Original Article

Correlation Between Axial Length and Anterior Chamber Depth in Short, Normal and Long Eyes in Kashmiri Population.

Syed Sadaf Altaf , Asif Amin Vakil , Sabia Rashid.

Abstract

Background

Since the ocular biometry parameters can be influenced by race, ethnicity, and genetics, their differences between different populations can probably explain the differences in refractive errors, and it would be useful to determine the distribution of biometric indices in each area of the world.

Materials and Methods

This observational, cross-sectional study included 150 eyes where eyes were divided into three groups according to the AL. Short Eyes: AL ≤22mm, Normal Eyes: AL >22mm and <24.50mm and Long Eyes: AL ≥24.50mm. AL and Anterior Chamber Depth (ACD) measurements were carried out using an Ultrasound Echorule Pro A-Scan Biometer Version 2.02 (Biomedix).

Results

Out of 150 patients, 34 were short, 88 were normal and 28 were long eyes. The mean ACD in short eyes was 2.95 ± 0.471 mm, in normal eyes was 3.09 ± 0.407 mm and in long eyes was 3.27 ± 0.289 mm. There was a positive correlation between AL and ACD in long eyes which further was found to be highly significant, while no statistically significant correlation was found between AL and ACD in short and normal eyes.

Conclusion

Although the main aim of our study was to evaluate ocular biometry characteristics in Kashmiri population and establish region specific differences, our findings were consistent with most of the available literature in different parts of world, however further studies should be conducted to understand the correlations between AL and ACD and their effect on IOL power calculations in order to get better refractive outcomes.

JK-Practitioner2024;29(1):30-33

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Indexed
EMBASE ,SCOPUS , IndMED ,ESBCO, Google Scholar besides other national and international databases

Cite this article as
Altaf SS, Vakil AA , Rashid S. Correlation Between Axial Length and Anterior Chamber Depth in Short, Normal and Long Eyes in Kashmiri Population.. JK Pract2024;29(1):30-33.

Full length article available at **Jkpractitioner.com** one month after publication

Keywords
Axial Length, Anterior Chamber Depth, Intraocular Lens.

Introduction

In human eyes, axial length, refractory power of the cornea and lens, and anterior chamber depth are interrelated determinants of optical function. Changes in each of ocular parameters accompany not only various refractory errors but also cataract, glaucoma, retinal disease, and other oculopathies [1]. Axial length, keratometric readings, anterior chamber depth, and other measurements are utilized to estimate postoperative effective lens position. Selecting the formula of intraocular lens (IOL) calculation depends mainly on axial length (AL) and anterior chamber depth (ACD) [2,3]. There are two common types of biometry based on different working principles. The first type is noncontact optical biometry, which is designed using partial coherence interferometry to provide ACD, AL and keratometry with a single measurement. The second type is contact ultrasound biometry using 10-MHz ultrasound waves to measure AL, ACD, and lens thickness [4]. Several studies have shown the correlation between ocular biometry, specially AL, with refractive errors. Since these parameters can be influenced by race, ethnicity, and genetics, their differences between different populations can probably explain the differences in refractive errors, and it would be useful to determine the distribution of biometric indices in each area of the world [5]. Understanding region specific differences regarding IOL power calculations is vital for post cataract surgery evaluations. Considering these differences, this study was conducted in order to investigate the relationship between AL and ACD in a referral center from Kashmir.

Materials and Methods

This observational, cross-sectional study was carried out in the Postgraduate Department of Ophthalmology, Government Medical College Srinagar for a period of six months (june-nov 2021). All patients who visited the department during that period for IOL implantation were included in the study. Any patient whose biometry was performed outside of the hospital, cases with ocular trauma and traumatic cataract, phacomorphic glaucoma, history of ocular surgery, uveitis, corneal ulcer, or the presence of posterior staphyloma were excluded from the study.

Sample Size: Using GPOWER software (Version 3.0.10), it was estimated that the least number of eyes with 80% power, 5% significance level and an effect size of 0.2 is 150. Therefore, we included 150 eyes in our study.

Methods

The eyes were divided into three groups according to the AL. Short Eyes: AL ≤22mm, Normal Eyes: AL >22mm and <24.50mm and Long Eyes: AL ≥24.50mm. AL and ACD measurements were carried out using an Ultrasound Echorule Pro A-Scan Biometer Version 2.02 (Biomedix).The biometry testing was carried out using the contact method by instilling a drop of proparacaine in the eye and while looking at the red light on the probe of the sonography machine, the probe was put in contact with the patient's cornea without applying any pressure. This was repeated ten times for each eye and the average AL was calculated by the machine. ACD was calculated automatically by the machine.

Statistical analysis

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Statistical software SPSS (version 20.0) and Microsoft Excel were used to carry out the statistical analysis of data. Continuous variables were expressed as Mean±SD and categorical variables were summarized as percentages. Analysis of variance (ANOVA) was employed for comparison of continuous variables. Chi-square test or Fisher's exact test, whichever appropriate, was used for comparison of categorical variables. Karl Pearson's correlation coefficient was applied to determine the correlation between axial length and anterior chamber depth in short, normal and long eyes. Graphically the data was presented by bar diagrams and scatter plots. A P-value of less than 0.05 was considered statistically significant.

Results

This study included 150 eyes of 150 patients, out of which 34 were short eyes, 88 were normal eyes and 28 were long eyes. The study population consisted of 78(52%) males and 72(48%) females. In the study, In the Short Eyes group, 13(38.2%) were male while 21(61.8%) were female, while in the Normal Eyes group, 49(55.7%) were male and 39(44.3%) were female. Also in the Long Eyes group, 16(57.1%) were male and 12(42.9%) were female, however the difference in the gender distribution was not significant (Table 1).

Table 1: Gender distribution of study patients with short, normal and long eyes

Gender	Short eyes		Normal eyes		Long eyes	
	No.	%age	No.	%age	No.	%age
Male	13	38.2	49	55.7	16	57.1
Female	21	61.8	39	44.3	12	42.9

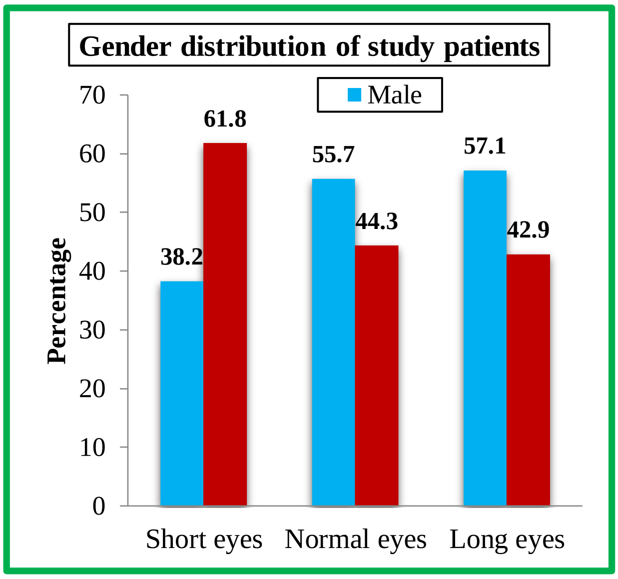

Figure 1: Gender Distribution of study patients

The mean age of patients was 61.4 ± 10.22 years while the range was 35-80 years. The mean age of the patients with short eyes was 61.7 ± 10.64 years (40-80), with long eyes was 62.1 ± 9.59 years (36-80) and with long eyes was 58.9 ± 11.63 years (37-70)(Table 2).

Table 2: Age distribution of study patients with short, normal and long eyes					
Age (Years)	**N**	**Mean**	**SD**	**Range**	**P-value**
Short eyes	34	61.7	10.64	40-80	0.332
Normal eyes	88	62.1	9.59	36-80	
Long eyes	28	58.9	11.63	37-76	

The mean ACD in short eyes was 2.95 ± 0.471 mm, in normal eyes was 3.09 ± 0.407 mm and in long eyes was 3.27 ± 0.289 mm which showed a statistically significant difference between the three groups (Table 3).
*Statistically Significant Difference (P-value<0.05)

Table 2: Age distribution of study patients with short, normal and long eyes					
Age (Years)	**N**	**Mean**	**SD**	**Range**	**P-value**
Short eyes	34	61.7	10.64	40-80	0.332
Normal eyes	88	62.1	9.59	36-80	
Long eyes	28	58.9	11.63	37-76	

*Statistically Significant Difference (P-value<0.05)

On studying the correlation between AL and ACD in the three groups it was found there was a positive correlation between AL and ACD in the long eyes which further was found to be highly significant, while no statistically significant correlation was found between AL and ACD in short and normal eyes (Table 4).

Table 4: Correlation between the axial length and the anterior chamber depth (ACD) in three groups.
***Statistically Significant Correlation (P-value<0.05)**

	Axial length					
	Short eyes		**Normal eyes**		**Long eyes**	
	r-value	**P-value**	**r-value**	**P-value**	**r-value**	**P-value**
ACD (mm)	0.197	0.265	0.182	0.089	0.736	<0.001*

Discussion:

In our study, the relationship between AL and ACD was evaluated in short, normal and long eyes, wherein a statistically significant positive correlation was found in long eyes and no statistically significant correlation was seen in short and normal eyes. In a similar study conducted by El-Ghazawy et al. [6] it was found that the correlation between AL and ACD among short eyes was statistically significant and they were negatively correlated ($r=-0.458$, $P=0.011$), while no statistically significant correlation existed between AL and ACD in normal and long eyes, which did not corroborate with our study. A study by Rodriguez Lopez CE et al.[7] found that ACD, white-to-white (WTW), and average keratometries (K) increase as AL increases in normal, short, and long eyes, but this correlation is not maintained in extremely long eyes. In another study by Chang JS et al.[8] which consisted of 1184 eyes of 1184 Chinese patients, the mean age was 65.8 ± 13.3 years (range, 19-98 years) and the mean AL and ACD were 24.73 ± 2.48 mm (range, 20.51-36.20 mm) and 3.09 ± 0.44 mm (range, 1.95-4.68 mm), respectively. Pearson correlation coefficients in all eyes, normal to long eyes (1026 eyes, 87%), and extremely long eyes (158 eyes, 13%) were 0.56 ($P < 0.001$), 0.59 ($P < 0.001$), and -0.15 ($P = 0.67$), respectively. This study concluded that there was a statistically significant positive correlation between AL and ACD in normal and long eyes but not in extremely long eyes. Also in a study of 698 cataract patients by Sedaghat MR et al.[9] it was found that among individuals who had normal AL (between 22-24.5mm), there was a positive correlation between AL and ACD ($p<0.001$, $r=0.17$), however, among individuals with short (AL<22mm) or long sightedness (AL>24.5mm), no significant correlation was detected. A study by Savitha DP et al.[10] established that there was a weak linear positive correlation between ACD and AL. It was observed that as overall mean AL decreased overall mean ACD also decreased but the differential correlation between different AL-based groups was very weak. Our results agree with most of the studies, where a positive correlation has been established in long eyes. However it disagrees with El-Ghazawy et al.(6) who concluded that there was a significant negative correlation in short eyes, where the reason could be the small sample size of their study group (90), which might not be representative of the population.

Conclusion

Although the main aim of our study was to evaluate ocular biometry characteristics in Kashmiri population and establish region specific differences, our findings were consistent with most of the available literature in different parts of world, however further studies should be conducted to understand the correlations between AL and ACD and their effect on IOL power calculations in order to get better refractive outcomes.

Abbreviations

AL	Axial Length
ACD	Anterior Chamber Depth
IOL	Intraocular Lens

References

1. Dae Woong Lee, Mo Kim, Chul Young Choi, et al. Age-related changes of ocular parameters in Korean subjects. Clin Ophthalmol 2010;4:725–730.
2. Hoffer KJ. The Hoffer Q formula: a comparison of theoretic and regression formulas. J Cataract Refract Surg 1993; 19:700–712.
3. Raymonds FI, Santamaria L. Comparing ultrasound biometry with partial coherence interferometry for intraocular lens power calculations. Invest Ophthalmol Vis Sci 2009; 50:2547–2552.
4. Hennessy MP, Franzco, Chan DG. Contact versus immersion biometry of axial length before cataract surgery. J Cataract Refract Surg 2003;29(11):2195–2198.
5. Hashemi H, Khabazkhoob M, Miraftab M, Emamian M, Shariati M. The distribution of axial length, anterior chamber depth, lens thickness, and vitreous chamber depth in an adult population of Shahroud, Iran. BMC Ophthalmol 2012;12:50.
6. El-Ghazawy, Rafik & El-Awamry, AmrI & Zaki, Rania & Toma, Joseph. Correlation between axial length and anterior chamber depth in short eyes, normal eyes, and long eyes. Journal of the Egyptian Ophthalmological Society. 2019,112:30-33.
7. Rodriguez Lopez CE, Mora Gonzalez GF, Felix JR, Perez Garcia SY, Ibanez Hernandez MA, Munoz AR. Correlation between axial length, anterior chamber depth, and other biometric measurements with iol master 700 in normal eyes, short eyes, long eyes, and extremely long eyes in latin american population. Pan Am J Ophthalmol 2021;3:1
8. Chang JS, Lau SY. Correlation Between Axial Length and Anterior Chamber Depth in Normal Eyes, Long Eyes, and Extremely Long Eyes. Asia Pac J Ophthalmol (Phila). 2012 Jul-Aug;1(4):213-5.
9. Sedaghat MR, Azimi A, Arasteh P, Tehranian N, Bamdad S. The Relationship between Anterior Chamber Depth, Axial Length and Intraocular Lens Power among Candidates for Cataract Surgery. Electron Physician. 2016 Oct 25;8(10):3127-3131.
10. Savitha DP, Sangapur AN, Lakshmi BR.Correlation between ocular axial length, anterior chamber depth, Average K-values and a differential analysis inshort. TropJ Ophthalmol Otolaryngol. 2019;4(8):452-456.