SHORT REPORT

Effect of 0.01% Atropine on diopter and optic axis in adolescents and children with myopia

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Abstract

The purpose of this study was to investigate the effect of 0.01% Atropine eye drops on diopter and optic axis in adolescents and children with myopia. A total of 164 children with myopia were randomly divided into two groups, Group A and Group B with 82 patients in each group, according to the digital table method. Group A was treated with 0.01% Atropine eye drops, while Group B was treated with single vision lenses. Before the treatment, there was no significant difference in diopter and axial length between the two groups (P=0.624 and P=0.123). After 12 months of treatment, the diopter and axial length of Group A were lower than those of Group B (P < 0.001 and P = 0.005). There were no obvious adverse reactions during corrective therapy in the two groups. The results show that compared with single vision lenses, 0.01% Atropine is more effective in correcting myopia, and may control the increase of optic axis in adolescents and children with myopia, in a better way, with high safety..

Keywords: Atropine, Teenagers, Children, Myopia, Diopter, Axial length.

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Introduction

Myopia is the refractive state when the focus falls in front of the retina when external parallel light is refracted by the refractive system of the eye in the state of adjustment and relaxation.[1] At present, there is no cure for myopia, which seriously affects the daily life and physical and mental health of adolescents and children. However, it is impossible to carry out routine surgical treatment in adolescents and children due to the incomplete visual development, and the operation also has certain requirements for patients' own conditions.[2] In addition, repeat surgery is difficult in patients with postoperative recurrence; while other problems make the clinical treatment of myopia in adolescents and children a major problem.

Atropine is a typical highly selective M choline receptor (muscarinic receptor) antagonist.[3] In recent years, Atropine eye drops are often used to slow down the progress of myopia, while this method belongs to off-label use.[4] Although there is no global survey data of off-label use, the phenomenon of off-label use is very common in clinical practice. The concentration of off-label use is not uniform, and some adverse reactions are not clear. The safety of Atropine eye drops has always been a troubling issue.[5] According to research, side effects of Atropine are related to the concentration of Atropine: the higher the concentration of Atropine, the more obvious the symptoms of adverse reactions.[6]

Some studies have observed that high concentration (1% and 0.5%) Atropine eye drops work effectively in controlling the progress of myopia, but is not easy to tolerate, the loss of visit rate is high, and the patients are prone to have photophobia, dyslexia, headache, and other adverse side effects, with poor compliance.[7]

Chia A et al noted that low concentration (0.01%) and high concentration (0.1% and 0.5%) Atropine eye drops could effectively slow down the progress of myopia in children.[8] A meta-analysis showed that low concentration (0.01%) Atropine played a positive role in controlling growth of optic axis and myopic diopter.[9] Yam et al observed that low concentration (0.01%) Atropine had no significant effect in controlling the change of optic axis, but could slow down the diopter of myopia.[10] Thus, it can be seen that the efficacy of low concentration (0.01%) Atropine in slowing myopia progress in children is still controversial.

The objective of this study was to investigate the effect of 0.01% Atropine eye drops on diopter and optic axis in adolescents and children with myopia.

Patients / Methods and Results

A total of 164 children with myopia who were admitted to special medical center of strategic support force, China, from August 2019 to December 2020 were included in the study.

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The inclusion criteria were patients with binocular myopia and corrected visual acuity 1.0, between 6 and 16 years of age, capable of language communication, with complete examination and medical history data, and informed consent of family members of children and voluntary participation in study.

The exclusion criteria were patients with severe cardiac, hepatic or renal dysfunction, hereditary myopia, xerophthalmia, acute inflammation of the eye, keratoconus, epilepsy, eye trauma or operation, mental illness or unconsciousness, organic ophthalmopathy, and those who had allergies or contraindications to Atropine drugs or other therapeutic drugs.

The patients were randomly divided into two groups, Group A and Group B with 82 participants in each group, according to random number table method.[11] The patients in Group A were treated with 0.01% Atropine eye drops. The patients were instructed to shake the bottle and then drip into the eyes before going to bed at night; after dripping the medicine, press the eyes with hands in the lacrimal bursa area for five minutes, once a night, five days a week for 12 months. The patients in Group B were treated with single vision lenses for 12 months.

The diopter and axial length of the two groups were compared before and 12 months after treatment. The occurrence of adverse reactions in the two groups was observed during the treatment.

The axial length of all children was measured by IOL master; children under 12 years of age were given 1% Atropine Sulfate Eye Gel for five days, and children over 12 years old were given compound Topiramate eye drops for 5min/ time, 20 minutes after 6 times; the diopter was determined by banded light band examination and comprehensive optometry after full mydriasis using the above drugs. The final diopter is equivalent spherical diopter.

The data were analysed and processed by SPSS 25. Measurement data were expressed by mean ± SD, and independent sample t-test was used for comparison between the groups. $P < 0.05$ means the difference is statistically significant.

Group A had 44 (53.7%) males and 38 (46.3%) females, aged 6-16 years old with an average age of 11.42±2.67 years, and the disease duration was 1-5 years with an average of 2.86±1.03 years.

Group B had 43 (52.4%) males and 39 (47.6%) females, aged 6-16 years with an average age of 11.51±2.84 years, and the disease duration was 1-5 years with an average of 2.90±1.12 years.

Before the treatment, there was no significant difference in diopter and axial length between the two groups ($P=0.624$ and $P=0.123$). After 12 months of treatment, the diopter and axial length of Group A were lower than those of Group B ($P < 0.001$ and $P = 0.005$), as shown in Table 1.

Table: Comparison of diopter, corneal curvature and axial length of patients in the two groups

Parameter	Group A (n=82)	Group B (n=82)	*p* value
Diopter before treatment (D)	- 2.76±0.39	- 2.79±0.42	0.624
Diopter after 12 months of treatment (D)	- 3.15±0.46	- 3.54±0.53	＜0.001
Axial length before treatment (mm)	22.21±1.48	22.58±1.62	0.123
Axial length after 12 months of treatment (mm)	23.00±1.53	23.72±1.70	0.005

There were no obvious adverse reactions during corrective therapy in the two groups.

Conclusion

Compared with single vision lenses, 0.01% Atropine is more effective in correcting myopia, and may better control the increase of optic axis in adolescents and children with myopia, with high safety. However, studies with large samples are needed to verify the conclusion of this study. The limitations of this study were that the effect of Atropine eye drops with concentration greater than 0.01% on myopia is not discussed, and clinical observation time was short.

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Conflict of Interest: None to declare.

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