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An assessment of the thickness of the retinal nerve fiber layer around the optic disc using spectral domain optical coherence tomography in myopia patients at an industrial hospital in India

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Myopia is rising as a silent epidemic across the globe with marked ocular morbidity and pathological changes. The retinal nerve fiber layer (RNFL) thinning is indicative of glaucomatous damage; it remains uncertain whether RNFL thickness would vary with the refractive status of the eye. It is therefore important to investigate whether any correlation exists between RNFL measurements and axial length/refractive error in myopia. ***Purpose.*** *To assess the peripapillary RNFL thickness by spectral domain optical coherence tomography (SD-OCT) and to determine the correlation between axial length and peripapillary RNFL thickness in myopia patients.* ***Material and methods.*** *A total of 100 patients (200 eyes) with low, moderate and high myopia (ave -3.58 ± 2.45 D) aged 15 to 40 years were examined to assess the peripapillary RNFL thickness by SD-OCT and to determine the correlation between axial length (AL) and peripapillary RNFL thickness myopia patients.* ***Results.*** *Average 360-degree RNFL thickness (mean ± SD) was 92.25 ± 10.04 μm. In the low myopic group this parameter was 98.82 ± 6.67 μm, in the moderate myopic group — 89.28±5.23 μm, and in the high myopic group — 78.54 ± 7.32 μm. The average 360-degree mean RNFL thickness in patients with AL < 24 mm was 100.06 ± 5.92 μm, in patients with AL between 24–26 mm — 89.48 ± 4.59 μm, and in patients with AL > 26 mm — 78.2 ± 6.77 μm. There was significant association between thinning of the average 360-degree RNFL thickness with increasing degree of myopia and AL (p < 0.0001).* ***Conclusion.*** *The study shows RNFL thickness decreases with increase in refractive error and increase in axial length of myopic eyes. The degree of myopia may affect the RNFL thickness differently.*

Keywords: myopia; retinal nerve fiber layer; spectral domain optical coherence tomography
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Толщина перипапиллярного слоя нервных волокон сетчатки у пациентов с миопией, обследованных в промышленной больнице Индии с помощью спектральной оптической когерентной томографии

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По всему миру наблюдается эпидемический рост заболеваемости близорукостью с патологическими изменениями глаз миопического генеза. Истончение слоя нервных волокон сетчатки (СНВС) ассоциировано с глаукомным поражением, но остается неясным, меняется ли толщина СНВС в зависимости от рефракционного статуса глаза. В связи с этим важно выяснить, существует ли какая-либо корреляция между толщиной СНВС и аксиальной длиной/аномалией рефракции при близорукости. ***Цель*** *работы — оценить толщину перипапиллярного слоя СНВС с помощью спектральной оптической когерентной томографии (SD-OKT) и определить корреляцию между длиной передне-задней оси (ПЗО) глаза и толщиной перипапиллярного СНВС у пациентов с миопией различной степени.* ***Материал и методы.*** *Перипапиллярную толщину СНВС измеряли методом SD-OKT у 100 пациентов (200 глаз) с миопией слабой, средней и высокой степени (в среднем -3,58 ± 2,45 дптр) в возрасте от 15 до 40 лет и оценивали корреляцию ее значений с длиной ПЗО.* ***Результаты.*** *Средняя толщина СНВС на 360° (mean ± SD) составила 92,25 ± 10,04 мкм. В группе слабой миопии величина этого показателя была 98,82 ± 6,67 мкм, в группе миопии средней степени — 89,28 ± 5,23 мкм, в группе высокой миопии — 78,54 ± 7,32 мкм. Средняя толщина СНВС на 360° у пациентов с ПЗО < 24 мм составила 100,06 ± 5,92 мкм, у пациентов с ПЗО от 24 до 26 мм — 89,48 ± 4,59 мкм, а у пациентов с ПЗО > 26 мм — 78,2 ± 6,77 мкм. Выявлена значительная связь между уменьшением средней толщины СНВС на 360° с увеличением степени миопии и ПЗО (p < 0,0001).* ***Заключение.*** *Толщина СНВС уменьшается с увеличением аномалии рефракции и увеличением ПЗО близоруких глаз. Степень миопии может по-разному влиять на толщину СНВС.*

Ключевые слова: миопия; слой нервных волокон сетчатки; спектральная оптическая когерентная томография
Конфликт интересов: отсутствует.
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Myopia is worldwide common type of refractive error and is a major threat for visual health. In some of the Asia-Pacific countries, the increase in prevalence has reached an epidemic scale. As Singapore estimates, 38.7% of adults are myopic, while 9.1% are high myopes [1]. The ocular morbidity related to myopia presents a major public health concern. Global prevalence of myopia in 2010 was 28.3% and this is projected to increase to 33.9% of the global population in 2020 and 49.8% in 2050 [2].

In India population-based studies, myopia prevalence ranged from 3.6 to 36.5%, while school-based and hospital-based studies reported rates of 7.5 to 8.6% and 9%, respectively [3–6]. Notably, studies primarily encompassed individuals 15–40 years, Tamil Nadu's population over 39 years rates varied between 17 and 31% [7]. In Pondicherry a single study observed a prevalence of 35.6% in those 15–39 years [8]. Additionally, R. Prema et al. noted higher prevalence in rural (31%) than urban areas (17%) [8, 9]. In Chattisgarh the prevalence of myopia among adults aged more than 15 years found to be 21.2% [10].

Myopia, particularly high myopia, results in marked pathologic changes, such as posterior staphyloma, scleral thinning, large tilted optic discs, Fuchs' spot, large cup to disc ratios, thin lamina cribrosa and localized retinal nerve fiber layer (RNFL) defects. The myopic eyeball is enlarged with the increase of axial length and stretching beyond normal dimensions, which may lead to the thinning of the retina [11–13].

The axial length (AL) is the distance between the anterior surface of the cornea and the fovea in retina. A 1 mm error in AL measurement results in a refractive error of approximately 2.35 D in a 23.5 mm eye. A 1-mm elongation of AL without other compensation is equivalent to a myopic shift of -2 or -2.5 D [14].

One of the potentially blinding ocular diseases associated with myopia is glaucoma which is characterized by progressive degeneration of retinal ganglion cells. The risk of developing glaucoma is 2–3 times higher in myopic individuals than in non-myopic individuals [15]. However, the clinical diagnosis of glaucoma in such patients is challenging because of the pre-existing myopic changes in the retina and the optic disc [16]. Currently, glaucoma is diagnosed by changes in the appearance of the optic disc, retinal nerve fiber layer (RNFL) thickness and visual field changes [17].

Optical coherence tomography (OCT) is an emerging as a powerful imaging technology for performing high-resolution cross-sectional imaging. It enables high-resolution evaluation of structures within the retina *in vivo* and tissue structure on the micron scale *in situ* and in real time [18]. It has become one of the most widely used equipment for assessing the fovea and peripapillary nerve fiber layer. The latest spectral domain optical coherence tomography (SD-OCT) provides reliable and reproducible high axial scanning resolution (< 10 μm) measurements of the peripapillary RNFL [19, 20].

Although RNFL thinning is indicative of glaucomatous damage, it remains uncertain whether RNFL thickness would vary with the refractive status of the eye. It is therefore important to investigate whether any correlation exists between RNFL measurements and axial length/refractive error in myopia, with regard to the observation that the risk of development of glaucoma is increased with an increasing degree of myopia.

OBJECTIVES

1. To assess the peripapillary RNFL thickness by spectral domain optical coherence tomography (SD-OCT) in myopia patients.
2. To determine the correlation between AL and peripapillary RNFL thickness myopia patients.

MATERIAL AND METHODS

After obtaining institutional ethical clearance, this hospital-based cross-sectional study was conducted under the Department of Ophthalmology, Jawaharlal Nehru Hospital and Research Centre, Bhilai Chhattisgarh, India for a period of September 2017 to August 2019. The study population consisted on myopia patients attending ophthalmology out-patient department for refractive error evaluation.

Inclusion Criteria. Myopia patients in the age 15 to 40 years, willing to participate and give informed consent.

Exclusion Criteria. 1) patients with a history of severe ocular trauma, previous intraocular or refractive surgery, refractive error other than myopia, amblyopia, strabismus, coexisting retinal diseases, uveitis, corneal abnormalities, media opacities and eyes with peripapillary atrophy, which may influence ONH edge detection; 2) diagnosed cases of all types of glaucoma, ocular hypertension or those with intraocular pressure (IOP) > 21 mm Hg in either eye; those showing evidence of a reproducible visual field defects in either eye as detected using the Humphrey Visual Field analyzer; 3) patients with neurological disorder.

Sample Size. To calculate the sample size we have taken r (the sample correlation between average RNFL thickness and AL) = -0.314 from previous study [13].

$$N = \left(\frac{Z_\alpha + Z_\beta}{C(r)} \right)^2 + 3$$

Where, $z_\alpha = 1.96$, $Z_\beta = 0.842$, $C(r) = 0.5 \log(1+r/1-r)$, $N = 78$

To increase the power of the study and to avoid loss of data, a total sample size of 100 was taken.

A total of 100 myopic patients were randomly selected and recruited for the study with their informed consent, followed by history taking, clinical examination, refractive correction, intraocular pressure measurement, fundus examination, visual field testing, AL measurement and RNFL measurement by cirrus HD SD-OCT.

All 200 eyes were divided into three groups depending upon refractive status: low myopia with a spherical equivalent of (SE < -3.00 D), moderate myopia (SE between -3.00 D and -6.00 D), high myopia with a spherical equivalent of (SE > -6.00 D), and also depending upon the AL of the myopic eyes. The first group had an AL of < 24 mm, the second group had an AL of 24–26 mm, and the third group had an AL of > 26 mm.

RNFL measurement by Cirrus HD SD-OCT. SD-OCT imaging: The thickness of the peri-papillary RNFL was measured through the dilated pupil using SD-OCT (Cirrus 4000 HD OCT system, Version: 5.1.1.4). RNFL thickness was measured with the fast RNFL scanning protocol (256 A-scans). After proper alignment, three 200 × 200-cube optic disc scans were obtained per eye by centering a circle of fixed diameter (3.4 mm) on the disc. Centration around the optic nerve head was assessed by the operator subjectively by aligning the midpoints of the horizontal and vertical axes. Scans with signal strength below 6 were discarded, and the scan with the highest signal strength and least eye movement was selected. All scans were done by same operator. This scan determines the global RNFL thickness as well as the average RNFL thickness in the superior (46°–135°), nasal (136°–225°), inferior (226°–315°) and temporal (316°–45°) quadrants. Three consecutive readings for RNFL thickness were taken and averages computed. Repeat scans were taken if the signal strength of the scan indicated as poor on the display. Mean RNFL thickness was generated by automated computerized program in the analysis report and compared with the built in age-matched normative database.

Table 1. Distribution of study participants according to their age and gender
Таблица 1. Распределение пациентов в зависимости от возраста и пола

Age, years Возраст, лет	Myopic patients, % Пациенты с миопией, %
15-20	24
21-30	48
31-40	28
Gender Пол	
Male Мужчины	45
Female Женщины	55
Total Всего	100

RESULTS

Table 1 shows the age- and gender-wise distribution of study participants (n = 100). The participants belong to the 15–40 year age group, with the majority of cases (48%) at the age of 21–30 years. The male-female ratio in this study was 0.8:1.

Table 2 shows the distribution of study participants according to their degree of myopia and axial length. The total 200 eyes of 100 patients were categorized on the basis of low myopia, moderate myopia, and high myopia, and the observed values in each segment were 52%, 29.5%, and 18.5%, respectively. The mean refractive error was -3.58 ± 2.45 D. Similarly, the AL of observed myopic eyes was categorized as < 24 mm, 24–26 mm, and > 26 mm, and the observed values in each segment were 46.5%, 34.5%, and 19%, respectively. The mean AL was 24.55 ± 1.47 mm (mean ± SD).

Table 3 shows the average 360-degree mean RNFL thickness in the low myopic group was 98.82 ± 6.67 μm, in the moderate myopic group was 89.28 ± 5.23 μm, and in the high myopic group was 78.54 ± 7.32 μm. Average 360-degree RNFL thickness (mean ± SD) in all 200 eyes was 92.25 ± 10.04 µm. The 'p' value was < 0.0001, which was significant. So there was a significant association between thinning of the average 360-degree RNFL thickness and an increasing degree of myopia.

Table 4 shows the average 360-degree mean RNFL thickness in patients with AL < 24 mm as 100.06 ± 5.92 µm, in patients with AL between 24–26 mm as 89.48 ± 4.59 µm, and in patients with AL > 26 mm as 78.2 ± 6.77 µm. Average 360-degree RNFL thickness (mean ± SD) in all 200 eyes was 92.25 ± 10.04 µm. The 'p' value was < 0.0001, which was significant. So there was a significant association between thinning of the average 360-degree RNFL thickness and increasing AL.

Table 5 reveals significant associations between AL and RNFL thickness in myopic patients using Pearson correlation analysis. The RNFL thickness at various quadrants demonstrated strong negative correlations with AL, indicating that as AL increases, the average and quadrant-specific RNFL thickness tends to decrease. Notably, these relationships were consistent for both the right and left eyes. The findings suggest a potential influence of AL on RNFL thickness, emphasizing the importance of considering ocular biometrics in assessing structural changes in myopic individuals, particularly in the context of clinical evaluations and interventions.

Table 2. Distribution of study participants according to degree of myopia and axial length
Талица 2. Распределение пациентов в зависимости от степени миопии и величины ПЗО

Degree of myopia Степень миопии	Myopia Миопия n (%)	Axial length, mm ПЗО, мм	Myopic patients Пациенты с миопией n (%)
Low Слабая	104 (52)	< 24	93 (46.5)
Moderate Средняя	59 (29.5)	24–26	69 (34.5)
High Высокая	37 (18.5)	> 26	38 (19)
Total Всего	200 (100)	Total Всего	200 (100)
Refractive error-3-3.58±2.45 D Рефракция -3,58±2,45 дптр Mean ± SD		Axial length 24.55±1.47 mm ПЗО 24,55±1,47 мм	

Table 3. Average 360 degree mean RNFL thickness measurement in different degree of myopia
Талица 3. Среднее значение толщины СНВС на 360° при различных степенях миопии

Degree of Myopia Степень миопии	No. of eyes Количество глаз n (%)	Mean RNFL thickness, µm Средняя толщина СНВС, мкм	p-value
Low Слабая	104 (52)	98.82 ± 6.67	< 0.0001
Moderate Средняя	59 (29.5)	89.28 ± 5.23	
High Высокая	37 (18.5)	78.54 ± 7.32	
Total Всего	200 (100)	92.25 ± 10.04	

Note. RNFL— retinal nerve fiber layer.
Примечание. СНВС — слой нервных волокон сетчатки.

Table 4. Average 360 degree mean RNFL thickness measurement of subgroups classified on AL
Талица 4. Среднее значение толщины СНВС на 360° для подгрупп, классифицированных по ПЗО

Axial length, mm ПЗО, мм	No. of eyes Количество глаз n (%)	RNFL thickness, µm Толщина СНВС, мкм	p-value
< 24	93 (46.5)	100.06 ± 5.92	< 0.0001
24-26	69 (34.5)	89.48 ± 4.59	
> 26	38 (19)	78.2 ± 6.77	
Total Всего	200 (100)	92.25 ± 10.04	

Note. RNFL— retinal nerve fiber layer.
Примечание. СНВС — слой нервных волокон сетчатки.

DISCUSSION

The study reported highest degree of myopia was seen in patients of 21-30 years of age followed by 31–40 years and 15–20 years. The mean spherical equivalent of refractive errors (SE) was -3.58 ± 2.45 D, ranges from -0.75 D to -12 D. SE in our study was comparable to N. Akhtar, et al [21]; the mean SE in their study was -3.25 ±1.93 D (-0.5 to -7.37). D. Singh, et al [22] showed a greater mean SE because they chose a significantly more myopic sample, enriched for SE greater than 4 D (70% of their subjects).

The mean AL in our study was 24.55 ± 1.47 mm and ranges from 21.91 to 28.43 mm. Similar result observed by comparable to N. Akhtar, et al [21] and D. Singh, et al [22] and it was lower than the studies by S. Ahmed, et al [23].

There was a significant association between thinning of average 360 degree RNFL with increasing degree of myopia (p < 0.0001). So it is obvious from our study that Average 360 degree RNFL thickness decreases with increase in degree of myopia. Similar trend observed by D.Singh, et al [22], S. Ahmed, et al [23] and A. Kamath, et al [24]. However, our study result was dissimilar to the studies S. Hoh, et al [25] and S. Hsu, et al [26]. Explanation for this discrepancy is that the latter studies may have been limited by the poorer resolution of the earlier generation OCT and confocal laser devices and thus lower sensitivity.

The study reported decrease in average 360 degree RNFL thickness with increase in AL. There was a significant association between thinning of RNFL in average 360 degree with increase in AL (p < 0.0001). Average 360 degree RNFL thickness (mean ± SD) in all 200 eyes was 92.25 ± 10.04 µm. Similar result observed by MAR M. Akram, et al [27], he concluded that there was decrease in the average 360 degree RNFL thickness with increase in AL. C. Murugan, et al [28] also showed that there was a decrease in RNFL thickness in each quadrant with increase in AL. A. Dhami, et al [29] found that the average RNFL showed statistically significant thinning with the increasing AL.

CONCLUSION

The study reported RNFL thickness decreases with increase in refractive error and increase in AL of myopic eyes. The degree of myopia may affect the RNFL thickness differently. The SD-OCT provides better axial resolution and faster scanning for RNFL thickness measurement and it can be used as tool to predict myopia progression. Prevalence of glaucoma is higher in myopic patients; thus, myopia may be a confounder in addition to being a risk factor.

Recommendation. For analyzing RNFL in myopic subjects, the normative database alone may be misleading, and refractive error and AL should always be considered in the interpretation of RNFL measurements. Knowledge and awareness about the risk of development of glaucoma among the myopic patients must be created.

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Table 5. Correlation matrix of RNFL thickness in different quadrats and AL in right (RE) and left (LE) eyes of myopic patients
Талица 5. Корреляционная матрица толщины СНВС в разных квадрантах и ПЗО в правом (OD) и левом (OS) глазах пациентов с близорукостью

Variables Name Показатели	Statistics Статистика	Axial Length, RE, mm ПЗО, OD, мм	Axial Length, LE, mm ПЗО, OS, мм
RNFL Thickness_avg 360_RE, μm Толщина СНВС, сред. 360_OD, мкм	r-value	-.861**	-.684**
	p-value	.000	.000
RNFL Thickness _avg 360_LE, μm Толщина СНВС, сред. 360_OS, мкм	r-value	-.809**	-.899**
	p-value	.000	.000
RNFL Thickness_sup quad_RE, μm Толщина СНВС_верх. квад_OD, мкм	r-value	-.850**	-.673**
	p-value	.000	.000
RNFL Thickness_sup quad_LE, μm Толщина СНВС_верх квад_360_OS, мкм	r-value	-.734**	-.837**
	p-value	.000	.000
RNFL Thickness_inf quad_RE, μm Толщина СНВС_нижн квад_360_OD, мкм	r-value	-.847**	-.664**
	p-value	.000	.000
RNFL Thickness_inf quad_LE, μm Толщина СНВС_нижн. квад_360_OS, мкм	r-value	-.735**	-.859**
	p-value	.000	.000
RNFL Thickness_nasal quad_RE μm Толщина СНВС_назал. квад_360_OD, мкм	r-value	-.820**	-.658**
	p-value	.000	.000
RNFL Thickness_nasal quad_LE, μm Толщина СНВС_назал. квад_360_OS, мкм	r-value	-.745**	-.756**
	p-value	.000	.000
RNFL Thickness_temp quad_RE, μm Толщина СНВС_темп. квад_360_OD, мкм	r-value	-.594**	-.486**
	p-value	.000	.000
RNFL Thickness_temp quad_LE, μm Толщина СНВС_темп. квад_360_OS, мкм	r-value	-.499**	-.545**
	p-value	.000	.000

Note. ** — the correlation is reliable.
Примечание. ** — корреляционная связь достоверна.

References/Литература

1. Wong TY, Foster PJ, Hee J, et al. Prevalence and risk factors for refractive errors in adult Chinese in Singapore. *Invest Ophthalmol Vis Sci*. 2000 Aug; 41 (9): 2486–94. PMID: 10937558
2. Holden BA, Fricke TR, Wilson DA, et al. Global prevalence of myopia and high myopia and temporal trends from 2000 through 2050. *Ophthalmology*. 2016 May; 123 (5): 1036–42. doi: 10.1016/j.ophtha.2016.01.006
3. Khan SA. A retrospective study of low-vision cases in an Indian tertiary eye-care hospital. *Indian J Ophthalmol*. 2000 Sep; 48 (3): 201–7. PMID: 11217251
4. Dandona R, Dandona L, Srinivas M, et al. Population-based assessment of refractive error in India: the Andhra Pradesh eye disease study. *Clin Experiment Ophthalmol*. 2002; 30 (2): 84–93. doi: 10.1046/j.1442-6404.2002.00492.x
5. Krishnaiah S, Srinivas M, Khanna RC, Rao GN. Prevalence and risk factors for refractive errors in the South Indian adult population: the Andhra Pradesh Eye disease study. *Clin Ophthalmol*. 2009; 3: 17–27. PMID: 19668540
6. Prabhu AV, Ve RS, Talukdar J, Chandrasekaran V. Prevalence of visual impairment in school-going children among the rural and urban setups in the Udupi district of Karnatak India: A cross-sectional study. *Oman J Ophthalmol*. 2019; 12 (3): 145–9. doi: 10.4103/ojo.OJO_190_2018
7. Raju P, Ramesh SV, Arvind H, et al. Prevalence of refractive errors in a rural Indian population. *Invest Ophthalmol Vis Sci*. 2004; 45 (12): 4268–72. doi:10.1167/iovs.04-0221
8. Prema R, George R, Sathyamangalam Ve R, et al. Comparison of refractive errors and factors associated with spectacle use in a rural and urban Indian population. *Indian J Ophthalmol*. 2008; 56 (2): 139–44. doi: https://doi.org/10.1167/iovs.04-0221
9. Joseph S, Krishnan T, Ravindran RD, et al. Prevalence and risk factors for myopia and other refractive errors in an adult population in India. *Ophthalmic Physiol Opt*. 2018; 38 (3): 346–58. doi: 10.1111/opo.12447
10. Agrawal D, Sahu A, Agrawal D. Prevalence of ocular morbidities among school children in Raipur district, India. *Indian J Ophthalmol*. 2020 Feb; 68 (2): 340–4. doi: 10.4103/ijo.IJO_1454_19
11. Kremmer S, Zadow T, Steuhl KP and Selnack JM. Scanning laser polarimetry in myopic and hyperopic subjects. *Grafes Arch Clin Exp Ophthalmol*. 2004 Jun; 242 (6): 489–94. doi: 10.1007/s00417-004-0859-1
12. Schweitzer KD, Ehmann D, Garcia R. Nerve fiber layer changes in highly myopic eyes by optical coherence tomography. *Can J Ophthalmol*. 2009 Jun; 44 (3): e13–6. doi: 10.3129/i09-058
13. Morgan IG, Ohno-Matsui K, Saw SM. Myopia. *Lancet*. 2012 May 5; 379 (9827): 1739–48. doi: 10.1016/S0140-6736(12)60272-4
14. Meng W, Butterworth J, Malecaze F, Calvas P. Axial length of myopia: A review of current research. *Ophthalmologica*. 2011; 225 (3): 127–34. doi: 10.1159/000317072
15. Mitchell P, Hourihan F, Sandbach J, et al. The relationship between glaucoma and myopia: the Blue Mountain Eye Study. *Ophthalmology*. 1999 Oct; 106 (10): 2010–5. doi: 10.1016/s0161-6420(99)90416-5
16. Melo GB, Libera RD, Barbosa AS, et al. Comparison of optic disk and retinal nerve fiber layer thickness in nonglaucomatous and glaucomatous patients with high myopia. *Am J Ophthalmol*. 2006 Nov; 142 (5): 858–60. doi: 10.1016/j.ajo.2006.05.022
17. Fujimoto JG, Pitris C, Boppart SA, Brezinski ME. Optical coherence tomography: an emerging technology for biomedical imaging and optical biopsy. *Neoplasia*. 2000 Jan-Apr; 2 (1–2): 9–25. doi: 10.1038/sj.neo.7900071
18. Aykut V, Öner V, Taş M, Işcan Y, Ağaçhan A. Influence of axial length on peripapillary retinal nerve fiber layer thickness in children: a study by RTVue spectral-domain optical coherence tomography. *Curr Eye Res*. 2013 Dec; 38 (12): 1241–7. doi: 10.3109/02713683.2013.820328
19. Sowmya V, Venkataramanan VR, Prasad V. Effect of refractive status and axial length on peripapillary retinal nerve fibre layer thickness: An analysis using 3D OCT. *J Clin Diagn Res*. 2015 Sep; 9 (9): NC01–4. doi: 10.7860/JCDR/2015/14112.6480
20. Leung CK, Mohamed S, Leung KS, et al. Retinal nerve fiber layer measurements in myopia; an optical coherence tomography study. *Invest Ophthalmol Vis Sci*. 2006 Dec; 47 (12): 5171–6. doi: 10.1167/iovs.06-0545
21. Akhtar N, Kausar A, Afzal F, Khalid Ali S, Hamid N. Peripapillary retinal nerve fiber layer (RNFL) thickness measurements by Topcon SD-OCT in myopic patients. *Journal of the College of Physicians and Surgeons Pakistan*. 2018, 28 (1): 26–30. doi: 10.29271/jcpsp.2018.01.26
22. Singh D, Mishra SK, Agarwal E, et al. Assessment of retinal nerve fiber layer changes by cirrus high-definition optical coherence tomography in myopia. *J Curr Glaucoma Pract*. 2017 May-Aug; 11 (2): 52–7. doi: 10.5005/jp-journals-10028-1223
23. Ahmed S, Ibrahem A, Salama A. Association of retinal nerve fiber layer thickness and degree of myopia using spectral domain optical coherence tomography. *Menoufia Medical Journal*. 2017 July-September; 30 (3): 966–70.
24. Kamath A, Dudeja L. Peri-papillary retinal nerve fiber layer thickness profile in subjects with myopia measured using optical coherence tomography. *Journal of Clinical Ophthalmology and Research*. 2014 Sep–Dec; 2 (3): 131–6. doi: 10.4103/2320-3897.138853
25. Hoh ST, Lim MC, Seah SK, et al. Peripapillary retinal nerve fiber layer thickness variations with myopia. *Ophthalmology*. 2006 May; 113 (5): 773–7. doi: 10.1016/j.ophtha.2006.01.058
26. Hsu SY, Chang MS, Ko ML, Harnod T. Retinal nerve fibre layer thickness and optic nerve head size measured in high myopes by optical coherence tomography. *Clin Exp Optom*. 2013 Jul; 96 (4): 373–8. doi: 10.1111/cxo.12052
27. Akram M, Malik I, Ahmad I, Sarwar S, Hussain M. Correlation between axial length and retinal nerve fiber layer thickness in myopic eyes. *Pak J Ophthalmol*. 2013; 29 (3): 169–72. http://www.pjo.com.pk/29/3/9.%20OA%20MA%20Rehman%20final.htm
28. Murugan C, Golodza BZ, Pillay K, et al. Retinal nerve fibre layer thickness of black and Indian myopic students at the University of KwaZulu-Natal. *Afr Vision Eye Health*. 2015; 74 (1), Art. #24, 6 pages. http://dx.doi.org/10.4102/aveh.v74i1.24
29. Dhami A, Dhasmana R, Nagpal RC. Correlation of retinal nerve fiber layer thickness and axial length on Fourier domain optical coherence tomography. *J Clin Diagn Res*. 2016 Apr; 10 (4): NC15–NC17. doi: 10.7860/JCDR/2016/15038.7672

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