




Accuracy of Axial Length Measurements Using Partial Coherence Interferometry in Silicone Oil-filled Eyes

Hurkan Kerimoglu
Gulfidan Bitirgen

Department of Ophthalmology
Necmettin Erbakan University Meram Faculty of Medicine
Konya, Turkey

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- **Introduction**

The development of a cataract is common in silicone-oil filled phakic eyes often necessitating cataract removal and intraocular lens implantation.^{1,2} To obtain a satisfactory refractive outcome, surgery is often performed in two steps. First, the silicone oil is removed; cataract surgery is carried out in a second procedure. It is also possible to perform both procedures in the same sitting.³ The success of such an operation depends on an accurate intraocular lens (IOL) power calculation to minimize postoperative refractive errors. The main purpose of this study was to assess the accuracy of axial length measurements by partial coherence laser interferometry (PCI) in eyes with silicone oil endotamponade.

- **Methods**

Thirty-nine silicone oil-filled eyes of 39 patients (22 male, 17 female) were included in the study. Axial length measurements were performed using PCI (IOLMaster; Carl Zeiss Meditec, Jena, Germany) the day before and at least 4 weeks after silicone oil removal. The intra-individual deviation between both measurements was analysed. Preoperative axial length measurements were performed in the silicone oil-filled mode provided by the IOLMaster, which also allows differentiation between phakic, aphakic and pseudophakic lens state. Preoperatively 29 eyes were pseudophakic and 10 were phakic. Statistical analyses were performed using SPSS ver. 17.0 (Chicago, IL, USA) software. Paired samples *t*-test was used to compare the data. A *p* value of less than 0.05 was considered statistically significant.

- **Results**

The mean age of the subjects was 56.1 ± 14.23 years (range 22-79 years). The mean axial length before silicone oil removal in pseudophakic and phakic eyes was 25.05 ± 1.68 mm and 24.19 ± 1.62 mm, respectively (Table 1). During the second measurement which was performed at least 4 weeks after silicone oil removal, the mean axial length in pseudophakic and phakic group was 24.16 ± 1.62 mm and 24.25 ± 3.11 mm, respectively. There was a statistically significant difference in axial length measurements before and after silicone oil removal in pseudophakic eyes ($p < 0.001$), while the difference in phakic eyes was not statistically significant ($p = 0.601$). The mean axial length deviation was 0.89 ± 0.20 mm in pseudophakic group, while it was 0.06 ± 0.35 mm in phakic group. The mean preoperative keratometry reading was 43.60 ± 1.77 diopters (D) in pseudophakic group and 43.65 ± 1.33 D in phakic group, and the mean postoperative keratometry readings were 43.79 ± 1.91 D and 43.72 ± 1.16 D, respectively. The mean preoperative anterior chamber depth (ACD) value was 4.37 ± 0.64 mm in pseudophakic eyes and 3.31 ± 0.39 mm in phakic eyes, while it was 4.43 ± 0.76 mm and 3.11 ± 0.34 mm, respectively, in postoperative measurements. The difference between preoperative and postoperative measurements of the mean keratometry reading and the mean ACD value in both groups did not show statistical significance ($p > 0.05$).

Table 1. The mean values of axial length, keratometry reading and anterior chamber depth according to lens state before and after silicone oil removal.

		Axial length (mm)	Keratometry (D)	Anterior chamber depth (mm)
Phakic	preoperative	24.19±3.36	43.65±1.33	3.31±0.39
	postoperative	24.25±3.11	43.72±1.16	3.11±0.34
	<i>p</i> value	0.601	0.839	0.179
Pseudophakic	preoperative	25.05±1.68	43.60±1.77	4.37±0.64
	postoperative	24.16±1.62	43.79±1.91	4.43±0.76
	<i>p</i> value	<0.001	0.207	0.686

• Discussion

The main challenge in ultrasound biometry of silicone oil-filled eyes is that the biometry measures the axial length longer than its actual length. Silicone oil produces a characteristic lengthening of the eye because of the slower velocity of sound transmission than saline or vitreous. Cataract is a frequent complication after silicone oil infusion, occurring in up to 100% of eyes retaining silicone oil for 6 months or longer.⁴

The Zeiss IOLMaster uses the method of partial coherence interferometry to measure the axial length of the eye. Presence of silicone oil as well as pseudophakic or aphakic lens state is taken into account by using modified refractive indices. However, the use of PCI is limited by the presence of severe corneal opacities, dense cataract or vitreoretinal disorders affecting the visual axis.⁵

In this study, the axial length measurements were taken into account since it is the most important factor for the accuracy of IOL power calculation. It has been shown that axial length measurements by PCI before and after conventional silicone oil removal were not significantly different.^{6,7} Based on our findings, there was not a statistically significant difference in axial length measurements of phakic eyes before and after silicone oil removal but in pseudophakic eyes, the axial length measurements were significantly longer in silicone oil-filled mode. In the study by Roessler et al.,⁷ the difference in preoperative and postoperative axial length measurements in both groups were not significant but the measurements in phakic eyes showed a trend for lower deviation compared with pseudophakic eyes.

- **Conclusion**

Considering the fact that the measurements will be performed with the phakic mode of the device in silicone oil-filled eyes which are requiring cataract surgery, our results support that optical biometry using PCI appears to be a satisfactorily accurate method to calculate axial length and thereby IOL power in eyes with silicone oil endotamponade.

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