

# Biometric Findings in Patients Undergoing Cataract Surgery; Gender Comparison

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**Purpose:** To report normal biometric findings in patients undergoing cataract surgery and make comparison of these values between males and females.

**Study Design:** Cross sectional, descriptive.

**Place and Duration of Study:** Data collected in Armed Forces Institute of Ophthalmology (AFIO) Rawalpindi during 2016 was analyzed.

**Material and Methods:** A total of 752 biometries were done in patients undergoing cataract operation. Axial length (AL), Keratometry readings (K1 and K2), Anterior chamber depth (ACD) and Posterior chamber intraocular lens power (PC IOL) of the patients were assessed to find mean, standard deviation, minimum value and maximum value. Statistical analysis was done in SPSS 20. Comparison of these values for males and females was done by Independent Samples t Test.

**Results:** Age ranged from 16 years to 105 years (Mean  $63.05 \pm 10.52$ ). Male were 412 (54.79%) and female were 340 (45.2%). Mean AL was  $23.22 \pm 1.08$  mm. Mean K1 was  $42.87 \pm 1.98$  D. Mean K2 was  $43.96 \pm 1.8$  D. 4.55. Mean ACD was  $3.2397 \pm .40$  and mean PC IOL was  $21.2 \pm 2.35$ . Significant differences were observed in all the parameters when the findings for males and females were compared.

**Conclusion:** Pakistani female cataract patients have smaller axial length and anterior chamber depth but higher corneal curvature when compared to their male counterparts.

**Keywords:** Axial length of eye, Keratometry, Intraocular lens.

Cataract surgery is one of the most commonly done operations in the world. Posterior Chamber Intraocular lens implantation (PC IOL) at the time of cataract surgery is routinely done nowadays and biometry is used to calculate the required power of the IOL. Biometry includes measurement of many parameters and the most important are axial length (AL), corneal curvature (Keratometry or K reading) and anterior chamber depth (ACD). Axial length is the anteroposterior diameter of the eye measured at center of the cornea. K readings are measured with keratometers and represent horizontal and vertical curvature of the cornea. Presence of corneal astigmatism reflected by difference of K readings in different corneal meridian

alerts eye surgeon to think of corrective methods before starting surgery. Good biometry improves post cataract surgery refractive status and this is now the aim of cataract surgery. We can achieve in more than 90% cases within  $\pm 1$  D of target refraction<sup>1</sup>. Thus measurement of axial length and corneal curvature are very important issues. Axial length is measured with different techniques<sup>2,3,4,5,6</sup>. Ultrasound biometers being most economical are still the predominant source of biometry in Pakistan. Cycloplegia<sup>7,8,9</sup> and trabeculectomy<sup>10</sup> have been associated with effect on ACD, AL and K readings. One should be cautious, not to take biometric findings after mydriasis/cycloplegia. Similarly findings after trabeculectomy operations cannot be taken as of normal population. There is

scarcity of good studies (involving large sample size) regarding age, axial length, corneal curvature and power of intraocular lens undergoing cataract surgery in Pakistani males and females. Keeping in mind all the above mentioned facts we conducted this study to find the normal biometric findings in Pakistani population.

**MATERIAL AND METHODS**

A total of 752 biometeries were done in patients undergoing cataract operation in Armed Forces Institute of Ophthalmology (AFIO) Rawalpindi from 1<sup>st</sup> January 2016 to 31<sup>st</sup> Dec 2016. This study was approved by the Ethics Committee of AFIO and followed the tenets of the Declaration of Helsinki. All the cases for cataract operations were included in the study. Patients who had history of any form of eye surgery were excluded from the study. All the data was collected by TS. Keratometry was done with autorefractometer RF 2 (Canon - Japan). AL was measured with Axis II ultrasound. A mode Biometer (Quantel Medical -France). SRK-T formula was used to

calculate PC IOL power. A constant was taken as 118.0. Axial length (AL), Keratometry readings (K1 and K2), anterior chamber depth (ACD) and PC IOL power of the patients were assessed to find mean, standard deviation, minimum value and maximum value in males and females. Findings were noted when the pupil was not dilated (without cycloplegia). Statistical analysis was done in SPSS 20.p-value of < 0.05 was taken as significant. Comparison of the values for males and females was done by Independent Samples T Test.

**RESULTS**

Age ranged from 16 years to 105 years (Mean 63.05 ± 10.52). Males were 412 (54.79%) and females were 340 (45.2%). Mean AL was 23.22 ± 1.08 mm (Table 1). Mean K1 was 42.87 + 1.98 D (Table 1). Mean K2 was 43.96 ± 1.8 D. 4.55. Mean ACD was 3.2397 ± .40 and mean PC IOL was 21.2 ± 2.35 (Table 1 and 2). Significant differences were observed in all the parameters when the findings for males and females were compared (Table 3).

**Table 1:** Descriptive Statistics.

	N	Minimum	Maximum	Mean	Std. Deviation
Age	742	16	105	63.05	10.520
Axial Length (mm)	677	20.04	28.83	23.2160	1.08738
K1(D)	705	23.66	48.75	42.8680	1.97796
K2 (D)	705	37.75	51.75	43.9611	1.80413
AC Depth (mm)	352	2.11	4.55	3.2397	.40445
PC IOL Power (D)	723	6.00	31.00	21.2055	2.35320

**Table 2:** Group Statistics.

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Age	Male	407	65.13	11.129	.552
	Female	335	60.52	9.123	.498
	Gender	N	Mean	Std. Deviation	Std. Error Mean
Axial Length (mm)	Male	368	23.4744	1.04453	.05445
	Female	309	22.9082	1.05841	.06021
	Gender	N	Mean	Std. Deviation	Std. Error Mean
Anterior Chamber Depth (mm)	Male	175	3.3122	.42181	.03189
	Female	177	3.1680	.37408	.02812
	Gender	N	Mean	Std. Deviation	Std. Error Mean
K1 (D)	Male	384	42.3846	2.11665	.10802
	Female	321	43.4463	1.62140	.09050
	Gender	N	Mean	Std. Deviation	Std. Error Mean
K2 (D)	Male	384	43.4987	1.74641	.08912
	Female	321	44.5142	1.71667	.09581

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Posterior Chamber Intra Ocular Lens Power (D)	Male	393	20.8219	2.10595	.10623
	Female	330	21.6624	2.54616	.14016

**Table 3:** Comparison between mean values of male and female patients.

	Male	Female	P value (sig)
Age	65.13	60.52	.000
Axial length	23.47	22.91	.000
Ant chamber depth	3.3122	3.1680	.001
K1	42.3846	43.4463	.001
K2	43.4987	44.5142	.000
Post chamber IOL Power	20.82	21.66	.000

## DISCUSSION

Age at the time of cataract operation varies from country to country e.g. in southern Chinese<sup>11</sup> mean age was 70.4 years  $\pm$  10.5 about 7 years older than our patients.

Similarly different readings of axial length and corneal curvature have been reported from different areas of the world. In West, Norfolk Island residents (descended from the English Bounty mutineers and their Polynesian wives) findings for AL, ACD and mean K (Km) were 23.5mm, 3.32mm and 43.52 D respectively<sup>12</sup>. In this study AL and ACD are higher but K is lower than our values. Their findings are comparable to another European study (Portugal) where mean AL, Km, and ACD have been 23.87  $\pm$  1.55 mm (19.8–31.92 mm), 43.91  $\pm$  1.71 D (40.61–51.14 D), and 3.25  $\pm$  0.44 mm (2.04–5.28 mm), respectively<sup>13</sup>.

Coming to Chinese studies, one study revealed AL, ACD, and mean K value of 24.07  $\pm$  2.14 mm, 3.01  $\pm$  0.57 mm and 44.13  $\pm$  1.63 D respectively<sup>11</sup>. All of these findings are slightly higher (except ACD) than our findings. In Beijing study mean axial length was 23.25  $\pm$  1.14 mm (range: 18.96–30.88 mm)<sup>14</sup> which is slightly less but close to our finding. Taiwan, China findings were mean AL of 24.75  $\pm$  2.71 mm, and the mean K value of 43.48  $\pm$  1.66 D<sup>15</sup>. AL in this study is higher than ours but K is almost same. Chinese in Singapore had AL and ACD of 23.23  $\pm$  1.17 mm and 2.90  $\pm$  0.44 mm respectively<sup>16</sup> and their AL was slightly higher and ACD was slightly less than our readings. AL was 23.13  $\pm$  1.15 mm in Mongolian adults aged 40 years or more which is slightly less than ours<sup>17</sup>.

Average corneal curvature in Nigerians was found to be 42.98  $\pm$  1.19 D<sup>18</sup>. It is very close to our finding. Central rural India finding of mean axial length was

22.6 $\pm$ 0.91 mm (range, 18.22 – 34.20 mm)<sup>19</sup>. It is less than our finding. Findings from Nepal for AL, K1 and K2 are 22.96 + 0.95, 43.64 + 1.45, 44.29 + 1.47 respectively<sup>20</sup>. So their AL is smaller while corneal curvature is comparable to ours.

Pakistani studies on this topic include following. In Hyderabad AL, K1 and K2 was found to be 22.96  $\pm$  1.04, 44.00  $\pm$  1.83, 44.78  $\pm$  1.88 respectively<sup>21</sup>. These readings are less than our readings. In a study from Gomal University the range of axial length was 19.50 to 28.0mm<sup>22</sup>. 581 (58.1%) patients were having axial length 22–23.50mm. Ten (1.0%) had axial length > 26 mm and 6 (0.6%) 25 D. The minimum K1 and K2 readings noted were 37.0 D, while the maximum readings were 48.0D. The minimum power calculated as 10.0 D, while the maximum one was 33.0 D. This study divided all the parameters in different subsets but did not give mean and standard deviation. Thus though the findings are close to our findings it is difficult to compare the two. Our findings are in agreement with the trend observed<sup>21</sup> that our eyes are shorter than European eyes and comparable to Chinese eyes. However our study differed that Indian eyes are shorter and not comparable.

Regarding differences between males and females, in older male Chinese AL was 23.38 mm (22.83, 24.00) and ACD was 2.75 mm (2.53, 3.00) while for females AL was 22.83 mm (22.32, 23.46) and ACD was 2.61 mm (2.42, 2.84)<sup>23</sup>. AL and ACD findings in this study for both males and females is close to our findings (though slightly less) and confirm our finding that female findings are lower than male readings. Los Angeles study also found that females had significantly shorter AL and shallower ACD than males<sup>24</sup>. In Rajasthan, India AL in emmetrope males 40 to 60 year of age, was 22.33 mm and in females 22.99

mm<sup>25</sup>. These readings are less than readings in our males and more than our female readings. This study is different because findings in both sexes have been subdivided according to refractive state and mean of total population studied is not available. Limitation of our study is that a few readings were missing in the analyzed data while strength of the study is a relatively large sample size.

## CONCLUSION

Axial length in Pakistani patients is less than that of Europeans but more than our Asian neighbors like India and Nepal. Chinese findings are more or less the same as ours. Pakistani female cataract patients have smaller axial length and anterior chamber depth but higher corneal curvature and they undergo operation at younger age as compared to their male counterparts.

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## Role of Authors

Khawaja Khalid Shoaib  
Study Design, Data Collection & Manuscript writing.

Dr. Tariq Shakoor  
Data collection, Manuscript writing, critical analysis

**Conflict of Interest:** None.

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