Longitudinal Changes in Retinal Nerve Fiber Layer Thickness after Acute Primary Angle Closure Measured with Optical Coherence Tomography

Jen-Chia Tsai, Pei-Wen Lin, Mei-Ching Teng, and Ing-Chou Lai

Purpose. Longitudinal follow-up of peripapillary retinal nerve fiber layer (RNFL) thickness after an episode of acute primary angle closure (APAC) using Stratus optical coherence tomography (OCT).

Methods. Seventeen patients who had experienced a single unilateral APAC episode (intraocular pressure, >50 mm Hg) were enrolled. The average and superior, temporal, inferior, and nasal quadrant RNFL thicknesses of the affected and fellow eyes at 1, 4, and 12 weeks after remission were compared by using StratusOCT. The relationship between average RNFL thickness and interval of follow-up were evaluated with regression analysis.

Results. The mean duration of the APAC episode was 13.8 hours (range, 3–40). Comparison of the average and four quadrant RNFL thicknesses in the affected eyes longitudinally showed significant differences between 1 and 4, and 1 and 12 weeks, but not between 4 and 12 weeks. The average and four-quadrant RNFL thicknesses for the affected eyes were greater than the analogous values for fellow eyes at 1 week. In contrast, the inferior- and superior-quadrant RNFL thicknesses for the affected eyes were lower at 4 and 12 weeks, whereas the average and nasal quadrant values for the affected eyes were lower than those in fellow eyes at 12 weeks. Average RNFL thickness for the affected eyes was correlated with the interval of follow-up by using inverse regression analysis ($P < 0.001$; $R^2 = 0.60$). Controlling for duration of APAC episode, the interval of follow-up on RNFL thickness reduction remained significant ($P < 0.001$, $r = -0.69$).

Conclusions. This study demonstrated an initial increase in diffuse RNFL thickness after a single APAC episode, followed by a subsequent decrease. (*Invest Ophthalmol Vis Sci.* 2007; 48:1659–1664) DOI:10.1167/iovs.06-0950

Acute primary angle closure (APAC) is an ophthalmic emergency and a potentially blinding disease. Optic nerve damage can occur after the sudden rise in intraocular pressure (IOP) associated with an APAC episode. The optic disc appears edematous during this episode, and pallor with or without cupping may develop after remission. When treatment is delayed, vision may be markedly reduced to hand movement or light perception.[1] Perimetric examination during acute episodes is difficult and usually unreliable. After remission, visual field defects vary greatly in severity and type.[2] Measurement of retinal nerve fiber layer (RNFL) thickness loss after APAC is very important, as it is both objective and sensitive in terms of detection of the optic disc damage with either normal or unreliable visual fields.

Scanning laser polarimetry with fixed corneal compensator (SLP-FCC) has been used for quantification of RNFL thickness change after APAC in cross-sectional study,[3,4] and, at 2 and 16 weeks after APAC.[5] However, the latter investigation included several patients with poor IOP control after an APAC episode, as determined by RNFL measurement at follow-up. Moreover, SLP-FCC has limited functionality in measurement of RNFL thickness because of the lack of correction for variation in corneal polarization axis and corneal curvature.[6]

StratusOCT is a powerful imaging technology that can measure RNFL thickness and image tissue structure to an axial resolution of <10 μm.[7] The stronger association with function in StratusOCT RNFL measurement compared with SLP-VCC suggests that the former may be superior for evaluation of glaucoma progression.[8] Therefore, the purpose of this study was to use StratusOCT to detect longitudinal change (1–12 weeks) in RNFL thickness after remission from a single APAC episode.

Materials and Methods

In this prospective study, longitudinal observations were made using RNFL measurements obtained from StratusOCT at 1, 4, and 12 weeks after a single episode of unilateral APAC. Seventeen consecutive patients were recruited while undergoing treatment in the emergency or the ophthalmology outpatient departments of the Chang Gung Memorial Hospital-Kaohsiung Medical Center over a 1-year period. The study and data accumulation were in conformity with all relevant Taiwanese laws, and the investigation was conducted in accordance with the tenets of the Declaration of Helsinki.

The APAC definition used for the study consisted of: (1) at least two of the following symptoms: eye pain, headache, blurred vision, and vomiting; (2) presence of all the following signs: conjunctival congestion, fixed mid-dilated pupil, and corneal edema; (3) closure of the chamber angle found on gonioscopic examination; and, (4) IOP > 50 mm Hg by Perkins applanation tonometry.

The inclusion criteria were: (1) duration of episode less than 48 hours (interval from onset of acute symptoms to first hospital presentation); (2) resolution of acute episode and IOP control (<21 mm Hg) after antiglaucoma medication prescribed on first presentation, with interval between presentation and resolution under 2 hours (patients were treated with intravenous mannitol drip, oral acetazolamide, topical β-blocker and pilocarpine; the IOP was then rechecked 30 to 60 minutes after treatment); (3) subsequent laser iridotomy (LI) performed within 2 days of presentation on both affected and fellow eyes; and, (4) IOP < 21 mm Hg in both eyes for up to 12 weeks after treatment. Antiglaucoma medication was used to control IOP before and after LI in both eyes to prevent elevation (IOP > 21 mm Hg).

The exclusion criteria were: (1) history of previous APAC in the affected or fellow eyes; (2) previous intraocular surgery, coexisting

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retinal disease, nonglaucomatous optic neuropathy or corneal disease; (3) corneal edema or corneal opacity persisting after APAC episode; (4) suspected chronic glaucoma, that is, cup-to-disc ratio (CDR) > 0.5 or asymmetric CDR > 0.2 between eyes, and typical diffuse or focal neuroretinal rim thinning from initial stereoscopic fundus examination; (5) poor quality OCT scan in which the scanning algorithm failed; and, (6) best corrected visual acuity (BCVA) < 20/50, refraction ≥ ±5.0 D (sphere) or 3 D (cylinder) in the affected or fellow eye after remission.

Swedish Interactive Thresholding Algorithm (SITA) standard 30-2 Humphrey automated perimetry (Carl Zeiss Meditec Inc., Dublin, CA) was performed 2 months after the APAC episode. Reliability criteria were: false negative <33%; false positive <33%; and, fixation loss <20%. A normal visual field (VF) was defined as mean deviation (MD) and pattern SD (PSD) within 95% confidence intervals, and a glaucoma hemifield test (GHT) result "within normal limits." A glaucomatous VF defect was defined as a VF with a GHT result "outside normal limits" and a PSD outside 95% confidence intervals. The GHT result, "generalized reduction of sensitivity" was applied where the VF did not satisfy the criteria for glaucomatous VF defect.

Optical Coherence Tomography Measurement

Peripapillary RNFL thickness was automatically calculated by Fast RNFL thickness of StratusOCT 3000 (ver. 4.0.2; Carl Zeiss Meditec, Inc.). At least three images were acquired from each eye, each consisting of 256 A-scan measurement points along a circular ring (diameter, 3.4 mm) around the optic disc. The details of this technique have been described previously.[7,9] Pupils were dilated with tropicamide 1% and phenylephrine 10%. Only high-quality images (signal strength, ≥6; maximum, 10) were included. The following RNFL measurements were analyzed: the average thickness (360° measurement), and those of the superior, nasal, inferior, and temporal quadrants.

Statistical Analysis

The RNFL thicknesses within the affected and fellow eyes at 1, 4, and 12 weeks were analyzed by using analysis of variance with Bonferroni correction. The RNFL thickness differences between the affected and fellow eyes at 1, 4, and 12 weeks for these measurements were compared using the two-tailed Student's *t*-test. $P < 0.05$ was considered to be statistically significant for all comparisons.

The relationships between the average RNFL thickness, VF index, and, duration of APAC episode, and, of subsequent follow-up were evaluated using univariate and multivariate regression analysis and Pearson correlation. $P < 0.01$ was considered statistically significant (SPSS software; ver. 12, SPSS Inc., Chicago, IL).

Results

The mean (±SD) duration of an APAC episode was 13.8 ± 10.6 hours (range, 3–40). Patient characteristics are shown in Table 1. The IOP measurements at presentation in the affected eyes were stratified (according to the maximum marker in Perkins applanation tonometry) as follows: 51 to 60 mm Hg ($n = 3$) and >60 mm Hg ($n = 14$).

In terms of RNFL thickness in the affected eyes, significant differences were demonstrated comparing 1 and 4 and 1 and 12 weeks for the average and four-quadrant RNFL thicknesses; however, no such differences were demonstrated between 4 and 12 weeks (Table 2).

Analogous longitudinal comparison of the RNFL thickness in the fellow eyes did not yield significant differences for the average ($P = 0.44$), superior ($P = 0.20$), nasal ($P = 0.82$), inferior ($P = 0.16$) or temporal quadrants ($P = 0.97$) at 1, 4, and 12 weeks.

The superior ($P < 0.001$, $R^2 = 0.45$), nasal ($P < 0.001$, $R^2 = 0.50$), inferior ($P < 0.001$, $R^2 = 0.46$), and temporal quadrant ($P < 0.001$, $R^2 = 0.34$) and average RNFL thicknesses for the affected eyes were correlated with post-APAC follow-up interval by inverse regression analysis (Fig. 1). Average RNFL thickness in the affected eyes was associated with duration of APAC episode at 4 ($P < 0.001$, $r = -0.69$) and 12 weeks ($P < 0.001$, $r = -0.92$), but not at 1 week ($P = 0.26$, $r = 0.20$) from linear regression analysis and Pearson correlation.

Controlling for duration of APAC episode with multivariate regression, the follow-up interval remained statistically significant for average RNFL thickness reduction ($P < 0.001$, $r = -0.69$).

Four of the affected eyes had repeatable glaucomatous VF defects, and five had a generalized reduction of sensitivity, with VF normal in the remaining eight and all the fellow eyes. Average RNFL thickness in the affected eyes correlated with MD and PSD at 12 weeks ($P < 0.001$, $r = 0$ 0.91 and $P = 0.004$, $r = -0.67$, respectively), but not at 1 week ($P = 0.78$, $r = -0.074$ and $P = 0.50$, $r = -0.18$, respectively) or 4 weeks ($P = 0.05$, $r = 0.48$ and $P = 0.18$, $r = -0.34$, respectively). One of the eight affected eyes with normal VF had abnormal average RNFL thickness (outside 95% confidence intervals, as determined by OCT software) at 12 weeks.

In terms of the intereye difference, the RNFL thicknesses (average and four quadrants) in the affected eyes were significantly greater than were the analogous thicknesses in the fellow eyes at 1 week after the APAC episode. In contrast, the inferior and superior quadrant RNFL thicknesses in the affected eyes were lower at 4 and 12 weeks, whereas the analogous average and nasal-quadrant RNFL dimensions were lower only at 12 weeks compared with the fellow eyes (Table 3).

Figure 2 shows a typical example of OCT findings and the optic disc photographs for an affected eye at 1, 4, and 12 weeks after APAC.

Table 1. Patient Characteristics after Unilateral APAC with RNFL Thickness Measurements using StratusOCT

	Affected Eyes ($n = 17$)	Fellow Eyes ($n = 17$)	P^*
Age (y)	58.8 ± 8.4 (41–71)		
Males/females	6/11		
Refraction (D)	0.8 ± 1.5	1.1 ± 1.2	0.63
Visual field			
MD (dB)	−2.0 ± 1.7	−0.8 ± 0.7	0.01
PSD (dB)	1.8 ± 1.0	1.3 ± 0.5	0.07
IOP (mm Hg)			
1 week	12.6 ± 2.9	12.4 ± 2.6	0.72
4 weeks	12.6 ± 2.7	12.8 ± 2.8	0.84
12 weeks	13.1 ± 3.1	12.6 ± 2.7	0.41

RNFL, retinal nerve fiber layer; OCT, optical coherence tomography; D, diopter of spherical equivalent; IOP, intraocular pressure; MD, mean deviation; PSD, pattern standard deviation. Data are the mean ± standard deviation and range.

* A paired *t*-test (two-tailed); $P < 0.05$ is significant difference.

Discussion

Comparing the affected eyes with their fellow counterparts provides a possible explanation for the greater average and four-quadrant RNFL thicknesses at 1 week—that is, the apparent edema of the optic nerve head after APAC episode, with mild edema possibly persisting at 1 week after onset in spite of remission. OCT measurement of RNFL thickness is influenced by optic disc edema from optic neuropathy, retinal vein occlusion, mild papilledema or pseudopapilledema; greater RNFL thickness was evident relative to control subjects.[10,11] Tso and Fine[12] also found that peripapillary RNFL thickness increased in patients with optic disc edema from histopathology. There-

TABLE 2. RNFL Thickness Measurements from StratusOCT in Affected Eyes at 1, 4, and 12 Weeks after APAC

	1 Week (n = 17)	4 Weeks (n = 17)	12 Weeks (n = 17)	P
Average thickness	141.3 ± 20.4 (131–152)	103.8 ± 13.9 (97–111)	91.6 ± 17.3 (82–100)	<0.001
Superior quadrant	173.5 ± 39.8 (153–194)	123.9 ± 26.9 (110–138)	107.6 ± 27.6 (93–122)	<0.001
Nasal quadrant	108.5 ± 21.5 (98–120)	80.2 ± 14.5 (73–88)	71.1 ± 11.9 (65–77)	<0.001
Inferior quadrant	182.8 ± 35.9 (164–201)	129.7 ± 26.3 (116–143)	117.8 ± 31.8 (101–134)	<0.001
Temporal quadrant	98.6 ± 24.4 (86–111)	75.6 ± 14.3 (68–83)	66.9 ± 16.4 (58–75)	<0.001

Data are mean micrometers ± SD and 95% CI. According to analysis of variance with Bonferroni correction. $P < 0.05$ is significant. Significant difference between 1 and 4 weeks ($P < 0.001$), and between 1 and 12 weeks ($P < 0.001$) for average thickness, and inferior, superior, and nasal quadrants. Significant difference between 1 and 4 weeks ($P = 0.003$), and between 1 and 12 weeks ($P < 0.001$) for temporal quadrant. No significant difference between 4 and 12 weeks for average thickness ($P = 0.27$), and superior ($P = 0.38$), nasal ($P = 0.43$), inferior ($P = 0.76$), and temporal quadrants ($P = 0.62$).

fore, real RNFL defects are not revealed using OCT measurement of RNFL thickness during the edematous stage of the underlying disease.

Quigley and Anderson[13] studied the degree of axonal transport blockade in various areas of the optic nerve head in 19 squirrel monkey eyes with acute IOP elevation (50–90 mm Hg) for 7 hours. Further, a marked transport blockade occurred throughout the nerve head, although the superior and inferior poles were somewhat more affected. This short-term transport blockade over the entire nerve head corresponds to the diffuse damage seen with acute glaucoma. Swelling of the optic disc during acute IOP elevation is due to total block of rapid transport in some axons, with gradual axon death developing in the ganglion cells, which cannot tolerate the blockade.[14]

Yoles and Schwartz[15] have suggested a mechanism whereby glaucomatous neuropathy continues to progress, even after alleviation of the high IOP. This mechanism involves processes collectively termed secondary degeneration, wherein there is a propagative effect on apparently healthy neurons that have escaped the primary insult but are adjacent to the injured neurons and are thus exposed to the degenerative milieu created by the latter.

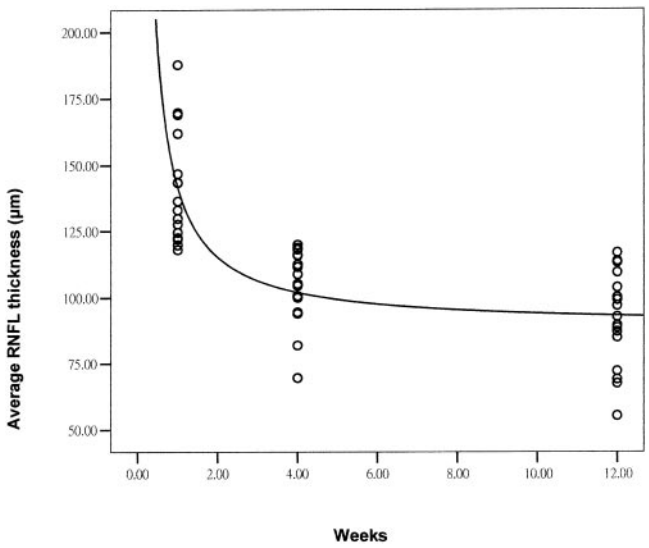

FIGURE 1. The relationship between follow-up interval after acute primary angle closure (1, 4, and 12 weeks) and average RNFL thickness, as measured by optical coherence tomography; the correlation was statistically significant according to inverse regression analysis ($y = 52.9/x + 88.7$, $P < 0.001$, $R^2 = 0.60$).

These findings are in general agreement with the increased average and four-quadrant RNFL thicknesses in the affected eyes in our study compared with their fellow eyes at 1 week after APAC and the progressive longitudinal decrease in this value. Thus, the RNFL thicknesses of some of the quadrants in the affected eyes and the averaged valued were lower than analogous fellow measurements at 4 and 12 weeks of follow-up.

Factors that influence the RNFL thickness measurements after an episode of APAC include duration of acute episode, interval to measurement of RNFL thickness, IOP control after APAC, and imaging modality. Thus, the variety of the reported RNFL thickness results after APAC according to SLP-FCC is hardly surprising. Tsai and Chang[3] used SLP-FCC to measure RNFL thickness 1 month after a single APAC episode (duration, <48 hours), finding no significant differences in the RNFL thickness parameters (average or any quadrant); however, significant differences were demonstrated for some standard SLP parameters, including the superior, inferior, and superior-nasal ratios, and maximum and ellipse modulation values, in comparison with normal subjects.

In their comparison of affected and fellow eyes, Lai et al.,[4] reported significant differences only for the mean inferior ratio and ellipse modulation values (episode duration, >48 hours) from the 12 standard scanning laser polarimetry measurement parameters at 6 months after a single APAC episode. In contrast, no significant changes in any RNFL thickness parameter were documented in eyes in which episode duration was less than 48 hours.

Aung et al.,[5] observed RNFL thickness measurement parameters at 2 weeks after APAC, and again at 16 weeks, with associated SLP parameters also compared within the affected eyes. In the APAC eyes, the superior average RNFL thickness decreased slightly from 63.8 ± 13.6 to 61.4 ± 11.2 μm (P = 0.04), whereas the inferior average decreased from 69.5 ± 14.4 to 66.3 ± 12.6 μm. However, there were study limitations: the inclusion threshold for IOP measurement during an acute episode of just IOP > 21 mm Hg and no details on optic nerve head status and episode duration. Further, IOP control was poor (>21 mm Hg) in 10.8% of the patients in Aung et al. 2 to

TABLE 3. RNFL Thickness Measurements from StratusOCT for Affected and Fellow Eyes at 1, 4 and 12 Weeks after APAC

	Affected Eyes (n = 17)	Fellow Eyes (n = 17)	*P	95% CI of Difference
1 Week				
Average thickness	141.3 ± 20.4 (131–152)	113.7 ± 7.9 (110–118)	<0.001	15.6–39.6
Superior quadrant	173.5 ± 39.8 (153–194)	141.4 ± 12.2 (135–148)	0.005	11.3–52.9
Nasal quadrant	108.5 ± 21.5 (98–120)	86.7 ± 15.3 (79–95)	0.016	4.7–38.9
Inferior quadrant	182.8 ± 35.9 (164–201)	156.3 ± 19.7 (146–166)	0.008	8.0–44.9
Temporal quadrant	98.6 ± 24.4 (86–111)	74.6 ± 8.8 (70–79)	0.001	10.9–37.0
4 Weeks				
Average thickness	103.8 ± 13.9 (97–111)	110.2 ± 9.2 (105–115)	0.12	−14.6–1.9
Superior quadrant	123.9 ± 26.9 (110–138)	136.4 ± 14.6 (129–144)	0.047	−24.7–−0.2
Nasal quadrant	80.2 ± 14.5 (73–88)	85.7 ± 18.8 (76–95)	0.34	−17.4–6.3
Inferior quadrant	129.7 ± 26.4 (116–143)	144.4 ± 20.1 (134–155)	0.021	−26.8–−2.5
Temporal quadrant	75.6 ± 14.3 (68–83)	75.5 ± 14.6 (68–83)	0.96	−6.4–6.7
12 Weeks				
Average thickness	91.6 ± 17.7 (82–100)	112.3 ± 7.7 (108–116)	<0.001	−29.0–−12.4
Superior quadrant	107.6 ± 27.6 (93–122)	133.7 ± 11.4 (128–140)	0.003	−1.9–−10.3
Nasal quadrant	71.1 ± 11.9 (65–77)	89.4 ± 19.0 (80–99)	<0.001	−27.0–−9.5
Inferior quadrant	117.8 ± 31.8 (101–134)	151.4 ± 15.6 (143–159)	<0.001	−45.4–−21.9
Temporal quadrant	66.9 ± 16.5 (58–75)	74.4 ± 13.7 (67–81)	0.095	−16.4–1.4

Data are mean micrometers ± SD, with and 95% CI in parentheses.

* *P:* difference between affected and fellow eyes from paired *t*-test (two-tailed), with significance at $P < 0.05$.

16 weeks after the APAC episode. In addition, the RNFL loss was a function not only of the APAC episode, but also of the chronic glaucomatous optic neuropathy from the persistently high IOP during follow-up. Therefore, the lack of association between RNFL reduction and duration of an acute episode in their study may be explained by the fact that the results were not a true reflection of longitudinal RNFL change after a single APAC episode.

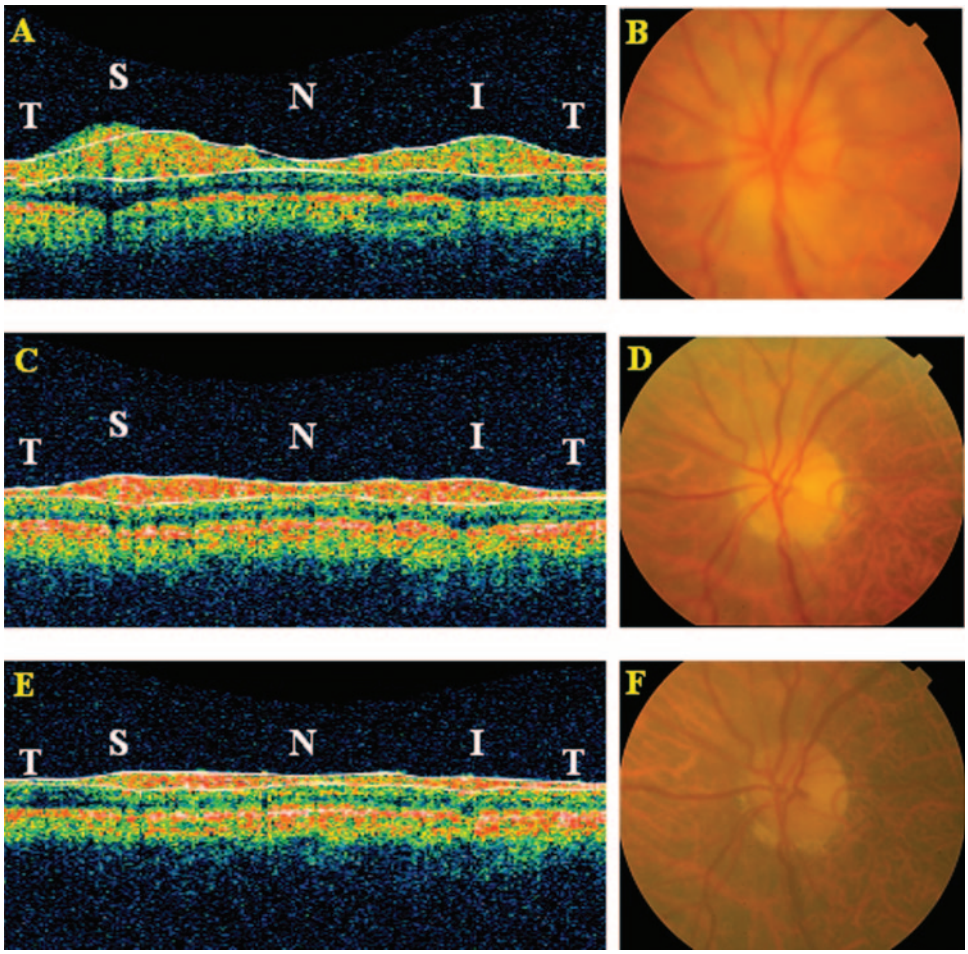

FIGURE 2. Temporal (T), superior (S), nasal (N) and inferior (I) quadrant retinal nerve fiber layer thickness, as measured by optical coherence tomography at 1 (**A**), 4 (**C**), and 12 (**E**) weeks, and optic disc photographs at 1 (**B**), 4 (**D**), and 12 (**F**) weeks after acute primary angle closure. Diffuse RNFL thickness progressively decreased from 1 to 12 weeks, and, the optic disc appeared edematous at 1 week, then became pale at 4 and 12 weeks.

On the other hand, SLP-FCC is limited in terms of assessment of RNFL thickness. Variation in corneal polarization axis and corneal curvature is not measured and corrected in this modality, potentially causing significant spurious results. SLP-FCC has been abandoned and superseded by SLP-VCC.[16,17] In their sample of acute unilateral disc edema cases, Bank et al.,[18] found that none of the SLP-FCC parameters was significantly increased, when comparing the affected eyes with fellow analogues, suggesting that SLP-FCC measurements of RNFL birefringence do not correspond to the actual RNFL thickness.

In a recent cross-sectional study,[19] StratusOCT was used to evaluate RNFL thickness 3 months after remission from a single episode of APAC associated with normal VF. The inferior-quadrant RNFL thickness was significantly decreased in the affected eyes, demonstrating that RNFL loss precedes onset of glaucomatous visual field loss, even after a short-duration APAC episode.

To our knowledge, longitudinal OCT evaluation of RNFL thickness after a single APAC episode from the acute stage through remission has not been reported. In this study, we found that the RNFL thickness reduction in the affected eyes correlated with interval of follow-up after APAC. Even after adjustment for episode duration, the interval of follow-up remained statistically significant in terms of the effect on average RNFL thickness reduction.

The average RNFL thickness reduction in the affected eyes was associated with the duration of APAC episode at 4 and 12 weeks' follow-up, but not at 1 week, which demonstrates that the interval after the episode influences the results of this measurement, with rapid thinning before 4 weeks and gradual stabilization thereafter observed in our investigation. Longitudinal follow-up of change in RNFL thickness is necessary to assess actual RNFL loss and damage and provides more information than cross-sectional measurement.

Analyzing the results of the present and previous studies, we found an initial increase in RNFL thickness after APAC, followed by a decrease. The average and four-quadrant RNFL thicknesses in our affected eyes increased compared with those in the unaffected fellow eyes (with normal VF) at 1 week after APAC. Although normal control subjects were not enrolled in this study, a previous investigation failed to demonstrate significant differences in the average and four-quadrant RNFL thicknesses, as measured by StratusOCT, comparing normal (average, 111.4 $\pm$ 7.2 μm) and unaffected fellow eyes with normal VF (average, 111.7 $\pm$ 7.9 μm) in patients with APAC.[19] It appears reasonable to infer, therefore, that an initial increase in RNFL thickness would occur after APAC. The average and four-quadrant RNFL thicknesses after APAC decreased in the affected eyes but not the fellow eyes during the 12-week follow-up, and the average and four-quadrant RNFL thickness for the affected eyes correlated strongly with interval of follow-up, according to inverse regression analysis in the present study. Therefore, we conclude that there is an initial increase in diffuse RNFL thickness after an APAC episode, followed by a decrease.

Perimetric examination during APAC episodes is usually unreliable. The causes of VF defects in the acute stage may arise from optic neuropathy due to high IOP, optic disc edema, or corneal edema. After remission, VF defects vary greatly in severity and type during follow-up.[2,20] Bonomi et al.,[2] assessed visual field damage 36 to 48 hours after remission from an APAC episode, using automated perimetry. The visual field was normal in 15% of eyes, but some form of visual field defect was present in the remaining 85%, typically of the generalized type, with a smaller proportion of mixed and a few localized-type defects. One month after remission, 45% of the eyes were found to be normal. In other reports, 63% of patients did not have a VF defect 6 months after the APAC episode.[20] Therefore, perimetry was performed 2 months after the APAC episode in our study to prevent spurious results.

The significant correlation between average RNFL thickness in the affected eyes and MD and PSD values at 12 weeks in the present study demonstrated that patients with more profound VF defects ultimately have more relative RNFL thinning.

Quantitative correlation between RNFL measured by OCT and optic disc CDR was difficult in this study because of the initial edema of the optic disc after APAC, which then became pale, with small or absent cupping because of the short duration of the APAC episode (< 48 hours) and follow-up (12 weeks). In a recent study, stereoscopic optic disc photographs were taken 2 and 16 weeks after APAC (mean duration of episode, 40.3 hours), and the images were analyzed by planimetry, with mean CDR increasing from 0.56 to 0.59.[21] Therefore, long-term follow-up should be considered in future evaluation of the relationship between RNFL measurement and CDR.

The main limitations of our study are the relatively small sample size and the limited number of patients with less severe APAC episodes (<48 hours); however, a prolonged episode may not only result in glaucomatous optic neuropathy but may also produce other persistent disorders involving the anterior and posterior segments. Anterior segment change, such as that produced by persistent corneal edema, can impair the quality of OCT scans, whereas, in the posterior segments, disorders and insults such as anterior ischemic optic neuropathy or retinal vascular accident can lead to poor vision.[22,23] Therefore, to prevent spurious RNFL thickness measurements, we excluded patients experiencing extended episodes (>48 hours) and those with poor vision (<20/50) after remission. Another limitation of the present study was that some patients may have had a chronic increase in IOP with ongoing RNFL damage before the acute episode.

In conclusion, the results of our intereye and intertest comparisons of RNFL thickness after a single unilateral APAC episode using StratusOCT demonstrated an initial increase in diffuse RNFL thickness, followed by a decrease. The interval between episode and measurement influences the results of assessment of RNFL thickness loss after an episode of APAC. It appears reasonable to suggest, therefore, that longitudinal follow-up must be considered in any comprehensive study of the long-term effects of APAC.

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