Supported by an Unrestricted Grant from Research to Prevent Blindness

SUNY EYE INSTITUTE
Collaborative Research Consortium
The State University of New York

ROSS EYE INSTITUTE

University at Buffalo
The State University of New York

Comparison of the Effects of Bright Light, Phenylephrine 2.5%, Tropicamide 1%, and Pilocarpine 2% on Anterior Chamber Depth and IOL Power

Mona Sane MD, Vincent Imbrogno DO, Hoon Jung MD

The authors have no financial interest in the subject matter of this poster.

Background

- Phenylephrine, tropicamide and pilocarpine are commonly used drops in ophthalmic practice. Prior studies have shown pupillary dilation to have no clinically significant effect on axial length and keratometry measurements.[1,2,3]
- However, their effect on the anterior chamber depth (ACD) and its impact on the calculated Intraocular (IOL) power has not been studied.
- Modern theoretical formulas for IOL power calculation include, among various parameters the effective lens position (ELP). Formulas such as Holladay 2, Haigis, and Olsen use the preoperative ACD for estimation of ELP. [4,5,6]. Thus, it is important to determine the influence of pupillary constricting and dilating effects of pharmacological drops on the ACD, and any potential effects on IOL power calculations.

Purpose

- The purpose of the study was to evaluate and compare the effect of bright light, phenylephrine 2.5%, tropicamide 1% and pilocarpine 2% on the anterior chamber depth (ACD), and anterior chamber intraocular lens (ACIOL) and posterior chamber intraocular lens (PCIOL) power.

Methods

- 20 healthy volunteers participated in this single center, prospective and comparative study.
- The IOLMaster was used to measure the ACD and other biometric parameters. The Holladay formula was used to calculate the ACIOL and PCIOL power in all eyes.
- The Alcon Acrysof IQ SN60WF PCIOL and MTA 4UO ACIOL models were chosen for comparison of intraocular lens power in all subjects.
- The measurements were done in both eyes in scotopic condition, in bright light, and 30 minutes following instillation of 2.5 % phenylephrine, 1 % tropicamide and 2 % pilocarpine drops in scotopic condition on separate days.
- Statistical analysis was done using the paired one tailed t test.

Results

- 40 eyes of 7 males and 13 females were analyzed. The mean age was of 35.8 years (range 24 to 62 years).
- 16 eyes were emmetropic, 18 were myopic and 6 were hyperopic.
- Refractive error ranged from -6.50 diopters to +2.00 diopters.
- The average ACD in scotopic condition was 3.59 ± 0.37 mm, in bright light 3.57± 0.37mm, following phenylephrine 3.64 ± 0.36 mm, following tropicamide 3.69 ± 0.36 mm, and following pilocarpine 3.27 ± 0.38 mm (Figure1).

Results

- The average PCIOL power in scotopic condition was 19.12 ± 3.21 D, in bright light 19.13± 3.19 D, following phenylephrine 19.15 ± 3.23 D, following tropicamide 19.16 ± 3.20 D, and following pilocarpine 9.26 ± 3.29 D.

- The average ACIOL power in scotopic condition was 15.76 ± 2.50 D, in bright light 15.8 ± 2.57D, following phenylephrine 15.75 ± 2.57D, following tropicamide 15.8 ± 2.56 D, and following pilocarpine 15.77 ± 2.60 D.

Results

- Compared to scotopic condition, bright light and pilocarpine decreased the ACD statistically significantly ($P=0.004$, $P<1E-04$ respectively), whereas phenylephrine and tropicamide increased the ACD statistically significantly ($P=0.002$, $P<1E-04$).

- Compared to scotopic condition, PCIOL power did not change significantly in bright light ($P=0.38$), or following phenylephrine ($P=0.29$), and tropicamide ($P=0.22$), but changed statistically significantly following pilocarpine ($P=0.01$).

- ACIOL power calculated in bright light ($P=0.16$), or following phenylephrine ($P=0.39$), tropicamide ($P=0.39$) and pilocarpine ($P=0.17$) was not statistically different from ACIOL power in scotopic condition.

Figure 1. Measurements of anterior chamber depth in mm in scotopic condition, bright light, and following phenylephrine, tropicamide and pilocarpine drops.

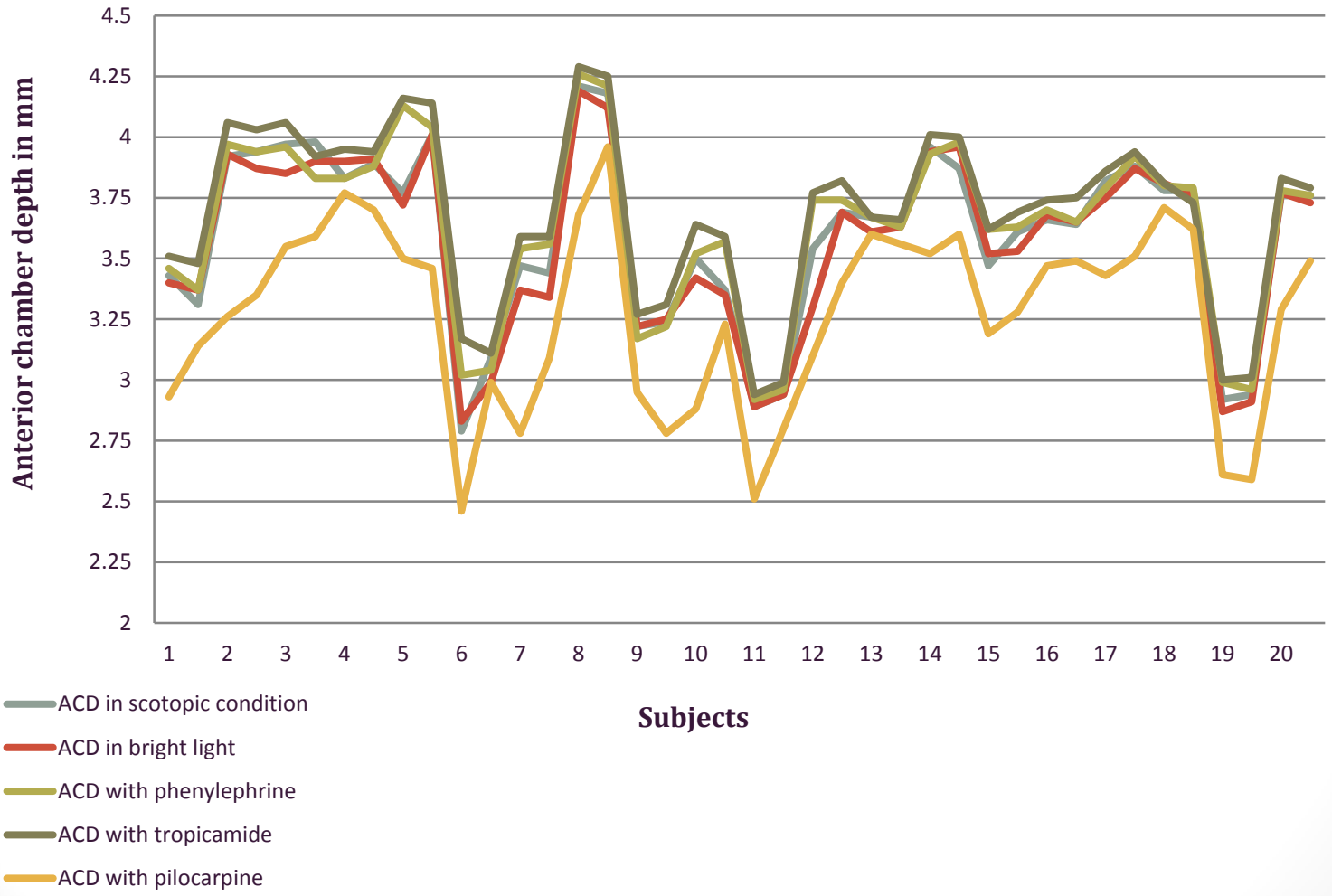


Figure 2. Measurement of PCIOL power in diopters in scotopic condition, bright light, and following phenylephrine, tropicamide and pilocarpine drops.

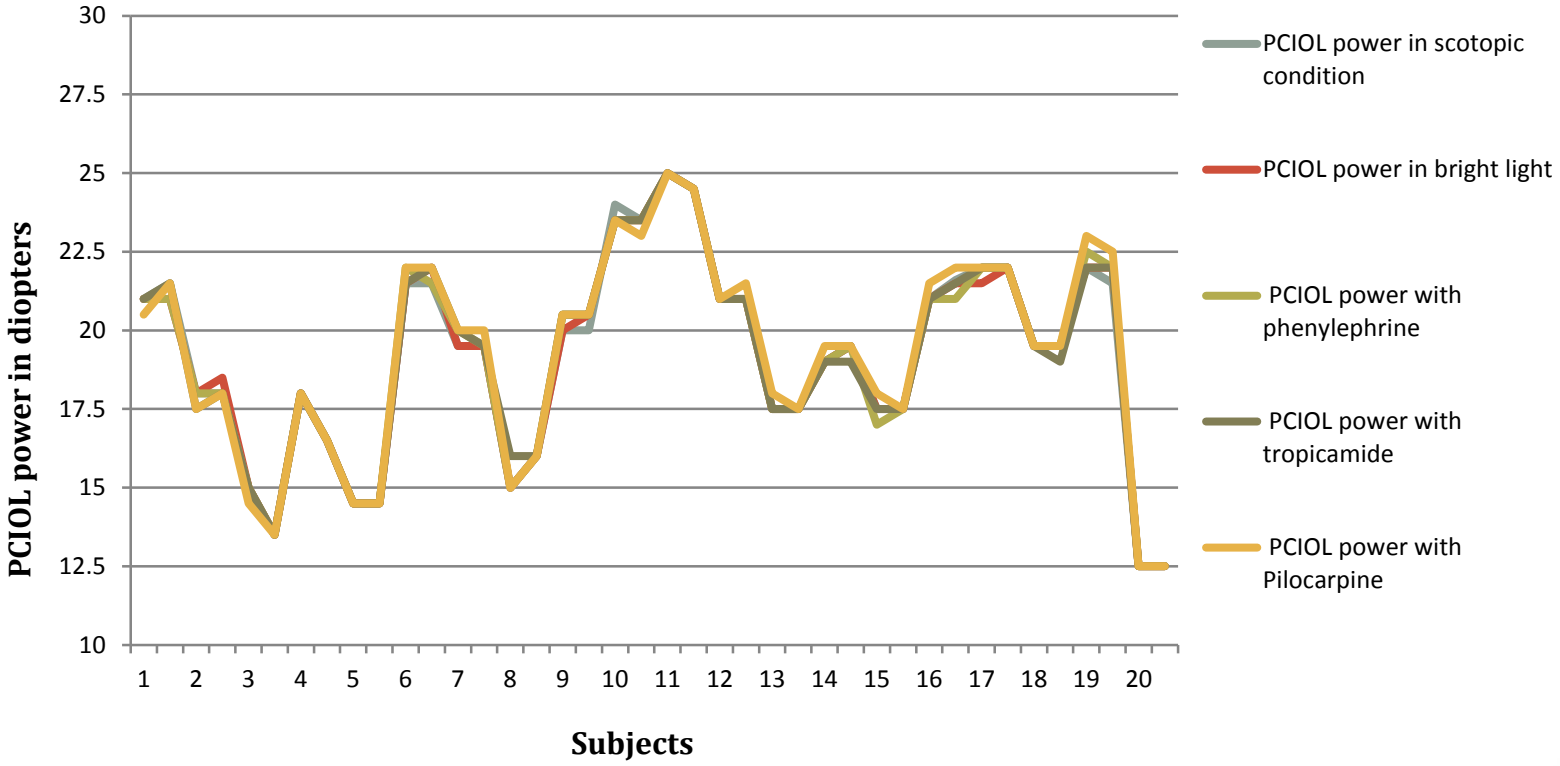
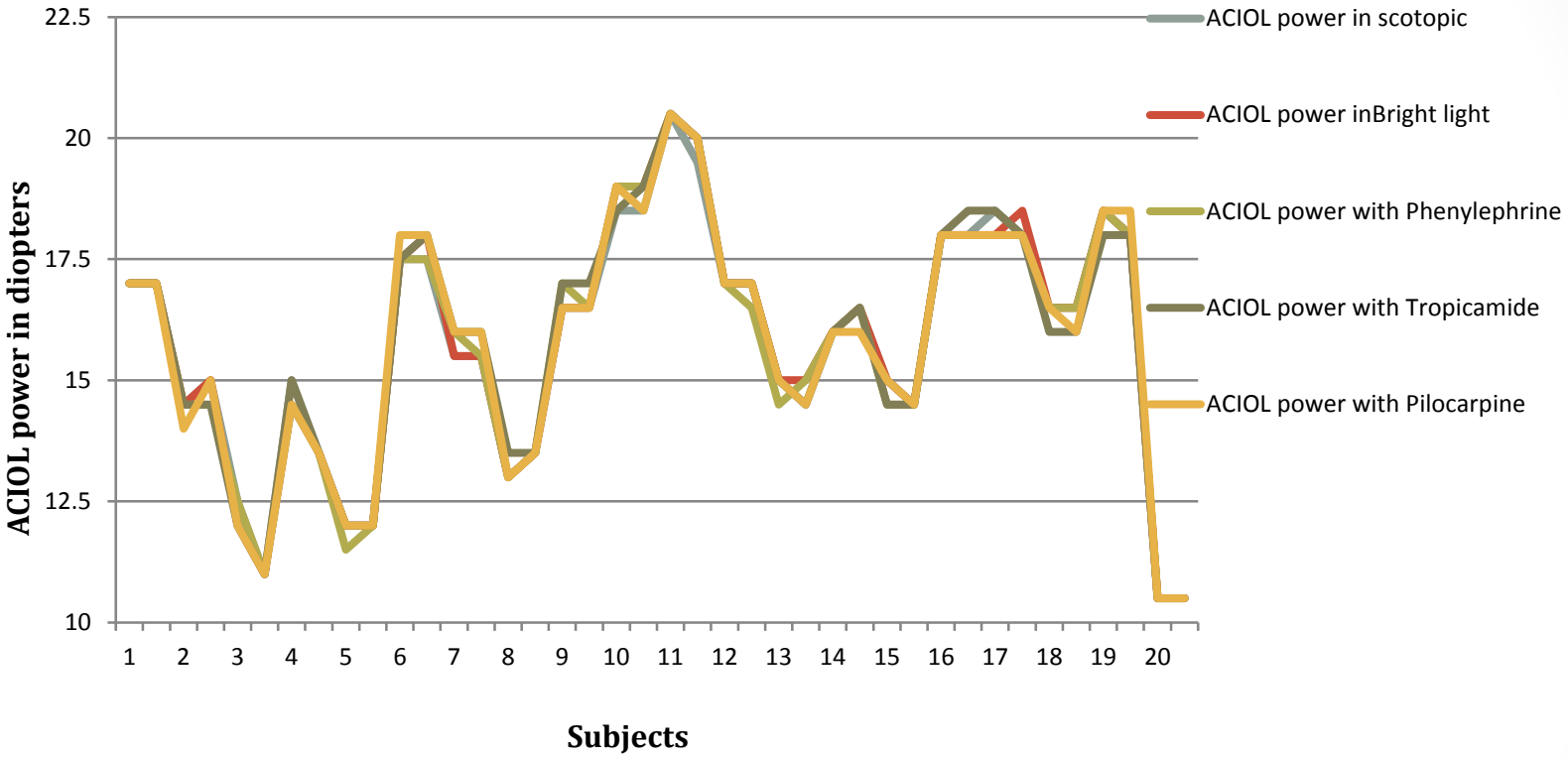


Figure 3: Measurements of ACIOL power in diopters in scotopic condition, bright light, and following phenylephrine, tropicamide and pilocarpine drops.



Conclusion

- The anterior chamber depth changes significantly with bright light, and following use of 2.5% phenylephrine, 1% tropicamide and 2% pilocarpine, as compared to scotopic condition. However this difference does not have a clinically significant impact on IOL power calculation. This is true for PCIOL and ACIOL models manufactured in incremental power of 0.50 diopters. However, pilocarpine may affect the selection of PCIOL power for models available in smaller increments of 0.25 diopters. This effect on the calculated IOL power could be clinically more significant when IOLs with finer incremental powers are available in the future to better deliver on desired refractive outcomes.

References

- 1. Bansal S, Quah SA, Turpin T, Batterbury M. Biometric calculation of intraocular lens power for cataract surgery following pupil dilatation. Clin Experiment Ophthalmol.2008 Mar;36(2):156-158.
- 2. Heatley CJ, Whitefield LA, Hugkulstone CE. Effect of pupil dilation on the accuracy of the IOLMaster. Journal of Cataract & Refractive Surgery. Volume 28, Issue 11; Nov 2002: 1993–1996.
- 3. Sadiq SA, Mc Elvanney AM. Pupillary dilation and axial length measurement for preoperative assessment of intraocular lens power. Eur J Ophthalmol.1996 Apr-Jun;6(2):147-149.
- 4. Olsen T. Prediction of the effective postoperative (intraocular lens) anterior chamber depth. J Cataract Refract Surg. 2006. Mar;32(3): 419-24.
- 5. Haigis W. Occurrence of erroneous anterior chamber depth in the SRK/T formula. J Cataract Refract Surg. 1993;19:442-6.
- 6. Hoffer KJ. Clinical results using the Holladay 2 intraocular lens power formula. J Cataract Refract Surg.2000 Aug;26(8):1233-7.