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DISTRIBUTION OF AXIAL LENGTH, ANTERIOR CHAMBER DEPTH, AND K READING IN SAUDI POPULATION

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ABSTRACT

Ocular biometry is the measurement of the various dimensions of the eye. The axial length and the corneal curvature are essential measurements to predict the correct lens power of an intraocular lens. Ocular biometric parameters can be influenced by race and genetics, and it leads to differences in refractive errors across different populations. This Cross sectional study was done to determine the distribution of Axial Length (AL), Anterior Chamber Depth (ACD), and Corneal Curvature (average K reading) in patients planned for phacoemulsification surgery. IOL master was used to evaluate the biometry. The period of study was between January, 2011 to December, 2014. The mean AL was 23.48 ± 1.40 mm, mean K reading was 43.74 ± 1.73 diopter(D), and the mean ACD was 3.10 ± 0.47 mm. Females had a significantly shorter mean axial length as compared to males, and the mean axial length and the mean anterior chamber depth were significantly shorter in the older age group above 40 years of age. The ocular biometric parameters in this study were comparable to other studies. Females had shorter axial lengths. The AL and ACD decreased with age.

KEYWORDS: Axial Length, Eye; Biometry; Cataract.

INTRODUCTION

The measurement of the various dimensions of the eye, and the inter relationships of its components is known as Ocular Biometry. Among these variables the most important ones are the axial length and the corneal curvature in order to predict the closest to correct power of an intraocular lens.[1,2]

Any variability in these different parameters may end with significant refractive errors.The relationship of age and the refractive error with axial length has been determined by various

studies.[3,4]These methods were based on ultrasound, whereas the newer methods are based on optical systems like IOL master.[5]These ocular parameters are also influenced by genetics and race.[6–8]

This study'saim was to determine the distribution of axial length (AL), anterior chamber depth (ACD), and corneal curvature (K reading in diopter) and to determine the possible variability between them with age and gender of the patients.

METHODOLOGY

The study was carried out at the ophthalmologycenter in King Abdullah Medical City (KAMC) Makkah, from July 2014 to December 2014.The data were collected from the software of IOL master machine for all patients who underwent ocular biometry measurement before phacoemulsification cataract surgery in the year 2014 at KAMC or Zabeedi Eye Center, and also from the surgical log books of KAMC for the period from January 2011 to December 2014.

The medical records of the patients were looked for previous history of ocular surgery prior to ocular biometry measurement to exclude those patients from the study.The following data were collected: age, gender, axial length (AL) for both eyes, anterior chamber depth (ACD) for both eyes, and the corneal curvature (K reading in diopter) for both eyes.

The data was recorded in electronic excel sheets, where the patients were identified by serial study codes, and two different persons performed the data entry.The collected data was then arranged & analyzed using the software Statistical Package for Social Sciences (SPSS).

RESULTS

In this study, only data from phakic eyes wasincluded, and those who had history of eye surgery were excluded. As there is usually insignificant variability in between the two eyes of a normal person, we recorded the average measurement from both eyes, if it was available. In case of patients with history of eye surgery in one of their eyes; the data of the non-operated eye was recorded.

The axial length and the corneal curvature data were available in 1248 patients; 691 (55.4%) of them were from Zabeedi Eye Center. But the anterior chamber depth (ACD) measurements were available in only 789 out of the 1248 patients.

The mean age of our 1248 patients was 58.1 ± 15.5, and 1066 (85.4%) were above 40 years of age. Meanwhile 634 (50.8%) of our patients were females, and there was no significant

difference in the mean age of patients in regard to their gender. Table – 1 shows the age distribution of our included patients.

Results in terms of mean ± SD and 95% confidence Interval of mean(CI), AL, K reading and ACD according to the age and gender are shown in Table – 2 and Table – 3.

DISCUSSION

Ocular biometry especially the axial length has important applications in ophthalmology. Ocular biometric parameters are influenced by race and genetics,[6-8] and therefore we aimed to determine the distribution of biometric parameters in our local area.

A comparative data among different ethnicities revealed that the axial length of Asians (East Asian 23.89 mm, South Asian 23.60 mm) was longer than Middle Eastern (23.45 mm) and Caucasians (23.24 mm) population.[9]

In our study the mean AL was 23.48 ± 1.40 mm (95% CI, 23.40 – 23.56) which is comparable to what was reported by Tariq et al.[9] Meanwhile; in the Iranian study;[10] the mean AL was 23.14 mm (95% CI, 23.11 – 23.17). The Beijing Eye Study;[11] reported the range of axial length between 18.96 – 30.88 mm which is comparable to our study (18.16 – 31.85). Indian populations have also shown similar axial length distribution.[12, 13]

The mean anterior chamber depth (ACD) was 3.10 ± 0.47mm (95% CI, 3.07 – 3.14) in our study, which is similar to what was reported by lee et al,[3] (3.11 mm), meanwhile; the ACD was 3.08 in the study of Roy et al,[14] and 2.62 in the Iranian study.[10] The range of ACD was 2.02 – 4.56 mm in our study, meanwhile in the Iranian study it was 2.57 – 3.41 mm.

In our study the mean K reading was 43.74 ± 1.73 D (95% CI, 43.65 – 43.84), and ranged from 38.14 – 51 D. Nizamani et al,[15] reported a similar range of keratometric values (36.00 – 52.00 D) which slightly differed from Elder's;16 range (40.25 – 47.87 D).

Gender based comparison of K reading in our study (M: 43.41 ± 1.74, F: 44.07 ± 1.65) was comparable to keratometric values reported by Nizamani et al,[15] (M: 43.68 ± 1.80, F: 44.31 ± 1.80) and the Canadian study;[17] (M: 43.54 ± 1.47, F: 44.21 ± 1.40).

There was no significant difference between the mean axial length of males and females in the Epic Norfolk Study conducted on British adults.[18] In contrast to this, females had a shorter mean axial length as compared to males (F: 23.34 ± 1.44 mm, M: 23.61 ± 1.33 mm) in our study. Similarly; several other studies have reported that females have smaller eyes and, therefore, shorter axial length and shallower anterior chamber compared to males.[3,10,15]

In our study the mean axial length and the mean ACD were significantly shorter in the older age group, which is similar to what was reported by lee et al,[3] and by the Iranian study,[10] and also in the study of Roy et al.[14] The axial length may decrease in advanced age due to some atrophic aging changes. Meanwhile the decrease in anterior chamber depth with age could be due to the increase in lens thickness with aging.[19]

CONCLUSION

In this study the mean AL was 23.48 ± 1.40 mm (95% CI, 23.40 – 23.56), mean K reading was 43.74 ± 1.73 D (95% CI, 43.65 – 43.84), and the mean ACD was 3.10 ± 0.47 mm (95% CI, 3.07 – 3.14). These results were comparable to other studies.

Females had a significantly shorter mean axial length as compared to males, and the mean axial length and the mean ACD were significantly shorter in the older age group above 40 years of age.

Table – 1: Age distribution of patients

Measurement type	All Eyes N = 1248	Age Forty or Less N = 182	Age Above Forty N = 1066
Mean ± SD	58.07 ± 15.49	29.10 ± 5.88	63.01 ± 10.35
95% Confidence Interval for Mean	57.21 – 58.93	28.24 – 29.96	62.39 – 63.64
Median	61	28.5	62.5
Minimum	14	14	41
Maximum	103	40	103

Table – 2: Comparison of AL, K reading and ACD according to gender

Measurement type	All eyes	Males	Females	P value
Axial length				
Mean ± SD	23.48 ± 1.40	23.61 ± 1.33	23.34 ± 1.44	0.001
95% CI for Mean	23.40 – 23.56	23.51 – 23.72	23.23 – 23.45	
Min – Max	18.16 –31.85	18.16 – 31.85	20.14 – 31.40	
K-reading				
Mean ± SD	43.74 ± 1.73	43.41 ± 1.74	44.07 ± 1.65	0.001
95% CI for Mean	43.65 – 43.84	43.27 – 43.55	43.94 – 44.19	
Min – Max	38.14 – 51.10	38.14 – 51.10	38.88 – 50.11	
ACD				
Mean ± SD	3.10 ± 0.47	3.13 ± 0.47	3.08 ± 0.46	0.128
95% CI for Mean	3.07 – 3.14	3.08 – 3.18	3.03 – 3.12	
Min – Max	2.02 – 4.56	2.04 – 4.21	2.02 – 4.56	

Table – 3: Comparison of AL, K reading and ACD according to age category

Measurement type	All eyes	Age Forty or Less	Age Above Forty	P value
Axial length				
Mean ± SD	23.48 ± 1.40	24.23 ± 1.81	23.35 ± 1.27	0.001
95% CI for Mean	23.40 – 23.56	23.96 – 24.49	23.27 – 23.42	
Min – Max	18.16 – 31.85	20.18 – 30.56	18.16 – 31.85	
K-reading				
Mean ± SD	43.74 ± 1.73	43.58 ± 1.90	43.77 ± 1.70	0.179
95% CI for Mean	43.65 – 43.84	43.30 – 43.86	43.67 – 43.87	
Min – Max	38.14 – 51.10	39.55 – 51.10	38.14 – 49.06	
ACD				
Mean ± SD	3.10 ± 0.47	3.47 ± 0.44	3.01 ± 0.42	0.001
95% CI for Mean	3.07 – 3.14	3.40 – 3.54	2.98 – 3.04	
Min – Max	2.02 – 4.56	2.23 – 4.22	2.02 – 4.56	

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REFERENCES

1. Pan CW, Wong TY, Chang L, Lin XY, Lavanya R, Zheng YF, Kok YO, Wu RY, Aung T, Saw SM. Ocular biometry in an urban Indian population: the Singapore Indian Eye Study (SINDI). Invest Ophthalmol Vis Sci 2011; 52 (9): 6636 – 42.
2. Wang JK, Chang SW. Optical biometry intraocular lens power calculation using different formulas in patients with different axial lengths. Int J Ophthalmol 2013; 6 (2): 150 – 4.
3. Lee KE, Klein BE, Klein R, Quandt Z, Wong TY. Association of age, stature, and education with ocular dimensions in an older white population. Arch Ophthalmol 2009; 127: 88 – 93.
4. Hashemi H1, Khabazkhoob M, Emamian MH, Shariati M, Abdolahi-nia T, Fotouhi A. All biometric components are important in anisometropia, not just axial length. Br J Ophthalmol 2013; 97 (12): 1586 – 91.
5. Findle O. Biometry and intraocular lens power calculation. CurrOpinOphthalmol 2005; 16: 61.
6. Wong TY, Foster PJ, Ng TP, Tielsch JM, Johnson GJ, Seah SK. Variations in ocular biometry in an adult Chinese population in Singapore: the TanjongPagar Survey. Invest Ophthalmol Vis Sci 2001; 42: 73 – 80.
7. He M, Huang W, Li Y, Zheng Y, Yin Q, Foster PJ. Refractive error and biometry in older Chinese adults: the Liwan Eye Study. Invest Ophthalmol Vis Sci 2009;50:5130 – 6.
8. Nangia V, Jonas JB, Sinha A, Matin A, Kulkarni M, Jonas SP. Ocular axial length and its associations in an adult population of Central Rural India. The Central India Eye and Medical Study.Ophthalmology 2010; 117: 1360 – 6.
9. Tariq YM, Samarawickrama C, Pai A, Burlutsky G, Mitchell P. Impact of ethnicity on the correlation of retinal parameters with axial length. IOVS 2010; 51: 4977 – 82.
10. Hashemi H, Khabazkhoob M, Miraftab M, Emamian MH, Shariati M, Abdolahinia T, Fotouhi A. 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 – 57.
11. Yin G, Wang XY, Yang H, Xu L, Jonas JB. The Beijing eye study group. Ocular axial length and its associations in Chinese: the Beijing eye study. PLoS ONE 2012; 7: e 43172.
12. Rashid H, Naseem A, Rahman F. Two years review of intraocular lens power calculation in Ophthalmology Department of Saidu teaching hospital, Swat. Pak J Ophthalmol 2007; 23: 122 – 5.
13. Bhardwaj V, Rajeshbhai GP. Axial length, anterior chamber depth: a study in different age groups and refractive errors. J ClinDiagn Res 2013; 7: 2211 – 2.
14. Roy A, Kar M, Mandal D, Ray RS, Kar C. Variation of Axial Ocular Dimensions with Age, Sex, Height, BMI-and Their Relation to Refractive Status. J ClinDiagn Res 2015; 9 (1): AC 01 – 4.
15. Nizamani NB, Surhio SA, Memon S, Talpur KI. Axial length variability in cataract surgery. J Coll Physicians Surg Pak 2014; 24 (12): 918 – 21.
16. ElderMJ. Predicting the refractive outcome after cataract surgery: the comparison of different IOLs and SRK-II v SRK-T.Br J Ophthalmol 2002; 86:620 – 2.
17. Al-Mahmoud T, Priest D, Munger R, Jackson WB. Correlation between refractiver error, corneal power and thickness in a large population with a wide range of ametropia. IOVS 2011; 52: 1235 – 42.
18. Foster PJ, Broadway DC, Hayat S, Luben R, Dalzell N, Bingham S, et al. Refractive error, axial length and anterior chamber depth of the eye in British adults: the EPIC-Norfolk Eye Study. Br J Ophthalmol 2010; 94: 827 – 830.
19. Praveen MR, Vasavada AR, Shah SK, Shah CB, Patel UP, Dixit NV et al. Lens thickness of Indian eyes: impact of isolated lens opacity, age, axial length, and influence on anterior chamber depth. Eye (Lond) 2009, 23: 1542 – 1548.