ORIGINAL RESEARCH PAPER
Volume - 11 | Issue - 03 | March - 2022 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

A COMPARATIVE STUDY OF AXIAL LENGTH MEASUREMENT USING CONTACT VERSUS IMMERSION TECHNIQUE IN PATIENTS UNDERGOING SMALL INCISION CATARACT SURGERY AND ITS IMPACT ON POSTOPERATIVE REFRACTIVE STATUS OF EYE

Ophthalomology

Dr. Surya Meenakshi Devi Pusapati — Postgraduate Department of Ophthalmology, Alluri Sitarama Raju Academy of Medical Sciences Andhra Pradesh 534005, India

Dr. Pakalapati Pradeep — Professor, Department of Ophthalmology, Alluri Sitarama Raju Academy of Medical Sciences Eluru, West Godavari District, Andhra Pradesh 534005, India

Dr. Asmina Meeraj* — Assistant Professor, Department of Ophthalmology, Alluri Sitarama Raju Academy of Medical Sciences Eluru, West Godavari District, Andhra Pradesh 534005, India. *Corresponding Author

ABSTRACT

INTRODUCTION: The important step in ocular biometry is to obtain desired postoperative refractive outcome for which standardization of techniques is required to ensure accurate measurements thereby providing correct calculation of IOL power needed.An error of 1mm in axial length results in a refractive error of approximately 2.35D error of IOL power in an average eye of 23.5mm.

AIM OF THE STUDY: To compare axial length measurement using contact versus immersion technique in patients undergoing small incision cataract surgery and its impact on postoperative refractive status of eye.A scan ultrasound is used to measure axial length of eyeball using contact or immersion technique.

MATERIALS &METHODS: Prospective cross sectional comparative study was conducted on 44 eyes of 44 patients having cataract from November 2020 to August 2021.Axial length was measured using both immersion and contact technique and randomly divided the patients into I and C group.The difference between two techniques were noted and IOL power obtained using SRK II formulae was implanted bysmall incision cataract surgery.At the end of 6 weeks post operatively residual spherical error was noted and compared.

RESULTS: Mean axiallengthwith immersion and contact technique were 22.92mm(±0.72) and 22.61mm(±0.79).Axial lengthwith contact technique on an average was 0.31mm shorter than immersion technique and showed statistically significant correlation between two techniques(correlation 0.978,p value < 0.001). At end of 6 weeks post operatively residual spherical error of ≤±0.5D was seen in 77.27% of patients in I group and in 63.63% of patients in C group.Mean value of residual spherical error for immersion group(I) was -0.238±0.373 while in contact group it was-0.375±0.492.Independent t test showed that difference was found to be statistically insignificant(*P>0.05*).

CONCLUSION: In this study there was a significant difference in axial length measurement using immersion and contact technique.In terms of postoperative residual spherical error there was comparatively better visual outcome in immersionthan contact group thereby concluding immersion technique is more preferrable than contact technique.

KEYWORDS

ocularbiometry,axial length, contact technique,immersiontechnique,cataract surgery

INTRODUCTION:

Modern-day cataract surgery is a refractive surgery aimed at providing excellent visual acuity to improve the patient's refractive status. Intraocular lens implantation is an essential step in cataract surgery to achieve emmetropia for the eye.The important step in ocular biometry is to obtaindesired postoperative refractive outcomefor which standardization of techniques is required to ensure accurate measurements thereby providingcorrect calculation of IOL power needed.[1]

A-scan ultrasound is a technique which involves passing an ultrasonic beam via a transducer through the eye,andafter hitting intraocular structures the beam is reflected and displayed as trace of ocular spikes on the monitor.A-scan ultrasound can be obtained either by contact(applanation),immersion cornea to orbital fat.[2]

Biometry values(axial length,lensthickness,anterior chamber depth) on,or optical methods.The contact/applanation technique is atechnique in whichan ultrasound probe is placed on the central cornea which slightly indents the surface leading to various degrees of corneal compressionsand this may introduce errors into thevalues unlike immersion technique which is relatively observer independent and uses saline filled scleral(Prager) shell which is placed between the eye and the probe.[3]

An error of 1mm in axial length results in a refractive error of approximately 2.35D error of IOL power in an average eye of 23.5mm and may translate to an error of 3.75D in a 20mm eye and much more in very short eye.[4]Errors in predicted refraction post implantation of calculated IOL power is the sum ofrandom error in the measurement of the axial length(54%),measurement ofcorneal power(8%), andestimation of pseudophakic ACD(38%).[5]

At our institute we mostly use contact method to measure axial length and while measuring axial length there will be some variation in value obtained when measured by different individuals thereby causing variation in IOL power obtained.

AIM:

To compare contact and immersion technique for measuring axial length and to see the impact on post operative refractive status of eye.

MATERIALAND METHODS:

The study was conducted in the Department of Ophthalmology, AlluriSitarama Raju Academy Of Medical Sciences,Eluru from November 2020 to August 2021 after obtaining approval from institutional ethical committee.

Study Design:

Prospective cross sectional comparative study.

Sample Size:

44 eyes of 44 patients undergoing cataract surgery.

Inclusion Criteria:

Patients aged between 50 to 70 years with age related cataract with axial length measuring between 22mm to 25mm and have potential for good visual acuity and patients willing to give consent for the study.

Exclusion Criteria:

Patients with nuclear sclerosis above grade III,history of corneal pathology,previous surgery to eye,any retinal pathology(hypertensive retinopathy, diabetic retinopathy, macular degeneration etc), H/o glaucoma, Preoperative refractive error greater than 4.00D sphere or 2.00D cylinder,any trauma to eye and history of any systemic illness were excluded from the study.

METHOD:

After selecting patients having cataract,written and informed consent

was obtained from the patients.Corneal curvature readings K_1 and K_2 values were obtained from automated keratometer(APPA AUTOREF-KERATOMETER,MODEL:AARK-1M) and then axial length, was measured using A scan(BIOMEDIX ASCAN BIOMETER).It has 10MHz A scan biometry probe for both immersion and contact technique.

Initially immersion technique was done first followed by contact technique by the same examiner.In immersion technique the patient was made to lie in supine position.A Prager scleral immersion shell was used to support the probe,and normal saline used as coupling fluid.The chamber was filled with saline using a 10cc syringe connected to a silicone tube.An automated sequence of 10 measurement readings was taken according to the preset amplitude and timing criteria for ultrasound reflections with 1 application of the shell and probe.Unreliable readings were discarded, leaving 4 to 5 measurements.In contact technique after pre anaesthetizing the cornea with local anaesthetic, A- scan probe was placed gently on the cornea and an automated sequence of ten reliable readings with characteristic peaks were taken.The spikes and corresponding gates produced in all instances were evaluated and unreliable readings were discarded leaving 4 to 5 measurements.The standard deviation was set <0.05.

Grouping:

While doing cataract surgery by small incision 6.2mm triplanar corneoscleral tunnel on steeper meridian serially the first patient was allotted group I(Immersion) and second patient group C(Contact) , third again group I and so on till 22 patients had been operated in each group.IOL power for axial length values obtained for both techniques was calculated using SRK II formulae(A constant 118.2) and the corresponding IOL power was implanted.All surgeries were performed by a single surgeon.Postoperatively at the end of 6 weeks, we compared theresidual spherical error(taking spherical refractive error component into consideration without considering cylindrical error) in dioptres obtained for both groups and the difference was noted between two groups.*P* value was calculated for both groups using unpaired "*t*"-test.A difference in *P* value ≤ 0.05 was considered statistically significant.

RESULTS:

The data was analysed with SPSS version 28.The biometry values of 44 eyes of 44 patients were taken.Their ages ranged from 45-60 years with a mean of 53.65±4.36 years.There were 22 males(50%) and 22 females(50%).The mean axial length obtained with immersion and contact technique were 22.92mm(±0.72) and 22.61mm(±0.79).There was a statistically significant correlation between two techniques (correlation 0.978,p<0.001).

Table 1:mean Axial Length In Both Groups

Parameter	Mean ± SD		T(df)	P
	Immersion group N = 22	Contact group N=22		
Axial length	22.92mm(±0.72)	22.61mm(±0.79)	12.41(43)	<0.001(S)

P<0.05 was taken as statistically significant

At the end of 6 weeks post op residual spherical refractive error was noted during the follow up period.In the 'I' group,maximum patients had a residual spherical error mounting to ≤±0.5D(77.27%) which was followed by 5 patients(22.72%) having residual spherical error>0.5D and ±1.50.None of the patients had residual spherical error> ±1.5D. Similarly in 'C' group maximum patients had residual spherical error mounting to ≤±0.5D(63.63%) followed by 8 patients(36.36%) having residual spherical error>0.5D and ±1.50.None of the patients had residual spherical error>±1.5D.

Table 2:residual Spherical Error In Both Groups

RESIDUAL SPHERICAL ERROR (DIOPTRES)	GROUP'I' n(%)	GROUP'C' n(%)
≤±0.5	17(77.27%)	14(63.63%)
>0.5-±1.50	5(22.72%)	8(36.36%)
>1.50-±2.50	0	0
>±2.50	0	0

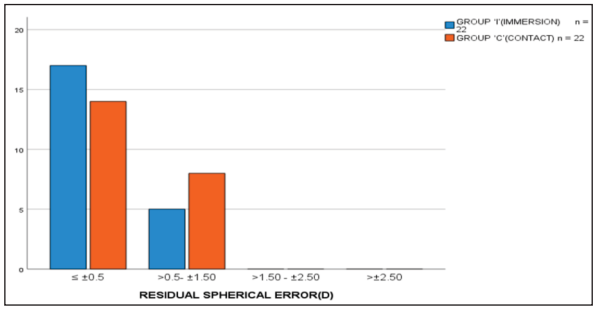

Figure 1:Residual Spherical Error

The mean value of residual spherical error for immersion group(I) was -0.238±0.373 while in contact group it was -0.375±0.492.Independent 't' test had shown that the difference was found to be statistically non significant(*P>0.05*) ,thereby showing that there was no significant difference in the mean residual error in dioptres assessed for group I and group C.

Table 3:mean Residual Spherical Error

Parameter	Mean ± SD		T(df)	P
	Immersion group N = 22	Contact group N=22		
Residual spherical error	-0.238±0.373	-0.375±0.492	1.034 (42)	<00.307 (NS).001(S)

DISCUSSION:

Ocular biometry is basic to cataract surgery.Measuring axial length is central to calculation of intraocular lens power to be inserted. Interobserver variations can be there.This necessitates the usage of operator independent technique like the immersion technique.

In our studyimmersion technique had given longer axial length than contact technique.Inthe immersion technique measurements are performed through immersion shell filled with water and hence this prevents direct contact of A scan probe with the cornea thereby avoiding corneal compression.The shell also stabilises the globe,keeps the eyelids wide open and maintains proper alignment of the globe with visual axis.

There was statistically significant difference(p<0.001) in the mean values obtained using contact and immersion technique.Mean axial length measurement in immersion technique was 22.92±0.92mm and in contact technique was 22.61mm±0.79 and there was a difference of 0.31±0.13mm which can impact the IOL power to be implanted and post operative refraction.This is similar to the study donePoopola et al[6],the means of biometry values with immersion and contact technique axial lengths were 23.66(±1.36) and 23.46 mm (±1.46) withmean axial length showed longer readings by immersion technique by an average of 0.21 ± 0.26 mm.It is also similar to studies by Shammas et al[7], and by Kroenburg et al[8], who got mean axial length difference as 0.24mm and 0.26mm respectively.This difference is due to the pressure exerted by the probe which indents the cornea and shortens the axial length[9].Other authors also reported similar significant differences between the two techniques.[10-12]Henessy et al[13],however reported on 36 eyes,with longer axial length measurement of 0.03 mm by contact method, andsuggested that measuring axial length repeatedly by contact technique made it comparable to that of immersion with no clinically significant difference in mean axial length measurements.

Considering the post operative residual spherical error in the 'I' group , maximum patients had a residual spherical error mounting to ≤ ±0.5D(77.27%) which was followed by 5 patients(22.72%) having residual spherical error >0.5D and ±1.50 with mean spherical residual error of -0.238±0.373.Similarly in 'C' group maximum patients had residual spherical error mounting to ≤ ±0.5D(63.63%) followed by 8 patients(36.36%) having residual spherical error >0.5D and ±1.50 having residual spherical error of -0.375±0.492None of the patients in both groups had residual spherical error > ±1.5D.P value was 0.307 showing no statistical significant correlation between them.

In a study done by J Hrebcova et al[14], where contact technique in 48 eyes, mean SE was -0.13 D while immersion technique in 63 eyes has

mean SE of 0.25 D with no statistically significant difference between them.Though there was no statistically significant correlation between two techniques in terms of post operative residual spherical error group 'I' patients had comparatively better visual outcome than patients in 'C' group making immersion technique more preferrable.

Our study has its own limitations.Sample size of the study wassmall.Large sample study should be undertaken for measuring accurate differences.While measuring the axial length anterior chamber depth,lens thickness were not taken into account. Eyes with short and long axial length were not taken into account which would cause greater difference in the IOL power obtained.

CONCLUSION:

In this study there was a significant difference in axial length measurement using immersion and contact technique.In terms of postoperative residual spherical error there was comparatively better visual outcome in immersion than contact group thereby concluding immersion technique is more preferrable than contact technique.

REFERENCES:

1. Norrby S. Sources of error in intraocular lens power calculation. J Cataract Refract Surg. 2008; 34:368-376.
2. R J, F M. The contact and immersion ultrasound methods compared using the ray tracing method. Optica Applicata. 2010;XL:77-92.
3. Hoffmann PC, Hutz WW, Eckhardt HB, Heuring AH. Intraocular lenscalculation and ultrasound biometry: immersion and contact procedures.KlinMonblAugenheilkd. 1998; 213:161-165.
4. Basic and Clinical Science Course, Section 3: American Academy ofOphthalmology 2011-2012; 211-223.
5. Olsen T. Sources of error in intraocular lens power calculation. J Cataract Refract Surg. 1992;18:125-129.
6. Dupe S. Ademola-Popoola, Donald A. Nzeh, Sadiat E. Saka, Lateefat B. Olokoba, Tokunbo S. Obajolowo, Comparison of ocular biometry measurements by applanation and immersion A-scan techniques,Journal of Current Ophthalmology, 2015;27:110-114.
7. Shammas HJ. A comparison of immersion and contact techniques for axial length measurement. J Am Intraocul Implant Soc. 1984;10:444-447.
8. Kronbauer AL, Kronbauer FL, Kronbauer CL. Comparative study of thebiometric measurements made by immersion and contact techniques. ArqBras Oftalmol. 2006;69:875-880.
9. Attah H. In: Ophthalmic ultrasound, a practical guide. 2008:555-560.
10. Ben-Zion I, Neely DE, Plager DA, Ofner S, Sprunger DT, Roberts GJ.Accuracy of IOL calculations in children: a comparison of immersionversus contact Ascanbiometry. J AAPOS. 2008;12:440-444.
11. Hitzenberger CK, Drexler W, Dolezal C, et al. Measurement of the axiallength of cataract eyes by laser Doppler interferometry. Invest OphthalmolVis Sci. 1993;34:1886-1893.
12. Olsen T, Nielsen PJ. Immersion versus contact technique in the measurementof axial length by ultrasound. Acta Ophthalmol (Copenh).1989;67:101-102.
13. Hennessy MP, Franzco, Chan DG. Contact versus immersion biometry ofaxial length before cataract surgery. J Cataract Refract Surg.2003;29:2195-2198.
14. Hrebcova J, Skorkovska S, Vasku A. Comparison of contact and immersion techniques of ultrasound biometry in terms of target postoperative refraction. CeskSlovOftalmol. 2009; 65:143-146.