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ORIGINAL ARTICLE

Comparison of Accuracy of IOL Master and a Scan Acoustic Biometry in Silicon Oil Filled Eyes

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ABSTRACT

Objective: Objective of our study was to determine accuracy of IOL Master and A scan acoustic biometry in silicon filled eyes in terms mean difference of axial length pre-operatively and mean post-operative refractive error
Study design: Comparative cross sectional study
Study settings and duration: Study was conducted at department of Ophthalmology (Eye Unit III) Mayo hospital Lahore (KEMU) from November 2019 to April 2020.
Material and methods: WHO calculator was used for calculation of patient sample (N=34). Patients were randomly divide in two groups Group I underwent preoperative axial length (AXL) measurement by using IOL Master and by acoustic a-scan ultrasound in Siliconized mode.
Results: Total 34 patients were included in study. There were 18(52.9%) male and 16(47.1%) female. Mean age of patients was 44.2±6.4 years. Patients undergone biometry with Master IOL showed better visual acuity (Log Mar) (0.25±0.7, 0.63±0.09, p=0.000), less post-operative refractive error (0.22±0.02, 0.72±0.17, p=0.000) as compared to those in which A scan acoustic biometry was done. A significant difference in post-operative axial length was reported (p=0.04)
Conclusion: IOL master is more accurate and reliable method of IOL power calculation resulting in better visual outcomes and less post-operative refractive error as compared to A scan acoustic biometry in silicon filled eyes.
Keywords: A scan Acoustic biometry, Axial length, IOL Master

INTRODUCTION

Silicon oil is used as a tamponading agent, worldwide in retinal detachment surgeries[1]. It is specifically used to displace retina towards eye wall (through surface tension) and fill retinal breaks (as a result of lower specific gravity). Silicon oil is associated with prevention of proliferative vitreoretinopathy (PVR)[2].

Cataract formation after vitreoretinal surgeries is common. Almost up to 80 percent eyes develop cataract in maximally 24 months of vitrectomy. Several factors are involved in cataract formation including surgical stress, direct trauma to posterior capsule during surgery, posterior capsular ischemia, Light toxicity, direct oxidative damage to lens proteins, vitreous substitutes as silicon oil causes cataract by inducing epithelial metaplasia due to inhibition of lens metabolism or by direct contact causing mechanical damage[3].

Intra-ocular lens (IOL) power calculation is very challenging in silicon filled eye for phacoemulsification. Axial length is a definitive variable required in all power calculation formulas measured by acoustic biometry or optical biometry (pre-operatively)[4]. Axial length measurement in optical biometry is based on non-contact partial coherence laser interferometry (signals of retinal pigment epithelium) principle while in acoustic biometry is based on A scan ultrasound method (signals from internal membrane)[5]. Moreover, A scan biometry is usually done with two principle techniques; applanation and immersion technique. Literature reported immersion technique as standard for measurement of axial length because in applanation technique corneal compression leads to misleading results[6].

Eyes that have no additional pathology have been shown to have better optical biometry accuracy than ears, according to the evidence.[7] However, literature regarding biometry in silicon eyes is not enough to reach any conclusion in Pakistan. Axial length measurement is very important to achieve better visual outcomes in silicone eyes. In Pakistan, relying on axial length of eye previously undergone phacoemulsification is a common practice. However, in case of abrupt and unusual axial length itis difficult to rely on that reading for IOL implantation. Therefore, objective of our study was to determine accuracy of IOL Master and A scan acoustic biometry in silicon filled eyes in terms mean difference of axial length (pre-operatively) and mean post-operative refractive error.

MATERIAL AND METHODS

A cross sectional comparative study was conducted at department of Ophthalmology (Eye Unit III) Mayo hospital Lahore (KEMU) from November 2019 to April 2020. A sample size of 34 was calculated using WHO calculator with following indices; Mean refractive error postoperatively in A scan group= $\mu1$=1.79D, Mean refractive error postoperatively with IOL master= $\mu2$ =0.60, standard deviation= SD= 1.24[8], power of study= 80% and level of significance= 5%. Patients were selected from OPD using consecutive non probability sampling. We took official approval from institutional review board committee of KEMU. All participating patients signed written consent forms. Inclusion criteria of patients wasbased upon age 20-70 years, both genders, patient with no history of trauma in lifetime, patients requiring IOL implantation with silicon oil filled eyes. Exclusion criteria was based upon patients with recurrent retinal detachments, patients with history of multiple vitreoretinal surgeries, patients with history of penetrating trauma in lifetime, patients with congenital anomalies, pregnant and breast feeding mothers.

Patients were randomly divide in two groups using lottery method; Group I underwent preoperative axial length (AXL) measurement by using IOL Master and by acoustic a-scan ultrasound in Siliconized mode. Standard protocols and a constant of 118.0 were used to compute the IOL power. Using the identical a- constant for IOLs, patients in both groups received silicon oil removal, phacoemulsification, and foldable IOL insertion all at the same time. For data gathering, a structured questionnaire was used. Accuracy of intervention was measured in terms of pre-operative axial length difference in two groups and post-operative refractive error in terms of spherical equivalent (S.E) after 3 months with autorefraction.

Silicon oil was removed by 23G three port technique with fluid attached at one port with active suction with 10 cc syringe with soft tip at the second port. Three to four cycles are repeated to wash the cavity with fluid. Retinal integrity is analyzed. Fluid Air exchange is done with all ports stitched.

IOL Power Calculation: IOL power calculation method is measurement of intraocular lens power before implantation in eye. IOL power will be measured using SRK formula[9] P=A-0.9K-2.5L

Where: A=IOL specific constant

K= Average corneal refractive power (D) L= length of eye (mm)

Data analysis: The data was analysed using SPSS version 20 software. T test and descriptive statistics like mean and standard deviation were used in the investigation. When the p-value was less than 0.05, it was considered significant.

RESULTS

Total 34 patients were included in study. There were 18(52.9%) male and 16(47.1%) female. Mean age of patients was 44.2±6.4 years. Among all the patients, 6(17.6%) were in age group 20-40 years while 28(82.4%) were in 41-70 years' age group. Disease eye was left in 15(44.1%) patients and right eye in 19(55.9%) patients. Out of all patients, 12(35.3%) were diabetic while 22(64.7%) were non diabetic patients. Among all the patients, 5(14.7%) were hypertensive while 29(85.3%) were non hypertensive. Mean duration of silicon eye was 1.91±0.7 months.

Pre-operative visual acuity was 0.89±0.08 Log Mar and 0.87±0.11 Log Mar in group I (Master IOL) and Group II (A scan acoustic biometry) (p=0.621). However, patients undergone biometry with Master IOL showed better best corrected visual acuity (Log Mar) as compared to those in which A scan acoustic biometry was done (0.25±0.7, 0.63±0.09, p=0.000) as shown in table 1.

There was no significant difference in pre-operative AXL of Master IOL group and A scan acoustic biometry group (p=0.853). However, significant difference in post-operative axial length in both groups was found (p=0.04) as shown in table 2.

Master IOL group patients showed significantly lower post-operative refractive error as compared to those who underwent biometry with Acoustic A scan (p=0.000) as shown in table 3.

Table 1: Comparison of pre and post-operative visual acuity in two interventional group

	N=34	Pre-operative visual acuity (Log Mar)	P value	Post- operative visualacuity (Log Mar)	P value
Group I Master IOL	17	0.89±0.08	0.621	0.25±0.7	0.000
Group II A Scan	17	0.87±0.11		0.63±0.09	

Table 2: Comparison of pre and post-operative axial length in both interventional groups

	N=34	Pre-operative Axial Length	P value	Post- operative Axial Length	P value
Group I Master IOL	17	22.0±0.79	0.853	22.3±0.7	0.04
Group II A Scan	17	21.6±1.0		20.9±0.9	

Table 3: Comparison of post-operative refractive error in both interventional groups

	N=34	Post-operative Refractive error (Spherical Equivalent)	P value
Group I Master IOL	17	-0.22±0.02	0.000
Group II A Scan	17	-0.72±0.17	

DISCUSSION

Treatment of cataract is IOL implantation. Success of IOL implantation is dependent on various factors including accurate power calculation of IOL[10]. However, silicon oil makes IOL power calculation challenging and results in more chances of increasing residual refractive error. Studies reported that biometry is difficult to perform in silicon filled eyes[11]. Moreover, biometric measurements are affected in silicon eyes due to sound and optical attenuation properties of silicon. However, IOL master uses partial coherence interferometry for axial length measurement depending upon reflection of retinal pigment epithelium (interference signal)[12].

The IOL master uses a process that measures the distance from the cornea's anterior surface to the retina's pigment epithelium to estimate axial length. The ILM (internal limiting membrane) is located within the cornea, and an a-scan biometric detects this distance. To avoid a potential misalignment between the patient's visual axis and that which is being measured, IOL master biometry is more accurate than ultrasound biometry.. It is more noticeable in myopic eyes with a long axial length because of the larger error in measurement. When the cornea is indented, axial length measurements will be incorrectly short. In eyes with lengthy axial lengths, posterior pole staphylomas can also cause A-scan measurement mistakes. To get superior results, IOL master in posterior pole staphyloma uses a more precise fovea location.[13]

In present study, patients undergone biometry with IOL master showed better visual outcomes and less post-operative refractive error as compared to patients undergone A Scan Acoustic biometry ($p<0.05$). Kunavisarut et al. reported that IOL Master had better accuracy and less postoperative refractive error than A san acoustic biometry in silicon filled eyes. In a similar investigation, the IOL Master was found to be a practical and accurate approach for measuring axial length. IOL Master and A scan, according to Findlo et al., provided equivalent and acceptable results for determining axial length and lens status[14]. Findlo et al. In comparison to A scan in silicon-filled eyes, Rajan et al found that IOL master was a more precise and superior approach for calculating axial length and postoperative refractive error[15].

In present study, a significant difference in post-operative axial length was found (p=0.04). Raymonds et al. reported that there is no significant difference in biometry of IOL master and A scan. However, there are certain situations in which A scan is mandatory[16]. Similar studies reported that IOL master is predicted to be more accurate and efficient in silicon filled eyes due to preoperative composite SNR of >100[17]. This composite is associated with improving axial length measurement and combines several signals together to get significant signal peak[18]. However, in some cases IOL master is not efficient (10-17%) due to machine limitations, patient poor fixation, media dense opacity while in these situations A scan is preferred technology[19]. A scan is also preferred in Aphakic patients and patients with axial length >25[20]. Small sample size and the fact that the study was conducted in one location limit the study's generalizability.

CONCLUSION

IOL master is more accurate and reliable method of IOL power calculation resulting in better visual outcomes and less post-operative refractive error as compared to A scan acoustic biometry in silicon filled eyes. Further clinical trials are required on eyes with dense cataract and poor visual acuity biometry using IOL master and A scan acoustic biometry.

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