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Childhood and Current Autistic Features in Adolescents with Schizotypal Personality Disorder

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Abstract

The diagnostic boundaries between autistic- and schizophrenia-spectrum disorders have varied over the years, and some overlap in diagnostic criteria persists. The present study examined childhood and current signs of autistic disorder (AD) in adolescents with schizotypal personality disorder (SPD) or other personality disorders, as well as healthy controls. A structured interview was administered to rate participants' current symptoms. Participants' guardians were interviewed with the Autism Diagnostic Inventory-Revised (ADI-R), a clinical assessment of childhood and current autistic signs. Compared to both the other personality-disordered and healthy groups, adolescents with SPD were rated as having significantly more impairment on childhood and current social functioning, and having more unusual interests and behaviors. For the entire sample, impaired childhood social functioning and unusual interests and behaviors were associated with higher negative symptom scores. Current impairments in social functioning, unusual interests and behaviors, and communication were also linked with greater negative symptoms. However, neither childhood nor current autistic features significantly predicted later conversion to an Axis I psychotic disorder over the course of three years of follow-up. The findings indicate that past and current autistic signs are more common in adolescents with SPD, but neither current nor childhood autistic features are linked with conversion to psychosis.

Keywords

Asperger's disorder; autistic disorder; schizophrenia; schizotypal personality disorder

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1. Introduction

Autistic disorder (AD) and schizophrenia are considered two of the most debilitating psychiatric disorders, and some early conceptualizations of childhood psychiatric illnesses proposed that these two disorders had a common etiology. Laretta Bender (1947), for example, argued that AD was essentially an early-onset, severe form of schizophrenia, whereas other researchers have argued for the validity of the etiologic distinction between AD and schizophrenia (Volkmar and Cohen, 1991). Over the years, the diagnostic boundaries between AD and schizophrenia have been made more explicit, and they are generally assumed to have different etiologies. Yet, conceptions of the two disorders have broadened, and it is now assumed that there is a spectrum of autistic disorders and a spectrum of schizophrenia-related disorders.

The most pronounced phenomenological overlap appears on the mild ends of the autistic and schizophrenic spectrums and is apparent in several functional domains. While the disorders do have differences, such as the high prevalence of mental retardation in autistic disorder compared to schizophrenia, there are many similarities. Both classes of disorders are characterized by motor abnormalities (Marsden, 1982; Ohta et al., 1987; Ornitz et al., 1977; Rapin, 1997; Rinehart et al., 2001), cognitive deficits (Mayes and Calhoun, 2003; Walker and Walder, 2003), communication impairments (Bagner et al., 2003; Condray et al., 2002; DeLisi, 2001; Lord and Paul, 1997), and social functioning deficits (Bellack et al., 1990; Bellack et al., 1997; Corrigan, 1997; Edwards et al., 2002; Loveland, 2005; Volkmar et al., 1997).

To date, only a few published studies have directly examined the co-occurrence of autistic and schizophrenic symptoms or syndromes. Several reports indicated that a subgroup of children diagnosed with AD develop schizophrenia later in life (Brown, 1963; Darr and Worden, 1951; Petty et al., 1984; Reiser and Brown, 1964), although Volkmar and Cohen (1991) found that individuals with AD are at no greater risk for schizophrenia when compared to individuals in the general population. Other studies have shown that individuals with schizophrenia are more likely than controls to display autistic features (Bender, 1970; Nylander and Gillberg, 2001; Sheitman et al., 2004). Furthermore, Sheitman and colleagues (2004) measured autistic signs in schizophrenia patients and found that autistic features covary with the negative symptoms of schizophrenia. With respect to etiology, recent studies of individuals with 22q11 deletion indicate heightened risk for autistic-spectrum, schizophrenia-spectrum and other psychotic disorders (Murphy et al., 1999; Vortsman et al., 2006), suggesting the possibility of some overlapping genetic liabilities.

To date, there has been only one published report on the relationship between autistic-like signs and schizophrenia-spectrum features. Hurst and colleagues (2007) found a positive association among features of Asperger's Disorder, a pervasive developmental disorder that is included in the autism spectrum, and features of schizotypal personality disorder (SPD) in a sample of college students from the general population. The association was especially strong between the interpersonal domain of SPD and the social skills domain of Asperger's Disorder. These findings are some of the first to demonstrate a link between traits of the two spectrums in the general population.

However, to date there have been no studies on the presence of autistic-spectrum features in a clinical sample of individuals who meet diagnostic criteria for SPD. SPD is considered to be on the mildest end of the schizophrenia spectrum, and is posited to be a more common phenotypic expression of the underlying neural diathesis for schizophrenia (Siever et al., 2003; Walker and Diforio, 1997). Most who meet diagnostic criteria for SPD do not receive antipsychotic medications that alter symptom expression. Thus, examination of autistic signs in a clinical sample of individuals with SPD may serve to further elucidate the phenotypic overlap between the autistic and schizophrenic spectrums. The current study sought to: (1) examine the rate of autistic features in a sample of adolescents diagnosed with SPD, (2) assess the association of current symptoms with past and current autistic features, and (3) investigate the relationship between autistic features and development of psychosis during a 3-year follow-up.

2. Methods

2.1. Participants

The sample included 121 adolescents, aged 11–18 years (mean, 14.2 ± 1.8 years), from a larger study of psychosis risk (Table 1). Approximately 58% were male, with 59.5% White, 35.5% African American, 2.5% Asian, and 2.5% other race. Participants were classified into three diagnostic categories at baseline: SPD ($n = 35$), no personality disorders (No PD; $n = 48$), and other PD ($n = 38$). These other PD included: obsessive-compulsive PD, schizoid PD, paranoid PD, narcissistic PD, borderline PD, avoidant PD, and antisocial PD. Baseline diagnoses were determined using the Structured Interview for DSM-IV Personality Disorders (SIDP-IV; Pfohl et al., 1997).

Baseline exclusion criteria included the presence of a neurological disorder, mental retardation, an Axis I disorder, or current substance abuse/addiction. Many individuals within the SPD group were taking psychotropic medications at baseline and not excluded from the study. However, within the three-year follow-up period, a total of 12 participants developed an Axis I psychotic disorder, with the majority of these ($n = 10$) from the SPD group. Detailed information about this subgroup is reported elsewhere (Mittal & Walker, 2007).

It should be noted that personality disorders are not routinely diagnosed in individuals less than 18 years of age. However, DSM-IV references that personality disorders have an onset in adolescence or early adulthood. Further, in accordance with DSM-IV, it is recognized that personality disorder traits “that appear in [childhood/adolescence] will often not persist unchanged into adult life.” Additionally, SPD symptoms in particular, parallel prodromal or “pre-psychotic” signs of schizophrenia. In fact, criteria for the disorder stem from “pre-psychotic” symptoms, and for many patients who develop schizophrenia, this prodromal or pre-psychotic phase begins in adolescence. The SPD diagnosis in adolescence is therefore an important developmental target for identifying symptoms mirroring the schizophrenia prodrome (i.e., DSM-IV SPD). Additionally, 24–45% of those diagnosed with DSM-IV SPD during adolescence/young adulthood develop schizophrenia (Miller et al., 2002; Yung et al., 2003).

2.3. Measures

The Structured Interview for DSM-IV Personality Disorders (SIDP-IV; Pfohl et al., 1997) was administered at baseline and follow-ups. On this measure, interviewers rate personality disorder criteria on a scale from 0 (not present) to 3 (strongly present). A total SPD symptom score was derived by averaging the ratings on the symptom criteria. The Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I; First et al., 2002) was used to diagnose Axis I disorders at each assessment throughout the study.

Given that some of the adolescents, especially those in the SPD group, were considered potentially prodromal for schizophrenia, the Structured Interview for Prodromal Syndromes (SIPS; Miller et al., 1999) was administered. The SIPS includes 29 items that assess positive, negative, disorganized, and general symptoms associated with the prodrome of psychotic disorders, with ratings ranging from 1 to 6 (1 and 2 are considered non-prodromal, 3–5 are within the prodromal range, and 6 indicates a clinical level of severity associated with psychotic disorder). The SIPS has shown acceptable reliability and validity (Miller et al., 2002).

The Autism Diagnostic Inventory-Revised (ADI-R; Lord et al., 1994) was used to assess childhood and current autistic features. The ADI-R is designed to tap the entire range of autistic features, from mild signs (e.g., social awkwardness) to more severe clinical manifestations (e.g., avoidance of social interaction). Before the initiation of the study, graduate students were trained for ADI-R administration using standardized tapes and reliability analyses. These trained graduate student clinicians administered the ADI-R to the adolescent's guardian. Items are scored from 0 to 3, with 0 indicating functioning within normal limits, and higher scores indicating increasing frequency or impairment. The following domains were examined: social interaction, unusual interests and behaviors, and communication/language. The three domains were scored separately for past (childhood) and current functioning.

2.2. Procedures

Newspaper announcements, aimed at parents of children with adjustment problems, consisted of a lay description of key diagnostic criteria present in SPD. Control participants were recruited through the university-based registry of children and adolescents in the Atlanta area. As expected, the announcements elicited responses from parents whose children manifested a range of problems. After completing a telephone-screening interview, individuals and one of their guardians underwent a baseline assessment, which was conducted by graduate-level examiners and videotaped. A licensed clinical psychologist and psychiatrist reviewed videotaped interviews to confirm diagnostic accuracy. Follow-up assessments were conducted annually to determine Axis I and II diagnostic status.

2.4. Data Analysis

All analyses were performed using SPSS 15.0. Demographic and clinical characteristics were examined using basic descriptive statistics to determine central tendency and variability. Appropriate statistical techniques, including Student's *t*-tests, multivariate

analysis of covariance (MANCOVA), linear regression, and logistic regression, were utilized to examine each of the study's objectives.

3. Results

3.1. Demographic and Clinical Characteristics of the Sample

As shown in Table 1, adolescents with SPD scored significantly higher on SPD symptoms as measured by the SIDP-IV [$F(2, 120) = 160.87, p < 0.001$], and SIPS positive [$F(2, 118) = 92.63, p < 0.001$], negative [$F(2, 118) = 29.26, p < 0.001$], disorganized [$F(2, 119) = 64.37, p < 0.001$], and general [$F(2, 119) = 29.72, p < 0.001$] prodromal symptoms, and they were significantly more likely to have developed psychosis when compared to adolescents with no PD or other PD [$\chi^2(2, n = 121) = 19.84, p < 0.001$].

Adolescents who developed an Axis I psychotic disorder were compared to adolescents who did not (Table 1). As expected, converters displayed more schizotypal symptoms ($t = 4.21, p < 0.001$), as well as more positive ($t = 3.55, p < 0.01$), negative ($t = 2.11, p < 0.05$), disorganized ($t = 3.04, p < 0.01$), and general prodromal symptoms ($t = 2.23, p < 0.05$) compared to nonconverters. There were no differences in demographic characteristics among the three diagnostic groups, or between converters and nonconverters.

3.2. Differences in Autistic Features across the Three Diagnostic Groups

Given the presence of sex differences in autistic features, a MANCOVA was used to control for sex. This analysis revealed an overall significant effect of diagnostic group on childhood autistic features, $F(6, 198) = 4.66, p < 0.001$ (Table 2). Univariate testing showed a difference between the three diagnostic groups in childhood social impairment [$F(2, 105) = 13.45, p < 0.001$] and childhood unusual interests and behaviors [$F(2, 105) = 5.70, p < 0.01$], but not in childhood communication. Paired comparisons showed that adolescents with SPD had significantly higher mean scores on both childhood social impairment ($M = 0.99, SD = 0.53$ vs. $M = 0.44, SD = 0.40; t = 4.97, p < 0.001$) and childhood unusual interests and behaviors ($M = 0.51, SD = 0.38$ vs. $M = 0.29, SD = 0.38; t = 2.83, p < 0.01$) compared to all other adolescents.

A second MANCOVA showed an effect of diagnostic group on current autistic features, $F(6, 220) = 5.07, p < 0.001$ (Table 2). Univariate tests again revealed significant differences between the three groups on current social impairment [$F(2, 116) = 13.44, p < 0.001$] and current unusual interests and behaviors [$F(2, 116) = 7.67, p < 0.01$]. Adolescents with SPD were then compared to all other adolescents on the autistic features that were found to be significantly different in the MANCOVA. Adolescents with SPD had significantly higher mean scores on current social impairment ($M = 0.82, SD = 0.59$ vs. $M = 0.34, SD = 0.36; t = 4.53, p < 0.001$) and current unusual interests and behaviors ($M = 0.46, SD = 0.32$ vs. $M = 0.24, SD = 0.33; t = 3.30, p < 0.001$).

To evaluate the nature of the ADI-R items that distinguish the SPD group from the other groups, comparisons were conducted on individual items in the domains of social impairment and unusual interests and behaviors. As shown in Table 3, adolescents with SPD differed from the other groups on both childhood and current social smiling, range of facial

expressions, social disinhibition, inappropriate social responses, social anxiety, group play with peers, and quality of friendships; childhood sharing enjoyment with others, quality of social overtures, inappropriate facial expressions, and lack of secure base; and current showing of affection. In the unusual interests and behaviors domain, they scored more severely on childhood and current circumscribed interests, abnormal response to stimuli, and resistance to change.

3.3. Associations between Schizotypal and Prodromal Symptoms and Autistic Features

The relationships between schizotypal and prodromal symptoms and autistic features were examined using multiple regression, controlling for sex (Table 4). In the overall sample, childhood autistic features significantly predicted 26% of the variance, and current autistic features predicted 28% of the variance in total schizotypal symptoms. Childhood social impairment ($t = 4.24, p < 0.001$), current social impairment ($t = 3.47, p < 0.01$), and current unusual interests and behaviors ($t = 3.43, p < 0.01$) were the significant individual predictors. When analyzed by diagnostic group, these relationships were not significant, likely due to reduced power.

In the overall sample, childhood autistic features predicted 21% of the variance, and current autistic features predicted 23% of the variance in positive symptoms, controlling for sex. Childhood social impairment ($t = 3.95, p < 0.001$), current social impairment ($t = 3.53, p < 0.01$), and current unusual interests and behaviors were significant individual predictors ($t = 2.31, p < 0.05$). When analyzed separately by diagnostic group, the relationships were not significant.

In the overall sample, childhood autistic features predicted 19% of the variance, and current autistic features predicted 26% of the variance in negative symptoms. Childhood social impairment ($t = 2.36, p < 0.05$), childhood unusual interests and behaviors ($t = 2.60, p < 0.05$), current social impairment ($t = 3.85, p < 0.001$), current unusual interests and behaviors ($t = 2.17, p < 0.05$), and current communication ($t = 2.32, p < 0.05$) were all significant individual predictors. When analyzed by separately by diagnostic group, only the relationship between current autistic features and negative symptoms was significant in adolescents with SPD ($r^2 = 0.25, p < 0.05$).

In the overall sample, childhood autistic features significantly predicted 11% of the variance, and current autistic features significantly predicted 15% of the variance in disorganized symptoms, controlling for sex. Childhood social impairment ($t = 2.75, p < 0.01$) and current social impairment ($t = 2.86, p < 0.01$) were the only significant individual predictors. These relations were not significant when the groups were analyzed separately.

In the overall sample, childhood autistic features significantly predicted 24% of the variance, and current autistic features significantly predicted 26% of the variance in general symptoms. Childhood social impairment ($t = 3.71, p < 0.001$), childhood unusual interests ($t = 2.07, p < 0.05$), current social impairment ($t = 3.74, p < 0.01$) and current unusual interests and behaviors ($t = 2.26, p < 0.05$) were significant individual predictors. When analyzed by diagnostic group, there were no significant relations.

3.4. Relationship between Autistic Features and Development of Psychosis during Longitudinal Follow-up

As noted, 12 participants met criteria for an Axis I psychotic disorder during follow-up. Two separate logistic regressions were conducted to predict the development of psychosis.

Results indicated that neither childhood nor current autistic features predicted the development of an Axis I psychotic disorder ($\chi^2 = 4.38$, $df = 3$, $p = 0.22$ and $\chi^2 = 1.31$, $df = 3$, $p = 0.73$, respectively).

4. Discussion

Current study findings indicate that adolescents with SPD showed significantly more severe current and past autistic features in the areas of social impairment and unusual interests and behaviors compared to normal and other personality-disorder controls. There were no diagnostic group differences in communication delays or abnormalities. These results are consistent with recent research on the overlap between autistic-spectrum and schizophrenia-spectrum features. Hurst and colleagues (2007) found that self-reported Asperger's Disorder and SPD traits were positively correlated in the general population. Furthermore, the two disorders were most strongly linked in the social functioning domain. Similarly, the current study shows that an SPD diagnosis is associated with the severity of autistic-like traits. This association is primarily explained by social impairment.

The present findings indicate significant phenomenologic overlap between autism-spectrum and schizophrenia-spectrum disorders. The ADI-R is undoubtedly tapping the general social deficits that are among the defining features of SPD (e.g., constricted affect, social anxiety, and odd or peculiar behavior). It also assesses behavioral characteristics that are more traditionally seen as more specific to autism-spectrum disorders. Included among these are lack of sharing enjoyment with others, social disinhibition, circumscribed interests, resistance to change, and abnormal response to stimuli. These items do not overlap with standard diagnostic criteria for SPD, yet adolescents with SPD were rated as having greater impairment in these behavioral domains. Thus, higher scores on these items reflect the presence of autistic-like features among these adolescents who did not have autistic disorder diagnoses.

Also interesting and consistent with previous literature were the findings linking current and childhood autistic features with prodromal symptoms. Sheitman and colleagues (2004) found increased autistic features in schizophrenia patients, and these features covaried with negative symptoms. In the overall sample, more severe childhood and current autistic features, namely social features and unusual interests and behaviors, were predictive of greater severity in not only negative symptoms, but also positive, disorganized, and general symptoms. Autistic features were also predictive of schizotypal symptoms. Thus, autistic features are linked with the spectrum of schizotypal and prodromal symptoms. Further, when analyzed separately, the relationship between autistic features and negative symptoms held for adolescents with SPD, perhaps suggesting a more pronounced relationship between autistic features and negative symptoms in the SPD group.

Adolescents with SPD are at heightened risk for psychotic disorders, and this was confirmed in this sample, as they were more likely to develop a psychotic disorder compared to other adolescents. However, neither childhood nor current autistic features predicted conversion. As noted, although earlier research suggested that children with AD had an elevated risk of schizophrenia as adults, Volkmar and Cohen (1991) found that adolescents and adults with histories of autism were at no greater risk of later developing schizophrenia than individuals in the general population.

The absence of a relation between autistic features and conversion to psychosis provides support for the notion that the ADI-R is not merely measuring signs of behavioral dysfunction that overlap conceptually with the diagnostic criteria for SPD or behavioral indicators of risk for schizophrenia-spectrum disorders. If it were, the ADI-R ratings would predict conversion, given the correlation between autistic features and SPD, and the relationship between SPD and conversion to psychosis. Data indicating that SPD symptoms differentiate converters from nonconverters, but that ADI-R scores do not, argues against the notion that our findings simply reflect the overlap between the diagnostic criteria for autistic-spectrum and schizophrenia-spectrum disorders.

Our results are consistent with the notion that etiologic risk factors can co-occur, but remain relatively distinct. More specifically, if risk factors for autistic and schizophrenia-spectrum disorders tend to co-occur, then individuals who show behavioral signs of risk for one of the spectrums would be more likely to also show behavioral signs of risk for the other. At the same time, if the risk factors are also relatively disorder-specific, the behavioral signs would not predict across disorders. As an example, research on the 22q11 chromosomal deletion has shown that it is associated with a broad and variable range of physical and psychiatric phenotypes, including autistic- and schizophrenia-spectrum disorders (Kraemer, 1996). It is assumed that this variability reflects individual differences in genomic deletions within the 22q11 region, as well as differences in gene expression (Meechan et al., 2007).

The fact that risk for both autism-spectrum and schizophrenia-spectrum disorders are elevated in 22q11 patients suggests that susceptibility genes for both lie within the same regions. Nonetheless, specific genes conferring risk for the two classes of disorder may be distinct. This may be an example of linkage disequilibrium (LD). LD refers to the association between neighboring alleles, reflecting a lower likelihood of separation in the process of recombination (Reich et al., 2001). If susceptibility genes for schizophrenia and autism were distinct, but in LD, risk for both would be correlated, yet behavioral risk indicators would not necessarily predict across disorders. This is, of course, purely speculative, but it does suggest one potential etiologic mechanism to account for the pattern of findings reported here and elsewhere.

There are several limitations of the present study. First, the information obtained from the ADI-R interview is subject to limitations inherent in informant-report. For example, the reliability of childhood information is limited by the integrity of long-term recall. Second, the longitudinal progression of autistic features and negative symptoms was not examined. Finally, our current conversion rate is likely an underestimate as the mean age range of the sample is much below the modal age at onset for psychosis.

Despite these limitations, the current study illustrates the association between autistic features and adolescent SPD. Findings on childhood autism-spectrum behaviors provide insight into the early developmental trajectory of SPD. Further, in combination with the growing literature on autistic and psychotic syndromes in 22q11 deletion patients, these findings highlight the importance of further research on this issue. In particular, it is possible that measurement of autistic features could aid in the identification of genetic subtypes of schizophrenia-spectrum disorders.

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Table 1

Demographic and Clinical Characteristics Stratified by Three Diagnostic Groups

Characteristic	SPD (<i>n</i> = 35)	No PD (<i>n</i> = 48)	Other PD (<i>n</i> = 38)	Converters (<i>n</i> = 12)
Mean Age	14.2 (range=11–18)	14.0 (range=11–14)	(range=12–17)	--
Sex (Male)	23 (65.7%)	27 (56.3%)	20 (52.6%)	6 (50.0%)
Race Caucasian	26 (74.3%)	25 (52.1%)	21 (55.3%)	9 (75.0%)
African American	7 (20.0%)	22 (45.8%)	14 (36.8%)	3 (25.0%)
Asian American	1 (2.9%)	0 (0.0%)	2 (5.3%)	0 (0.0%)
Other	1 (2.9%)	1 (2.1%)	1 (2.6%)	0 (0.0%)
Mean Schizotypal Symptoms(SID-P) *	15.26 range=11–25)	3.0 (range=0–12)	5.2 (range=0–11)	13.83 ** (range=4–25)
Mean Positive Symptoms(SIPS) *	2.54 (range=1.2–4.6)	0.55 (range=0–2.2)	0.87 (range=0–2.4)	2.25 (range=1–4.2) **
Mean Negative Symptoms(SIPS) *	1.95 (range=0–4.7)	0.5 (range=0–1.8)	0.9 (range=0–2.3)	1.95 ** (range=0.2–4.7)
Mean Disorganized Symptoms (SIPS) *	1.77 (range=0.5–3.8)	0.27 (range=0–1.3)	0.50 (range=0–2.5)	1.73 ** (range=0.5–3.8)
Mean General Symptoms(SIPS) *	1.76 (range=0–4.3)	0.42 (range=0–1.5)	0.81 (range=0–3.8)	1.73 ** (range =0.0–4.0)
Conversion to Axis I Disorder *	10 (28.6%)	0 (0.0%)	2 (5.3%)	--

* Represents a significant difference between the three diagnostic groups ($p < 0.01$)

** Represents a significant difference between converters and nonconverters ($p < 0.05$)

Table 2
Diagnostic Group Differences in Severity of Childhood and Current Autistic Features

Independent	Dependent	df	F	η^2	p
Between subjects childhood autistic features					
Diagnostic Group	Social functioning	2	13.45	0.21	<0.001
	Unusual interests and behavior	2	5.70	0.10	<0.01
	Communication	2	0.14	0.00	0.87
Between subjects current autistic features					
Diagnostic Group	Social functioning	2	13.44	0.19	<0.001
	Unusual interests and behavior	2	7.67	0.12	<0.01
	Communication	2	0.05	0.01	0.63

Table 3Diagnostic Group Differences on Individual ADI-R Items¹

Childhood Item	Diagnostic Group	Item Mean	t-value	Item Description
Childhood social smiling	SPD	1.29 ± 1.15	3.65 **	Spontaneous smiling directed at a variety of people, including smiling back at someone smiling, smiling during an approach, and in response to what someone does or says
	Other	0.48 ± 0.95		
Current social smiling	SPD	1.20 ± 1.18	3.53 **	
	Other	0.42 ± 0.47		
Childhood sharing enjoyment with others	SPD	0.51 ± 0.71	2.31 *	Attempt to share his/her enjoyment of things that give him/her pleasure with others, with no apparent motive but sharing
	Other	0.20 ± 0.28		
Childhood quality of social overtures	SPD	0.49 ± 0.89	2.28 *	Quality of social intentionality when seeking help; consistently makes vocalizations that are integrated with other behaviors, including eye gaze
	Other	0.13 ± 0.40		
Childhood range of facial expressions	SPD	0.80 ± 1.05	3.09 **	Focus on facial expressions used to communicate, not just those associated with the experience of emotions; includes more subtle facial expressions used communicatively including surprise, guilt, disgust, interest, amusement, and embarrassment
	Other	0.21 ± 0.65		
Current range of facial expressions	SPD	0.66 ± 0.91	3.46 **	
	Other	0.19 ± 0.56		
Childhood inappropriate facial expressions	SPD	0.91 ± 1.42	2.46 *	Those expressions that indicate emotions that are incongruent with the situation, such as laughing when someone is upset or hurt or laughing or crying for no discernable reason
	Other	0.45 ± 0.65		
Current showing affection	SPD	0.97 ± 1.42	2.76 **	Spontaneous positive expression of love or caring directed to a specific person and shown through touching seeking proximity, offers of gifts or vocalization accompanied by an appropriate facial expression
	Other	0.45 ± 0.65		
Childhood social disinhibition	SPD	1.31 ± 1.13	4.15 **	Behavior that is not appropriately modulated according to social expectations in the socio-cultural environment; may arise from a variety of causes, but the aim here is inhibition that arises from a lack of awareness of social cues
	Other	0.45 ± 0.78		
Current social disinhibition	SPD	1.14 ± 0.97	4.39 **	
	Other	0.35 ± 0.67		
Childhood inappropriate social responses	SPD	1.17 ± 1.15	2.92 **	How child responds when adults, other than parents attempt to interact with him/her in everyday but non-routine situations
	Other	0.54 ± 0.87		
Current inappropriate social responses	SPD	0.89 ± 1.05	2.50 *	
	Other	0.40 ± 0.77		
Childhood social anxiety	SPD	1.46 ± 1.62	3.68 **	Marked anxiety in ordinary social situations, of a degree that is associated with avoidance behavior in the situation
	Other	0.42 ± 0.68		
Current social anxiety	SPD	1.40 ± 1.63	3.82 **	
	Other	0.31 ± 0.64		
Childhood lack of secure base	SPD	1.84 ± 1.88	2.81 **	Use of caregivers as a base from which he/she can explore
	Other	0.81 ± 1.29		
Childhood group play with peers	SPD	1.60 ± 1.17	4.94 **	Subject's participation in groups of other children in spontaneous games or activities; cooperation must involve the subject attending to his/her peers and modifying his/her behavior in a way that clearly demonstrates spontaneous, flexible, interactive play
	Other	0.55 ± 0.75		
Current group play with peers	SPD	1.40 ± 1.12	4.60 **	

Childhood Item	Diagnostic Group	Item Mean	<i>t</i> -value	Item Description
	Other	0.47 ± 0.70		
Childhood quality of friendships	SPD	1.76 ± 1.00	6.73 **	Selective, reciprocal relationships between two persons of approximately the same age who seek each other's company and share activities and interests
	Other	0.50 ± 0.87		
Current quality of friendships	SPD	1.46 ± 1.01	5.38 **	
	Other	0.43 ± 0.79		

¹ Higher scores indicate poorer functioning.

*
p < 0.05

**
p < 0.01

Childhood and Current Autistic Features Predicting Schizotypal (SID-P) and Prodromal (SIPS) Symptoms in the Overall Sample

Table 4

Age	Symptoms	Individual Predictor	B	SE B	β
Childhood Autistic Features	Total Schizotypal ¹	Social impairment ²	0.48	0.24	0.20
		Unusual interests and behaviors	0.72	0.28	0.26
		Communication impairment	0.23	0.19	0.11
Current Autistic Features	Total Schizotypal ¹	Social impairment ³	0.74	0.19	0.35
		Unusual interests and behaviors ³	0.63	0.29	0.19
		Communication impairment	0.60	0.26	0.18
Childhood Autistic Features	Positive ¹	Social impairment ³	0.87	0.22	0.40
		Unusual interests and behaviors	0.30	0.30	0.09
		Communication impairment	0.12	0.21	0.05
Current Autistic Features	Positive ¹	Social impairment ³	0.77	0.22	0.34
		Unusual interests and behaviors ²	0.76	0.33	0.22
		Communication impairment	0.32	0.29	0.09
Childhood Autistic Features	Negative ¹	Social impairment ²	0.48	0.20	0.24
		Unusual interests and behaviors ²	0.72	0.28	0.26
		Communication impairment	0.23	0.19	0.11
Current Autistic Features	Negative ¹	Social impairment ³	0.74	0.19	0.35
		Unusual interests and behaviors ²	0.63	0.29	0.19
		Communication impairment ²	0.59	0.26	0.18
Childhood Autistic Features	Disorganized ⁴	Social impairment ³	0.48	0.18	0.29
		Unusual interests and behaviors	0.23	0.24	0.09
		Communication impairment	0.01	0.17	0.00
Current Autistic Features	Disorganized ¹	Social impairment ²	0.51	0.18	0.28
		Unusual interests and behaviors	0.46	0.27	0.17
		Communication impairment	0.20	0.24	0.07

Age	Symptoms	Individual Predictor	B	SE B	β
Childhood Autistic Features	General ¹	Social impairment ³	0.72	0.20	0.37
		Unusual interests and behaviors ²	0.72	0.20	0.37
		Communication impairment	0.56	0.27	0.20
Current Autistic Features	General ¹	Social impairment ³	0.71	0.19	0.36
		Unusual interests and behaviors ²	0.64	0.29	0.21
		Communication impairment	0.41	0.25	0.13

¹ Overall model significant at $p < 0.001$

² Individual predictor significant at $p < 0.05$

³ Individual predictor significant at $p < 0.01$

⁴ Overall model significant at $p < 0.01$