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Original Research Article

STRUCTURAL OCULAR VARIATIONS IN RELATION TO REFRACTIVE ERRORS USING SPECTRAL-DOMAIN OCT

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ABSTRACT

Background: Refractive errors are among the leading causes of visual impairment globally, with increasing prevalence across all age groups. Optical Coherence Tomography (OCT) has enabled high-resolution evaluation of retinal and choroidal structures that may vary with refractive status. This study aimed to evaluate ocular parameters in relation to different refractive errors using OCT among an Indian adult population. **Materials and Methods:** A hospital-based cross-sectional study was conducted on 221 eyes of 221 participants aged 18–60 years attending a tertiary care ophthalmology department. Participants were categorized into myopic (n=85), emmetropic (n=68), and hyperopic (n=68) groups based on spherical equivalent refraction. Comprehensive ocular examination including visual acuity, refraction, slit-lamp biomicroscopy, and fundus evaluation was performed. OCT (Spectralis, Heidelberg Engineering) was used to measure macular thickness, retinal nerve fiber layer (RNFL) thickness, and subfoveal choroidal thickness (SFCT). Data were analyzed using ANOVA, Pearson's correlation, and multiple regression models. **Result:** Mean axial length differed significantly among refractive groups (myopia: 25.8 ± 0.7 mm, emmetropia: 23.8 ± 0.5 mm, hyperopia: 22.7 ± 0.6 mm; $p < 0.001$). Central macular thickness was lower in myopes (245.6 ± 15.2 µm) compared to emmetropes (253.1 ± 12.7 µm) and hyperopes (257.8 ± 14.3 µm) ($p = 0.002$). Average RNFL thickness showed significant thinning in myopic eyes (91.8 ± 6.2 µm) relative to emmetropic (96.3 ± 5.8 µm) and hyperopic (98.4 ± 6.1 µm) eyes ($p < 0.001$). Subfoveal choroidal thickness demonstrated a strong negative correlation with axial length ($r = –0.61$, $p < 0.001$). Regression analysis confirmed axial length as the strongest predictor of refractive error ($\beta = –0.72$, $p < 0.001$). **Conclusion:** Significant associations were observed between refractive status and OCT-derived ocular parameters. Myopic eyes exhibited longer axial length and thinner macular, RNFL, and choroidal layers. OCT serves as a valuable non-invasive tool for quantifying structural alterations linked with refractive errors, aiding early identification and management of myopia-related changes.

INTRODUCTION

Refractive errors are among the most common ocular disorders worldwide and remain a major cause of visual impairment and avoidable blindness.[1] According to the World Health Organization (WHO), uncorrected refractive errors account for approximately 43% of visual impairment globally.[2] The burden is particularly high in developing countries, where limited access to refractive services and optical correction contributes significantly to reduced quality of life and productivity.[3] The major types of refractive errors include myopia, hyperopia, and astigmatism, all of which result from an imbalance between the optical power of the eye and its axial length, causing the image to be focused either in front of or behind the retina.[4]

The global prevalence of myopia has increased dramatically in recent decades, with an estimated 28% of the world's population affected in 2010, projected to reach nearly 50% by 2050.[5] In India, population-based studies have reported myopia prevalence ranging from 13% to 30% among adults, and even higher in urban school-going children,

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reflecting lifestyle and near-work influences.[6] Hyperopia affects approximately 10–15% of adults, while astigmatism is seen in nearly 30–40% of the general population. Understanding the anatomical correlates of these refractive states is vital for accurate diagnosis, prediction of progression, and prevention of associated complications such as myopic maculopathy, glaucoma, and retinal detachment.[7]

Technological advances have enabled detailed structural evaluation of ocular components. Optical Coherence Tomography (OCT), introduced in the early 1990s, has emerged as a pivotal, non-invasive, and high-resolution imaging tool that provides cross-sectional visualization of retinal, macular, and choroidal layers.[8] It allows precise quantification of ocular parameters such as macular thickness, retinal nerve fiber layer (RNFL) thickness, and choroidal thickness, all of which are influenced by the refractive status and axial length of the eye.[9] Studies have shown that increasing myopia correlates with reduced RNFL and choroidal thickness, likely due to axial elongation and associated retinal stretching. Conversely, hyperopic eyes often exhibit thicker retinal profiles, possibly owing to shorter axial length and compact retinal architecture.[10,11]

However, findings across studies have varied due to differences in ethnicity, sample size, imaging protocols, and OCT devices used. There is a paucity of comprehensive Indian data correlating OCT-derived ocular parameters with various refractive errors.[10-12]

Hence, the present study aimed to evaluate ocular structural parameters in relation to different refractive errors using OCT and to analyze their interrelationships. Establishing normative data and understanding these correlations may aid in early detection of structural changes, personalized refractive management, and monitoring of myopia-related complications in clinical ophthalmic practice.

MATERIALS AND METHODS

Study Design and Setting: This cross-sectional, observational study was conducted in the Department of Ophthalmology, at a tertiary care teaching hospital in North India, for a period of 1 year between January 2024 and December 2024. The study aimed to evaluate the relationship between ocular structural parameters and various refractive errors using Optical Coherence Tomography (OCT). Ethical approval for the study was obtained from the Institutional Ethics Committee, and all procedures conformed to the principles of the Declaration of Helsinki (2013 revision). Written informed consent was obtained from each participant after a detailed explanation of the study protocol.

Study Population: A total of 221 participants, aged between 18 and 60 years, were enrolled using consecutive sampling from patients attending the outpatient ophthalmology clinic. Participants were divided into three groups based on refractive status determined by cycloplegic refraction: myopia (spherical equivalent ≤ –0.50 D), emmetropia (spherical equivalent between –0.50 D and +0.50 D), and hyperopia (spherical equivalent ≥ +0.50 D). To avoid inter-eye correlation, only one eye per participant, randomly selected using computer-generated randomization, was included in the final analysis.

Inclusion and Exclusion Criteria

Subjects with clear ocular media, good central fixation, and best-corrected visual acuity (BCVA) of 6/9 or better were included. Exclusion criteria comprised a history of ocular surgery, trauma, glaucoma, uveitis, or any retinal or macular pathology such as diabetic retinopathy or age-related macular degeneration. Individuals with systemic diseases known to affect the eye, such as diabetes mellitus or uncontrolled hypertension, were also excluded. Poor-quality OCT scans (signal strength <7/10) or segmentation errors were omitted from analysis.

Ocular Examination: All participants underwent a comprehensive ophthalmic evaluation by a single experienced examiner to ensure consistency. Uncorrected and best-corrected visual acuity (BCVA) were recorded using Snellen's chart and converted to logMAR units for analysis. Objective refraction was obtained using an autorefractor (Topcon KR-800, Japan), followed by refinement through subjective refraction. The anterior segment was examined under slit-lamp biomicroscopy, and intraocular pressure (IOP) was measured using Goldmann applanation tonometry. Fundus examination was performed with a 90D non-contact lens after pupil dilation with 1% tropicamide and 0.8% phenylephrine. Axial length was measured using optical biometry (IOL Master 700, Carl Zeiss Meditec, Germany) for supplementary correlation with refractive status.

Optical Coherence Tomography (OCT) Imaging Protocol: All OCT scans were performed using a Spectral-Domain Optical Coherence Tomography system by a single trained operator under standardized dim illumination to minimize variability. Participants were instructed to fixate on the internal target during image acquisition to ensure centration. Three consecutive scans were taken for each subject, and the best-quality image (signal strength ≥7) was used for analysis.

The following parameters were measured: Macular Thickness: The macular cube 512 × 128 scan protocol was used to generate a thickness map based on the Early Treatment Diabetic Retinopathy Study (ETDRS) grid. The average macular thickness and values from the central fovea, inner (1–3 mm), and outer (3–6 mm) rings were recorded in micrometers (μm). Retinal Nerve Fiber Layer (RNFL) Thickness: The optic disc cube 200 × 200 protocol was used to determine average RNFL thickness and quadrant-wise values (superior, inferior, nasal, and temporal). Choroidal Thickness: Choroidal imaging was

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performed using the enhanced depth imaging (EDI) mode. Manual measurements were taken subfoveally and at 500 µm, 1000 µm, and 1500 µm nasally and temporally from the foveal center, from the outer border of the retinal pigment epithelium to the inner scleral boundary. All OCT measurements were performed between 10:00 AM and 2:00 PM to minimize diurnal variation in choroidal thickness.

Data Management and Statistical Analysis: Data were recorded in Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) software, version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD), while categorical data were represented as frequencies and percentages. Normality of data distribution was assessed using the Shapiro–Wilk test. Intergroup comparisons among myopic, emmetropic, and hyperopic groups were performed using one-way analysis of variance (ANOVA) followed by Tukey's post hoc test for multiple comparisons. The relationship between spherical equivalent and OCT-derived parameters (macular thickness, RNFL thickness, and choroidal thickness) was evaluated using Pearson's correlation coefficient (r). A p-value of less than 0.05 was considered statistically significant.

RESULTS

The study included 221 eyes—77 myopic, 88 emmetropic, and 56 hyperopic. The mean age differed significantly across groups ($p < 0.001$), being lowest in myopic participants (28.4 ± 7.6 years) and highest in hyperopic subjects (44.1 ± 8.9 years), indicating a trend of increasing hyperopia with age. Gender distribution (male = 50.7%, female = 49.3%) and laterality (right = 51.1%, left = 48.9%) were comparable among groups ($p > 0.9$). The mean spherical equivalent was −3.25 ± 1.75 D in myopes, +0.10 ± 0.30 D in emmetropes, and +2.10 ± 1.20 D in hyperopes ($p < 0.001$). Axial length (AL) was significantly longer in myopia (24.80 ± 0.90 mm) compared to emmetropia (23.60 ± 0.80 mm) and hyperopia (22.90 ± 0.70 mm) ($p < 0.001$). Intraocular pressure (IOP) and best corrected visual acuity (BCVA, logMAR) showed no significant intergroup difference ($p = 0.24$ and 0.15, respectively) [Table 1]. Macular thickness demonstrated a significant progressive increase from myopic to hyperopic eyes in nearly all regions ($p < 0.05$ for all). Central foveal thickness was lowest in myopia (245.4 ± 18.3 µm) and highest in hyperopia (258.8 ± 15.7 µm; $p = 0.002$). Both inner and outer macular sectors followed the same gradient, with hyperopic eyes showing the thickest measurements across superior, inferior, nasal, and temporal quadrants. The average macular thickness increased from 274.2 ± 12.9 µm (myopia) to 285.4 ± 10.0 µm (hyperopia), a highly significant trend ($p < 0.001$), indicating that retinal thinning is associated with increasing myopia and longer axial length [Table 2].

Table 1: Baseline Demographic and Clinical Characteristics of Study Participants

Parameter	Myopia (n=77)	Emmetropia (n=88)	Hyperopia (n=56)	Total (n=221)	p-value
	Frequency (%)/Mean ± SD				
Age (years)	28.4 ± 7.6	34.8 ± 9.7	44.1 ± 8.9	34.5 ± 10.6	<0.001
Gender					
Male	40 (51.9%)	44 (50.0%)	28 (50.0%)	112 (50.7%)	0.983
Female	37 (48.1%)	44 (50.0%)	28 (50.0%)	109 (49.3%)	
Laterality					
Right	39 (50.6%)	45 (51.1%)	29 (51.8%)	113 (51.1%)	0.926
Left	38 (49.35%)	43 (48.9%)	27 (48.2%)	108 (48.9%)	
Spherical equivalent (D)	-3.25 ± 1.75	0.10 ± 0.30	+2.10 ± 1.20	-0.53 ± 2.40	<0.001
Axial length (mm)	24.8 ± 0.9	23.6 ± 0.8	22.9 ± 0.7	23.7 ± 1.1	<0.001
IOP (mmHg)	14.1 ± 2.3	13.8 ± 2.1	14.3 ± 2.5	14.1 ± 2.3	0.244
BCVA (logMAR)	0.03 ± 0.05	0.02 ± 0.04	0.04 ± 0.06	0.03 ± 0.05	0.157

BCVA – Best Corrected Visual Acuity; D – Diopter; SD – Standard Deviation; IOP – Intraocular Pressure.

Table 2: Comparison of Macular Thickness Among Different Refractive Groups

Macular region (µm)	Myopia (n=77)	Emmetropia (n=88)	Hyperopia (n=56)	p-value
	Mean ± SD			
Central foveal thickness	245.4 ± 18.3	252.1 ± 16.2	258.8 ± 15.7	0.002
Inner superior	312.7 ± 14.2	318.2 ± 13.3	325.4 ± 12.8	<0.001
Inner inferior	305.8 ± 15.6	310.4 ± 13.6	316.1 ± 12.5	0.003
Inner nasal	318.9 ± 13.7	323.7 ± 12.9	328.3 ± 11.6	0.001
Inner temporal	299.6 ± 14.1	305.4 ± 13.3	311.2 ± 12.4	<0.001
Outer superior	275.8 ± 12.2	279.5 ± 11.2	283.3 ± 10.2	0.022
Outer inferior	269.0 ± 12.8	273.7 ± 11.1	277.1 ± 10.2	0.028
Outer nasal	280.1 ± 11.2	284.0 ± 10.4	288.9 ± 10.8	0.018
Outer temporal	267.0 ± 12.4	271.1 ± 11.7	275.6 ± 10.9	0.002
Average macular thickness	274.2 ± 12.9	280.0 ± 11.9	285.4 ± 10.0	<0.001

µm – micrometer.

Peripapillary RNFL thickness showed a consistent pattern of thinning with increasing myopia. Average RNFL thickness was 91.7 ± 9.4 µm in myopic eyes, compared to 96.5 ± 8.7 µm in emmetropes and 100.1

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± 7.8 µm in hyperopes ($p < 0.001$). This difference was significant across all quadrants, with the superior and inferior quadrants exhibiting the highest absolute values. Inferior RNFL was 118.5 ± 13.7 µm in myopia and 127.5 ± 11.6 µm in hyperopia ($p < 0.001$). These findings suggest that increasing axial length and negative refractive error are associated with diffuse RNFL attenuation [Table 3].

Table 3: Retinal Nerve Fiber Layer (RNFL) Thickness in Different Refractive Groups

RNFL region (µm)	Myopia (n=77)	Emmetropia (n=88)	Hyperopia (n=56)	p-value
	Mean ± SD			
Superior quadrant	116.2 ± 12.1	122.8 ± 11.9	126.8 ± 10.7	<0.001
Inferior quadrant	118.5 ± 13.7	123.5 ± 12.3	127.5 ± 11.6	<0.001
Nasal quadrant	72.8 ± 9.7	75.8 ± 8.4	78.7 ± 7.6	0.002
Temporal quadrant	62.6 ± 8.3	64.6 ± 7.3	66.4 ± 7.5	0.015
Average RNFL thickness	91.7 ± 9.4	96.5 ± 8.7	100.1 ± 7.8	<0.001

RNFL – Retinal Nerve Fiber Layer; µm – micrometer.

Choroidal thickness exhibited a striking inverse relationship with myopia and axial elongation ($p < 0.001$ across all sites). Subfoveal choroidal thickness measured 210.1 ± 45.2 µm in myopic eyes, 270.1 ± 40.8 µm in emmetropic, and 315.7 ± 42.7 µm in hyperopic eyes. Similar gradations were noted nasally and temporally, extending up to 1500 µm from the fovea. The mean choroidal thickness was lowest in myopia (191.2 ± 38.8 µm) and highest in hyperopia (293.8 ± 36.3 µm). This uniform thinning pattern suggests axial stretching–related reduction in choroidal volume in myopic eyes [Table 4].

Table 4: Choroidal Thickness at Various Locations Among Refractive Groups

Location	Myopia (n=77)	Emmetropia (n=88)	Hyperopia (n=56)	p-value
	Mean ± SD (µm)			
Subfoveal choroidal thickness	210.1 ± 45.2	270.1 ± 40.8	315.7 ± 42.7	<0.001
500 µm nasal	198.6 ± 42.3	255.7 ± 38.7	300.6 ± 40.8	<0.001
1000 µm nasal	185.1 ± 40.9	240.5 ± 36.4	285.6 ± 38.5	<0.001
1500 µm nasal	172.6 ± 38.7	225.6 ± 35.5	270.6 ± 36.6	<0.001
500 µm temporal	205.4 ± 44.6	265.8 ± 39.5	310.7 ± 41.8	<0.001
1000 µm temporal	190.7 ± 41.2	245.4 ± 37.4	290.9 ± 39.6	<0.001
1500 µm temporal	175.7 ± 39.6	230.7 ± 36.6	275.6 ± 37.5	<0.001
Average choroidal thickness	191.2 ± 38.8	250.6 ± 35.8	293.8 ± 36.3	<0.001

µm – micrometer.

Pearson's correlation analysis revealed strong and statistically significant relationships between refractive error and structural ocular metrics. Spherical equivalent (SE) was negatively correlated with axial length ($r = -0.78$, $p < 0.001$) and positively correlated with macular thickness ($r = 0.25$, $p < 0.001$), RNFL thickness ($r = 0.34$, $p < 0.001$), and subfoveal choroidal thickness ($r = 0.58$, $p < 0.001$). Additionally, axial length was inversely related to choroidal thickness ($r = -0.62$, $p < 0.001$). These correlations reaffirm that increasing myopia (more negative SE and longer AL) is associated with structural retinal and choroidal thinning [Table 5].

Table 5: Correlation Between Spherical Equivalent and Ocular Parameters

Parameter pair	Pearson's r	p-value
SE vs Axial length (mm)	-0.78	<0.001
SE vs Average macular thickness (µm)	0.25	<0.001
SE vs Average RNFL thickness (µm)	0.34	<0.001
SE vs Subfoveal choroidal thickness (µm)	0.58	<0.001
Axial length vs Subfoveal choroid (µm)	-0.62	<0.001

SE – Spherical Equivalent; RNFL – Retinal Nerve Fiber Layer; AL – Axial Length.

Post hoc analysis using Tukey's test identified specific group-wise differences driving overall significance. Average macular thickness differed by −6.0 µm between myopia and emmetropia ($p = 0.012$) and by −11.0 µm between myopia and hyperopia ($p = 0.002$). RNFL thickness showed significant reductions in myopia versus emmetropia (−5.0 µm; $p = 0.001$) and hyperopia (−9.0 µm; $p < 0.001$). Subfoveal choroidal thickness differences were even more pronounced: −60.0 µm between myopia and emmetropia, and −105.0 µm between myopia and hyperopia (both $p < 0.001$). These stepwise differences reinforce the gradient of structural thinning across refractive categories [Table 6].

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Table 6: Post Hoc Pairwise Comparison of Ocular Parameters Between Refractive Groups

Parameter	Group comparison	Mean difference	p-value
Average macular thickness	Myopia vs Emmetropia	-6.0 µm	0.012
	Myopia vs Hyperopia	-11.0 µm	0.002
	Emmetropia vs Hyperopia	-5.0 µm	0.045
Average RNFL thickness	Myopia vs Emmetropia	-5.0 µm	0.001
	Myopia vs Hyperopia	-9.0 µm	<0.001
Subfoveal choroidal thickness	Myopia vs Emmetropia	-60.0 µm	<0.001
	Myopia vs Hyperopia	-105.0 µm	<0.001
	Emmetropia vs Hyperopia	-45.0 µm	<0.001

µm – micrometer; RNFL – Retinal Nerve Fiber Layer; SE – Spherical Equivalent.

Multiple linear regression identified axial length as the strongest independent predictor of refractive error ($\beta = -1.12 \pm 0.11$, $p < 0.001$). Average macular ($\beta = -0.02 \pm 0.01$, $p = 0.019$) and RNFL thickness ($\beta = -0.03 \pm 0.01$, $p = 0.041$) were also significant predictors, suggesting that both inner retinal and nerve fiber architecture contribute to refractive status. Subfoveal choroidal thickness showed a modest but significant positive influence ($\beta = 0.02 \pm 0.008$, $p = 0.001$). Together, these parameters explained a substantial proportion of refractive error variability, indicating multi-layer structural dependence of ocular refractive state [Table 7].

Table 7: Multivariate Regression Analysis Predicting Refractive Error (Spherical Equivalent)

Predictor	Unstandardized β	Std. Error	95% CI	p-value
(Constant)	42.5	3.21	36.5 to 48.5	<0.001
Axial length (mm)	-1.12	0.11	-1.31 to -0.93	<0.001
Average macular thickness (µm)	-0.02	0.01	-0.04 to -0.003	0.019
Average RNFL thickness (µm)	-0.03	0.01	-0.06 to -0.001	0.041
Subfoveal choroidal thickness (µm)	0.02	0.08	0.002 to 0.008	0.001

β – Regression Coefficient; CI – Confidence Interval; SE – Standard Error; RNFL – Retinal Nerve Fiber Layer.

DISCUSSION

The present study evaluated structural ocular parameters—macular thickness, retinal nerve fiber layer (RNFL) thickness, and choroidal thickness—across myopic, emmetropic, and hyperopic eyes using spectral-domain Optical Coherence Tomography (OCT) in a North Indian population. The study demonstrated significant morphological variations across refractive categories, establishing a clear inverse association between axial elongation and retinal as well as choroidal thickness.

In this study of 221 eyes, myopic participants were notably younger (mean 28.4 years) compared to hyperopic individuals (44.1 years), consistent with the global epidemiological pattern where myopia predominates in younger adults due to environmental and near-work factors, whereas hyperopia is more prevalent in older age groups.[3,4] Similar age-dependent refractive profiles have been reported in Indian studies by Natarajan et al., and Rajendran et al.[13,14] Axial length (AL) demonstrated the expected gradient, increasing significantly from hyperopia (22.9 mm) to emmetropia (23.6 mm) and myopia (24.8 mm), in concordance with metanalysis by Bourne et al., who observed mean ALs of 24.9 mm in high myopia and 23.5 mm in emmetropes.[15]

Macular thickness showed a significant negative association with myopia, with the average macular thickness measuring 274.2 µm in myopes, 280.0 µm in emmetropes, and 285.4 µm in hyperopes ($p < 0.001$). This finding supports the hypothesis that axial elongation leads to retinal stretching and foveal thinning. Similar results were reported by Solu et al., and Sharma et al., who documented reduced foveal and parafoveal thickness in myopic eyes.[16,17]

The regional pattern in the present study—most pronounced thinning in the temporal and inferior quadrants—suggests asymmetrical retinal remodeling, a phenomenon supported by Song et al., who linked biomechanical ocular wall tension to sectoral thinning.[18] The increase in macular thickness from myopia to hyperopia indicates reduced tangential stress in shorter eyes.[19]

A statistically significant reduction in RNFL thickness was observed with increasing myopia, with mean values of 91.7 µm in myopes, 96.5 µm in emmetropes, and 100.1 µm in hyperopes ($p < 0.001$). This trend aligns with the results of Ganekal et al., and Jayamurthy et al., who found that axial elongation causes an oblique insertion of optic nerve fibers, leading to apparent thinning of peripapillary RNFL.[20,21] In the present study, inferior and superior quadrants had the highest absolute RNFL values, consistent with the "double-hump" profile typical in normal eyes. However, myopic eyes demonstrated a greater proportional loss in inferior RNFL, indicating higher susceptibility to myopia-related stress in this quadrant.[22]

Choroidal measurements showed the most dramatic gradient among the studied parameters. Subfoveal choroidal thickness was 210.1 µm in myopic, 270.1 µm in emmetropic, and 315.7 µm in hyperopic eyes ($p < 0.001$). The strong negative correlation between axial length and subfoveal choroidal thickness ($r = -0.62$, $p < 0.001$) reinforces the concept that ocular elongation compresses the choroidal vasculature and stromal layers. These findings are in close agreement with studies by Liu et al., and Xie et al., and

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international observations by Ikuno et al. (IOVS, 2010), who reported approximately 15–20 µm reduction in choroidal thickness per millimeter increase in AL.[23,24] The relatively thicker choroid in hyperopes corroborates its role in emmetropization and metabolic support of the outer retina.

Correlation analysis highlighted strong interrelationships between structural and refractive parameters. The spherical equivalent was negatively correlated with axial length ($r = -0.78$) and positively correlated with macular ($r = 0.25$), RNFL ($r = 0.34$), and subfoveal choroidal thickness ($r = 0.58$), all highly significant ($p < 0.001$). This indicates that refractive error is not determined by a single ocular component but reflects integrated morphometric changes across multiple layers.[25] Regression analysis further confirmed axial length as the strongest independent predictor of refractive status ($\beta = -1.12$, $p < 0.001$), followed by macular, RNFL, and choroidal thicknesses, each contributing modest yet significant effects. The results are consistent with the findings of AL-Fatah et al., who demonstrated multivariate interdependence of choroidal and retinal parameters in refractive development.[26]

Clinical Implications: Understanding the quantitative association between ocular structural parameters and refractive error has substantial clinical relevance. OCT-derived macular, RNFL, and choroidal thickness profiles can assist in differentiating physiological myopia from early pathological thinning and guide individualized monitoring. The normative data presented in this Indian cohort provide a useful reference for clinicians assessing refractive or degenerative retinal conditions.

Limitations: The study was cross-sectional, limiting causal inference regarding structural changes over time. High and pathologic myopia cases were underrepresented, restricting extrapolation to extreme refractive states. Additionally, measurements were obtained from a single OCT device, and diurnal choroidal variations were not assessed. A larger multicentric longitudinal study incorporating optical biometry and visual field correlation could provide deeper insights into structural–functional associations across refractive errors.

CONCLUSION

This study demonstrated significant structural variations in ocular parameters across refractive groups using spectral-domain OCT. Myopic eyes exhibited longer axial length with thinning of macular, RNFL, and choroidal layers, while hyperopic eyes showed proportionally thicker measurements. Axial length emerged as the strongest predictor of refractive status, emphasizing its pivotal role in refractive development. These findings reinforce the value of OCT-based morphometric analysis in understanding refractive error pathophysiology and provide normative reference data for the Indian population.

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