The Place of Optical Coherence Tomography in Patients with Obsessive Compulsive Disorder

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ABSTRACT

Objective: Optical coherence tomography (OCT) is an increasingly used new method that investigates changes in the retinal nerve fiber layer (RNFL) in neurodegenerative diseases. It provides high-resolution cross-sectional imaging of biological tissues. This study aimed to investigate the structural changes in RNFL in patients with obsessive compulsive disorder (OCD) using OCT and to investigate the possible effects of retinal function on the etiopathogenesis of OCD.

Materials and Methods: In this study, 30 patients diagnosed with OCD at the end of the Structured Clinical Interview for DSM (SCID-I), without any drug use status, and 31 healthy participants paired with the patients in terms of their sociodemographic characteristics were included. In the patient and control groups, the RNFL thickness was measured and compared at each locus using OCT.

Results: Statistically significant differences were found in RNFL, ganglion cell layer thickness, and central foveal thickness between the patients with OCD and the control group. In this study, the choroidal thickness values of the patient group were found to be higher than those of the control group; and a statistically significant difference was observed in the mean choroidal thickness values (p=0.045).

Conclusion: The findings of the study suggest that the RNFL thickness of patients with OCD does not decrease, but choroidal thickness may be an important biomarker to determine the etiopathogenesis of the disease and follow neurodegeneration.

Keywords: Obsessive compulsive disorder, tomography, optic coherence

Introduction

Obsessive compulsive disorder (OCD) is a psychiatric disorder that has a place in daily life. It disrupts functionality and affects occupational and social skills. It can be defined as a pattern of troubling, repetitive, and involuntary actions or thoughts. A mental disorder, OCD is characterized with obsessions and/or compulsions. An obsession is repetitive, disruptive thoughts, impulses, or images, involuntarily within subconscious, that one is aware are meaningless or wrong. Compulsion is motor or mental actions carried out based on certain rules that a person can feel obliged to do to prevent an obsession or to relieve from his or her troubled mindset [1]. The anxiety caused by thoughts results in the counterattack of practicing certain habits (compulsions) against the troublesome obsession. This attack provides a temporary sense of relief; however, it can take away hours from the person's lifecycle as it becomes a ritual. It negatively affects peoples' professional skills, social activities, and domestic relationships. As this becomes more common, the developments in biological medicine and genetics direct researchers' attention to questioning causality more comprehensively and considering different areas. Although no noteworthy or comprehensive results have been announced from the previous research on the relationship between OCD and genetics, it would be out of the question to claim no relationship between the aforementioned concepts. Another prominent method in the light of recent developments is to investigate the relationship between any deformation and psychiatric disorders using imaging techniques [2-4]. Several structural and functional imaging studies have shown that OCD is associated with abnormalities of neuroanatomical structures in cortical-striatal-thalamic-cortical circuits [5]. A study showed that orbitofrontal-limbic-basal ganglion dysfunction was present in OCD with neuroimaging methods [6]. In another study, which was thought to be biologic factors,

neuropsychological tests supported frontal lobe dysfunction [7, 8]. Parkinson's disease, function of frontobasal ganglia cycle neurodegenerative disease. The same cycle of OCD also important in pathophysiology [9].

Studies on ophthalmological findings in psychiatric disorders date back to a long time ago [2-4]. Considered an extension of the brain, retina is believed to be a critical part to monitor possible degenerations as a part of the central nervous system [8]. It was suggested that changes can be observed in retina in cases like schizophrenia where there is a progressive brain tissue loss [10-13]. The connection to eye movements in studies investigating anxiety and accompanying cognitive changes was analyzed, reaching the studies that were carried out with most patients with OCD [14, 15]. Recently, the more salient studies are considered the ones that analyze the changes in the neural networks in retina in the cases of neurodegenerative diseases using OCT, which is a new method in high-resolution cross-sectional imaging of biological tissues [16-19]. There are a limited number of studies on patients diagnosed using OCT as having a psychological disorder, a large part of which involve patients with schizophrenia, bipolar disorder, or major depressive disorder [20-22]. Although a number of studies investigate neurodegenerative disorders in patients with OCD in the literature [23-25], only one study analyzed the neural networks in retina using OCT [26].

This study aimed to discover the structural changes in the retinal nerve fiber layer (RNFL) using OCT in patients diagnosed with OCD, and to investigate the possible effects of the retinal function in the etiopathogenesis of OCD.

Materials and Methods

Patients

Among patients admitted to the psychiatry outpatient clinic in Recep Tayyip Erdogan University Training and Research Hospital between April and November 2016 for psychiatric examination consecutively, 30 patients diagnosed as having OCD as their primary diagnosis with symptoms appearing more than at least a year ago, without any drug use status, aged between 18 and 65 years; and 31 control cases aged between 18 and 65 years with no diagnosed psychiatric disorder who were admitted to the ophthalmic outpatient department for examination were included in the study. The exclusion criteria were having previous psychiatric diagnosis and therapy history, mental retardation, and being illiterate. Both groups received the Structured Clinical Interview for DSM-IV Axis-I Disorder (SCID-I) [27, 28] and went thorough ophthalmological examinations before completing their "Informed" form. During the research, the patients were given the sociodemographic information form and Yale-Brown Obsessive Compulsive Scale (Y-BOCS).

The ethics committee approval for the study was given by the Recep Tayyip Erdogan University School of Medicine Ethics Committee on 17/03/2017 with the decision number 39. Written informed consent was obtained from patients and controls who participated in this study.

Structured Clinical Interview for DSM-IV Axis-I Disorder (SCID-I): Based on the DSM-IV system, it was first developed by First et al. [27] for the purpose of diagnosing, and was translated into Turkish by Özkürkçügil et al. [28] with its reliability tested and guidelines published.

Sociodemographic Information Form: The sociodemographic information form was prepared by the researcher to obtain data regarding age, sex, educational background, place of residence, occupation, age of onset, duration of disease, Yale points, parents' relationship, income per capita, number of siblings, medical and psychiatric history, and family history.

Yale-Brown Obsessive Compulsive Scale (Y-BOCS): It was developed by Goodman et al. [29] to measure the types and severity of obsessive compulsive symptoms. The interviewer performs it. It consists of 19 items; however, only the first 10 items (except item 1b and 6b) are used to calculate the total score. Each question has a score between 0 and 4. Furthermore, there is a Y-BOCS Symptom Checklist as well as the scale. Its adaptation into Turkish and the validity and reliability test were done by Karamustafalıoğlu et al. [30] and Tek et al. [31], respectively.

Optical Coherence Tomography Measurements

Measurements of peripapillary RNFL thickness and optic nerve head area were performed using Cirrus HD spectral-domain OCT. Two experienced operators carried out the measurements under mydriasis. After the pupilla was dilated, a 6×6 mm optical disk cube scan was obtained from the 200 A after every 200 B scan. The device automatically determined the center of the disk from this data cube and created a calculation circle around the disc with a diameter of 3.4 mm. The RNFL thickness was analyzed through this peripapillary circle and compared with normative data.

Statistical Analysis

Statistical Package for Social Sciences version 22.0 (IBM Corp.; Armonk, NY, USA) was used for statistical analysis. Whether there was a statistical difference in the RNFL thickness between the groups was evaluated with one-way ANOVA, and the level of significance was considered $p<0.05$ with chi-square test. The paired t-test was used to compare choroidal thickness at each location. Independent-samples t-test was used for the mean analyses.

Results

The mean age of the patient group was 28.2±9.9 years (range 18-62), whereas it was 29.5±10.1 years (range 18-63) for the control group. A total of 26% (8/30) of the patient group and 32% (10/31) of the control group were male. There was no significant difference between the groups in terms of age and sex ($p>0.05$).

Of the patient group, 2 (6.7%) were retired, 10 (33.3%) were housewives, 8 (26.7%) were students, 2 (6.7%) were self-employed, 5 (16.7%) were paid workers, and 3 (10%) did not work. Also, 17 (56.7%) were single, 1 (3.3%) was divorced, and 12 (40%) were married.

Of the patient group, 13 (43.3%) had psychiatric diseases in their history, and 17 (56.7%) had not. Psychiatric disease in family history was found in 15 (50%) cases, whereas 1 (3.3%) had bipolar, 7 (23.3%) had depression, and 7 (23.3%) had OCD in their family history. Of the patients, 18 (60%) had psychiatric disease in their family history, 12 (40%) did not. The percentages were 6 (20%) for OCD, 8 (26.7%) for depression, 1 (3.3%) for trichotillomania, 1 (3.3%) for social phobia, and 2 (6.7%) for behavioral disorder.

The mean score in Y-BOCS was 26.93±1.541 for the patient group. The mean age of onset for OCD was 19.37±0.866 years (range 7-29), and the mean duration of disease was 8.87±1.768 years (range 1-40). Supporting the literature, the most frequent of the types of obsession patients stated were transmission obsession, 25 (32.50%); symmetry and order obsession, 16 (22.10%); and religious obsessions, 15 (19.50%). The most common compulsions were discovered to be checking, 25 (31.60%); and washing/bathing, 21 (26.60%).

The mean values of choroidal thickness in the patient group were subfoveal 357.23±59.71 µ (259-501), temporal1 351.67±63.18 µ (250-501), temporal2 350.70±78.17 µ (218-566), Temporal3 351.87±72.35 µ (229-503), Nasal1 325.17±69.48 µ (193-473), Nasal2 275.60±69.07 µ (184-452), Nasal3 233.00±63.22 µ (103-358), the mean being 320.75±80.66 µ (103–566).

As for the control group, the values were subfoveal 332.03±59.71 μ (144-476), Temporal1 334.13±81.17 μ (141-487), Temporal2 336.06±90.70 μ (143-478), Temporal3 315.35±96.37 μ (120-473), Nasal1 311.42±76.16 μ (148-485), Nasal2 271.74±72.72 μ (126-416), Nasal3 224.32±69.51 μ (104-369), the mean being 302.97±87.92 μ (104-487) (Table 1).

Comparing the groups, a statistically significant difference was found in the mean choroidal thickness values of the patient group (p=0.045). Comparing the groups in terms of retinal nerve fiber thickness, the patient group had a mean value of 94.63±8.14 μ (79-110) whereas this was 95.81±8.53 μ (74-109) for the control group (p>0.05). The mean ganglion cell layer thickness was 83.43±11.23 μ (34-109) in the patient group and 83.68±5.75 μ (67-92) in the control group (p>0.05). The mean central foveal thickness values were 247.27±19.95 μ (207-278) in the patient group and 247.19±16.32 μ (207-274) in the control group (Table 2).

There was a negative relationship (-0.202) between duration of disease and choroidal thickness, and a positive relationship between retina nerve fiber thickness and ganglion cell layer thickness; however, this finding was not statistically significant (p>0.05).

Discussion

Recently, there have been critical improvements in studies that aim to explain the etiopathogenesis of psychiatric diseases. The number of studies that use neuroimaging methods have increased. There have been more studies in the last years on the changes in the neural networks in retina as they began using OCT as the diagnostic procedure [15-19, 32-35]. Because retina and brain tissue develop from ectoderm neurodevelopmentally and have the same biological origin, and as an outward part of the central nervous system, retina is considered an important area in investigating neurodegeneration [36]. Therefore, a change that could happen in the structure or function of the brain could be reflected onto the retina. The limited number of studies on patients diagnosed as having schizophrenia, bipolar disorder, and major depression using OCT so far have analyzed the changes in the neural networks in retina and obtained inconsistent results [16-19, 36, 37]. The changes in the neural networks in retina in anxiety disorders are within the field of psychological disorder that should be investigated using OCT. This is because neuropsychological and neuroimaging studies show that performance of frontal lobe functions, visuospatial functions, eye movements, and mnemonic functions in patients with OCD worsen, although the results in these studies are not particularly harmonious [38-40]. Studies investigating neurodegeneration in patients with OCD claim that it is possible to observe neuronal dysfunction and a possible accompanying retinal neural network defect [40-42]. The first study to analyze the retinal neural network to see a possible neurodegeneration in patients with OCD using OCT was by Ozen et al. [26]. Their study compared 50 patients with OCD and 42 healthy control cases using OCT. They reported that compared with the control group, the patient group had thinning in RNFL albeit statistically insignificant, distinct decrease in ganglion cell layer and central foveal thickness levels, and significant thickening in choroidal layer [26]. One of the first studies in this field, our study had similar results to that of Ozen et al. [26]. Furthermore, dissimilarly, our study had no statistically significant difference between the groups in terms of ganglion cell layer thickness and central foveal thickness. It is worth noticing that both studies have found thinning in RNFL and thickening in choroidal layer in the patients with OCD. RNFL shows similarity to the substantia grisea in the brain, and the changes in its thickness are only based on the axon damage: RNFL damage assessment is only possible after 50% ganglion cell damage [43]. In other words, the study supports the views that significant decrease in RNFL can only be noticed when the disease progresses, and there would not be a significant change in early stages. Cases with schizophrenia and bipolar disorder are reported to have a significant relationship between severity and duration of disease and RNFL [37, 44]. A negative relationship between duration of disease and choroidal thickness, and a positive relationship between RNFL and ganglion cell layer thickness was observed in our study; however, this finding was not statistically significant. In other studies in the field of psychiatry using OCT, it was reported that ganglion cell layer thickness decreased, the first degeneration had begun on the ganglion cell layer, and as the disease progresses, the RNFL could degenerate as well [38]. In our study, no significant difference was observed between the groups in terms of ganglion cell layer thickness. The reason for this finding could be the participants being young in age. Retinal choroidal thickness is measured with OCT. Choroid is one of the most highly vascularized tissues in the body that takes on important tasks such as providing oxygen and nourishment to the outer layers of the retina, the temperature regulation in retina, positioning of the retina, removing retinal waste, and secreting growth factors. Thus, it is a type of tissue that can be affected by any kind of systemic occurrence to do with blood flow [26]. In studies where OCT was used in patients with schizophrenia and major depression, choroid thickness was found to be significantly higher [35, 45]. Therefore, both retinal neural degeneration and microvascular pathological findings could be seen in patients with schizophrenia [35]. The choroid thickness was reported to have increased in the patients with major depressive disorder compared with the patients with resilient depression. It was stated that major depressive disorder could be an-

Table 1. Choroidal thickness values for the patient and control groups

	Choroidal thickness (μm)		
Location from fovea (mm)	Patient group (Mean CT (μm)	Control group (Mean CT (μm)	p
Subfoveal	357.23±59.71	332.03±59.71	p=0.763
Temporal1	351.67±63.18	334.13±81.17	p=0.687
Temporal2	350.70±78.17	336.06±90.70	p=0.671
Temporal3	351.87±72.35	315.35±96.37	p=0.819
Nasal1	325.17±69.48	311.42±76.16	p=0.785
Nasal 2	275.60±69.07	271.74±72.72	p=0.564
Nasal3	233.00±63.22	224.32±69.51	p=0.754
Choroidal thickness (Mean CT (μm))	320.75±80.66	302.97±87.92	p=0.045

Table 2. The comparative values of retinal nerve fiber, mean ganglion cell layer, and mean central foveal thickness for the patient and control groups

Location	Patient group (Mean CT (μm))	Control group (Mean CT (μm)	p
Retinal nerve fiber thickness (μm)	94.63±8.14	95.81±8.53	p=0.628
Mean ganglion cell layer thickness (μm)	83.43±11.23	83.68±5.75	p=0.642
Mean central foveal thickness (μm)	247.27±19.95	247.19±16.32	p=0.710

other autoimmune or inflammatory disease that progresses with attacks. A significant part of the psychiatric studies carried out with OCT report that the choroid thickness could be a crucial biomarker in monitoring neurodegeneration [26, 35, 45]. The findings in our study demonstrate that the choroid thickness can be a significant factor in determining the etiopathogenesis of OCD and during the inflammatory process. The fact that there are only a few studies in this area limits the interpretation of the results on the OCT measurements.

The main limitations of our study are that it was carried out in only one setting and had a small number of cases. The lack of investigation on the relationship between severity and symptoms of the disease and OCT is another limitation. However, being one of the first studies investigating this issue, meticulous sampling of the patients and comparisons with the control group are the strengths of this study.

In conclusion, the increase in the number of studies that use neuroimaging methods raised curiosity toward the evaluation of the neuronal destruction results in different disciplines. Our study is a thought-provoking study toward how OCT can be a critical tool to detect neurodegeneration in patients with OCD. Assuming RNFL is the last layer to be affected by degeneration, monitoring ganglion cell layer, central foveal thickness, and choroid thickness could be found a significant biomarker. However, we believe there is a need for further studies with a larger sample and with a focus on the relationships with other neurodegenerative factors to confirm the results of this study.

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics Committee of Recep Tayyip Erdogan University School of Medicine (17/03/2017; 39).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

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