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Original Article

Ophthalmology Section

Axial Length, Anterior Chamber Depth-A Study in Different Age Groups and Refractive Errors

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ABSTRACT

Introduction: Axial length and anterior chamber depth play an important role in refractive status of the eye in different age groups.

Material and Methods: The present study has been done on 240 patients (480 eyes) who attended eye OPD of Department of Ophthalmology at NIMS Medical College & Hospital Jaipur, Rajasthan, India. The patients attending eye OPD between July 2011 to December 2012 of different ages groups were without significant history of any ocular disease. The axial length and anterior chamber depth were measured and compared.

Conclusion: Hypermetropic eyes have shallow anterior chamber depth and shorter axial length as compared to myopic and emmtropic eyes.

Key words: Axial lenght(Axl), Anterior chamber depth(Acd), Uncorrected visual acuity(Ucva)

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 membranee [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 shown in several studies that the newborn and infants exhibit considerable refractive errors which then by emmetropisation process, decrease as the child grows older [11-16].

MATERIAL AND METHODS

The study was conducted on 480 eyes of 240 patients of different age group attending the eye OPD which were taken randomly. 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. 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).

RESULTS

[Table/Fig-1-3].

Group	Emmetropia		Ametropia					
			Myopia		Hypermetropia		Astigmatism	
	Male	Female	Male	Female	Male	Female	Male	Female
A	7 (11.67%)	10 (16.67%)	10 (16.67%)	9 (15%)	5 (8.33%)	7 (11.67%)	5 (8.33%)	7 (11.67%)
B	10 (16.67%)	6 (10%)	8 (13.33%)	10 (16.67%)	7 (11.67%)	5 (8.33%)	8 (13.33%)	6 (10%)
C	10 (16.67%)	6 (10%)	8 (13.33%)	9 (15%)	7 (11.67%)	5 (8.33%)	8 (13.33%)	7 (11.67%)
D	7 (11.67%)	8 (13.33%)	8 (13.33%)	11 (18.33%)	6 (10%)	10 (16.67%)	6 (10%)	4 (6.67%)

[Table/Fig-1]: Sex ratio in different refractive errors in relation to different age groups

Group	Emmetropia		Ametropia					
			Myopia		Hypermetropia		Astigmatism	
	Male	Female	Male	Female	Male	Female	Male	Female
A	3.16	3.22	3.44	3.46	2.98	2.97	3.06	3.12
SD	0.22	0.27	0.23	0.14	0.11	0.13	0.15	0.26
B	3.04	3.06	3.41	3.57	2.79	2.90	3.05	2.93
SD	0.14	0.19	0.38	0.26	0.8	0.15	0.18	0.46
C	2.86	2.89	3.40	3.29	2.55	2.61	3.02	3.03
SD	0.17	0.15	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	0.3	0.20	0.24	0.26	0.19	0.16	0.32	0.21

[Table/Fig-2]: Average Anterior Chamber Depth (in mm) in different refractive errors in relation to different age group

Age (years)	Emmetropia		Ametropia					
			Myopia		Hypermetropia		Astigmatism	
	Male	Female	Male	Female	Male	Female	Male	Female
0-10	22.28	21.93	22.81	22.82	21.22	21.29	22.32	22.03
SD	0.50	0.67	1.10	1.68	0.21	0.31	0.24	0.32
11-20	23.23	23.42	24.07	24.18	21.97	21.71	23.13	23.06
SD	0.48	0.46	0.67	0.40	1.09	0.56	1.01	1.07
21-40	22.71	22.99	23.58	23.56	22.06	22.01	23.23	22.16
SD	1.21	0.91	1.65	2.53	0.90	1.28	2.26	1.39
>40	22.33	22.99	23.64	23.95	21.68	21.61	22.06	21.5
SD	0.49	0.71	1.69	1.72	0.35	0.47	0.49	0.26

[Table/Fig-3]: Average Axial length (in mm) in different refractive errors in relation to different age groups

DISCUSSION

In our study there was not any significant difference in the anterior chamber depth between males and females in all four groups as shown in [Table/Fig-2]. 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., [17] who found that eyes with more myopic refractive error tends to have deeper anterior chamber (r= 0.651,.p<0.001). Osuobeni EP et al., [18] 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, [19] 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 as shown in [Table/Fig-3]. 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 Ggroup-A to Ggroup B as shown in [Table/Fig-3].

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 support 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 [20].

Zadnik K et al., [21] found that there is a general pattern of ocular growth between the ages of 6 to 14 years. Lourdes Llorente et al., [22] also found that the Axial Length (AL) of hyperopic eyes (22.62 + 0.76 mm) was significantly lower (p<.001) 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.

LIMITATION

Children below the age of 3 years could not be included in study.

Parameters like crystalline lens thickness were not considered in the study.

High and low degree of refractive errors were not considered in studies.

CONCLUSION

In our study, it was found that eyeball (axial length) tends to grow upto16-18 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 upto certain age group.

Our study was done on rural population who were from lower economical class and were poorly educated. Still our findings are similar to the studies done on urban population. This shows that enviormental factors, nourishment and education does not play any significant role in the development of refractive error and so on axial length and anterior chamber depth.

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