Original Article

Longitudinal changes in peri-papillary retinal nerve fiber layer thickness in patients with unilateral branch retinal vein occlusion

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ABSTRACT

Background: Associations between retinal venous occlusion (RVO), elevated intraocular pressure, and glaucoma have been reported. Further investigations into structural alterations in the fellow eyes of individuals with unilateral RVO have revealed that the peripapillary retinal nerve fiber layer is thinner than in healthy eyes, suggesting that there may be systemic risk factors common to both RVO and glaucoma. We aimed to evaluate changes in peripapillary retinal nerve fiber layer thickness (pRNFLT) among individuals with unilateral branch retinal vein occlusion (BRVO).

Methods: This prospective observational study recruited 30 individuals (60 eyes) with newly diagnosed unilateral BRVO and macular edema, and a control group of 30 healthy individuals (30 eyes) with no abnormalities on fundus examination or concurrent systemic comorbidities. After baseline measurements, the participants were reassessed at 6, 12, and 24 months by measuring global and sectoral pRNFLT using spectral-domain optical coherence tomography.

Results: The mean age and sex distributions were comparable between the patient and control groups (both $P > 0.05$). When compared to fellow eyes, global and sectoral pRNFLT in eyes with BRVO were significantly higher at baseline (all $P < 0.05$). Over time, pRNFLT decreased dramatically, and by the conclusion of the two-year follow-up, there was a significant reduction from baseline in the affected eyes (all $P < 0.05$). Likewise, affected eyes experienced a significant improvement in best-corrected distance visual acuity and central macular thickness over the two-year follow-up (both $P \leq 0.001$). Comparing the global and all-sector pRNFLT of fellow eyes in the patient group with those of normal eyes in the control group, there were no significant differences at any visit, except in the temporal sector, which revealed a significant reduction in pRNFLT at 24 months in the fellow eyes of patients with unilateral BRVO ($P = 0.02$).

Conclusions: Patients with unilateral BRVO experienced a significant reduction in pRNFLT in the affected eyes and, to a lesser extent, in the fellow eyes, compared with that of the control arm, suggesting that they are prone to retinal nerve fiber layer damage. The reduction in pRNFLT in the normal fellow eyes of patients with BRVO may be attributed to age or concurrent systemic comorbidities. Further studies with long follow-up periods are required to shed light on the etiology of functional and structural changes in both the retinal nerve fiber layer and ganglion cell complex in the normal and affected eyes of patients with unilateral BRVO.

KEYWORDS

retinal vein occlusions, branch retinal vein occlusion, retinal edema, optical coherence tomography, peripapillary retinal nerve fiber layer thickness, visual acuities, intraocular pressures

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INTRODUCTION

Retinal vein occlusion (RVO) is a common ocular vascular condition that threatens vision and causes macular edema and severe visual impairment [1]. The vein occlusion can be either branch (BRVO) or central (CRVO), depending on its location [2].

The incidence of BRVO is estimated to be 4 – 6 times higher than that of CRVO [3]. Risk factors for RVO include hypertension (HTN) and other metabolic diseases, such as diabetes mellitus (DM), arteriosclerosis, and hyperlipidemia. Identifying and managing these diseases as early as possible is essential because they are associated with severe cardiovascular and cerebrovascular complications [4].

The Beaver Dam Investigation stated that the cumulative incidences of BRVO and CRVO over 15 years were 1.8% and 0.5%, respectively [5], whereas the cumulative probabilities of a second RVO in the opposite eye within two years and four years were 7.7% and 11.9%, respectively [6]. Therefore, owing to the high incidence of second eye involvement, patients with unilateral RVO must have both eyes examined.

Glaucoma is more common in RVO patients than in healthy individuals [7]. This can be explained by elevated intraocular pressure (IOP), which causes blood vessel constriction and subsequent intimal proliferation, resulting in RVO [8]. Several studies have reported a relationship between RVO development, elevated IOP, and glaucoma [9-11]. Investigations of the fellow eyes of individuals with unilateral RVO have revealed that the peripapillary retinal nerve fiber layer (pRNFL) is thinner than in healthy eyes, suggesting that there may be systemic risk factors common to both RVO and glaucoma [12].

This study aimed to evaluate the longitudinal alterations in pRNFL thickness (pRNFLT) in the affected and unaffected fellow eyes of individuals with newly diagnosed unilateral BRVO.

METHODS

This prospective, longitudinal, comparative study consecutively recruited individuals from December 2020 to August 2022 with newly diagnosed, treatment-naive, unilateral BRVO with macular edema, along with a control group having normal findings on fundus examination and no concurrent systemic comorbidities. This investigation was conducted in accordance with the tenets of the Declaration of Helsinki. The study was approved by the Al-Azhar University Ethics Board. Before recruitment, each patient provided written informed consent.

The exclusion criteria for both groups included a history of retinal or optic nerve diseases, such as glaucomatous optic disc, ischemic optic neuropathy, or optic neuritis; history of trauma, intravitreal injections, vitreoretinal surgeries, and retinal or macular laser treatments; media opacity significantly obscuring the capture of clear images; use of systemic medications, such as corticosteroids, anti-tubercular agents, and any medication that may affect the optic nerve or pRNFLT; and pregnancy or lactation. Individuals in the control group had no history of DM or HTN.

All included participants underwent a thorough documentation of medical and surgical history, along with demographic data encompassing sex and age; a comprehensive ophthalmic evaluation including measurement of uncorrected and best-corrected visual acuities, both near and distant, using a Snellen chart (Auto Chart Projector CP 670; Nidek Co., Ltd., Gamagori, Japan); assessment of IOP using the Goldmann applanation tonometer (AT900; Haag-Streit, Koeniz, Switzerland); anterior and posterior segment slit-lamp examination (Photo-Slit Lamp BX 900; Haag-Streit); and spectral domain optical coherence tomography (SD-OCT, Cirrus, Carl Zeiss Meditec, Dublin, CA, USA).

All patients with unilateral BRVO underwent fundus investigations using an indirect ophthalmoscope (Keeler Instruments Inc., PA, USA) and a + 20-diopter ancillary lens (VOLK Optical Inc., Mentor, OH, USA) and fundus fluorescein angiography (Heidelberg Retinal Angiograph; Heidelberg Engineering, Inc., Dossenheim, Germany) [13]. After confirmation of unilateral BRVO with macular edema, and with informed consent given, each participant underwent three consecutive monthly intravitreal injections of aflibercept (2 mg / 0.05 mL) (VEGF Trap-Eye, Eylea®; Regeneron, Inc., Tarrytown, NY, USA and Bayer Healthcare Pharmaceuticals, Berlin, Germany) [14, 15] in the affected eye. IOP was assessed on the second and seventh days post-injection, then again at 6, 12, and 24 months. During the 6-, 12-, and 24-month follow-ups, measurements of best-corrected distance visual acuity (BCDVA), undilated iris and angle examination for the presence of neovascularization, anterior segment examination, dilated fundus examination, fundus fluorescein angiography, and SD-OCT images to evaluate central macular thickness (CMT) and alterations in the global and sectoral pRNFL thickness were repeated for the patient group.

Following pupillary dilation with 1% tropicamide (Mydrapid eye drops; Alexandria Company for

Pharmaceutical and Chemical Industries, Alexandria, Egypt) to achieve a minimum diameter of 5 mm, a skilled technician conducted SD-OCT imaging for all participants using the peripapillary Fast RNFL program. The circular scan revolved around the optic nerve head, while the studied eye was fixed with an internal fixation light. The pRNFLT was assessed three times by performing a single scan at 256 points, encompassing a fixed diameter of 3.4 mm around the optic disc center. We disregarded scans with low image quality (strength < 7) or noticeably misaligned position of the measurement circle. SD-OCT data were aligned based on the orientation of the right eye. Therefore, the temporal side of the optic disc was observed in both eyes at the 9 o'clock position on the circumpapillary scan. Ultimately, pRNFLT in the nasal, inferior nasal, superior nasal, temporal, inferior temporal, and superior temporal sectors and the global pRNFLT were documented for subsequent analysis [16].

IBM SPSS Statistics for Windows, version 22.0 (IBM Corp., Armonk, NY, USA) was used for statistical analysis. The maximum adjusted BCDVA data were transformed to logarithm of the minimum angle of resolution (logMAR) values. The normality of data distribution was assessed using the Kolmogorov – Smirnov test. Qualitative data are expressed as frequencies and percentages, and quantitative data are expressed as means and standard deviations (SDs). For quantitative data, both independent- and paired-sample *t*-tests were used when applicable. Statistical significance was defined as a *P*-value ≤ 0.05.

RESULTS

Thirty patients (60 eyes) with unilateral BRVO and 30 healthy controls (30 eyes) were recruited. Demographic data of the participants are summarized in Table 1. The mean age and sex distributions were comparable between the patient and control groups (both $P > 0.05$). Some patients had medically controlled HTN (n = 19, 63.3%) or type 2 DM (n = 7, 23.3%) (Table 1).

The global and all-sector pRNFLT values in the BRVO eyes were significantly higher than those in the fellow eyes at baseline (all $P < 0.05$). The pRNFLT of the superior temporal sector was significantly decreased in the affected eyes compared to that of the fellow eyes at 24 months ($P = 0.050$). Despite a significant reduction in the global and all-sector pRNFLT at 24 months compared to baseline values in the affected and fellow eyes (all $P < 0.05$), values were comparable between the two eyes at each follow-up visit (all $P > 0.05$) (Table 2).

Comparing the global and all-sector pRNFLT of the fellow eyes in patients with unilateral BRVO to those of normal eyes in the control group, no significant difference was found at baseline or at each follow-up visit (all $P > 0.05$), except for the temporal sector pRNFLT, which was significantly decreased at 24 months compared with that of eyes in the control group ($P = 0.020$) (Table 3).

In the patient group, the affected eyes demonstrated a significant improvement in BCDVA and CMT at 24 months compared to the baseline values (both $P \leq 0.001$), whereas those of the fellow eyes remained unchanged (both $P > 0.05$) (Table 4). However, at baseline and each follow-up visit, the BCDVA and CMT of the fellow eyes were significantly better than those of the affected eyes (all $P < 0.001$) (Table 4). IOP did not significantly differ from baseline at the end of 24 months in the affected or fellow eyes, or between the affected and fellow eyes at the baseline visit (all $P > 0.05$). However, IOP was significantly lower in the fellow eyes than in the affected eyes at each follow-up visit (all $P < 0.05$) (Table 4).

Table 1. Demographic data of study participants

Variables	Patients with unilateral BRVO (n = 30)	Controls (n = 30)	*P*-value
Age (y), Mean ± SD	55.6 ± 5.6	54.6 ± 6.5	0.490
Sex (Male / Female), n (%)	17 (56.7) / 13 (43.3)	16 (53.3) / 14 (46.7)	0.760
Laterality (OD / OS), n (%)	12 (40.0) / 18 (60.0)	16 (53.3) / 14 (46.7)	0.300
Systemic diseases			
HTN, n (%)	19 (63.3)	0 (0.0)	-
T2DM, n (%)	7 (23.3)	0 (0.0)	-

Abbreviations: BRVO, branch retinal vein occlusion; n, number; y, years; SD, standard deviation; %, percentage; OD, right eye; OS, left eye; HTN, hypertension; T2DM, type 2 diabetes mellitus. Note: In the patient group, *laterality* indicates the eye affected with BRVO; in the control participants, *laterality* indicates the side of the randomly included eye; thirty eyes of 30 healthy individuals were included in the control group.

Table 2. Comparison of pRNFLT in affected versus normal fellow eyes in patients with unilateral BRVO

Variable	Affected eye (n = 30)	Fellow eye (n = 30)	[a] *P*-value
Global pRNFLT (µm), Mean ± SD			
Baseline	117.3 ± 5.5	103.2 ± 5.6	**< 0.001**
6 months	105.6 ± 4.6	102.6 ± 5.9	**0.020**
12 months	103.8 ± 5.3	101.9 ± 6.1	0.180
24 months	101.3 ± 6.3	100.4 ± 6.5	0.500
[b] *P*-value	**< 0.001**	**< 0.01**	
Nasal sector pRNFLT (µm), Mean ± SD			
Baseline	85.4 ± 14.3	76.2 ± 18.0	**0.030**
6 months	79.0 ± 16.9	75.4 ± 18.0	0.400
12 months	76.4 ± 17.5	74.6 ± 18.2	0.600
24 months	74.2 ± 18.1	73.8 ± 18.4	0.900
[b] *P*-value	**< 0.001**	**< 0.01**	
Inferior nasal sector pRNFLT (µm), Mean ± SD			
Baseline	126.7 ± 15.9	116.7 ± 18.9	**0.020**
6 months	117.9 ± 18.3	116.1 ± 19.4	0.700
12 months	115.7 ± 19.0	115.2 ± 19.5	0.900
24 months	113.3 ± 19.6	114.4 ± 19.8	0.800
[b] *P*-value	**< 0.001**	**< 0.01**	
Superior nasal sector pRNFLT (µm), Mean ± SD			
Baseline	131.4 ± 12.7	119.7 ± 16.4	**0.003**
6 months	122.2 ± 15.0	119.4 ± 16.6	0.500
12 months	119.3 ± 16.3	118.9 ± 16.9	0.900
24 months	118.1 ± 16.5	117.7 ± 17.0	0.900
[b] *P*-value	**< 0.001**	**< 0.01**	
Temporal sector pRNFLT (µm), Mean ± SD			
Baseline	99.8 ± 9.2	75.8 ± 16.7	**< 0.001**
6 months	82.1 ± 14.5	75.1 ± 16.8	0.080
12 months	80.0 ± 14.3	74.9 ± 16.6	0.200
24 months	75.5 ± 16.3	73.5 ± 17.0	0.600
[b] *P*-value	**< 0.001**	**< 0.01**	
Inferior temporal sector pRNFLT (µm), Mean ± SD			
Baseline	157.8 ± 9.6	141.8 ± 15.0	**< 0.001**
6 months	140.6 ± 14.4	142.9 ± 14.0	0.500
12 months	140.0 ± 14.1	142.5 ± 13.7	0.400
24 months	135.5 ± 15.9	142.4 ± 13.8	0.700
[b] *P*-value	**< 0.001**	**< 0.02**	
Superior temporal sector pRNFLT (µm), Mean ± SD			
Baseline	152.4 ± 11.2	133.2 ± 18.3	**< 0.001**
6 months	131.7 ± 17.4	133.6 ± 17.9	0.600
12 months	126.5 ± 18.6	133.4 ± 18.1	0.100
24 months	120.6 ± 19.8	130.3 ± 18.7	**0.050**
[b] *P*-value	**< 0.001**	**< 0.01**	

Abbreviations: pRNFLT, peri-papillary retinal nerve fiber layer thickness; BRVO, branch retinal vein occlusion; µm, micrometers; SD, standard deviation. Note: *P*-values < 0.05 are shown in bold; [a] *P*-value comparing pRNFLT in the affected and fellow eyes during each visit using the independent *t*-test; [b] *P*-value comparing pRNFLT in the affected or fellow eyes at baseline and 24 months using the paired *t*-test.

Table 3. Comparison of pRNFLT in fellow eyes of patients with unilateral BRVO versus normal eyes of the control group

Variable	Fellow eyes (n = 30)	Normal eyes (n = 30)	[a] *P*-value
Global pRNFLT (µm), Mean ± SD			
Baseline	103.2 ± 5.6	102.3 ± 6.0	0.500
6 months	102.6 ± 5.9	101.5 ± 6.4	0.500
12 months	101.9 ± 6.1	100.9 ± 6.7	0.500
24 months	100.4 ± 6.5	100.4 ± 6.9	0.600
[b] ***P*-value**	**< 0.01**	**< 0.01**	
Nasal sector pRNFLT (µm), Mean ± SD			
Baseline	76.2 ± 18.0	72.3 ± 18.9	0.400
6 months	75.4 ± 18.1	70.4 ± 18.9	0.200
12 months	74.6 ± 18.2	69.4 ± 18.9	0.200
24 months	73.8 ± 18.4	66.9 ± 18.4	0.100
[b] ***P*-value**	**< 0.01**	**< 0.001**	
Inferior nasal sector pRNFLT (µm), Mean ± SD			
Baseline	116.7 ± 18.9	114.1 ± 20.1	0.600
6 months	116.1 ± 19.4	116.9 ± 19.2	0.800
12 months	115.2 ± 19.5	114.7 ± 19.8	0.900
24 months	114.4 ± 19.8	113.8 ± 20.2	0.900
[b] ***P*-value**	**< 0.01**	0.190	
Superior nasal sector pRNFLT (µm), Mean ± SD			
Baseline	119.7 ± 16.4	120.6 ± 17.0	0.800
6 months	119.4 ± 16.6	118.9 ± 17.4	0.900
12 months	118.9 ± 16.9	118.1 ± 17.6	0.800
24 months	117.7 ± 17.0	117.7 ± 17.8	0.900
[b] ***P*-value**	**< 0.01**	**< 0.01**	
Temporal sector pRNFLT (µm), Mean ± SD			
Baseline	75.8 ± 16.7	77.3 ± 17.2	0.700
6 months	75.1 ± 16.8	78.8 ± 17.5	0.400
12 months	74.9 ± 16.6	81.6 ± 17.8	0.100
24 months	73.5 ± 17.0	84.4 ± 18.4	**0.020**
[b] ***P*-value**	**< 0.01**	**< 0.01**	
Inferior temporal sector pRNFLT (µm), Mean ± SD			
Baseline	141.8 ± 15.0	137.6 ± 16.4	0.300
6 months	142.9 ± 14.0	138.4 ± 16.3	0.200
12 months	142.5 ± 13.7	140.3 ± 16.4	0.500
24 months	142.4 ± 13.8	140.6 ± 16.8	0.600
[b] ***P*-value**	**< 0.02**	**< 0.01**	
Superior temporal sector pRNFLT (µm), Mean ± SD			
Baseline	133.2 ± 18.3	132.6 ± 18.9	0.900
6 months	133.6 ± 17.9	134.2 ± 19.1	0.800
12 months	133.4 ± 18.1	131.1 ± 19.3	0.600
24 months	130.3 ± 18.7	130.1 ± 19.3	0.900
[b] ***P*-value**	**< 0.01**	**< 0.01**	

Abbreviations: pRNFLT, peri-papillary retinal nerve fiber layer thickness; BRVO, branch retinal vein occlusion; µm, micrometers; SD, standard deviation. Note: *P*-values < 0.05 are shown in bold; [a] *P*-value comparing pRNFLT in the normal fellow eyes of patients with unilateral BRVO with that of normal eyes in the control group during each visit using the independent *t*-test; [b] *P*-value comparing pRNFLT in the normal fellow eyes of patients with unilateral BRVO or normal eyes in the control group at baseline versus at 24-months using the paired *t*-test.

Table 4. Mean BCDVA, CMT, and IOP at baseline and follow-up visits in affected versus normal fellow eyes of patients with unilateral BRVO

Variable		Time Point				[b] *P*-value
		Baseline	6 months	12 months	24 months	
BCDVA (logMAR), Mean ± SD	Affected eyes	1.3 ± 0.3	1.0 ± 0.3	0.6 ± 0.2	0.4 ± 0.2	**≤ 0.001**
	Fellow eyes	0.1 ± 0.1	0.2 ± 0.1	0.2 ± 0.1	0.2 ± 0.1	0.100
	[a] *P*-value	**≤ 0.001**	**≤ 0.001**	**≤ 0.001**	**≤ 0.001**	
CMT (μm), Mean ± SD	Affected eyes	647.4 ± 140.5	379.5 ± 90.4	283.9 ± 31.3	242.9 ± 20.9	**≤ 0.001**
	Fellow eyes	203.6 ± 10.4	203.6 ± 10.3	202.9 ± 10.1	202.70 ± 10.0	0.400
	[a] *P*-value	**< 0.001**	**< 0.001**	**< 0.001**	**< 0.001**	
IOP (mmHg), Mean ± SD	Affected eyes	16.0 ± 1.9	16.6 ± 1.8	15.7 ± 1.0	15.0 ± 1.1	0.230
	Fellow eyes	15.8 ± 1.6	15.5 ± 1.6	14.9 ± 1.0	14.3 ± 1.2	0.540
	[a] *P*-value	0.600	**0.010**	**0.002**	**0.020**	

Abbreviations: BCDVA, best-corrected distance visual acuity; CMT, central macular thickness; IOP, intraocular pressure; BRVO, branch retinal vein occlusion; logMAR, logarithm of minimal angle of resolution; SD, standard deviation; μm, micrometers; mmHg, millimeters of mercury. Note: *P*-values < 0.05 are shown in bold; [a] *P*-value comparing BCDVA, CMT, and IOP in the affected and fellow eyes during each visit using the independent *t*-test; [b] *P*-value comparing BCDVA, CMT, and IOP in the affected or fellow eyes at baseline and 24 months using the paired *t*-test.

DISCUSSION

We observed a significant reduction in global and all-sector pRNFLT and an improvement in BCDVA and CMT in eyes with BRVO that received three loading injections of aflibercept at monthly intervals. In the two-year follow-up, except for the pRNFLT of the superior temporal sector, which was significantly thinner in the affected eyes at the 24-month visit, the global pRNFLT and pRNFLT in the other sectors were comparable between the two eyes at each follow-up visit. Comparing the global and all-sector pRNFLT of the fellow eyes with those of age- and sex-matched healthy individuals, we found no significant differences at baseline or at each follow-up visit, except for a significantly thinner temporal sector pRNFLT at 24 months in the fellow eyes of patients with unilateral BRVO.

RVO is a prevalent retinal vascular disease with serious implications for vision [17]. There is a longstanding recognition of the association of RVO with glaucoma [9-11, 18]. Some have suggested that this is not a simple cause-and-effect relationship but rather a reflection of underlying systemic vascular diseases such as atherosclerosis, HTN, and DM [18]. We documented medically controlled HTN and type 2 DM in 63.3% and 23.3% of the patients with unilateral BRVO, respectively.

Owing to the systemic risk factors shared by RVO and glaucoma, researchers have concentrated on the healthy fellow eyes of patients with RVO for timely detection of glaucomatous changes [7, 9, 19]. Examination for the presence of glaucomatous damage in eyes affected by RVO would be beneficial to explore the potential connections between these two conditions [9]. However, this approach is not feasible, as retinal edema is present in the initial phase of RVO [20], increasing the pRNFLT in the affected sectors. Therefore, it is better to consider measurements in the fellow eyes. Consequently, we evaluated the longitudinal changes in pRNFLT among individuals with unilateral BRVO in the affected and fellow eyes.

Similar to the findings of Ahn et al. [16] and Kim et al. [21], we observed a significant decrease in global and sectoral pRNFLT at 24 months in affected eyes with BRVO. By comparing the global and sectoral pRNFLT of the fellow eyes of our patients to those of the control group at 24 months, the difference was not significant, except in the temporal sector, in which the RNFL was significantly thinner in the normal fellow eyes of the patients than in the controls. Ahn et al. [16] found comparable global and all-sector pRNFLT between the fellow eyes of patients with unilateral BRVO and controls at baseline and at 6, 12, and 24 months. Similar to Ahn et al., we found significantly higher baseline global and all-sector pRNFLT values in affected eyes than in normal fellow eyes [16]. However, this difference disappeared throughout the follow-up period, except in the superior temporal sector, in which the pRNFLT was significantly decreased in the affected eyes compared to the fellow eyes at 24 months. BCDVA and CMT were significantly improved in the affected eyes at 24 months. We observed IOP changes in neither the affected nor the normal fellow eyes. These findings are consistent with those of Ahn et al. [16].

In contrast to our findings, an observational cross-sectional study by Kim et al. [12] showed significantly

thinner average RNFL and inferior-quadrant RNFL in the fellow eyes of patients with RVO than in the control group. Using OCT, Shin et al. [22] found significantly thinner average and inferior RNFLs as well as ganglion cell-inner plexiform layers in the fellow eyes of patients with RVO than in normal controls. However, similar to our observations at 24 months, the temporal sector RNFL was significantly thinner in the fellow eyes of patients with RVO than in normal controls in studies by Kim et al. [12] and Shin et al. [22]. Further longitudinal studies should verify the significance of these findings. Both studies [12, 22] did not exclude controls with concurrent systemic comorbidities and had no longitudinal RNFL assessment. This may explain the differences observed between their findings and those of our study.

Using a single measurement, Fan et al. [23] observed that the pRNFLT was similar in both fellow RVO eyes and normal eyes in the superior hemisphere and the superior and nasal sectors, but significantly thinner in the inferior hemisphere and the inferior and temporal sectors, as well as the average pRNFLT. We observed that the temporal pRNFLT was significantly lower in fellow eyes than in normal eyes. Although we included apparently healthy individuals in the control group, Fan et al. [23] did not exclude controls with concurrent systemic comorbidities. Furthermore, we recorded longitudinal changes in pRNFLT over a two-year period rather than using a single reading.

Inferior pRNFLT had the strongest correlation with visual function and the best performance in discriminating between glaucoma and suspected glaucoma [24]. The fellow eyes of our patients with unilateral BRVO had a significant thinning of the inferior nasal sector pRNFLT at 24 months compared with baseline, and this remained unchanged in controls but was comparable in all follow-ups. The observed longitudinal changes may be due to the hypothesized association between RVO and glaucoma. However, a study on diagnostic accuracy is required to verify this inference. Individuals with prediabetes have a significantly thinner temporal pRNFLT than those with normal glucose metabolism [25]. We found significant thinning in the mean values of the temporal sector pRNFLT in fellow eyes at 24 months compared to baseline, and it increased in controls. This difference may be attributable to the systemic comorbidities documented in the patient group, which were absent in the controls. We recommend longitudinal studies involving patients with systemic comorbidities in different age groups to prove or disprove this reasoning.

The current study featured a long follow-up period, which is a significant strength compared to those of several studies on RVO and pRNFL. However, our study was limited by its small sample size, including patients with BRVO but not CRVO, and by evaluating structural changes in the pRNFL, not functional changes, using a visual field test. Further studies with larger sample sizes, including both CRVO and BRVO, are needed to assess their differences and evaluate the relationship between them and the occurrence of glaucoma. In addition, future studies should include simultaneous evaluation of structural and optic nerve functional changes.

CONCLUSIONS

A substantial reduction in pRNFLT can be detected over time in the affected eyes and, to a small extent, in the fellow eyes of patients with unilateral BRVO compared to normal controls. Therefore, close and regular observation is advisable for the timely detection of changes in the pRNFL in both affected and normal fellow eyes following RVO. Future longitudinal studies with simultaneous evaluations of structural and optic nerve functional changes are needed to verify these findings.

ETHICAL DECLARATIONS

Ethical approval: This investigation was conducted in accordance with the tenets of the Declaration of Helsinki. The study was approved by the Al-Azhar University Ethics Board. Before recruitment, each patient provided written informed consent.
Conflict of interest: None.

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