A Study on Comparison of Axial Length and IOL Power in A-Scan Biometry versus IOL Master

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ABSTRACT

BACKGROUND

Cataract is the leading cause of preventable blindness in the world. Accurate biometry is an essential component in determining the visual outcome after cataract surgery. With the introduction of newer instruments, various studies have been conducted regarding the accuracy of axial length and IOL power measurements. The aim of our study is to compare axial length (AXL) and IOL power values in A-scan biometry versus IOL master.

METHODS

A cross-sectional study was performed on 100 eyes in 100 patients presenting to clinical practice for cataract surgery with no retinal pathology in a tertiary eye care centre. Keratometry values were obtained from Auto ref-keratometer and the values were kept constant for both methods. Axial length was measured with Biomedix applanation ultrasound A-scan biometry and the Zeiss-700 IOL-Master. IOL power was calculated using SRK/T formula from the obtained values. Both values were compared between A-scan biometry and IOL-master.

RESULTS

Out of 100 patients, 67 were females and 33 were males. Mean age of the patients was 62.74 ± 7.92. The mean K1 and K2 were 44.30D and 44.90D respectively. The mean AXL measured by A-scan was 23.34 ± 0.72 mm and that with IOL master was 23.20 ± 0.65 mm. There was no statistically significant difference between two methods (p=0.1). The mean IOL power was 20.15 ± 4.84D with A-scan versus 20.85 ± 4.75D with IOL-master and the difference between the two methods was not statistically significant (p=0.2).

CONCLUSIONS

There is no significant difference in axial length and IOL power values when measured in A-scan biometry and IOL master. Both methods give accurate results and can be chosen accordingly.

KEYWORDS

Axial Length, IOL Power, A-Scan Biometry, IOL-Master

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BACKGROUND

Cataract has been reported to be responsible for 50-80% of the bilateral blindness in India.[1] Data from the World Health Organization (WHO) shows that there is a 25% decrease in blindness prevalence in India which could be due to the increased number of cataract surgeries.[2] Intraocular Lens (IOL) power calculations have become a focal point of cataract surgery. Precise biometry is one of the key factors to achieve maximum visual acuity after cataract surgery. Biometry depends on various factors such as axial length (AXL), keratometry, and anterior chamber depth and lens formulas.

Axial length is considered to be the key determinant among all the factors. It is defined as the distance from the anterior surface of the cornea to the macular photoreceptor in visual axis. When there is an error of 1 mm in axial length measurement, it results in refractive error of 2.35 D in a 23.5 mm eye, but drops to 1.75 D/ mm in a 30 mm eye and rises dramatically to 3.75 D/ mm in a 20 mm eye.[3] Various studies have shown that in predicted refraction after IOL implantation 54% of errors can be attributed to axial length measurement error, 8% to corneal power measurement errors and 38% to incorrect estimation of postoperative anterior chamber depth.[4] Hence accuracy of axial length measurement plays an important role in biometry.

There are various methods to measure axial length which includes A-scan ultrasonography and optical biometry. Most commonly used method is A-scan ultrasonography. The ultrasonic biometry mainly measures the transit time of the ultrasound pulse, thus measuring the distance from the corneal vertex to the internal limiting membrane.[5] In applanation A-scan biometry, the ultrasound probe is placed directly on the corneal surface. Measurements taken by this method will frequently show variability from one to the next, which results from inconsistent corneal compression.

The Zeiss IOL Master is a type of non-contact optical biometry which is based on principle of partial coherence interferometer. It utilizes the infrared diode laser of high spatial coherence. It measures the distance between corneal vertex surface and the retinal pigment epithelium reflection of the interference signal of the retinal pigment epithelium. It is said to be potentially more accurate method in measurements of axial length, anterior chamber depth and IOL power calculations using appropriate formulae.[5]

In studies conducted by Gabella et al on Forty eyes of 40 patients -mean AXL measured by IOL master was higher (26.18 ± 2.92 mm) than that with A-scan (26.02 ± 2.99 mm) with a mean difference of 0.2 ± 0.44 mm (p=0.07). There was no significant difference between IOL master and A-scan biometry.[6] Rose et al, in his studies, concluded that using the IOL Master over applanation ultrasound biometry significantly improved the postoperative refractive outcome from 0.65 D to 0.42 D (P =0.011).[5]

Hence, the aim of our study was to compare axial length and IOL power values by both A-scan applanation biometry and IOL Master so as to determine the accurate method for improving postoperative outcomes.

We wanted to evaluate difference in axial length (AXL) and IOL power as calculated in A-scan biometry v/s IOL master.

METHODS

A cross sectional study was conducted on 100 eyes in 100 patients presenting to clinical practice for cataract surgery at Minto ophthalmic Hospital, Regional institute of ophthalmology, Bangalore during the period of January 2019 - June 2019. Patients with no ocular pathology apart from age-related senile immature cataract were included in the study.

Exclusion Criteria

- Posterior segment pathology
- Dense ocular media opacities such as central corneal scars or dense posterior sub-capsular cataracts, mature and hyper mature cataracts.
- Patients who underwent previous corneal surgeries.
- Patient with traumatic cataract and history of trauma.

Of all the patients who satisfied inclusion and exclusion criteria, demographic details, ocular and medical history was taken. All patients underwent detailed ophthalmic examination which included best corrected visual acuity by Snellen's Log mar chart, anterior segment evaluation by slit lamp biomicroscopy, Intraocular pressure was measured by Perkins applanation tonometry and posterior segment evaluation done in indirect ophthalmoscope as well as slit lamp biomicroscope with 90D. Keratometry readings (K1 and K2) were obtained from ACCUREF k-900 Auto Ref-Keratometer. Axial length was measured with Biomedix applanation ultrasound A-scan biometry after instilling a drop of proparacaine in sitting position followed by ZEISS IOL Master 700. IOL power was calculated SRK/T formula. Both A-scan and IOL power values were compared between A-scan biometry and IOL-master. Data analysis was done using IBM.-SPSS statistics software 23.0 version. The data was summarized using mean ± SD, minimum and maximum in quantitative data and using frequency (count) and relative frequency (percentage) for categorical data. P value was calculated using paired T-test. P value <0.05 was considered significant.

RESULTS

A cross sectional study was conducted on 100 eyes of 100 patients with senile immature cataract. Out of 100 patients, 67 were females and 33 were males. Age of the patients ranged from 40 years to 88 years with mean age of 62.74 ± 7.92 (Figure 1). Most of the patients were in the age group of 60-70 years. Keratometry values varied between 41 D and 49D. The mean K1 was 44.30D and K2 was 44.90D. The axial length measured from A-scan biometry ranged between 21.33 mm and 25.37 mm and that measured with

IOL Master ranged from 21.48 mm to 25.11 mm. The mean AXL measured by A-scan was 23.34 ± 0.72 mm and that with IOL master was 23.20 ± 0.65 mm (Table 1, Figure 2) but there was no statistically significant difference in both methods (P value =0.1). The IOL power obtained from A-scan biometry values ranged between 15.5D and 25D and that measured with IOL Master ranged from 14.5D to 24.5D. The mean IOL power was 20.15 ± 4.84D with A-scan versus 20.85 ± 4.75D with IOL-master (Table 2). There was no statistically significant difference in the IOL power calculated from both methods (p=0.2).

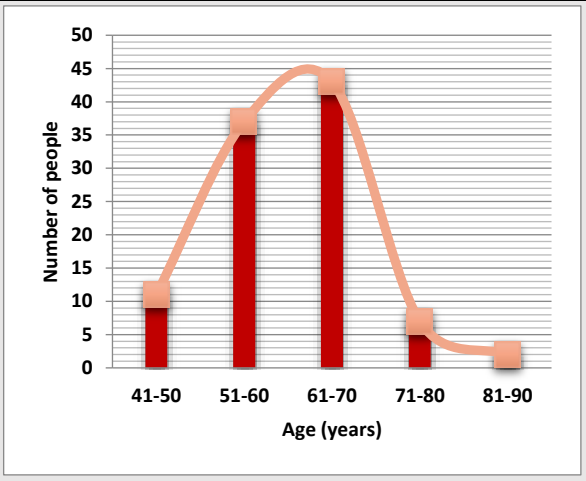

Figure 1. Age Distribution

Variables (mm)	Mean	Standard Deviation	p-Value
A Scan Axial Length	23.22	0.86	0.1
IOL Master axial Length	23.14	0.82	

Table 1. Mean Axial Length Values Measured in A-Scan and IOL Master

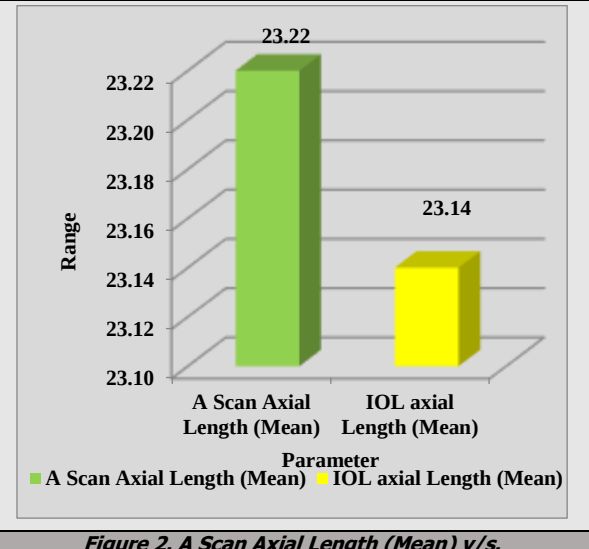

Figure 2. A Scan Axial Length (Mean) v/s. IOL Master Axial Length (Mean)

Variables(D)	Mean	Standard Deviation	p-Value
A Scan IOL power	20.15	4.84	
IOL Master IOL Power	20.85	4.75	0.2

Table 2. Mean IOL Power Values Measured in A-Scan and IOL Master

DISCUSSION

Biometry plays a very important role in determining the post-operative visual outcomes after cataract surgeries. Axial length measurement and IOL power calculation are its key determinants. The IOL master is noncontact technique for axial length measurements which measures the distance between the anterior corneal surface and the retinal pigment epithelium. It measures the ocular AXL along the visual axis, as the patient fixates at the measurement beam. Whereas A-scan biometry measures the distance from the corneal vertex to the internal limiting membrane (ILM). The resulting differences of the measured AXL from both the methods are between 150 and 350µm which is due to the thickness of cell layer.[7,8]

Table 3 summarizes the results of our study with various other studies. We have conducted study with sample size of 100 which is twice that of sample size included in studies of Gabella et al[6] and Rose et al[5]. The mean age in our study was 62.74 ± 7.92 which was comparable to the study conducted by Gopi et al, where the mean age was 60 ± 7.90.[9] In our study, mean Axial measured by A-scan was 23.22mm and that with IOL master was 23.14 mm. There is no statistically significant between the values measured from two methods (p=0.1). This is similar to the other studies (Table 3).

Regarding the IOL power calculation, the mean IOL power was 20.15 ± 4.84D with A-scan versus 20.85 ± 4.75D with IOL-master (p=0.2). There was no statistical difference between the values obtained from both methods. Our values are comparable with the results of Gabella et al who in his studies showed that no statistically significant difference in IOL power values in group of patients with nuclear sclerosis grade 1 and 2 (p=0.15).

Various Studies	Gabella et al[6]	Gopi et al[9]	Aravind Roy et al[10]	Rose et al[5]	Our Study
Sample size	40	211	31	51	100
Mean age (yrs.)	55.52 ± 10.5	60 ± 7.90	65 ± 11 (IOL master) 58 ± 10 (A-scan)	72	62.74 ± 7.92
Axial length in A-scan (mm)	26.02 ± 2.99	25.21 ± 3.37	23.23 ± 0.98	23.21 ± 1.30	23.22 ± 0.8
Axial length in IOL master (mm)	26.18 ± 2.92	25.32 ± 3.45	23.43 ± 1.06	23.36 ± 1.24	23.14 ± 0.82

Table 3. Comparison of Various Studies with Our Study

CONCLUSIONS

There is no significant difference in axial length and IOL power values when measured in A-scan biometry and IOL master. Both methods give accurate results and can be chosen accordingly. IOL master is non-contact method which is quick and easy to use. However, IOL master is limited by its cost effectiveness and inability to measure AXL in dense ocular media, non-optimal fixation as in cases of age-related macular degeneration and in patients with mobility problems in which ultrasound biometry still has a

role. Both methods have advantages over one another in terms of cost and technique.

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