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Lenstar LS 900 Analysis of 2000 Cataract Patients: A Cross-Sectional Study

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Abstract

Purpose: To analyze biometry data and corneal astigmatism in cataract candidates from Yazd.

Methods: The corneal thickness, anterior chamber depth and keratometry measurements of anteroposterior width were measured using the IOL Master system. Ocular biometric data were collected and analyzed in the year 2015.

Results: The study comprised of 2000 patients' cataract candidates with a mean age of 66.79 ± 10.72 years (range 28 to 100 years). No significant differences were found between these variables for mean ± SDs of age and gender (p<0.05). The correlation coefficients analysis between four evaluated variables and age showed there is a significant correlation between anterior chamber depth and age; however, there was no association between age and other factors. Also, the results showed a significant correlation between the radius of cornal curvature, anterior chamber depth, corneal thickness and anterior-posterior length.

Conclusions: This study provides reference data for cataract patients from Yazd. The profiles of ocular biometric data can help improve surgical procedures and intraocular lens design for the Yazd population.

Keywords: Biometric indices; Cataract surgery; IOL

Introduction

Cataracts are the third most-common cause of blindness in developing countries and are considered to be the end stage of many eye abnormalities. Of interest is that both the prevalence and incidence of cataracts are rising rapidly. The prevalence in 45-64 year-old adults is 2% to 8% and this increase to 21 to 39% in 65-79 year-old adults [1]. Intraocular lenses (IOLs) are commonly used to correct refractive errors after cataract surgery.

Despite the stunning results of manual small-incision cataract surgery (MSICS) on decreasing astigmatism, uncertainty still remains about the effectiveness of this technique for obtaining a stable refraction after cataract surgery. There are two major problems concerning IOL treatment: the inappropriate insertion and the subluxation of IOLs. The main worry of patients was residual refraction after cataract surgery [2].

Measuring the longitudinal axis is one basic parameter for determining the most appropriate intraocular lens. Inaccuracy of measurements of biometric parameters has a significant effect on the surgical outcome and may even lead to the failure of treatment. The true test of optical biometry is its performance with challenging eyes. There are several devices of varying accuracy for biometric evaluations and it is necessary to determine the most accurate device to use. Lenstar LS 900 provides highly accurate laser optic measurements for every section of the eye-from the cornea to the retina. The IOL Master (Carl Zeiss Meditec) is one of the most popular devices and appears to achieve a measurement success ratio higher than that of other optical biometry devices [3,4]. To the best of our knowledge, few studies in Iran have reported the performence of IOL master device; this is one of the first reports from Shahid Sadoughi Hospital in Yazd on cataract extractions.

Methods

This cross-sectional study was carried out in Yazd during the year 2015. In this study, 2000 patients who were candidates for Cataract extractions were selected using the cluster sampling method from among those receiving cataract extraction treatment at Shahid Sadoughi Hospital. This institution provides modern ophthalmologic diagnostic and treatment services to the patient population in Yazd and from other areas of Iran. A signed consent form which had been approved by the Ethical committee of Shahid Sadoughi Medical University was obtained from each participant.

All patients underwent a full ophthalmic examination. Inclusion criteria were being an adult patient undergoing unilateral cataract surgery. Exclusion criteria included history of trauma to the eye, mature cataracts, severe corneal or vitreous opacity, severe retinal disease, and significant systemic disease, history of previous ophthalmic surgery or patients with cognitive problems.

Each patient was examined on a Lenstar LS 900 device (Iran Memco company) by a single experienced examiner. The parameters of corneal thickness, anterior chamber depth, keratometry and measurements of anteroposterior length were recorded.

Continuous variables were checked for normality using the Kolmogorov-Smirnov test. Categorical variables were compared using one-way ANOVA and were expressed as mean and standard deviation (SD). When parametric analysis was not possible, the Mann-Whitney and Kruskal-Wallis tests were applied to assess the significance of differences between examinations. Statistical analysis was performed using SPSS for windows (vers. 19.0). In all cases, p<0.05 was considered statistically significant.

	Age groups	frequency	Mean ± SD	p-value
Radius of curvature	30-54	251	44.47 ± 1.98	0.457
	55-59	264	44.35 ± 1.97	
	60-64	343	44.24 ± 1.99	
	65-69	326	44.37 ± 2.01	
	70-74	285	44.21 ± 2.00	
	75-79	264	44.52 ± 1.83	
	80-99	263	44.40 ± 1.85	
Central corneal thickness	30-54	251	532.87 ± 35.37	0.927
	55-59	264	535.87 ± 38.29	
	60-64	343	535.30 ± 37.93	
	65-69	326	534.74 ± 40.54	
	70-74	285	537.16 ± 38.58	
	75-79	264	534.07 ± 38.70	
	80-99	263	534.71 ± 45.26	
Anterior chamber depth	30-54	251	2.7 ± 0.54	0.124
	55-59	264	2.74 ± 0.57	
	60-64	343	2.74 ± 0.57	
	65-69	326	2.79 ± 0.65	
	70-74	285	2.8 ± 0.64	
	75-79	264	2.84 ± 0.58	
	80-99	263	2.78 ± 0.56	
Axial length	30-54	251	23.42 ± 1.26	0.828
	55-59	264	23.46 ± 1.24	
	60-64	343	23.43 ± 1.39	
	65-69	326	23.39 ± 1.19	
	70-74	285	23.52 ± 1.35	
	75-79	264	23.42 ± 1.14	
	80-99	263	23.37 ± 1.21	

Table 1: The average biometric indices measured with Lenstar Device based on different age groups.

Result

The study enrolled 2000 patients with a mean age of 66.79 ± 10.72 years (28 to 100 years). There were 921 men (46.1%) and 1078 women (53.9%). The average radius of curvature of the cornea as measured by the Lenstar Device is shown in Tables 1 and 2. The mean and standard deviation of corneal radius curvature was 44.36 ± 1.95 diopters (D) (36.71 to 52.44 D) at a 95% Confidence Interval (CI) of 44.272 to 44.44. The mean and standard deviation of corneal radius curvature for the various age classifications is shown in Table 1 and indicates no significant statistical differences between variables (p=0.457).

	Sex groups	frequency	Mean ± SD	p-value
Radius of curvature	m	921	44.40 ± 1.93	0.431
	f	1077	44.32 ± 1.97	
Central corneal thickness	m	921	534.96 ± 39.85	0.961
	f	1077	535.04 ± 38.83	
Anterior chamber depth	m	921	2.76 ± 0.58	0.409
	f	1077	2.78 ± 0.60	
Axial length	m	921	23.46 ± 1.30	0.313
	f	1077	23.40 ± 1.23	

Table 2: The average biometric indices measured with Lenstar Device based on different sex groups.

Table 2 shows that the mean and standard deviation of corneal radius curvature was 44.4 ± 1.93 and 44.35 ± 1.97 D for men and women respectively. There was no significant difference in this value for corneal radius curvature between genders (p=0.431). The age and gender distribution of the mean and standard deviation of central corneal thickness (CCT) are summarized in Tables 1 and 2. The mean value of the CCT was 535.003 ± 39.31 (range 388 to 758) and showed no statistically difference versus age and gender (p=0.927, p=0.961, respectively). The mean and standard deviation of the Anterior chamber depth (ACD) and axial length (AL) of participants are also presented in Tables 1 and 2. No significant differences were found between these variables for mean and standard deviations of age and gender (p<0.05).

The correlation coefficients analysis between for the evaluated variables versus age showed a significant positive correlation between anterior chamber depth and age; however, there was no significant association between age and the other factors. Anterior chamber depth is positively correlated with radius of curvature, central corneal thickness and axial length; also axial length is associated with radius of curvature in a positive manner (Data shown in Table 3).

Discussion

Partial coherence interferometry (PCI) is widely used in ocular biometry and IOL calculations [5-7]. Compared with ultrasonography biometry, PCI is more simple, accurate and repeatable. In addition, it does not require local anesthesia or physical contact of the cornea with a US probe; thus, corneal abrasions and infections can be prevented [8]. Environmental factors are major factors affecting the power of an IOL master device to calculate data accurately. Patient characteristics are the most determining factors. The accuracy of the technique depends on cooperation between the patient and the examining techniques [9]. In this study, because all the patients were over the age of 30 years, this cooperation was high, so the impact of this factor on the data was not considered and data accurately expressed the measurement parameters.

Variable		Age	Radius of curvature	Central corneal thickness	Anterior chamber depth
Radius of curvature	Correlation coefficient	0.003	-	-	-
	p	0.886	-	-	-
	frequency	1996	-	-	-
Central corneal thickness	Correlation coefficient	0.003	0.018	-	-
	p	0.885	0.425	-	-
	frequency	1996	1998	-	-
Anterior chamber depth	Correlation coefficient	0.059	0.149	0.063	-
	p	0.008	0	0.005	-
	frequency	1996	1998	1998	-
Axial length	Correlation coefficient	0.005	0.389	0.015	0.263
	p	0.832	0	0.499	0
	frequency	1996	1998	1998	1998

Table 3: The correlation coefficients analysis between four evaluated biometric variables and age in patients with cataract surgery.

Gender differences in ocular biometric parameters have been reported in some studies [5,10,11] but no such significant differences between variables and gender were observed in the current study. Studies on the Chinese population in Singapore [12], indigenous communities in Alaska [13] and the Caucasian population in Iceland [14] have shown that AL has a negative correlation with age; In spite of the negative correlation between AL and patient age, our results introduced anterior chamber depth as a robust marker to be positively correlated with age. In the current study, all variables and the corneal power were normally distributed in the population, which differs from the results of previous studies [15]. The mean AL in the Chinese study was longer than in the current and some previous studies and appears to be closely associated with genetic and environmental Factors [16].

The limitations of the current study were that the data was drawn from cataract candidates at one hospital and, thus, does not completely represent the ocular biometric data of the general population. Also, the relationship between biometric features and refraction could not be comprehensively analyzed due to a lack of measurements of the central corneal thickness, lens thickness, vitreous chamber depth, and refractive data. Moreover, the correlation between ocular biometric parameters and anthropometric measurements, social status, education, and occupation should be more thoroughly evaluated. In this study we evaluated the distribution of ocular biometric parameters in patients who were a candidate for cataract extraction surgery. Whereas we did not ask for patients nations, this is not representative of the entire population of Yazd.

In conclusion, the present study determined the distribution of ocular biometric parameters in cataract surgery candidates in Yazd. The parameters measured using an IOL master in patients scheduled for cataract surgery, included the radius of curvature of the cornea, corneal thickness, anterior and posterior chamber depth. There is an agreement between our results and other important studies. Our results are consistent with a 2011 study by Galecki T which proved that Lenstar LS 900 is able to conduct accurate and reliable measurements of biometric indices [17]. Reasonable agreements have been seen for biometric indices such as CCT and ACD between Lenstar and other common devices such as Pentacam. Further studies are needed in order to assess more biometric indices in patients using Lenstar LS 900.

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