Original Article

Effectiveness 0.05% Atropine for Controlling Myopia Progression in School Going Children

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ABSTRACT

Purpose: Although there is evidence that Atropine is effective in improving myopia but there is variable response with use of 0.05% concentration. We conducted this study to find mean change in myopia progression after giving 0.05% Atropine to school going children with myopia.

Study Design: Quasi experimental study.

Place and Duration of Study: Unit-II, Department of Ophthalmology, Mayo Hospital, Lahore from 3rdNovember 2020 to 3rd February 2021.

Methods: One hundred children of 5 to 14 years of age with myopia greater than 0.5 D were selected by consecutive sampling. Patients with other refractive errors, other ocular diseases or ocular surgeries were excluded. Cycloplegic retinoscopy was performed and 0.05% atropine eye drops were advised once at night for 3 months. Cycloplegic retinoscope was performed and change in myopia progression (mean myopia progression rate) was calculated. Paired T-test was applied to calculate significant change in myopia. P-value ≤0.05 was taken as significant. Data was stratified for age, gender and duration of myopia.

Results: Mean age of children was 9.26 ± 2.87 years. There were 40% males and Male-to-female ratio was 1:1.5. Mean duration of myopia was 13.81 ± 6.04 months. Mean myopia at baseline was -1.02 ± 0.30D, which was improved to -0.18 ± 0.44 D after treatment. Mean change in myopia after treatment was -0.84 ± 0.30 D. The change was statistically significant ($p < 0.05$).

Conclusion: Atropine 0.05% is effective in reducing degrees of myopia and may help in preventing myopia progression in school going children.

Key Words: Myopia, Atropine, Diopter, Pediatrics, Refractive error.

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INTRODUCTION

Pathophysiology of myopia is not fully understood.[1] Globally, myopia is becoming more prevalent and East Asia is experiencing rising public health concerns as the situation has become almost epidemic.[2] By 2050, myopia and high myopia are expected to become more common, impacting approximately 5 billion and 1 billion individuals all over the world, respectively.[3] In other words, nearly 1 billion people will be affected from high myopia, indicating an unsettling rise in frequency on a global scale.[3]

Furthermore, as many as 88% of children who have myopia suffer from uncorrected refractive error, making the consequences of an increase in myopia prevalence around the world significant.[4] The World Health Organization states that axial lengths of 26mm or greater and refractive errors of−5 diopters (D) or greater are significantly associated with an elevated lifetime risk for visual impairment.[5]

A number of complications including chorioretinal atrophy, retinoschisis, choroidal neovascularization, rhegmatogenous retinal detachment, cataract, glaucoma and irreversible visual loss, may result in individuals with untreated myopia.[6] Therefore, there is a need for figuring an effective method to delay or stop development of myopia in young children.[7]

A multitude of degenerative processes that take place in macula in patients with severe myopia and pathological myopia can cause them to lose their eyesight.[8] Eye exercises have been implemented in China as an intervention for slowing myopia progression in children.[9]

The development of fundus lesions is facilitated by the expansion and thinning of the posterior scleral layer, which worsens during high myopia processing. The adjacent posterior choroid and retina also expand and thin, contributing to these changes. Scleral reinforcement surgeries have also been performed to control the progression of high rates of myopia in children, but the outcomes were unsatisfactory.[10,11]

This study was conducted to address this global issue in term of decreasing severity of myopia and halting its progression. The rationale was to evaluate the efficacy of 0.05% atropine for the prevention of myopia progression in school-going children in our local perspective.

METHODS

It was a Quasi experimental study conducted at Unit - II, Department of Ophthalmology, Mayo Hospital, Lahore, from November 2020 to February 2021. Sample size of 100 cases was calculated using formula with 95% confidence level, d=absolute level of precision at 1% and mean change was 0.43±0.28. Sample was collected using non-Probability, consecutive sampling.

Children of5-14years of either gender and with myopia (spherical equivalent greater than -0.5D) were included. Patients with other refractive errors, astigmatism (cylinder refraction greater than 2D), amblyopia or strabismus, cataract or retinal disease and history of any ocular surgery were excluded. Children fulfilling selection criteria were enrolled in the study from OPD of Unit-II, Department of Ophthalmology, Mayo Hospital, Lahore. Informed consent was obtained from parents. Demographic information (name, age, gender, duration of symptoms and contact) was noted. Cycloplegic retinoscopy was performed and parents of children were advised to instill 0.05% atropine eye drops once at night for 3 months. Each child was given a small calendar to tick off the days when the eye drops were used in order to monitor compliance. All children were examined in OPD after 3 months. Patient's cycloplegic retinoscopy was performed and myopia progression was assessed in terms of diopter. Change in myopia progression (mean myopia progression rate) was calculated and information was recorded on self-designed proforma.

Data was analyzed by using SPSS version 21. Quantitative variables like age, duration of symptoms, diopter at baseline and after 3 months and change in myopia were calculated in the form of mean and standard deviation. Qualitative variables like gender were presented in the form of frequency and percentage. Paired sample T-test was applied to calculate significant change in myopia. P-value≤0.05 was taken as significant. Data was stratified for age, gender and duration of myopia. Paired sample t-test was applied to calculate significant change in myopia for each strata. P-value ≤ 0.05 was taken as significant.

RESULTS

Mean change in myopia after treatment was -0.84 ± 0.30 which was observed from -1.02 ± 0.30 D to -0.18 ± 0.44 D. The change was statistically significant ($p < 0.05$). Out of 100 children, 52% were aged 5-9 years while 48% were 10 – 14 years of age.

In children aged 5 – 9 years, the mean change in myopia was -0.87 ± 0.29 D. In children aged 10 – 14 years, the mean change in myopia was -0.82 ± 0.30 D. The difference between both groups was insignificant ($p > 0.05$).

In children aged 5 – 9 years, mean change in myopia was from -1.01 ± 0.30 D to -0.14 ± 0.44 D which was statistically significant ($p < 0.05$) and in children of 10 – 14 years, mean change was from -1.04 ± 0.30 D to -0.22 ± 0.45 D which was statistically significant ($p < 0.05$).

In males, mean change in myopia was -0.83 ± 0.32 D and in females was -0.85 ± 0.28 D. The difference between the two was insignificant ($p > 0.05$).

In males, the mean change in myopia was observed from -1.09 ± 0.29 D to -0.26 ± 0.45 D which was statistically significant ($p < 0.05$). In females, the mean change was observed from -0.98 ± 0.29 D to

-0.13 ± 0.43 D which was statistically significant ($p < 0.05$).

Out of 100 children, 41% had myopia for ≤ 1 year while 59% had for > 1 year. In children who had myopia for ≤ 1 year, the mean change in myopia was -0.77 ± 0.32 D and in children who had myopia for > 1 year, the mean change in myopia was -0.90 ± 0.27 D. The difference between both groups was significant ($p < 0.05$).

DISCUSSION

The effectiveness of Atropine has previously been evaluated through systematic reviews, but there has not been a quantitative evaluation of its side effects. Given that race and iris colour have been shown to influence cycloplegia, atropine side effects may be more severe in white people with a light-colored eye.[12] One study found that mean change in myopia was -0.43 ± 0.28 D with the use of 0.05% atropine in school-going children.[13]

Myopia usually begins at elementary school age and progression ends after puberty. After the age of 25, continued advancement is rare.[14] Although most researchers agree that refractive status is largely genetically determined, current research suggests that early-life visual exposure may have an impact on ocular development and ultimately refractive status.[15]

In a cross-sectional research on the prevalence of myopia in Western and Northern Europe, it was revealed that there was a tendency towards higher incidence of the condition in younger persons with a more recent birth year. Over the last century, myopia prevalence has increased by four times.[16] It is considered a major global public health concern, particularly in East Asia.[17] Myopia has become more important in epidemiological studies because of its high frequency. Early-onset myopia puts children at higher risk for difficulties since it can escalate to high myopia and myopic retinal degeneration over time.[18]

Atropine has been used for more than a century to arrest myopia progression. Compelling evidence of its protective effect has been reported in well-designed clinical studies, mainly performed during the last two decades. However, its exact mechanism of action has not been determined. Experimental findings have shown that the mechanism is not related to accommodation, as was thought for decades.[19]

In our study, mean change in myopia after treatment was -0.84 ± 0.30 D. The change was statistically significant ($p < 0.05$). The study Atropine in the Treatment of Myopia (ATOM 1) by Chua et al, was a randomized, double-blind, placebo-controlled trial including 400 children. It showed that 1.0% atropine eye drops applied daily in one eye over a period of 24 months reduced progression of myopia by 77% compared with the untreated eye (1.2 D in the control group compared to 0.28 D in eyes treated with atropine).[20] The primary effect of atropine appeared to be by limiting the depth of the vitreous chamber expansion, which in turn decelerate axial length increase.[21]

Wu et al., published the results of a retrospective, case-control study including 117 children who received 0.05% atropine and progression of more than -0.5 D during a 6-month follow-up was observed. No side effects were reported in this study.[22] While Wang et al., found that with 0.05% atropine, mean change in myopia was -1.1D to -0.8D.[23]

Our study was a single center study with limited number of children. Different concentrations can be compared to see which is the most effective dose to halt progression of myopia. Longer follow up studies can give further evidence on its effectiveness.

CONCLUSION

Atropine 0.05% is effective in reducing myopia progression in pediatric age group.

Conflict of Interest: Authors declared no conflict of interest.

Ethical Approval: The study was approved by the Institutional review board/Ethical review board **(KEMU/67/12-04-2023).**

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Authors' Designation and Contribution

Nayab Khalid; Consultant Ophthalmologist: *Concepts, Design, Data Acquisition, Manuscript Preparation, Manuscript Editing.*

Chaudhry Nasir Ahmad; Associate Professor: *Statistical Analysis, Manuscript Review.*

Irfan Muslim; Consultant Ophthalmologist: *Data Analysis.*

Komal Javed; Consultant Pathologist: Literature *Search.*

Abdul Basit; Resident: *Literature Search, Data Analysis.*