Orthoptic Treatment in the Management of Intermittent Exotropia

Abstract

**Purpose:** To evaluate the role of orthoptic treatments in the management of intermittent exotropia

**Methods:** In a retrospective study, clinical records of patients diagnosed with intermittent exotropia were reviewed. Patients with basic, convergence insufficiency (CI) and divergence excess (DE) types of intermittent exotropia who underwent orthoptic treatments were enrolled. Office treatments included prism exercises and pencil push-ups, and home exercises included pencil push-ups, 3D tests and dominant eye occlusion. Clinical evaluation of symptoms, binocular orthoptic status and maximum angle of deviation was done before treatment and at 8 weeks after the beginning of the treatment and at the time of last examination.

**Results:** Seventy four patients with a mean age of 18.4±12.2 years and mean follow-up of 13.5±10.1 weeks were included in the study. Forty three (58.1%) patients had a basic type of exodeviation, 22 (29.7%) had a CI type of exodeviation and 9 (12%) had a DE type of exodeviation. The treatment was successful in 88.3% of patients in basic type, all patients in CI type and 88.8% in DE group. Success rate was not significantly different between the three groups (P=0.25). Strabismus surgery was performed in one patient in basic type and one in DE group due to the lack of improvement.

**Conclusion:** Orthoptic treatment seems to be effective in reducing symptoms and improving signs of intermittent exotropia.

**Keywords:** Orthoptic Therapy, Intermittent Exotropia

Introduction

Intermittent exotropia is a common form of strabismus occurring in about 25% of all strabismic cases and in 1% of the general population. Its age of onset varies but is often between 6 months and 4 years. It is an ocular deviation that at times is completely controlled by positive fusional vergence and presents as an exophoria and at other times is not controlled by positive fusional vergence and presents as an exotropia. Although it has been reported to be a progressive disorder, the exact clinical course of intermittent exotropia is unclear. Interestingly, some authors believe that intermittent exotropia does not progress with age.

In view of the intermittent nature of the problem and unclear course of the disease, very often the patients are reluctant to accept as first choice the surgical form of treatment which therefore is avoided or delayed.
As an alternative, various non-surgical approaches to the problem have been tried with varied results.3-9 Regarding orthoptic management, a lot of controversy still exist.3-7 Some authors deny the role of orthoptic treatment,8 while others found it to be effective in certain types of intermittent exotropia,5-7,9 while still others considered that combined therapy (surgery with orthoptic treatments) is a better approach to attain long term stability of results.10,11

The purpose of this study was to determine if orthoptic treatments were effective in the management of intermittent exotropia.

Methods
In a retrospective study the clinical records of all patients diagnosed with intermittent exotropia for distance and/or near, attended to the strabismus clinic of Rassoul Akram Hospital from April 2005 to December 2006 were reviewed. The patients were subjected to a complete clinical evaluation including detailed history, cycloplegic refraction, corrected and uncorrected visual acuity, dilated funduscopy, ocular motility testing including cover test for near (33 centimeters) and distance (6 meters), prism cover test for near and distance, AC/A ratio and measurement of near point of convergence (NPC). All measurements were performed by one experienced orthoptist (NS). Patients with best corrected visual acuity (BCVA) equal to or greater than 20/25 OU at distance and near and willingness to wear eyeglasses or contact lenses to correct refractive error who saw crossing lines in the Bagolini test, were included in the study. Exclusion criteria were amblyopia, constant strabismus, history of strabismus surgery, vertical heterophoria more than 1 prism diopter (PD), any systemic diseases known to affect accommodation, vergence, and ocular motility, such as multiple sclerosis, Graves thyroid disease, myasthenia gravis, diabetes, and Parkinson disease, any ocular or systemic medication known to affect accommodation or vergence, manifest or latent nystagmus and attention deficit/hyperactivity disorder or learning disability.

Orthoptic exercises were practiced in the office and home. Office exercises included working with prism and pencil push-ups. In the prism exercises we make the patient to converge until he or she encounters diplopia. We put base-out prisms in front of one eye, doing the exercise and then changing the eye and repeating the exercise. Then prism power will be lessened 1-2 PD until diplopia is lifted. If it is not lifted, patient then is made to convergence by either telling him/her to look at the point of his/her nose or with the help of a pencil by bringing it forth towards his/her eyes. Just as diplopia is removed, the power of prism is increased so that diplopia appears again. This should be done again and again until diplopia could not be removed. This condition shows that we have reached to the maximum convergence. This exercise should be done 3-4 times for each eye both for far and near. If degree of deviation was less than 20 PD for far and near, the office exercises were scheduled weekly for one month and twice in a month for the second month followed by monthly for three months. If degree of deviation was more than 20 PD, weekly office exercises were performed for two months followed by every two weeks for the next month. The treatment was also begun at home from the first session. This included pencil push-ups (for diplopia awareness) and 3D Stereogram tests. Dominant eye occlusion for 0.5-1 hour daily was also performed for patients who had suppression. Patients were taught a pencil push-up procedure that included monitoring for suppression. Patients were instructed to hold a pencil at arm’s length directly between their eyes, and an index card, serving as a suppression control, was placed on the wall 2 to 3 meters away. Patients were instructed to look at the very tip of the sharpened pencil and to try and keep the pencil point single while moving it toward their nose. If the cards in the background disappeared, patients were instructed to stop moving the pencil and blink their eyes until both cards were present. Patients were told to continue moving the pencil slowly toward their nose until it could no longer be single and then to try and get the pencil point back into 1. If patients were able to regain single vision, they were asked to continue moving the pencil closer to their nose. If patients could not get the pencil back to 1, they were instructed to start the procedure again. Patients were instructed to do 3 sets of 20 pencil push-ups per day at home. Three D vision tests (stereogram) are
images which show two approximately equal images drawn or taken from two different angles and unification of these two images induces a 3D image to the viewer. Three D exercises were performed once daily. Orthoptic treatment was tapered according to the response of patient. If there was no response after 12 months, the treatment was stopped.

Success was defined as relieve of presenting symptoms associated with improvement in ocular deviation or a deviation less than 10 PD of exotropia. Clinical evaluation of symptoms, binocular orthoptic status and maximum angle of deviation was done at 4 and 8 weeks and at the time of last examination.

Data were entered using SPSS version 11.5 for Windows (SPSS Inc., Chicago, IL, USA). T-test and Chi square test were used for statistical analysis. A P-value less than 0.05 was considered statistically significant.

Results
Seventy four patients including 18 males and 56 females with a mean age of 18.4±12.2 years (range 4-54) were evaluated. Sixty four patients (86.4%) completed 4 weeks of follow-up. The mean±standard deviation (SD) follow-up was 13.5±10.1 (median 8) weeks. The most frequent complaint was of intermittent squint in 67.2%, followed by eye strain in 23% and diplopia in 9.8%. Forty three (58.1%) patients had a basic type of exodeviation, 22 (29.7%) had a convergence insufficiency (CI) type of exodeviation and 9 (12%) had a divergence excess (DE) type of exodeviation. Table 1 summarizes the characteristics of each group.

The treatment was successful in 88.3% of patients in basic type and all patients in CI type and 88.8% in DE group. Strabismus surgery was performed in one patient in basic type and one in DE group due to lack of improvement. No significant difference was found between the three groups regarding the rate of success (P=0.25).

There was a significant reduction of the angle of near and far deviations at 8-week and last follow-up, in basic type intermittent exotropic patients (P<0.001). In CI type patients, 8-week and last follow-up measured angle of near deviation were significantly less than baseline measurements (P<0.001). In DE group, significant difference was found between baseline distant measurements and follow-ups (P=0.004 for 8-week and P=0.024 for last measurements). Mean NPC measured at last follow-up was significantly less than baseline measurement in the basic and CI types (P<0.001), however, no significant difference was found in DE type (P=0.9). At the end of follow-up no recurrence more than 10 PD was observed in either group.

Table 1. Data of patients with intermittent exotropia, treated by orthoptic exercises

<table>
<thead>
<tr>
<th></th>
<th>Basic type</th>
<th>Convergence insufficiency</th>
<th>Divergence excess</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean angle of baseline distant deviation (D)</td>
<td>20.2±9.2</td>
<td>0.47±1.2</td>
<td>16.7±6.3</td>
</tr>
<tr>
<td>Mean angle of baseline near deviation (D)</td>
<td>24±12.4</td>
<td>17±3.9</td>
<td>1.1±2.2</td>
</tr>
<tr>
<td>Mean of baseline near point of convergence (cm)</td>
<td>11.9±6.5</td>
<td>18.6±11.7</td>
<td>8±1.7</td>
</tr>
<tr>
<td>Mean angle of 8 weeks distant deviation (D)</td>
<td>7.3±6.6</td>
<td>0.00</td>
<td>5.1±3.8</td>
</tr>
<tr>
<td>Mean angle of 8 weeks near deviation (D)</td>
<td>6.8±6.6</td>
<td>4.8±3</td>
<td>0.00</td>
</tr>
<tr>
<td>Mean angle of last distant deviation (D)</td>
<td>7±8</td>
<td>0.00</td>
<td>3.7±7.7</td>
</tr>
<tr>
<td>Mean angle of last near deviation (D)</td>
<td>7.1±7.5</td>
<td>6.5±6</td>
<td>0.00</td>
</tr>
<tr>
<td>Mean of last near point of convergence (cm)</td>
<td>4.6±1.2</td>
<td>5.4±2</td>
<td>5±0.1</td>
</tr>
</tbody>
</table>
Discussion

The clinical course of intermittent exotropia is unclear. It has been reported to be a progressive disorder. Progression or deterioration over time may take different forms. The intermittent exotropia may increase in size, may spread to another fixation distance, may become more frequent, or may become constant with loss of binocular vision and stereopsis.\textsuperscript{1} Some of the factors leading to progression include decreased tonic convergence, decreased accommodation, suppression and increased separation of the orbits with age.

Treatment interventions for intermittent exotropia are aimed at establishing binocular alignment and preserving or establishing binocular single vision.\textsuperscript{11} The treatment of choice for intermittent exotropia is still unclear.\textsuperscript{1,11} In some centers, intermittent exotropia is considered to be a surgical condition with only decision being whether or not to operate.\textsuperscript{11} At other institutions, more emphasis is placed on the sensory aspects of retaining binocularity. Treatment approaches include: overminus lenses; feedback training to improve range of sensory fusion; occlusion therapy; (antisuppression treatment); horizontal rectus surgery with/without oblique muscle surgery for A or V pattern exotropia; and prism therapy.\textsuperscript{11}

Some studies imply that observation may be ideal in some patients with intermittent exotropia (particularly small angle strabismus). Von Noorden\textsuperscript{12} followed 51 patients with intermittent exotropia who were not treated for an average of 3.5 years. In 25% of the cases the intermittent exotropia either remained unchanged or improved. Rutstein and Corliss\textsuperscript{1} in a recent retrospective study on 73 patients, concluded that exodeviations did not progress with age and approximately 36% cases were phoric/orthophoric at the last visit (mean follow-up: 10 years). Chia et al\textsuperscript{13} reported that without treatment, 18% of patients with intermittent exotropia for distance and 6% of patients with intermittent exotropia for near improved to orthophoric state (initial exodeviation averaged 36 PD for far, 26 PD for near). Hiles et al\textsuperscript{14} studied the course of 48 exotropia patients (mean follow-up: 11.7 years) and observed that 65% improved to exophoria <20 PD without any treatment.

On the other hand, some studies emphasize the need for intervention for patients with intermittent exotropia. Carta et al\textsuperscript{15} evaluated treatment of intermittent exotropia patients divided into four groups: orthoptic exercise, surgery, exercises combined with surgery and no therapy. Highest failure rates were observed in patients not treated.

Another group of studies, report the effect of combining orthoptic exercises with surgery versus surgery alone. Hardesty et al\textsuperscript{16} in a review of the long-term results of 100 surgically-treated intermittent exotropia cases (mean follow-up: 6.1 years), reported a 50% success in patients treated with surgery and orthoptic treatments and a 32% success with surgery alone. Higher success rates of surgery with vision/occlusion therapy over surgery alone were also reported by Cooper and Leyman.\textsuperscript{10} They reported success rate of 42% for surgery alone and 52% for combined surgery and vision therapy group. However, Velez\textsuperscript{17} observed a 40.2% (29/72) success in patients who had surgery and preoperative orthoptic treatments and 41.1% (14/34) in patients who had surgery only.

Some studies indicate that orthoptic exercises alone are useful in the management of patients with intermittent exotropia. In one clinical series of 31 exotropes, most having constant deviations, Sanfilippo and Clahane\textsuperscript{18} reported a success rate of 64% with vision therapy alone after 4.5 years.

Fournier and colleagues\textsuperscript{19} treated 35 of their 65 patients with either vision therapy, prisms, or over-minus lenses and reported that the average distance exotropia decreased from 21 PD to 15.6 PD, whereas for the 30 patients not receiving treatment, the magnitude remained relatively stable. In a study conducted by Freeman and Isenberg,\textsuperscript{20} all of 11 exotropes undergoing part-time occlusion of the dominant eye from 4 to 6 hours a day, converted to hetero- or orthophoria, at least temporarily. In the study done by Suh et al\textsuperscript{21} on 44 children with basic type and 26 children with convergence-insufficiency type intermittent exotropia, after 3 months occlusion for 3 hours each day, the near deviation measurements decreased significantly in both the basic and convergence-insufficiency type of intermittent...
exotropia. The reduction of the exoangle was greater on the near measurement than on the distance measurement during the 3 months of patching. These results indicate fissional ability increases with part-time occlusion therapy, especially with regard to the near measurements. In a retrospective study of 673 cases, Cooper and Leyman\textsuperscript{10} reported that orthoptic treatments alone had the highest success rate (59\%) and lowest failure rate (5\%), as compared with the three other therapeutic approaches; occlusion only, surgery only and orthoptic treatments and surgery. In a recent randomized controlled study of 60 adult patients with CI, Birnbaum et al\textsuperscript{22} found that office-based vision therapy was successful in 61.9\% of patients while home-based vision therapy was successful in only 10.5\% of patients.

Convergence exercises, by increasing the range of fusional vergence, correct the CI form of intermittent exotropia.\textsuperscript{5-7} Occlusion therapy limits binocular stimulation, avoiding and correcting abnormal retinal correspondence and suppression.\textsuperscript{14} Patching has sensory and motor effects on intermittent exotropia: sensory effects are a reduction in scotoma size (measured on haploscopic devices) and motor effects are improved fusional amplitudes.\textsuperscript{15}

The current study reports a high successful treatment rate for intermittent exotropia after orthoptic therapy at a mean of 7-month follow-up. Our results confirm the work of others\textsuperscript{5-7,9} who have studied the effect of orthoptic treatment. In spite of these publications, sensory treatment of intermittent exotropia is still largely ignored in many parts of the world.\textsuperscript{11}

Our study has some limitations. The sample size was small specially in DE and CI groups. Also, lack of control group and short term follow-up precluded definite conclusion. Moreover, 86.4\% of our patients completed 4 weeks of follow-up. This may be due to the incompliance of the patients to the orthoptic treatments or reflect the fact that many of our patients come from far cities that make returning for scheduled follow up difficult. This should be considered in treatment planning. In our study, some measurements in 8 weeks of follow-up were better than final measurements. This may be due to the temporary effect of orthoptic treatment and needs further investigations. Also, we didn’t observe any case of recurrence more than 10 PD during follow-up. This may also be due to incomplete and different course of follow-up. The high rate of success in our study should be considered carefully since its possible limitation such as retrospective design and variable follow-up period as well as those mentioned previously, may affect its precision. We recommend prospective controlled clinical trials to elucidate the definite role of orthoptic treatments in the management of intermittent exotropia, however, based on the results of this study, it would appear that orthoptic treatments is effective for achieving clinically significant improvements in the symptoms or signs associated with intermittent exotropia.

**Conclusion**

In summary, intermittent exotropia improved both quantitatively and qualitatively for many of our patients. Intermittent exotropia may not be a progressive disorder for many patients. A long-term prospective study that carefully monitors the magnitude and quality of intermittent exotropia is needed to add to our knowledge of this type of strabismus.

**References**