The Effect Of Pupil Dilation On Biometric Parameters Of The Aladdin Optical Biometry

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Abstract

Purpose: To evaluate the effect of pupil dilation on biometric parameters of the Aladdin optical biometry and compare the accuracy IOL power calculation according to pupil dilation and difference in anterior chamber depth.

Methods: This prospective cross-sectional study included 51 eyes of 42 patients who underwent uneventful phacoemulsification with IOL implantation. Preoperative IOL power calculations were performed using Aladdin optical biometer. Postoperative actual refractive errors and errors predicted by the SRK/T formula in eyes with non-dilated and dilated pupils were analyzed. The mean estimation error (EE), mean absolute estimation error (AEE) and the percentage of eyes within ±0.50 and ±1.00 D of target refraction for each of two groups were calculated and compared. (Group 1: eyes with non-dilated pupil, Group 2: eyes with dilated pupil).

Results: Smaller mean AEE and EE was provided in non-dilated group, however there was no statistically significant difference between two groups (p=0.12 and p=….. respectively). In non-dilated group, higher percentage of eyes within ±0.50 and ±1.00 D of target refraction was also found (62% and 98%), when compared with dilated group (54% and 94%).

Conclusions: Based on the Aladdin biometric data used in our study, although better results was obtained when biometric measurements had been done in eyes with non-dilated pupil, there was no statistically significant difference.

Key words: Aladdin optical biometer, pupil dilation, anterior chamber depth, IOL power.

INTRODUCTION

Patients' postoperative refractive expectations have been increased in cataract surgery. Therefore accurate intraocular lens (IOL) power calculation is very important to attain postoperative target refraction[1,2]. Accuracy and consistency of postoperative refractive outcames require ongoing effort. IOL power is calculated using preoperatively measured keratometric (K) value, axial length(AL), A constant of IOL.

Optical biometry devices can measure some other variables. They are fast, non invasive and independent from technician experience. The built in software in these devices gives us more accurate IOL power calculation and multiple choices of IOL formulas [3,4]. Several new optical biyometry can also perform ocular biometry and IOL power calculation as accurate as the first standart optical biometry such as IOL Master [5]. The Aladdin, Topcon, Tokyo, Japan is one of the most recently released optical bimetry device. The

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device is an optical low coherence interferometer (OLCI) which can measure six variables; K value, AL, anterior chamber depth(ACD),WTW diameter, pupil size, corneal topograpy. AL is measured using OLCI with 820 nm superluminescent diode. ACD is measured using LED making horizontal slit projections across the anterior chamber, similarly to the IOL Master. Corneal topography and keratometry measurement are based on 24 placido disk reflection [6]. The IOL power is calculated by five different formulas built into the device.

IOL power is estimated preoperatively by means of several formulas [1-2,7-12]. Formulas such as Holladay 1, Hoffer Q, SRK/T, SRK II calculates the estimated IOL power using AL, K value, and a constant as variables. Latest formulas such as Haigis uses additionally ACD[13]. Miscalculation in measurement of ACD, AL, and K can contribute to in order of 42, 36, 22 % of errors [7]. In advanced cataract cases optical biometries may have difficulties in performing measurements. We may solve this problem by dilating the pupil. Also in clinic conditions, sometimes we forget performing biometry before fundus examination by dilating pupil. We know that pupil dilation causes changes in ACD parameter. The aim of this study was to evaluate the effect of pupil dilation on biometric parameters of the Aladdin optical biometry and compare the accuracy IOL power calculation according to difference in ACD and pupil dilation.

MATERIALS AND METHODS

Subjects enrolled in this prospective cross-sectional study were 42 eyes of 51 patients with cataract who underwent uneventful phacoemulsification with IOL implantation at Ophthalmology Department of Nisa Hospital, Istanbul, Turkey between January 26, 2015 and April 30, 2015. The study was explained to each patient and written informed consent was obtained. The study project was approved by Institutional Ethical Board of Istanbul Medipol University. All research and data collection adhered to the tenets of the Declaration of Helsinki.

Patients with good quality Aladdin biometry measurements and best-corrected visual acuities (BCVA) greater than 20/40 after cataract surgery were included in the study. Exclusion criteria were history of traumatic or uveitic cataracts, previous intraocular or corneal surgery (eg, refractive surgery or glaucoma surgery), intraoperative complications (eg, anterior or posterior capsule ruptures, vitreous loss or zonule dehiscence), or postoperative complications (eg, tilted or decentrated IOL).

Preoperatively all patients had a complete examination including manifest refraction, BCVA testing, intraocular pressure (IOP) measurements with applanation tonometry, slit lamp, and dilated fundus examinations. Each patient underwent biometry measurement on Aladdin optical biometer (Topcon, Tokyo, Japan) by the same examiner. After carefully positioning of patient, Aladdin biometer was focused as determined by a clear view of anterior segment and the display of a 'green eye' quality control image. After the first measurements with non-dilated pupil (group 1), the second readings were performed after pupil dilation with %0.1 tropicamide (group 2). Six AL measurements, three K values and three ACD readings were obtained. IOL power was calculated using the SRK/T formula. The goal in IOL power selection was a value that would provide a postoperative refraction nearest to plano, staying on the side of myopia.

All phacoemulsification and IOL implantations were performed under topical anesthesia by one of two experienced surgeons (F.K. and I.K.). A standard phacoemulsification was performed through a 2.8 mm temporal clear corneal incision. The monoblock foldable hydrophobic acrylic IOL (Acrysof SA 60, Alcon Lab. Inc., FtWorth, Tex, USA) was inserted into the capsular bag using an injector system.

By the end of first postoperative month, ophthalmological examination was carried out for

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all patients. Postoperative objective refractive error was measured by using Topcon KR 8800 autorefractometer (Topcon, Tokyo, Japan). Uncorrected visual acuity (UCVA) and BCVA were also evaluated.

The estimation error (EE) was defined as the difference between the postoperative objective refractive error (spherical equivalent) and the preoperative refractive error predicted by the Aladdin optical biometer for two groups. The absolute estimation error (AEE) was defined as the absolute value of the EE.

The Wilcoxon matched pairs test was used to evaluate differences in mean EE and mean AEE between two groups. The paired two-sample t-test was used to evaluate differences between K value, AL and ACD values. Differences between percentage of eyes with EE within ±0.50 and ±1.00 D of target refraction (EWTR) were evaluated by using Chi-square test. Statistical analysis was performed using the Statistical

Package for Social Sciences (SPSS) version 12.0(SPSS Inc, Chicago, Illinois, USA). *P* values <0.05 were considered to be statistically significant.

RESULTS

51 eyes (30 left and 21 right eyes) of 42 patients (16 men and 26 women) were included in the study. The mean patient age was 69 ± 7.4 years (range, 55 - 86 years). Preoperative; the mean K value was 43.71±1.68, astigmatism value was -0.73±0.41, mean AL was 23.37±0.95 and mean ACD was 3.1±0.30 in group 1. Preoperative; the mean K value was 43.65±1.62, astigmatism value was -0.65±0.36, mean AL was 23.37±0.94 and mean ACD was 3.26±0.32 in group 2. There was no statistically significant difference between two groups' K value and AL (p=0.27 and p=0.76 respectively). But difference between ACD of two groups was significant (p<0.0001). Characteristics of patients for group 1 and group 2 are shown in table 1.

Table 1: Characteristics of patients for group 1 and group 2

Parameter	Group 1 (non-dilated group)		Group 2 (dilated group)	
	Mean ± SD	Range	Mean ± SD	Range
Age, *years*	69±7.4	55-86	69±7.4	55-86
Sex, *n (%)*		-		-
Male	16 (%38)		16 (%38)	
Female	26 (%62)		26 (%62)	
Laterality, *n (%)*		-		-
Right eye				
Left eye	30 (%59)		30 (%59)	
	21 (%41)		21 (%41)	
K value, *D*	43.71±1.68	39.32-47	43.65±1.62	39.38±47.19
Astigmatism, D	-0.73±0.41	-2.8- -0.22	-0.65±0.36	-1.66-0
ACD, *mm*	3.1±0.30	2.61-3.78	3.26±0.32	2.64-3.88
Axial length, *mm*	23.37±0.95	21.48-25.83	23.37±0.94	21.47-25.79
IOL power, *D*	21.4 ± 2.31	17.5-27	21.4 ± 2.31	17.5-27

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In Group 1 mean AEE was 0.42±0.28 as it was 0.5±0.48 in group 2. There was no significant difference of mean AEE between two groups (p=0.12). In Group 1 mean EE was -0.03±0.51 as it was -0.16±0.68 in group 2. Although there was no statistically significant difference between two groups; in group 1 there were more eyes with EE within ±0.50 and ±1.00 D of target refraction (62 % and 98 % respectively) when compared to group 2 (54 % and 94 % respectively). The results of two groups concerning the EE, AEE, and percentages of eyes within target refraction for two groups are shown in Table 2.

Table 2: Comparison of mean absolute estimation error (AEE), estimation error (EE), and percentage of eyes within target refraction (EWTR) between two groups (n=51).

	Group 1	Group 2	P value
Mean AEE±SD (range),*D*	0.42 ± 0.28 (0.01-1.19)	0.5± 0.48 (0.03 – 3.18)	0.12*
Mean EE±SD (range), *D*	-0.03 ± 0.51 (-0.99 - 1.19)	-0.16 ± 0.68 (-3.18 - 1.21)	*
EWTR ±0.50 D *(%)*	62	54	0.26**
EWTR ±1.00 D *(%)*	98	94	0.23**

Wilcoxon matched pairs test

**Chi-square test*

DISCUSSION

Pupil dilation is an important part of full eye examination. The measurement of AL in eyes with dense nuclear or posterior subcapsuler cataract can be difficult with optical biometries such as Lenstar and the IOL Master[14]. We may solve this problem by dilating the pupil, but this condition might cause incorrect outcomes on biometric parameters. Sadiq and colleagues presented that dilating pupil did not seem to affect the accuracy of AL measurements using an ultrasonic biometry[15]. There have not been so many reports about effect of pupil dilation on measurements with optical biometries, especially Aladdin optical biometry. Huang et al found that cycloplegia had no significant effect on AL and corneal curvature measurements with the Lenstar or the IOL Master, as it had significant effect on ACD measurements. They found that ACD measurements with cycloplegia were significantly deeper than without cycloplegia[16]. Sheng et al and Cheung found similar outcomes with the IOL Master for AL, keratometric values and ACD[17, 18]. Bakbak et al and Heatley et al showed statistically significant change in keratometric values but no significant change in AL or IOL power between biometric measurements with dilated and non-dilated pupil [19, 20]. In study of Bakbak there was significant difference in the ACD parameter. On the other hand, some other studies such as Saitoh and Sun revealed no change in corneal curvature after pupil dilation[21, 22]. Arriola-Villalobos presented no significant change in AL, corneal curvature and IOL power. But ACD was found deeper in eyes with dilated pupil[23].

In our study there was significant difference in ACD results. ACD was significantly deeper in eyes with dilated pupils. But we found no statistically significant change in AL, K values and IOL power between non-dilated and dilated pupil biometry readings. As we used SRK/T formula in our study, the difference in ACD did

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not affect IOL power calculation. In the future, the effect of pupil dilation in IOL calculations should be studied with other formulas, such as Haigis formula which uses ACD parameter for IOL calculation.

Smaller mean AEE and EE was provided in non-dilated group (0.42±0.28 and -0.03±0.51 in group 1 vs 0.5±0.48 and -0.16±0.68 in group 2 respectively), however there was no statistically significant difference between two groups. In non-dilated group, although there was no statistically significant difference, higher percentage of eyes within ±0.50 and ±1.00 D of target refraction was also found (62% and 98%), when compared with dilated group (54% and 94%).

In conclusion, based on the Aladdin biometric data used in our study, there is no statistically significant difference in biometric measurements those done in eyes with dilated or non-dilated pupil; especially when SRK/T formula is used.

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