

TO EVALUATE THE CLINICAL ACCURACY OF ULTRASOUND AND OPTICAL BIOMETRY: A COMPARATIVE STUDY.

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Abstract

Aim: to compare the clinical accuracy between ultrasound and optical biometry

Material and methods: prospective comparative study was conducted on 200 randomly selected patients diagnosed with cataract without underlying pathology visited the department of Ophthalmology, Patna Medical College and Hospital, Patna, Bihar, India. Group-1 IOL power calculated by optical biometer (N=100) and Group-2 IOL power calculated by ultrasound biometry (N=100).

Results: mean age of the study population was 60.21 years. Majority of the patients affected with cataract were female. Group 1 showed better visual outcome postoperatively than compared with ultrasound A scan in Group 2 ($p \leq 0.05$).

Conclusion: concluded that optical biometry with the AL scan (Nidek) found to be more accurate than ultrasound biometry for IOL power calculation

Keywords: AL scan, Biometry, IOL

Introduction

Final refractive outcomes and patient satisfaction are essential for determining the success of cataract surgery. Thus, accurate preoperative intraocular lens (IOL) power calculations are fundamental to achieving the desired refractive outcomes.¹

Biometry is the method of applying mathematics to biology. The term was originally used by Whewell initially in the 1800s for calculating life expectancy. The refractive power of the eye primarily depends upon the cornea, the lens, ocular media, and the axial length of the eye.

To determine IOL power, biometry data are necessary; these include axial length (AL), keratometry (K) values, and anterior chamber depth (ACD) (corneal epithelium to lens). To achieve optimum outcomes, precise preoperative measurements are necessary and an accurate IOL power formula must be used.

A previous study of ultrasound (US) biometry reported that 54% of the errors in predicted refraction after IOL implantation can be attributed to errors in AL measurements, 8% to keratometric error, and 38% to incorrect estimation of the postoperative effective lens position (ELP).²

For long time biometry with the IOL Master 500 is considered the gold standard for AL measurement.³⁻⁵ In 2012, the AL-Scan optical biometer (Nidek Co., Ltd.) was introduced for clinical practice in Europe. This optical

biometer uses an 830 nm infrared laser diode for AL measurement with PCI.

Most of the technical features of the IOL Master and AL-Scan are comparable, including AL measurement with PCI, K readings at a 2.4 mm diameter, and ACD measurement. The IOL Master device uses dual-beam PCI to measure the reflection of the infrared laser from internal tissue interfaces; that is, the optical path length from the anterior surface of the cornea to the retinal pigment epithelium.⁶

As with any new device introduced into clinical practice, studies that compare it with the most common clinically accepted device are warranted. The purpose of this prospective study was to compare the clinical accuracy between ultrasound and optical biometry.

Materials and methods

The present prospective comparative study was conducted on 200 randomly selected patients diagnosed with cataract without underlying pathology visited the department of Ophthalmology, Patna Medical College and Hospital, Patna, Bihar, India.

Exclusion criteria:

1. Patients not willing to participate in the study
2. Ocular pathology involved along with cataract.
3. Patients with mature senile cataract (MSC) and hypermature senile cataract (HMSC)

Ethical approval and Informed consent

The study protocol was reviewed by the Ethical Committee of the Hospital and granted ethical clearance. After explaining the purpose and details of the study, a written informed consent was obtained.

Sample selection

The sample size was calculated using a prior type of power analysis by G* Power Software Version 3.0.1.0 (Franz Faul, Universitat Kiel, Germany). The minimum sample size was calculated, following these input conditions: power of 0.80 and $P \leq 0.05$ and sample size arrived were 94 participants in each group. The final sample achieved was 100 per group.

Methodology

After taking detailed history and recording demographic data patient was undergo keratometry and A- scan and values was documented IOL power was calculated using SRK T formula. Optical biometry values was measured and values was documented IOL power was calculated using SRK T formula.

Patients was asked to sit on the chair and look straight then under local anesthesia containing proparacaine hydrochloride 0.5 percent with a- scan probe, center of cornea was touched to calculate the axial length. Average of thee readings was taken. K1 and k2 values are calculated by keratometry. In optical biometry the patients was asked to sit in front of the instrument and asked to look straight and the readings was taken.

The patients are divided into two groups:

Group 1: IOL power calculated by optical biometer, keratometric value in optical biometry group was measured by manual keratometry with Bausch & Lomb (B&L) Keratometer and axial length by optical biometry.

Group 2: IOL power calculated by ultrasound biometry used for measuring axial length (AL) and K_1 K_2 measured by B&L keratometer.

The postoperative natural visual acuity and refractive error was carried out after 6 weeks of cataract surgery.

Statistical Analysis

The data was coded and entered into Microsoft Excel spreadsheet. Analysis was done using SPSS version 20 (IBM SPSS Statistics Inc., Chicago, Illinois, USA) Windows software program.

Results

Table 1: Demographic profile

Age (years)	60.21±3.81
Gender (M:F)	1:2

Table 2: Comparison of AL and IOL readings in both the groups

Parameter	Group	Mean	Std. Dev
AL	Group 1	20.19	1.03
	Group 2	21.27	1.01
p-value	≥0.05		
IOL	Group 1	20.11	2.35
	Group 2	19.15	3.23
p-value	≥0.05		

Table 3: Spherical Refractive error (D)

Groups		Mean	Std. Deviation
Group 1	Without Correction	0.00	0.00
	With Correction	0.17	0.61
p-value	≤0.05		
Group 2	Without Correction	0.00	0.00
	With Correction	0.21	0.79
p-value	≤0.05		

Table 4: Comparison of postoperative visual acuity after spherical correction

		6/12	6/18	6/24	6/6	6/9	Total
Group 1	No.	3	1	2	70	24	100
	%	3%	1.0%	2.0%	70.0%	24%	100%
Group 2	No.	3	2	2	62	31	100
	%	3%	2.0%	2.0%	62.0%	31%	100%
Total	N	6	3	4	132	55	200
	%	3%	1.5%	2.0%	66.0%	27.5%	100%

Discussion

In our study it is found that mean age of the cataract patients was 60.21 years. Singh S et al.⁷ in 2019, they reported that the prevalence of cataract in population more than equal to 60 years in south India in both urban and rural population. We found that prevalence of cataract in female is more than male. It is similar to study done by PK Nirmalan et al.⁸ found that prevalence of cataract significantly lower in male. Similarly, Vashist P et al.⁹ concluded that prevalence of cataract increases with age and was higher in women than in men.

In our study we found that Optical biometry done in group 1 showed better visual outcome postoperatively than compared with ultrasound A scan in group 2. This is comparable to studies conducted by Kiss B et al.¹⁰ and Rose LT et al.¹¹ study.

Sang woo moon et al.¹² in their study showed the difference is not statistically significant intraocular lens calculation done by AL scan were nearly same in predicting postoperative optical refraction compare to those of applanation ultrasound.

Raymond S et al.¹³ in their prospective double-blind randomised clinical study demonstrated no clinical advantage of PCI technology over conventional applanation US for IOL power calculation.

Also, Moeini et al.¹⁴ in their study shows that was no significant difference in IOL power calculation.

Other authors demonstrate that results with optical biometry are more precise and have more predictable refractive outcome than the conventional ultrasound biometry.^{15,16}

Conclusion

Our study results concluded that optical biometry with the AL scan (Nidek) proved to be slightly more accurate than ultrasound biometry for IOL power calculation. Our study suggest that the AL-Scan biometer can be used for routine clinical practice to acquire accurate biometry measurements for IOL power calculation

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