Original Article

Immersion Vs Contact Biometery for Axial Length Measurement before Phacoemulsification with Foldable IOL

Irum Abbas, Atif Mansoor Ahmad, Tahir Mahmood

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See end of article for
authors affiliations

Correspondence to:
Tahir Mahmood
Department of Ophthalmology
Shaikh Zayed Hospital
Lahore

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Purpose: To compare the findings of contact and immersion techniques of biometry before cataract surgery

Material and Mathods: This cross sectional comparative study was conducted in the Department of Ophthalmology Shaikh Zayed Hospital, Lahore for six months from 1-10-2007 to 31-03-2008. One hundred patients meeting the inclusion criteria were selected for this study. Immersion measurements were performed before contact measurements. For contact measurements, unreliable readings were discarded with the standard deviation of final set <0.12. For immersion measurements, unreliable readings were discarded with standard deviation of the final set <0.12. Two sets of measurements for both immersion and contact biometery were performed by two operators. Mean and standard deviation of measurement sets were compared.

Results: The first operator immersion mean was 22.99±0.90 as compared with second operator immersion mean was 22.99±0.88 with no significant difference. The first operator immersion standard deviation (SD) was 0.034±0.022 as compared with second operator immersion SD was 0.032±0.021 with no significant difference. The first operator contact mean was 22.74±0.94 as compared with second operator contact mean was 22.75±0.91 with no significant difference. The first operator contact SD was 0.058±0.025 as compared with second operator contact SD was 0.059±0.027 with no significant difference.

Conclusion: There is no significant difference in the findings of contact and immersion techniques when controlling the confounding factor and performed by experienced operators.

Over the last fifty years the main objective of cataract extraction has been transformed form merely improving the quality of vision to that improving the quality of life[1].

A significant improvement in the refractive outcome of cataract surgery is from a more precise measurement of pre operative intraocular distances and therefore a more accurate prediction of the intraocular lens power could be achieved[2]. To optimize the accuracy of predicting the postoperative refraction, formulae have been developed to calculate the IOL (intraocular lens) power[3]. Although good surgical techniques with low complication rates are important, biometry is often the most critical factor in obtaining the expected refractive results[4].

Biometry involves keratometric measurement of curvature of the cornea and also the measurement of axial length[5].

There are two methods of axial length measurement currently is practice, one is acoustic biometry and other one is called optical biometry. In acoustic biometry ultrasonic waves follow the optical axis of eye. In optical biometry partial coherence laser interferometer measure the axial length along the visual axis[5]. Ultrasound biometry may be performed either by directly putting the probe on the cornea called as contact technique or by using water bath method called as immersion technique[6].

Immersion ultrasound is generally considered superior to contact technique. The absence of corneal depression as a confounding factor reduces the risk of inter-technician variability[7].

In our study the repeatability of contact and immersion ultrasound biometry of axial length was compared. The mean and standard deviation of the measurement sets were compared, and the differences between repeat measures were calculated.

MATERIAL AND METHODS

This cross sectional comparative study was conducted in Department of Ophthalmology, Shaikh Zayed Hospital, Lahore. For six months from 1-10-2007 to 31-03-2008.

SAMPLE SELECTION: Non-probability purposive sampling.

INCLUSION CRITERIA

1. Patients presenting with age related cataract between the ages of 40 to 90 years diagnosed on the basis of slit lamp examination.
2. Both sexes.
3. Patients who have potential for good visual acuity.
4. Axial length between 21mm and 27mm.

EXCLUSION CRITERIA

1. Patients with known corneal curvature abnormalities such as previous penetrating keratoplasty or refractive procedures.
2. Patients with poor visual prognosis due to retinal pathology e.g. diabetic and hypertensive retinopathy or macular degeneration.
3. Allergy to topical anaesthetic.
4. Preoperative refractive error greater than 4.00 D sphere or 2.00 D cylinder.

One hundred patients meeting the inclusion criteria were identified from the eye outpatient department (OPD). Diagnosis was made on the basis of history, measurement of visual acuity and slit lamp examination. A demographic profile of all the patients admitted for cataract surgery was noted on a proforma attached. Immersion measurements were performed before contact measurements so corneal applanation did not influence the immersion technique.

For immersion measurements, a scleral immersion shell (Prager shell) was used to support the probe and normal saline was used as the coupling fluid. An automated sequence of 8 readings was taken. Unreliable readings was discarded with standard deviation of the final set <0.12.

For contact measurements, an automated sequence of 8 measurements were taken according to preset amplitude and timing criteria for ultrasound reflection. Unreliable readings were discarded with the standard deviation of final set <0.12.

A measurement set was defined as a group of readings taken by one operator with one technique at one time. Each eye had four measuremnet sets, two performed by contact and two by immersion by two different operators of adequate experience and the number of readings was recorded.

All the collected information was entered into SPSS version 12 and analyzed. The study variables were age, sex, keratometry, side of eye and axial lengths. Descriptive statistics were calculated. Mean and standard deviation was calculated for numerical data like age, keratometry results and axial length. Qualitative variables like sex and side of eye were presented as proportion and percentages. Statistical significance of any observed difference between the findings of two techniques were determined by using paired 't' test. Statistical significance for all compare-sons were given as P value ≤0.05.

RESULTS

The demographic and disease profile of patients is shown in (Table 1).

The comparison of mean and SD of first operator first immersion reading and 2nd operators first immersion readings show no significant different (P>0.05) (Table 2, 3).

The comparison of mean and SD of first operator second immersion redings with 2nd operator 2nd immersion reading show no significant difference (P>0.05) (Table 4,5).

The comparison of mean and SD of 1st operator first contact biometery reading and 2nd operator first contact reading show no significant difference (Table 6,7).

The comparison of mean and SD of 1st operators 2nd contact and 2nd operators 2nd contact show no significant difference (Table 8,9).

Table 1: Demographic and disease profiles of patients

Age (Mean ± SD)	60.35 ± 7.92
Sex	
Male/Female	946:54 (1.1)
Keratometery (Mean ± SD)	
1st Operator	44.01 ± 1.36
2nd Operator	44.77 ± 1.49
Cataract (n=100)	
Right eye	51
Left eye	49

Table 2: Comparison of first mean immersion (axial length) between two operators (n=100)

Mean immersion range	Operator 1 No of patients n (%)	Operator 2 No of patients n (%)
21.0-22.0	11 (11.0)	11 (11.0)
22.1-23.0	38 (38.0)	39 (39.0)
23.1-24.0	36 (36.0)	40 (40.0)
24.1-25.0	13 (13.0)	8 (8.0)
25.1-26.0	2 (2.0)	2 (2.0)
Mean±SD	22.99±0.90	22.90±0.88

P 0.85, Key

The clinical biometric findings between measurements of immersion technique and contact

Table 3: Comparison of first standard deviation of immersion between two operators (n=100)

Standard deviation of immersion	Operator 1	Operator 2
	No of patients n (%)	No of patients n (%)
0-0.5	87 (87.0)	83 (83.0)
0.6-1.0	13 (13.0)	17 (17.0)
Mean±SD	0.034±0.022	0.032±0.021

P 0.57

Table 4: Comparison of second mean immersion between two operators (n=100)

Mean immersion range	Operator 1 No of patients n (%)	Operator 2 No of patients n (%)

21.0-22.0	11 (11.0)	12 (12.0)
22.1-23.0	38 (38.0)	37 (37.0)
23.1-24.0	41 (41.0)	40 (40.0)
24.1-25.0	8 (8.0)	8 (8.0)
25.1-26.0	2 (2.0)	2 (2.0)
Mean±SD	22.82±2.27	23.0±0.90

P 0.37

Table 5: Comparison of second standard deviation of immersion between two operators (n=100)

Immersion SD range	Operator 1	Operator 2
	No of patients n (%)	No of patients n (%)
0-0.5	76 (76.0)	86 (86.0)
0.6-1.0	24 (24.0)	14 (14.0)
Mean±SD	0.056±0.024	0.034±0.021

P 0.23

technique were compared. The mean axial length was found to be 22.92 ± 1.20mm with the immersion technique and 22.75 ± 0.92 mm with the contact technique, using the same transducer probe. The difference of 0.17mm was not significant statistically. The mean standard deviation between recurrent measures in same eye was found to be 0.039 ± 0.034 with the immersion technique and 0.058 ± 0.025 with the contact technique. The difference of 0.02 was not significant statistically.

Table 6: Comparison of first mean contact between two operators (n=100)

Mean contact range	Operator 1	Operator 2
	No of patients n (%)	No of patients n (%)
21.0-22.0	17 (17.0)	19 (19.0)
22.1-23.0	49 (49.0)	42 (42.0)
23.1-24.0	26 (26.0)	33 (33.0)
24.1-25.0	6 (6.0)	4 (4.0)
25.1-26.0	2 (2.0)	2 (2.0)
Mean±SD	22.74±0.94	22.75±0.91

P 0.66

Table 7: Comparison of first standard deviation contact between two operators (n=100)

SD Contact range	Operator 1	Operator 2
	No of patients n (%)	No of patients n (%)
0-0.5	50 (50.00	48 (48.0)
0.6-1.0	48 (48.0)	49 (49.0)
1.1-1.2	2 (2.0)	3 (3.0)
Mean±SD	0.058±0.025	0.059±0.0.27

P 0.41

Table 8: Comparison of second mean contact between two operators (n=100)

Mean contact range	Operator 1	Operator 2
	No of patients n (%)	No of patients n (%)
21.0-22.0	22 (22.0)	18 (18.0)
22.1-23.0	38 (38.0)	41 (41.0)
23.1-24.0	32 (32.0)	34 (34.0)
24.1-25.0	9 (9.0)	6 (6.0)
25.1-26.0	1 (1.0)	1 (1.0)
Mean±SD	22.76±0.94	22.76±0.92

P 0.97

Table9: Comparison of second Standard deviation contact between two operators (n=100)

SD Contact range	Operator 1	Operator 2
	No of patients n (%)	No of patients n (%)
0-0.5	45 (45.0)	49 (49.0)
0.6-1.0	48 (48.0)	47 (47.0)
1.1-1.2	2 (2.0)	4 (4.0)
Mean±SD	0.032±0.022	0.058±0.027

P 0.89

The contact and immersion A-scan techniques produce comparable measures of the magnitude of eye axial length. Measurements of eye axial length obtained by the immersion technique averaged 0.17 mm longer than those obtained by the contact technique was confirmed in eyes subjected to repeated measurements. Both techniques give consistent results, but the difference between axial lengths measured by the two techniques has implications for choice of intra-ocular lens power.

DISCUSSION

Cataract extraction with implantation of intraocular lens is one of the most frequently and successfully performed ophthalmic procedures. Visual impairment is by far the most common indication for cataract surgery[7]. Patients stress for perfect refractive outcome with early visual rehabilitation.

Although good surgical techniques with low complication rates are important, biometry is often the most critical factor in obtaining the expected refractive results[3].

The most critical step in biometry is precise measurement of axial length, defined as the distance between the anterior corneal surface and the sensory retina[2].

Although contact method is most commonly used but it is cumbersome to the patient due to direct contact of probe with cornea also increasing the risk of corneal erosion. If the probe is pressed against the cornea an abnormally short axial length is recorded resulting in inaccurate calculation of intraocular lens power and refractive outcome is not as expected. Immersion technique eliminates corneal depression. If both techniques are performed carefully by experienced operators the chances of inter operator error are less and the results are comparable.

In our study the mean age of the patients is 60.35 ± 7.92 years. As compared with the study of Edge and Navon[8] the mean age of the patients was 62.4 ± 15.7 years.

In our study there is slight increased female to male as apposed to Navon and Edge[8] where the males gender was higher.

In our study, mean axial length by immertion technique was 22.92± 1.2 as compared with the study of Kronbauer et al[10] the mean axial length was found to be 23.19±1.32 using the same transducer probe, which is comparable with our study.

Immersion standard deviation (SD) 0.039±0.034 comparable with the study of Kronbauer et al[10] the mean standard deviation between recurrent measures was found to be 0.04 with the immersion technique.

In our study contact mean 22.75±0.92 compared with the study of Kronbauer et al[10] the mean axial length was found to be 22.93±1.32 with the contact technique.

In our study, contact SD was 0.058±0.025 comparable with the study of Kronbauer et al[9] the mean standard deviation was found to be 0.19 with the contact technique.

Immersion V/S contact difference in axial length measurements.

Hennessy et al[10] compared the repeatability and agreement of contact and immersion ultrasound biometry of axial length. Axial length measurement was longer with the contact method than with immersion by 0.03 mm. The repeatability of the 2 techniques was similar.

Watson and Armstrong[11] evaluated those measurements of eye axial length obtained by the immersion technique averaged 0.1 mm longer than those obtained by the contact technique. Both techniques give consistent results, but the difference between axial lengths measured by the two techniques has implications for choice of intra-ocular lens power[9].

CONCLUSION

There is no significant difference in the repeated findings of contact and immersion techniques when controlling the confounding factor and performed by experienced operators. When the measurement set was repeated, the precision of contact ultrasound biometry was comparable to that of immersion, with no clinically significant difference in mean axial length measurements.

Author's affiliation

Irrum Ibbas
Trainee Registrar
Department of Ophthalmology
Shaikh Zayed Hospital, Lahore

Dr. Atif Mansoor Ahmad
Assistant Professor
Department of Ophthalmology
Shaikh Zayed Hospital, Lahore

Prof. Tahir Mahmood
Head Department of Ophthalmology
Shaikh Zayed Hospital, Lahore

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