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Original Research Article

A STUDY ON CENTRAL CORNEAL THICKNESS, ANTERIOR CHAMBER DEPTH AND AXIAL LENGTH IN EYES WITH VARYING DEGREES OF MYOPIA AT A TERTIARY CARE CENTRE OF BIHAR

Shailendra Kumar[1], Nilesh Gautam[1], Asif Shahnawaz[2]

[1]Senior Resident, Department of Ophthalmology, Darbhanga Medical College and Hospital, Darbhanga, Bihar, India.
[2]Assistant Professor and HOD, Department of Ophthalmology, Darbhanga Medical College and Hospital, Darbhanga, Bihar, India.

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Corresponding Author:
Dr. Nilesh Gautam,
Email: drnileshgautam007@gmail.com

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Abstract

Background: The current study was aimed to find out the status of axial length, central corneal thickness and anterior chamber depth among patients attending the ophthalmology at a tertiary care centre in Bihar. **Materials and Methods:** An observational study was planned and conducted in the department of ophthalmology at Darbhanga Medical College and Hospital, Darbhanga, Bihar. The study period was 1 year from February 2022 to January 2023. Prior approval to conduct the study was obtained from the Institutional Ethics Committee. A total of 200 patients were included in the study, hence 400 eyes were examined during the period. Anterior chamber depth and axial length measurements were taken by DGH 3000 SSB computed A-Scan model. Refraction was done under complete cyclopegia by Streak retinoscopy. CCT was measured by pentacam. Following parameters were measured for each right and left eye. Statistical analysis was carried out using SPSS (Statistical Package for Social Sciences) ver. 24.0. Descriptive statistics was performed. **Result:** A total of 200 patients were included. Each group had 50 patients with 100 eyes. Regarding refraction data, the mean sphere was −0.42 ± 3.91 D, the mean cylinder was −1.31 ±0.79 D, the mean axis was 90.6 ± 62.1 D, and the axial length was 25.2 ± 1.82 mm. **Conclusion:** In our study, it was found that eyeball (axial length) tends to grow up to 16-18 years of age. Then after it ceases to enlarge. Also, it was observed in our study that myopes tend to have longer axial length and hypermetropes tend to have a shorter axial length comparing to that with emmetropes and astigmatics up to certain age group.

INTRODUCTION

The average newborn's eyeball is about 16 millimeters in diameter, from front to back (axial length). In an infant, the eye grows slightly to a length of approximately 19½ millimeters. The eye continues to grow, gradually, to the length of about 24-25 millimeters.[1] The Axial Length (AL) is the distance from the corneal surface to an interference peak corresponding to the retinal pigment epithelium/ Bruch's membrane.[2,3] A majority of axial length elongation takes place in the first 3 to 6 months of life and a gradual reduction of growth over the next two years,[4] and by three years the adult size is attained. It is found that the depth and volume of the anterior chamber diminish with age and are related to the degree of ametropia. The large scale studies on the growth of the ocular components suggest that the eye has reached its adult emmetropic axial length by the age of 13 years. Studies have also shown that the anterior chamber has normally reached its maximum depth, and to by crystalline lens its minimum thickness about 15 years of age, because the crystalline lens decreases in power during the slow coordinated growth period of the eye in childhood.[5,6] In the adult, axial length remains practically unaltered. A slight but steady change towards hyperopia is the rule, especially after the age of 40. The human eye grows extensively after birth. The full term newborn eye has a mean axial length of 16-18 mm & mean anterior chamber depth 1.5-2.9 mm.[7-10] The mean adult values for axial length are 22-25 mm and mean refractive power -25.0 -+1.0 D.

The mean depth of the anterior chamber in an adult emmetropic eye is 3-4 mm. Accumulating evidence from human studies point out that both heredity and the environment contribute to the refractive power of the eye. It has been noted that the newborn and infants exhibit considerable refractive errors which

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then by emmetropisation process, decrease as the child grows older. The determination of corneal thickness has gained re1evance in recent years, partly owing to the growing interest in refractive surgery.[11] Studies that have attempted to investigate the effect of refractive errors on central corneal thickness (CCT) and axial length have reported conf1icting results.[12] The current study was aimed to find out the status of axial length, central corneal thickness and anterior chamber depth among patients attending the ophthalmology at a tertiary care centre in Bihar.

MATERIALS AND METHODS

An observational study was planned and conducted in the department of ophthalmology at Darbhanga Medical College and Hospital, Darbhanga, Bihar. The study period was 1 year from February 2022 to January 2023. Prior approval to conduct the study was obtained from the Institutional Ethics Committee. A total of 200 patients were included in the study, hence 400 eyes were examined during the period. They are divided into 4 groups depending on the age: Group A: Patients of 0-10 years of age, Group B: Patients of 11-20 years of age, Group C: Patients of 21-40 years of age, Group D: Patients of 41-60 years of age. Anterior chamber depth and axial length measurements were taken by DGH 3000 SSB computed A-Scan model. Refraction was done under complete cyclopegia by Streak retinoscopy. CCT was measured by pentacam. Following parameters were measured for each right and left eye. a. Uncorrected visual acuity (UCVA). b. Anterior chamber depth (in mm). c. Axial length (in mm). d. Central corneal thickness (in nm).
Statistical analysis was carried out using SPSS (Statistical Package for Social Sciences) ver. 24.0. Descriptive statistics was performed. Result has been expressed in terms of mean and standard deviation.

RESULTS

A total of 200 patients were included. Each group had 50 patients with 100 eyes. Regarding refraction data, the mean sphere was −0.42 ± 3.91 D, the mean cylinder was −1.31 ±0.79 D, the mean axis was 90.6 ± 62.1 D, and the axial length was 25.2 ± 1.82 mm. The age and gender distribution of the patients in terms of the degree of refractive error has been detailed in [Table 1]. Mean anterior chamber depth and axial length along with SD has been reported in [Table 2 and 3]. In our study there was not any significant difference in the anterior chamber depth between males and females in all four groups. It was noted that myopes tend to have a longer axial length and hypermetropes tend to have shorter axial length as compared to those with emmetropes. Also, axial length significantly increases from group A to group B. The mean CCT of all patients was 541.31 ±31.63 nm.

Table 1: Sex ratio in different refractive errors in relation to different age groups

Group	Enmetropia		Ametropia					
			Myopia		Hypermetropia		Astigmatism	
	M	F	M	F	M	F	M	F
A	14	18	12	11	7	10	12	16
B	15	10	21	18	10	12	10	4
C	15	9	17	20	17	15	4	3
D	14	15	18	15	12	16	6	4

Table 2: Mean anterior chamber depth with SD (in mm) in different refractive error in relation to different age groups

Group	Enmetropia		Ametropia					
			Myopia		Hypermetropia		Astigmatism	
	M	F	M	F	M	F	M	F
A	3.11	3.16	3.51	3.49	2.54	2.75	3.12	3.17
SD	0.22	0.26	0.21	0.16	0.09	0.13	0.19	0.31
B	3.12	3.11	3.51	3.57	2.45	2.76	3.12	3.09
SD	0.11	0.17	0.33	0.32	0.71	0.75	0.21	0.35
C	2.78	2.32	3.21	3.29	2.87	2.63	3.01	3.11
SD	0.11	0.14	0.23	0.27	0.19	0.42	0.40	0.22
D	2.77	2.73	3.24	3.18	2.50	2.57	2.91	2.61
SD	0.29	0.21	0.22	0.31	0.21	0.14	0.31	0.24

Table 3: Mean axial length with SD (in mm) in different refractive error in relation to different age groups

Group	Enmetropia		Ametropia					
			Myopia		Hypermetropia		Astigmatism	
	M	F	M	F	M	F	M	F
A	22.31	21.87	22.76	22.81	21.11	22.09	21.98	22.03
SD	0.50	0.67	1.10	1.68	0.21	0.31	0.24	0.32
B	22.09	22.42	24.07	24.18	21.97	21.71	23.13	23.06
SD	0.46	0.47	0.67	0.40	1.09	0.56	1.07	1.01
C	21.98	21.99	22.58	25.56	22.06	22.01	23.23	22.16
SD	1.11	0.91	1.65	2.53	0.90	1.28	2.26	1.39
D	23.01	21.99	24.64	24.95	21.68	21.61	22.06	21.5
SD	0.42	0.91	1.69	1.72	0.35	0.47	0.49	0.26

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DISCUSSION

In our study there was not any significant difference in the anterior chamber depth between males and females in all four groups. Most of the earlier investigators have also found higher values in myopic eyes as compared to emmetropic and hypermetropic eyes like Chen MJ et al,[13] who found that eyes with more myopic refractive error tends to have deeper anterior chamber. Osuobeni EP et al,[14] studied on ocular components measured by ultrasonography in 152 adult Saudis from 16 to 50 years and found that myopes had significantly deeper ACD as compared to nonmyopes. Scott T Fontana; Richard F Brubaker, MD,[15] also found that the depth and volume of the anterior chamber diminish with age and are related to the degree of ametropia. Frequency distributions suggested that these dimensions were distributed normally in the test population. In our study it can be made out from the results that in all age groups, myopes tend to have an longer axial length and hypermetropes tend to have shorter axial length as compared to those with emmetropes. Which coincides with other previous studies and no significant difference is found between emmetropes and astigmatics. It can be made out that in all refractive errors axial length significantly increases from group-A to group B. The differences in axial length according to age are also seen. Axial length in myopes and hypermetropes increases with age which is significant between Group A and Group B. This also supports the process of emmetropization. Francois et al,[5] also noted a difference of 0.40 mm in patients less than 40 years and above 40 and this decrease in axial length was statistically significant. Similar findings were noted by Gernet H et al., in 1964.[16] Zadnik K et al,[17] found that there is a general pattern of ocular growth between the ages of 6 to 14 years. Lourdes Llorente et al,[18] also found that the Axial Length (AL) of hyperopic eyes (22.62 + 0.76 mm) was significantly lower than the axial length of myopic eyes 25.16 + 1.23 mm in 30.3 + 5.2 and 30.5 + 3.8 years old, respectively.

The study showed that median CCT in the myopia group was 542 µm (508–546.5), median CCT in the hyperopia group was 520.5 µm and median CCT in the emmetropia group was 556.5 µm. Hence, it can be seen that the CCT and axial refractive errors were related as CCT was higher in the emmetropia group compared with the myopia and the hyperopia groups. Kadhim et al,[19] studied the correlation between CCT and refractive errors where CCT was evaluated by ultrasound pachymeter. They reported significantly thinner corneas in myopia (539.5 nm) than emmetropia (550.47 nm), which correlated with our results. Chang et al,[20] studied the cornea in myopic adults. CCT was evaluated by specular microscopy. They found that mean corneal thickness was 533 (SD 29) µm and reported thinner corneal thickness in more myopic eyes (r=0.16, P=0.021) and in cases with longer axial lengths, which correlated with our results. Saxena et al,[21] studied the important considerations of CCT in ophthalmology clinic. CCT was evaluated with ultrasound pachymeter. They reported thinner CCT in myopic individuals (522.87±18.034 nm) than hyperopic individuals (536.39±17.753 nm), which contradicted our results, as we found thinner corneas in the hyperopia group compared with the myopia group (median CCT measured 523 and 531 µm for the hyperopia and the myopia groups respectively), but this difference was not statistically significant.

CONCLUSION

In our study, it was found that eyeball (axial length) tends to grow up to 16-18 years of age. Then after it ceases to enlarge. Also, it was observed in our study that myopes tend to have longer axial length and hypermetropes tend to have a shorter axial length comparing to that with emmetropes and astigmatics up to certain age group.

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