

Idiom Comprehension Deficits in High-Functioning Autism Spectrum Disorder Using a Korean Autism Social Language Task

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Purpose: High-functioning autism spectrum disorder (ASD) involves pragmatic impairment of language skills. Among numerous tasks for assessing pragmatic linguistic skills, idioms are important to evaluating high-functioning ASD. Nevertheless, no assessment tool has been developed with specific consideration of Korean culture. Therefore, we designed the Korean Autism Social Language Task (KASLAT) to test idiom comprehension in ASD. The aim of the current study was to introduce this novel psychological tool and evaluate idiom comprehension deficits in high-functioning ASD.

Materials and Methods: The participants included 42 children, ages 6–11 years, who visited our child psychiatric clinic between April 2014 and May 2015. The ASD group comprised 16 children; the attention deficit hyperactivity disorder (ADHD) group consisted of 16 children. An additional 10 normal control children who had not been diagnosed with either disorder participated in this study. Idiom comprehension ability was assessed in these three groups using the KASLAT.

Results: Both ASD and ADHD groups had significantly lower scores on the matched and mismatched tasks, compared to the normal control children (matched tasks mean score: ASD 11.56, ADHD 11.56, normal control 14.30; mismatched tasks mean score: ASD 6.50, ADHD 4.31, normal control 11.30). However, no significant differences were found in scores of KASLAT between the ADHD and ASD groups.

Conclusion: These findings suggest that children with ASD exhibit greater impairment in idiom comprehension, compared to normal control children. The KASLAT may be useful in evaluating idiom comprehension ability.

Key Words: High functioning autism spectrum disorder, comprehension of idiom, Korean Autism Social Language Task

INTRODUCTION

According to the Diagnostic and Statistical Manual of Mental

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Disorders, 4th edition, text revision (DSM-IV-TR), autism spectrum disorder (ASD) is a behaviorally demarcated syndrome defined by disabilities in three areas of development: social interaction, communication, and perceptual organization. However, in the DSM-5,¹ a subtle change was made with regard to the core symptoms; social interaction and communication were integrated into one category as ‘social communication.’ This small change reflects the fact that social reciprocity and communicative skills are intimately connected and therefore difficult to segregate.

Among factors contributing to impaired social reciprocity, pragmatic language impairment is an established feature of ASD,² and previous research has investigated the connection between social and pragmatic deficits in patients with autism. The association theory and the cognitive theory explain the re-

relationship between social and pragmatic deficits differently.³ The association theory maintains that autistic children lack in-born ability to emotionally network with others and fail to identify people’s mental states, thereby experience pragmatic deficit. The cognitive theory insists that innate central cognitive deficit in autistic children makes understanding meta-representation, such as symbolic expressions in pragmatic language, difficult. According to the criteria for Asperger syndrome and high-functioning ASD, these patients would not be expected to exhibit deficits in verbal and nonverbal social communication skills. However, several studies have found that these deficits do indeed appear in patients with Asperger syndrome and ASD. In particular, findings indicate that the specific linguistic techniques of patients with Asperger syndrome and high functioning ASD suggest impairments in pragmatic language skills,^{4,5} such as interactive language use, production/comprehension of speech prosody, and literal interpretation of utterances.⁶

Pragmatics is defined as the use of speech and gestures in a communicative way and in an appropriate social context.⁷ In order to comprehend pragmatic language correctly, both lifetime literal experience and figurative competence (analysis of social cues and situational context) are required.⁸ Classically, there are numerous tasks for assessing the pragmatic linguistic skills of ASD children,⁹ such as Mental State Verb Task, Script Inferencing Task, Speech Acts Task, and so on. Amongst these, metaphor/idiom tasks are reported to reflect the figurative language ability of ASD children. According to the relevance theory,¹⁰ in order to assess the speaker’s use of figurative language, including idioms, it is essential to grasp his/her intention by understanding the non-verbal information provided by him/her. Nonliteral communication knowledge is required for understanding idioms¹¹ and humor,¹² as well as metaphors and irony.^{10,13} However, children with ASD do not infer the meaning of mental state verbs in context, make inferences about social scripts, understand metaphor, or produce speech acts, all of which are the basis of successful social communication, as they elaborate meaning or convey intentions.¹⁴ Therefore, idioms are important evaluation tools for assessing high-functioning ASD, because they enable examiners to assess whether ASD children understand and use social cues and situational context in their daily lives.

Unfortunately, no satisfactory assessment tool has been developed with specific consideration of Korean culture or for

use in the Korean population. Therefore, we designed the Korean Autism Social Language Test Korean Autism Social Language Task (KASLAT) in order to evaluate language comprehension, cognitive inference ability, ability to find common features, sequential connection, and providing missing information (filling in the blank). Together, these measures comprise a tool that can be used to assess social cues-based understanding of children with autism. The aim of the present study was to introduce the KASLAT and to assess idiom comprehension deficits in school-aged high functioning children with ASD using this novel psychological assessment tool.

MATERIALS AND METHODS

Subjects

We included patients aged 6–11 years who were patients at a child and adolescent psychiatry clinic in Severance Hospital, Yonsei University College of Medicine, Seoul, Korea from April 2014 to May 2015. A psychological test and clinical symptom scales, such as Childhood Autism Rating Scale (CARS), Social Communication Questionnaire (SCQ), and Social Responsiveness Scale (SRS), were conducted for the 42 patients who were diagnosed with ASD and attention deficit hyperactivity disorder (ADHD), using DSM-IV-TR criteria and 10 normal control children who visited for a medical health check-up. All participants in this trial were Korean, and all family members were proficient native speakers of Korean. The present study was approved by the Institutional Review Board for research with human subjects at the University Hospital where the present study was performed (approval number: 4-2012-0828).

Demographic characteristics

Both the ASD and the ADHD group consisted of 16 children each (ASD group: 12 boys, 4 girls; mean age, 9.31±1.70 years; ADHD group: 14 boys, 2 girls; mean age, 8.00±1.59 years). There was no significant difference between the groups in terms of age, gender distribution, and intelligence quotient (IQ) (Table 1).

Development of Korean Autism Social Language Task (KASLAT)

The KASLAT is a task designed to evaluate idiom comprehension ability in social situations by our research team. The KASLAT was built based on ‘the study of Metaphor, Metonymy

Table 1. Demographic Characteristics of the ASD, ADHD, and Normal Control Groups

	ASD (n=16)	ADHD (n=16)	Normal control (n=10)
Age (months, SD)	9.31±1.70	8.00±1.59	9.30±1.76
Gender (M)	12	14	5
IQ	94.75±15.96	92.73±12.28	

ASD, autism spectrum disorder; ADHD, attention-deficit/hyperactivity disorder; IQ, intelligence quotient. There was no significant difference in age, gender distribution, and IQ between ASD, ADHD, and normal control groups (age and IQ differences were analyzed by ANOVA, gender difference by chi-squared test).

of Korean Pragmatics.¹⁵ The completion of sentences in the current KASLAT question sheet was as follows: first, about 700 low-level idioms were selected through discussion, and next, language professionals, such as language therapists and elementary school teachers, evaluated the validity of the words and a final decision was made.

The KASLAT is composed of three sections: matched, mismatched, and neutral. The matched task includes an idiom and shows a corresponding image. For example, the Korean pragmatic sentence “This smells weird,” has a meaning similar to the English expression “There’s something fishy about it,” or “I smell a rat.” Although literally these expressions indicate an awkward smell, in social context, Koreans would naturally understand that something suspicious or unreliable is going on. Likewise, corresponding pictures are presented to the children simultaneously (Fig. 1A). Thereby, the sentence and the picture are “matched.” Another example of a matched group is the sentence “Father became a pickled onion,” and Fig. 1B. To elaborate, the appearance of a pickled onion is not fresh; it is limp and lifeless, and therefore, this metaphorically implies an absolutely exhausted person.

On the other hand, mismatched tasks are composed of idioms and mismatched images. For example, the sentence “He is digging his own grave,” and Fig. 2A are given to the child simultaneously. In Korea, this proverb is used when referring to someone doing a foolish thing or making a blunder, whereas the picture in this questionnaire is demonstrating the literal meaning of the sentence as the man is shown actually digging his own grave. Another example is the phrase “The crying fist,” and the image in Fig. 2B. The Korean phrase “crying fist” refers to a person in extreme anger or frustration; the expression originates in the shape of the hands when people clench their hands in an emotion of madness or frustration. Neutral tasks comprise sentences with straightforward dictionary definition and matching pictures such as “Sit with your two legs stretched forward,” and Fig. 3A, or “He shouted from the top of the mountain” and Fig. 3B. Therefore, there is no conflict between the literal and figurative meanings of the sentence (Supplementary Fig. 1, only online).

The KASLAT procedure is carried out as follows: before the start of the test, the examiner explains the task in detail. The children are told that the picture and the sentence will be shown together; when the two indicate the same meaning they should answer “yes,” and when they do not, they should say “no.” A total of 45 questions (15 questions each from the matched, mismatched, and neutral groups) are randomly mixed in advance. The sentence-image pair is shown to the examinee for five seconds to give enough time to make a decision. Then the examinee is asked whether the sentence and the image indicate the same meaning or not. The answer should be either ‘yes’ or ‘no.’ Meanwhile, the examiner keeps a track of the number of correct answers for each examinee.

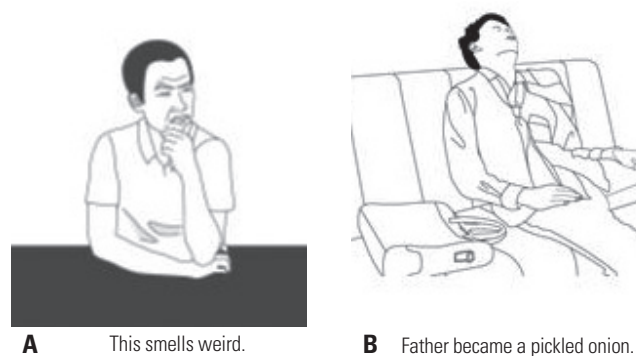


Fig. 1. Examples of matched tasks. (A) “This smells weird,” means “I smell something fishy.” (B) “Father became a pickled onion,” means “about as limp as spring onion kimchi/dog-tired.”

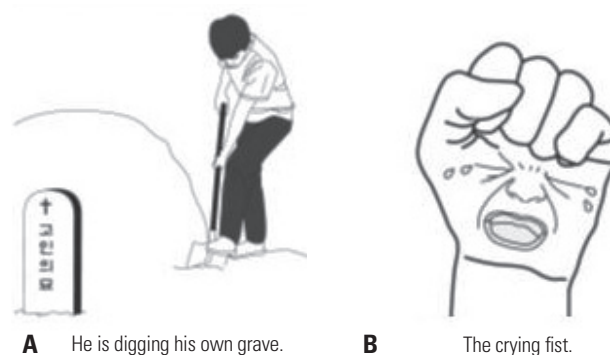


Fig. 2. Examples of mismatched tasks. (A) “He is digging his own grave,” means “dig one’s own grave.” (B) “The crying fist,” means “clench one’s fist.”

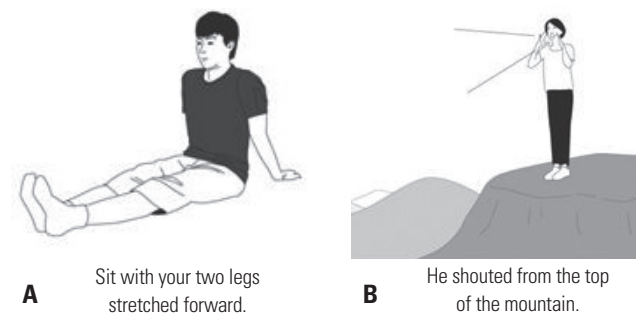


Fig. 3. Examples of neutral tasks. (A) “Sit with your two legs stretched forward,” means “Sit with your legs straight.” (B) “He shouted from the top of the mountain,” means “He shouted from the top of the mountain.”

Data analyses

All data were parametrically distributed and were analyzed by one-factor analysis of variance (ANOVA) for a between-group comparison of demographic characteristics and KASLAT scores. If the ANOVA yielded significant results, we performed post hoc analyses with Scheffe’s method for comparisons between each pair of groups. Correlations were evaluated using the Pearson product moment correlation coefficient. Chi-square test was used for between-group comparison of gender distribution. Cronbach’s alpha was used to analyze the internal consistency

Table 2. Mean and SD of KASLAT Scores for the ASD, ADHD, and Normal Control Groups

	ASD (n=16)		ADHD (n=16)		Normal (n=10)		Post hoc analysis
	Mean	SD	Mean	SD	Mean	SD	p value
Matched*	11.56	3.01	11.56	2.73	14.30	1.33	ASD vs. normal 0.043, ADHD vs. normal 0.043
Mismatched†	6.50	5.28	4.31	4.66	11.30	2.58	ASD vs. normal 0.043, ADHD vs. normal 0.002
Neutral	13.88	0.96	13.56	1.96	14.80	0.42	ASD vs. normal 0.577, ADHD vs. normal 0.553
Total‡	31.94	5.57	29.44	4.10	40.50	3.68	ASD vs. normal <0.001, ADHD vs. normal <0.001

ASD, autism spectrum disorder; ADHD, attention-deficit/hyperactivity disorder; KASLAT, Korean Autism Social Language Task.

Significant differences were identified between the groups in Matched scores, Mismatched scores and Total score by ANOVA. No significant differences between the groups were found in neutral scores.

*Matched score $p=0.022$, †Mismatched score $p=0.002$, ‡Total score $p=0.001$.

Table 3. Internal Consistency of the KASLAT

Type of task	Number of items	Cronbach's alpha
Matched	15	0.793
Mismatched	15	0.938
Neutral	15	0.691

KASLAT, Korean Autism Social Language Task.

within each subgroup (matched, mismatched, neutral). All data were analyzed using SPSS software, version 18.0 (SPSS Inc., Chicago, IL, USA).

RESULTS

ANOVA was performed to compare the mean KASLAT scores between the ASD, ADHD, and normal control groups. Significant differences were observed in the Matched, Mismatched, and Total scores between the groups. The mean score of the ASD and ADHD groups for the matched task was 11.56, while normal controls had a mean score of 14.30. In the mismatched task, the mean score was 6.50 for ASD, 4.31 for ADHD, and 11.30 for the normal control group. In the neutral task, the mean scores for each group were 13.88 for ASD, 13.56 for ADHD, and 14.80 for normal control; there was no significant difference between each group. Multiple comparison through Scheffe's method revealed that both the ASD and the ADHD groups had lower matched, mismatched, and total scores than the normal control group. However, when the ADHD group was compared with the ASD group, no significant difference was found in the scores for any of the three tasks (Table 2). This suggested that the idiom comprehension skills of the ASD and the ADHD group children were inferior to those of the normal control group children. Internal consistency reliability for each subgroup (matched, mismatched, and neutral) was confirmed by Cronbach's alpha (Table 3). The correlation test showed that the scores for each subgroup (matched, mismatched, neutral) were not correlated with the total scores of the CARS and the SCQ or the total T-score of the SRS and subscale T-scores of the SRS in the ASD and ADHD groups.

DISCUSSION

Our study assessed idiom comprehension abilities by the KASLAT in three diagnostic groups of children: those with ASD, those with ADHD, and normal control children. The reason why ADHD was chosen out of various clinical groups was because ADHD has a high prevalence. Also, since ADHD children exhibit problems with social skills as in ASD, we thought comparing differences in pragmatic language skill between ADHD and ASD would be beneficial. Only pure ASD and ADHD without comorbidity were chosen. The ADHD subjects comprised patients undergoing regular medicine treatment who showed mild symptom severity with a mean ADHD rating scale score 18.04.

We found that the ASD group children had significantly lower scores on the matched and mismatched tasks, compared to normal control children; no significant difference was found between the two groups in the neutral task. These findings suggest that children with ASD face greater difficulty than normal children in understanding idioms; they fail to consider social context and tend to interpret expressions literally. Previous studies also showed that one discrete feature of mild ASD (such as Asperger syndrome and high-function ASD) is the literal interpretation of words,^{6,16} because autistic children find it hard to make contextual inferences in everyday speech.¹⁴ Literal interpretation has been found to be a factor that makes understanding idioms difficult.¹¹

Our findings also suggest that the ASD group children exhibit greater impairment in pragmatic language abilities than normal control children. In many studies, understanding contextual cues was regarded as the key to understanding pragmatic language.^{17,18} According to Rescorla and Mirak,¹⁹ infants aged 12 to 15 months use requests, commands, questions, responses, and comments to convey their intent to their caregiver, using a rich repertoire of vocalization and gestures with facial expressions. These abilities are the initial signs of the development of pragmatic language skills in children. Therefore, acquirement of age-appropriate language skills by children is essential for their future social interactions. As already mentioned, the ability to interpret figurative language is necessary for using pragmatic language. Comprehension and production of figurative language is of the utmost importance in the typical development

of children in the later period.²⁰ These abilities are generally completed by the age of 4-5 years, when children start using pragmatic language in daily life. Moreover, the influence of age and higher education are also associated with inferential comprehension in normal individuals,²¹ since application of pragmatic utterances and comprehension of social context improves with age. In our previous study, we found that detection of aberrant language characteristics at an early age in children with ASD would be useful for screening ASD.²² Most autistic children tend to show delayed language development in comparison with normal control children. Their language-related deficits range from a lower level (receptive/expressive language disorder) to a higher level [phonological (encoding sound), structural, and semantic (i.e., encoding the meaning of a word and relating it to similar words with similar meaning) processing]. Depending on the severity of autism, autistic children have different linguistic issues.²³

We found no significant difference in the scores on the three tasks of the KASLAT between children with ASD and those with ADHD. This result could be explained by a decrease in the pragmatic language ability of children with ADHD similar to ASD children. In a review by Camarata and Gibson,²⁴ the pragmatic language deficits of children with ADHD was confirmed. ADHD affects language acquisition, causing deficits in grammar and/or semantics and also resulting in deficits in pragmatic language skills. Thus, pragmatic deficits may be associated with reduced learning opportunities. Meanwhile, another possible explanation for this result is that the children with ADHD may have said "yes" in response to all the questions in the KASLAT without thinking carefully, since ADHD children have deficits in response inhibition. In this sense, there is a possibility of them having a low score on the mismatched tasks. According to The Stop Task by Nigg,²⁵ ADHD is related to slower stop signal response time. This deficit of response inhibition in children with ADHD, who show significantly slower stop signal reaction times than normal children, has also been found in other previous studies.^{26,27}

The strength of this study is that for the first time, to our best knowledge, pragmatic language ability was assessed in Korean children using tasks developed especially for this purpose and suited to Korean culture. Nevertheless, this study also has some potential limitations. First, since the sample size was small, it may be difficult to generalize the results of the present study. Thus, future studies would be required with larger sample sizes and diverse clinical group. Second, pragmatic language ability through the tasks and clinical symptom scale (CARS, SCQ, SRS score) of ASD are not significantly correlated. This result may stem from the small sample size. We also postulated that Korean parents tend to underestimate several social problems in their children given that in Korean culture parents do not easily accept that their children could have problems. Such stigma, therefore, possibly could have made the clinical symptoms scales reported by the parents less relevant. To expand the use

of the KASALT, standardization of score distributions or T-score with a greater number of normal controls is needed.

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