Comparison of Optic Disc Parameters Of Eyes With Unilateral Vitreopapillary Adhesion

Hazan Gül Kahraman[1], Pelin Kiyat [1], Yusuf Ziya Güven [2]

ABSTRACT

Introduction and Purpose: Interocular comparison of the optic disc structures of the eye swith and without vitreopapillary adhesion (VPA) to determine the disc anatomical features that may predispose to VPA.

Method: Optical coherence tomography (OCT) images of patients who applied to our clinic were retrospectively scanned and cases with unilateral VPA were identified. A total of 52 patients with unilateral VPA were retrospectively evaluated. OCT parameters include four retinal nerve fiber layer (RNFL) thicknesses, rim area (RA), disc area (DA), linear cup/disc ratio (lcdr), vertical cup/disc ratio (vcdr), cup volume (cv) data, VPA and non-VPA eye parameters were recorded and compared.

Results: According to the recorded OCT findings of the patients, the mean inferior quadrant RNFL thickness was found to be 131.46±23.63 in the VPA+ eyes and 125.65±26.39 in the VPA- eyes. When the cup/disc ratios were examined, the average value of the lcdr in VPA+ eyes was 0.50±0.28, while 0.59±0.24 in VPA- eyes. The difference between lcdr and vcdr observed to be statistically significant.

Discussion: We think that the anatomical structure of the optic disc may be effective in the occurrence of VPA. The fact that the longitudinal and vertical cup/disc ratios in eyes with VPA in our study were smaller than those in eyes without VPA supports our idea. In cases and eyes with VPA, vitreopapillary traction may be occurring on the disc head in the future and may play a role in the etiology of non-ischemic anterior optic neuropathy by affecting disc perfusion.

Key words: Optic Disc, Posterior Vitreous Detachment, OCT

INTRODUCTION AND PURPOSE

Adhesion weakens as a result of changes in the vitreo-retinal interface with the aging process. During the separation process of the posterior vitreous, synchisis and syneresis of the vitreous occur ([1]). Vitreo-retinal interface adhesions weaken and vitreo-retinal separation occurs. During this separation, if the connections at the vitreo-retinal interface are not sufficiently weakened and are not completely separated, abnormal posterior vitreous detachment occurs ([2]).

Abnormal posterior vitreous detachment developing at the optic disc head may cause vitreous hemorrhage and neovascularization in ischemic retinopathies [(1)]. For this reason, while the continuity of vitreopapillary adhesion at the disc head is important, it is suggested that vitreopapillary interface problems constitute a subgroup that may cause NAION. Vitreopapillary traction (VPT) optic neuropathy (VPTON), which is caused by adhesion at the optic disc head reaching the traction level, is considered a subgroup of non-arteritic anterior ischemic optic neuropathy

1- İzmir Demokrasi Üniversitesi Buca Seyfi Demirsoy Eğitim ve Araştırma Hastanesi, Göz Hastalıkları Anabilim Dalı, İzmir, Türkiye

2 İzmir Katip Çelebi Üniversitesi Atatürk Eğitim ve Araştırma Hastanesi, Göz Hastalıkları Anabilim Dalı, İzmir, Türkiye

Received: 07.08.2024
Accepted: 05.06.2025

J Ret-Vit 2025; 34: 116-120

DOI:10.37845/ret.vit.2025.34.18

Correspondence author:
Hazan Gül Kahraman
Email: hazangulakduman@hotmail.com

(NAION)[3,4]. NAION is an ophthalmological problem whose treatment is still controversial and seriously affects visual acuity and visual field in patients with the disease. While some systemic diseases predispose to NAION, some ophthalmological features also pose a risk. It has been determined in previous studies that the c/d ratio is smaller in patients with NAION, and the eye disc with a small c/d has been defined as at risk [5]. Apart from the cup/disc (C/D) ratio, vitreopapillary interface properties are also a matter of debate regarding the risk of NAION.

Nowadays, with the widespread use of optic coherence tomography (OCT), vitreoretinal interface problems are diagnosed more easily. Cases in the adhesion stage before vitreopapillary traction develops may not cause symptoms, but can be detected by OCT.

Our aim in this study is to compare the OCT parameters of the eye with unilateral vitreopapillary adhesion, which is not completely separated from the optic disc head, which is one of the places where the vitreous is most tightly attached to the retina during posterior vitreous detachment, with the contralateral eye without adhesion, to determine the anatomical features that cause vitreopapillary adhesion VPA, and to determine its effect on retinal nerve fiber layer (RNFL) thickness.

METHOD

This retrospective study was carried out at the ophthalmology polyclinic of Izmir Democracy University Buca Seyfi Demirsoy Training and Research Hospital. The study was approved by the institutional ethics committee and was conducted in accordance with the principles of the Declaration of Helsinki.

3d+line wide-angle images of patients who applied to our eye clinic were retrospectively scanned using the OCT (DRI OCT Triton, Topcon Corporation) device. Cases with unilateral VPA were identified among the patients. Among these patients, patients with poor image quality, patients with vitreo-retinal interface disorders such as macular hole and epiretinal membrane, patients with any ophthalmological disease in the retrospective review of anamneses, cylindrical and spherical refraction errors greater than ±2 dioptre, eyes which has axial length more than 24 mm or less than 21 mm, intraocular pressure >21 mmHg, previous ocular surgery were excluded from the study.

Patients with unilateral PVD onset but no detachment of the optic disc (OD) head were included in the study. A total of 52 patients who met the inclusion criteria were included in the final analysis. OCT parameters include inferior, nasal, superior and temporal quadrant retinal nerve fiber layer thicknesses, rim area (RA), disc area (DA), linear cup/disc ratio (LCDR), vertical cup/disc ratio (VCDR), cup volume (CV). VPA+ and VPA- contralateral eye parameters were recorded and compared between each other. The images included in the study were taken from the contralateral eyes of the same patient, with the aim of minimizing the effect of systemic comorbidities.

STATISTICAL ANALYSIS

SPSS 22.0 was used for statistical analysis. In the study, the normality of the data was evaluated with the Kolmogorov-Smirnov test. The differences between the means of the data that were found to be not normally distributed were used with the Wilcoxon signed rank test, and the dependent sample t test was used to test whether there was a difference between the means for the normally distributed dependent samples. The results were written as mean ± standard deviation and $p<0.05$ was considered statistically significant.

RESULTS

In our study, 44.23% of VPA+ eyes were right eyes, while 55.76% were left eyes of total 52 patients. Among the recorded OCT findings of the patients, the mean inferior quadrant RNFL thickness was 131.46±23.63 in the VPA+ eye and 125.65±26.39 in the VPA- eye (Table-1). The difference in thickness between the two eyes was statistically significant and was thicker in the VPA+ group. Mean values of RNFL thickness in other quadrants were also found to be higher in VPA+ eyes, but this difference was not statistically significant.

When the cup/disc ratios were examined, the average value of the linear cup/disc ratio in VPA+ eyes was 0.50±0.28, while this average was found to be 0.59±0.24 in VPA- eyes. The difference between LCDR between both eyes is statistically significant, and the average value is lower in VPA+ eyes than in non-VPA eyes. While the vcdr was

TABLE-1: Comparison of OCT parameters of eyes with VPA+ and eyes without VPA			
	VPA+	VPA-	P value
Inferior	**131,46±23,63 µm**	**125,65±26,39 µm**	**0,044**
Superior	**123,63±20,26 µm**	**121,50±21,80 µm**	**0,122**
Nasal	**80,08±14,90 µm**	**78,40±14,54 µm**	**0,283**
Temporal	**72,94±13,26 µm**	**71,58±12,83 µm**	**0,299**
Rim area	**1,34±0,49 mm²**	**1,26±0,75 mm²**	**0,377**
Disc area	**2,02±0,40 mm²**	**2,16±0,59 mm²**	**0,497**
Lcdr	**0,50±0,28**	**0,59±0,24**	**0,019***
Vcdr	**0,50±0,27**	**0,59±0,24**	**0,047***
Cup colume	**0,15±0,18 mm³**	**0,20±0,24 mm³**	**0,313**
Lcdr: longitudinal cup/disc volüme, Vcdr: vertical cup/disc volume, *p<0,05, µm: micrometer, mm²: millimetres squared, mm³: millimetres cubed			

TABLE-2: Comparison of right and left eye OCT parameters of patients with unilateral VPA			
	Right eye	**Left eye**	**p value**
Inferior	129,83±25,00 µm	127,29±25,36 µm	0,305
Superior	120,94±18,55 µm	124,19±23,21 µm	0,218
Nasal	82,10±14,20 µm	76,38±14,73 µm	0,024*
Temporal	73,52±13,52µm	71,00±12,47 µm	0,165
Rim area	1,27±0,54 mm²	1,33±0,71 mm²	0,259
Disc area	2,07±0,41 mm²	2,12±0,59 mm²	0,26
Lcdr	0,56±0,26	0,54±0,26	0,46
Vcdr	0,56±0,26	0,53±0,26	0,442
Cup colume	0,19±0,23 mm³	0,16±0,20 mm³	0,442
Lcdr: longitudinal cup/disc volüme, Vcdr: vertical cup/disc volume, *p<0,05, µm: micrometer, mm²: millimetres squared, mm³: millimetres cubed			

0.50±0.27 in eyes with VPA, it was 0.59±0.24 in eyes without VPA, and it was determined that the vcdr was wider in without VPA than in eyes with VPA+, and this difference was observed to be statistically significant. (p=0.047).

OCT imaging findings of the patients included in the study were also compared between right and left eyes, regardless of whether VPA was present or not (Table-2). As a result of comparing interocular parameters, regardless of VPA, the finding that showed a statistically significant difference between the right and left eyes was determined only in the retinal nerve fiber thickness in the nasal quadrant. Contrary to the results comparing eyes with and without VPA, no statistical difference was observed between the LCDR and VCDR values between the two eyes.

DISCUSSION

Continuation of vitreopapillary adhesion at the optic disc head is important in some ophthalmological diseases. For example, in the etiology of VPTON, which is defined as a subgroup of NAION, it is thought that prelaminar flow is impaired as a result of vitreopapillary traction on the optic disc head [6]. In addition, it has been shown that incomplete posterior vitreous detachment in ischemic retinopathies plays a role in the development of neovascularization [1]. In the follow-up of patients with lamellar macular hole, incomplete posterior vitreous detachment has been shown to be associated with poor visual prognosis [7]. The importance of incomplete posterior vitreous detachment is understood when its effect in such ophthalmological pathologies is examined.

Comparing VPA+ and VPA- eyes, our study shows that PVD is not complete in eyes with small longitudinal and vertical cup/disc ratios and adhesion at the optic disc head continues. The importance of small crowded discs in the etiology of NAION is already known (8). We think that if there is a predisposition to VPA as a result of the small cup/disc ratio, this adhesion on the disc head may create traction and predispose to VPTON. No significant difference was observed between RNFL thicknesses except the lower quadrant, and when the lower quadrant RNFL thicknesses were examined, it was observed that they were thicker in VPA+ cases. We think that this may affect the OCT measurement of the continuity on the vitreopapillary surface, resulting in a thicker measurement. It has already been shown that posterior vitreous detachment begins perifoveal region and then completes in the upper quadrants, then lower quadrants and finally in the peripapillary region, and it has been suggested in previous studies that this probably occurs due to the effect of gravity (9). The difference in RNFL thickness only in the inferior quadrant may have occurred as a result of the continuity of the vitreoretinal interface, especially in the lower part, affecting OCT imaging.

It was observed that there was no significant difference in vcdr when comparing the right and left eyes of the patients included in the study, regardless of their VPA status. This shows the importance of the vcdr in the etiology of VPA development. Song et al. in their study examining interocular symmetry, when the right and left eyes were compared, the average disc and rim area was found to be smaller in the right eye, and this difference was statistically significant[10]. In our study, the mean values of disc space and rim area were lower in the right eye, but were not statistically significant. Pawar et al. in their study, it was determined that the mean and vertical c/d ratios were greater in the right eye [11]. Similar to our study, most studies except Pawar and Song et al., found no difference between the two eyes [12-14].

When studies comparing the difference in retinal nerve fiber thickness between the right and left eyes are analysed, there are studies showing that the upper quadrant is thinner in the right eye and thicker in the temporal quadrant [11-16]. In our study, unlike these studies, the RNFL thickness in the nasal quadrant was found to be thicker in the right eye. No difference in this context was observed in other studies.

LIMITATIONS

This study has several limitations. As a retrospective, single-center analysis with a cross-sectional design, it limits the ability to establish causality and may reduce the generalizability of the findings. Additionally, the absence of longitudinal follow-up precludes assessment of the natural course or progression of VPA and its potential evolution into vitreopapillary traction optic neuropathy (VPTON). OCT angiography (OCTA) was not utilized, preventing evaluation of optic disc perfusion and the hemodynamic relevance of VPA in relation to NAION risk. Future studies incorporating OCTA are warranted to explore this relationship in greater depth. Moreover, OCT-based measurements may be influenced by inter-scan and inter-observer variability. Finally, demographic variables such as age and sex were not analyzed in association with anatomical parameters, which could have provided further insights.

Conclusion

The difference in vcdr in contralateral eyes may play a role in the etiology of incomplete posterior vitreous detachment. This may be a factor that makes a difference in the prognosis of some ophthalmological diseases.

Ethics

Ethics Committee Approval: Ethical approval for the current study was obtained

Informed Consent: Retrospective study.

Authorship Contributions

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

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

REFERENCES

1. Sebag J. Vitreoschisis. Vol. 246, Graefe's Archive for Clinical and Experimental Ophthalmology. 2008. p. 329–32.
2. Sebag J. Anomalous posterior vitreous detachment: a unifying concept in vitreo-retinal disease. Graefe's Archive for Clinical and Experimental Ophthalmology. 2004 Aug 10;242(8):690–8.

3. Sebag J. Anatomy and pathology of the vitreo-retinal interface. Eye. 1992 Nov;6(6):541–52.

4. Nagesha C, Rishi P, Rishi E. Vitrectomy for vitreopapillary traction in a nondiabetic 16-year-old girl. Oman J Ophthalmol. 2017;10(1):38.

5. Behbehani R, Ali A, Al-Moosa A. Risk factors and visual outcome of Non-Arteritic Ischemic Optic Neuropathy (NAION): Experience of a tertiary center in Kuwait. PLoS One. 2021 Feb 18;16(2):e0247126.

6. Gabriel RS, Boisvert CJ, Mehta MC. Review of Vitreopapillary Traction Syndrome. Neuro-Ophthalmology. 2020 Jul 3;44(4):213–8.

7. Romano MR, Vallejo-Garcia JL, Camesasca FI, Vinciguerra P, Costagliola C. Vitreo-papillary adhesion as a prognostic factor in pseudo- and lamellar macular holes. Eye. 2012 Jun 16;26(6):810–5.

8. Ma CH, Wang CY, Dai TT, Chen TT, Zhu WH. Risk factors of non-arteritic anterior ischaemic optic neuropathy and central retinal artery occlusion. Int J Ophthalmol. 2024 May 18;17(5):869-876

9. Johnson MW. Posterior Vitreous Detachment: Evolution and Complications of Its Early Stages. Am J Ophthalmol. 2010;149(3).

10. Song MY, Hwang YH. Interocular symmetry of optical coherence tomography parameters in healthy children and adolescents. Sci Rep. 2022 Jan 13;12(1):653.

11. Pawar N, Maheshwari D, Ravindran M, Ramakrishnan R. Interocular symmetry of retinal nerve fiber layer and optic nerve head parameters measured by Cirrus high-definition optical coherence tomography in a normal pediatric population. Indian J Ophthalmol. 2017;65(10):955.

12. Al-Haddad C, Antonios R, Tamim H, Noureddin B. Interocular symmetry in retinal and optic nerve parameters in children as measured by spectral domain optical coherence tomography. British Journal of Ophthalmology. 2014 Apr;98(4):502–6.

13. Altemir I, Oros D, Elía N, Polo V, Larrosa JM, Pueyo V. Retinal Asymmetry in Children Measured With Optical Coherence Tomography. Am J Ophthalmol. 2013 Dec;156(6):1238-1243.e1.

14. Yabas Kiziloglu O, Toygar O, Toygar B, Hacimustafaoglu AM. Optic Nerve Head Parameters Measured with Spectral-Domain Optical Coherence Tomography in Healthy Turkish Children: Normal Values, Repeatability, and Interocular Symmetry. Neuro-Ophthalmology. 2018 Mar 4;42(2):83–9.

15. Weng C, Xia F, Xu D, Zhou X, Wu L. Axial length growth difference between eyes after monocular laser refractive surgery: eight patients who underwent myopic laser ablation for both eyes at intervals of several years. BMC Ophthalmol. 2022;22(1):20.

16. Larsson E, Molnar A, Holmström G. Repeatability, reproducibility and interocular difference in the assessments of optic nerve OCT in children– a Swedish population-based study. BMC Ophthalmol. 2018 Dec 22;18(1):270.