Effect of amblyopia training in regulating the amblyopic eye in children with ametropic amblyopia

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ABSTRACT

Objective: To explore the effect of amblyopia training in regulating the amblyopic eye in children with ametropic amblyopia. Methods: A total of 50 children with ametropic amblyopia who were admitted in our hospital from March, 2012 to February, 2014 for amblyopia training were included in the study and served as the amblyopia group (n=90). The clinical efficacy and average time to enhance 1 line LogMAR vision in children with different degrees of ambylopa were recorded. The regulatory function indicators of amblyopic eye were detected. A total of 36 children with normal visions who came for physical examinations at the same stage were served as the control group (n=72). Results: The average time to enhance 1 line LogMAR vision for children with severe amblyopia in the amblyopia group was the shortest, secondly was the moderate amblyopia children, while the average time for children with mild amblyopia was the longest, and the comparison among each group was statistically significant. The accommodation amplitude and accommodation flexibility before and after treatment in the amblyopia group were significantly lower than those in the control group, while the accommodation lag was significantly higher than that in the control group. The accommodation amplitude and accommodation flexibility 3 months after treatment in the amblyopia group were significantly elevated, and those in children with mild and moderate amblyopia were significantly higher than those in children with severe amblyopia, while the accommodation lag was significantly reduced, and that in children with mild and moderate amblyopia was significantly lower than that in children with severe amblyopia. Conclusions: Amblyopia training for children with ametropic amblyopia can effectively improve the regulatory function, and is beneficial for the recovery.

1. Introduction
Amblyopia is highly occurring in children, and is associated with that due to refraction abnormality, the distant objects are unable to image on the retina, which can greatly affect the visual function[1]. According to the statistics[2,3], ametropic amblyopia accounts for more than 50% of amblyopia, and positive and effective early treatment is key to promote the visual function recovery, and improve the prognosis. The study is aimed to explore the effect of amblyopia training in regulating the amblyopic eye in children with ametropic amblyopia.

2. Materials and methods
2.1. Clinical materials
A total of 50 children with ametropic amblyopia who were admitted in our hospital from March, 2012 to February, 2014 for amblyopia training were included in the study and served as the amblyopia group (n=90), among which 28 were male, and 22 were female; aged from 4 to 10 years old; 40 had monocular amblyopia, and 10 had binocular amblyopia; 34 had mild amblyopia, 38 had moderate amblyopia, and 18 had severe amblyopia. All the children were in accordance with the related diagnostic criteria of ametropic amblyopia in the Expert Consensus of Amblyopia Diagnosis (2011)[4]. Those who had other eye disorder, mental disorders, consciousness disturbances, severe organic diseases, vital organ...
dysfunction or malignant tumor, and poor treatment compliance were excluded from the study. A total of 36 children with normal visions who came for physical examinations at the same stage were served as the control group (n=72), among which 20 were male, and 16 were female; aged from 5 to 10 years old.

2.2. Methods

2.2.1. Treatment methods
The amblyopia training was referring to the related operation specifications in the Expert Consensus of Amblyopia Diagnosis (2011), and guided by the same physician. According to the instructions of VP-V402 multi-functional amblyopia treatment apparatus, the amblyopia training was performed for 3 months.

2.2.2. Regulatory function detection methods
The comprehensive optometry unit was used to detect the regulatory function. The positive and negative spherical lens overturn method was used to detect the accommodation flexibility. The negative lens method was used to detect the accommodation amplitude. The integration crossed cylinder optometry was used to detect the accommodation lag. All the examinations were performed by the same physician.

2.3. Observation indicators
The clinical efficacy and average time to enhance 1 line LogMAR vision in children with different degrees of amblyopia were recorded. The regulatory function indicators of amblyopic eye were detected (accommodation flexibility, accommodation amplitude, and accommodation lag).

2.4. Statistical analysis
SPSS 19.0 software was used for the statistical analysis. The measurement data were expressed as mean ± SD, and the paired t test was used. P<0.05 was regarded as statistically significant.

3. Results

3.1. Comparison of the vision enhancing time in children with different degrees of amblyopia
The average time to enhance 1 line LogMAR vision in children with mild, moderate, and severe amblyopia was (26.3±3.5) h, (16.5±2.0) h, and (12.6±2.3) h, respectively. The average time to enhance 1 line LogMAR vision in children with severe amblyopia was significantly shorter than that in children with mild and moderate amblyopia (P<0.05). The average time to enhance 1 line LogMAR vision in children with moderate amblyopia was significantly shorter than that in children with mild amblyopia (P<0.05).

3.2. Comparison of the regulatory function detection results between the two groups
The accommodation amplitude and accommodation flexibility before and after treatment in the amblyopia group were significantly lower than those in the control group (P<0.05), while the accommodation lag was significantly higher than that in the control group (P<0.05). The accommodation amplitude and accommodation flexibility 3 months after treatment in the amblyopia group were significantly elevated (P<0.05), while the accommodation lag was significantly reduced (P<0.05) (Table 1).

3.3. Comparison of the regulatory function detection results before and after treatment in children with different degrees of amblyopia
The accommodation amplitude and accommodation flexibility results in children with different degrees of amblyopia before treatment were: mild > moderate > severe (P<0.05), while the comparison of accommodation flexibility

<table>
<thead>
<tr>
<th>Groups</th>
<th>Time</th>
<th>n</th>
<th>Accommodation amplitude</th>
<th>Accommodation flexibility</th>
<th>Accommodation lag</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amblyopia</td>
<td>Before treatment</td>
<td>90</td>
<td>11.96±1.32</td>
<td>5.26±0.48</td>
<td>1.72±0.35</td>
</tr>
<tr>
<td></td>
<td>After treatment</td>
<td>90</td>
<td>13.69±1.44</td>
<td>6.11±0.50</td>
<td>0.86±0.28</td>
</tr>
<tr>
<td>Control</td>
<td></td>
<td>72</td>
<td>15.36±1.53</td>
<td>6.72±0.68</td>
<td>0.26±0.13</td>
</tr>
</tbody>
</table>

*P<0.05, when compared with the control group; #P<0.05, when compared with before treatment.

<table>
<thead>
<tr>
<th>Time</th>
<th>Amblyopia degree</th>
<th>n</th>
<th>Accommodation amplitude</th>
<th>Accommodation flexibility</th>
<th>Accommodation lag</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before treatment</td>
<td>Mild</td>
<td>34</td>
<td>12.56±1.26</td>
<td>5.26±0.44</td>
<td>1.72±0.37</td>
</tr>
<tr>
<td></td>
<td>Moderate</td>
<td>38</td>
<td>11.34±1.11</td>
<td>5.24±0.46</td>
<td>1.73±0.36</td>
</tr>
<tr>
<td></td>
<td>Severe</td>
<td>18</td>
<td>9.63±1.06</td>
<td>5.25±0.45</td>
<td>1.74±0.36</td>
</tr>
<tr>
<td>After treatment</td>
<td>Mild</td>
<td>34</td>
<td>14.68±1.37</td>
<td>6.05±0.50</td>
<td>0.47±0.24</td>
</tr>
<tr>
<td></td>
<td>Moderate</td>
<td>38</td>
<td>13.18±1.20</td>
<td>5.82±0.43</td>
<td>0.66±0.35</td>
</tr>
<tr>
<td></td>
<td>Severe</td>
<td>18</td>
<td>11.90±1.14</td>
<td>5.30±0.45</td>
<td>1.03±0.36</td>
</tr>
</tbody>
</table>

*P<0.05, when compared with the mild amblyopia group; †P<0.05, when compared with the severe amblyopia group; ‡P<0.05, when compared with before treatment.
and accommodation lag was not statistically significant (P>0.05). The accommodation amplitude and accommodation flexibility 3 months after treatment in the amblyopia group were significantly elevated, and those in children with mild and moderate amblyopia were significantly higher than those in children with severe amblyopia (P<0.05), while the accommodation lag was significantly reduced, and that in children with mild and moderate amblyopia was significantly lower than that in children with severe amblyopia (P<0.05) (Table 2).

4. Discussion

The phenomenon of lens refraction ability changed with the viewing distance shifting when eyes watching the close objects is called the eye regulatory function in the clinic. In a normal condition, the binocular regulatory function is coordinating and unifying, the ciliary muscle will shrink when watching the objects from the distance to the near end, resulting in phakocele and increased refractive power, while the ciliary muscle will relax when watching the objects from the near end to the distance, resulting in reduced refractive power[6-8]. Some researches demonstrate that[9] the refraction state is closely associated with eye regulatory function, both of which are mutually correlated and affected. Most children with ametropic amblyopia are accompanied by abnormal eye regulatory function; therefore, it should receive attention.

It is reported that the regulatory dysfunction plays an important role in the occurrence and development of ametropic amblyopia[10,11], can cause the alternation vision, and inhibit the steroscopic vision. The vicious cycle will continuously reduce the accommodation amplitude, and the retinal image will disappear, finally leading to the irreversible damage. The results in the study showed that 50 children with ametropic amblyopia were accompanied by regulatory dysfunction in different degrees, with manifestations of regulatory fatigue, reduced accommodation amplitude and accommodation flexibility, and accommodation lag. The regulatory function examination can be served as an important indicator to measure the visual function, and provide evidences for ametropic amblyopia. Some scholars argue that[12,13] the lens elasticity will reduce with age, and the ciliary muscle strength will weaken with age, resulting in the reduced regulatory function[6]; therefore, positive and effective early treatment can maximumly enhance the clinical efficacy, and be beneficial for the recovery. Amblyopia training, as one of the effective ways of early interventions, can not only improve the visual function, enhance the visual sensitivity, and promote the great growth of visual levels, but also improve the regulatory function to a certain degree through enhancing the accommodation amplitude and improving the accommodation flexibility[14,15]. The results in the study showed that after amblyopia training, the improvement effect of accommodation amplitude and flexibility in children with amblyopia was still significantly different from that in the normal children (P<0.05), but was significantly elevated when compared with before treatment, indicating that the amblyopia training has a high application value in improving the regulatory function in children with ametropic amblyopia, and can be served as a supplementary means to combine with other methods to help the children return normal life[16].

In conclusion, amblyopia training for children with ametropic amblyopia can effectively improve the regulatory function, and greatly enhance the vision.

References