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RESEARCH ARTICLE

Childhood trauma, neurological soft signs, and their relationship in obsessive–compulsive disorder

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ABSTRACT

Objective: Neurodevelopmental mechanisms are thought to play a role in the etiology of obsessive–compulsive disorder (OCD). Childhood traumas and neurological soft signs (NSSs) are more frequent in OCD patients. However, there has been no study that determined whether or not there is a relationship between childhood traumas and NSSs in OCD patients. The aim of this study was to determine the relationship between childhood traumas and NSSs in OCD patients and healthy individuals.

Method: The study included 40 OCD patients and 40 healthy controls. Linear regression analyses were used to investigate the relationship between childhood traumas and NSSs which was evaluated with Neurological Evaluation Scale (NES) in OCD patients and the healthy control group.

Results: The Childhood Trauma Questionnaire-28, Beck Depression Inventory, and Beck Anxiety Inventory scores were found to be higher in OCD patients. The NES total score, subscales of sensory integration, complex motor sequences, and other NSSs were significantly higher in OCD patients. In the OCD group, age and emotional abuse were determined as variables predicting motor coordination, and age and physical neglect predicted both sensory integration and complex motor sequences. In the healthy control group, age and emotional abuse were determined as variables predicting other NSSs, and physical neglect was determined as the only variable predicting primitive reflexes.

Conclusion: This study demonstrated that childhood traumas may be related to neurodevelopmental impairment seen in OCD. The evaluation of NSSs could be another method to investigate the effects of childhood traumas on central nervous system development. The effects of childhood traumas should be considered in psychiatric disorders in which NSSs are severe.

Keywords: Child abuse, child neglect, neurologic signs, obsessive–compulsive disorder

INTRODUCTION

Obsessive–compulsive disorder (OCD) is characterized by recurrent, resistant, unwanted thoughts, and repeated ritual behaviors, which cause significant functional impairment (1,2). In OCD, there is structural and functional dysfunction in the cortico-striato-thalamo-cortical circuits (3,4). Previous studies have shown higher rates of childhood trauma in OCD patients compared with the normal population (5,6). It has been suggested that childhood trauma may be one of the causes of the first emergence of obsessive–compulsive symptoms and may play a role in the transformation of intrusive thoughts into obsessive thoughts (7). Moreover, childhood trauma may be a reason for an increase in the frequency and intensity of obsessive thoughts (8) and may have an impact on the content of the obsessive thoughts (9).

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Neurological soft signs (NSSs) are mild neurological and nonlocalized abnormalities associated with defects of motor coordination, balance, and integration, as well as sensory integration of the central nervous system (10,11). NSSs have been characterized in several psychiatric disorders. It has been reported that NSSs are seen more often in OCD patients than in healthy individuals (12,13). They are separated into subcategories of dysfunction in simple motor coordination, complex motor sequences, sensory integration, and primitive reflexes (11). Although the causes of NSSs are not fully known, it is thought that these symptoms originate from impairments in the subcortical structures such as basal ganglions and the limbic system or from a deficiency in integration between the sensory and motor systems (14). In parallel with brain development, NSSs reduce toward late childhood and adolescence, but this decrease does not occur when there is a neurodevelopmental problem, and NSSs continue to be seen in adulthood (15). Therefore, the frequent observation of these findings in a group of disorders suggests that neurodevelopmental impairments play a role in that disorder. The NSSs in OCD patients have been shown to be related to poor insight (12,16), psychotic features (17,18), neuropsychological dysfunction (19), and a low response to selective serotonin reuptake inhibitors (SSRIs) (20). These findings suggest that NSSs have important features associated with the clinical manifestations and prognosis of OCD. Considering that OCD is a neurodevelopmental disorder (21), it comes to mind that there may be a relationship between NSSs and underlying pathophysiological mechanisms. Therefore, it is important to reveal the possible factors that are related to NSSs to be able to clarify the potential neurodevelopmental mechanisms underlying OCD.

The above information suggests that psychological trauma in childhood could be associated with NSSs in adulthood. This study focused on this question in OCD patients and healthy individuals. To the best of our knowledge, there has been only one study to date that has addressed this issue. Zhao et al. (22) reported that childhood maltreatment (emotional abuse/neglect, physical abuse/neglect, and sexual abuse) in depressive patients is especially associated with frontal and temporal area-related NSSs. Investigation of this subject in OCD patients and healthy individuals would provide more detailed information about the effects of childhood traumas in OCD, the neurodevelopmental mechanisms of OCD, and the mechanisms of the emergence of NSSs. It is known that NSSs are common in many psychiatric disorders such as schizophrenia, bipolar disorder, attention deficiency and hyperactivity disorder (ADHD), and social phobia (16,23). Therefore, determining the factors related to NSSs would also provide valuable information about neurodevelopmental mechanisms in these disorders. Compared with the healthy population, childhood traumas are known to have been experienced more by those with psychiatric disorders such as schizophrenia, mood disorders, and anxiety disorders (24–26). The neurodevelopmental process may be negatively affected by the possible effects of childhood traumas, and NSSs may be one of the markers of this impact in OCD patients. Thus, the hypothesis of this study was that there is a relationship between childhood traumas and NSSs in OCD. Structural and functional neuroimaging methods were used to investigate the impact of childhood traumas on the central nervous system (27), so the findings of this study may show that NSS evaluation, which is a cheaper and easily applied method, can also be used to investigate the impact of these traumas. For all these reasons, the aim of this study was to determine whether or not there is a relationship between childhood traumas and NSSs in OCD patients and healthy control subjects.

METHOD

Participants

The study included 40 patients (in the age range of 18–65 years) who were admitted to the outpatient psychiatry clinic and were diagnosed with OCD according to the DSM-5 criteria. The research project was approved by the local ethical committee, and written informed consent was obtained from all the participants. The necessary permissions to conduct the study were received from the local Ethics Committee prior to the initiation of the research. The research project was approved by the Afyonkarahisar Health Sciences University Faculty of Medicine Ethical Committee (number: 2019/32 and date: January 18, 2019).

Patients who had a psychotic disorder, bipolar disorder, intellectual disability, a tic disorder, ADHD, major depressive disorder, anxiety disorders, or neurocognitive disorder were excluded from the study. The healthy control subjects were selected from staff in the hospital and relatives of the staff who

Table 1: Comparison of sociodemographic features, childhood traumas, neurological soft signs, anxiety, and depression scores between OCD and control groups

	OCD (n=40)	Control (n=40)	χ^2	df	p
	n (%)	n (%)			
Sex (male/female)	13 (32.5)/27	13 (32.5)/27	<0.001	1	1.000
Marital status (single/married)	20 (50.0)/20	23 (57.5)/17	0.453	1	0.501
Education			<0.001	2	1.000
Primary school	13 (32.5)	13 (32.5)			
High school	23 (57.5)	23 (57.5)			
University	4 (10)	4 (10)			
Employment			1.979	2	0.372
Unemployed	17 (42.5)	11 (27.5)			
Officer/worker	11 (27.5)	14 (35.0)			
Student	12 (30.0)	15 (37.5)			
Lifetime suicide attempt	1 (2.5)	0 (0.0)	1.013	1	0.314
Family history of psychiatric disorder	6 (15.0)	2 (5.0)	2.222	1	0.136
	Mean (SD)	**Mean (SD)**	**t**	**df**	**p**
CTQ-28 total	37.90 (12.05)	27.77 (2.31)	-5.218	41.873	<**0.001**
Physical abuse	5.67 (1.52)	5.02 (0.15)	-2.680	39.838	**0.011**
Emotional abuse	8.10 (3.52)	5.50 (1.33)	-4.357	50.015	<**0.001**
Sexual abuse	5.60 (2.03)	5.05 (0.22)	-1.699	39.917	0.097
Physical neglect	7.02 (2.93)	5.40 (0.74)	-3.389	43.979	**0.001**
Emotional neglect	11.50 (5.16)	6.80 (1.36)	-5.561	44.394	<**0.001**
NES total	8.31 (5.73)	5.08 (3.53)	-3.030	64.889	**0.004**
Motor coordination	2.22 (1.77)	1.63 (1.36)	-1.662	73.190	0.101
Sensory integration	1.60 (1.21)	0.52 (0.59)	-5.036	57.011	<**0.001**
Complex motor sequences	1.50 (1.95)	0.75 (0.98)	-2.166	57.407	**0.034**
Primitive reflexes	0.77 (0.76)	0.87 (0.60)	0.646	74.073	0.520
Other neurological soft signs	2.21 (1.87)	1.30 (1.34)	-2.503	70.716	**0.015**
BDI total	19.05 (15.47)	5.30 (4.68)	-5.378	46.073	<**0.001**
BAI total	17.87 (14.52)	4.35 (4.48)	-5.626	46.353	<**0.001**

OCD: Obsessive–compulsive disorder; n: Number; SD: Standard deviation; CTQ-28: Childhood Trauma Questionnaire-28; NES: Neurological Evaluation Scale; BDI: Beck Depression Inventory; BAI: Beck Anxiety Inventory. P<0.05 (bold values).

volunteered. The control group included 40 healthy subjects without any psychiatric disorder and who were matched with the OCD group for age, gender, and education level. All participants underwent a clinical interview, and structured diagnostic information was obtained in face-to-face interviews with an experienced psychiatrist in the psychiatry department.

Measures

Sociodemographic Data Form

This form was developed by the researchers to be used in this study to record the sociodemographic characteristics of the participants.

Childhood Trauma Questionnaire (CTQ-28)

Childhood Trauma Questionnaire (CTQ-28) is a 28-item self-report instrument that evaluates childhood emotional, physical, and sexual abuse and childhood physical and emotional neglect. Total scores for the subscales of childhood trauma range from 5 to 25, and the total of the scores derived from each trauma type provides a total score ranging from 5 to 25. The reliability and validity of the Turkish version of the CTQ-28 have been examined and found to be as high as in its original version (28).

Neurological Evaluation Scale (NES)

Neurological Evaluation Scale (NES) is sensitive to soft developmental changes and soft motor deficits in

Table 2: Correlation analysis between neurological soft signs, childhood traumas, depression, and anxiety levels in OCD patients and healthy control group (HC)

		Age	Physical abuse	Emotional abuse	Sexual abuse	Physical neglect	Emotional neglect	BAI	BDI
Motor coordination	OCD	0.429**	0.085	0.347*	-0.081	0.250	0.332*	0.135	0.366*
	HC	0.486**	0.043	0.088	-0.109	-0.106	0.050	0.451**	0.453**
Sensory integration	OCD	0.655**	0.025	0.211	-0.134	0.554**	0.230	0.352*	0.306
	HC	0.634**	0.129	0.240	-0.010	-0.138	0.132	0.331*	0.391*
Complex motor sequences	OCD	0.516**	-0.013	0.275	-0.045	0.492**	0.187	0.238	0.137
	HC	0.292	-0.124	0.371*	-0.178	-0.105	0.134	0.522**	0.659**
Primitive reflexes	OCD	0.289	0.308	0.255	-0.010	0.207	0.262	-0.044	-0.008
	HC	0.291	0.033	0.016	0.048	-0.397*	-0.155	0.026	-0.059
Other neurological soft signs	OCD	0.150	-0.087	0.169	0.140	0.318*	0.267	0.454**	0.398*
	HC	0.327*	0.084	0.613**	-0.052	0.185	0.300	0.595**	0.479**
NES total	OCD	0.535**	0.040	0.335*	-0.024	0.494**	0.337*	0.379*	0.251
	HC	0.517**	0.042	0.413**	-0.104	-0.092	0.166	0.606**	0.596**

**: P<0.01; *: P<0.05; OCD: Obsessive–compulsive disorder; HC: Healthy control group; BDI: Beck Depression Inventory; BAI: Beck Anxiety Inventory; NES: Neurological Evaluation Scale.

central nervous system development. The NES includes 26 items, of which 14 are rated separately on the right and left. It is a structured instrument divided into five subscales corresponding to functional manifestation areas of NSSs: (i) motor coordination, (ii) complex motion sequences, (iii) sensory integration, (iv) primitive reflections, and (v) other NSSs. The subscale of motor coordination includes tandem walk, rapid alternating movements, finger–thumb opposition, and the finger-to-nose test. The subscale of complex motion sequences consists of the fist-ring test, fist-edge-palm test, Ozeretski test, and rhythm tapping test. The subscale of sensory integration evaluates audiovisual integration, stereognosis, graphesthesia, extinction, and right/left confusion. The subscale of other NSSs consists of adventitious overflow, the Romberg test, tremor, memory, mirror movements, rhythm tapping test A, synkinesis, convergence, gaze impersistence, glabellar reflex, snout reflex, grasp reflex, and sucking reflex. The mean score is calculated by calculating the average of the scores of the 14 items evaluated separately for the left and right sides (29).

Yale-Brown Obsessive–Compulsive Scale (Y-BOCS)

Yale-Brown Obsessive–Compulsive Scale (Y-BOCS) is a 10-item scale, with each item rated from 0 to 4, yielding a severity score that ranges from 0 to 40. The severity and types of OCD symptoms are assessed using the Y-BOCS (30). The validity and reliability study of the Turkish version was conducted by Tek et al. (31) and found to be strong.

Beck Depression Inventory (BDI)

Beck Depression Inventory (BDI) is a 21-item self-report inventory, which is a reliable and valid measure of depression severity in both clinical and nonclinical populations (32). Total scores vary between 0 and 63. The scale was adapted to Turkish by Hisli, and the Turkish version has yielded high values of reliability and validity (33).

Beck Anxiety Inventory (BAI)

Beck Anxiety Inventory (BAI) is used to measure the severity of anxiety. It is a Likert-type self-report scale consisting of 21 items and scored in the range of 0–3. It was first developed by Beck et al. (34). The validity and reliability of the Turkish version were demonstrated by Ulusoy et al. (35) and found to be high.

Statistical Analysis

Statistical analysis was performed using the SPSS v23.0 software. Student's t-test was used to compare continuous variables with normal distribution. Categorical data were compared using Pearson's Chi-squared test. Correlations between parametric numerical variables were examined using Pearson's correlation coefficients. Multiple linear regression analyses were used to investigate the associations between childhood trauma and NSSs in OCD patients and a healthy control group. In these analyses, variables that were determined to show a significant correlation with each NSS subscales were taken as predictors. The significance level was established as $\alpha=0.05$.

RESULTS

In OCD patients, the mean age of onset was 21.42±7.59 years, the duration of illness was 7.77±5.26 years, the duration of treatment was 4.03±3.77 years, and the number of hospitalization was 0.32±0.91. Of the OCD patients, 36 were taking medication and 4 were not. Of

Table 3: Linear regression analysis of neurological soft signs and childhood traumas in OCD patients (n=40)

Model		B	SE	β	t	p
Dependent variable: NES motor coordination. Predictors: age, BDI, emotional neglect, emotional abuse. Adjusted R^2 for model 1=0.059, for model 2=0.084, for model 3=0.097						
1	Constant	-1.203	1.002		-1.201	0.238
	Age	0.078	0.031	0.392	2.542	**0.016**
	BDI	-0.001	0.019	-0.008	-0.046	0.964
	Emotional abuse	0.157	0.115	0.313	1.360	0.183
	Emotional neglect	-0.009	0.086	-0.026	-0.105	0.917
2	Constant	-1.207	0.984		-1.227	0.228
	Age	0.078	0.030	0.392	2.587	**0.014**
	Emotional abuse	0.157	0.114	0.312	1.379	0.177
	Emotional neglect	-0.010	0.081	-0.030	-0.125	0.901
3	Constant	-1.201	0.969		-1.239	0.223
	Age	0.077	0.028	0.387	2.716	**0.010**
	Emotional abuse	0.146	0.071	0.290	2.039	**0.049**
Dependent variable: NES sensory integration. Predictors: age, BAI, physical neglect. Adjusted R^2 for model 1=0.309, for model 2=0.289						
1	Constant	-1.349	0.494		-2.730	**0.010**
	Age	0.066	0.018	0.489	3.697	**0.001**
	BAI	0.013	0.010	0.162	1.337	0.190
	Physical neglect	0.110	0.056	0.266	1.965	**0.057**
2	Constant	-1.291	0.497		-2.595	**0.013**
	Age	0.068	0.018	0.505	3.790	**0.001**
	Physical neglect	0.127	0.055	0.308	2.312	**0.026**
Dependent variable: NES others. Predictors: BAI, physical neglect. Adjusted R^2 for model 1=0.200, for model 2=0.185						
1	Constant	0.419	0.708		0.591	0.558
	Physical neglect	0.126	0.096	0.198	1.318	0.196
	BAI	0.051	0.019	0.393	2.616	**0.013**
2	Constant	1.167	0.427		2.730	**0.010**
	BAI	0.058	0.019	0.454	3.137	**0.003**
Dependent variable: complex motor sequences. Predictors: age, physical neglect. Adjusted R^2 for model 1=0.256						
1	Constant	-1.919	0.606		-3.167	**0.002**
	Age	0.046	0.018	0.258	2.562	**0.012**
	Physical neglect	0.272	0.070	0.392	3.890	<**0.001**
Dependent variable: NES total. Predictors: age, BAI, emotional neglect, emotional abuse, physical neglect. Adjusted R^2 for model 1=0.328, for model 2=0.339, for model 3=0.352, for model 4=0.322						
1	Constant	-4.254	2.941		-1.446	0.157
	Age	0.255	0.100	0.397	2.542	**0.016**
	Emotional abuse	0.297	0.353	0.183	0.843	0.405
	Physical neglect	0.434	0.329	0.222	1.320	0.196
	Emotional neglect	-0.155	0.247	-0.140	-0.629	0.533
	BAI	0.081	0.062	0.206	1.313	0.198
2	Constant	-4.188	2.914		-1.437	0.160
	Age	0.242	0.097	0.376	2.487	**0.018**
	Emotional abuse	0.151	0.264	0.093	0.574	0.569
	Physical neglect	0.413	0.324	0.212	1.274	0.211

Table 3 (cont): Linear regression analysis of neurological soft signs and childhood traumas in OCD patients (n=40)

Model		B	SE	β	t	p
	BAI	0.073	0.060	0.185	1.216	0.232
3	Constant	-3.493	2.626		-1.330	0.192
	Age	0.234	0.095	0.364	2.452	**0.019**
	Physical neglect	0.485	0.296	0.249	1.638	0.110
	BAI	0.088	0.054	0.222	1.635	0.111
4	Constant	-3.112	2.674		-1.164	0.252
	Age	0.248	0.097	0.385	2.549	**0.015**
	Physical neglect	0.596	0.295	0.306	2.024	**0.050**

BDI: Beck Depression Inventory; BAI: Beck Anxiety Inventory; NES: Neurological Evaluation Scale.

the patients taking medication, SSRI was taken by 22, clomipramine alone by 1, SSRI and antipsychotic by 12, and SSRI and clomipramine by 1. The mean doses of the medications used were citalopram 40 mg/day (n=1), escitalopram 10 mg/day (n=1), fluvoxamine 100 mg/day (n=2), paroxetine 30 mg/day (n=1), clomipramine 37.5 mg/day (n=2), sertraline 88.8 mg/day (n=18), fluoxetine 29.1 mg/day (n=12), amisulpride 100 mg/day (n=1), risperidone 1 mg/day (n=8), aripiprazole 3.75 mg/day (n=2), and olanzapine 2.5/day (n=1).

The comparisons of the sociodemographic features, NES, CTQ-28, BDI, and BAI total scores between OCD patients and the healthy control group are presented in Table 1. The CTQ-28 total scores and the scores of the subscales (emotional and physical abuse, physical and emotional neglect), BDI, and BAI were found to be significantly higher in patients with OCD. The NES total score, subscales of sensory integration, complex motor sequences, and other NSSs were significantly higher in OCD patients.

In OCD patients, motor coordination was positively correlated with age, emotional abuse, emotional neglect, and depression level. Sensory integration was positively correlated with age, physical neglect, and anxiety level. Complex motor sequences were positively correlated with age and physical neglect. Other NSSs were positively correlated with physical neglect, anxiety, and depression levels. The NES total score was positively correlated with age, emotional abuse, physical neglect, emotional neglect, and anxiety level. There was no significant correlation between primitive reflexes and childhood trauma, depression, and anxiety levels in OCD patients.

In the healthy control group, motor coordination and sensory integration were positively correlated with age, anxiety, and depression level. Complex motor sequences were positively correlated with emotional abuse, anxiety, and depression levels. Primitive reflexes were only negatively correlated with physical neglect. Other NSSs were positively correlated with age, emotional abuse, anxiety, and depression levels. The NES total score was positively correlated with age, emotional abuse, anxiety, and depression level. The correlations detected between age, NES, CTQ-28 subscales, BDI, and BAI scores in both the OCD group and the healthy control group are shown in Table 2.

In OCD patients, there was a significant positive correlation between Y-BOCS and depression (r=0.802, p<0.001) and anxiety scores (r=0.736, p<0.001). There was no correlation between Y-BOCS and NES subscales. A moderate correlation was found between Y-BOCS and emotional abuse (r=0.432, p=0.005) and emotional neglect (r=0.391, p=0.013). When partial correlation analyses were performed to assess the relationship between Y-BOCS and childhood trauma independently of depression and anxiety, no correlation was found between Y-BOCS and emotional neglect, and emotional abuse. In addition, age of onset in OCD patients was positively correlated with motor coordination (r=0.360, p=0.022), sensory integration (r=0.446, p=0.004), complex motor sequences (r=0.408, p=0.009), primitive reflexes (r=0.360, p=0.023), and NES total score (r=0.434, p=0.005).

Multiple linear regression analyses (stepwise backward) were used to determine the relationship between childhood trauma and NSSs in both groups. The variables found to be associated with NSSs in the previously applied correlation analysis were taken as predictors in these linear regression analyses. In the OCD group, age and emotional abuse were determined as variables predicting motor coordination, and age and physical neglect predicted both sensory integration and complex motor sequences (Table 3). In the healthy control group, age and emotional abuse were determined as variables predicting other NSSs, and physical neglect was determined as the only variable predicting primitive reflexes (Table 4).

Table 4: Linear regression analysis of neurological soft signs and childhood trauma in the healthy control group (n=40)

Model		B	SE	β	t	p
Dependent variable: NES complex motor sequences. Predictors: BDI, BAI, emotional abuse. Adjusted R^2 for model 1=0.398, for model 2=0.408, for model 3=0.420						
1	Constant	0.445	0.614		0.725	0.473
	BDI	0.135	0.041	0.646	3.339	**0.002**
	BAI	-0.029	0.046	0.131	0.622	0.538
	Emotional abuse	-0.098	0.132	-0.133	-0.741	0.463
2	Constant	0.296	0.561		0.528	0.601
	BDI	0.149	0.034	0.713	4.456	<**0.001**
	Emotional abuse	-0.061	0.117	-0.084	-0.524	0.604
3	Constant	0.018	0.180		0.100	0.921
	BDI	0.138	0.026	0.659	5.404	<**0.001**
Dependent variable: NES others. Predictors: age, BAI, BDI, emotional abuse. Adjusted R^2 for model 1=0.515, for model 2=0.528, for model 3=0.529						
1	Constant	-3.736	1.066		-3.504	**0.001**
	BDI	0.011	0.050	0.039	0.222	0.826
	BAI	0.039	0.060	0.130	0.654	0.518
	Age	0.059	0.018	0.395	3.305	**0.002**
	Emotional abuse	0.556	0.170	0.554	3.277	**0.002**
2	Constant	-3.735	1.052		-3.550	**0.001**
	BAI	0.046	0.049	0.155	0.947	0.350
	age	0.059	0.018	0.392	3.346	**0.002**
	Emotional abuse	0.563	0.164	0.561	3.423	**0.002**
3	Constant	-4.316	0.854		-5.057	<**0.001**
	Age	0.064	0.017	0.426	3.838	<**0.001**
	Emotional abuse	0.677	0.111	0.675	6.079	<**0.001**
Dependent variable: NES total. Predictors: age, BAI, BDI, emotional abuse. Adjusted R^2 for model 1=0.627. for model 2=0.631, for model 3=0.622						
1	Constant	-5.047	2.459		-2.052	**0.048**
	BDI	0.328	0.116	0.435	2.833	**0.008**
	BAI	0.106	0.138	0.134	0.766	0.449
	Age	0.210	0.041	0.532	5.075	<**0.001**
	Emotional abuse	0.316	0.391	0.120	0.809	0.424
2	Constant	-5.967	2.135		-2.795	**0.008**
	BDI	0.377	0.096	0.500	3.943	<**0.001**
	Age	0.220	0.039	0.557	5.646	<**0.001**
	Emotional abuse	0.465	0.338	0.176	1.377	0.177
3	Constant	-3.591	1.272		-2.823	**0.008**
	BDI	0.462	0.074	0.612	6.212	<**0.001**
	Age	0.211	0.039	0.535	5.428	<**0.001**
Dependent variable: NES primitive reflexes. Predictor: physical neglect. Adjusted R^2 for model 1=0.136						
1	Constant	2.625	0.662		3.966	<**0.001**
	Physical neglect	-0.324	0.121	-0.397	-2.668	**0.011**

BDI: Beck Depression Inventory; BAI: Beck Anxiety Inventory; NES: Neurological Evaluation Scale.

DISCUSSION

The results of this study demonstrated that physical neglect and emotional abuse in childhood were associated with NSSs in both OCD patients and healthy controls. While physical neglect was associated with sensory integration and complex motor sequences in OCD patients, it was associated with primitive reflexes in healthy controls. In addition, while emotional abuse was associated with motor coordination in OCD patients, it was associated with other NSSs in healthy controls.

In this study, it was seen that the childhood traumas affecting NSSs in OCD patients and healthy controls are similar (physical neglect and emotional abuse), but these traumas are associated with different NSSs in healthy individuals and OCD patients. Despite exposure to childhood trauma, the presence of social and biological protective factors can lead to differences in neurobiological changes (36). Moreover, the neurobiological effects of childhood trauma vary according to the developmental stage of the brain when exposed to trauma and the chronicity of the trauma (37–39). Therefore, the NSSs related to childhood trauma may show differences in both healthy individuals and OCD patients. The underlying mechanisms for these associations are not clearly defined, and it does not necessarily suggest a causal link. However, reverse causation is unlikely in this association. While the results of this study do not pinpoint underlying mechanisms for these associations, they suggest that childhood traumas are related to NSSs and neurodevelopment in OCD patients.

Previous studies have suggested that childhood maltreatment permanently impairs the structure and function of the brain during neural development (27,40,41). Early-life stress can lead to neuronal atrophy in the medial prefrontal cortex (mPFC), the dorsomedial striatum, and changes in the amygdala (42,43), the hippocampus, and the dorsolateral striatum (44). Exposure to childhood trauma is also associated with gray matter loss throughout the corticostriatal-limbic circuitry and in the mPFC (45,46). These brain structures, which are claimed to be affected by childhood traumas, overlap with structures that also play a role in the neurobiology of OCD (4). Therefore, all these findings suggest that the negative effects of childhood trauma on neurodevelopment may prevent the later elimination with the age of NSSs seen in childhood in OCD patients. There is a need for longitudinal studies assessing childhood traumas and NSSs to contribute to further explanation of the neurodevelopmental mechanisms in OCD.

Earlier studies in the literature have emphasized that NSSs may be an endophenotype associated with genetic transmission in schizophrenia (47). In contrast, the current study presents important findings that NSSs seen in OCD patients may also be acquired. Moreover, Zhao et al. (22) reported similar findings in depressive patients according to the assessment of brain area-related NSS. In that study, it was reported that there may be specific relationships between some childhood traumas and NSSs, as patients experiencing childhood emotional or physical neglect were found to display more frontal area-related NSSs compared with the respective non-maltreatment group. It was also observed that physical neglect caused more temporal area-related NSSs. When the findings of Zhao et al. (22) and the current study are evaluated together, it can be thought that NSSs may be associated with childhood traumas in other psychiatric disorders such as bipolar disorder and schizophrenia. One of the effects of childhood traumas on some psychopathologies may be a neurodevelopmental mechanism that increases NSSs. Genetic factors and environmental factors including maternal factors, toxins, infections, and oxidative stress have been defined to be associated with NSSs; however, childhood traumas have been ignored in this regard (15). This study is important because it showed the possible relationship between NSSs and childhood traumas in OCD patients. In studies examining NSSs in other psychiatric disorders, the effect of childhood traumas on NSSs should be considered.

Age is also a demographic variable associated with NSSs. In this study, NSSs that positively correlated with age in both healthy and OCD groups were motor coordination, sensory integration, and NES total scores. Bachmann et al. (48) found that worsening motor function and sensory integration yielded the most important share of overall NSS increase between the ages of 50 and 60 years. Also, there is evidence that NSSs reduce toward late childhood and adolescence, and thus persistence of NSSs into later childhood can be a marker for atypical neurological function. However, there is not enough evidence to support a direct link between neurodevelopmental disorders and specific NSSs (49).

This study had several limitations, primarily the cross-sectional design, so the results do not allow for propositions regarding the causal mechanisms of the relationships. The evaluation of childhood trauma using a self-report survey might also be considered a limitation, although, for obvious reasons, measures other than self-report are rarely administered in studies focusing on childhood trauma. A limitation of the CTQ-28 is that retrospective recall is prone to simple forgetting or recall bias depending on the individual's current mental health. Another limitation of this study was that OCD patients were using medication, which may have affected NSSs and symptom severity. Finally, another limitation of this study was not to evaluate the insight of OCD patients. OCD with poor insight patients may have more NSSs than with good insight (12).

Early-life trauma has the potential to disrupt neurodevelopmental processes both in OCD patients and healthy individuals, and this effect can also be evaluated with NSSs, which is a clinically easy and cheap assessment method. There is a need for prospective studies investigating the relationship between childhood traumas and NSSs in other psychiatric disorders in which neurodevelopmental mechanisms are thought to play a role.

Contribution Categories		Author Initials
Category 1	Concept/Design	B.Y., H.Y.
	Literature review	B.Y., H.Y., S.T.
	Data analysis/Interpretation	B.Y., S.T.
Category 2	Drafting manuscript	B.Y., H.Y., S.T.
	Critical revision of manuscript	B.Y., H.Y., S.T., A.U.
Category 3	Final approval and accountability	B.Y., S.T.
Other	Technical or material support	B.Y., H.Y.
	Supervision	S.T., A.U.

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