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Randomized Controlled Study to Compare Axial Length Measurement using Contact Technique and Immersion Technique in Cataractous Eyes in a Tertiary Care Hospital, Bagalkot

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Abstract

Purpose: Comparison of contact technique with immersion technique in terms of axial length measurements in cataractous eyes & to compare prediction errors in these eyes as measured after surgery.

Materials & Methods: Randomised control study done in 101 patients from December 2019 to June 2022. IOL Power was calculated using SRK/T formula in both groups. Prediction error was compared along with BCVA in contact and immersion technique.

Results: Postoperatively out of 51 cases 24 cases (47.05%) were in the estimated target refractive group (-0.25 to -1 D) and immersion group showed 49 cases (98%) within the estimated target refractive group (-0.25 to -1D). Mean prediction error in contact group was -0.85 ± 0.74 and immersion group -0.25 ± 0.16 with "p" value of <0.001 which is clinically significant.

Conclusion: There was a significant difference in ocular biometry measurement with the contact and immersion ultrasound technique. Precision of immersion technique is better than contact technique.

Keywords: Axial length measurement; Contact technique; Immersion technique; Prediction error.

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INTRODUCTION

Among the many artificial prosthesis invented by man, the intraocular lens is undoubtedly one of the most gratifying. It has revolutionized the treatment of cataract for a better result, in comparison with the other available modalities of optical rehabilitation like aphakic spectacles.[1]

In regular ophthalmological practice, ocular

biometric values like axial length, anterior chamber depth and lens thickness values are measured routinely.[2,3] It has great importance in measuring IOL power before cataract surgery which is aimed not only to restore visual clarity but also to provide good vision in refractive terms.[2]

Errors in axial length are the most significant errors in IOL power calculation.[4,5,6] The ultrasound axial length of the eye is commonly measured using either contact or immersion techniques. In the contact method, cornea can be compressed by the probe which can result in shorter axial length.[7] Immersion A-scan measurement eliminates corneal compression and is considered better technique for axial length measurement.[8-11]

MATERIALS AND METHODS

This study was conducted on 101 patients who visited in the Ophthalmology Department of S. Nijalingappa medical college and HSK hospital and research centre, Bagalkot.

Source of data: Ophthalmology Department of S. Nijalingappa medical college and HSK hospital and research centre, Bagalkot.

Type of study: Randomized Controlled Study.

Sample size calculation: Done using med calc software & estimated is 40 in each group. Taking dropout rate: 20%, 50 in immersion group & 51 in contact group was taken. Computer generated random allocation of study subjects into 2 groups (immersion and contact) was done. Duration of the study – 1.5 years (December 2019 - June 2021).

Ethical clearance was taken from institutional ethical committee.

Inclusion Criteria:

- All patients coming to OPD in ophthalmology department from December 2019 to May 2021 with uncomplicated, senile, immature and mature cataract.
- Willing to take part in the study.

Exclusion Criteria

- Hyper mature cataract.
- Traumatic cataract.
- Paediatric cataract.
- Patient with associated ocular pathology.
- Complicated cataract.
- Secondary cataract.
- Non-cooperative patients.

Pre-operative evaluation was done by history taking general examination, local examination with torch light, slit lamp examination, visual acuity for distance and near without and with corrections, intraocular pressure measurement using Goldmanns applanation tonometry, fundoscopy with dilated pupil by using 90 D Volks lens in slit lamp, Lacrimal sac syringing & Serology test was done for HIV, HCV and HBsAg.

B-Scan was done in patients with mature cataract to rule out any vitreous or fundus pathology & special investigations were carried out for patients having diabetes and hypertension.

IOL power was calculated using keratometry readings & axial length measurements.

Keratometry: It was carried out by Bausch and Lomb type of keratometer & readings were available in dioptres whose range was 36 D to 50 D.

A-Scan Biometry: Axial length of the eye was measured using Biomedix Echorule 2 biometer with a built in microprocessor and computing a suggested IOL power.

The transducer when applied to the cornea directly as in contact method or indirectly through the pregar shell as in immersion technique will fire many ultrasonic pulse through the eye, time these pulses and convert them into numerical value. Incorrect readings are avoided as the microprocessor analyses the retinal and lens spikes for amplitude and uses them as criteria to ensure proper alignment. Proper alignment was indicated by the beep sound and automated 5 readings were recorded. Mean axial length reading with SD of ≤ 0.06 was taken.

Two different techniques were used for A-scan biometry-A) Contact & B) Immersion

Calculation of IOL Power

- The machine was set in calculation mode and SRK-T formula was chosen for calculation.
- The keratometry readings K1 and K2, the A constant and axial length were entered & calculated IOL power displayed on the screen was recorded & in general the aim was to make the patients slightly myopic.

Follow Up:

All the patients were reviewed after 1 week and then at 4-6 week. During each visit they were examined for visual acuity, condition of wound, condition of the cornea, anterior chamber depth and reactions. Pupils were examined for size, shape

and rection to light. IOL was examined and its position was noted. Fundoscopy was done using direct ophthalmoscope.

After 4-6 weeks, manual refraction was done as refractive status considered to be stable. Retinoscopy was performed and correction was given for distance and near. In a few patients who had oblique astigmatism automated refraction was done and correction given. The difference between the expected and postoperatively calculated refraction was noted

RESULT

The study under taken included 101 cases. All the patients under went small incision cataract surgery with a posterior chamber intraocular lens implantation. The results post surgically (i.e., four to six weeks postoperatively) were analysed and the following observations were made.

Out of 101 cases in the study, 51 cases (50.5%) belong to contact group and 50 cases (49.5%) belong to immersion group. In our study, maximum number of cases i.e., 36 cases (35.64%) belong to age group of 60-69 years followed by 31 cases (30.69%) belonging to age group of 50-59 years. Out of 101 cases, 44 cases (43.5%) were male and 57 cases (56.5%) were female. Contact group comprised of 51 cases out of which 21 cases (41.2%) were male and 30 cases (58.8%) were female. Immersion group comprised of 50 cases out of which 23 cases (46%) were male and 27 cases (54%) were female.

In our study, maximum axial length was between 22-24 mm which is seen in 81 cases (80.2%) followed by 12 cases (11.9%) having axial length more than 24 mm and 8 cases (7.9%) having axial length less than 22 mm.

In this study, mean estimated post-operative refraction in dioptre was -0.51±0.09D in contact group and -0.49 ± 0.099 D in immersion group & mean actual post-operative refraction found tobe -1.18±0.91 D and -0.68 ± 0.25 D in contact and immersion group respectively having p value of <0.001 which is statistically significant.

Minimum prediction error of 0 to 0.50 D was seen in 22 cases (43.13%) incontact group and 46 cases (92%) in immersion group respectively Mean prediction error (indioptre) in contact group was -0.85±0.74 D where as in immersion group it was -0.25 ± 0.16 D.

Table 1: Comparison of BCVA with Contact and Immersion groups (N=101)

BCVA	Technique		Total	Chi square	Pvalue
	Contact	Immersion			
6-Jun	6 (11.76%)	27 (54%)	33(32.67%)		
6-Sep	44 (86.27%)	23 (46%)	67 (66.33%)	24.86	<0.001
6-Dec	1 (1.96%)	0 (0%)	1 (1%)		
Total	51 (100%)	50 (100%)	101 (100%)		

In contact group, only 6 cases (11.8%)achieved BCVA of 6/6 where as in immersion group, 27 cases (54%) achieved BCVA of 6/6 (table 1 and chart 1).

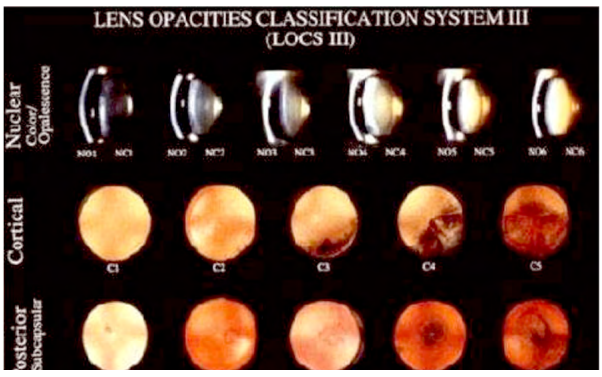

Chart 1: Bar chart of comparison of BCVA with contact & immersion group(N=101)

DISCUSSSION

Minimizing the post-operative refractive error or prediction error is a primary goal in all cataract surgery patients. Accurate postoperative refraction target would potentially yield a better visual acuity in the operated eye, by minimizing long term anisometropia and possible secondary amblyopia or the need for later IOL exchange.[12]

In our study, the average age was 60.55 ± 10.30 year in contact group and 63.70 ± 9.42 year in immersion group. There was slight female preponderance with 30 cases (58.8%) and 27 cases (54%) in contact and immersion group respectively showing no significance difference in incidence of cataract between sexes.

Precise measurement of ocular biometry values, especially axial length measurement is central to the accurate calculation of IOL power inserted at surgery.

Axial length measurement was done by two methods in our study, contact and immersion method respectively

In immersion technique, measurements are performed through a water bath. This prevents direct contact of the A-scan probe with the cornea thus avoiding corneal compression. The shell also stabilises the globe, keeps the eyelid open, and allows proper alignment of the probe to visual axis.[13] In the contact method, the probe touches the cornea and may result in corneal compression and a shorter axial length.[3,9,10,14] The error in preoperative axial length measurement was the most significant error in IOL power calculation and equates to almost 2.5 D/mm in IOL power in a normal AL eye but decreases to 1.75 D/mm in a 30 mm eye and increases to 3.75 D/mm in a 20 mm eye.[15]

Ademola-Popoola DA. et al[2], did a similar study in year 2016 on 92 cases in which average axial length (22-24.4 mm) was reported to be in 75 cases (81.5%). In our study of 101 cases, average axial length (22-24 mm) was found to be in 81 cases (80.2%) which was similar to the above study (table 2).

In our study, mean axial length by contact technique was found to be 23.07 ± 0.87 mm and by immersion technique was 22.96 ± 0.81 mm.

Table 2: Comparative analysis of mean axial length in contact and immersion technique

Study	Mean Axial Lenth (Contact)mm	Mean Axial Length (Immersion)mm
Hoffer[16] (1981)	22.7	23.10
Shammas[17] (1984)	23.28	23.52
Artaria[18] (1986)	23.13	23.44
Schelenz[10] (1989)	22.39	22.59
Olsen[13] (1989)	23.35	23.49
Watson And Armstrong[9] (1999)	23.24	23.55
Hennessy MP et al[3] (2003)	23.28	23.25
Trivedi RH et al[4] (2011)	21.36 ±3.04	21.63 ±3.09
Ademola-Popoola DA. Et al	23.46 ±1.46	23.66 ±1.36
Present study	23.07 ±0.87	22.96 ±0.81

In our study among contact group, postoperatively out of 51 cases, 2 cases (3.92%) became hyperopic, 2 cases (3.92%) became emmetropic and 47 cases (92.15%) became myopic out of which 24 cases (47.05%) were in the estimated target refractive group (-0.25 to -1 D) and 23 cases (45.09%) were above the targeted refractive group (>-1 D)(table3).

Table 3: Comparative analysis of Spherical post-operative correction (Dioptre)

Study		N.K. Limbdi66 (1991)	" Present study (Contact)	Present study (Immersion)
Spherical	> +0.25	52 (52%)	02 (3.92%)	–
post-	–	11 (11%)	02 (3.92%)	–
operative	-0.25 to -1	28 (28%)	24 (47.05%)	49 (98%)
correction in	–1.25 to –2	07 (7%)	16 (31.37%)	01 (2%)
Dioptre	>-2	02 (2%)	07 (13.72%)	–

Immersion group showed 49 cases (98%) were in the estimated target refractive group (-0.25 to -1 D) and 1 case (2%) was above the targeted refractive group (>-1 D).

This leads to conclusion that immersion technique is better than contact method to achieve the target refractive outcome.

In our study, we found that mean prediction error in contact group was -0.85 ± 0.74 D and immersion group -0.25 ± 0.16 D with "p" value of <0.001 which is clinically significant.

CONCLUSION

The targeted spherical refractive equivalent error is achieved in 24 cases (47.05%) in contact group and 49 cases (98%) in immersion group with SRK/T formulae. BCVA for distance was done 4-6 week postoperatively which showed that in contact group, 6 cases (11.76%) out of 51 cases got correction of 6/6 whereas in immersion group, 27 cases (54%) out of 50 cases got correction up to 6/6. The "p" value of <0.001 suggest that the difference in mean actual postoperative refraction in contact and immersion group is clinically significant.

Mean prediction error (estimated postoperative refraction – actual postoperative refraction) in contact and immersion group were -0.85 ± 0.74 and -0.25 ± 0.16 respectively with "p" value <0.001 suggesting the study is clinically significant. So, immersion technique is better than contact technique according to my study and it is the most applicable method for calculation of required intraocular lens power before cataract surgery.

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