

# Is it possible to differentiate early-onset accommodative esotropia from early-onset essential esotropia?

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## Abstract

**Purpose** To determine the frequency of  $\geq 2.50$  diopter (D) hyperopia in infantile esotropia with onset up to the age of 6 months and by evaluating the treatment results of these cases retrospectively, to find the factors that may help to differentiate early-onset accommodative esotropia from early-onset essential esotropia.

**Methods** The charts of 256 patients with infantile esotropia were reviewed. Thirtyseven cases, with hyperopia of  $\geq 2.50$  D, no other systemic and neurologic disease, and at least 1 year of follow-up, were included in this study. The age at the start of therapy, refractive error, deviation angle, type of therapy (antiaccommodative therapy, surgery) and the presence of amblyopia, latent nystagmus, inferior oblique overaction, dissociated vertical deviation and cross-fixation were recorded for each case.

**Results** The prevalence of high hyperopia was found to be 14.4% (37/256) in infantile esotropia. In 18 of the cases (48.6%), antiaccommodative therapy alone was found to be adequate (Group I). In the remaining 19, although antiaccommodative therapy was found to decrease the deviation angle significantly ( $P < 0.001$ ), surgery was also required (Group II). Groups were compared with respect to age at the initial examination, refractive error, deviation angle, presence of amblyopia, anisometropia, and inferior oblique overaction, but no factor could be determined to predict the pure refractive ones ( $P > 0.05$ ). Essential infantile esotropia-associated findings did not help because they are rarely evident at the time of initial diagnosis.

**Conclusions** Half of the high hyperopic infantile esotropes could be corrected fully by antiaccommodative therapy alone, while the remaining ones could also benefit significantly. It is strongly recommended to try spectacles at first in the treatment of infantile esotropia with hyperopia  $\geq 2.5$  D.

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**Keywords:** infantile esotropia; accommodation; antiaccommodative therapy; surgery

## Introduction

The onset of accommodative esotropia, whether refractive or nonrefractive, usually occurs between the ages of 6 months and 7 years: the average age of onset is 2.5 years.<sup>1</sup> However, occasionally it may occur under the age of 1 year.<sup>1–4</sup> It has become apparent through the work of Haynes *et al*<sup>5</sup> and Marg *et al*<sup>6</sup> that accommodation and good vision are present in the first 2–3 months of life. There is a problem in infantile onset esotropes with high hyperopia. If we classify them as essential infantile esotropia, then we have to operate them as soon as possible to give the child a chance to develop binocularity in the sensitive period. If we classify them as accommodative esotropia, then we have to give antiaccommodative therapy. These cases could only be differentiated retrospectively after an antiaccommodative therapy trial. This study evaluates the response to the antiaccommodative therapy in these cases, and looks for any clues to differentiate early-onset accommodative esotropia from early-onset essential esotropia at the beginning of the therapy.

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## Methods

Records of 356 infantile esotropes seen during a 5-year period from 1995 to 2000 were reviewed retrospectively. Thirtyseven cases who fulfilled the following criteria were identified: onset of esotropia prior to 6 months of age confirmed by the photographs or ophthalmologic examination, refractive error (spherical equivalent)  $\geq +2.5$  D, at least 1 year follow-up, no other neurologic abnormality or systemic disease.

Patients were divided into two groups, based on the response to antiaccommodative therapy: 18 cases, in whom antiaccommodative treatment alone suffice, were grouped as Group I, and 19 cases, in whom besides antiaccommodative treatment surgery was also needed, were grouped as Group II. A complete ocular examination was performed and full refractive error was prescribed in each patient. Each patient was seen on at least two occasions after spectacles had been worn for at least 6 weeks. Krinsky and prism cover tests were used to measure the deviation angles.

Ages at the start of therapy, spherical equivalents of the refractive errors of the two eyes averaged together, angles of deviation before and after spectacles, prevalence of amblyopia, anisometropia and essential infantile esotropia-associated findings like cross-fixation, latent nystagmus (LN), dissociated vertical deviation (DVD), inferior oblique overaction (IOOA) were noted for each patient, and a comparison was made between the groups with respect to these parameters to see if they help to differentiate refractive and essential forms of infantile esotropia.

## Results

The prevalence of high hyperopia ( $\geq 2.50$  D) was found to be 14.4% (37/256) in infantile esotropia. In 18 of the cases (%48.6), antiaccommodative therapy alone was found adequate (Group I). In the remaining 19, although

antiaccommodative therapy was found to decrease the deviation angle significantly ( $P < 0.001$ ), surgery was also required (Group II). The mean age at the start of therapy was 24 months (2–48) in the first group and 22 months (2–60) in the second group (Table 1). (Mann–Whitney U test,  $P > 0.05$ ). The mean refractive errors were  $+4.44$  D (2.50–9.00) and  $+4.18$  D (2.50–7.50) in the groups, respectively. We compared the refractive errors to see if they had any determining role in the management, but found no difference (Mann–Whitney U test,  $P > 0.05$ ). Deviations at the start of therapy without glasses were found to be 45.00 PD (20–70) and 54.84 PD (20–90) in the groups, respectively. Although it was higher in the second group, it did not carry statistical importance (Mann–Whitney U test,  $P > 0.05$ ). After full correction, deviation angles were reduced within 10 PD in all patients of the first group. Esotropias were also reduced to smaller angles (40.42 PD (20–70)) in most of the patients in the second group (Wilcoxon matched pairs,  $P < 0.05$ ). Deviations did not change after a spectacle trial of at least 6 weeks in only two patients, others had at least 10 PD reduction and another patient had 30 PD esotropia recurrence after initial improvement to orthophoria, although he continued to wear full corrected glasses.

At the start of therapy, 11 and nine patients were amblyopic in the groups, respectively. After occlusion treatment, four of the patients in each group were still amblyopic. The prevalences of it in the groups before ( $\chi^2$  test,  $P > 0.05$ ) and after (Fisher's exact test,  $P > 0.05$ ) occlusion treatment were found to be similar. Anisometropia of 1.5 D or more was found in three cases in both the groups (Fisher's exact test,  $P > 0.05$ ).

The characteristics of essential infantile esotropia were looked for in the groups to see if they were helpful to distinguish early-onset accommodative and essential esotropes. The prevalence of IOOA was not different in the groups ( $P > 0.05$ ). It was observed in two and four cases in the groups, respectively. Since there was a high

**Table 1** Comparison of the spectacle-only Group (I) and the combined spectacles and surgery Group (II) with respect to several factors

Criteria for comparison	Group I (n=18)	Group II (n=19)	P
Mean age at the start of therapy (month)	24.61 ( $\pm 14.17$ ) (5–48)	22.68 ( $\pm 16.58$ ) (2–60)	0.603
Mean hyperopia (diopter)	4.44 ( $\pm 1.90$ ) (2.50–9.00)	4.18 ( $\pm 1.42$ ) (2.50–7.50)	0.842
Mean deviation angle (prism diopter)	45.00 ( $\pm 13.82$ ) (20–70)	54.84 ( $\pm 20.89$ ) (20–90)	0.152
Amblyopic cases	11 (61%)	9 (47%)	0.401
Amblyopic cases after occlusion	4 (22%)	4 (21%)	0.621
Anisometropic cases	3 (17%)	3 (16%)	0.643
Cases with IOOA	2 (11%)	4 (21%)	0.356
Cases with DVD	1 (5%)	7 (37%)	0.025
Cases with LN	0 (0%)	4 (21%)	0.058
Cross-fixating cases	2 (11%)	3 (16%)	0.526

IOOA, inferior oblique overaction; DVD, dissociated vertical deviation; LN, latent nystagmus.

prevalence of amblyopia at the presentation, cross-fixation was not observed too often. Two of the cases in the first group and three of the cases in the second group were cross-fixating at the presentation (Fisher's exact test,  $P > 0.05$ ). LN and DVD were more frequently observed in the second group. Seven cases had DVD, and in two of them LN was also present. One case had only LN without DVD in the second group. In the first group, no case demonstrated LN and only one case demonstrated DVD. Although LN could not be found statistically more prevalent in the essential group, maybe because of small sample sizes, it may be helpful to distinguish if present (Fisher's exact test,  $P > 0.05$ ). DVD was also more prevalent in the essential group (Fisher's exact test,  $P < 0.05$ ), but did not help to differentiate at the start of therapy since DVD did not appear at the first presentation of the patients.

## Discussion

It was shown that approximately 40–60% of infantile esotropes, if operated on early, go on to develop the monofixation syndrome,<sup>7</sup> meaning they acquire normal fusional vergences, which provide a stable ocular alignment for them throughout their lives.<sup>8</sup> On the other hand, an increasing age at the completion of treatment tended to move the patients away from the monofixation syndrome and into the less desirable microtropia and small-angle esotropia or exotropia groups.<sup>8</sup> It was also suggested that optimum timing of surgery might be 2.5–3 months of age to obtain good binocular vision.<sup>9–11</sup> However, high hyperopic esotropic infants are the problematic cases, hyperopia may add an accommodative part to the deviation angle or hyperopia alone may be responsible from the whole deviation of them. It is difficult to decide what to do: immediate surgery so as not to miss the sensitive period or spectacles. In this study, we looked for some clues, by retrospectively evaluating high hyperopic infantile esotropes, to make this decision easily.

We found that 14.4% of infantile esotropes were 2.5 D or more hyperopic, and 49% of these cases could be aligned with the hyperopic correction alone; on the other hand, 51% of them need surgery eventually although spectacles provide a significant reduction in the deviation angles of most of them. However, this reduction in the deviation angle changed the surgical plans and perhaps prevented future consecutive exotropia in some cases. It was proved in this study that approximately 90% of the infants, who were  $\geq 2.50$  D hyperopic and developed esotropia in the first 6 months of life, have an accommodative component in their esotropia to some extent and must be treated accordingly. There are other studies proving the existence of the

accommodative component in the infantile esotropes.

Two studies reported a total of 17 cases who had infantile onset esotropia and  $> 2.25$  D hyperopia; in eight (47%) of these, deviation could be fully corrected with spectacles alone.<sup>2,3</sup> If refractive errors of these cases are not corrected at the initial management, they may develop accommodative esotropia after surgical management and may need antiaccommodative therapy during the follow-up period. Several studies showed 28–42% rates of redevelopment of esotropia, which was responding spectacle correction after surgical management of infantile esotropia in a follow-up period ranging from 6 months to 4.5 years.<sup>12–14</sup> The incidences in the reported series of consecutive exotropia ranged from 4 to 20% and initially uncorrected high hyperopia was found to be one of the responsible factors in the development.<sup>15,16</sup>

This study showed that neither the size of the deviation nor the amount of refractive error could help differentiate infantile accommodative esotropes from infantile essential esotropes at the beginning of the therapy. The incidence of amblyopia was almost similar in the groups before and after occlusion treatment. The prevalences of anisometropia were also similar in both groups. They were also not found helpful in differentiating these groups of infantile esotropes.

Cross-fixation, IOOA, LN, DVD are the other characteristics known to be closely associated with essential infantile esotropia. In this study, cross-fixation was not observed too often since most of the patients had already developed amblyopia at the initial examination. The distribution of cross-fixating patients in the groups was not different. Prior series of congenital esotropia patients have reported a wide range of incidence of DVD, ranging from 51 to 92%.<sup>8,10,17,18</sup> The incidence increases as the follow-up period increases.<sup>10,17</sup> It is characterized as a response to a failed mechanism of fusion.<sup>10,17</sup> In this study, the prevalence was 5% in the pure accommodative group, and 37% in the presumed essential group after 1–5 years follow-up. Although it was observed more often in the presumed essential group, it could not help us differentiate cases at the start of therapy because it is a time-related phenomenon and there is a latent period for its development. Like DVD, IOOA was also a finding closely associated with essential infantile esotropia and its onset is also time related. Hiles *et al*<sup>10</sup> noted the onset of IOOA to be most frequent during the second year of life with a mean rate of 33% per year; the greatest occurrence was during years 3 and 7. The incidence of it in patients with essential infantile esotropia has been reported to be 68–78%.<sup>10,19</sup> In this study, the prevalences of IOOA in the pure accommodative and presumed essential infantile groups were 11 and 21%, respectively. LN was the last finding that was looked for in the groups in this study. It was observed in 21% of the presumed

infantile group, but none in the pure accommodative group. Its incidence in essential infantile esotropes has been reported to change from 10 to 50%.<sup>8,20</sup> It may be helpful, if it exists, to differentiate infantile esotropia.

In conclusion, pure accommodative esotropia is not rare in the infantile period. It occurs almost in 50% of the cases with  $\geq 2.5$  D hyperopia. No helpful clues could be found to differentiate these cases from high hyperopic essential infantile esotropic cases. Essential infantile esotropia-associated findings did not help because they are rarely evident at the time of initial diagnosis. However, this study showed that almost 90% of cases having  $\geq 2.5$  D hyperopia may benefit from antiaccommodative therapy as the initial management, and almost 50% of them could be corrected fully by antiaccommodative therapy alone. So, it is strongly recommended to try spectacles in the treatment of infantile esotropia with hyperopia  $\geq 2.5$  D. Surgery should be planned to the part of deviation that the spectacles failed to control after 2–3 months of trial period. Since these patients do not have normal binocular reflexes, spectacles should be continued to be worn after the surgery to prevent the development of superimposed accommodative esotropia and refractive amblyopia.

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