Original Article

Delayed Face Recognition in Children and Adolescents with Autism Spectrum Disorders

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Objective: Children with autism spectrum disorders (ASDs) have great problems in social interactions including face recognition. There are many studies reporting deficits in face memory in individuals with ASDs. On the other hand, some studies indicate that this kind of memory is intact in this group. In the present study, delayed face recognition has been investigated in children and adolescents with ASDs compared to the age and sex matched typically developing group .
Methods: In two sessions, Benton Facial Recognition Test was administered to 15 children and adolescents with ASDs (high functioning autism and Asperger syndrome) and to 15 normal participants, ages 8-17 years. In the first condition, the long form of Benton Facial Recognition Test was used without any delay. In the second session, this test was administered with 15 seconds delay after one week. The reaction times and correct responses were measured in both conditions as the dependent variables .
Results: Comparison of the reaction times and correct responses in the two groups revealed no significant difference in delayed and non-delayed conditions. Furthermore, no significant difference was observed between the two conditions in ASDs patients when comparing the variables. Although a significant correlation ($p<0.05$) was found between delayed and non-delayed conditions, it was not significant in the normal group. Moreover, data analysis revealed no significant difference between the two groups in the two conditions when the IQ was considered as covariate .
Conclusion: In this study, it was found that the ability to recognize faces in simultaneous and delayed conditions is similar between adolescents with ASDs and their normal counterparts.

Key words: *Neurobehavioral Manifestations, Pervasive child development disorders, Psychophysiology*

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Autism Spectrum Disorders (ASDs) refer to a group of Pervasive Developmental Disorders, including autistic disorders, Asperger syndrome and PDD not otherwise specified (1-3) .

Face recognition is the ability to identify people through their facial specifications, which play a fundamental role in social interactions. Since Children with ASDs have great problems in social relationship and eye contact, there are many literatures studying the ability of face recognition in these children (4). Most studies have shown face recognition deficits in children with ASDs. The first research was carried out by Langdell (5). He studied face processing in two groups of autistic children aged 9 to 14 years, and compared them to IQ and age matched control groups. The results showed that autistic youth could recognize peers from their face pictures just like the control group.

However, when some parts of the face were covered, their performance was different. It was found that autistic children were significantly better than control group in face recognition through mouth. The younger autistic children recognized faces while looking at the eyes, but this ability was poorer than the normal group (5). In an investigation performed by Hobson, autistic participants used mouth compared to eye to recognize emotions (5). Studies by de Gelder and Hauck indicated poorer face memory in autistic children compared to normal children (4, 6). Another study done by Baucher and Lewis revealed that the ability to recognize unfamiliar faces was impaired in autistic children compared to the matched normal group (7). Klin and colleagues in their research confirmed the Baucher and Lewis`s findings. Moreover, they found a weak correlation between face recognition and

nonverbal intelligence in younger autistic children (8). Blair also showed impaired face recognition in individuals with autism (9). Furthermore, Williams and colleagues evaluated immediate and delayed recall of faces in adults with high-functioning autism compared to normal controls, and found that autistic people performed more poorly than controls on both immediate and delayed recall, but their performance in delayed condition was not significantly different compared to immediate recall (10). Wallace also found impaired face processing in individuals with ASDs (11).

A few studies used Benton Facial Recognition Test to evaluate this ability in children with ASDs. Annaz compared face recognition in school-aged children with high and low functioning autism, Down syndrome, and Williams's syndrome with typically developing children, using the Benton Facial Recognition Test (BFRT). Except for the Williams group, other children`s performance was significantly poorer than typically developing children. However, the results showed that face recognition in high-functioning autism was not very different from the normal group. However, this difference in low-functioning autism and Down syndrome was very high (12). In another study by O'Hearn, the Cambridge Face Memory Test was used to investigate face memory development in individuals with ASD. Children and adolescents with ASDs performed the test similar to their normal counterparts matched in age and IQ (13).

In a recent study carried out by McPartland and colleagues, adolescents with ASDs obtained significantly lower scores on measures of face recognition compared to their normal peers (14). Using the Cambridge Face Memory Test, Hedley and colleagues found that individuals with Asperger syndrome performed significantly worse than normal people (15).

Since the literature on face memory in youth with ASDs is rare, we conducted this study to investigate delayed face recognition ability in children and adolescents with ASDs compared to their normal age matched counterparts.

Materials and Method

Participants

Fifteen children and adolescents with ASDs (Asperger and high functioning autism) aged 8 - 17 years were recruited for this study from a child and adolescent psychiatry clinic. They were compared with 15 age matched typically developing individuals. Participants with ASDs were diagnosed by a child and adolescent psychiatrist based on DSM IV criteria (16). The Asperger Syndrome Diagnostic Scale was also administered to confirm the symptoms and diagnosis. The participants had no history of major neurological and medical problems such as epilepsy, brain injury, or metabolic disorders. They were off medication 48 hours prior to the study. All participants had IQ scores above 70 based on Raven`s Progressive Matrices Test. The age matched normal group was recruited from mainstream schools. A consent form was obtained from the participants' parents prior to the study.

Assessments

All participants were assessed on delayed and non-delayed face recognition using Benton Facial Recognition Test (BFRT). The long form of BFRT with 54 possible points is presented with a target face above six stimulus faces which are centered within a black background. For the first six trials, only one of the six stimulus faces is identical to the target face. In the next seven trials, three of the stimulus faces match the target. In the next nine trials, there are three matches per item, and stimulus faces are presented with different lighting conditions (17).

In this study, the long form of BFRT was administered in two sessions. In the first condition, the test was used without any delays between the target face and stimulus faces presentation. In the second session, the mentioned test was administered with delay after one week: each target face was presented for 5 seconds, and the stimuli faces were showed after 15 seconds; then, the participants had to recognize the target among them. The reaction times and correct responses were measured in both conditions as the dependent variables.

The Raven's Progressive Matrices (RPM) test was administered to evaluate participants` intellectual abilities (18).

Asperger Syndrome Diagnostic Scale (ASDS) was used to confirm the Asperger`s symptoms. This scale is a 50-item, "Yes" or "No" questionnaire, designed to identify children and adolescents ages 5-18 with Asperger syndrome. These questions cover five different aspects of mental states including cognition, language skills, social interactions, sensorimotor, and maladaptive behaviors (19).

Procedure

The participants were firstly interviewed by a child and adolescent psychiatrist and diagnosed as having Autism Spectrum Disorders based on DSM-IV criteria. Then, they were evaluated using the ASDS to confirm the diagnosis, and were examined on non-delayed and delayed conditions of BFRT .

Statistical Analysis

Independent Samples T test was used to compare the two groups in terms of different variables. Paired Samples T test was used to compare the delayed and non-delayed conditions of the test in each group. IQ was considered as covariate, and the two groups were compared again to eliminate the IQ effect. In this research, all statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS), version 16.

Table 1. Demographic variables in participants with ASDs and normal group

Subjects	ASDs		Normal			
	Mean	SD	Mean	SD	t	p value
Age	12.80	3.23	10.53	3.04	.373	.058
IQ	99	11.92	113.47	8.29	1.242	.001

Table 2. Comparison between delayed and non-delayed conditions in Benton Facial Recognition Test in participants with ASDs and normal group

Subjects	ASDs		Normal			
Delayed and non-delayed Benton Facial Recognition Test	Mean	SD	Mean	SD	t	p value
First mean time on early condition of Benton (E)	4.49	3.36	3.83	2.08	0.046	0.520
Delayed first mean time on early condition of Benton (E)	3.82	2.10	3.68	1.34	2.923	0.832
First mean time on later condition of Benton (L)	13.19	19.23	8.84	4.01	2.658	0.399
Delayed first mean time on later condition of Benton (L)	6.62	4.51	4.73	2.59	3.805	0.170
First mean time on short form of Benton (SF)	9.16	11.71	6.52	2.64	2.155	0.401
Delayed first mean time on short form of Benton (SF)	5.35	3	4.39	1.67	4.489	0.295
First mean time on remaining items of Benton (R)	12.12	18.69	6.29	3.52	2.439	0.245
Delayed first mean time on remaining items of Benton (R)	6.54	5.37	4.76	2.42	1.222	0.251
First mean time on long form of Benton (LF)	10.33	14.51	6.16	2.45	2.433	0.281
Delayed first mean time on long form of Benton (LF)	5.83	3.82	4.32	1.62	3.702	0.168
Completed mean time on later condition of Benton	22.78	21.79	28.52	17.95	0.020	0.438
Delayed completed mean time on later condition of Benton	14.53	8.35	12.27	5.43	1.893	0.388
Completed mean time on remaining items of Benton	22.38	21.26	15.41	5.83	2.257	0.231
Delayed completed mean time on remaining items of Benton	13.60	8.53	10.75	4.79	0.797	0.269
Correct responses on early condition of Benton	5.40	1.05	5.80	0.414	7.049	0.188
Correct responses on delayed early condition of Benton	5	1.60	5.73	0.457	4.897	0.108
Correct responses on later condition of Benton	15.13	3.18	15.73	2.43	1.210	0.566
Correct responses on delayed later condition of Benton	16.26	3.21	16.60	2.55	0.175	0.756
Correct responses on short form of Benton	20.53	3.71	21.60	2.64	1.398	0.373
Correct responses on delayed short form of Benton	21.26	4.51	22.40	2.64	1.303	0.408
Correct responses on remaining items of Benton	20.66	3.35	22	2.64	0.308	0.237
Correct responses on delayed remaining items of Benton	21.40	2.99	21.66	2.74	0.005	0.801
Correct responses on long form of Benton	41.20	6.42	43.60	4.70	1.114	0.253
Correct responses on delayed long form of Benton	42.80	7.38	44.06	5.17	0.828	0.591

Table 3. Correlation between delayed and non-delayed conditions of Benton Facial Recognition Test in children and adolescents with ASDs

Delayed and non-delayed Benton Facial Recognition Test	t	p value	Pearson correlation coefficient	p value
First mean time on early condition of Benton (E) Delayed first mean time on early condition of Benton (E)	0.900	0.384	0.518	0.048
First mean time on later condition of Benton (L) Delayed first mean time on later condition of Benton (L)	1.546	0.144	0.689	0.005
First mean time on short form of Benton (SF) Delayed first mean time on short form of Benton (SF)	1.470	0.164	0.643	0.010
First mean time on remaining items of Benton (R) Delayed first mean time on remaining items of Benton (R)	1.553	0.143	0.920	0.000
First mean time on long form of Benton (LF) Delayed first mean time on long form of Benton (LF)	1.508	0.154	0.827	0.0001
Completed mean time on later condition of Benton Delayed completed mean time on later condition of Benton	1.898	0.078	0.719	0.003
Completed mean time on remaining items of Benton Delayed completed mean time on remaining items of Benton	2.489	0.026	0.933	0.0001
Correct responses on early condition of Benton Correct responses on delayed early condition of Benton	1.065	0.305	0.464	0.081
Correct responses on later condition of Benton Correct responses on delayed later condition of Benton	-2.283	0.039	0.820	0.0001
Correct responses on short form of Benton Correct responses on delayed short form of Benton	-1.068	0.303	0.808	0.0001
Correct responses on remaining items of Benton Correct responses on delayed remaining items of Benton	-1.228	0.240	0.740	0.002
Correct responses on long form of Benton Correct responses on delayed long form of Benton	-1.740	0.104	0.876	0.0001

Results

The mean age of children and adolescents with ASDs was 12.80 (SD=3.23) while the mean age of control group was 10.53 (SD= 3.04).

No significant difference was found between the two groups in terms of age. With regards to IQ, participants with ASDs had significantly lower IQs compared to normal children and adolescents ($P<0.01$) (table 1).

No significant difference ($p>0.05$) was found between the two groups in delayed and non-delayed conditions when the reaction times and correct responses of BFRT was compared (table 2).

Comparing the reaction times and correct responses of BFRT revealed no significant differences ($p>0.05$) between delayed and non-delayed conditions of the test in ASDs patients. However, there was a significant correlation ($p<0.05$) between variables in both conditions in participants with ASDs (table 3).

Comparing delayed and non-delayed conditions of the test in normal participants showed significant differences between these two conditions on "First mean time on later condition of Benton" ($t = 4.126$, $p = 0.001$), "First mean time on short form of Benton" ($t = 3.397$, $p = 0.004$), "First mean time on long form of Benton" ($t = 4.169$, $p = 0.001$), "Completed mean time on later condition of Benton" ($t = 3.840$, $p = 0.002$) and "Completed mean time on remaining items of Benton" ($t = 4.345$, $p = 0.001$); but no significant differences ($p>0.05$) were observed between the two conditions on the correct responses indices .

Analyzing the data when the IQ was considered as covariate revealed no significant differences ($p>0.05$) between the two groups in delayed and non-delayed conditions.

Discussion

Several studies investigated face recognition in children with autism spectrum disorders (ASDs). While the majority of the findings indicate abnormality in face recognition of ASDs individuals, others report relatively normal face recognition especially in the patients with high functioning autism and Asperger syndrome. Since no study used Benton Facial Recognition Test (BFRT) to evaluate delayed face recognition in children and adolescents with ASDs, the current study was designed to investigate this ability in children and adolescents with ASDs compared to normal group.

In this study, it was found that participants with ASDs performed similar to their normal counterparts in delayed and non-delayed conditions of the BFRT. It was also found that these children and adolescents had similar performance on recognizing and recalling face patterns in both delayed and non-delayed conditions of the test .

These findings are inconsistent with the results of some studies which found that children and adolescents with ASDs have impaired face recognition (4, 6-11, 14, 15). This inconsistency may be due to difference between the tasks used in our study and that of other studies. Face recognition tasks used in previous studies were more complicated, so children and adolescents with ASDs may have more problems in face recognition compared to normal developing youth. The difference between the two groups was not found to be significant in our study, and this might be due to using BFRT which is a less complicated test. On the other hand, these findings are consistent with the results of Langdell's study on face processing in autistic children, which showed that autistic children recognize peers from their face pictures just like the matched control group (5). The results of this research are also consistent with another research carried out by Williams and colleagues which showed that participants with autism performed similarly in the face recognition subtest in both immediate and delayed recall (10).

The findings of the current study confirm the results of Annaz's study which showed that face recognition was near to normal in children with high-functioning autism compared to typically developing children (12). The results of this research are also in agreement with the findings of O'Hearn's study on face memory development in individuals with ASDs, which indicated that children and adolescents with ASDs performed the Cambridge Face Memory Test similarly to typically developing group (13).

Since face recognition scores were not affected by the IQ variable in this research, it seems that face recognition ability is not related to nonverbal intelligence in individuals with ASDs (8).

The findings of this study suggest that children and adolescents with ASDs are not inferior in delayed and non-delayed face recognition ability compared to normal youth. Since the results of this study are in contrast with other findings which show impairment in face recognition in this disorder, this hypothesis should be reevaluated in larger samples using different tasks.

Limitations

One limitation of this study was the difference between the two groups in terms of IQ. Since the intellectual abilities of youth with ASD are mostly lower than their age matched normal group, matching the IQs of the two groups was rather difficult. However, to eliminate the IQ effect on the findings, we analyzed the data while IQ was considered as covariate.

Conclusion

Based on the findings of this study, it could be concluded that youth with autism spectrum disorder may have similar ability to recognize faces in simultaneous and delayed conditions compared to normal children and adolescents.

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