



“EFFECT OF TROPICAMIDE ON CRYSTALLINE LENS BIOMETRIC PARAMETERS IN MYOPIC EYE”

Dr Ruju Upadhyaya	Third Year Resident, Department of Ophthalmology, GMERS Medical College Gotri.
Dr Heena Radadia	Associate Professor, Department of Ophthalmology, GMERS Medical College Gotri.
Dr Jignesh J Jethva	Assistant Professor, Department of Ophthalmology, GMERS Medical College Gotri.
Dr Ashwini Sapre	Professor and Head of Department of Ophthalmology, GMERS Medical College Gotri.
Dr Happy Patel*	Second Year Resident, Department of Ophthalmology, GMERS Medical College Gotri. *Corresponding Author
Dr Mudra Bhatt	First Year Resident, Department of Ophthalmology, GMERS Medical College Gotri.

ABSTRACT Aims- Myopia is major public health problem worldwide. Biometric parameter like ACD and LT are most important elements influencing refractive error. Cycloplegic drug like tropicamide have been shown to produce alteration in the anterior segment and crystalline lens to overcome myopic shift. Main aim of this study to find out changes in ACD and LT after instilling 1% tropicamide eye drops in myopic eyes and changes in different grade of myopia. **Method-** It was cross sectional study conducted in the tertiary health care centre, over a period of 2 years. We studied 200 eyes of 200 patients of age 15-40 years having myopia for biometric parameters before and after using Tropicamide 1% eye drops for cycloplegia. ACD, LT, AL were measured by biomedix echo rule 2 A-scan biometer. **Result-** The ACD increased from 3.69 ± 0.07 to 3.76 ± 0.08 ($p < 0.00001$) in low grade myopes, from 3.74 ± 0.07 to 3.81 ± 0.08 ($p < 0.00001$) in moderately myopic eyes and from 3.90 ± 0.07 to 3.97 ± 0.10 ($p = 0.0179$) in high myopes. The LT decreased significantly in low myopes from 4.00 ± 0.35 to 3.97 ± 0.35 ($p < 0.00001$) and from 4.01 ± 0.30 to 3.97 ± 0.31 ($p = 0.0321$) in moderate myopes. In high myopes, it decreased from 3.49 ± 0.16 to 3.47 ± 0.17 ($p = 0.6121$). **Conclusion-** we observe that LT decreases significantly in low and moderate grades of myopia. ACD increases significantly after cycloplegia in all grades of myopia. In conclusion, cycloplegia resulted in a deeper ACD and thinner LT.

KEYWORDS : Anterior chamber depth, Lens thickness, Axial length, Refractive error

INTRODUCTION

The global myopia prevalence has risen to 28.3% in 2010 and is projected to reach 49.8% by 2050 if current trends continue.^[1] Uncorrected refractive errors are the most prevalent cause of vision impairment and the second leading cause of preventable blindness in India. Myopia affects up to 70% of the world population.^[2]

Biometric parameters like Anterior chamber depth and Lens thickness are the most important elements influencing refractive errors. Evidence suggests that anterior chamber depth changes occur in myopic children's eyes in tandem with axial length growth. It is found to be deeper in myopic eyes.^[3,4]

Tropicamide 1% eye drops are popular eye drops used in daily ophthalmic practice. Tropicamide is an Anticholinergic agent having short acting cycloplegic and mydriatic effects. It has diagnostic and therapeutic implications. However, because tropicamide eye drops have distinct cycloplegic effects depending on refractive status, its effects on anterior segment parameters in emmetropic, hyperopic, and myopic eyes may differ.^[5]

METHOD AND MATERIALS

This cross-sectional observational study was conducted in the Ophthalmology outpatient department at a tertiary care centre from April to October -2022. After approval from the Institutional Ethics Committee, a total 200 eyes of 200 subjects were included in this study. Age from 15 to 40 years, Patients with Myopia and Myopic Astigmatism has been included in study. Any patient who Denied for consent, Age <15 years and >40 years, Ocular surface pathology, Any other ocular pathology, Past history of ocular surgery, Emmetropic subjects, Any other RE has been excluded from study.

After Written and valid informed consent, Complete ocular examination including Uncorrected refractive error, Best corrected visual acuity, Slit lamp examination, Fundus examination and Applanation Tonometry were done in each case before hand to rule out any other ocular disease or condition.

Baseline crystalline lens biometric parameters namely LT, ACD, AL were measured by Biomedix echo rule 2 A-scan biometer. The A-Scan ultrasonic method is the most routinely and widely used approach, and

its measurements of ACD and other axial parameters represent the Gold Standard for biometric measurement.^[6]

The anaesthesia required for A-Scan was obtained by instilling 0.5% Proparacaine hydrochloride eye drops in each eye. 1% Tropicamide eye drop was instilled at the interval of 15 mins for 4 cycles. Readings were repeated 15 mins after the last drop of tropicamide. Average of three readings for each parameter was noted.

Paired t-test was used for analysis of biometric parameters before and after cycloplegia. Kruskal-wallis test was used for comparison of changes in biometric parameters among low, moderate and high myopes.

RESULT

A total of 200 eyes from 200 subjects were included in the study. The mean age of the subjects was 27.29 ± 7.51 ranging from 15 years to 40 years. Among these 200 subjects, 138 were male and 62 were female. Male to female ratio was 2.22:1.

Table 1 shows the subject demographics of the three groups of different grades of myopia. No significant difference was found in the age and sex among these three groups of myopia ($p > 0.05$).

All subjects were divided into three groups of different grades of myopia depending upon RE. The low myopia group had RE of -0.25 to -3.0 D (118 subjects). The moderate myopia group had RE of -3.25 to -6.0 D (72 subjects). The high myopia group had RE of -6.25 D and above (10 subjects).

As shown in Table-2 The Paired t-test was used for calculation of p value at significance level of 0.05. ACD significantly increased from 3.72 ± 0.08 to 3.79 ± 0.09 . (T value is 28.15, p value is <0.00001.) LT decreased significantly from 3.97 ± 0.34 to 3.94 ± 0.34 . (T value is -5.13, p value is <0.00001.) AL did not change significantly after cycloplegia from 24.24 ± 0.43 . (T value is 0.508482, p value is 0.61168.)

Table 3 shows the ACD increased from 3.69 ± 0.07 to 3.76 ± 0.08 ($p < 0.00001$) in low grade myopes, from 3.74 ± 0.07 to 3.81 ± 0.08 ($p < 0.00001$) in moderately myopic eyes and from 3.90 ± 0.07 to $3.97 \pm$

0.10 ($p = 0.0179$) in high myopes. The LT decreased significantly in low myopes from 4.00 ± 0.35 to 3.97 ± 0.35 ($p < 0.00001$) and from 4.01 ± 0.30 to 3.97 ± 0.31 ($p = 0.0321$) in moderate myopes. In high myopes, it decreased from 3.49 ± 0.16 to 3.47 ± 0.17 ($p = 0.6121$). The change in AL was not statistically significant in low myopes ($p = 0.82$) and moderate myopes ($p = 0.62$). In high myopes, change in AL was statistically significant with $p = 0.0011$.

The difference in changes in ACD among low, moderate and high myopia was statistically not significant with $p = 0.82621$. Changes in LT also was not significant among three groups with $p = 0.67644$. The changes in AL among low, moderate and high myopic groups was statistically significant with $p = 0.01544$ (Table-4).

DISCUSSION

ACD measurement gives useful information in a variety of ophthalmic domains. Accurate determination of Anterior chamber depth (ACD) is required in cataract surgery and phakic intraocular lens (pIOL) implantation to calculate IOL power and position to prevent endothelial damage.^[6] Furthermore, lens thickness (LT) is required parameter for methods such as the Holladay II IOL power prediction algorithm. ACD measurement may also be used to detect glaucoma, as the anterior chamber is shallower in people at risk of narrow angle glaucoma. A shallow ACD and/or narrow angle are associated with an increased risk of iris pigment chafing, particularly when posterior chamber hyperopic phakic IOLs are installed.^[7]

However, cycloplegics like Atropine, Cyclopentolate, and Tropicamide which paralyze the ciliary muscle, have been shown to produce alterations in the anterior segment and crystalline lens parameters to overcome myopic shift.^[8]

In our study we found that the ACD increased from 3.69 ± 0.07 to 3.76 ± 0.08 ($p < 0.00001$) in low grade myopes, from 3.74 ± 0.07 to 3.81 ± 0.08 ($p < 0.00001$) in moderately myopic eyes and from 3.90 ± 0.07 to 3.97 ± 0.10 ($p = 0.0179$) in high myopes.

The LT decreased significantly in low myopes from 4.00 ± 0.35 to 3.97 ± 0.35 ($p < 0.00001$) and from 4.01 ± 0.30 to 3.97 ± 0.31 ($p = 0.0321$) in moderate myopes. In high myopes, it decreased from 3.49 ± 0.16 to 3.47 ± 0.17 ($p = 0.6121$) which was not significant.

The change in AL was not statistically significant in low myopes ($p = 0.82$) and moderate myopes ($p = 0.62$). In high myopes, change in AL was statistically significant with $p = 0.0011$ which could be attributed to intra-observer variability or could be related to posterior segment changes. It could also be attributed to lesser subjects with high myopia in the study.

In the study conducted by **Momeni-Moghaddam Hamed et al**^[9] in 2019, significant statistical changes in ACD (increased by 0.06 ± 0.05 mm; $p < 0.001$), anterior chamber volume (increased by 15.19 ± 10.32 mm³; $p < 0.001$), and lens thickness (decreased by 0.02 ± 0.03 mm; $p < 0.001$) were observed post-cycloplegia by 1% Tropicamide eye drops.

In a study by **Chen et al**^[10] in 2020, similar to our study, crystalline lens thickness decreased significantly after cycloplegia by 0.5% Tropicamide ($p < 0.001$); whereas ACD increased ($p < 0.001$).

In study by **Chang SW et al**^[11] in 2016, Cycloplegia by 1% Tropicamide induced significant deepening of ACD (0.08 ± 0.06 , $p < 0.001$) was recorded. The AL did not change with cycloplegia similar to low and moderate myopic groups of present study.

In a study by **Lin F et al**^[12] in 2022, post cycloplegia by Tropicamide, LT significantly decreased from 3.42 ± 0.18 mm to 3.38 ± 0.19 mm in emmetropic eyes, from 3.37 ± 0.16 mm to 3.34 ± 0.15 mm in myopic eyes which was similar to present study. Similar to present study, ACD significantly increased from 3.21 ± 0.19 mm to 3.30 ± 0.19 m in emmetropic eyes, from 3.34 ± 0.20 mm to 3.40 ± 0.20 mm in myopic eyes ($p < 0.01$).

CONCLUSION

A scan measurement of ACD, LT and AL pre- and post cycloplegia in young myopic adults concluded that LT decreases significantly in low and moderate grades of myopia. In high myopic patients, even though a decrease in LT was found in few subjects, it was statistically not significant. ACD increases significantly after cycloplegia in all grades

of myopia. This could be attributed to decrease in lens thickness post cycloplegia. In conclusion, cycloplegia resulted in a deeper ACD and thinner LT. These results aid in explicating the impact of crystalline lens changes during the process of accommodation.

Table 1:- Demographics based on grades of myopia

	Low Myopia	Moderate Myopia	High Myopia
Sex Ratio (M:F)	88:30	44:28	6:4
Age	27.27 $\pm$ 7.81	27.10 $\pm$ 7.11	28.80 $\pm$ 7.11

Table 2:- Anterior segment parameters before and after cycloplegia

	Before-T	After-T	P-value
ACD	3.72 $\pm$ 0.08	3.79 $\pm$ 0.09	<0.00001
LT	3.97 $\pm$ 0.34	3.94 $\pm$ 0.34	<0.00001
AL	24.24 $\pm$ 0.43	24.24 $\pm$ 0.43	0.61168

Table 3:- Anterior segment parameters before and after cycloplegia in different grades of myopia.

	Grade of Myopia	Before-T	After-T	P - value
ACD	Low	3.69 $\pm$ 0.07	3.76 $\pm$ 0.08	< 0.00001
	Moderate	3.74 $\pm$ 0.07	3.81 $\pm$ 0.08	< 0.00001
	High	3.90 $\pm$ 0.07	3.97 $\pm$ 0.10	0.0179
LT	Low	4.00 $\pm$ 0.35	3.97 $\pm$ 0.35	< 0.00001
	Moderate	4.01 $\pm$ 0.30	3.97 $\pm$ 0.31	0.0312
	High	3.49 $\pm$ 0.16	3.47 $\pm$ 0.17	0.6121
AL	Low	24.07 $\pm$ 0.34	24.07 $\pm$ 0.34	0.8236
	Moderate	24.39 $\pm$ 0.33	24.39 $\pm$ 0.33	0.6177
	High	25.23 $\pm$ 0.48	25.25 $\pm$ 0.48	0.0011

Table 4:- Comparison of Changes in Biometric Parameters among Low, Moderate and High myopes.

	Low Myopia	Moderate Myopia	High Myopia	P Value
ACD	0.07 $\pm$ 0.03	0.07 $\pm$ 0.03	0.07 $\pm$ 0.07	0.82621
LT	0.03 $\pm$ 0.01	0.04 $\pm$ 0.14	0.02 $\pm$ 0.13	0.67644
AL	0.00 $\pm$ 0.02	0.00 $\pm$ 0.02	0.02 $\pm$ 0.01	0.01544

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