

Inner and outer segment junction (IS/OS line) integrity in ocular Behçet's disease

Integridade da junção do segmento interno e externo (linha IS/OS) na doença de Behçet ocular

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ABSTRACT

Purpose: In this study, we examined the spectral domain optical coherence tomography (OCT) findings of ocular Behçet's disease (OB) in patients with inactive uveitis. Specifically, we analyzed the inner and outer segment junction (IS/OS line) integrity and the effect of disturbed IS/OS line integrity on visual acuity.

Methods: Patient files and OCT images of OB patients who had been followed-up between January and June of the year 2013 at the Dicle University Eye Clinic were evaluated retrospectively. Sixty-six eyes of 39 patients were included in the study.

Results: OCT examination of the patients with inactive OB revealed that approximately 25% of the patients had disturbed IS/OS and external limiting membrane (ELM) line integrity, lower visual acuity (VA), and lower macular thickness than others. Linear regression analysis revealed that macular thickness was not an independent variable for VA. In contrast, the IS/OS line integrity was an independent variable for VA in inactive OB patients.

Conclusion: In this study, we showed that the IS/OS line integrity was an independent variable for VA in inactive OB patients. Further prospective studies are needed to evaluate the integrity of the IS/OS line in OB patients.

Keywords: Behçet disease; Tomography optical coherence; Retinal photoreceptor cell inner segment; Retinal photoreceptor cell outer segment

RESUMO

Objetivo: Neste estudo, examinamos os achados da tomografia de coerência óptica (OCT) de domínio espectral na doença de Behçet ocular (OB) em pacientes com uveíte inativa. Especificamente, analisamos a integridade da junção dos segmentos interno e externo (linha IS/OS) e o efeito da alteração da integridade da linha IS/OS na acuidade visual.

Métodos: Avaliamos retrospectivamente os prontuários e as imagens de OCT dos pacientes com OB examinados entre janeiro e junho de 2013 na Dicle University Eye Clinic. Sessenta e seis olhos de 39 pacientes foram incluídos no estudo.

Resultados: Análise das imagens de OCT dos pacientes com OB inativa revelou que aproximadamente 25% dos pacientes tinham alterações da integridade da linha IS/OS e da membrana limitante externa (ELM), e apresentavam acuidade visual (VA) e espessura macular menor do que os outros. A análise de regressão linear revelou que a espessura macular não é uma variável independente para VA. Por outro lado, a integridade da linha IS/OS foi uma variável independente para VA em pacientes com OB inativa.

Conclusão: Neste estudo, nós mostramos que a integridade da linha IS/OS foi uma variável independente para a VA em pacientes com OB inativa. Precisamos de mais estudos prospectivos para avaliar a integridade da linha IS/OS em pacientes com OB.

Descritores: Síndrome de Behçet; Tomografia de coerência óptica; Segmento interno das células fotorreceptoras da retina; Segmento externo das células fotorreceptoras da retina

INTRODUCTION

Behçet's disease (BD) is a chronic, inflammatory, multisystemic vasculitis. The most important sites involved in BD are the skin, eyes, joints, central nervous system, and the gastrointestinal system. Ocular involvement is typically seen 2-3 years after the onset of the disease^(1,2). Previous reports have shown that ocular involvement rates are between 23% and 96%^(1,3,4). Ocular involvement usually presents as panuveitis and occlusive vasculitis, which may lead to severe vision loss due to macular edema, severe vasculitis, and optic atrophy⁽¹⁾.

Fluorescein angiography (FA) and optical coherence tomography (OCT) are the most commonly used imaging techniques in BD. FA can monitor the disease activity and is particularly useful for detecting retinal vasculitis in Ocular Behçet's disease (OB)⁽⁵⁾. The optical coherence tomography (OCT) is a valuable device for diagnosing and monitoring macular complications such as cystic macular edema, photoreceptor damage, and foveal atrophy^(6,7). The spectral domain OCT devices allow one to view the details of the retinal layers, particularly the photoreceptor inner and outer segment junction (IS/OS line), the external limiting membrane (ELM) line, and the retinal pigment epithelium, which can be clearly seen as hyper-reflective bands.

In this study, the spectral domain optical coherence tomography (OCT) findings of ocular BD (OB) patients with inactive uveitis were

examined. Specifically, the IS/OS line integrity and the effect of the disturbed IS/OS line integrity on visual acuity were analyzed.

METHODS

In this study, patient files and OCT images of OB patients who had been followed-up between January to June of 2013 at the Dicle University Eye Clinic were evaluated retrospectively. Eighty eyes of 40 OB patients were reviewed. Patients were excluded from the study if they had active uveitis, a central macular thickness (CMT) higher than 250 µm, if they could not undergo OCT imaging due to media opacity, or if they had another ocular disease. Active uveitis was defined as having cells in the anterior chamber or vitreous and retinal vasculitis. All patients underwent a complete ophthalmologic examination and OCT imaging (Spectralis, Heidelberg Engineering, Germany). Visual acuity was measured with the help of a Snellen Chart, and logMAR equivalents were recorded for statistical analysis. The CMT, the integrity of the IS/OS line, and the external limiting membrane (ELM) were recorded from the OCT scans passing through the foveal center. The IS/OS and ELM lines were described as the third and fourth hyper-reflective bands, respectively, after the Bruch Membrane and the retinal pigment epithelium layer in OCT. Patients were grouped

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according to the integrity of the IS/OS line as follows: IS/OS (-) if the integrity of the IS/OS line was disturbed, or IS/OS (+) if the integrity of the IS/OS line was intact.

Statistical analyses were performed using the Statistical Program for Social Science version 15 (SPSS, Chicago, Illinois, USA). The Kolmogorov-Smirnov test was used to analyze the distribution of the data. The data were not distributed normally and non-parametric tests were used in the analysis. The Mann-Whitney U test was used in the comparison of numeric variables. We used Spearman's correlation analysis for non-parametric correlation analysis. Linear regression analysis was carried out for detecting the independent effect of the variables, which were found to have an effect on VA. Data are presented as mean \pm standard deviation.

RESULTS

Fourteen of the 80 eyes were excluded from the study because 8 had active uveitis and macular edema, and 6 had vitreous opacity, which prevented OCT imaging. Of the remaining 66 eyes, 16 (24.2%) had a disturbed IS/OS line and 19 (28.8%) had a disturbed ELM line. All patients in the IS/OS (-) group also had disturbed ELM integrity. The mean logMAR visual acuity of the patients in the IS/OS (-) group was 1.13 ± 0.72 , whereas this value was 0.66 ± 0.21 in the IS/OS (+) group ($P < 0.001$). The mean CMT in the IS/OS (-) and IS/OS (+) groups were 187 ± 51 and 224 ± 33 μm , respectively ($P = 0.001$). The mean disease duration was 4.38 ± 4.71 years in the IS/OS (-) group and 3.42 ± 4.82 years in the IS/OS (+) group [not statistically significant ($P = 0.098$)].

Further analysis revealed a significant correlation between the VA and CMT. A decrease in the CMT was associated with a decrease in VA (Spearman's correlation coefficient = -0.339 , $P = 0.006$, VA were taken as logMAR). Linear regression analysis showed that the IS/OS integrity, but not CMT, was an independent variable for VA, ($R^2 = 0.582$, Table 1).

DISCUSSION

Optical coherence tomography, which produces images similar to that of the histological cross-sections of the retina, is a non-invasive method used in the diagnosis and management of many ocular diseases. With the use of spectral domain technology, high-resolution images (nearly 8-10 μm) can be obtained from OCT devices.

In the present study, we evaluated inactive OB patients with the help of spectral domain OCT. The data revealed that approximately 25% of the patients had disturbed IS/OS line and ELM integrity, and a lower VA and macular thickness than others.

The IS/OS line is at the junction between the photoreceptor outer and inner segments. The significance of the IS/OS line integrity has been reported for many retinal diseases. Disturbed IS/OS line integrity is associated with low VA. Ota et al. reported that patients with a disturbed IS/OS line had poorer VA than those with an intact IS/OS line in the central and branch retinal vein occlusion (RVO)^(8,9). Shin et al. found lower VA in diabetic retinopathy and in RVO patients with disturbed IS/OS lines^(10,11). Erdem et al. showed that 65% of the active uveitis patients had interrupted IS/OS lines, but 30.8% of the patients regained the integrity of the IS/OS line during remission⁽¹²⁾. However, the sample was not homogeneous with respect to the etiology of the uveitis. Unoki et al., who studied a smaller patient group (24 eyes

of 14 patients), reported that OB patients with a disturbed IS/OS line had lower VA and CMT⁽⁶⁾. However a regression analysis was not used to evaluate the effect of IS/OS line integrity on VA.

The mechanisms responsible for the IS/OS line disturbance in the above diseases have not been fully elucidated. Murakami et al. reported that in diabetic macular edema patients, the areas under the cystoid spaces had increased transverse length of disrupted or faint IS/OS lines and disrupted ELM lines than those without cystoid spaces⁽¹¹⁾. OB patients also suffer from recurrent macular edema attacks due to recurrent uveitis, which may lead to photoreceptor damage. Additionally, pathological studies have shown that there is retinal damage in enucleated eyes of patients with Behçet's disease⁽³⁾. Another possible mechanism for the photoreceptor damage might be the involvement of the choroidal vessels, which aids outer sensorial retinal oxygenation. Choroidal involvement in BD patients has been documented by many studies. In patients with OB, the involvement of choroidal vasculature has been shown by indocyanine green (ICG) angiography. ICG findings revealed delayed and irregular filling of choriocapillaris, stromal hyperfluorescence, hyperfluorescent spots, hypofluorescent plaques, and diffuse choroidal hyperfluorescence^(12,13). Further, Coşkun et al., who employed enhanced deep imaging OCT, reported that choroidal thickness decreased in BD⁽¹⁴⁾.

Our analysis revealed a correlation between macular thickness and VA. Because we excluded patients with macular edema, we did not have any patients with increased macular thickness and low VA. On the contrary, patients with reduced macular thickness, a sign of an atrophic macula, had low VA. Linear regression analysis revealed that macular thickness was not an independent variable for VA. However, the IS/OS line integrity was found to be an independent variable for VA in inactive BD patients.

Because media opacity and retinal edema could prevent the imaging of the retinal layers, we did not evaluate the patients during an acute attack. More importantly, retinal edema would reduce the VA during an acute attack, and in this study, we specifically aimed to evaluate the relationship between the IS/OS line integrity and VA in inactive OB.

Limitations of this study include retrospective study design, patients were evaluated cross-sectionally, and active and inactive phases of the disease could not be compared.

In summary, we showed that the IS/OS line integrity is an independent variable for VA in inactive OB patients. However, further prospective studies are needed to evaluate the integrity of the IS/OS line in OB patients.

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REFERENCES

1. Yazici H, Fresko I, Yurdakul S. Behçet's syndrome: disease manifestations, management, and advances in treatment. *Nat Clin Pract Rheumatol*. 2007;3(3):148-55.
2. Sakane T, Takeno M, Suzuki N, Inaba G. Behçet's disease. *N Engl J Med*. 1999;341(17):1284-91.
3. Mishima S, Masuda K, Izawa Y, Mochizuki M, Namba K. The eighth Frederick H. Verhoeff Lecture. presented by Saiichi Mishima, MD Behçet's disease in Japan: ophthalmologic aspects. *Trans Am Ophthalmol Soc*. 1979;77:225-79.
4. Saylan T, Mat C, Fresko I, Melikoğlu M. Behçet's disease in the Middle East. *Clin Dermatol*. 1999;17(2):209-23.
5. Atmaca LS. Fundus changes associated with Behçet's disease. *Graefes Arch Clin Exp Ophthalmol*. 1989;27(4):340-4.
6. Unoki N, Nishijima K, Kita M, Hayashi R, Yoshimura N. Structural changes of fovea during remission of Behçet's disease as imaged by spectral domain optical coherence tomography. *Eye (Lond)*. 2010;24(6):969-5.
7. Takeuchi M, Iwasaki T, Kezuka T, Usui Y, Okunuki Y, Sakai J, et al. Functional and morphological changes in the eyes of Behçet's patients with uveitis. *Acta Ophthalmol*. 2010;88(2):257-62.
8. Ota M, Tsujikawa A, Kita M, Miyamoto K, Sakamoto A, Yamaike N, et al. Integrity of foveal photoreceptor layer in central retinal vein occlusion. *Retina*. 2008;28(10):1502-8.
9. Ota M, Tsujikawa A, Murakami T, Yamaike N, Sakamoto A, Kotera Y, et al. Foveal photo-

Table 1. Regression analysis of the factors that were found to influence the visual acuity in a univariate analysis

	Beta	t	P value	Collinearity statistics	
				Tolerance	VIF
IS/OS integrity	0.767	8.609	<0.0001	0.850	1.177
CMT	0.012	0.130	0.897	0.850	1.177

Dependent variable is visual acuity; $R^2 = 0.582$; IS/OS = inner and outer segment junction; CMT = central macular thickness; VIF = variance inflation factor.

- receptor layer in eyes with persistent cystoid macular edema associated with branch retinal vein occlusion. *Am J Ophthalmol.* 2008;145(2):273-80.
10. Erdem E, Şekeroğlu HT, Soylu M, et al. The correlation of clinical findings and macular changes detected by optical coherence tomography in patients with uveitis. *TJO.* 2011;41:396-400.
 11. Markomichelakis NN, Halkiadakis I, Pantelia E, Georgalas I, Chrysanthi K, Theodosiadis P, et al. Course of macular edema in uveitis under medical treatment. *Ocul Immunol Inflamm.* 2007;15(2):71-9.
 12. Klaeger A, Tran VT, Hiroz CA, Morisod L, Herbort CP. Indocyanine green angiography in Behçet's uveitis. *Retina.* 2000;20(3):309-14.
 13. Gedik Ş, Akova YA, Yılmaz G, Bozbeyoğlu S. Indocyanine green and fundus fluorescein angiographic findings in patients with active ocular Behçet's disease. *Ocul Immunol Inflamm.* 2005;13(1):51-8.
 14. Coskun E, Gurler B, Pehlivan Y, Kisacik B, Okumus S, Yayuspay R, et al. Enhanced depth imaging optical coherence tomography findings in Behçet disease. *Ocul Immunol Inflamm.* 2013;21(6):440-5.

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