

EFFECT OF ATROPINE EYE DROPS 0.01% ON MYOPIA PROGRESSION IN HIGH AND LOW MYOPIA IN PATIENTS VISITING ARMED FORCES INSTITUTE OF OPHTHALMOLOGY RAWALPINDI

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ABSTRACT

Objective: To determine the effect of atropine eye drop 0.01% on myopia progression in high and low myopes.

Study Design: Quasi experimental study.

Place and Duration of study: Armed Forces Institute of Ophthalmology (AFIO) Rawalpindi, Pakistan from Mar 2017 to Jul 2018.

Methodology: A total of 72 eyes of 36 patients successfully completed the follow up. Age ranging from 5 to 15 years, refractive error from 2.0D to 20D was considered and grouped into high and low myope on the basis of refractive error and axial length (AL). Those with other ocular disease were excluded. Increase in Axial Length of 0.5mm or refractive error 0.5D in 3 months were started 0.01% atropine eye drop in both eyes. Follow up was 3 monthly, final readings of axial length and spherical equivalent (SE) were noted at 12 months of treatment initiation.

Results: The mean spherical equivalent and axial length in group high myopes was 12.40D \pm 3.55 and 27.28 \pm 1.19mm respectively while in group low myopes was 4.99D \pm 0.68 and 24.27 \pm 1.40 mm respectively. The induced change in spherical equivalent and axial length at the end of 01 year after atropine treatment was 0.81 \pm 0.26 D and 0.77 \pm 0.16 mm respectively in group high myopes while 0.76 \pm 0.21 D and 0.81 \pm 0.26 mm respectively in group LM. There was statistically no significant difference of induced change between the two groups.

Conclusion: Atropine eye drop (0.01%) was effective in halting myopia progression in both high and low myopes.

Keywords: Atropine, Axial length, Myopia.

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INTRODUCTION

Myopes are unable to see distant objects clearly so to overcome this problem they usually squeeze their eyes to gain pinhole effect and make a clear image of distant objects¹. Myopia is a common ocular problem affecting up to 2.5 billion people worldwide². It is classified into two groups: non-pathologic and pathologic myopia. If the refracting surfaces of the eye develops normally but there is high refractive power which does not correspond to axial length of the eye then it is called non-pathologic myopia. The refractive error is usually <6.00 diopters. Whereas pathologic myopia is that state in which due to increase in axial length (>26.5mm) there is progression of refractive error (SE >6.00

diopters)³. The prevalence of visual impairment due to pathologic myopia is high in Asian population (0.2% - 1.4%) as compare to European population (0.1% to 0.5%)⁴.

Myopia is a common progressive disease with more than 80% prevalence of myopia and 20% of high myopia⁵. Many methods have been devised to control its progression. Spectacles, rigid and soft contact lenses, atropine eye drops, increase outdoor activities and decrease near work all are different methods to control its progression. Out of these, atropine was found to be most effective on myopia progression control⁶. The mechanism does not involve accommodative spasm instead there is inhibition of scleral or retinal tissue growth⁷. High concentration of atropine causes accommodative loss, blurring of vision, pupillary dilatation but with low concentration, these side effects are minimal and myopia progression is well controlled⁸. At a

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Received: 16 Jan 2020; revised received: 10 Mar 2020; accepted: 15 Mar 2019

concentration of 0.01% no pupillary dilatation or loss of accommodation was noticed⁹. Also with high concentration, rebound phenomenon is common but with low concentration of atropine rebound phenomenon is very minimal¹⁰.

Asians are more affected by myopia as compared to other populations. Prevalence among young asians is higher (6.8%–21.6%) compared to other populations (2.0%–2.3%). It is important to control myopia progression as it is associated with severe retinal complications like retinal detachment, macular hole, choroidal neovascularization and peripapillary atrophy.

This study will help us in knowing the effect of 0.01% atropine eye drops in both high myopes and low myopes and management of myopic patients.

METHODOLOGY

Quasi experimental study was carried out at Armed Forces Institute of Ophthalmology (AFIO) Rawalpindi, Pakistan from March 2017 to July 2018. This study was started after taking approval from the institutional ethics committee. All the patients were informed about the study and written informed consent was taken from each patient before including in the study. Sample size was calculated by WHO sample size calculator using level of significance population proportion of slow progression 0.24, taking confidence interval 95%. The sample size was found to be 72 eyes. Initially 86 eyes of 43 patients were recruited but only 38 patients gave consent so 76 eyes of 38 patients were registered. In this study both genders with age 5 to 15 years showing progression of 0.5mm in axial length or 0.5 diopter increase in refractive error over a period of 3 months were included. By non-probability purposive sampling subjects were grouped into low myopes (LM) and high myopes (HM). By definition, LM are those with Axial Length (AL) smaller than 26.5mm and refractive error less than -6D and HM are those with AL longer than 26.5mm and refractive error more than -6D. Patients with any history of corneal opacity, keratoconus, strabismus,

lenticular opacity, macular disease, trauma or previous surgery were excluded from the study.

Thirty-six eyes were included in High Myope (HM) group and remaining 36 eyes were included in LM group. Two eyes of the same patient were taken independently. All patients in both groups underwent complete ophthalmic examination and data was recorded on a work up performa. Along with demographic details, we noted uncorrected visual acuity (UCVA), best corrected visual acuity (BCVA), pinhole (PH), cycloplegic refraction with Auto Ref-keratometer (RK-F1, Canon), Spherical Equivalent (SE), and AL using PACSCAN 300A and slit lamp examination to rule out any other anterior or posterior segment disease.

Atropine eyedrops (0.01%) were prepared by adding 0.1ml Atropine in 10ml of Blink fresh eye drop by a single trainee researcher to exclude bias. Method of instillation was explained to all patients and their parents. Instill one drop of 0.01% atropine eye drop at bed time and occlude the punctum for 2 minutes after instilling medicine. Patients were reviewed after every 3 months, uncorrected and best corrected visual acuity, spherical equivalent and axial length were noted on every visit. However, results include the comparison of SE and AL on presentation and after 12 months of starting atropine treatment.

Statistical analysis was carried out with the help of Statistical Program for Social Sciences (SPSS 16.0). The terms used to describe the data was mean \pm SD (standard deviation). The categorical variables such as gender were analyzed by frequency distribution while continuous variables such as age, spherical equivalent, AL and induced change in axial length and refractive error was assessed statistically with paired sample and independent sample t-test ($p \leq 0.05$ significance level).

RESULTS

In this study total 76 eyes of 38 patients were included but 2 patients had irregular follow up so finally there were 72 eyes of 36 patients, 36 eyes in high myope group and 36 eyes in low myope

group. Age of children ranging from 5 to 15 years were included in both groups. Mean age of 8.47 ± 3.04 years in group HM while 8.41 ± 2.43 years in group LM. Statistical test applied and insignificant difference of age between the two groups were found ($p=0.926$). Out of 36 patients gender distribution between the two groups was 25 (69.44%) males and 11 (30.55%) females in group HM while 21 (58.33%) males and 15 (41.66%) females in group LM. The mean and standard deviation of age, spherical equivalent and axial length of the patients on presentation in group HM and LM is given in table-I.

table-III. Progression of myopia in both high and low myopes was halted by 0.01% atropine eye drop. Total progression in both groups was compared and regression of myopia progression was almost equal in low and high myopes (p -value >0.05).

DISCUSSION

Since myopia is a vision threatening condition, it has now become the leading cause of blindness in East Asia¹¹⁻¹³. Prevalence of myopia in East Asia among young has now reached to 80% and high myopia more than 20%. With this

Table-I: Mean and standard deviation of age, spherical equivalent and axial length at the time of presentation.

Variables	Group HM (High Myope) n=36 (Mean ± SD)	Group LM (Low Myope) n=36 (Mean ± SD)	Significance (p-value)
Age	8.47 ± 3.04	8.41 ± 2.43	0.936
Spherical Equivalent	12.40 D ± 3.55	4.99 ± 0.68	<0.001
Axial Length	27.28 ± 1.19	24.27 ± 1.40	<0.001

Table-II: Spherical equivalent and axial length before and after treatment in group high myopes and low myopes.

Groups	Spherical Equivalent (Mean ± SD)		p-values	Axial Length (Mean ± SD)		p-values
	Before	After (12 months)		Before	After (12 months)	
High Myope Group (HM)	12.40 ± 3.55	13.20 ± 3.58	$p < 0.001$	27.28 ± 1.19	28.07 ± 1.13	<0.001
Low Myope Group (LM)	4.99 ± 0.68	5.75 ± 0.74	$p < 0.001$	24.27 ± 1.40	25.09 ± 1.46	<0.001
Significance (p-value)	<0.001	<0.001		<0.001	<0.001	

Table-III: Induced change in spherical equivalent and Axial length in groups high myopes and low myopes.

	High Myope group (HM) (Mean ± SD)	Low Myope group (LM) (Mean ± SD)	p-value
Induced change in SE	0.81 ± 0.26	0.76 ± 0.21	0.373
Induced change in AL	0.77 ± 0.16	0.81 ± 0.26	0.43

The mean SE and AL after 12 months of treatment with 0.01% atropine is given in table-II. Statistical test was applied on AL and refractive error values checked on presentation and last visit. Test was significant (p -value <0.05) which showed that no significant increase in axial length and refractive error occurred after starting atropine treatment.

The induced change in SE and AL before and after treatment in both the groups is given in

enormous increase in prevalence it is thought that the graph of pathologic myopia will continue to rise¹³. Pathologic myopia is one of the major cause of progressive visual deterioration and visual decline is expected in about 40% of the patients¹⁴. Studies conducted earlier showed that myopia progression can be halted by different methods. A recent study conducted in Singapore showed that 0.01% atropine eye drop is most effective in controlling myopia progression in

children¹⁵. Similarly another study showed that low concentration atropine eye drops (0.05%, 0.025% and 0.01%) are also effective in controlling myopia progression¹⁶. But both studies did not quantify how much it is effective in controlling myopia progression in high and low myopes.

In our study we classified eyes into LM and HM category and used atropine eye drops in concentration of 0.01% in all eyes. The effect of atropine 0.01% was compared to see how much progression is controlled in low and high myopes. After 1 year of treatment with atropine 0.01% eye drops, progression of myopia was equally controlled in low and high myopes (p -value >0.05).

The exact mechanism of action of atropine on myopia progression is not known. Previously convergence was considered as the cause of myopia so atropine was recommended as a treatment for suspected spasm of accommodation in myopic patients. But now it is believed that atropine inhibits the growth of scleral and retinal tissue, and thereby eye growth^{15,17}. Very little increase in axial length and refractive error after starting 0.01% atropine eye drops showed that eye growth is responding to inhibitory effects of atropine eye drops.

Our study has showed that children from 5-15 years of age benefited from this treatment. It was equally effective in low myopes and high myopes. A daily dose of 0.01% Atropine is an effective treatment in children aged 5-15 years, who showed progression of myopia of ≥ 0.5 D in the preceding year. Treatment should be continued during growing phase of eye so that the final myopia level would be less than that which eye would achieve if it was allowed to grow with same progression. If the eye continues to grow, chances of developing complications, associated with pathologic myopia like retinal detachment, glaucoma, choroidal neovascularization and macular hole increases¹². So if we try to inhibit the eye growth at younger age, then there will be less chances of developing such potentially blinding complications. The results of

our study show that 0.01% atropine eye drops is effective in controlling myopia progression in both low and high myopes.

Despite controlling myopia progression in both groups, there were certain limitations in our study. Firstly the duration of our study was small so we recommend that studies with longer duration to see myopia progression after stopping 0.01% atropine eye drops should be done to yield more comprehensive results. As it is mentioned in the literature that there is progression of myopia after cessation of atropine treatment¹⁸.

CONCLUSION

Our study demonstrated that atropine eye drop 0.01% was effective in controlling progression of myopia in both low and high myopes equally. It is concluded that glasses only correct the refractive error but don't halt myopia progression so in addition to glasses, use of 0.01% atropine eye drop once daily at bed time can regress myopia progression.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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