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The effect of low-concentration atropine combined with auricular acupoint stimulation in myopia control

Han-Chih Cheng[a], Yi-Ting Hsieh[a,b,c,*]

[a] Department of Ophthalmology, Taipei Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, New Taipei, Taiwan
[b] School of Medicine, Tzu Chi University, Hualien, Taiwan
[c] Department of Ophthalmology, National Taiwan University Hospital, Taipei, Taiwan
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KEYWORDS
Acupuncture;
Anterior chamber depth;
Atropine;
Auricular acupoint;
Axial length;
Intraocular pressure;
Myopia

Summary
Objectives: To compare the effect of myopia control between patients treated with low-concentration atropine eye drops combined with auricular acupoint stimulation and those treated with atropine alone.
Design and settings: Single-blinded randomized controlled clinical trial in a regional teaching hospital.
Interventions: The patients received either topical 0.125% atropine nightly plus auricular acupoint stimulation (0.125A + ACU group) or topical 0.125% atropine alone nightly (0.125A group).
Main outcome measures: The changes in spherical equivalent (SE), axial length (AL), anterior chamber depth (ACD), and intraocular pressure (IOP) per year were compared between the two groups.
Results: Seventy-three of 110 total patients (66.4%) completed at least 6 months of follow-up. Patients in the 0.125A + ACU group had less myopic progression and AL elongation (−0.41 diopter and 0.24 mm/year) than those in the 0.125A group (−0.66 diopter and 0.32 mm/year) (mean follow-up 14.7 months, $p < 0.0001$ and $p = 0.02$, respectively). The ACD increased more in the 0.125A + ACU group than in the 0.125A group (0.076 mm vs. 0.023 mm/year, $p = 0.0004$). IOP decreased more in the 0.125A + ACU group than in the 0.125A group (−1.01 mmHg vs. −0.13 mmHg/year, $p = 0.007$). A decrease of 1 mmHg of IOP correlated with a decrease of myopic progression of 0.021 diopter/year ($p = 0.006$).
Conclusions: Patients treated with 0.125% atropine eye drops plus auricular acupoint stimulation had less myopic progression, less axial length elongation, more anterior chamber deepening, and greater IOP reductions than those treated with 0.125% atropine alone. Auricular acupoint stimulation in combination with low-concentration topical atropine was beneficial for myopia control.
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* Corresponding author at: Department of Ophthalmology, National Taiwan University Hospital, 7 Zhongshan S. Rd., Zhongzheng Dist., Taipei 10002, Taiwan. Tel.: +886 2 23123456x62131; fax: +886 2 23934420.
E-mail address: ythyth@gmail.com (Y.-T. Hsieh).

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Myopia has been an increasing problem among school children, especially in Asian countries.[1–3] High myopia is not only a refractive problem, but also a disease that can result in a number of sight-threatening complications such as macular degeneration, retinal detachment, glaucoma, and cataract.[3,4] There are numerous ways to slow or arrest myopic progression, such as cycloplegics, ocular hypotensives, contact lenses, bifocals, and multifocals.[5–7] Atropine eye drops were first used by Bedrossian in 1979 to control the progression of myopia.[8] Atropine is a long-acting nonselective muscarinic antagonist that blocks accommodation by paralyzing ciliary muscles; it may affect remodeling of the sclera and suppress the elongation of axial length (AL).[8–10] However, the side effects of atropine, including photophobia, blurred near vision, and possible long-term adverse effects such as ultraviolet exposure induced-retinal toxicity and cataract formation, have limited its use.[11] In order to reduce side effects, several lower concentrations of atropine (1%, 0.5%, 0.25%, 0.125%, 0.05%, 0.01%) have been used for myopia control in different clinical trials.[12–14]

Acupuncture and acupressure have been widely used in traditional Chinese medicine for thousands of years. Auricular acupoint stimulation by acupuncture or acupressure has been reported to improve visual acuity in myopic patients.[15–22] Liang et al.[23] reported that auricular acupoint stimulation enhanced the effect of 0.25% atropine in myopic control after an average of 8 months of follow-up. Auricular acupoint stimulation has also been reported to have an IOP-lowering effect.[24] In this study, we performed a randomized controlled trial using lower concentrations of atropine alone or in combination with auricular acupoint stimulation to evaluate their effects on myopia control and IOP, and the relationships between IOP and myopia control.

Materials and methods

Study design and population

This was a single-blinded randomized clinical controlled trial conducted at Taipei Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation. Children aged from 6 to 12 years with myopia, defined as spherical equivalent (SE) of −0.5 diopter (D) or less, were recruited from the outpatient clinics from January 2011 to June 2012. Exclusion criteria included: (1) abnormal IOP (>21 mmHg) at presentation, (2) astigmatism or anisometropia of more than 1.5 D, (3) amblyopia or strabismus, (4) the presence of any related eyelid diseases, ocular diseases, or auricular diseases, (5) the presence of hemostatic disorders or other related major systemic diseases, (6) history of allergy to atropine, and (7) previous or current use of contact lenses, bifocals, progressive lenses, or other forms of treatment for myopia.

Study procedure

Children visiting for regular visual examinations in the outpatient clinics received examinations including: best-corrected visual acuity (BCVA) on a Snellen chart, IOP measured by a noncontact tonometer (Canon TX-10, Canon Inc., Tokyo, Japan), and refractive status examined with an automatic refractometer (Topcon KR-8800, Topcon, Tokyo, Japan) after cycloplegia with topical tropicamide. Spherical equivalent (SE) was calculated as: SE = spherical + cylinder/2. Those who were myopic (SE ≤ −0.5 D) were recruited as candidates for this study, and the parents of all study participants were advised about the nature and possible consequences of the study. After informed consent was obtained from the parents, these patients received measurement of AL and anterior chamber depth (ACD) with the IOLMaster Version 4.0 (Carl Zeiss Meditec, Dublin, CA). Each patient was randomized to one of the two groups according to their chart numbers. Patients with an odd chart number were randomized to the control group and received topical 0.125% atropine eye drops (Sinphar Pharmaceutical, Ilan, Taiwan) 1 gt nightly only (0.125A group); patients with an even chart number were randomized to the experimental group and received topical 0.125% atropine eye drops plus auricular acupoint stimulation three times a day (0.125A + ACU group). Five auricular acupoints (Shenmen, Xin, Yan, Mu 1 and Mu 2) were selected for taping stimulation according to their relation to ocular system in traditional Chinese medicine as described in Fig. 1.[15] For those receiving auricular acupoint stimulation, taping stimulation was administered by using a 1-mm alloy ball (Magrain®; Sakamura, Kyoto, Japan) by their fingers three times a day, each time for five minutes over the five selected acupoints. They had to return to our clinic every week to change the laterality of the ears for alloy ball taping and acupoint stimulation to avoid any allergic reaction. Acupoint selection and alloy ball taping of all patients were performed by the same doctor (HC Cheng) who had four years of experiences of acupuncture practice in the Traditional Chinese Medicine Society of Taipei Medical University, Taipei, Taiwan. The patient enrollment, randomization and treatment group allocation were all performed by the same doctor (HC Cheng).

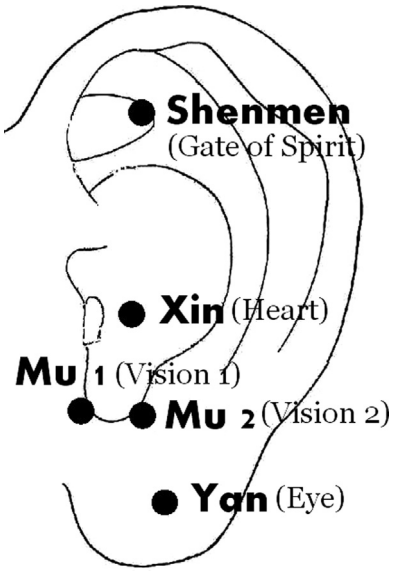

Figure 1 The five auricular acupoints (Shenmen, Xin, Yan, Mu1 and Mu2), which were chosen for alloy ball stimulation in our study.

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