Aud Vest Res (2016);25(1):49-54.

RESEARCH ARTICLE

Development and determination of the validity of Persian version of monaural selective auditory attention test in learning disabled children

Saeid Aarabi[1], Farnoush Jarollahi[1]*, Shohreh Jalaie[2]

[1]- Department of Audiology, School of Rehabilitation Sciences, Iran University of Medical Sciences, Tehran, Iran
[2]- Biostatistics, School of Rehabilitation, Tehran University of Medical Sciences, Iran

Received: 21 December 2015, Accepted: 19 February 2016

Abstract

Background and Aim: Given the prevalence of selective auditory attention deficit in children with learning disability (LD) and the need for standardization of screening tests and diagnosis of this deficit in our country, the aim of this study was development and determination of the validity of monaural selective auditory attention test "mSAAT" in Persian.

Methods: This study was a test development based on cross sectional method that was performed in two steps, development and validation of the test and then the initial study. A four minute story and two lists of 25 mono-syllabic words from Persian word intelligibility by picture identification test was recorded by a male speaker. To maximize difficulty a 0 dB signal to noise ratio was used. After validity evaluation, 27 normal and 7 LD children aged 8 to 9 years were tested in both competitive and non-competitive manner.

Results: Persian version of mSAAT had content-validity ratio of 0.91, 0.94, 1.00 for the first and second list and competing story respectively, and content-validity index of 0.88 was calculated for the whole test. Face validity was 4.16 and also significant difference was observed between test scores of the two groups of normal subjects and subjects with LD ($p<0.001$) that approved acceptable discriminant validity.

Conclusion: Based on the obtained result, the Persian version of mSAAT appeared to have the potential as a valid measure of selective auditory attention skill and seems that it's the same as the original test.

Keywords: Learning disability, monaural selective auditory attention test, selective auditory attention

* **Corresponding author:** Department of Audiology, School of Rehabilitation Sciences, Iran University of Medical Sciences, Shahid Shahnazari St., Madar Square, Mirdamad Blvd., Tehran, 15459-13487, Iran.
Tel: 009821-22221577 ext. 266,
E-mail: jarollahi.f@iums.ac.ir

Introduction

In order to have successful learning, children must be able to focus on target signal among other distractor signals. Selective auditory attention is the ability to select a specific stimuli among background competing sounds and focus on it [1,2]. Brain permits the modulation of neural activity according to person demands, allowing the selection, efficient encoding, and appropriate behavioral response to the stimuli of the greatest biological interest. Selective attention helps this modulation, directing the allocation of neural resources to selectively encode one aspect of the environment while excluding competing aspects. Brain behavior

control areas (e.g. prefrontal cortex) in contribution with selective attention cause increased activity of neurons that respond to target signal which leads to ignoring competitive signals [3].

Based on the National Joint Committee on Learning Disabilities (NJCLD) definition, learning disability (LD) is referred to a varying group of neurologically based disorders which occurs in different manners and degrees during one's life. There are some primary signs that indicate a child with LD including having delay in language and speech development, deficits in auditory discrimination and selective auditory attention, reasoning, perception, social interaction, motor coordination, requirements of educational performance and accomplishments, and any other criteria in relation with achieving academic objectives [4]. Chermak, et al. [5] reported persistent selective listening difficulties among learning-disabled adults who, compared to normal controls, exhibited depressed word identification in the presence of competing noise and speech.

Evaluation of speech recognition in the presence of background noise or competing speech is one of the most common approaches to identify a child with auditory disability [6].

Selective auditory attention test (SAAT) developed to assist in identifying young children "whose selective attention deficits may lead to academic problems" [1]. The SAAT was designed for the first time by Cherry and is a brief and intrinsically interesting task for assessing selective auditory attention ability of LD children and requires no special equipment or materials for administration. This test includes two sub-tests and is performed in a dichotic way: 1) presenting of monosyllabic words without the presence of competing noise and 2) presenting of monosyllables with presence of competing noise. She used meaningful speech, meaningless speech and white noise for determining the best competing signal. Performance on the list presented in quiet, assesses auditory discrimination; performance on the list presented against the competing speech background should reflect selective auditory attention ability [7].

Cherry in 1980 reported that the SAAT identified 90% of the LD children and 40% of at risk children judged by teachers. She concluded that the SAAT may efficiently identify LD children. Because it is convenient and easy to administer, the SAAT could be a valuable tool for the assessment of selective attention in children [1].

Since language plays an important role in tests with speech materials, it is important to provide Persian version of mSSAT as a tool for evaluation of selective auditory attention skill to assess LD children. Thus, the purpose of this article was to introduce development of Persian version of monaural SAAT and evaluating its content validity.

Methods

This study was a test development based on cross sectional method that was performed in two steps. First, construction of Persian version of mSAAT and evaluation of its content validity, second, conducting a primary study on 27 normal and 7 learning disability children to obtain discriminant validity.

Test design

monaural selective auditory attention test (mSAAT) contains two sub-tests: 1) two lists of 5 monosyllabic words, recorded in the absence of competing massage for obtaining speech discrimination score and 2) two lists of 25 monosyllabic words, recorded in the presence of competing massage. In this test, competing massage is a four minute story for each list that is attractive for age group of test participants. One of the selected stories was presented by Tehran's children cultural, intellectual and educational center which was written for B age group children (6-9 years old), and was recorded by a male voice.

For designing this test, two lists of phonetic balanced monosyllabic words in accordance with child's vocabulary level is required. In the original version of this test, Cherry used lists of monosyllabic words of word intelligibility by picture identification (WIPI) test to design

SAAT Reasons for using these lists are: 1) containing stimulus words within the recognition vocabulary of young children 2) involving a closed response task. 3) not requiring the ability to read. 4) not requiring a verbal response 5) having identification tasks rather than a same/different decision task. Minimizing short-term memory requirements 6) utilizing colored pictures 7) containing four equal lists of 25 monosyllabic words 8) using the same carrier phrase to introduce all words to eliminate the context that may aid in the identification of target words [9].

In Persian language there are many word lists. According to our findings, those lists provided by Adel Ghahraman et al., were the most suitable phonetic balanced monosyllabic words for test participants in Persian language which also have the possibility to be pictured. The validity and reliability of these lists have been evaluated [10].

A 25 page visual booklet was prepared with six colored pictures in each page which is in accordance with pagination of the original version. Four pictures were selected from four phonetic balanced lists with maximum phonetic similarity (each picture should be selected from one list). For making the test harder and reduce the child's guessing level, two other optional pictures were added to each page.

In order to omit phonetic symbols, the competing story and monosyllabic words were recorded in the studio by the same male person. Signal to noise ratio (SNR) was set zero to have maximum hardness.

Phrase "show me…" was said before presenting each word. Using the same phrase for presenting each word reduces the effect of context. The story and words are presented monotonically. The story begins before presenting the first word of the list and continues without pausing until the last word of the list.

Content and face validity

For measuring content validity, all prepared materials were given to ten experts in the field of auditory rehabilitation, and then they discussed about them and made comments. After collecting comments, the content was reviewed and the revised test was sent to them again for final comments. Finally, content validity ratio (CVR) and content validity index (CVI) were calculated.

For measuring face validity, opinions of ten children about the clearness of each item in the target group were collected, and then the mean score of face validity was calculated.

Primary evaluation and discriminant validity

For solving possible defects during the test, a pre-test performed on 27 normal and 7 children with learning disorder aged from 8 to 9 years in 2013. Normal and LD children were selected from Tehran elementary school and Akhavan Center, respectively. Selection criteria included hearing within normal limits as evidenced by the passing of a pure tone screening in each ear at 500 to 4000 Hz at 20 dB HL, type A tympanometry and normal acoustic reflex thresholds, an IQ score no less than 75, a speech recognition score of at least 88%, presented monotonically under headphones on one list of the WIPI test administered at a comfortable loudness level without a competing message, enrollment in regular classrooms for both groups and for LD children, presently taking no drugs to control hyperactivity, and classifying LD by child study team if they exhibited disability in one or more basic processes involved in the development of the spoken or writing language and not primarily due to sensory disorder, motor handicap, mental retardation, emotional disturbance or environmental disadvantage. The disabilities are manifested in the perceptual areas involved in listening, reading, writing, spelling and thinking.

At the beginning of the test in order to make the child familiar with the pictures, the pictures of the booklet were shown to the child. Then the first track (that includes the first list of WIPI and the competing message) was presented at 50 dB HL to right or left ear randomly. In the next step, second track (that includes the second list of WIPI and the competing message) was

Table 1. Content and face validity of Persian version of monaural selective auditory attention test

Index	Competing story	First list	Second list	Whole test
CVR	1.00	0.91	0.94	
CVI	-	-	-	0.88
Face validity	4.50	4.10	3.90	4.16

CVR; content validity ratio, CVI; content validity index

presented to the other ear. Each child received 4 percent for each correct word, with a maximum score of 100% on each list.

At the end, after applying final review and performing the pre-test, the final structure of mSAAT was changed as blew:

Five monosyllabic words presented to each ear to evaluate speech recognition ability. As well as two lists of 25 words with competing story that has a zero signal to noise ratio and pictures booklet in order to get child's answer.

Finally, for calculated CVR we used CVR formula, and independent t-test was used for evaluation of discriminant validity of the test.

Results

According to the experts' comments in the revision, pictures of /naql/ and /no/ were changed. Results of content and face validity of the questionnaire for each lists, competitive story and whole test, after applying collected data in the formula, has shown in Table 1.

Pre-test performance in 27 normal and 7 children with learning disorder led to relocating the presentation sequence of /aab/ and /tan/ in the test structure. Also approximate performance time for non-competing sub-test was one minute and for competing sub-test was 4 minutes for each ear which makes it 10 minutes for both ears. A test which evaluates both ears in 10 minutes is acceptable to be used as a screening tool.

Statistical analysis of test results including mean, median, maximum and minimum scores of competing test in normal and children with learning disorder is shown in Table 2.

The calculated results from independent t-test from scores of normal children's competing sub-test and children with learning disorder, was $t=13.497$ and $p<0.001$ which show acceptable differential validity.

Discussion

The most important factor that should be noticed is test validation. A test has content-validity ratio (CVR) of 0.91, 0.94, 1.00 for first and second list and competing story respectively, and content-validity index (CVI) of 0.88 was calculated for the whole test. Face validity was 4.16 and p-value for discriminant validity was 0.0001 ($p<0.0001$). Simultaneous assessment of content, face and differential validity confirmed the accuracy of the test. One of the flaws of the original version of SAAT is not calculating the validity [11]. However, Cherry claimed the validity of SAAT is suitable for screening test, she considered that the cut of point was 25% lower than normal group score and stated that the test is able to detect 90% of LD children [7]. Despite normative data for children in range of 4-9 years old, she also argued that there is no golden standard test to diagnose auditory processing disorder, therefore, sensitivity and specificity cannot be calculated [8].

Monaural SAAT evaluates the field of monaural low redundancy speech. Pillars of mSAAT are based on this hypothesis that weakness in skills of selective auditory attention causes learning disorder [9]. This test evaluates speech recognition in the presence of competing signal (competing signal in this test is speech) in one ear. We should consider this matter that difficulty of speech perception in the presence

Table 2. Descriptive indexes of monaural selective auditory attention test in normal and learning disability children for each ear

	Normal		Learning disabled	
	Right ear	Left ear	Right ear	Left ear
Number	27	27	7	7
Mean	89.33	90.37	63.42	62.28
Standard deviation	5.06	5.21	8.40	7.85
Minimum	84.00	84.00	56.00	56.00
Maximum	96.00	100.00	72.00	72.00

of background noise is the most common complain of children who suffer from auditory processing problems [6]. Until now, some tests such as speech in noise, dichotic digits and competing sentences were used for evaluation of selective auditory attention in Iran [2]. According to many studies, meaningful competing signal has higher adverse impact on selective auditory attention skill rather than meaningless signals and this complication is more for LD children than normal ones [5,6].

Cherry reported that the SAAT identified 90% of the LD children and results of this study showed that performance of LD children on Persian version of mSAAT is significantly different compared to normal achieving children scores [1].

On the other hand, Cherry and Rubinstein in 2006 compared the score of SAAT in diotic and monotic conditions. The result of this study showed that monotic administration causes evaluation of each ear separately and most importantly enhance the sensitivity of the test [8].

The results of this study are also consistent with Iliadou et al. who reported that 30-50% of LD children had some form of auditory impairment [12].

The foregoing highlights the importance of the Persian version of mSAAT for assessing selective auditory attention skill along with other tests to diagnose LD.

Conclusion

Based on the obtained results, the Persian version of mSAAT with acceptable validity appears to have potential as a useful measure of selective auditory attention skill and seems it functions as the original test.

Acknowledgements

The research has been supported by Iran University of Medical Sciences grant No. 22518-01-92. We would like to thank Rochelle Cherry and Gail D. Chermak for their great assistance.

REFERENCES

1. Cherry RS, Kruger B. Selective auditory attention abilities of learning disabled and normal achieving children. J Learn Disabil. 1983;16(4):202-5.
2. Talebi H, Tahayi SA, Akbari M, Kamali M. The comparison of auditory selective attention and auditory divided attention between patients with cerebrovascular accident and normal cases. Journal of Rehabilitation. 2007;8(1):17-24.
3. Cacace AT, McFarland DJ. Central auditory processing disorder in school-aged children: a critical review. J Speech Lang Hear Res. 1998;41(2):355-73.
4. American Speech-Language-Hearing Association. Learning disabilities: issues on definition [Relevant Paper]. 1991. Available from www.asha.org/policy.
5. Chermak GD, Vonhof MR, Bendel RB. Word identification performance in the presence of competing speech and noise in learning disabled adults. Ear Hear. 1989;10(2):90-3.
6. Katz J, Wilde L. Central auditory processing evaluation: a test battery approach. In: Katz J, editor. Handbook of clinical audiology. 7th ed. Baltimore: Lippincott Williams & Wilkins; 2015. p. 545-57.
7. Cherry R. The selective auditory attention test (SAAT): a screening test for central auditory processing disorders

in children. In: Bess FH, Hall JW, editors. Screening children for auditory function. Bill Wilkerson Center Press; 1992. p. 361-71.
8. Cherry R, Rubinstein A. Comparing monotic and diotic selective auditory attention abilities in children. Lang Speech Hear Serv Sch. 2006;37(2):137-42.
9. Chermak GD, Montgomery MJ. Form equivalence of the Selective Auditory Attention Test administered to 6-year-old children. J Speech Hear Res. 1992;35(3):661-5.
10. Adel Ghahraman M, Modaresi Y, Sedaei M, Babaei G. Development, standardization and evaluation of a close-set speech recognition test for Persian speaking children of 4 to 6 years old. Audiol. 2000;8(1-2):14-9. Persian.
11. Friberg JC, McNamara TL. Evaluating the reliability and validity of (central) auditory processing tests: a preliminary investigation. J Educ Audiol. 2010;16:4-17.
12. Iliadou V, Bamiou D, Kaprinis S, Kandylis D, Kaprinis D. Auditory Processing Disorders in children suspected of Learning Disabilities—A need for screening? Int J Pediatr Otorhinolaryngol. 2009;73(7):1029-34.