

Autism Spectrum Symptoms in Children and Adolescents with Obsessive Compulsive Disorder and Their Mothers

Gonca ÖZYURT¹ , Lütfullah BEŞİROĞLU² 

¹Department of Child Psychiatry, Nevşehir State Hospital, Nevşehir, Turkey

²Department of Psychiatry, Katip Çelebi University Medical Faculty, İzmir, Turkey

ABSTRACT

Introduction: Obsessive-compulsive disorder (OCD) affects 1-3% of children and adolescents. Although a close relation between OCD and autism spectrum disorder (ASD) has been pointed out, the relation between maternal ASD symptoms and subclinical ASD symptoms in OCD have not been evaluated adequately. In this study, children and adolescents with OCD diagnosis, and OSB indications in their mothers were investigated. The relationship between the clinical severity of these indications in children and adolescents with OCD, and maternal OSB indications will be examined.

Method: The study group consisted of 38 cases (8-18 years old) diagnosed with OCD. The control group (n=39) comprised patients of other clinics at hospital, and was matched for gender and age to the OCD patients. The Kiddie Schedule for Affective Disorders and Schizophrenia for School Aged Children - Present and Lifetime Version (K-SADS-PL) was used to diagnose OCD and accompanying comorbidities. Social Communication Questionnaire (SCQ) was used to evaluate children's ASD symptoms while Autism Spectrum Quotient (ASQ) was used to evaluate maternal broad autism phenotype. OCD symptoms in children

were evaluated with Children Yale-Brown Obsessive Compulsive Scale-(C-Y-BOCS), and OCD symptoms in mothers were evaluated with Yale-Brown Obsessive Compulsive Scale-(Y-BOCS).

Results: There was no significant difference between sociodemographic data of two groups. When cases and controls were compared with SCQ; all subscales' scores and total score of SCQ were statistically significant higher in OCD group and also mothers of OCD group had statistically significant higher scores in total score of ASQ and subscales except "imagination". Also in comparing the groups with Y-BOCS and C-Y-BOCS; OCD group had statistically significant higher scores in these scales.

Conclusion: ASD symptoms are prevalent in cases diagnosed with OCD and ASD symptoms increases with OCD severity. Further studies are needed to examine genetic and environmental common risk factors between OCD and ASD.

Keywords: Autism spectrum disorder, broad autism phenotype, obsessive compulsive disorder

Cite this article as: Özyurt G, Beşiroğlu L. Autism Spectrum Symptoms in Children and Adolescents with Obsessive Compulsive Disorder and Their Mothers. Arch Neuropsychiatry 2018;55:40-48. <https://doi.org/10.29399/npa.18138>

INTRODUCTION

Obsessive Compulsive Disorder (OCD) is defined as a disorder characterized by ego-dystonic and repetitive thoughts, impulse, or fantasies, and repetitive behaviors or mental actions that severely influence social, academic, and occupational functioning of individuals, and are disturbing them (1). OCD is observed at the rate of 1-3% during childhood, and evidences regarding that an important part of OCD symptoms observed in adulthood start during childhood have been gradually increasing (2, 3). Symptoms start before the age of 15 years in approximately one third of adult patients (4).

Autism Spectrum Disorder (ASD) is a neuro-developmental disorder characterized by limited attention and repetitive behaviors as well as insufficiencies in mutual social communication and interaction, which generally occurs before the age of 3 (5, 6). Repetitive behaviors in ASD

usually overlap with phenomena in OCD or obsessive compulsive spectrum disorder, and it might be frequently confusing to distinguish phenomenological characteristics of ASD from OCD (7). Some researchers suggested that stereotypical and rigid behaviors seen in cases diagnosed with ASD show parallelism with obsession and compulsions seen in OCD (8-10). For instance, characteristics of cases diagnosed with ASD such as having the same organization for stuff, insisting on wearing the same clothes, or doing the same thing at the same hour every day are thought to be similar with obsession and compulsions in OCD in terms of phenomenological aspect (11). In neuroimaging studies conducted on ASD and OCD; while compulsive attachment to routines and stereotypical behaviors seen in ASD were found to be associated with changes in striatum especially in nucleus caudatus (12, 13), compulsions observed in OCD were shown to be associated with caudate nucleus dysfunction (14).

These results have made us think that there might be similar neuronal abnormalities underlying repetitive behaviors seen in ASD and OCD (15).

In clinical studies, on the other hand, obsessions and compulsions observed in individuals diagnosed with ASD are characterized by less ego-dystonic and more limited content, and reported to be more severe (16,17). Resistance to change and locking on routines or rituals might be seen in both disorders (18). In addition, children and adolescents diagnosed with OCD and ASD present similar rates in terms of repetitive behaviors (16).

77–85% of children and adolescents diagnosed with OCD are also accompanied by comorbid psychiatric disorder (2, 19). Even though anxiety disorder, attention deficit and hyperactivity disorder, depression, and tic disorders are the most frequently diagnosed comorbid cases (20, 21), autism spectrum disorders (ASD) are also revealed to be a common psychopathology in OCD (2, 19) in a limited number of studies. While prevalence of ASD is seen at rates ranging between %0.07 and 1.8% in normal population (22–24); prevalence of autism spectrum disorder in OCD is also reported to be 4–8% (19, 25–27). While rate of OCD in normal population is approximately 1–3% (reference), diagnosis of OCD is comorbid in 17% of individuals diagnosed with ASD (28, 29). As it is seen, while prevalence of ASD in childhood OCD is found to be 4–8 times greater compared to general population, prevalence of subclinical ASD symptoms seen in childhood OCD is not known enough (20,30). Symptoms of ASD in rates varying between %5 and 35% were found to be comorbid with OCD diagnosis in adults (31–33).

Family studies conducted in relation to genetic causes reveal that prevalence of ASD increase in relatives of family members diagnosed with ASD, and also prevalence of OCD was is high (34–35).

Studies conducted with families of cases diagnosed with ASD also show that family members could have clinical characteristics of ASD even though they are not diagnosed with ASD (36,37). Broad autism phenotype (BAP) was suggested as a concept which define these characteristics. Broad autism phenotype (BAP) is defined as incidence of difficulties in social communication and interaction, and stereotypical behaviors similar to autism at the lower rate in relatives of children diagnosed with ASD (38). Again, BAP as a description made for characteristics that increase susceptibility to autism in next generations, are milder but determinant for ASD (38,39). Social cognition and social skill deficiency (40), miscommunications (41), and language anomalies with cold and distant personality (39) among characteristics of ASD are symptoms of broad autism phenotype. Deficiencies in social communication and interaction field are the most genetically based characteristics among autism related characteristics (36). Family members of patients with ASD were shown to experience common problems also with social development, communication, and behaviors that can be evaluated within BAP (42). Thus, it is thought that mild social deficiencies observed in relatives of patients might be associated with genetic susceptibility (43,44).

If it is considered that family members might also have been exposed to similar environmental factors, possibility of ASD-related disorders in family members of children diagnosed with OCD seems to be an issue that is worth researching. Even though family members of children diagnosed with OCD were examined for OCD (34,35), there are few studies about prevalence of ASD symptoms in families of individuals with OCD.

The aim of this study is to research symptoms of ASD in children and adolescents diagnosed with OCD and their mothers, and to investigate correlation between clinical OCD severity of these symptoms of children and adolescents, and ASD symptoms of mothers.

METHOD

The sample of the study consisted of 8–18-year-old cases (mean age=12.3±2.7, 39.4% female) who applied to a Nevşehir State Hospital child psychiatry outpatient clinic between September 2015 and February 2016. They were diagnosed with OCD according to DSM 5 after being evaluated, and have never used medicine before as well as their mothers (mean age=37.8±4.8). Thirty-nine children (mean age=11.5±2.1, 41% girls) who applied to different outpatient clinics such as Pediatrics, Eye Diseases, Dermatology of the same public hospital did not have any psychiatric disorder and any chronic disorder (diabetes mellitus, hypertension, rheumatic and immunological diseases, epilepsy, and genetic disorders), agreed to participate in the study, and were similar to patient group in terms of age and gender, and their mothers (mean age=37.9±4.7) were also included in the study. The mothers were included in the study because cases and controls came to hospital mostly with their mothers. Children and adolescents having no diagnosis of mental retardation and having clinically normal intelligence in evaluation were included in the study. When mothers of cases and controls were included in the study; the mothers who were not diagnosed with bipolar disorder, psychiatric disorder or mental retardation according to information received from mothers, and those who did not receive any psychiatric therapy within last one year were included in the study. Ethics committee approval of the study was obtained from Nevşehir Hacı Bektaş Veli University Clinical Trials Ethics Committee. Verbal and written consents of the children and their mothers who participated in the study were taken. Fifty-four children and adolescents applied to child psychiatry outpatient clinic within the period of the study; 2 children with chronic disorder were not included in the study. While mothers were included in the study because children applied to outpatient clinic with their mothers; 3 of the mothers did not participate in the study because they were receiving psychiatric medications. When children and mothers were together, they were informed about the study, and their consents were obtained. They were informed about ASD and 10 individuals did not agree to participate in the study. Table 1 describes socio-demographic characteristics of case and control groups participating in the study.

When comorbid psychiatric diagnoses of children in the case group were examined it was found that, while 12 of the cases (31.6%) had any anxiety disorder, 7 (18.4%) had attention deficit and hyperactivity disorder, and 4 (10.5%) had tic disorder, 15 (39.5%) cases had no comorbid psychiatric disorder.

TOOLS

Socio-demographic Questionnaire

It was prepared to collect information about socio-demographic characteristics of children and parents. The questionnaire had questions examining child's age, gender, socio-economic level of family, academic status, peer relationship and parents' age, educational level, marital status, and occupation. It was filled by the clinician.

Schedule for Affective Disorders and Schizophrenia for School Age Children Present and Life-time (KIDDIE-SADS-PL)

It is a semi-structured interview tool developed by Kauffman et al. (1997) in order to search present and life time psychopathology in children and adolescents aged between 6–18 years (45). K-SADS-PL was prepared in accordance with DSM-IV (American Psychiatric Association 1994) diagnostic criteria. Turkish translation, and validity and reliability study of K-SADS-PL was conducted by Gökler et al. (46). This evaluation includes fundamental diagnosis of major depression, dysthymia, mania, hypomania, cyclothymia, bipolar disorder, schizoaffective disorders, schizophrenia, schizophreniform disorder, brief reactive psychosis, panic disorder, agoraphobia, separation anxiety disorder, avoidant disorder, simple phobia, social phobia, generalized anxiety disorder,

obsessive compulsive disorder, attention deficit hyperactivity disorder, conduct disorder, oppositional defiant disorder, enuresis, encopresis, anorexia nervosa, bulimia, transient tic disorders, Tourette's disorder, chronic motor or vocal tic disorder, alcohol abuse, substance abuse, posttraumatic stress disorder, and adjustment disorder (45). Diagnoses of obsessive compulsive disorder, tic disorder, attention deficit hyperactivity disorder, and anxiety disorder in this sample were established with this evaluation.

Children's Yale-Brown Obsessive Compulsive Scale (Y-BOCS)

Being based on semi-structured clinical interview, this scale was developed by Scahill L et al. in 1997. In this scale the evaluation is performed based on clinical judgment of interviewer based on information given by child and parents (47). In conclusion, obsession severity score, compulsion severity score, and total severity score including sum of both are obtained. Turkish reliability study of the scale was conducted by Yücelen et al. (48).

Yale-Brown Obsessive Compulsive Scale (Y-BOCS)

It is a semi-structured scale used in order to measure type and severity of obsessive compulsive symptoms. Turkish validity and reliability study of the scale, which was developed by Goodman et al. (49) was conducted by Tek et al. (50). Despite the fact that it consists of 19 items in total, only first 10 items are used in order to measure severity of symptom. In scoring of Y-BOCS, obsessions and compulsions are scored with five items, each item is separately scored over four points, and a total score is obtained through subtotal scores of obsession and compulsion, and maximum 40 points in the end.

Social Communication Questionnaire (SCQ)

SCQ, previously known as Autism Screening Questionnaire, is a screening scale which was developed by Rutter and Lord, and is filled by primary caregivers (51). It was developed as an ancillary screening scale for Autism Diagnostic Interview-Revised, ADI-R (52) which takes an important place, and is assumed as gold standard in diagnosis of ASD, and takes at least 2.5 hours to apply. SCQ prepared based on ADI-R consists of 40 items, and can be applied to all individuals whose chronological age is 4 and older, provided that a mental age is at least 2 (53). Similar to ADI-R, most of SCQ items are regulated under 3 subscales which are mutual social interaction, communication, and restricted, repetitive, and stereotypical behaviors. The most important intended purpose of the scale is to choose individuals requiring further evaluation in terms of Autism Spectrum Disorder. In addition, SCQ can also be used to compare symptom levels of ASD in different groups with ASD that is associated with any of medical conditions such as developmental language disorder, Fragile X, Tuberous sclerosis, and Down syndrome. Changes in ASD symptom levels in time can also be followed up by repeating SCQ in certain intervals. Turkish validity and reliability study of the scale was conducted by Avcil et al., and Cronbach's α value of the scale was found to be 0.80 in this study (54). Cronbach's α value was found to be 0.72 in the present study.

Autism Spectrum Quotient (ASQ)

Autism Spectrum Quotient (ASQ) was developed by Baron-Cohen et al. (55). It aims to determine at which degree any adult with 6 ASQ normal intelligence capacity exhibit autistic characteristics, or have 'broad phenotype'. ASQ originally consists of five areas, each of which involves ten questions: (i) social skills, (ii) attention switching, (iii) attention to detail, (iv) communication, and (v) imagination. If participant marked weak or strong but abnormal/autistic like behaviors for each of the described questions, it is given 1 point. Abnormality is evaluated as: weak social skill, weak communication skill, weak imagination, extreme attention to details, and insufficiency in attention switching/strongly focused attention. Cronbach's α value of ASQ was found to be 0.63 (55). Validity and reliability study of Turkish version of the scale was conducted by Köse et al. (56). Cronbach's α value of Turkish version of scale was

found to be 0.63. It was used in order to question BAP symptoms of mothers. Cronbach's α value was determined as 0.57 in the present study.

Statistical Analysis

SPSS 15.0 (Statistical Package for the Social Sciences Inc; Chicago, IL, ABD) program was used for statistical analysis of variables obtained in the study. Socio-demographic and some clinical categorical variables belonging to case and control groups were evaluated with number, and percentage values. Crosstab chi-square test was used to compare classified categorical variables. Firstly, distribution of data was evaluated by using Kolmogorov-Smirnov method. Because distribution of data was not compatible with normal distribution, comparisons between paired groups were evaluated by using Mann-Whitney U test. Spearman's correlation analysis was used in order to determine correlation between continuous variables. Significance level was accepted as $p < 0.05$ at confidence interval of 95%.

RESULTS

As the group diagnosed with Obsessive Compulsive Disorder was compared with control group, no difference was found between children's age, gender, age of parents, educational level, marital status, employment

Table 1. Comparison of sociodemographic features between cases and controls

	OCD	Control	z/χ^2	P
Age*	12.37±2.77	11.59±2.16	-1.086	0.278
Gender**				
Male	23	23	0.019	0.890
Female	15	16		
Marital status**				
Married	34	32	0.866	0.352
Divorced	4	7		
Maternal age*	37.81±4.76	37.89±4.66	-0.056	0.955
Maternal education**				
<8 years	16	15	0.106	0.818
>8 years	22	24		
Maternal working status**				
Working	19	18	0.114	0.821
Housewife	19	21		
Paternal education**				
<8 years	16	12	1.069	0.301
>8 years	22	27		
Paternal working status**				
Worker-officer	21	25	0.625	0.429
Self employment	17	14		
Socioeconomic status**				
Low-middle income	20	21	0.011	0.915
High income	18	18		
School success**				
Low-middle success	10	3	4.757	0.029
High success	28	36		
Peer relation**				
Good. enough friends	19	32	8.841	0.004
No close friends	19	7		
Medical disorder in family**				
Yes	6	4	0.521	0.470
No	32	35		
Mental disorder in family**				
Yes	18	4	12.989	<0.001
No	20	35		

*: Mann-Whitney U was used to evaluate.

**: Chisquare analysis was used to evaluate.

Table 2. Comparison of cases and controls with social communication questionnaire and Autism Spectrum Quotient

	OCD	Control	Z	p	Cohen's d	Effect size
SCQ total	6.92±3.89	4.41±3.63	-2.872	0.004	0.667	0.316
Reciprocal social interaction	2.50±1.58	1.46±1.21	-2.857	0.004	0.739	0.346
Communication (SCQ)	1.65±1.16	1.07±1.03	-2.260	0.024	0.528	0.255
Repetitive behaviors	2.76±1.63	1.76±1.51	-2.799	0.005	0.636	0.303
ASQ total	15.81±4.12	12.87±4.69	-2.466	0.014	0.666	0.315
Ability To Shift Attention	3.38±1.19	2.66±1.22	-2.297	0.022	0.597	0.286
Paying Attention To Details	3.00±0.86	2.46±0.91	-2.235	0.025	0.609	0.291
Imagination	3.42±1.44	2.98±1.39	-1.356	0.175	0.310	0.153
Communication	2.86±0.70	2.41±0.84	-2.391	0.017	0.582	0.279
Social Skills	2.97±0.85	2.38±0.98	-2.667	0.008	0.643	0.306

SCQ: Social Communication Questionnaire

ASQ: Autism Spectrum Quotient

Mann-Whitney U test was used to evaluate.

Table 3. Comparison of children with Children Yale-Brown Obsessive Compulsive Scale and mothers Yale-Brown Obsessive Compulsive Scale

	OCD group	Control group	z/x ²	p	Cohen's d	Effect size
CYBOCS obsession	9.78±1.71	0.87±0.65	-7.688	<0.001	6.887	0.960
CYBOCS compulsion	9.28±1.46	0.76±1.70	-7.655	<0.001	5.376	0.937
CYBOCS total	19.07±2.55	1.58±1.11	-7.593	<0.001	8.893	0.975
YBOCS obsesion	1.78±0.9	0.71±0.68	-4.858	<0.001	1.341	0.557
YBOCS compulsion	2.57±1.03	0.61±0.67	-6.699	<0.001	2.255	0.748
YBOCS total	4.36±1.54	1.30±1.12	-6.587	<0.001	2.272	0.750

CYBOCS: Children Yale-Brown Obsessive Compulsive Scale

YBOCS: Yale-Brown Obsessive Compulsive Scale

Mann-Whitney U testi ile kıyaslanmıştır.

status, and socioeconomic status. Table 1 shows socio-demographic characteristics of the groups. It was found that school success of the group diagnosed with Obsessive Compulsive Disorder was lower, and peer relationship was worse; this group had more mental disorders in family ($p=0.029$, $p=0.004$, $p<0.001$; respectively).

When the group diagnosed with Obsessive Compulsive Disorder and control group were compared by using SCQ, and their mothers were examined via ASQ, the group diagnosed with Obsessive Compulsive Disorder was determined to have statistically higher scores in all subscale, and total scores (Table 2). As groups were compared by using YBOCS and CYBOCS, OCD group was found to have statistically significant highness in subscales, and total score (Table 3).

The Spearman's correlation analysis was used to examine correlation of autistic symptoms with other variables in children and adolescents diagnosed with Obsessive Compulsive Disorder. As a result of the conducted analysis, a correlation was determined between SCQ total score and ASQ total score ($r=0.474^{**}$, $p<0.001$), CYBOCS total score ($r=0.267^{*}$, $p=0.018$), CYBOCS obsession score ($r=0.274^{*}$, $p=0.015$), CYBOCS compulsion score ($r=0.303^{**}$, $p=0.007$) YBOCS total score ($r=0.170$, $p=0.138$), YBOCS obsession score ($r=0.128$, $p=0.263$), and YBOCS compulsion score ($r=0.160$, $p=0.161$). Table 4 shows correlation between subscales of SCQ and ASQ.

According to results of correlation between evaluation results of children diagnosed with OCS and their mothers, a significant positive correlation ($r=0.752^{**}$, $p<0.001$) was determined between SCQ scores of children, and ASQ scores of mothers. Correlation was not determined between CYBOCS values, and YBOCS values ($r=0.218$, $p=0.188$). There was no

correlation determined between SCQ scores of children in control group and ASQ scores of mothers ($r=0.197$, $p=0.592$), and CYBOCS values and YBOCS values ($r=-0.138$, $p=0.402$). While Table 5 shows autism symptoms of children, and correlation of other variables; Table 6 shows autism symptoms of mothers, and correlation of other variables.

When OCD group was divided as 8–12 and 13–18 in terms of age, and compared by using Mann Whitney U test; no statistically significant difference was determined between groups in terms of SCQ, ASQ, YBOCS and CYBOCS scales, and their subscales. When OCD group was divided as female and male, and compared by using Mann Whitney U test; while males obtained statistically significant higher scores in terms of SCQ total score, social interaction score, and stereotypical behaviors subscales ($p=0.006$, $p=0.012$, $p=0.007$, respectively) compared to females; no statistically significant difference was determined in terms of SCQ communication subscale, ASQ, YBOCS and CYBOCS scales, and subscales.

DISCUSSION

The first objective of the present study was to determine ASD symptoms in children and adolescents diagnosed with OCD by making comparison with healthy children and adolescents, and ASD symptoms in children and adolescents diagnosed with OCD were found to be higher as a result of the present study. Another important finding of the present study was that ASD symptoms of children and adolescents increased as severity of OCD increased.

Similar to other studies examining ASD symptoms of children and adolescents diagnosed with Obsessive Compulsive Disorder; when as children and adolescents diagnosed with OCD were compared

Table 4. Correlation of subscales of Social Communication Questionnaire and Autism Spectrum Quotient

	SCQ Communication	SCQ Social Interaction	SCQ Repetitive	SCQ total
Ability To Shift Attention	r=0.320** p=0.004	r=0.399** p<0.001	r=0.366** p=0.001	r=0.420** p<0.001
Paying Attention To Details	r=0.301** p=0.007	r=0.406** p<0.001	r=0.363** p=0.001	r=0.407** p<0.001
Imagination	r=0.340** p=0.002	r=0.383** p=0.001	r=0.421** p<0.001	r=0.441** p<0.001
Communication	r=0.287* p=0.011	r=0.365** p=0.001	r=0.235* p=0.039	r=0.331** p=0.001
Social skills	r=0.186 p=0.004	r=0.322** p=0.004	r=0.136 p=0.235	r=0.263* p=0.020
ASQ total	r=0.365** p=0.001	r=0.466** p<0.001	r=0.401** p<0.001	r=0.474** p<0.001

SCQ: Social Communication Questionnaire

ASQ: Autism Spectrum Quotient

Spearman correlation was used to evaluate.

Table 5. Relation of SCQ total score and other parameters in OCD and control group

SCQ	OCD		CONTROL	
	r	P	r	P
CYBOCS	0.08	0.632	-0.197	0.222
YBOCS	-0.214	0.197	-0.066	0.688
ASQ	0.071	<0.001	0.086	0.597
Ability To Shift Attention	0.586	<0.001	0.095	0.559
Paying Attention To Details	0.534	0.001	0.099	0.541
Imagination	0.749	<0.001	0.022	0.891
Communication	0.537	<0.001	-0.156	0.335
Social skills	0.219	0.188	0.041	0.803

SCQ: Social Communication Questionnaire

ASQ: Autism Spectrum Quotient

CYBOCS: Children Yale-Brown Obsessive Compulsive Scale

YBOCS: Yale-Brown Obsessive Compulsive Scale

Spearman correlation was used to evaluate

Table 6. Relation of ASQ total score and other parameters in OCD and control group

ASQ	OCD		CONTROL	
	r	P	r	P
CYBOCS	-0.045	0.789	0.186	0.25
YBOCS	-0.247	0.135	0.241	0.733
SCQ	0.71	<0.001	0.086	0.597
Reciprocal social interaction	0.686	<0.001	0.124	0.447
Communication (SCQ)	0.682	<0.001	-0.019	0.906
Repetitive behaviors	0.538	<0.001	0.105	0.519

ASQ: Autism Spectrum Quotient

CYBOCS: Children Yale-Brown Obsessive Compulsive Scale

YBOCS: Yale-Brown Obsessive Compulsive Scale

Spearman correlation was used to evaluate.

with healthy controls; subclinical ASD symptoms in group with OCD were found to be more (20,57,58). In the study of Arildskov TW et al. (2015), clinically significant ASD symptoms were found in 35% of cases diagnosed with OCD (59). Even though adolescents diagnosed with OCD do not exactly meet diagnostic criteria related to ASD, ASD associated clinical characteristics are not less at all (58). Prevalence of lifetime ASD in adults diagnosed with OCD, on the other hand, was found to be 2–3% (60); previous studies indicate that ASD symptoms are not few in both adults and children and adolescents (61). In the study of Bejerot, about 20% of patients with OCD (mean age 42, interval 17–82) were shown to

have clinically significant autistic symptoms (64). As ASD symptoms are thought to have effects on functionality and treatment, it is crucial to be informed about subclinical ASD symptoms in OCD observed in children and adolescents (62).

In another study conducted by Meier S et al. (63), searching familial and longitudinal risks between OCD and ASD, it was indicated that ASD was seen more in cases diagnosed with OCD compared to community; while it was found that those with initial diagnosis of ASD were diagnosed with OCD two times greater in future, the rate of being diagnosed with

ASD increased four times in those diagnosed with OCD at early age, and there were familial relationships in these two disorders. When ASD symptoms of children diagnosed with OCD were compared with ASD symptoms of mothers, a positive correlation was determined between ASD symptoms but no correlation was found in control group which might be an important result in terms of common genetics of ASD and OCD. However, OCD related distinctive characteristics of ASQ questions might be insufficient; because the scale questioned similar characteristics, such results could be obtained. The fact that the correlation with repetitive behaviors, which is similar feature of ASD and OCD, was found in social interaction and communication subscales of SCQ was a result making us think that there may be a correlation between OCD and ASD.

Another finding of the present study was that there was positive correlation between ASD symptoms and severity of OCD symptoms in children. Results of the study conducted by Arildskov TW et al. (59) were also similar to results of the present study; ASD symptoms were indicated to increase severity of OCD. Information about the effect of ASD comorbid with OCD or subclinical ASD symptoms on severity of OCD is not clear (8,32,61,64), Bejerot identified a subtype related to autism in OCD, and stated that this subtype might be associated with clinically more severe symptoms and resistance to treatment (62). In fact, this result might also be associated with the fact that psychiatric conditions comorbid with OCD increase clinical severity of OCD in children and adolescents (65,66). Studies on the effect of ASD symptoms on severity of OCD are needed. In addition, ASD symptoms can also be observed in individuals who were not clinically diagnosed depending on age or developmental period (18,61). As multidimensional structure and nature of ASD is understood better; dimensional approach related to ASD rather than categorical approach will be preferred more in terms of examining correlation between OCD and ASD.

Some cases with ASD are tend to be diagnosed at late age and diagnosis of comorbid OCD in this late diagnosed group is more frequently observed. First of all, behavioral abnormalities (repetitive behaviors) in children diagnosed with OCD might have clinically occurred before, or be more dominant; difficulties of social interaction and communication may occur in cases that require social capacity to be used more at younger ages. OCD, again, may exacerbate subclinical ASD symptoms to relapse, or may induce subclinical ASD symptoms (8,31,57). Although some studies indicated that OCD and ASD can be distinguished according to nature of repetitive behaviors or thoughts (10), it might not be always such easy to establish differential diagnosis of OCD and ASD. Stereotypical behaviors identified especially in broad autism phenotype might be very similar to compulsive behaviors in OCD (67). Obsessions and compulsions found in OCD are rather ego-dystonic and individuals try to stop these behaviors and thoughts. Autistic repetitive behaviors might be enjoyed by individual, and people may react harshly when it is tried to stop them. As intelligence and language developments of cases are not good enough, it might be more difficult to evaluate obsessive symptoms, and sometimes they are misevaluated (68,69).

Autism Spectrum Quotient is a questionnaire used in order to reveal ASD symptoms in clinical or nonclinical populations. In several studies, it was shown to reveal BAP (55,70,71). Even though broad ASD phenotype is determined in mothers and fathers of children with ASD, a study on children with OCD has not been conducted up to present day. ASD symptoms in mothers of children and adolescents diagnosed with OCD who participated in the present study were found to be higher compared to mothers of healthy controls, and ASD symptoms were found to be higher also in mothers when there is much ASD symptoms in children. This study is the first one investigating ASD symptoms in mothers of children and adolescents with OCD.

When ASD symptoms of children with OCD was compared with ASD symptoms of their mothers, a positive correlation was determined between ASD symptoms but any correlation was not determined in control group. This revealed that as ASD symptoms in children diagnosed with OCD increased, ASD symptoms of mothers increased.

Incidence of OCD is observed more than expected in relatives of cases diagnosed with autism spectrum disorder (72,73). It was found that OCD was more frequent in parents of cases having stereotypical and repetitive behaviors (74). Association of therapy resistant OCD with ASD was shown in a genetic study as well (75).

ASQ scores of parents of cases diagnosed with ASD were determined to be higher by using Autism spectrum quotient in a study conducted by Bishop DV et al. (38) to examine broad autism phenotype in parents of cases diagnosed with ASD; when subscales were evaluated, difference between two groups was not determined in "imagination" subscale similar to the present study. Results of another study are just like as the previous study, and ASQ total score and scores of four subscales were found to be higher in parents of children diagnosed with ASD. This result is an indicator of that early finding of study conducted by Bishop et al. was repeated in a broader sample (38).

In another study evaluating parents of children diagnosed with autism spectrum disorder in terms of OCD and using YBOCS; OCD symptoms were found more in parents of cases diagnosed with OCD compared to control group, and OCD symptoms were observed more in parents of cases especially who had more repetitive behaviors and higher scores in ADI-R interview, that is clinically more severe cases (74). In the study conducted by Ingersoll and Hambrick (76), 145 parents of children diagnosed with OCD were included in study, and BAP score of parents of children diagnosed with OCD was determined to be higher compared to parents of control group, and a positive correlation was determined between BAP score of parents and severity of ASD symptoms of children. This result is again similar to the result of the present study.

In a study comparing adolescents diagnosed with anorexia nervosa and their parents in terms of ASD and OCD symptoms; 150 adolescents with AN were included in the study, and while symptoms of OCD and ASD were found to be higher in cases diagnosed with AN compared to controls, OCD and ASD symptoms of their parents were similar to parents of controls (77).

There is no other study examining ASD symptoms of parents of cases diagnosed with OCD in the literature. In the present study, all subscale scores, except for imagination subscale, and ASD total score of parents were found to be higher at statistically significant level compared to controls. When correlation between autism symptoms of the cases was examined, a positive correlation was determined between SCQ and its subscales, and ASQ and its subscales. In other words, as ASD symptoms of cases increased, ASD symptoms in parents also increased.

Even though it was shown in studies conducted so far that ASD symptoms were higher in cases with OCD, underlying relationship could not be revealed. Underlying relationship might be associated with dichotomous structure of diagnoses; as underlying neuro-circuits become clear and neuropsychological functioning loss are revealed, specific causes of ASD symptoms in OCD will be understood better.

Etiology of a complicated disorder like autism spectrum disorder usually can be heterogeneous and variable. When heritability of ASD (78,79) and OCD (80,81) was examined, common genetic variables can explain some of the pathways between OCD and ASD. In a previous study, it was found that OCD diagnostic rate in parents of children diagnosed with

ASD was similar to OCD prevalence in 2nd and 3rd degree relatives of cases diagnosed with OCD (81). Numerous studies revealed that similar environmental factors take part in occurrence of OCD and ASD (78,81).

The most important limitation of the present study was that psychiatric condition of mothers was not evaluated via semi structured interviews. The sample results were not sufficient in terms of generalization as well. It might have facilitated understanding correlation between OCD and ASD to examine first degree relatives except for mothers. The present study might have paid more attention to several psychiatric symptoms in mothers of case group compared to mothers of control group, and as a result of this, scale scores might have been influenced.

Consequently; high comorbidity and common familial risks might be among shared etiological mechanisms of two severe mental disorders such as OCD and ASD. Firstly, it is required to conduct longitudinal studies and scale studies for diagnostic criteria, which can clinically distinguish diagnoses of OCD and ASD, to become psychiatric diagnoses which are established also by considering sustainability within the period. Possible mutual points among etiological causes of OCD and ASD were shown with preclinical and neuro-imaging and neuro-chemical studies examining dopaminergic, glutamatergic, and serotonergic systems (82–87). Further studies recognizing OCD diagnosis in childhood and examining genetic and environmental common risk factors between OCD and ASD are needed.

Ethics Committee Approval: Ethics committee approval of the study was obtained from Nevşehir Hacı Bektaş Veli University Clinical Trials Ethics Committee.

Informed Consent: It was taken from all the children and their mothers who participated in the study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - GÖ, LB; Design - GÖ, LB; Supervision - LB; Resource - GÖ; Materials - GÖ; Data Collection and/or Processing - GÖ; Analysis and/or Interpretation - LB; Literature Search - GÖ; Writing - GÖ, LB; Critical Reviews - LB.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study has received no financial support.

REFERENCES

- American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, 5th ed. Washington DC: APA; 2013. [CrossRef]
- Bellini S. The development of social anxiety in high functioning adolescents with autism spectrum disorders. *Focus Autism Other Dev Disabil* 2006;21:138–145. [CrossRef]
- Reaven J. The treatment of anxiety symptoms in youth with high-functioning autism spectrum disorders; developmental considerations for parents. *Brain Res* 2011;1380:255–263. [CrossRef]
- Öner P, Aysev A. Çocuk ve ergenlerde obsesif kompulsif bozukluk. *Sürekli Tıp Eğitim Dergisi* 2001;10:409–411.
- Kanner L. Autistic disturbances of affective contact. *Acta Paedopsychiatr* 1968;35:100–136.
- Wong C, Odom S, Hume K, Cox AW, Fetting A, Kucharczyk S, Brock ME, Plavnick JB, Fleury VP, Schultz TR. Evidence Based Practices for Children, Youth and Young Adults with Autism Spectrum Disorder: A Comprehensive Review. *J Autism Dev Disord* 2015;45:1951–1966. [CrossRef]
- Hollander E, Wang AT, Braun A, March L. Neurological considerations; autism and parkinson's disease. In: Hollander E, Zohar J, Sirovatka PJ, & Regier DA, editors. *Obsessive-Compulsive Spectrum Disorders: Refining the Research Agenda for DSM-V*. Arlington VA: APA; 2010:161–182.
- Cath DC, Ran N, Smit JH, van Balkom AJ, Comijs HC. Symptom overlap between autism spectrum disorders, generalized social anxiety disorder and obsessive-compulsive disorder in adults: a preliminary case-controlled study. *Psychopathology* 2008;41:101–110. [CrossRef]
- Hollander E, Phillips A, Chaplin W, Zagursky K, Novotny S, Wasserman S, Iyengar R. A placebo controlled crossover trial of liquid fluoxetine on repetitive behaviors in childhood and adolescent autism. *Neuropsychopharmacology* 2005;30:582–589. [CrossRef]
- McDougle C, Kresch LE, Goodman WK, Naylor ST, Volkmar FR, Cohen DJ, Price LH. A case-controlled study of repetitive thoughts and behavior in adults with autistic disorder and obsessive-compulsive disorder. *Am J Psychiatry* 2011;168:772–777. [CrossRef]
- Lam KSL, Bodfish JW, Piven J. Evidence for three subtypes of repetitive behavior in autism that differ in familiarity and association with other symptoms. *J Child Psychol Psychiatry* 2008;49:1193–1200. [CrossRef]
- Langen M, Leemans A, Johnston P, Ecker C, Daly E, Murphy CM, Dell'Acqua F, Durston S; AIMS Consortium, Murphy DG. Fronto-striatal circuitry and inhibitory control in autism: Findings from diffusion tensor imaging tractography. *Cortex* 2011;48:183–193. [CrossRef]
- Langen M, Schnack HG, Nederveen H, Bos D, Lahuis BE, de Jonge MV, van Engeland H, Durston S. Changes in the developmental trajectories of striatum in autism. *Biol Psychiatry* 2009;66:327–333. [CrossRef]
- Markarian Y, Larson MJ, Aldea MA, Baldwin SA, Good D, Berkeljon A, Murphy TK, Storch EA, McKay D. Multiple pathways to functional impairment in obsessive-compulsive disorder. *Clin Psychol Rev* 2010;30:78–88. [CrossRef]
- South M, Ozonoff S, McMahon WM. Repetitive behavior profiles in Asperger syndrome and high-functioning autism. *J Autism Dev Disord* 2005;35:145–158.
- Zandt F, Prior M, Kyrios M. Repetitive behavior in children with high functioning autism and obsessive compulsive disorder. *J Autism Dev Disord* 2007;37:251–259. [CrossRef]
- Russell AJ, Mataix-Cols D, Anson M, Murphy DG. Obsessions and compulsions in Asperger syndrome and high-functioning autism. *Br J Psychiatry* 2005;186:525–528. [CrossRef]
- Paula-Pérez I. Differential diagnosis between obsessive compulsive disorder and restrictive and repetitive behavioural patterns, activities and interests in autism spectrum disorder. *Rev Psiquiatr Salud Ment* 2013;6:178–186. [CrossRef]
- Russell E, Sofronoff S. Anxiety and social worries in children with Asperger syndrome. *Aust N Z J Psychiatry* 2005;39:633–638. [CrossRef]
- Huang LC, Tsai KJ, Wang HK, Sung PS, Wu MH, Hung KW, Lin SH. Prevalence, incidence and comorbidity of clinically diagnosed obsessive-compulsive disorder in Taiwan: a national population-based study. *Psychiatry Res* 2014;220:335–341. [CrossRef]
- Swedo SE, Rapoport JL, Leonard H, Lenane M, Cheslow D. Obsessive-compulsive disorder in children and adolescents. Clinical phenomenology of 70 consecutive cases. *Arch Gen Psychiatry* 1989;46:335–341.
- Yeargin-Allsopp M, Rice C, Karapurkar T, Doernberg N, Boyle C, Murphy C. Prevalence of autism in a US metropolitan area. *JAMA* 2003;289:49–55.
- Kim YS, Leventhal BL, Koh YJ, Fombonne E, Laska E, Lim EC, Cheon KA, Kim SJ, Kim YK, Lee H, Song DH, Grinker RR. Prevalence of autism spectrum disorders in a total population sample. *Am J Psychiatry* 2011;168:904–912. [CrossRef]
- Kawamura Y, Takahashi O, Ishii T. Reevaluating the incidence of pervasive developmental disorders: impact of elevated rates of detection through implementation of an integrated system of screening in Toyota, Japan. *Psychiatry Clin Neurosci* 2008;62:152–159. [CrossRef]
- Gillott A, Furniss F, Walter A. Anxiety in high-functioning children with autism. *Autism* 2001;5:277–286. [CrossRef]
- Strang JF, Kenworthy L, Daniolos P, Case L, Wills MC, Martin A, Wallace GL. Depression and anxiety symptoms in children and adolescents with autism spectrum disorders without intellectual disability. *Res Autism Spectr Disord* 2012;6:406–412. [CrossRef]
- White SW, Oswald D, Ollendick T, Sachill L. Anxiety in children and adolescents with autism spectrum disorders. *Clin Psychol Rev* 2009;29:216–229. [CrossRef]
- Leyfer OT, Folstein SE, Bacalman S, Davis NO, Dinh E, Morgan J, Tager-Flusberg H, Lainhart JE. Comorbid psychiatric disorders in children with autism: interview development and rates of disorders. *J Autism Dev Disord* 2006;36:849–861. [CrossRef]
- Muris P, Steerneman P, Merckelbach H, Holdright I, Meesters C. Comorbid anxiety symptoms in children with pervasive developmental disorders. *J Anxiety Disord* 1998;12:387–393. [CrossRef]
- Lai M, Lombardo MV, Baron-Cohen S. Autism. *The Lancet* 2014;383:896–910. [CrossRef]
- Anholt GE, Cath DC, van Oppen P, Eikelenboom M, Smit J, van Megen H, van Balkom AJ. Autism and ADHD symptoms in patients with OCD: are they associated with specific OC symptom dimensions or OC symptom severity? *J Autism Dev Disord* 2010;40:580–589. [CrossRef]

32. Bejerot S, Nylander L, Lindström E. Autistic traits in obsessive-compulsive disorder. *Nord J Psychiatry* 2001;55:169–176. [CrossRef]
33. Mito H, Matsuura N, Mukai K, Yanagisawa Y, Nakajima A, Motoyama M, Arikawa A, Yamanishi K, Matsunaga H. The impacts of elevated autism spectrum disorder traits on clinical and psychosocial features and long-term treatment outcome in adult patients with obsessive-compulsive disorder. *Compr Psychiatry* 2014;55:1526–1533. [CrossRef]
34. Mosconi MW, Kay M, D'Cruz AM, Guter S, Kapur K, Macmillan C, Sweney JA. Neurobehavioral abnormalities in first-degree relatives of individuals with autism. *Arch Gen Psychiatry* 2010;67:830–840. [CrossRef]
35. Sandin S, Lichtenstein P, Kuja-Halkola R, Larsson H, Hultman CM, Reichenberg A. The familial risk of autism. *JAMA* 2014;311:1770–1777. [CrossRef]
36. Gerdts J, Bernier R. The broader autism phenotype and its implications on the etiology and treatment of autism spectrum disorders. *Autism Res Treat* 2011;2011:545901. [CrossRef]
37. Szatmari P, Georgiades S, Duku E, Zwaigenbaum L, Goldberg J, Bennett T. Alexithymia in parents of children with autism spectrum disorder. *J Autism Dev Disord* 2008;38:1859–1865. [CrossRef]
38. Bishop D, Maybery M, Maley A, Wong D, Hill W, Hallmayer J. Using self-report to identify the broad phenotype in parents of children with autistic spectrum disorders: a study using the Autism-Spectrum Quotient. *J Child Psychol Psychiatry* 2004;45:1431–1436. [CrossRef]
39. Piven J. Genetic liability for autism: the behavioural expression in relatives. *Int Rev Psychiatry* 1999;11:299–308. [CrossRef]
40. Sasson NJ, Nowlin RB, Pinkham AE. Social cognition, social skill, and the broad autism phenotype. *Autism* 2013;17:655–667. [CrossRef]
41. Köse S, Bora E, Ererim S, Özbaran B, Bildik T, Aydın C. Broader autistic phenotype in parents of children with autism: Autism Spectrum Quotient - Turkish version. *Psychiatry Clin Neurosci* 2013;67:20–27. [CrossRef]
42. Volkmar FR, Paul R, Rogers SJ, Pelphrey KA. *Handbook of Autism and Pervasive Developmental Disorders*, 4th ed. Vol 1. New Jersey: John Wiley & Sons, Inc; 2014.
43. Constantino JN, Lajonchere C, Lutz M, Gray T, Abbacchi A, McKenna K, Singh D, Todd RD. Autistic social impairment in the siblings of children with pervasive developmental disorders. *Am J Psychiatry* 2006;163:294–296. [CrossRef]
44. Constantino JN, Zhang Y, Frazier T, Abbacchi AM, Law P. Sibling recurrence and the genetic epidemiology of autism. *Am J Psychiatry* 2010;167:1349–1356. [CrossRef]
45. Kaufman J, Birmaher B, Brent D, Rao U, Flynn C, Moreci P, Williamson D, Ryan N. Schedule for affective disorders and schizophrenia for school-age children-present and lifetime version (K-SADS-PL): initial reliability and validity data. *J Am Acad Child Adolesc Psychiatry* 1997;36:980–988. [CrossRef]
46. Gökler B, Ünal F, Pehlivanlı B, Kültür EÇ, Akdemir D, Taner Y. Okul Çağı Çocukları İçin Duygulanım Bozuklukları ve Şizofreni Görüşme Çizelgesi -Şimdi ve Yaşam Boyu Şekli- Türkiye uyarlamasının geçerlik ve güvenilirliği. *Çocuk ve Gençlik Ruh Sağlığı Dergisi* 2004;11:109–116.
47. Scahill L, Riddle MA, McSwiggan-Hardin M, Ort SI, King RA, Goodman WK, Cicchetti D, Leckman JF. Children's Yale-Brown Obsessive Compulsive Scale: reliability and validity. *J Am Acad Child Adolesc Psychiatry* 1997;36:844–852. [CrossRef]
48. Yücelen A, Arman V, Topçuoğlu G. Çocuklar için Yale-Brown obsesif-kompulsif geçerlik ve güvenilirlik değerlendirmesi 10th National Child and Adolescent Mental Health Congress, Poster Presentation. Sarıgerme (Turkey); 2000.
49. Goodman WK, Price LH, Rasmussen SA, Mazure C, Fleischmann RL, Hill CL, Heninger GR, Charney DS. The Yale-Brown Obsessive Compulsive Scale: I. Development, use, and reliability. *Arch Gen Psychiatry* 1989;46:1006–1011.
50. Tek C, Uluğ B, Rezaki BG, Tanrıverdi N, Mercan S, Demir B, Vargel S. Yale-Brown Obsessive Compulsive Scale and US National Institute of Mental Health Global Obsessive Compulsive Scale in Turkish: reliability and validity. *Acta Psychiatr Scand* 1995;91:410–413.
51. Rutter M, Bailey A, Lord C. *The Social Communication Questionnaire: Manual*. Western Psychological Services; 2003. Erişim: https://www.wpspublish.com/store/Images/Downloads/Product/SCQ_Manual_Chapter_1.pdf
52. Couteur AL, Lord C, Rutter M. Autism Diagnostic Interview-Revised. Western Psychological Service; 2003.
53. Rutter M, Bailey A, Lord C. *The Social Communication Questionnaire (SCQ)*, second printing. Western Psychological Services; 2007.
54. Avci S, Baykara B, Baydur H, Münir KM, İnal Emiroğlu N. 4–18 Yaş Aralığındaki Otistik Bireylerde Sosyal İletişim Ölçeği Türkçe Formunun Geçerlik ve Güvenilirlik Çalışması. *Türk Psikiyatri Derg* 2015;26:56–64.
55. Baron-Cohen S, Wheelwright S, Skinner R, Martin J, Clubley E. The autism-spectrum quotient (AQ): Evidence from Asperger syndrome/high-functioning autism, males and females, scientists and mathematicians. *J Autism Dev Disord* 2001;31:5–17.
56. Köse S, Bora E, Ererim S, Aydın C. Otizm-Spektrum Anketi Türkçe formunun psikometrik özellikleri. *Anadolu Psikiyatri Dergisi* 2010;11:253–260.
57. Weidle B, Melin K, Drotz E, Jozeiak T, Ivarsson T. Preschool and current autistic symptoms in children and adolescents with obsessive-compulsive disorder (OCD). *J Obsessive Compuls Relat Disord* 2012;1:168–174.
58. Ehlers S, Gillberg C. The epidemiology of Asperger syndrome. A total population study. *J Child Psychol Psychiatry* 1993;34:1327–1350.
59. Arildskov TW, Højgaard DR, Skarphedinnsson G, Thomsen PH, Ivarsson T, Weidle B, Melin KH, Hybel KA. Subclinical autism spectrum symptoms in pediatric obsessive-compulsive disorder. *Eur Child Adolesc Psychiatry* 2016;25:711–723. [CrossRef]
60. LaSalle VH, Cromer KR, Nelson KN, Kazuba D, Justement L, Murphy DL. Diagnostic interview assessed neuropsychiatric disorder comorbidity in 334 individuals with obsessive-compulsive disorder. *Depress Anxiety* 2004;19:163–173. [CrossRef]
61. Lewin AB, Wood JJ, Gunderson S, Murphy TK, Storch EA. Phenomenology of comorbid autism spectrum and obsessive-compulsive disorders among children. *J Dev Phys Disabil* 2011;23:1–11.
62. Bejerot S. An autistic dimension: a proposed subtype of obsessive-compulsive disorder. *Autism* 2007;11:101–110. [CrossRef]
63. Meier SM, Petersen L, Schendel DE, Mattheisen M, Mortensen PB, Mors O. Obsessive-Compulsive Disorder and Autism Spectrum Disorders: Longitudinal and Offspring Risk. *PLoS ONE* 2015;10:e0141703. [CrossRef]
64. Gothelf D, Goralı O, Avni S, Stawski M, Hartmann I, Basel-Vanagaite L, Apter A. Psychiatric morbidity with focus on obsessive-compulsive disorder in an Israeli cohort of adolescents with mild to moderate mental retardation. *J Neural Transm (Vienna)* 2008;115:929–936. [CrossRef]
65. Langley AK, Lewin AB, Bergman RL, Lee JC, Piacentini J. Correlates of comorbid anxiety and externalizing disorders in childhood obsessive compulsive disorder. *Eur Child Adolesc Psychiatry* 2010;19:637–645. [CrossRef]
66. Storch EA, Larson MJ, Merlo LJ, Keeley ML, Jacob ML, Geffken GR, Murphy TK, Goodman WK. Comorbidity of pediatric obsessive-compulsive disorder and anxiety disorders: impact on symptom severity and impairment. *J Psychopathol Behav Assess* 2008;30:111–120. [CrossRef]
67. Cadman T, Spain D, Johnston P, Russell A, Mataix-Cols D, Craig M, Deeley Q, Robertson D, Murphy C, Gillan N, Wilson CE, Mendez M, Ecker C, Daly E, Findon J, Glaser K; MRC AIMS Consortium, Happé F, Murphy D. Obsessive-Compulsive Disorder in Adults with High-Functioning Autism Spectrum Disorder: What Does Self-Report with the OCI-R Tell Us? *Autism Res* 2015;8:477–485. [CrossRef]
68. Lauritsen MB, Jørgensen M, Madsen KM, Lemcke S, Toft S, Grove J, Schendel DE, Thorsen P. Validity of childhood autism in the Danish Psychiatric Central Register: findings from a cohort sample born 1990–1999. *J Autism Dev Disord* 2010;40:139–148. [CrossRef]
69. Huerta M, Bishop SL, Duncan A, Hus V, Lord C. Application of DSM-5 criteria for autism spectrum disorder to three samples of children with DSM-IV diagnoses of pervasive developmental disorders. *Am J Psychiatry* 2012;169:1056–1064. [CrossRef]
70. Austin EJ. Personality correlates of the broader autism phenotype as assessed by the Autism Spectrum Quotient (AQ). *Pers Individ Dif* 2005;38:1230–1240.
71. Kadak MT, Demirel ÖF, Gökalep B, Erdoğan Z, Demirel A. Relationship between temperament, character and the autistic trait in parents of children with autistic spectrum disorder. *Int J Psychiatry Clin Pract* 2015;19:216–220. [CrossRef]
72. Bolton PF, Pickles A, Murphy M, Rutter M. Autism, affective and other psychiatric disorders: patterns of familial aggregation. *Psychol Med* 1998;28:385–395.
73. Micali N, Chakrabarti S, Fombonne E. The broad autism phenotype: findings from an epidemiological survey. *Autism* 2004;8:21–37. [CrossRef]
74. Hollander E, King A, Delaney K, Smith CJ, Silverman JM. Obsessive-compulsive behaviors in parents of multiplex autism families. *Psychiatry Res* 2003;117:11–16.
75. Ozaki N, Goldman D, Kaye WH, Plotnicov K, Greenberg BD, Lappalainen J, Rudnick G, Murphy DL. Serotonin transporter missense mutation associated with a complex neuropsychiatric phenotype. *Mol Psychiatry* 2003;8:933–936. [CrossRef]
76. Ingersoll B, Hambrick DZ. The relationship between the broader autism phenotype, child severity, and stress and depression in parents of children with autism spectrum disorders. *Research in Autism Spectrum Disorders* 2011;5:337–344. [CrossRef]
77. Rhind C, Bonfili E, Hibbs R, Goddard E, Macdonald P, Gowers S, Schmidt U, Tchanturia K, Micali N, Treasure J. An examination of autism spectrum traits in adolescents with anorexia nervosa and their parents. *Mol Autism* 2014;5:56. [CrossRef]

78. Lichtenstein P, Carlström E, Rastam M, Gillberg C, Anckarsäter H. The genetics of autism spectrum disorders and related neuropsychiatric disorders in childhood. *Am J Psychiatry* 2010;167(11):1357–1363. [\[CrossRef\]](#)
79. Hallmayer J, Cleveland S, Torres A, Phillips J, Cohen B, Torigoe T, Miller J, Fedele A, Collins J, Smith K, Lotspeich L, Croen LA, Ozonoff S, Lajonchere C, Grether JK, Risch N. Genetic heritability and shared environmental factors among twin pairs with autism. *Arch Gen Psychiatry* 2011;68:1095–1102. [\[CrossRef\]](#)
80. Iervolino AC, Rijdsdijk FV, Cherkas L, Fullana MA, Mataix-Cols D. A multivariate twin study of obsessive-compulsive symptom dimensions. *Arch Gen Psychiatry* 2011;68:637–644. [\[CrossRef\]](#)
81. Mataix-Cols D, Boman M, Monzani B, Ruck C, Serlachius E, Langström N, Lichtenstein P. Population-based, multigenerational family clustering study of obsessive-compulsive disorder. *JAMA Psychiatry* 2013;70:709–717. [\[CrossRef\]](#)
82. Hollander E, Soorya L, Chaplin W, Anagnostou E, Taylor BP, Ferretti CJ, Wasserman S, Swanson E, Settipani C. A double-blind placebo-controlled trial of fluoxetine for repetitive behaviors and global severity in adult autism spectrum disorders. *Am J Psychiatry* 2012;169:292–299. [\[CrossRef\]](#)
83. Neuhaus E, Beauchaine TP, Bernier R. Neurobiological correlates of social functioning in autism. *Clin Psychol Rev* 2010;30:733–748. [\[CrossRef\]](#)
84. Li X, Zou H, Brown WT. Genes associated with autism spectrum disorder. *Brain Res Bull* 2012;88:543–552. [\[CrossRef\]](#)
85. Nikolaus S, Antke C, Beu M, Müller HW. Cortical GABA, striatal dopamine and midbrain serotonin as the key players in compulsive and anxiety disorders –results from in vivo imaging studies. *Rev Neurosci* 2010;21:119–139.
86. Koo MS, Kim EJ, Roh D, Kim CH. Role of dopamine in the pathophysiology and treatment of obsessive-compulsive disorder. *Expert Rev Neurother* 2010;10:275–290. [\[CrossRef\]](#)
87. Wu K, Hanna GL, Rosenberg DR, Arnold PD. The role of glutamate signaling in the pathogenesis and treatment of obsessive-compulsive disorder. *Pharmacol Biochem Behav* 2012;100:726–735. [\[CrossRef\]](#)