Efficacy of low-dose atropine to reduce myopia progression among Indian children

Dear Editor,

The prevalence of myopia across the globe continues to increase at an alarming rate and it is estimated that almost half of the world's population will be myopic by the year 2050, with 10% of them being highly myopic.[1] Following a similar trend to the worldwide data, the prevalence of myopia among school children in India has increased from 5.6% in 2002[2] to 13.1% in 2015.[3] Minimizing the degree of myopia is important as greater myopia, 6 dioptres or more, is associated with an increased incidence of ocular pathology such as myopic degeneration, retinal detachment, and glaucoma;[4] however, recently it has been shown that even low and moderate levels of myopia increase the risk of pathology.[5] Finding an effective and safe way to reduce the progression of myopia early in life is becoming increasingly important.

A recent meta-analysis of myopia interventions including atropine, orthokeratology, outdoor exposure, spectacle correction, and contact lens correction of refractive error showed atropine to be the most effective.[6] The Atropine for the Treatment of Myopia (ATOM) 2 study was conducted to test if lower concentrations (0.5%, 0.1%, and 0.01%) of atropine could have similar efficacy as 1% atropine. The overall progression of myopia was lower in the 0.01% atropine group (−0.72 ± 0.72 D) followed by the 0.1% atropine group (−1.04 ± 0.83 D), with the highest progression noted in children who were treated with 0.5% atropine (−1.15 ± 0.81 D) at the end of 3 years.[7] The Low-Concentration Atropine for Myopia Progression (LAMP) study demonstrated mean myopia progression of 0.27 D, 0.46 D, 0.59 D, and 0.81 D over 1 year, for participants allocated with 0.05%, 0.025%, and 0.01% compared with placebo, with a mean increase in axial length of 0.20 mm, 0.29 mm, 0.36 mm, and 0.41 mm, respectively. It was concluded that all concentrations were well tolerated without any adverse effects, and of the three concentrations used, 0.05% atropine was the most effective in controlling the progression and axial length elongation over 1 year.[8]

Recently, the I-ATOM study group published results from a randomized clinical trial showing that 0.01% atropine is found to be effective in controlling myopia by 54% among Indian children, but interestingly there was no statistically significant difference in axial length.[9]

There are several ethical issues and practical challenges in conducting a placebo-controlled trial of 0.01% atropine in India as it is a licensed drug, so an open trial was conducted to investigate the efficacy of low-dose (0.01%) atropine in children recruited from a tertiary eye care center in south India.

After treatment for 1 year with 0.01% atropine, the mean rate of progression of myopia (RMP – Difference between current visit cycloplegic spherical equivalent [SE] and previous year visit cycloplegic SE) was 0.41 D/year and 0.45 D/year in the right and left eye, respectively, as opposed to 0.93 D/year and 0.93 D/year before treatment [Fig. 1]. The mean increase in the axial length was 0.18 mm and 0.25 mm in the right and left eye, respectively, after treatment. Among the 60 children, 50 (83.33%) responded to the treatment, whereas 10 (16.67%) of them showed a progression of >0.50 D despite treatment. Table 1 shows the mean spherical equivalent and axial length at baseline and at 1 year.

Among the 60 children, three (5%) of them had mild stinging (reported once) immediately after the instillation of the eye drops, however, it was temporary. No participants had reading difficulties or any complaints of photophobia or glare. Visual acuity, accommodation, and ocular surface were all unaffected by treatment.

In this study, the increase in axial length did not correlate with the change in refraction and this requires further exploration. Ten participants had significant myopia progression despite treatment with 0.01% atropine. In these nonresponders, an approach with a higher dose of atropine or a combined strategy with other optical treatments could be attempted.

Atropine treatment has now been incorporated into clinical practice in India and shows real promise as a treatment for controlling myopia, however, future studies are required to investigate the mechanism of action of the low-dose atropine and the disparity between refractive error and axial length data during treatment.

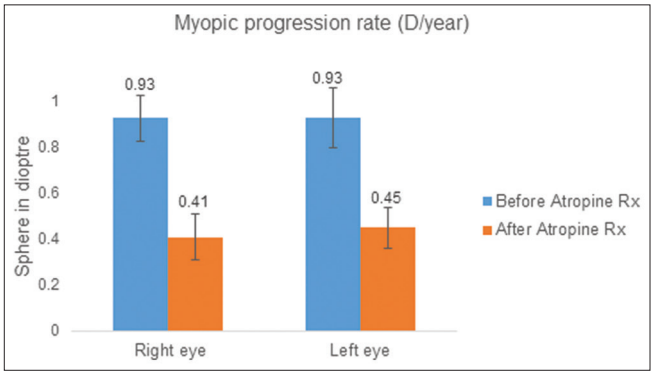

Figure 1: Myopia progression in the year before treatment and at 12 months of treatment with 0.01% topical atropine. Error bars represent the 95% confidence intervals

Table 1: Mean spherical equivalent (SE) and axial length at baseline and at 1 year

	Spherical Equivalent (OD) (Range)	Spherical Equivalent (OS) (Range)	Axial Length (OD) (Range)	Axial Length (OS) (Range)
Baseline	−4.90±1.98 (−2.00/−11.88) (RMP** 0.93D)	−4.76±1.95 (−2.00/−12.12) (RMP** 0.93D)	25.16±0.99 (23.01/28.02)	25.11±1.01 (23.02/28.07)
1 year follow-up	−5.49±1.98 (RMP** 0.41D)	−5.31±1.80 (RMP** 0.45D)	25.43±1.05	25.42±1.03
*P**	<0.001	<0.001	<0.001	<0.001

*Paired *t*-test. **RMP - Rate of myopia progression calculated as the difference between current visit cycloplegic SE and previous year visit cycloplegic SE

Moreover, an optical or combined strategy for nonresponders remains unclear. Although some of the evidence suggests using a combination of optical and pharmacological treatments, further studies are needed to test the efficacy of a combination of treatment modalities. Additional work is needed to address some areas of uncertainty, for example, the best time to start and stop treatment.

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Conflicts of interest

There are no conflicts of interest.

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