

Comparison of Biometry Readings Taken by Intra Ocular Lens (IOL) Master and Sonomed in the Pakistani Population

Abdul Rasheed Khokar¹, Nargis Nizam Ashraf¹ and Mehwish Hussain²

ABSTRACT

Objective: To compare the Keratometry (K) readings, axial length and posterior chamber (PC) intraocular lens power taken by IOL master and Sonomed in the Pakistani population.

Study Design: Comparative / cross-sectional study

Place and Duration of Study: This study was conducted at the Department of Ophthalmology Unit 2, Dow University of Health Sciences, Karachi from 1st March 2017 to 31st May 2017.

Materials and Methods: Keratometry readings was recorded in two meridians ,horizontal (K1) and vertical (K2) axes, axial length of the eye was measured and posterior chamber intraocular lens (PC IOL) power was recorded by IOL Master and Sonomed in 74 eyes.

Results: The mean K1 of the study group with IOL Master and Sonomed were respectively 43.6 ± 1.9 mm and 43.5 ± 1.9 mm. and the mean K2 were 44.5 ± 2 mm and 44.6 ± 2 mm respectively. No significant differences were observed in the measurements of K1 (p value >0.160) and K2 (p value >0.704). The mean axial length with IOL master was 23.2 ± 0.9 mm and was significantly lower than corresponding measurement with Sonomed, 23.3 ± 0.9 mm ($P < 0.001$). The PC IOL power recorded with IOL Master (21.5 ± 2.2 mm) was significantly higher than that with Sonomed (21.1 ± 2.4 mm) ($P < 0.001$).

Conclusion: The mean axial length measurement was significantly lower when recorded with IOL master and PC IOL power was significantly higher as compared to Sonomed. There was no significant difference in the mean K1 and K2 measurement when recorded with the two methods.

Key Words: Biometry, axial length, IOL master, Sonomed

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INTRODUCTION

Amongst the different types of eye surgeries, cataract extraction leads the list. With the passage of time and the refinement of technique, the outcome of cataract surgery has improved considerably and so have the expectations of the patients. Precise biometry and calculation of Intraocular lens (IOL) power are essential for good outcome¹.

As the newer and better types of intraocular lenses have been developed, the techniques of biometry have also changed in the recent years. Amongst the different methods, there is A-Scan Biometry which employs the principle of echo delay time.²

The Intraocular lens (IOL) master is another tool of measurement of axial length and is based on the principal of partial coherence interferometry².

Anterior chamber (AC) depth assessment is also very important as it is needed in the biometric formulae. New techniques for AC depth measurement are scanning-slit topography, anterior segment optical coherence tomography (OCT) and Scheimpflug imaging technique³. In case there are opacities in the media or if there is dense cataract, the ultrasound methods show better results.⁴

Biometric measurements have to be very precise. A 0.25 D error can occur with 0.1mm incorrect measurement of axial length. Similarly, 1.25D error from 0.5 mm difference and 2.50 D error results from 1.0 mm difference.⁵ The data is then fed into IOL calculation formulae, many have been made. At first were the third generation formulas and then came the fourth generation formulas.^{6,7,8}

IOL master incorporates infra-red light of the twin beam. Ultrasound waves reflect at the level of the internal limiting membrane as opposed to the partial coherence laser interferometry in which laser light is reflected from the retinal pigment epithelium.² To make results from both the machines reliable, a conversion factor is put in the software of the instrument. IOL Master is a non touch technique and is the preferred method. However it does not give reliable results where there are opacities in the media where Sonomed is the preferred choice.

¹. Department of Ophthalmology, Unit- II / Research2, Dow University of Health Sciences, Karachi.

Correspondence: Dr. Nargis Nizam Ashraf, Department of Ophthalmology, Unit- II, Dow University of Health Sciences, Karachi.

Contact No: 03002712875

Email: nargis.ashraf99@hotmail.com

This study has been conducted to compare the K-readings, axial length and IOL power measurements taken by the IOLmaster and Sonomed in the Pakistani population and to see which one of the two is a better technique.

MATERIALS AND METHODS

This study was conducted over a period of 3 months at the Diagnostic Section of the Department of Ophthalmology, Unit II, of Dow University of Health Sciences from 1st March 2017 to 31st May 2017. Recordings were made in 74 consecutive patients undergoing cataract surgery. An informed consent was taken prior to inclusion in the study. Axial length measurement, K-readings and IOL power was taken both by IOL master (NIDEK) and Sonomed in 74 eyes. Keratometry was performed in the horizontal (K1) and vertical (K2) meridian. Axial length was measured and Intraocular lens power was calculated both by IOL Master and Sonomed. Prior to axial length measurement by Sonomed, eye was anaesthetised with topical anaesthetic drops. Three readings were taken for each parameter and the mean was calculated. The data was then entered into Microsoft excel and subsequently transferred to SPSS for analysis..

Statistical analysis: Frequencies and percentages were computed for the description of gender and eye. Descriptive statistics of continuous variables such as age, keratometry measures, axial length and PC IOL were expressed with mean $\pm$ standard deviation. Before proceeding comparative analysis, normality of the continuous variables was assessed by Kolmogorov-Smirnov's test and outcome exhibited p values more

than 0.05 indicating fulfillment of normality assumptions for all the continuous variables. Comparative analysis was divided into two steps as univariable and multivariable. At univariable stage, to compare biometry readings using IOL master and sonomed paired samples t-test was run. While to compare these readings with respect to gender and eye, independent samples t-test was executed. Pearson's correlation coefficient was measured to determine association of age with biometry readings. At multivariable stage, repeated measures ANOVA was used to compare biometry readings with the two diagnostic methods while confounding with personal characteristics like gender and age.

RESULTS

Out of total 74 patients, 35 (47.3%) were female. Nearly half of the patients' of left eye was used for the diagnosis. The average age of the participant was 54.9 ± 14.2 years.

The mean K1 of the overall sample with IOL master and sonomed were respectively 43.6 ± 1.9 mm and 43.5 ± 1.9 mm. While the mean K2 were 44.5 ± 2 mm and 44.6 ± 2 mm while measured using IOL master and sonomed respectively. No significant differences were observed in the measurements of K1 ($P=0.160$) and K2 ($P=0.704$). Axial length with IOL master was 23.2 ± 0.9 mm and significantly lower than measured with sonomed 23.3 ± 0.9 mm ($P<0.001$). The PC IOL power using IOL master (21.5 ± 2.2 mm) was significantly higher than diagnosed with sonomed (21.1 ± 2.4 mm) ($P=0.001$).

Table No.1: Biometry readings between gender and eye

		With IOL Master				With Sonomed			
		Keratometry (k1)	Kertometry (k2)	Axial length	PC IOL	Keratometry (k1)	Kertometry (k2)	Axial length	PC IOL
Gender	F (n=35)	44.0 $\pm$ 1.7	44.8 $\pm$ 1.8	22.9 $\pm$ 0.6	22.1 $\pm$ 2.3	44.0 $\pm$ 1.7	44.8 $\pm$ 1.8	23.0 $\pm$ 0.8	21.7 $\pm$ 2.6
	M (n=39)	43.1 $\pm$ 2.0	44.3 $\pm$ 2.2	23.5 $\pm$ 0.9	20.8 $\pm$ 2.0	43.1 $\pm$ 2.0	44.3 $\pm$ 2.2	23.6 $\pm$ 0.9	20.6 $\pm$ 2.2
Eye	L (n=36)	43.5 $\pm$ 2.0	44.5 $\pm$ 2.0	23.2 $\pm$ 0.9	21.4 $\pm$ 2.3	43.4 $\pm$ 1.9	44.6 $\pm$ 2.0	23.3 $\pm$ 1.0	21.1 $\pm$ 2.4
	R (n=38)	43.6 $\pm$ 1.8	44.6 $\pm$ 2.0	23.2 $\pm$ 0.8	21.5 $\pm$ 2.2	43.6 $\pm$ 1.9	44.5 $\pm$ 2.0	23.3 $\pm$ 0.9	21.1 $\pm$ 2.5
Overall (n=74)		43.6 $\pm$ 1.9	44.5 $\pm$ 2.0	23.2 $\pm$ 0.9	21.5 $\pm$ 2.2	43.5 $\pm$ 1.9	44.6 $\pm$ 2.0	23.3 $\pm$ 0.9	21.1 $\pm$ 2.4

Table 1 described the biometry readings between gender and eye. Among females, the mean K1 using IOL master was significantly higher ($P=0.034$) as compared to males. However, no significant difference was found in K2 readings between male and female when measured with IOL master ($P=0.343$). Axial length ($P=0.001$) and PC IOL power ($P=0.010$) were significantly higher in males when diagnosed with IOL master. While diagnosing biometry readings using sonomed K1 measure ($P=0.039$) and PCL IOL ($P=0.043$) of female and axial length of male ($P=0.005$)

were significantly higher. On the other hand, no significant difference in the mean values of K1 was found when measured with sonomed ($P=0.351$). Moreover, the biometry readings did not show significant difference in left and right eyes either diagnosed with IOL or sonomed (all P values >0.05). The correlations of age with all biometry readings were insignificant except with the PC IOL. The higher age of the patients depicted lower values of PC IOL when measured with both IOL master ($r= -0.297$) and sonomed ($r= -0.258$).

After confounding for gender the K1 did not show significant difference in readings from PC IOL and sonomed ($P=0.159$). However, axial length ($P<0.0001$) and PC IOL ($P=0.001$) showed significant difference in the readings from IOL master and sonomed. The readings of PCL IOL using IOL master and sonomed did not exhibit significant difference when adjusted for only age ($P=0.251$) and for both age and gender simultaneously ($P=0.323$).

DISCUSSION

Partial coherence interferometry is being incorporated in different devices since 2001 for Biometry⁹. The reason for its popularity is that it's non-contact, less time consuming and accurate.

Several studies have been conducted, comparing the different biometric techniques for measurement of these parameters. In our study we have compared the K-readings, axial length and IOL power taken by IOL master and Sonomed (Ultrasonic method) in the Pakistani population. Although similar study has been done elsewhere, there is little data for the Pakistani population.

Jaswinder et al reported a favourable comparison and same values between Lenstar and IOL master but not with ultrasound biometry¹⁰. In IOL master, the measurement is between anterior corneal surface and retinal pigment epithelium, whereas in ultrasound biometry it is up to the internal limiting membrane¹¹.

In 2016, Kongsap reported good comparison between axial length, anterior chamber depth and k-readings between IOL master and a new optical low coherence reflectometer. But comparison wasn't good enough for White to white diameter ($r=0.259$)¹². In our study K readings were the same with both machines but axial length was significantly lower and PC IOL power was significantly higher with IOL master.

Nakwi documented in 2014 a conversion factor for the IOL master and ultrasound biometry. With diminution of wavelength, the results get better and there are better results with laser interferometry because of smaller wavelength.¹³

In certain scenarios such as hard cataracts, hazy media corneal degeneration etc. Ultrasonic biometry in conjunction with laser interferometry is needed¹⁴. It was reported by Hitzenberger et al that as compared to immersion, axial length by IOL master came out to be 0.18 mm more.¹⁵ Whereas, this difference between the two methods was about 0.22 mm as documented by Kiss et al.¹⁶

In a study by Honkanen et al in 2013 documenting residents training about 50% cases were within 0.50 DS of the expected result.¹⁷

Shin, Lee et al in 2012, compared the pre and post-operative ocular biometry in eyes with phakic intraocular lens implants. The anterior chamber depth was 1 mm shallower post operatively after putting in an

ins fixated IOL.¹⁸ It was seen that the effective measure of axial length by silicon oil is less impaired in doing it with IOL master.¹⁹

Kunert, Peter et al compared biometry done with new swept source OCT biometer and partial coherence interferometry and optical low coherence reflectometry. There was a good comparison with SS-OCT giving the most reliable results²⁰. Mehrawaran et al performed it with 5 types of devices and showed a good correlation between them²¹.

CONCLUSION

In conclusion, the mean axial length measurement was found to be significantly lower when recorded with IOL master and PC IOL power was significantly higher as compared to Sonomed. There was no significant difference in the mean K1 and K2 measurement when recorded with the two methods. Therefore both machines have to be used in conjunction for measurement of axial length and PC IOL power but either one can be used for keratometry.

Author's Contribution:

Concept & Design of Study:	Abdul Rasheed Khokar
Drafting:	Abdul Rasheed Khokar
Data Analysis:	Mehwish Hussain
Revisiting Critically:	Nargis Nizam Ashraf
Final Approval of version:	Abdul Rasheed Khokar

Conflict of Interest: The study has no conflict of interest to declare by any author.

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