



[ORIGINAL RESEARCH]

Can Tactile Sensory Processing Differentiate Between Children with Autistic Disorder and Asperger's Disorder?

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ABSTRACT

Objective. There are debates whether autistic disorder (autism) and Asperger's disorder are two distinct disorders. Moreover, interventional sensory occupational therapy should consider the clinical characteristics of patients. Already, commonalities and differences between Asperger's disorder and autistic disorder are not well studied. The aim of this study is to compare tactile sensory function of children with autistic disorder and children with Asperger's disorder.

Methods. Tactile sensory function was compared between 36 children with autism and 19 children with Asperger's disorder. The two disorders were diagnosed based on *Diagnostic and Statistical Manual of Mental Disorders Fourth Edition, Text Revision*. The parent-reported Tactile Dysfunction Checklist was used to assess the three aspects of hypersensitivity, hyposensitivity, and poor tactile perception and discrimination. Developmental coordination was also assessed.

Results. Developmental coordination problems total score was not associated with group. The mean (standard deviation) score of tactile hyper-responsivity was not different between the groups. Tactile hyposensitivity and poor tactile perception and discrimination scores were statistically higher in autistic disorder than Asperger's disorder group.

Conclusion. These results for the first time indicated that at least some aspects of tactile perception can differentiate these two disorders. Children with autistic disorder have more tactile sensory seeking behaviors than children with Asperger's disorder. Moreover, the ability of children with autistic disorder for tactile discrimination and sensory perception is less than those with Asperger's disorder. Interventional sensory therapy in children with autistic disorder should have some characteristics that can be different and specific for children with Asperger's disorder. Formal intelligence quotient testing was not performed on all of the children

evaluated, which is a limitation to this study. In some cases, a clinical estimation of intelligence quotient was given, which limits the conclusions that can be drawn from the data. Additional research using formal intelligence quotient testing on all of the subjects should be performed in order to draw more concrete conclusions.

INTRODUCTION

Autistic disorder (autism) and Asperger's disorder are two different disorders with some common features of communication impairment, social interaction impairment, and restricted behaviors and interests.¹ The presence of marked language delay in autism but not Asperger's disorder is a difference between the two groups. There is a difference between autism and Asperger's disorder regarding neurobiological endophenotypes.²

Tactile defensiveness is a negative reaction, such as withdrawal, avoiding, or escaping, in response to tactile stimulations, such as rubbing and scratching. This exaggerated response is explained by slower habituation to repeated tactile stimulus.³ However, tactile experiences in autism can be a positive experience (e.g., some children with autism seek out certain sensory stimulation).

Touch sensory processing using the Sensory Profile Questionnaire in patients with autism aged 3 to 56 years is abnormal.⁴ Parent-reported tactile hypersensitivity is common in autism.^{5,6} This over-reaction may also occur toward other sensory stimulus, such as cold, heat, and pain.^{7,8} Parents of children with autism reported that their children had exaggerated reaction to tactile stimulus, such as tickle, pain, itch, and touch.⁷ This can be a reason that the children cannot tolerate or dislike some textures and are opposed to wearing clothing made from certain materials.⁵ There are also deficits in sensory processing abilities of children with autism as measured by the Sensory Profile.⁹ In autism spectrum disorders (ASD), under-responsive sensory functioning using questionnaires is also reported.^{10,11} The

parent-reported studies showed that sensory disturbance correlates with severity of autism.¹² While sensitivity to gentle tactile stimuli reduces with age, tactile sensitivity persists with the increasing of age.⁴

There are confusing reports about the association of developmental level and sensory reactivity. Intelligence quotient (IQ) level or developmental level is not related to parent-reported tactile sensory reactivity in children with autism or general developmental disorders.⁵ Moreover, hyper-responsiveness in autism is similar to that in children with developmental delay group.¹³ However, another study reported that hyper-responsiveness to sensory stimuli in children with autism is influenced by developmental level.³ Meanwhile, abnormal sensory response is related to overall adaptive behavior in autism.⁵ Sensory reactivity of children with developmental delays is similar to that in mental age-matched typically developing toddlers.⁵ Children with autism have significantly more sensory symptoms than those with developmental disabilities.⁵ However, the sensory reactivity of children with developmental delays is not different from mental age-matched typically developing toddlers.⁵ Contrary to the expectations of the authors, developmental level and IQ are not related to sensory reactivity in children with autism or those with developmental delays.⁵

Individuals with Asperger's disorder have tactile hypersensitivity. They perceive tactile stimulus significantly more tickly and intense than do individuals in the control group.¹⁴ The adult Asperger's disorder group rated self-produced touch as less tickly than external touch.¹⁴ Both types of tactile stimulus, including self-produced touch and external touch, were rated significantly more tickly and intense in the Asperger's disorder group than in the control group.¹⁴ A previous study compared the sensory characteristics of children with autism and Asperger's disorder using Sensory Profile Parent-reported Questionnaire and indicated that

some areas of sensory processing pattern of autism and Asperger's disorder are different. Touch processing was more impaired in Asperger's disorder than in autism. Of course, the study did not match the two groups for IQ, and children with autism had poorer psychoeducational profiles than those with Asperger's disorder. Touch processing was measured by parent-reported child's response to tactile stimuli. The investigators only compared the hyper-responsivity between the two groups.¹⁵ Pressure discrimination ability in autism was not different from the typically developing control group.¹⁶

The current study aimed to investigate commonalities and differences between Asperger's disorder and autism regarding the different aspects of tactile sensory issues. Although autism and Asperger's disorder are studied extensively, there are a few studies comparing the tactile sensory function between autism and Asperger's disorder. Studying the difference is important for interventional planning. The excessive and/or diminished patterns of tactile sensory processing between autism and Asperger's disorder may be related to the specific neural complexity required to process the tactile stimuli. Tactile sensory assessment might help to make decisions for the pharmacological management of children with attention deficit hyperactivity disorder (ADHD) or autism.^{17,18} Pharmacological agents may be helpful for management of some sensory problems in autism.¹⁹ No study was found that compared the three different aspects of tactile sensory processing between autism and Asperger's disorder. All of the previously mentioned studies surveyed tactile hypersensitivity in autism while tactile hypo-responsivity and poor tactile perception and discrimination (PTPD) also included in the current study. Interventional sensory occupational therapy in children with autism should consider characteristics that can be different

and specific for children with Asperger's disorder.

METHODS

The subjects of this study consisted of 55 children: 36 children with autism and 19 with Asperger's disorder. The participants were from the university-affiliated Child Psychiatry Clinic of Hafez Hospital, Shiraz, Iran. The children were new referrals and they had not taken medication since at least the previous two weeks. This is part of a broader ongoing study on children with pervasive developmental disorders. Autism and Asperger's were diagnosed based on the *Diagnostic and Statistical Manual of Mental Disorders Fourth Edition, Text Revision (DSM-IV-TR)* diagnostic criteria administered by a board-certified child and adolescent psychiatrist and according to the Autism Diagnostic Interview-Revised (ADI-R).^{20,21}

TACTILE DYSFUNCTION CHECKLIST

Tactile sensory function was assessed by Tactile Dysfunction Checklist.²² Parents reported their children's tactile sensory response using the Tactile Dysfunction Checklist. This instrument assesses not only hypersensitivity (defensiveness) to tactile stimuli but also hyposensitivity (under-responsive or sensory seeking) and poor tactile perception and discrimination (PTPD). The instrument does not indicate tactile sensory disorder but it shows tactile sensory-related behavior. Tactile Dysfunction Checklist consists of 28 items and three subscales. The reliability of the hypersensitivity subscale is 0.78. It has 0.76 and 0.75 reliability for hyposensitivity and PTPD subscales, respectively.²² More information about its convergent and discriminant validity was reported elsewhere.²⁰ Parents reported their information about the frequency in which the children had usually responded to the situation. The response categories for each item ranges from 0 to 3 with 0=never, 1=occasionally, 2=often, and 3=always. There are 15 items for

hypersensitivity, eight items for hyposensitivity, and five items for PTPD. The range of scoring for the subscales of hypersensitivity, hyposensitivity, and PTPD are 0 to 45, 0 to 24, and 0 to 15, respectively. Higher scores represent higher dysfunction. Some of the items for hypersensitivity subscale include "doesn't like to brush his/her hair or easily annoyed by it" and "he/she is very sensitive to tickling." "Enjoys touching vibration of mobile phone" and "likes biting or pinching himself/herself" are examples of the hyposensitivity (sensory seeking) subscale. An example item for the items of PTPD is, "It is hard for him/her to realize physical quality of objects, such as its shape, weight, size, etc."

DEVELOPMENTAL COORDINATION DISORDER QUESTIONNAIRE (DCD-Q)

DCD-Q is a parent-completed questionnaire and a clinical screening tool that measures subtle motor problems with a high internal consistency ($\alpha=0.94$), sensitivity (85%), and specificity (71%).²³ The Farsi version of DCD-Q was used. Cronbach's alpha for this Farsi version questionnaire is 0.84.²⁴ It consists of three dimensions including fine motor/handwriting, gross motor/coordination function, and the general coordination.

INTELLIGENT QUOTIENT (IQ)

The global IQ score of some children was available using their medical records. In some cases without identified IQ score, it was clinically assessed according to clinical estimation using *DSM-IV-TR* diagnostic criteria. The range for total IQ score for children with autism was 45 to 110. Of the children with autism, 37.9 percent had an IQ score of less than 71 and 44.2 percent were in the range of 71 and 80. The range of total IQ score for the children with Asperger's disorder was clearly different from children with autism. The range for Asperger's group was 80 to 135. While there was no subject

with intellectual disabilities in the Asperger's disorder group, the majority of children with autism were in the range of intellectual disabilities.

Considering the population standard deviation (SD) of 2.3, the acceptable mean difference of 3.1, desired confidence interval of 90 percent, and alpha less than 0.5, the sample size to compare hyposensitivity was 17 patients in each group. Participation in this study was voluntary. Informed consent and assent was provided for participation by the parents and their children, respectively, whenever it was applicable. This study was conducted in accordance with the Helsinki Declaration of 1975, as revised in 2000.

STATISTICAL ANALYSIS

T-test was used to compare the mean age of the children with Asperger's disorder and those with autism. Fisher's exact test was used to examine the association of gender and group. Mann-Whitney U tests were used to examine the association of group and DCD total score, control during movement score, fine motor and handwriting score, and general coordination score. The mean score of tactile hyper-responsivity, tactile hyporesponsivity, and poor tactile discrimination between autism and Asperger's disorder were examined by independent sample *t*-tests. The mean score of developmental coordination and its domains were compared between groups by independent *t*-tests. The significance level was set at *P* value less than 0.05. The data of three children with Asperger's disorder and three with autism were not included in the analysis because they refused to participate and complete the questionnaires.

FINDINGS

The mean age of the children with Asperger's disorder and autism was 7.2 (2.1) and 6.8 (2.6) years, respectively, and there was no statistically significant association between age and group ($t=0.5$, $df=44$, $P=0.5$). There was no statistically

TABLE 1. Comparison of the mean score of tactile hyper-responsivity and tactile hypo-responsivity between autistic disorder and Asperger's disorder

TACTILE RESPONSIVITY	PERVASIVE DEVELOPMENTAL DISORDERS SUBTYPES	N	MEAN	STANDARD DEVIATION	<i>t</i>	<i>df</i>	SIG. (2-TAILED)	95% CONFIDENCE INTERVAL	
								Lower	Upper
Hypersensitivity	Autism	33	14.4	8.5	2.08	47	0.930	25.51	5.047
	Asperger's disorder	16	14.6	8.7					
Hyposensitivity	Autism	33	6.5	3.8	2.90	46	0.006	0.97	5.37
	Asperger's disorder	15	3.4	2.4					
Poor tactile perception and discrimination (PTPD)	Autism	30	7.3	3.3	3.02	44	0.004	0.94	4.72
	Asperger's disorder	16	4.5	2.3					

significant association between gender and group ($P=0.5$). The mean age of mothers and fathers was 33.1 (SD=7.3) and 38.8 (SD=8.4) years, respectively. The mean years of educational level of fathers and mothers was 12.4 (SD=3.3) and 12.2 (SD=3.0), respectively. There was no statistically significant difference between the groups for DCD problems score ($P=0.1$).

Tactile hypo-responsivity score was statistically different between the autism and Asperger's disorder groups ($t=2.9$, $df=46$, $P<0.006$). The score was higher in autism than Asperger's disorder group (6.4 [3.8] versus 3.4 [2.4]). The score of PTPD was also significantly higher in the autism group than in the Asperger's group ($t=3.0$, $df=44$, $P<0.004$) (Table 1). The mean (SD) score of tactile hyper-responsivity in autism and Asperger's disorder was 14.4 (8.5) and 14.6 (8.7), respectively. It was not statistically different between groups ($t=0.08$, $df=47$, $P=0.9$).

DISCUSSION

The developmental level of a large number of children with autism was in the range of intellectual disabilities while the children with Asperger's disorder were without intellectual disabilities. Although some studies report that hyper-responsivity in autism is not related to developmental level,⁵ others report that hyper-responsiveness to sensory stimuli is

associated with developmental level.³ So, current results could be considered as preliminary at the parent-reported behavioral level. However, the findings are valuable for research implications.

Hyposensitivity (sensory seeking) to tactile stimuli is seen more often in children with autism than in children with Asperger's disorder. Tactile sensory information processing is dependent on different parts, such as sensation at peripheral receptors, spinal pathways and synapses, perception in the brain, and cognition. The impaired level of tactile hyper- and hypo-responsivity is not clearly known in autism.^{25,26} The autism group was hypo-responsive, so we might conclude that interventional sensory therapy in children with autism should have some characteristics that are different and specific than those for children with Asperger's disorder. For example, further studies should investigate whether deep-pressure massage, using compression devices, or giving hugs are more favorable for children with autism than Asperger's disorder.

A possible research implication for more hypo-responsivity in autism than Asperger's disorder may be related to the better developmental level and cognition in Asperger's disorder.²⁷ Further studies comparing children with autism and intellectual disabilities to children with only intellectual disabilities are recommended to examine this explanation.

Lack of difference between autism and Asperger's disorder regarding hyper-responsivity may not support the idea that these two disorders are distinct from one another regarding tactile hyper-responsivity. In other words, lack of habituation after being repeatedly exposed to a sensory stimulus occurs in Asperger's disorder as well as in autism. Another explanation might be that these two disorders are caused by a common factor. A possible clinical implication for this finding is that interventional modalities for hyper-responsivity in children with Asperger's disorder should be similar to those with autism. Another possible interpretation is that the tactile sensory items used in the current study may not have been sufficiently specific to discover the difference between the low sample size groups.

There are limitations to this study, such as small sample size and lack of matching for IQ. This study is, to the best of the author's knowledge, the first one to compare tactile sensory processing in autism and Asperger's disorder, including the different aspects of tactile sensory processing. The first finding is that autism and Asperger's disorder are two distinct disorders regarding tactile sensory processing information. It cannot be ignored that the difference may be related to the difference in intelligence levels. However, about two thirds of children with autism are suffering from intellectual disabilities.

In fact, intellectual disabilities are commonly comorbid with autism. So, even if the difference is attributed to the IQ level, the results suggest that clinical intervention could be different.

Poor tactile perception score is higher in autism than in Asperger's disorder. It may indicate that individuals with autism identify and discriminate objects using tactile perception less than children with Asperger's disorder. Perhaps tactile perception is less efficient in children with autism than in children with Asperger's disorder, making it more difficult for autistic children to identify objects. A possible explanation for the tactile perception impairment and the higher score of hyposensitivity in children with autism is that children with Asperger's disorder have a higher awareness and intelligence and are able to recognize objects or respond to stimuli more meaningfully. In other words, an individual with Asperger's disorder has a greater ability to express a response to environment than an individual with autism. Although the role of developmental level cannot be ignored, poor tactile perception may differentiate autism and Asperger's disorder. Another possible explanation for the high score of hyposensitivity in individuals with autism is that children with Asperger's disorder typically express themselves better verbally than children with autism. So, the response pattern can be different between the two disorders. The higher scores for hyposensitivity and PTPD may indicate that children with autism process the tactile information in less detail than children with Asperger's disorder. Further studies may investigate whether poorer tactile perception is an endophenotype characteristic for Asperger's disorder and autism.

It is not clear whether children with autism receive less tactile stimuli than children with Asperger's disorder or if the information is interpreted differently by them. It might be useful for future research to investigate the level in which information processing

is impaired in autism compared to Asperger's. In addition, further studies may indicate whether hyposensitivity and PTPD are specific to autism.

The mechanoreceptors of the skin are different regarding morphology, distribution, and response threshold. Tactile thresholds for these receptors can be different. Further studies with more objective methods may investigate the association of these different receptors in autism and Asperger's disorder.¹⁴ Complexity is another matter that can be included in further studies. There are some reports indicating that there is a diminished level of auditory processing in tasks with complex stimuli in autism,²⁸ while processing may be heightened with simple auditory tones.²⁹

The children in this study were from the author's child psychiatry clinic. The clinical samples of children with autism usually have more severe symptoms than a community sample would.^{30,31} High-functioning children with autism are not different from typically developing children for enhanced tactile perception. Their ability to discriminate the roughness of different grades of sand paper or to detect synthetic fibers pressed on the skin is similar.¹⁶ So, the generalization of the results to the community samples is not guaranteed.

There are other points that should be taken into consideration. It is clear that this cross-sectional study does not investigate any cause and effect relationship. Moreover, the checklist is just a screening guide and it is not a diagnostic test that can be affected by informant bias or misunderstanding. However, using parent questionnaires has the advantage of collecting information on relatively low-frequency behaviors in different places and times by a very familiar observer.⁵ So, some behaviors that are not very common will be observed in a longer duration of time. The question that remains is whether tactile sensory differences between autism and Asperger's disorder are due to IQ difference or specific to autism.

CONCLUSION

The current findings indicate that persons with Asperger's disorder display a particular strength in parent-reported behavior related to tactile sensory discrimination: they have less hyposensitivity to tactile sensory stimuli. Further studies should indicate whether tactile perceptual abilities can differentiate pervasive developmental disorder subtypes. Tactile sensory seeking behavior is more common in children with autism than in children with Asperger's disorder. Moreover, the ability of children with autism to differentiate tactile sensories and sensory perception is less than that of children with Asperger's disorder. When treating children with autism or Asperger's disorder, it is important to keep in mind that children with autism likely will have different intellectual and perception levels from those of children with Asperger's disorder; therefore, interventional sensory therapy should reflect the needs of each individual child and should take into consideration these differences.

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