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Evaluation of Optical Coherence Tomography Findings in Antisocial Personality Disorder Patients

ABSTRACT

Background: Antisocial personality disorder is a frequently studied personality disorder, and its etiopathogenesis is still investigated. Neuroimaging demonstrated that certain regions of the brain could be associated with this disorder, and in the present study, we aimed to investigate the changes in retina, which could be considered an extension of the brain in antisocial personality disorder patients with optical coherence tomography.

Methods: The study was conducted with 35 patients and 35 healthy controls. The study data were collected with the Sociodemographic and Clinical Data Form, Beck Anxiety Inventory, Beck Depression Inventory, and Barratt Impulsivity Scale—Short Form. Retinal nerve fiber layer thickness, choroidal thickness, and macular thickness were analyzed based on optical coherence tomography.

Results: The Beck Depression Inventory ($P = .044$), Beck Anxiety Inventory ($P = .005$), Barratt Impulsivity Scale—motor ($P < .001$), Barratt Impulsivity Scale—non-planning dimension ($P < .001$), and Barratt Impulsivity Scale—total scores ($P < .001$) of the patients were significantly higher when compared to the controls. The superior ($P = .013$) and inferior retinal nerve fiber layer thickness ($P < .001$) of the patients were significantly lower when compared to the control group.

Conclusion: Retinal nerve fiber layer thickness was significantly lower in the patient group when compared to healthy controls, which suggested that it could be associated with the pathophysiology of antisocial personality disorder.

Keywords: Antisocial personality disorder, OCT, retina, RNFL, choroid, macula

Introduction

Antisocial personality disorder (ASPD) is a difficult-to-treat chronic disorder, characterized by behavioral deterioration without the deterioration of cognitive skills, leading to interpersonal relationship difficulties and social anxiety.[1] Its prevalence is between 1% and 4%, and it is observed 3-5 times more among men when compared to women.[2,3] It is known that substance abuse is common in ASPD when compared to other personality disorders, and these individuals are more susceptible to criminal behavior, posing a greater danger to society.[4,5] Although aging leads to improvement and significant reduction in dangerous behavior, educational and employment losses or their hope are never recovered.[6] Due to these losses, early detection of ASPD is important. Although the etiology of ASPD is not completely known, the role of genetic and environmental factors in its etiology is evidenced.[7] Several studies employed imaging techniques to elucidate its etiology and to identify neurodegenerative changes. In a magnetic resonance imaging (MRI) study conducted on ASPD, thinning of the medial sections of the bilateral postcentral gyrus, bilateral precentral gyrus, and superior parietal cortex was identified.[8] In another MRI study conducted with prisoners incarcerated due to violent crimes and diagnosed with ASPD, gray matter volume was lower in the bilateral anterior rostral prefrontal cortex and the bilateral temporal poles.[9] Functional MRI demonstrated significantly increased activation in the orbitofrontal cortex, dorsolateral prefrontal cortex, brain sac, and cerebellum in ASPD.[10]

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The retina is accepted as an extension of the central nervous system since it develops from the same embryonic origin as the brain during early development and it consists of synapsing neural layers.[11] Thus, it allows the visualization of cerebral pathologies and access to early cerebral data.[12] Studies reported that retina provides clues for the detection of neurodegeneration before any brain dysfunction.[13] In recent years, optical coherence tomography (OCT) has been commonly employed as a non-invasive retinal imaging technique that allows detailed analysis of the retina and its layers and measurement of their thickness.[14] Optical coherence tomography allows the measurement of retinal nerve fiber layer thickness, macular volume, macular thickness, and choroid layer, rich in blood vessels.[15] The correlation between retinal neuron loss and neurodegeneration is known, and retinal ganglion cell loss was determined with OCT imaging in Alzheimer's and Parkinson's diseases and multiple sclerosis.[16-18] Optical coherence tomography studies on psychiatric diseases reported the thinning of the retinal layers, especially in schizophrenia.[19] Optical coherence tomography was also used in conversion disorder and obsessive compulsive disorder, and significant findings were detected.[20,21] Retinal nerve fiber layer thickness (RNFL) and ganglion cell complex were found to be lower in patients who attempted suicide in bipolar disorder, and it was suggested that it may be due to neurodegeneration.[22] The studies on ASPD, which was considered to play a role in neurodegeneration, conducted with functional and structural imaging methods, demonstrated that psychopathic traits could be associated with paralimbic and limbic cortex structures.[23,24] Also, in an MRI study, a decrease in amygdala and hippocampus volumes was reported in ASPD.[25]

Although ASPD is among the most studied personality disorders, it is also one of the most resistant disorders to treatment. It could be suggested that the failure to break this resistance has been due to the unacceptance of ASPD as a neurodevelopmental disorder, preventing early intervention. In the present study, the employment of OCT in ASPD patients could help elucidate the etiopathogenesis of the disease and could be used as an early biomarker. At the same time, OCT can be used as a new method in ASPD patients for degeneration follow-up or for observing the progression of the disease.

Material and Methods

The research was approved by Fırat University, Faculty of Medicine ethics committee (Date: November 4, 2021; Number: 2021/11-16). The study was in compliance with Declaration of Helsinki, 1983 revision principles. The study was conducted on outpatients admitted to Elazığ Fethi Sekin City Hospital, Mental Health and Diseases and Ophthalmology outpatient clinic between March and September 2022. The study was conducted with 35 consecutive patients who presented to the Elazığ Fethi Sekin City Hospital, Mental Health and Diseases Clinic, were diagnosed with ASPD based on DSM-5 (Diagnostic and Statistical Manual of Mental Disorders, 5th edition), and met the study criteria. Thirty-five volunteers who applied for eye checkups without mental illness based on DSM-5 were included.

Power analysis revealed that the study should be conducted with 56 subjects, including at least 28 patients and 28 controls, within the CI of 95%.[20]

Structured interviews were conducted with the participants by the psychiatrist that lasted about 30 minutes. Sociodemographic forms, Beck Anxiety Inventory (BAI), Beck Depression Inventory (BDI), and Barratt Impulsivity Scale—-Short Form (BIS-11) were completed by all participants, and informed consent form was signed by the participants. After full eye examination, all participants were scanned with OCT. Six patients and 3 control group members were excluded from the study due to poor image quality. Patients, who were between 18 and 50 years old, diagnosed with ASPD, and without a known metabolic disease, a physical pathology, or a neurological disease, who were not prescribed with additional medication, and who had not received psychiatric treatment for the last 6 months were included in the study. Thirty-five healthy individuals in the same age group and without systemic or ocular disease were included. Retinal nerve fiber layer thickness, choroidal thickness, and macular thickness were measured with OCT in both groups.

Data Collection Instruments

Sociodemographic Data Form. The form included questions on participant demographics, i.e., gender, marital status, education level, psychosocial stress factors, psychiatric diagnosis, and psychiatric disorder history such as depressive disorder and anxiety disorder, which are common in ASPD.

Beck Depression Inventory. This scale was developed to determine depression symptoms.[26] It is a Likert-type scale, the validity and reliability of which was determined in Turkish language.[27] In our study, the Cronbach's alpha for BDI was 0.82.

Beck Anxiety Inventory (BAI). This scale was developed to determine anxiety symptoms.[28] Its validity and reliability were determined in Turkish language.[29] In our study, Cronbach's alpha for BAI was 0.83.

Barratt Impulsivity Scale—Short Form. The scale was developed by Patton and Barratt to measure impulsivity. It is a scale that includes 30 items, scored between 1 and 4 in 3 sub-dimensions: planning, attention, and motor. A high sub-dimension score indicates a high relevant trait score. The scale has no cutoff score. A high overall scale score indicates high level of impulsivity.[30] The validity and reliability of the scale in Turkish language was determined by Güleç et al,[31] and in our study, the Cronbach's alpha for BIS-11 was 0.88.

Optical Coherence Tomography Scan and Analysis

Choroidal thickness was measured with OCT (Canon OCT-HS 100). The device has a scanning speed of 70 000 A-scan/s, 3 mm axial resolution, and 2 mm scanning depth. Device's choroid mode provides high-quality images, and this mode was employed during the measurements. Choroidal thickness was based on the vertical distance between the outer hyperreflective border that corresponds to the retinal pigment epithelium and the inner sclera surface (Figure 1). The circumpapillary RNFL thickness in 4 quadrants (temporal, nasal,

MAIN POINTS

- *It was observed that antisocial personality disorder patients exhibited severe anxiety and moderate depression symptoms.*
- *The total Barratt Impulsivity Scale—Short Form and motor nonplanning dimension scores were higher in the antisocial personality disorder group when compared to the control group.*
- *Retinal nerve fiber layer thickness was significantly lower in the patient group when compared to the control.*

Figure 1. Choroidal thickness measurements from the fovea.

superior, and inferior) and macular thickness were measured for all patients and controls. All measurements were conducted by an experienced blind.

The analyses were conducted at 12:00 PM to avoid variations. Although both eyes were examined, the right eye results were included.

Statistical Analysis

Statistical analyses were conducted on the Statistical Package for the Social Sciences (SPSS) version 22.0 software (IBM SPSS Corp.; Armonk, NY USA). Categorical descriptive data are presented in frequencies and percentages, and continuous data are presented as mean (SD). The categorical variables were compared between the groups with the Pearson chi-square analysis. The Fisher–Freeman–Halton test was applied on 3 × 2 tables. Normal distribution of the continuous data was analyzed with the Shapiro–Wilk test. The Student's *t*-test was used for comparison of the variables between 2 groups. The Pearson correlation test was employed to determine the correlations between continuous variables. The statistical significance was accepted as $P < .05$.

Results

Thirty-five patients and 35 controls were included in the study. The mean patient age was 24.7 ± 5.1 and the mean control group age was 24.3 ± 4.5, and there was no significant difference between the groups based on age ($P = .690$).

The rate of psychiatric disorder history was significantly higher in the patient group (71.4%) when compared to the control group (8.6%) ($P < .001$). The rate of smokers was significantly higher in the patient group (65.7%) when compared to the control group (28.6%) ($P < .001$). Alcohol/substance abuse was significantly higher in the patient group (71.4%) when compared to the control group (0%) ($P < .001$) (Table 1).

The BDI ($P = .044$), BAI ($P = .005$), BIS-11—motor ($P < .001$), BIS-11—non-planning ($P < .001$), and BIS-11—total scores ($P < .001$) of the patients were significantly higher when compared to the control group (Table 2).

The superior RNFL ($P = .013$) and inferior RNFL ($P < .001$) were significantly lower in the patient group when compared to the control group (Table 3).

A positive and significant correlation was observed between patient BDI and BAI scores ($r = 0.765$; $P < .001$). There was a positive and significant correlation between BIS-11—motor sub-dimension ($r = 0.541$; $P = .001$), BIS-11—total score and macular thickness ($r = 0.424$; $P = .011$). A positive and significant correlation was observed between the BIS-11—inattention sub-dimension and the BIS-11—total scores

Table 1. Comparison of Participant Demographics

		Patient (n = 35)		Control (n = 35)		
		n	%	n	%	*P*
Age, mean ± SD		24.7 ± 5.1		24.3 ± 4.5		.690**
Marital status	Unmarried	22	62.9	23	65.7	.803**
	Married	13	37.1	12	34.3	
Education	Primary or lower	26	74.3	26	74.3	1.000**
	Secondary or higher	9	25.7	9	25.7	
Residence	Township	13	37.1	18	51.4	.229**
	Urban	22	62.9	17	48.6	
Income	Low	20	57.1	16	45.7	.686***
	Medium	12	34.3	15	42.9	
	High	3	8.6	4	11.4	
Psychiatric disorder history	Yes	25	71.4	3	8.6	<.001**
	No	10	28.6	32	91.4	
Smoking	Yes	23	65.7	10	28.6	.002**
	No	12	34.3	25	71.4	
Alcohol/substance abuse	Yes	25	71.4	0	.0	<.001**
	No	10	28.6	35	100.0	

**Student's *t*-test.
***Fisher–Freeman–Halton test was performed.

Table 2. Comparison of Group Scale Scores

	Patient (n = 35)	Control (n = 35)	
	Mean ± SD	Mean ± SD	P*
BDI	7.3 ± 4.4	5.2 ± 4.1	.044
BAI	8.5 ± 5.4	5.3 ± 3.3	.005
BIS-11—motor	20.1 ± 2.9	16.1 ± 3.0	<.001
BIS-11—inattention	21.3 ± 3.2	22.4 ± 3.0	.146
BIS-11—non-planning	22.7 ± 3.0	19.1 ± 2.5	<.001
BIS-11—total	64.2 ± 6.3	55.1 ± 7.6	<.001

*Student's *t*-test was performed.
BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; BIS-11, Barratt Impulsivity Scale.

Table 3. Comparison of Group OCT findings

	Patient (n = 35)	Control (n = 35)	
	Mean ± SD	Mean ± SD	P*
RNFL superior	118.6 ± 15.9	128.3 ± 16.1	.013
RNFL inferior	121.4 ± 22.9	141.6 ± 17.5	<.001
RNFL temporal	72.4 ± 10.5	74.4 ± 8.0	.374
RNFL nasal	81.5 ± 12.5	85.4 ± 14.7	.240
Choroidal thickness	496.4 ± 69.9	482.3 ± 72.4	.410
Macular thickness	260.5 ± 15.2	267.4 ± 33.8	.277

*Student's *t*-test was performed.
OCT, optical coherence tomography; RNFL, retinal nerve fiber level thickness.

($r = 0.732$; $P < .001$). There was a positive and significant correlation between the BIS-11—non-planning sub-dimension and the BIS-11—total scores ($r = 0.704$; $P < .001$). A significant positive correlation was determined between superior RNFL and nasal RNFL ($r = 0.414$; $P = .013$). A significant positive correlation was identified between inferior RNFL and nasal RNFL ($r = 0.355$; $P = .036$) (Table 4).

Discussion

Antisocial personality disorder patients demonstrated high levels of depression and anxiety as shown in previous studies.[32] As expected, patients' anxiety and depression levels were found to be high in our study.

The most significant finding of the present study was lower superior and inferior RNFL values, which are associated with degenerative cranial processes in ASPD patients when compared to healthy controls. One of the most important variables that affect RNFL thickness is age. Studies reported that every decade causes a 1-2 µm decrease in RNFL thickness.[33] Young and similar mean age in the control and patient groups in our study is a factor that strengthens the causal analysis of the determined difference. Studies reported that the decrease in RNFL thickness was strongly associated with cranial atrophy. In psychiatry, the first OCT studies were conducted on schizophrenia patients. Decreases in RNFL thickness and macular volume were reported in schizophrenia patients.[34,35] Another study in schizophrenia found a negative correlation between RNFL and disease duration. The relationship between the Positive and Negative Syndrome Scale scores and RNFL was examined, and it was reported that there was no relationship between disease symptoms and RNFL.[36] Results are similar in bipolar disorder. The decrease in RNFL thickness in bipolar disorder is associated with the duration of the disease,[37] and it has been reported that neuronal degeneration first begins in the ganglion cell layer (GCL), and inner plexiform layer (IPL) and RNFL are also affected as the disease progresses.[38] However, in some studies, no difference was found in terms of RNFL thickness between patients and healthy control groups in OCD and major depressive disorder. These studies showed significant differences between the regions with OCT.[39,40] In a study of depressive disorder, it was found that the duration of the last episode was correlated with the inner IPL and nasal RNFL thickness.[39] In the study conducted on OCD patients, no significant change was detected in the RNFL, and a decrease in IPL and GCL thicknesses was observed which was associated with neuronal loss.[20] Karadag et al[21] reported that GCL and IPL layers were thinned due to neurodegeneration in patients with conversion disorder compared to controls, and there was no change in RNFL and there would be a change in RNFL after 50% of ganglion cells were damaged.

Optical coherence tomography findings, an important predictor of degeneration in ASPD, are reported for the first time in the current study. This finding was important since it demonstrated that degeneration played a role in the etiopathogenesis of the disease in ASPD patients similar to other psychiatric disorders. Furthermore, these individuals could abuse substances due to the nature of the disease. About 71.4% of our patient abused alcohol/substances, preventing the exclusion of this group. Contrary to our findings, in the literature, RNFL measurements of the patient with cannabis use disorder and multiple substance use disorder were found to be more than the healthy controls. This finding is explained by the neuroprotective effect of cannabis [41,42]. Further comprehensive studies are required for concrete causal analysis of the role of degenerative processes in ASPD.

A significant limitation of the study was the limited number of cases and the cross-sectional design. A strength of the study was that our patient group was in an age group that is not affected by age-related OCT findings. However, we do not have enough data on some variables that may affect the OCT findings such as psychiatric, neurological, and systemic diseases, previous head trauma, glaucoma, and retinal diseases that may cause degeneration findings on OCT in patients. The lack of evaluation of ophthalmologic pathologies such as refractive errors and refractive errors is one of the important limitations of our study. Although people with these variables were excluded from the study, this was done according to the statement of the person at the time of inclusion in the study. In addition, the high rate of previous psychiatric disease in the patients included in the study is one of the limitations of the study in terms of increasing the possibility of previous psychiatric disease burden causing possible OCT abnormalities. Longitudinal studies with larger patient groups will yield stronger results in the examination of structural changes in the retina in ASPD.

In the present study, conducted with OCT in ASPD patients, the RNFL was significantly lower in the patient group when compared to the controls. It could be suggested that the employment of the noninvasive OCT method could facilitate early detection and intervention of neurodegeneration. However, further studies with larger groups are required to support our findings.

Ethics Committee Approval: *The research was approved by Fırat University, Faculty of Medicine ethics committee (Date: November 4, 2021; Number: 2021/11-16).*

Table 4. Correlation Between Patient Scale Scores and OCT Findings

		BDI	1	2	3	4	5	6	7	8	9	10
BAI (1)	*r*	0.765										
	P	.000										
BIS-11—motor (2)	*r*	–0.144	0.042									
	P	.408	.810									
BIS-11—inattention (3)	*r*	–0.090	–0.097	0.242								
	P	.606	.581	.161								
BIS-11—non-planning (4)	*r*	–0.281	–0.312	0.213	0.224							
	P	.102	.068	.219	.196							
BIS-11—total (5)	*r*	–0.211	–0.173	0.541	0.732	0.704						
	P	.224	.322	.001	.000	.000						
RNFL superior (6)	*r*	–0.151	–0.200	0.015	–0.121	0.304	0.170					
	P	.385	.250	.930	.490	.076	.330					
RNFL inferior (7)	*r*	–0.194	–0.223	0.011	–0.047	–0.025	0.015	0.290				
	P	.265	.197	.952	.789	.885	.933	.091				
RNFL temporal (8)	*r*	0.070	0.046	–0.028	–0.291	–0.094	–0.171	0.179	0.283			
	P	.690	.792	.874	.090	.591	.326	.305	.100			
RNFL nasal (9)	*r*	–0.049	0.060	0.072	0.224	0.130	0.281	0.414	0.355	0.144		
	P	.779	.731	.679	.195	.457	.102	.013	.036	.408		
Choroidal thickness (10)	*r*	–0.135	–0.019	–0.069	0.226	0.274	0.296	0.315	0.265	0.040	0.148	
	P	.438	.916	.696	.192	.111	.084	.066	.123	.820	.396	
Macular thickness (11)	*r*	–0.071	–0.008	0.424	0.172	0.088	0.272	–0.097	–0.109	–0.023	0.270	–0.292
	P	.687	.966	.011	.323	.616	.114	.578	.534	.893	.117	.089

BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; BIS-11, Barratt Impulsivity Scale; OCT, optical coherence tomography; RNFL, retinal nerve fiber level thickness.

Informed Consent: *Written informed consent was obtained from all participants.*

Peer-review: *Externally peer-reviewed.*

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