Comparative Analysis of Optical Biometry: Lenstar Versus IOL Master in Silicon Oil Filled Eyes

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Silicone oil tamponades are commonly used as an adjunct for vitreoretinal surgery for the treatment of complex retinal disorders. The development of Cataract or progression of already existing cataract is a well known side effect of conventional silicone oil. Hence the success of visual improvement in silicone oil (SO) filled phakic-induced cataract which require oil and/or cataract removal, and intraocular lens (IOL) implantation in one operation to avoid subsequent surgery. Inaccurate measurement of AL, estimation of postoperative ACD and corneal power contribute to 36%, 42% and 22% respectively, of the error in predicted refraction of an IOL using optical biometry. In past years optical biometric method such as IOL master (Carl Zeiss, Jena, Germany) based on partial coherence interferometry and the Lenstar (Haag-streit AG, Switzerland) using optical low-coherence reflectometry has been in use to measure the axial length with high precision and good resolution in cataractous, pseudophakic, aphakic silicone oil- filled and healthy eyes. It has been also suggested that optical biometry is more accurate and reliable in problematic eyes including high myopia, posterior staphyloma and SO-filled eyes.

The purpose of the study was to compare the results of optical biometry in post- vitrectomised silicon oil filled eyes undergoing phacoemulsification.

MATERIALS AND METHODS

The study design was retrospective nonrandomized case series. The medical records of 82 cases of silicon oil filled eyes that underwent clear corneal phacoemulsification with IOL implantation and SO removal from January 2013- March 2014 at Aravind Eye Hospital, Madurai were reviewed. Preoperative data included patient age, gender, axial length, IOL power and type of vitreoretinal surgery done (SB+PPV+SO or PPV+SO). Patient with recurrent retinal detachment or other ocular problems such as corneal scar and an irregular surface, which may influence measurement of the AL and final outcome, were excluded. Keratometric measurements were taken using IOL master (Version 5.0 Carl Zeiss Meditec, Germany), and Lenstar (LS900 Haag-streit AG, Switzerland) and AL was measured using SO-filled eye program respectively. At least five consecutive AL measurements were
acquired for both IOL master and Lenstar. The Intraocular Lens power was calculated by using the SRK-T formula targeting emmetropia. Postoperative refraction was performed in span of one to six month using objective method. The subjective refraction was adjusted when patients were able to determine a difference in the quality of vision. The absolute postoperative refractive errors were analyzed with respect to preoperative axial length (AL), biometry method and type of retinal surgery done. Predictive error in each group was calculated by predicted postoperative error - postoperative spherical equivalent of the refractive error.

**Statistical Method**

Mann-Whitney U test was used to assess the difference between the continuous variables. Fisher’s exact test or chi-square test was used to assess the difference between the categorical variable. P-value is less than 0.05 considered as statistically significant. All statistical analysis will be done by statistical software STATA 11.0.

**RESULTS**

82 eyes of 82 patients met the inclusion criteria and were included in the study. The mean age of the patients in study was 45+ 13.8 years. It includes 58 males and 24 females of age range between 18 to 73 years. The mean preoperative axial length was 24+2.85 mm (range 16.5 to 34.9 mm). In eyes with AL < 24 mm group, absolute refractive error was 1.19 + 0..69.D in Lenstar and 1.79+1.95D in IOL Master (p=0.847) whereas the eyes with AL >24 mm group, the absolute refractive error was 1.78+2.02D in Lenstar and 2.46+ 3.00D in IOL Master (P=0.664). The absolute refractive error with Lenstar group was 1.52+1.54D and IOL Master group was 2.10+ 2.49D which was not statistically significant (P=0.657). The absolute refractive error for scleral buckling with vitrectomy group in Lenstar was 1.18+1.09.D and 2.24+2.52D in IOL Master (P=0.294) and vitrectomy alone group was 1.98+2.09D in Lenstar and 1.85+2.46D (P=0.549). The absolute refractive error in Lenstar group was <1D in 42.9 %, 1-2D in 35.7% and >2D in 21.4% and 44.1%, 20.5% and 35.3% respectively in IOL Master biometry group (p= 0.417).

**DISCUSSION**

Accurate measurement of AL, keratometry and ACD are the key parameters for determination of accurate intraocular lens power to achieve optimal postoperative outcome undergoing cataract surgery in silicon oil filled eyes. Biometry in SO- filled eyes with conventional ultrasound is difficult to perform and measurement may be unobtainable, due to optical and sound attenuation properties of silicon oil. A post-op refractive surprise is a major cause for IOL explantation, the most common causes described to
be inaccurate AL and keratometry determination.\textsuperscript{1} The Lenstar is based on the OLCR \textsuperscript{5,6} powered with an superluminscent diode (SLD).\textsuperscript{7,8,9} The IOL Master uses the well-known principle of partial coherence interferometry in a dual-beam configuration to measure the axial eye length, and it is operated with a multimode laser diode.\textsuperscript{10,11} Because of the different spectral characteristics, a higher resolution can be achieved with the use of an SLD compared with a multimode laser diode. With an SLD, reflective structures within the cornea, anterior chamber, crystalline lens, and retina are measured and displayed. Furthermore, the dual-beam configuration is not incorporated in the Lenstar. This allows A-scans ranging from the corneal tear film to the retina and hence simultaneous measurements of AL, CCT, ACD (with or without cornea), and LT.

The present study showed both Lenstar and IOL Master are reliable method for axial length measurement in silicon filled eyes. When comparing the results between the Lenstar and IOL Master, both methods have showed no statistical significant difference in respect to preoperative axial length (AL), biometry method and type of retinal surgery. The literature search revealed that many studies have been done to compare the two optical biometry device in normal and cataractous eyes.\textsuperscript{12-14} However only a single study has been done to compare the results of optical biometry in silicone oil filled eyes.\textsuperscript{12} All the previous studies showed a high correlation for all the measurement between the Lenstar and the IOL Master which is similar to the results of our study. There are several factors that might influence the accuracy of predicted refraction such as macular thickening, scleral buckling and posterior staphyloma.\textsuperscript{15} These factors may confound the accurate measurement of AL in presence of silicone oil. Studies have pointed out that the measurement with optical biometry in such conditions is more reliable than conventional ultra sound. The present study has not included these cases. Hence a further study is required to predict the refractive outcome such pathological conditions with optical biometry.

\section*{CONCLUSION}
Measurement with Lenstar is well correlated with IOL Master are in silicone oil filled eyes.

\section*{REFERENCES}


