

Contact Lens Update

CLINICAL INSIGHTS BASED IN CURRENT RESEARCH

Atropine for the treatment of childhood myopia: An article review

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Myopia, a refractive condition in which light rays from a distant object are focused in front of the retina, resulting in a blurred distance image, is reaching epidemic proportions in certain countries, especially in East Asia. Jake Sivak's editorial outlines the extent of this epidemic. Researchers are actively investigating a slew of possible methods aimed at reducing or preventing the progression of myopia. Atropine was first suggested as a means of slowing the progression of myopia as early as the 1920s, with the thought that myopia could be prevented by paralyzing the accommodative system, a well-known effect of atropine. More recent data have suggested that atropine may prevent the progression of myopia by exerting anti-muscarinic biochemical effects on the sclera or retina.^{1,2} While some small scale human clinical trials of the use of atropine to prevent the progression of myopia proved to be successful, until recently no large scale, appropriately masked and controlled studies had been performed to test this concept. This review summarizes the research described in two related articles sharing the results of The Atropine in the Treatment of Myopia studies (ATOM 1 and ATOM 2), a series of large scale, double-masked clinical trials investigating atropine at various concentrations as a means to prevent or retard myopia progression:

Chua WH, et al. Atropine for the treatment of childhood myopia. Ophthalmology 2006;113:2285-91.

Chia A, et al. Atropine for the treatment of childhood myopia: Safety and efficacy of 0.5%, 0.1%, and 0.01% doses (Atropine for the Treatment of Myopia 2). Ophthalmology 2012;119:347-54.

Methods

ATOM1 consisted of daily monocular treatment with topical 1% atropine, with saline drops serving as a placebo in a cohort of 400 children aged 6-12 years. The primary outcome measures were (1) the degree of myopia progression as measured by cycloplegic auto-refraction, and (2) the change in axial length as measured by ultrasound. Patients were followed for two years while on the treatment, as well as a subsequent year after treatment cessation to ascertain the longevity of the treatment effect.

ATOM2 involved similar treatment protocols as ATOM1, with the primary change being the binocular administration of a lower concentration of atropine (0.5%, 0.1% or 0.01%). Again, the children were followed for two years on the treatment and a further year after treatment cessation. Historical progression data from ATOM1 was used as a comparison control, as it was deemed unethical to treat children participating in the study with a true placebo due to the positive results of treatment on myopia progression seen in ATOM1. Primary outcome measures were again cycloplegic refraction measured by the autorefractor, and axial length, this time measured using the more accurate IOL master. Children were given the option of utilizing photochromic glasses containing

a reading addition should they have difficulty with glare or reading. ATOM2 also established the effects of reduced atropine concentration administration on the participants' amplitude of accommodation, pupil size and visual acuity.

Results

The results from the ATOM1 trial were: Monocular, daily instillation of 1% atropine reduced the progression of myopia by 77% compared to placebo treated controls.³ Unfortunately, there was a clear rebound effect after treatment cessation where, post-treatment, atropine-treated eyes progressed at a significantly higher rate than placebo-treated eyes.⁴ At the end of the three years, the atropine-treated eyes were still less myopic than the untreated controls (average -4.29D vs. -5.22D).

ATOM2 attempted to address some of the limitations of ATOM1 by lowering the concentration of atropine used to mitigate the deleterious effects of the drug on pupil size, accommodative amplitude and visual acuity. Treating children with 0.5%, 0.1% or 0.01% atropine suggested a dose-response relationship: the eyes treated with lower concentrations of atropine demonstrated the greatest myopia progression, although this result may not have been clinically significant.

Treatment	Myopia Progression (Over 2 years) ⁵
1.0% Atropine (ATOM1)	-0.29D
0.5% Atropine (ATOM2)	-0.30D
0.1% Atropine (ATOM2)	-0.38D
0.01% Atropine (ATOM2)	-0.49D

These results were a surprise to the researchers as they had initially intended for the 0.01% atropine treated group to serve as a control for the other two higher concentration treatments, and did not expect such a low concentration of atropine to have such a significant impact on myopia progression. While patients in the 0.01% atropine-treated group may have experienced more progression of myopia, other measures of visual function and patient utility were more favorable: their accommodative amplitudes, visual acuities and pupil sizes were all less affected than those in the other treatment groups. This was reflected by the number of patients requesting progressive addition lenses for use through the study; 70% and 61% of the children treated with 0.5% or 0.1% atropine requested spectacles with a reading addition, and only 6% of the children treated with 0.01% atropine opted to do so.

A similar result to ATOM1 was observed in the one-year post-treatment washout period, with all eyes rebounding and accelerating in their myopia progression compared to when they were on treatment. The eyes treated with the higher concentrations of atropine showed the greatest rates of myopia progression, while the eyes treated with 0.01% atropine progressed at a slower rate, but still faster than when they were on treatment.⁶

Conclusion

The strength of the ATOM1 and ATOM2 trials in the use of atropine as a means of myopia control are the use of a double-masked design with a large cohort of children (400 in each study) with a relatively low dropout rate. The limitations of the study likely centres around the population studied, which in both cases was over 90% ethnic Chinese, and thus further work in other ethnic populations may be needed to conclusively prove the treatment modality. Considering the myopic rebound that was seen in the treated participants, further work is needed to elucidate how long of a treatment interval is needed to allow the effect on myopia progression to stabilize and prevent further progression when not on treatment, and whether this is safe to do so.

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