Comparison of the Effect of Atropine and Cyclopentolate on Myopia

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We evaluated the effectiveness of cycloplegics in the treatment of myopia. Patients were selected randomly and divided into three groups: Group 1 received atropine 1% eye drops every other night; Group 2 received cyclopentolate 1% eye drops every night; and Group 3 received normal saline eye drops every night. All the patients were rechecked every three months. The results were evaluated at the end of one year. Ninety-six patients were evaluated, 32 in each group.

The mean myopic progression was -0.219 D in the atropine group, -0.578D in the cyclopentolate group, and -0.914D in the saline group. Analysis showed that atropine and cyclopentolate are effective in slowing the progression of myopia. The effect of atropine is better than that of cyclopentolate.

There is an association between an increased prevalence of myopia with higher degrees and intensity of schooling. The incidence of myopia increases from 5% to 10% to 35% to 45% from first grade to sixth grade, causing a severe social problem in Taiwan. Several statistical studies have addressed the subject of close work as a cause of myopia.1,2

Since Bedrossian’s3 study in 1964, interest in the treatment of progressive myopia with cycloplegic drugs in children has been rekindled. We did a prospective study of treatment of progressive myopia with atropine 1%, cyclopentolate 1%, and normal saline.

Patients and Methods

From July 1, 1985 to October 31, 1986, 247 children with simple myopia were selected randomly from the patients in our Refraction Clinic. There were 118 boys and 129 girls. The age distribution was from six to 14 years old (average age, 9). The refraction error was from −0.5D to −4.0D. Patients with a tropia, amblyopia, or a cylinder refraction greater than 1D were excluded.

All children had a complete ophthalmologic examination, including vision, cycloplegic refraction, keratometry, axial length, funduscopy, and intraocular pressure examination. The cycloplegic refraction was done with two drops of cyclopentolate 1% and two drops of tropicamide 1%, separated by a five-minute interval. Refraction was done 30 minutes later.

All 247 children were divided randomly into three groups. The first group received at-
ropine 1% eye drops every other night, and refraction was rechecked two weeks later. Bifocal glasses were prescribed at this time. Then, the patients were followed up every three months for vision, refraction, funduscopy, and intraocular pressure. The second group received cyclopentolate 1% eye drops every night. Single-vision glasses were prescribed if necessary. Then, the patients were followed every three months for vision and refraction. The third group received normal saline eye drops every night as a control. Single-vision glasses were prescribed if needed. The patients were followed every three months for vision and refraction.

To avoid deviation during retinoscopy, all examinations were done by three doctors. Every patient was followed by the same doctor. Patients who discontinued the eye drops or who did not use them regularly were excluded from the study.

Patients who used the eye drops continuously for one year received another complete ophthalmologic examination, including vision, keratometry, axial length, funduscopy, intraocular pressure, and cycloplegic refraction at the end of one year. (The atropine group became cycloplegic through use of atropine.)

In October 1986, 96 such patients were collected for evaluation, 32 in each group. The mean age was 10.5 years old in the atropine group, ten years old in the cyclopentolate group, and 10.4 years old in the control group.

In the atropine group, refraction was analyzed after two weeks of medication and at the final visit. In the cyclopentolate and the control group, refraction was analyzed before treatment and at the final visit. All refractions were listed as spherical equivalents, and only the right eyes were evaluated.

**Results**

The Figure shows the distribution of refraction error of three groups before treatment. There was no statistically significant difference between the three groups (Table I). After one year of treatment, the mean progression was -0.219D in the atropine group, -0.578D in the cyclopentolate group, and -0.914D in the control group. The differences were statistically significant (Table II).

When we compared the effect of atropine and saline, cyclopentolate and saline, and atropine and cyclopentolate, all differences were statistically significant ($P < .01$) (Table III). This means that atropine and cyclopentolate
can retard myopic progression. The effect of atropine was better than that of cyclopentolate.

Table IV shows the distribution of progression in the three groups. There were 78% in the atropine group, 60% in the cyclopentolate group, and 37% in the control group, whose myopic progression was within $-0.5$D. There were 6% in the control group whose refraction did not change at all during the study period. There were 3% in the atropine group whose myopia progressed more than $-1.0$D.

The following side effects occurred. All patients in the atropine group had photophobia. Most of them stopped gymnastic classes in school, and they did not like to go outdoors on weekends. This was not observed in the cyclopentolate or control groups. Many patients dropped out of the study. Except for photophobia in the atropine group, patients complained that it was inconvenient to use the eye drops every night and after several weeks, they discontinued the drops. No systemic or ocular complications were observed during this study.

**Table IV** Myopic Progression in Three Groups

<table>
<thead>
<tr>
<th></th>
<th>Atropine</th>
<th></th>
<th>Cyclopentolate</th>
<th></th>
<th>Saline</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of eyes</td>
<td>%</td>
<td>No. of eyes</td>
<td>%</td>
<td>No. of eyes</td>
</tr>
<tr>
<td>No change</td>
<td>18</td>
<td>56%</td>
<td>6</td>
<td>19%</td>
<td>2</td>
</tr>
<tr>
<td>Progression $\leq -0.5$D</td>
<td>7</td>
<td>22%</td>
<td>13</td>
<td>41%</td>
<td>10</td>
</tr>
<tr>
<td>Progression $-0.51$ to $-1.0$D</td>
<td>6</td>
<td>19%</td>
<td>9</td>
<td>28%</td>
<td>10</td>
</tr>
<tr>
<td>Progression $&gt;-1.0$D</td>
<td>1</td>
<td>3%</td>
<td>4</td>
<td>13%</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
<td>100%</td>
<td>32</td>
<td>100%</td>
<td>32</td>
</tr>
</tbody>
</table>

myopic progression. The effect of atropine was better than that of cyclopentolate. The mean progression was $-0.219$D in the atropine group, $-0.578$D in the cyclopentolate group, and $-0.914$D in the saline group.

Although atropine delays the progression of myopia, it does not arrest the tendency for progression in susceptible persons. There were 3% in the atropine group whose myopia progressed more than $-1.0$D in one year. Sampson found that all patients had rapid progression when atropine was discontinued. Brodstein suggested that the treatment program should be extended to at least 16 years of age. Although long-term atropinization may be valuable in the management of functional myopia, it may be too costly.

Atropine and cyclopentolate can induce severe ocular and systemic side effects and must be prescribed with care. Safir criticized the use of atropine in children because of the possible hazards including the retina's reception of 25 times more solar energy when the pupils were dilated fully.

Even though their spectacles were sunglasses with ultraviolet inhibitors, all patients in the atropine group complained of photophobia. Most stopped gymnastic classes in school and outdoor life on weekends. This was not observed in the cyclopentolate or saline groups. Even though the physiologic side effects of long-term atropinization may be proved to have no significant sequelae on the eye and its function, the psychologic effects of such a forced regimen in children for such a benign condition as school myopia are serious.

Although cyclopentolate is not as potent as atropine, it has less side effects. One drop at bedtime caused a few patients to have difficulty with near vision the next morning, but most tolerated it well. During treatment, it is effective in 60% of patients. (Myopic progres-

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References


References