect to Semantic and Phonemic structure (Table 3).

Considering the performance on subtests, all aphasic groups, even the patients with amnesic aphasia, were significantly more impaired than both control groups, although the brain damaged controls always had some more difficulties than the normal controls. Surprisingly, there was no difference between global and Wernicke's aphasia on any of the subtests. Both groups showed very poor performance. For diagnostic purposes it is important to know what the discriminating quality of the test is in terms of both, selection aphasics from non-aphasics and differentiating patients as belonging to

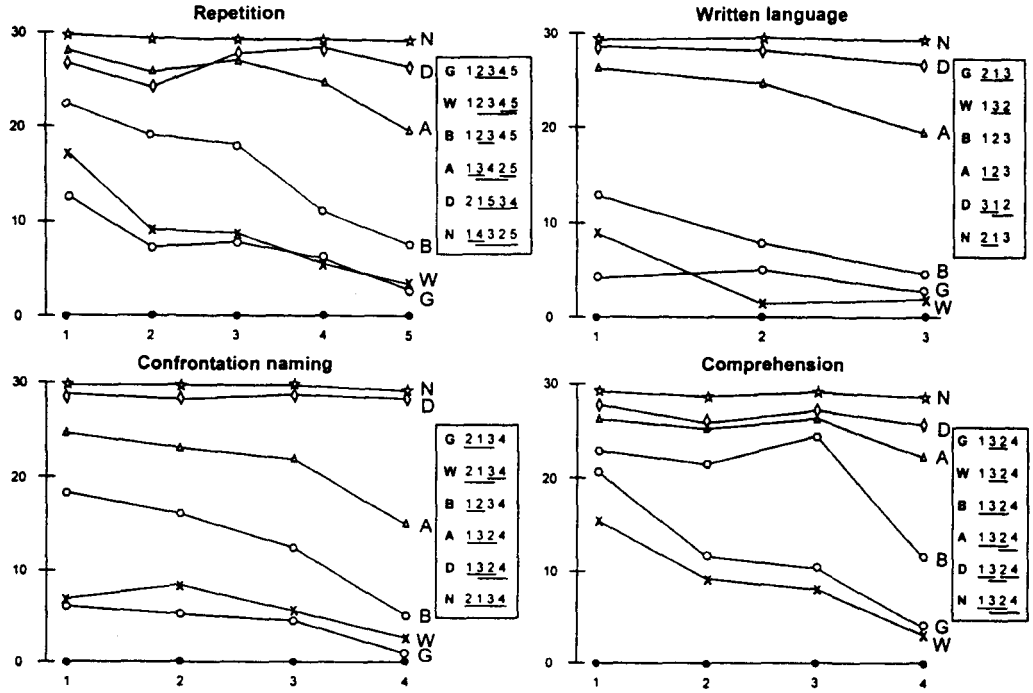

Fig. 3. THAI-AAT : Mean performance across item groups per subtest.

Table 3. THAI-AAT : group comparison.

Spontaneous speech						
Communication abilitity	G	W	B	A		
Articulation and prosody	G	B	W	A		
Automatic speech	G	W	B	A		
Semantic structure	G	W	B	A		
Phonetic structure	G	W	B	A		
Syntactic structure	G	B	W	A		
Subtests						
Token test	G	W	B	A	D	N
Repetition	G	W	B	A	D	N
Written language	G	W	B	A	D	N
Confrontation naming	W	G	B	A	D	N
comprehension	W	G	B	A	D	N

Syndrome groups underlined were not significantly different.
(G=global aphasia, W=Wernicke's aphasia, B=Broca's aphasia, A=amnesic aphasia, D=brain damaged control, N=normal)

different syndrome groups. This can be studied by means of discriminant analysis (DA). Because there were non-normal distributions with different amounts of variation of test scores, a non-parametric DA procedure was used (ALLOC 80). With respect to selection, we introduced a posterior classification probability criterion of at least 80 per cent for presence or absence of aphasia. When all five subtests were considered, the selection of aphasia was perfect, i.e. non of the aphasic patients was incorrectly identified as non-aphasic (and vice versa). Among the controls the patients with diffuse brain damage were poorly identified which was related to their clinical heterogeneity. When selecting the best distinguishing subtest in a stepwise manner, confrontation naming was chosen first.

Table 4. THAI-AAT : grouping of clinically classified patients (non-parametric discriminant analysis. ALLOC 80).

(n=125)		Spontaneous speech				Spontaneous speech and subtests			
		G	W	B	A	G	W	B	A
Clinical classification	G	24	3	3	0	27	3	0	0
	W	4	17	1	0	1	21	0	0
	B	7	1	22	0	3	1	26	0
	A	0	0	0	30	0	0	0	30
Correctly classified :		83%				92.9%			
Selected variables :		SPON.1: Com. SPON.5: Pho. SPON6 : Syn.				SPON.3 : Aut. SPON.6 : Syn. Subtests : Repetition , Written language, Comprehension.			
		(Correct : 68.82%)				(Correct : 83.9%)			

Table 5. Regrouping of clinically classified aphasic patients.

External clinical classification

Spontaneous speech

THAI-AAT Spontaneous speech (6 scales)	Global n = 30	Wernicke's n = 30	Broca's n = 30	Amnesic n = 30
Global	20	3	7	-
- doubtful*	3	-	1	-
Wernicke's	2	18	1	-
- doubtful*	1	-	-	-
Broca's	2	-	18	-
- doubtful*	2	1	3	-
Amnesic	-	-	-	30
- doubtful*	-	-	-	-

Spontaneous speech plus subtests (11 variables)

Spontaneous speech and subtests (11 variables)	Global n = 30	Wernicke's n = 30	Broca's n = 30	Amnesic n = 30
Global	25	1	4	-
- doubtful*	1	-	2	-
Wernicke's	4	20	-	-
- doubtful*	-	1	-	-
Broca's	1	-	22	-
- doubtful*	-	-	2	-
Amnesic	-	-	-	30
- doubtful*	-	-	-	-

* Classification probabilities < 70%

Based on naming alone, only 3 aphasics (patients with amnesic aphasia) and 3 controls (all having diffuse brain damage) were misclassified (Table 4). For syndrome classification, we introduced a classification criterion of at least 70 per cent. Based on all six Spontaneous speech rating scales the overall classification rate was 76.8 per cent, (82.1%) if the 70 per cent criterion was not considered). Based on the complete test with 11 variables an even better classification rate of 86.6 per cent was obtained (90.2% without the 70% criterion). Considering the misclassified cases, we mainly found variation

Table 6. Internal consistency (Cronbach's alpha, n = 125).

subtest	number of items	coefficient alpha	standard deviation	90% conf. interval
Token test	**50**	**.976**	**15.33**	**±3.91**
1.part I	10	.895	3.47	±1.85
2.part II	10	.908	3.06	±1.53
3.part III	10	.913	3.49	±1.69
4.part IV	10	.894	3.87	±2.07
5.part V	10	.907	3.05	±1.53
Repetition	**50**	**.974**	**44.34**	**±11.76**
1. sound	10	.876	9.03	±2.40
2. words	10	.909	10.14	±5.87
3 foreign words	10	.923	10.75	±4.91
4 phrases	10	.923	10.33	±4.72
5 sentences	10	.901	9.01	±4.66
Written language	**30**	**.964**	**27.17**	**±8.48**
1. reading aloud	10	.919	10.45	±4.89
2. putting together	10	.927	10.28	±4.57
3.writing to dictation	10	.912	8.70	±4.25
Confrontation naming	**40**	**.959**	**34.60**	**±11.52**
1.nouns	10	.888	10.35	±5.70
2.colours	10	.850	9.15	±5.83
3.compound nouns	10	.873	9.93	±5.82
4. sentences	10	.871	8.34	±4.93
Comprehension	**40**	**.959**	**30.25**	**±10.08**
1. auditory word level	10	.833	6.75	±4.54
2. autitory senten. level	10	.876	8.69	±5.03
3. reading word level	10	.931	10.07	±4.35
4. readingsenten.level	10	.899	9.05	±4.73
auditory	20	.912	14.28	±6.97
reading	20	.951	18.22	±6.63

between global and Broca's aphasia as well as between global and severe Wernicke's aphasics with jargon (Table 5).

Reliability

We studied internal consistency using Cronbach's alpha coefficient. A coefficient greater than 0.95 was found for each of the subtests, and even for item groups with only 10 items each the majority of coefficients was around 0.90. Thus, the calculation of subtest totals is justified (Table 6).

DISCUSSION

From the results of the validation study it is fair to conclude that the Thai version of the Aachen Aphasia Test has as satisfying psychometric properties as its other language versions (German: Huber W et al, 1983, Italian: Luzzatti C et al, 1991, Dutch: Graetz P et al, 1993, English: Miller N et al, 1998)[9,5-7]. This holds true for construct validity, differential validity and internal consistency. Another psychometric property is objectivity, which has two aspects: administration and scoring. The THAI-AAT can be easily administered in a clinical setting, because its rules for application as well as for discontinuation are specified in detail for each item group. Variance in scoring was extensively studied only for the original German version. Among clinicians specialized for aphasia the inter-rater agreement coefficients ranged from 0.75 to 0.86 for the Spontaneous speech ratings and were found to be as high as 0.99 for the rating of aphasic responses on the expressive language subtests (Repetition, Confrontation naming, Written language). For the receptive language subtest (Comprehension and Token test), no scoring problems can arise as they have a multiple choice format. The Thai version is parallel in test design to the European versions of the AAT and used exactly the same linguistic criteria for rating of the aphasic output. Therefore, it was considered unnecessary to carry out a separate agreement study for the THAI-AAT. For the retest reliability, this was examined for the German version, after an interval of only two days, the test scores did not show substantial increase or decrease and were highly inter-correlated for patients or acute as well as chronic aphasia selected from the four standard syndromes. The linguistic

design of the AAT varies systematically between modalities, units and regularities of the language. With respect to modalities, input and output components are combined and varied in oral, written and pictorial codes. The units comprise phonemes/graphemes, morphemes, lexemes and sentences. The regularities focus on relevant linguistic parameters contrasting different degrees of complexity in sound, morpheme and sentence structure. In construction the Thai version of the AAT, specific contrasts of the Thai language were selected (Pracharitpukdee N et al,1998)[8]. i.e. the Thai version is not a translation of the original German version, but an adaptation of test design to the Thai Linguistic structure.

Studying the pattern of intercorrelations among item groups, a clustering which is in agreement with the expectation based on the linguistic test design was obtained, Overall, the modality based subtest structure was clearly revealed by applying hierarchically cluster analysis. There was an interesting exception concerning the subtest written language. On the one hand, Reading aloud clustered with naming rather than with writing (Putting together and handwriting to dictation). On the other hand, Reading comprehension clustered with writing rather than with Auditory comprehension. We propose a common linguistic basis for both effects. Thai orthography is irregular to a large extent, i.e. written words, often have to be processed in a holistic fashion rather than by segmental analysis. As a result, reading aloud of written words becomes similar - at least in conditions of aphasia - to labeling of pictures by spoken words. Likewise, Writing to dictation ends in a processing component, which requires holistic visual check of the words being written. This is similar to the take - in of word form information in reading for comprehension. Among the European language versions of the AAT similar splits in clustering of Written language and Comprehension were only found for English which is known for its highly irregular orthography in contrast to the more regular spelling in Italian, Dutch and German.

Another aspect of the intercorrelational pattern among item groups was brought about by Smallest Space Analysis. A surprisingly clear radex structure was found showing circular bands and wedge – like segments. The segments of the radex clearly reflect the subtest structure of the AAT. In addition, the circular bands in the order from the periphery to the center contain: Repetition and Auditory comprehension, Reading and Writing, Naming and finally, - at the core of the radex – the Token test. This " centripedal " order seems to reflect increase in processing demands rather than a graduation of linguistic units. Further research has to clearly extent this result to what is related to the language specificities of Thai or to the composition of the validation sample of aphasic patients.

Among the patients referred to our clinics there was a rather large proportion of patients with a severe degree of aphasia. This had an impact on the findings with respect to differential validity of the test. Due to their severe receptive and expressive language impairment, patients with Wernicke's aphasia could not be differentiated from global aphasia on any of the subtests. However, in spontaneous speech, the Wernicke's aphasics were always rated less severe than the global.

Considering the complete test profile, the four standard syndromes of aphasia were differentiated as well as in the validation studies of the other language versions of the AAT. In approximately 90 per cent of the patients, the aphasic syndrome as clinically judged prior to formal testing was identified by the profile of test score. It is important to note that the discriminatory power of the test comes to a large extent from the Spontaneous speech ratings alone (82%). Obviously, the characteristic aphasic symptoms can be well observed in a conversation – like situation and are captured by the six levels of Spontaneous speech rating introduced in the AAT. Their individual setup allows for a gradation based on explicitly defined symptoms as well as on their frequency of occurrence and/or degree of deviation. The selection properties of the THAI-AAT were found to be very good, i.e. none of the aphasic patients was either allocated to normal or to brain damaged control subjects. In part, this may also be due to the severity distribution among the aphasic patients. On the other hand, the non-aphasic subjects were likewise not incorrectly assigned to having the aphasia. Thus, the THAI-AAT is both highly sensitive in detecting aphasia and specific in rejecting non-aphasics. Lastly, the internal consistency of the THAI-AAT subtests is high, this is important for the possibility of conducting a psychometrically sound assessment of the test profile of an individual patient and for comparing the test performances at different occasions during recovery (Willmes K, 1985)[15].

The linguistic and psychometric properties make the THAI-AAT a useful, reliable and valid tool for the clinical diagnosis of aphasia. The test is also appropriate for follow-up studies, e.g. the efficacy of speech therapy. Furthermore, baseline data for research purposes can be obtained e.g. cross-linguistic study or even neurolinguistics in Thailand. Nevertheless, before the THAI-AAT can be statistically safely applied in a routine manner, normative data have to be collected, which must be based on a much larger sample of at least 200 aphasic patients as has already been achieved for other fully standardized versions of the AAT.

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แบบทดสอบอาเค่นอะเฟเซีย ฉบับภาษาไทย

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เนื่องจากคลินิกฝึกแก้ไขการพูดในประเทศไทย ยังไม่มีแบบทดสอบอะเฟเซียมาตรฐานสำหรับการวินิจฉัยและการประเมินผลความบกพร่องทางการสื่อความหมาย สำหรับผู้ป่วยอะเฟเซียไทย เป็นผลให้การวินิจฉัย การวางแผนการรักษา ตลอดจนการศึกษาเกี่ยวกับผู้ป่วยอะเฟเซียเป็นไปอย่างไม่มีระบบ และขาดประสิทธิภาพ การวิจัยครั้งนี้จึงมีจุดประสงค์ที่จะนำแบบทดสอบอาเค่นอะเฟเซีย ฉบับภาษาไทย ซึ่งได้ดัดแปลงอย่างมีระบบตามกฎเกณฑ์ทางภาษาศาสตร์และทาง psychometric เช่นเดียวกับแบบทดสอบอะเฟเซียมาตรฐานฉบับภาษาเยอรมัน โดยปรับให้เหมาะสมกับระบบภาษา สังคม และวัฒนธรรมไทย มาทดสอบความสามารถในการสื่อความหมายของผู้ป่วยอะเฟเซียไทย ประชากรที่เข้าร่วมการศึกษาแบ่งเป็น 3 กลุ่ม ได้แก่ ประชากรปกติจำนวน 120 ราย ผู้ป่วยทางระบบประสาทที่ไม่มีความบกพร่องทางภาษาจำนวน 60 ราย และผู้ป่วยอะเฟเซียจำนวน 125 ราย จากผลการศึกษาพบว่าแบบทดสอบอาเค่นอะเฟเซีย ฉบับภาษาไทยสามารถนำมาใช้ทดสอบความสามารถทางภาษาของผู้ป่วยอะเฟเซียไทยได้ตามจุดประสงค์ กล่าวคือ สามารถคัดแยกผู้ป่วยอะเฟเซียออกจากผู้ป่วยทางระบบประสาทอื่น ๆ ที่ไม่มีปัญหาทางภาษา และสามารถวินิจฉัยแยกประเภทและระดับความรุนแรงของอาการอะเฟเซียได้

คำสำคัญ : อะเฟเซีย, แบบทดสอบอาเค่นอะเฟเซีย, ฉบับภาษาไทย

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