

ORIGINAL RESEARCH

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Restoration of photoreceptor layer and its prognostic value in eyes with macular edema due to branch retinal vein occlusion

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Abstract

To evaluate the restoration of outer segment ellipsoid zone (EZ) layer and its prognostic value in visual gain following resolution of macular edema (ME) due to branch retinal vein occlusion (BRVO). In this retrospective study, 33 eyes of 33 patients with ME due to BRVO who underwent intravitreal ranibizumab (IVR) injections were studied. All of the patients had the resolution of macular edema after IVR therapy. At baseline and final visit, SD-OCT scans were obtained. Best-corrected visual acuity (BCVA), central macular thickness (CMT) and integrity of outer segment ellipsoid zone (EZ) defects were determined. We divided the eyes with initial EZ defects into two groups. Group-1 had restoration of EZ and group-2 had EZ defects before and after treatment. 14 of 33 eyes (42.4%) did not have EZ defects and 19 of 33 eyes had EZ defects before treatment. 9 eyes (27.3%) had restoration of EZ defects and 2 patients (6.1%) had EZ defects after treatment while they did not have at initial visit. According to EZ change status (group-1 and group-2) the groups were similar in terms of initial BCVA and CMT. Group-1 had better final BCVA ($p=0.005$). There was a statically significant difference in BCVA improvement between groups ($p=0.001$). Disorganization of photoreceptors can have recovery after resolution of ME with ranibizumab treatment and to have better BCVA after resolution of ME, restoration of the structure of the photoreceptors is required.

Keywords: Branch retinal vein occlusion, macular edema, integrity of photoreceptors layer, optical coherence tomography

Introduction

The main causes of branch retinal vein occlusion (BRVO) are vascular compression during arteriovenous passages, degenerative changes in venous walls and hypercoagulability [1]. These factors increase the amount of vascular endothelial growth (VEGF) factor which can increase vascular permeability and cause macular edema (ME) [2,3]. The most common cause of visual loss in BRVO is ME [4-7]. There are some treatment options for macular edema such as intravitreal dexamethasone implants, laser treatment, and intravitreal injections of anti-vascular endothelial growth factor (anti-VEGF) agents [8,9]. These treatments have effects on resolution of ME. Resolution of ME often leads visual improvement. But sometimes, despite resolution of ME some patients have poor visual acuity. Recently, spectral domain optical coherence tomography (SD-OCT) studies have shown that the integrity of the foveal photoreceptor layer is closely associated with visual function and the restoration of the structure of the foveal photoreceptor is needed to achieve good visual acuity. The

outer segment ellipsoid zone (EZ) is a hallmark of the integrity of the foveal photoreceptor layer. In this study, we aimed to investigate the correlation between EZ change and visual acuity after resolution of ME due to BRVO.

Material and methods

We evaluated 33 eyes of 33 patients who underwent intravitreal ranibizumab (IVR) injections with ME due to BRVO retrospectively at Okmeydanı Research & Training Hospital between January 2015 and January 2017. Patients with central macular thickness (CMT) $>300 \mu\text{m}$ in OCT were treated and the patients with CMT $<300 \mu\text{m}$ were defined as resolution of ME.

Patients with a history of cerebral infarction, anti-VEGF therapy, dexamethasone therapy, vitrectomy, uveitis, glaucoma or other vitreoretinal diseases were excluded.

All of the patients had had standard ophthalmic examinations before treatment and after treatment. At final visit all of the patients had complete resolution of ME. The examinations included slit-lamp microscopy, BCVA, tonometry, SD-OCT, indirect ophthalmoscopy. The BCVA was measured with snellen chart, and the decimal

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visual acuity was converted to the logarithm of the minimal angle of resolution (logMAR) units for the statistical analyses. The OCT acquisition was performed on the SD-OCT (Cirrus HD-OCT; Carl Zeiss Meditec). We noted CMT and integrity of EZ at initial visit and final visit.

Statistical analyses were performed using the SPSS software version 21. Descriptive analyses were presented using means and standard deviations for normally distributed variables. Kruskal-wallis test was used to compare the parameters between the groups. A p value of 0.05 was considered statistically significant.

This retrospective study was conducted in accordance with the Declaration of Helsinki. All necessary authorizations were obtained from the Institutional Review Board of Okmeydanı Research&Traning Hospital, Istanbul,Turkey.

Results

33 eyes of 33 patients who have ME due to BRVO were studied. The mean age was 60.33 ± 10.37 , the mean IVR injections number was 3.76 ± 1.65 , the BCVA and CMT at initial visit were 0.86 ± 0.61 logMAR and $477 \pm 159 \mu\text{m}$. The BCVA and CMT at final visit were 0.40 ± 0.57 and 246 ± 32 . 10 patients (%30) had laser photocoagulation. 19 eyes of 33 patients had EZ defect at initial visit. After treatment 9 eyes(%47) of EZ defects patients had recovered. 2 eyes(%10) of patients who did not have EZ defects had defects after treatment. Table 1 shows the baseline and final clinical characteristics of the patients.

Table 1. The baseline and final clinical characteristics of the patients

Age (years $\pm$ SD)	60.33 ± 10.37
Gender (men/women)	24(%72.7)/9(%27.3)
Mean IVR injections	3.76 ± 1.65
Initial BCVA	0.86 ± 0.61 logMAR
Initial CMT	$477 \pm 159 \mu\text{m}$
Final BCVA	0.40 ± 0.57 logMAR
Final CMT	$246 \pm 32 \mu\text{m}$
Initial EZ defects (yes/no)	19(57.5)/14(42.5)
laser photocoagulation (yes/no)	10(%30)/23(%70)
EZ recovery after treatment	9 eyes of 19 EZ defects patients (%47)

We divided patients who had EZ defects at initial visit into two groups. Group-1 had restoration of EZ and group 2 had EZ defects before and after treatment. Group-1 had 9 eyes while group-2 had 10 eyes. There were no differences between groups in terms of initial BCVA, CMT, age and number of injections. Group-1 had better BCVA at final visit ($p=0.004$) and improvement in BCVA was better in group-1($p=0.002$) (Figure-1). There was not any difference between groups in terms of CMT improvement (Figure-2).

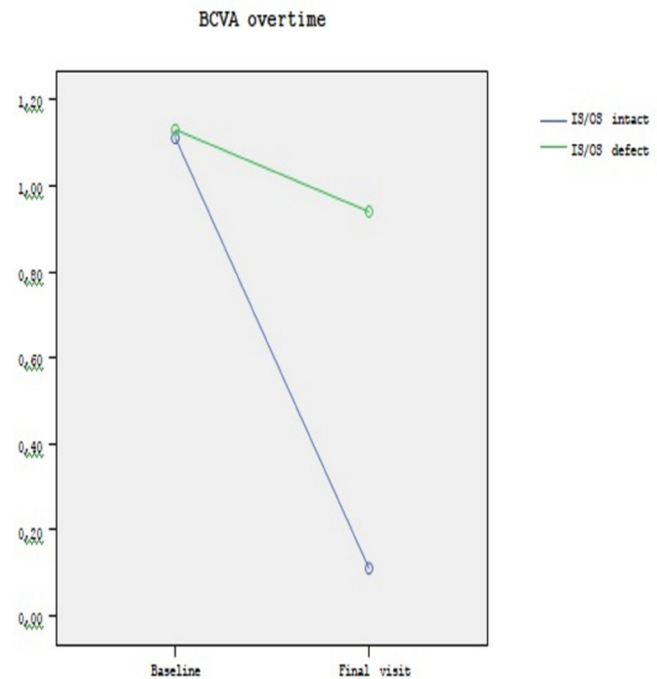


Figure 1. Changes in best corrected visual acuity(BCVA) over time. Group-1 has better BCVA at final visit($p=0.004$) and improvement in BCVA was better in group-1 ($p=0.002$)

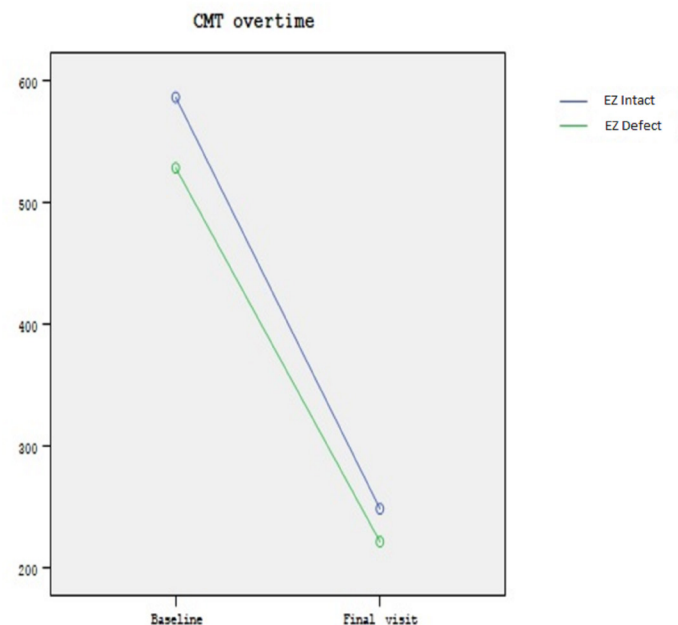


Figure 2. Changes in central macular thickness (CMT) There was not any difference between groups

Discussion

In this study, we wanted to explain why some patients with ME due to BRVO experienced poor visual outcomes even when macular edema was completely resolved, and to determine whether or not affected eyes might be expected to achieve sufficient visual recovery after resolution of ME.

It is widely known that EZ integrity, which is an important indicator of photoreceptor function, has a close relationship with better final visual acuity [10]. Several studies using OCT have shown that the

status of the EZ is significant in patients with retinitis pigmentosa, central serous chorioretinopathy, diabetic macular edema (DME) and even in BRVO [11-16]. Our study showed similar results in patients with BRVO.

Sakamoto et al. suggested that the integrity of the foveal photoreceptor layer is associated with VA after resolution of DME through pars plana vitrectomy [17]. They showed that simple reduction in foveal thickness was insufficient to achieve good visual recovery, and that restoration of the structure of the photoreceptors to a more physiologic condition was required. Also, Otani et al reported that the integrities of the EZ and ELM were strongly correlated with BCVA in DME [18]. Furthermore, Masheshwary et al. showed that not only posttreatment but also pre-treatment conditions of the photoreceptor layer around the fovea were associated with visual outcomes in DME [16]. Similar to them, we also found that restoration of the structure of the photoreceptors was required to have better BCVA.

In a study, Kanra AY. and his friends had shown that final BCVA was associated with initial BCVA and integrity of EZ in patients with BRVO which were treated dexamethasone implantation [19]. In their study, they showed that although patients had recovery in CMT, EZ defects and foveal atrophy affected the final BCVA. Their study supports our results.

Coscas G. et al. studied the patients with BRVO which were treated with dexamethasone implantation. In their study, they showed that with resolution of ME, BCVA was statically significant improved. But they discovered that final BCVA in eyes with EZ defects was significantly poorer than that in eyes with a normal EZ [20].

There are some limitations in this study. First, this is a retrospective study, secondly we have fewer patients. In order to be able to explain this topic better, larger study population and prospective design studies are needed.

Conclusion

In conclusion, we have found that disorganization of photoreceptors can have recovery after resolution of ME with ranibizumab treatment and to have better BCVA after resolution of ME, restoration of the structure of the photoreceptors is required.

Competing interests

The authors declare that they have no competing interest.

Financial Disclosure

The financial support for this study was provided by the investigators themselves.

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