

Effect of Pupillary Dilation on Intraocular Lens Power Calculation.

Pranav Gupta, Etti Goyal, Ashutosh Dokania

Abstract

One of the most frequently performed ophthalmic surgical procedures is cataract extraction. The success of cataract surgery depends on the postoperative refractive status of the patient and for achieving emmetropia postoperatively, almost accurate power of intraocular lens to be implanted should be calculated preoperatively. This study was conducted to evaluate the effect of pupillary dilation, if any, on calculation of intraocular lens power. Present study was performed on 50 patients with cataract at the outpatient department of Rohilkhand Medical College and Hospital, Bareilly from 1st December, 2016 to 31st January, 2017. The axial length, keratometry, and intraocular lens power were measured before and after instillation of 5% tropicamide and 0.8% phenylephrine eye drop. The Sanders/Retzlaff/Kraff Theoretical (SRK/T) formula was employed for IOL power calculation. Each parameter was compared by a paired t-test prior to and after pupillary dilation. The mean age of the patients was 62.8 ± 7.2 years. No statistically significant differences in AL, mean K and IOL power were obtained post dilation. Pharmacological pupillary dilation doesn't affect the IOL power calculation.

Keywords

SRK/T, Ultrasonic, Tropicamide, Phenylephrine

Introduction

One of the most frequently performed ophthalmic surgical procedures is cataract extraction.(1) The success of cataract surgery depends on the postoperative refractive status of the patient and for achieving emmetropia postoperatively, almost accurate power of intraocular lens to be implanted should be calculated preoperatively.

Calculation of Intraocular lens (IOL) power is done by using pre-operatively measured keratometric (K) value, axial length (AL), A constant of IOL and employing these values in various formulae such as Holladay 1, Hoffer Q, SRK/T, SRK II etc.(2) Latest formulae i.e. fourth generation such as Haigis formula and Holladay II formula, additionally use anterior chamber depth (ACD) for the same.(3)

In clinical settings, pupils of patients are dilated before performing biometry to save time and infrequently surgeons forget to perform biometry before dilating the pupil for fundus examination.(4) Also, in advanced cataract cases, dilation of pupil helps in IOL power calculation, which can be difficult otherwise.(5) The aim of the present study was to assess the effect of pupil dilation on the accuracy IOL power calculation.

Materials and Methods

A prospective study was conducted at the outpatient department (OPD) of Rohilkhand Medical College and Hospital, Bareilly from 1st December, 2016 to 31st January, 2017 on 50 patients with cataract, selected on the basis of inclusion and exclusion criteria.

From the : Department of Ophthalmology, Rohilkhand Medical College and Hospital, Bareilly, U.P, India

Correspondence to : Dr. Pranav Gupta, Junior Resident, Dept of Ophthalmology, Rohilkhand Medical College, Bareilly, U.P

Inclusion criteria were

- Age > 18 years
- Otherwise healthy patients with senile cataract in one or both eyes

Exclusion criteria were

- Traumatic or Uveitic cataracts,
- Previous intraocular or corneal surgery (eg, refractive surgery or glaucoma surgery),
- Shallow anterior chamber (Grade 1 and 2; van Herick method for anterior chamber angle assessment),
- History of use of topical or systemic medication that has the effect of pupillary dilation,
- History of allergy to the mydriatic used,
- Subjects who were unable to perform ocular fixation and maintain an upright posture.

An informed consent was taken from all the patients. Before biometric examination a detailed ocular and systemic examination of each patient was done. Keratometry was done using automated keratometer (**Topcon**). Ultrasonic measurement of axial length by appplanation method was done using Nidek Echoscans US-4000. Then, all these values along with respective constant for the specific IOL to be implanted were entered into the pre-installed software in the biometer and SRK/T formula was employed to calculate the IOL power. Following this, pupils of the patients were dilated by instilling a single drop of 0.8% Tropicamide and 5% Phenylephrine every 15 minutes for 3 times. Upon pupillary dilation, same procedure of IOL power calculation was repeated and results noted.

Statistical Analysis

Statistical analysis of data was done using Statistical Package for the Social Sciences software version 22.0 and paired t-test was applied. A p-value of < 0.05 was considered statistically significant.

Results

50 cataract patients were included in the present study with a mean age of 59.82 ± 6.39 years. Out of these, 32 (64%) were males and 18 (36%) were females. Among the 50 eyes studied, 27 (54%) were right eyes and 23

(46%) were left eyes. These demographic characteristics are summarized in Table 1.

All the parameters were measured for each patient. Pre and post dilation biometric data and the difference between them are given in Table 2. On applying paired t-test, no statistically significant result was seen in either mean K ($p = 0.5$) or AL ($p = 0.23$) or IOL power ($p = 0.5$).

Table 1. Demographic Data

Age mean age	59.82
Sex n(%) M:F	32(64%): 18(36%)
Laterality n(%)	Right eye - 27(54%) Left eye- 23(46%)

Table.2 Biometric Data- Pre and Post Dilation

	Pre-dilation (Mean \pm SD)	Post-dilation (Mean \pm SD)	Difference (Mean \pm SD)	p-value
Mean K (Diopters)	45.12 \pm 1.54	45.12 \pm 1.54	0.001 \pm 0.11	0.5
Axial length (millimeters)	22.57 \pm 1.34	22.56 \pm 1.32	0.008 \pm 0.03	0.23
IOL power (Diopters)	22.43 \pm 1.49	22.43 \pm 1.45	0.125 \pm 0.23	0.5

Discussion

Pharmacological dilation of pupils is a pre-requisite for the cataract surgery. (6) Most of centers, operate upon the patients same day they present and to save time, pupils are dilated first and then biometry and fundus examination is performed.(7) Present study was conducted with an aim to know if there is any effect of pupil dilation on IOL power calculation.

Sadiq and McElvanney conducted a study on 64 patients and measured axial lengths of the patients before and after dilating the pupil. (8) They concluded that there was no significant change ($p = 0.10$) in AL before and after pupil dilation. Can et al studied 72 patients and observed that pupil dilation did not affect the IOL power measurement.(9) Heatley *et al* performed biometry using IOL Master and SRK/T formula both pre and post pupillary dilation and found a significant change in average keratometry readings but no significant change

in IOL power.(10) Khambhiphant *et al* studied the effect of pupillary dilation on Haigis formula-calculated IOL power calculation using IOL Master on 373 eyes of 192 healthy individuals and observed that biometry measurements after pupillary dilation should be done in formulae that use parameters other than AL and K.(11) Similarly, Rodriguez-Raton *et al* observed that pupil dilation produces significant increase in anterior chamber depth (ACD) and different IOL power according to Haigis formula.(12)

In our study, 50 patients were studied using automated keratometer and ultrasonic AL measurement and IOL power calculation using SRK/T formula, both before and after pupil dilation. No statistically significant change was noted in mean K values, AL and IOL power measurements. Limitations of the present study were a small sample size, exclusion of anterior chamber depth from the comparison and use of earlier generation formula for the calculation of IOL power. Future studies will be taken up to address these limitations and to study their role in IOL power calculation.

Conclusion

No statistically significant differences were noted in the measurement of IOL power calculation (using SRK/T formula) before and after dilating the pupil.

References

1. Lee AC, Qazi MA, Pepose JS. Biometry and intraocular lens power calculation. *Curr Opin Ophthalmol*. 2008;19:13–17.
2. Kielhorn I, Rajan MS, Tesha PM, Subryan VR, Bell JA. Clinical assessment of the Zeiss IOLMaster. *J Cataract Refract Surg* 2003;29:518–522.

3. Németh J, Fekete O, Pesztenlehrer N. Optical and ultrasound measurement of axial length and anterior chamber depth for intraocular lens power calculation. *J Cataract Refract Surg* 2003;29:85–88.
4. Olsen T. Calculation of intraocular lens power: a review. *Acta Ophthalmol Scand* 2007;85:472–485.
5. Khambhiphant B, Chatbunchachai N, Pongpirul K. The effect of pupillary dilatation on IOL power measurements by using the IOLMaster. *Int Ophthalmol* 2015;35:853–859.
6. Huang J, McAlinden C, Su B, *et al*. The effect of cycloplegia on the lenstar and the IOLMaster biometry. *Optom Vis Sci*. 2012;89:1691–1696.
7. Bakbak B, Koktekir BE, Gedik S, Guzel H. The effect of pupil dilation on biometric parameters of the Lenstar 900. *Cornea* 2013;32(4):e21–e24.
8. Sadiq SA1, McElvanney AM. Pupillary dilation and axial length measurement for preoperative assessment of intraocular lens power. *Eur J Ophthalmol*. 1996 ;6(2):147-9.
9. Can E , Duran M , Çetinkaya T , Arýtürk N. The effect of pupil dilation on AL Scan biometric parameters. *Int Ophthalmol* 2016 ;36(2):179-83.
10. Heatley CJ, Whitefield LA, Hugkulstone CE. Effect of pupil dilation on the accuracy of the IOLMaster. *J Cataract Refract Surg* 2002;28:1993–1996.
11. Khambhiphant B, Sasiwilasagorn S, Chatbunchachai N, Pongpirul K. Effect of pupillary dilation on Haigis formula-calculated intraocular lens power measurement by using optical biometry. *Clin Ophthalmol* 2016, 10:1405—10.
12. RodriguezRaton A, JimenezAlvarez M, ArtechLimousin L, MediavillaPeña E, LarruceaMartinez I. Effect of pupil dilation on biometry measurements with partial coherence interferometry and its effect on IOL power formula calculation. *Eur J Ophthalmol*. 2015;25(4):309–314.