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Case report / Приказ болесника

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Evaluation of macular and optic nerve head changes in young female patients with unilateral optic neuritis using optic coherence tomography angiography – two case reports

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SUMMARY

Introduction Optic neuritis (ON) is described as an inflammation of the optic nerve which leads to the sudden loss of vision taking place over the course of several hours or days. Optical coherence tomography angiography (OCT-A) is a non-invasive imaging tool which can be used for quantitative measurements of the microvascular changes in the retinochoroidal layers and optic nerve head.

Outlines of cases We present two case reports of Serbian patients, with unilateral ON whose macular and optic nerve head parameters were observed using OCT-A up to six months following initial diagnosis and the administration of corticosteroid therapy. Patient 1 was a female 23 years old with ON on her right eye. Patient 2 was also female, 23 years old with ON on her right eye. Retinal nerve fiber layer (RNFL) thickness and the radial peripapillary capillary plexus density were significantly lower in the affected *vs*. healthy eyes in both whole image scan area and optic nerve head ($p < 0.05$). Central macular thickness (CMT) was significantly lower in the affected *vs*. healthy eyes ($p < 0.05$). Both superficial capillary plexus (SCP) and deep capillary plexus (DCP) vessel densities in the fovea were significantly lower in the affected *vs*. healthy eyes ($p < 0.05$). SCP vessel density was also lower in the macula of the affected eyes ($p < 0.05$). Significant differences related to the size of foveal avascular zone (FAZ) and selected flow area were not found ($p > 0.05$).

Conclusion Optic neuritis (ON) leaves permanent structural changes which can be detected using OCT-A even in patients with fully recovered visual acuity. Therefore, OCT-A should be included more in our daily clinical practice since it can provide useful data for the prognosis of various neuro-ophthalmological diseases and conditions.

Keywords: optic neuritis; OCT-A; optic nerve head; macula; RNFL; vessel density

САЖЕТАК

Увод Оптички неуритис (ОН) представља запаљење оптичког нерва које доводи до наглог губитка вида, а развија се током неколико сати или дана. Оптичка кохерентна томографија ангиографија (*OCT-A*) неинвазивна је метода снимања која се може користити за квантитативно мерење микроваскуларних промена у ретинохориоидалним слојевима и глави оптичког нерва.

Приказ болесникâ Приказујемо два случаја из Србије. Болесница 1 старости 23 године дијангностикован је ОН на десном оку, док је болесници 2 исте старости дијагностикован ОН исто на десном оку. Код обе болеснице праћени су параметри макуле и главе оптичког нерва *OCT-A* методом током периода до шест месеци након постављања почетне дијагнозе и примене кортикостероидне терапије. Дебљина слоја нервних влакана ретине (*RNFL*) и густина радијалног перипапиларног капиларног сплета биле су значајно ниже на захваћеном оку у поређењу са здравим, како на целокупно посматраној површини снимка, тако и у пределу главе оптичког нерва ($p < 0,05$). Централна дебљина макуле (*CMT*) била је значајно мања на захваћеном оку ($p < 0,05$). Густина крвних судова површинског капиларног сплета (*SCP*) и дубоког капиларног сплета (*DCP*) у фовеи била је значајно нижа на захваћеном у односу на здраво око ($p < 0,05$). Густина крвних судова *SCP*-а била је такође нижа у макули захваћеног ока ($p < 0,05$). Нису утврђене значајне разлике у величини фовеалне аваскуларне зоне (*FAZ*) нити у изабраном подручју протока ($p > 0,05$).

Закључак Оптички неуритис оставља трајне структурне промене које се могу открити методом *OCT-A* чак и код болесника са потпуно опорављеном видном оштрином. Стога, *OCT-A* треба чешће укључивати у свакодневну клиничку праксу, јер може пружити драгоцене податке за прогнозу различитих неуроофталмолошких болести и стања.

Кључне речи: оптички неуритис; *OCT-A*; глава оптичког нерва; жута мрља; *RNFL*; густина крвних судова

INTRODUCTION

Optic neuritis (ON) is described as an inflammation of the optic nerve which leads to the sudden loss of vision taking place over the course of several hours or days [1]. It is mostly idiopathic, however it can be associated with wide range of conditions such as demyelinating lesions, autoimmune disorders, infectious and inflammatory conditions, trauma, vascular insufficiency, metastases, toxins, or nutritional deficiencies [2]. Optical coherence tomography angiography (OCT-A) (Figures 1 and 2) is a non-invasive imaging tool which enables high resolution imaging of the blood stream in various layers of the retina generating three-dimensional images, therefore allowing quantitative measurements of the microvascular changes in the retinochoroidal layers and optic nerve head [3].

Here we present two case reports of young female patients with unilateral ON whose macular and optic nerve head parameters were observed using OCT-A up to six months following initial diagnosis and the administration of corticosteroid therapy.

REPORTS OF CASES

Two female patients, both aged around 23 years, presented to the University Clinical Centre of Serbia Eye Hospital due to the sudden loss of vision followed by pain during eye movement and reduced colour vision in the right eye. No previous medical history was reported. Patients were taking no medications. Upon admission, they underwent a complete ophthalmological examination and diagnosis. Best corrected visual acuities (BCVA) were 20/640 and 20/40 in the right, affected eyes with both having 20/20 in the left, healthy eyes. The intraocular pressures were normal, ranged between 14 and 18 mmHg. Ocular movements were in full range but associated with pain. A relative afferent pupillary defect (RAPD) was present in the affected eyes. The anterior segment examination was normal, without any pathological findings. The posterior segment examination showed normal macula, peripheral retina and optic nerve head in both patients. Visual field testing (VFT) of the affected eyes showed significant defects in all four quadrants. The systemic and neurological examinations were in normal range. Both patients received methylprednisolone (1000 mg) in a form of pulse therapy intrathecally with gradual dose reduction. Significant recovery of BCVA in the affected eyes and the reduction of defects in VFT could be observed few days following corticosteroid administration. Patients were discharged from the Clinic with oral prednisone therapy and scheduled for the first check-up one month after initial treatment. A month later, at the first post-discharge check-up, OCT-A images of the macula and optic nerve head were captured for fist patient (Figure 1) as well

as second (figure 2) in both affected and healthy eyes using the AngioVue OCT-A system version 2017.1 (Optovue Inc., Fremont, CA, USA). Parameters analyzed using OCT-A (Figures 2, 4) were: 1. central macular thickness (CMT), 2. foveal avascular zone (FAZ) size, 3. macular flow using the automatic "flow" analysis function in a selected area of 3.144 mm^2 centered on the fovea, 4. superficial (SCP) and deep capillary plexus (DCP) density in the macula (scanning area 6 × 6 mm centred on the fovea) and fovea, 5. retinal nerve fiber layer (RNFL) thickness (figures 2,4) and 6. radial peripapillary capillary (RPC) plexus density in both affected and healthy eyes (whole image and inside disc vessel density). Whole image vessel density is calculated from the entire 4.5 × 4.5mm scan field centered on the optic disc. Inside disc vessel density refers to the area inside an ellipse fitted to the optic disc boundary [4]. Both patients were followed during a period of 6 months. Regular check-ups were performed on monthly basis with BCVA, VFT and OCT-A of the macula and optic nerve head in both affected and healthy eyes being checked each time. The differences were tested using a paired sample t-test. Statistical analysis was performed using SPSS 21.0, and the difference was considered significant if $p < 0.05$. All results are presented in Table 1 (mean ± SD).

We have not observed significant difference related to the size of FAZ ($t_1(7) = 3.047$, $P_1 > 0.05$ and $t_2(6) = 1.332$, $P_2 > 0.05$, respectively) and selected flow area ($t_1(7) = 1.074$, $P_1 > 0.05$ and $t_2(6) = 0.961$, $P_2 > 0.05$) in the affected *vs*. healthy eyes. However, CMT was significantly thinner in the affected *vs*. healthy eyes in both patients ($t_1(7) = 8.496$, $P_1 < 0.05$ and $t_2(6) = 26.14$, $P_2 < 0.05$). Also, SCP vessel density was significantly lower in both macula (scanning area 6 × 6 mm) ($t_1(7) = 6.705$, $P_1 < 0.05$ and $t_2(6) = 4.143$, $P_2 < 0.05$) and fovea ($t_1(7) = 4.224$, $P_1 < 0.05$ and $t_2(6) = 11.136$, $P_2 < 0.05$). DCP vessel density was significantly lower in the fovea of the affected eyes ($t_1(7) = 3.623$, $P_1 < 0.05$ and $t_2(6) = 6.073$, $P_2 < 0.05$). RPC plexus density (whole image) was significantly lower in the affected *vs*. healthy eyes ($t_1(7) = 11.925$, $P_1 < 0.05$ and $t_2(6) = 5,768$, $P_2 < 0.05$). RPC plexus density of the optic nerve head was significantly lower in the affected *vs*. healthy eye in one patient ($t_1(7) = 4.946$, $P_1 < 0.05$ and $t_2(6) = 1,522$, $P_2 > 0.05$). RNFL thickness was significantly lower in both patients on the affected *vs*. healthy eyes ($t_1(7) = 20.714$, $P_1 < 0.05$ and $t_2(6) = 18.89$, $P_2 < 0.05$). During this period of time, BCVA of the affected eyes showed complete recovery of 20/20 in both patients, and VFT results were far better compared to the ones done previously.

Ethics: Written informed consent was obtained from the patients for publication of this case report and any accompanying images.

DISCUSSION

In this study we investigated vascular parameters of the macula and optic nerve head using OCT-A in two young female patients with unilateral ON up to six months following initial diagnosis and the administration of corticosteroid therapy. Although, BCVA in the affected eyes improved significantly being 20/20 at the end of the follow-up period in both patients, permanent structural damage affecting different retinal layers and optic nerve head were observed using OCT-A.

Previous studies have shown that although patients with a history of ON associated with multiple sclerosis (MS) did not have any functional visual loss, structural neurodegeneration could be demonstrated in the affected eye. RNFL thinning in the inferior or temporal sector was independently associated with ON [5]. Recent studies have also indicated the importance of RPC plexus density reduction, as an early event in MS, which may be relevant as a potential biomarker of disease pathology [6]. The reduction of SCP vessel density in both macula and peripapillary region in relapsing remitting MS individuals with or without ON, being more pronounced in ON patients has also been demonstrated [7]. Another study showed that the vessel density of SCP is significantly lower in ON eyes of both MS and patients with neuromyelitis optica spectrum disorder (NMOSD) than in non-ON eyes while the density of DCP is significantly higher in MS+ON and MS-ON patients compared to the healthy controls. The difference was not observed when comparing NMOSD+ON and NMOSD-ON patients with healthy controls [8]. ON may cause not only retinal structural damage, but also a decreased retinal perfusion, even in patients with good visual acuity following treatment for ON [9]. Other studies support these patterns of reduced retinal SCP vessel density which correlate with reduced visual function, longer disease duration and higher levels of global disability in MS patients with ON history [10, 11].

Based on the results of our study, RNFL thickness and the RPC plexus density were significantly lower in the affected *vs*. healthy eyes in both, whole image scan area and optic nerve head. CMT was significantly lower in the affected *vs*. healthy eyes in both patients. Also, SCP and DCP vessel densities in the fovea were significantly lower in the affected *vs*. healthy eyes. Both patients showed significantly lower SCP vessel density in the macula of the affected eyes.

It can be concluded that even though visual acuity fully recovered following corticosteroid therapy, ON leaves permanent structural changes which can be detected using OCT-A. Therefore, OCT-A should be included more in our daily clinical practice since this powerful imaging tool can provide useful data for the prognosis of various neuro-ophthalmological diseases and

conditions. To the best of our knowledge, this is the first study designed to investigated vascular parameters of the macula and optic nerve head using OCT-A in the patients with unilateral ON.

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Authors' contributions: MJ, MB, TK analyzed and interpreted the patient data. MJ, MB, DV were involved in conceptualization and writing of original manuscript. DV and AR were responsible for manuscript review and prepare of study for publication. All authors red and approved the final manuscript.

Conflict of interest: None declared.

REFERENCES

1. Hawkes CH, Giovannoni G, Lechner-Scott J, Levy M, Yeh A. Treatment of first and subsequent attacks in multiple sclerosis. Mult Scler Relat Disord. 2025;101:106665. [DOI: 10.1016/j.msard.2025.106665] [PMID: 40803050]
2. Jugnet M, David T, Pierre M, Valentino R, Mehdaoui H, Merle H. Therapeutic plasma exchange for severe optic neuritis in a region with a high prevalence of neuromyelitis optica. Ophthalmol Ther. 2025;14(10):2469–79. [DOI: 10.1007/s40123-025-01216-w] [PMID: 40782297]
3. Xie J, Ye L, Yang J, Zhong Y, Xu P, Gao B, et al. Comparison of coronary angiographic-derived and intracoronary imaging-based fractional flow reserve in assessing coronary artery stenosis severity: a systematic review and network meta-analysis. J Evid Based Med. 2025;18:e70054. [DOI: 10.1111/jebm.70054] [PMID: 40810699]
4. Sihota R, Shakrawal J, Azad SV, Kamble N, Dada T. Circumpapillary optical coherence tomography angiography differences in perimetrically affected and unaffected hemispheres in primary open-angle glaucoma and the preperimetric fellow eye. Indian J Ophthalmol. 2021;69(5):1120–6. [DOI: 10.4103/IJO.IJO_1191_20] [PMID: 33913845]
5. Uctepe F, Orenc P, Gungel H, Toprak UE. Evaluation of optical coherence tomography findings in patients with multiple sclerosis and glaucoma. Int Ophthalmol. 2024;44(1):226. [DOI: 10.1007/s10792-024-03099-5] [PMID: 38758396]
6. Liu J, Song S, Gu X, Li H, Yu X. Microvascular impairments detected by optical coherence tomography angiography in multiple sclerosis patients: a systematic review and meta-analysis. Front Neurosci. 2023;16:1121899. [DOI: 10.3389/fnins.2022.1121899] [PMID: 36711144]
7. El Ayoubi NK, Ismail A, Fahd F, Younes L, Chakra NA, Khoury SJ. Retinal optical coherence tomography measures in multiple sclerosis: a systematic review and meta-analysis. Ann Clin Transl Neurol. 2024;11(9):2236–53. [DOI: 10.1002/acn3.52165] [PMID: 39073308]
8. Rogaczewska M, Michalak S, Stopa M. Macular vessel density differs in multiple sclerosis and neuromyelitis optica spectrum disorder: an optical coherence tomography angiography study. PLoS One. 2021;16(6):e0253417. [DOI: 10.1371/journal.pone.0253417] [PMID: 34138927]
9. Cennamo G, Solari D, Montorio D, Scala MR, D'Andrea L, Tranfa F, et al. The role of OCT-angiography in predicting anatomical and functional recovery after endoscopic endonasal pituitary surgery: a 1-year longitudinal study. PLoS One. 2021;16(12):e0260029. [DOI: 10.1371/journal.pone.0260029] [PMID: 34855775]
10. Murphy OC, Kwakyi O, Iftikhar M, Zafar S, Lambe J, Pellegrini N, et al. Alterations in the retinal vasculature occur in multiple sclerosis and exhibit novel correlations with disability and visual function measures. Mult Scler. 2020;26(7):815–28. [DOI: 10.1177/1352458519845116] [PMID: 31094280]
11. Marjanović I, Marić V, Božić M. Optical coherent tomography with angiography in glaucoma. Srp Arh Celok Lek. 2023;151(11–12):725–9. [DOI: 10.2298/SARH230211096M] [PMID: 38010183].

Table 1. Quantitative optical coherence tomography and optical coherence tomography angiography parameters of the affected and healthy eyes in two patients with unilateral optic neuritis

Parameters	Affected eye (case 1) (mean ± SD)	Healthy eye (case 1) (mean ± SD)	Affected eye (case 2) (mean ± SD)	Healthy eye (case 2) (mean ± SD)
FAZ (mm^2)	0.187 ± 0.004	0.199 ± 0.014	0.293 ± 0.020	0.283 ± 0.005
CMT (μm)	232.85 ± 3.976	242.28 ± 2.058	216.7 ± 1.253	229.28 ± 1.704
SCP vessel density in the macula (%)	38.987 ± 2.564	50.012 ± 3.132	46.714 ± 0.786	51.357 ± 2.702
SCP vessel density in the fovea (%)	16.163 ± 1.316	20.825 ± 2.526	12.312 ± 2.395	18.96 ± 1.957
DCP vessel density in the macula (%)	50.712 ± 8.952	55.425 ± 4.953	55.014 ± 2.554	53.501 ± 5.365
DCP vessel density in the fovea (%)	35.25 ± 4.198	41.47 ± 4.804	33.25 ± 1.168	37.47 ± 1.514
Selected flow area (mm^2)	2.244 ± 0.059	2.259 ± 0.059	2.286 ± 0.057	2.313 ± 0.042
RPC density – whole image (%)	50.085 ± 2.432	58.171 ± 1.151	52.728 ± 2.002	57.814 ± 1.007
RPC density – PNO (%)	56.83 ± 3.973	63.72 ± 1.332	63.55 ± 2.597	61.157 ± 2.505
RNFL thickness (μm)	82.25 ± 5.47	124 ± 2.97	86.14 ± 4.18	120.14 ± 2.67

FAZ – foveal avascular zone; CMT – central macular thickness; SCP – superficial capillary plexus; DCP – deep capillary plexus; RPC – radial peripapillary capillary; PNO – *papilla nervi optici*; RNFL – retinal nerve fiber layer

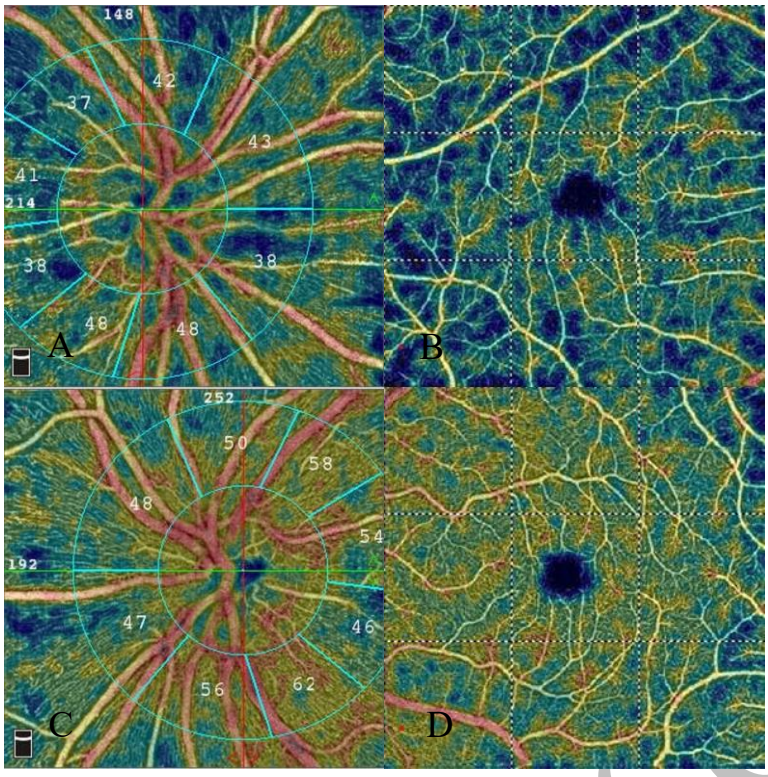

Figure 1. Optical coherence tomography angiography (OCT-A) images of the first patient; images to the left (A, C) represent radial peripapillary capillary vessel density of the right eye (A), left eye (C); images to the right (B, D) represent OCT-A macular superficial layer of the right affected eye B, and the left eye D

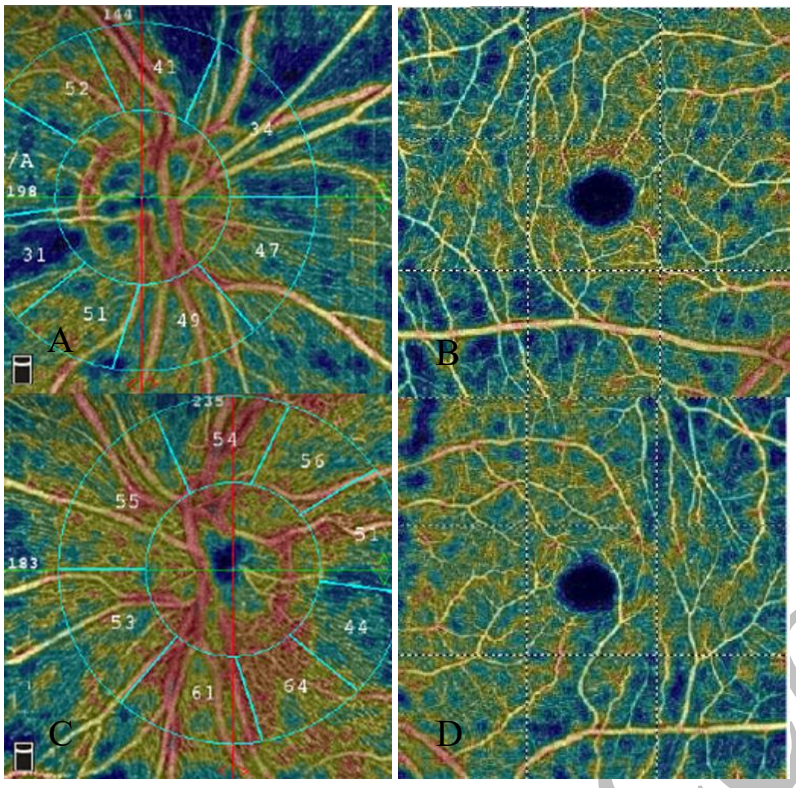

Figure 2. Optical coherence tomography angiography (OCT-A) images of the second patient; images to the left (A, C) represent radial peripapillary capillary (RPC) vessel density of right eye A, left eye C; images to the right (B, D) represent OCT-A macular superficial layer of the right affected eye B, and the left eye D

