

Monocular visual outcome in untreated early onset esotropia

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Abstract

The incidence of amblyopia was analysed in a group of 20 patients with early onset esotropia. These patients reached adulthood without any form of previous treatment. The incidence of amblyopia was compared in a group of 20 patients who received conventional treatment, including occlusion and early surgical alignment. Only three patients (15%) in the untreated group presented with amblyopia, compared with 16 (80%) in the treated group. After treatment 35% of the control group remained amblyopic. Spherical anisometropia of more than 2 dioptres was present in two of the patients with amblyopia in the untreated group, but was not associated with amblyopia in the control group. Early surgical alignment permits the development of peripheral fusion, allowing long term alignment stability, but amblyopia appears to be more common after surgical alignment.

(*Br J Ophthalmol* 1993; 77: 492-494)

The current management of infantile esotropia often consists of surgical alignment of the eyes after amblyopia therapy. Studies have shown that alignment by the age of 2 years improves the likelihood of developing fusion.¹⁻³ The presence of fusion in turn allows long term stability of alignment.^{4,5}

In developing countries where health care standards remain low, infantile strabismus may be left untreated. We examined a group of immigrants from south east Asia who received no medical or orthoptic treatment for early onset strabismus. These patients offer a rare opportunity to study the visual outcome of untreated, early onset esotropia.

Patients and methods

Between January 1982 and March 1992 20 patients with a history of early onset strabismus and no previous medical or orthoptic treatment were seen in this department. These patients were all seeking improvement in their cosmetic appearance. All but two had emigrated from Vietnam, Laos, or Cambodia. Their average age was 20.3 years (range 12-34 years). There were 15 males and five females (Tables 1 and 2).

A full ocular examination including cycloplegic refraction was performed by at least one of us (WVG, CSH). The angle of strabismus was measured using the prism cover/uncover technique. Patients were classified as amblyopic if there was a difference of two lines or more in the best corrected visual acuity of each eye.

We reviewed the records of 20 patients with infantile esotropia who were treated conventionally and followed from 11 months to 8 years and 10 months (mean 4 years and 5 months), to verify the incidence of amblyopia in this group of patients. Patients were considered to have amblyopia in the course of treatment if they presented fixation preference, or if there was a difference of two lines or more in the best corrected visual acuity of each eye. These patients were chosen in a consecutive fashion, but only those patients who received surgical care were included.

No other neurological or craniofacial anomaly was identified in any of the patients in this study.

Results

All patients were esotropic, with an angle of deviation ranging from 45 to 70 prism dioptres and a mean of 57 prism dioptres. The angle of

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Accepted for publication 19 March 1993

Table 1 Patients with untreated early onset esotropia and no amblyopia

Case	Sex	Age	Deviation (prism dioptres)	Cycloplegic refraction	Comments
1	M	16	55	+1.00	
2	M	25	70	+1.00 plano+0.50×90 plano+0.75×90	Brother accommodative esotropia
3	M	21	50	1.75	
4	M	12	55	+0.25+0.25×180 +0.25+0.25×180	
5	M	19	60	-1.00+1.75×80 -0.75+1.50×100	Bilateral inferior oblique overaction
6	F	14	45	+1.00+0.50×180 +0.75+0.50×180	Dissociated vertical deviation
7	M	20	60	-0.50+0.75×75 -0.75+0.75×135	
8	M	34	55	+0.50 +0.75	
9	F	19	45	+0.75 +0.75	
10	M	16	60	+2.25 +2.00	V pattern
11	M	36	60	-3.00+0.50×170 -1.75+1.00×10	
12	M	21	55	plano+1.00×80 plano+0.75×110	
13	F	15	60	+0.25+1.00×180 +0.25+0.75×180	
14	M	27	65	-0.50+1.00×90 -0.25+0.75×90	Dissociated vertical deviation
15	F	16	50	+1.25 +1.00	
16	M	23	55	plano+0.25×90 plano+0.25×90	
17	M	60	60	-0.50 -0.50	

Table 2 Patients with untreated early onset esotropia and amblyopia

Case	Sex	Age	Deviation (prism dioptres)	Cycloplegic refraction	Visual acuity
1	M	24	60	+0.50+1.00×180 +2.75+1.75×180	20/20 20/200
2	M	17	55	+0.50 +0.50	20/70 20/20
3	F	26	65	-0.50+0.75×90 -2.50+0.50×85	20/20 20/100

Table 3 Patients submitted to conventional treatment

	Amblyopia	No amblyopia
Preoperatively (%)	4 (20)	16 (80)
Postoperatively (%)	16 (80)	4 (20)
Final (%)	7 (35)	13 (65)

strabismus and refraction of each patient is shown in Tables 1 and 2.

Amblyopia was detected in three of the 20 patients (15%) (Table 2). These three patients had a corrected visual acuity of 20/20 in the preferred eye, while the vision in the amblyopic eye ranged from 20/70 to 20/100. Dissociated vertical deviation was detected in two patients and inferior oblique overaction in one. Thirteen patients had latent nystagmus.

Two amblyopic patients (cases 1 and 2) had more than 2 dioptres of spherical anisometropia. The third amblyopic patient (case 3) had the same refractive error in each eye.

In the 17 patients with no amblyopia, the difference in the spherical portion was 0.25 dioptres in seven patients and 1.75 dioptres in one patient. There were no patients with a difference greater than 0.25 dioptres of astigmatism in each eye, and no asymmetry in the angle of the cylinder.

In the group of 20 patients submitted to conventional treatment, four (20%) patients had amblyopia before surgery (Table 3). After surgery 16 patients (80%) required occlusion because of amblyopia during follow up. Only seven (35%) patients remained amblyopic at the last visit (Table 3). There was no spherical or cylindrical anisometropia greater than 0.5 dioptres in this group.

Discussion

Treatment of early onset esotropia is designed to achieve good visual acuity in both eyes, to obtain a degree of binocular vision, and to align the eyes. Occlusion is used to treat amblyopia. Surgical alignment is undertaken when amblyopia has been successfully treated. The results of this method of management of infantile esotropia show that ocular alignment can be achieved in 50–80% of cases.^{1,2,6} Some form of binocularity is present in 48–70%.^{1,3,7} Surgical correction may even result in improvement of fine motor skills and motor maturation.⁸

Despite the satisfying results and indications for early surgery, the surgeon risks inducing amblyopia in patients who are successfully surgically aligned. Costenbader found that 41% of patients treated for congenital esotropia were amblyopic.⁶ Others have reported an incidence of amblyopia after treatment ranging from 20 to 51%.^{9,10} When postoperative amblyopia was studied using vision evoked potential measurements, the incidence was 61% (*v* 20% preoperatively).¹¹

We had the opportunity to examine 20 adult patients with untreated early onset esotropia who had immigrated to the United States from Asia. These patients offered us the unusual opportunity to evaluate the natural history of early onset esotropia, and to assess visual outcome. We compared this adult immigrant population

with a group of children who received early surgical therapy. Amblyopia was present in three (15%) untreated, adult patients. This finding supports the study by Murray and Calcutt in which amblyopia was uncommon in untreated early onset esotropia.¹² Two of our patients had anisometropia of 2.0 and 2.25 dioptres respectively. In the control group amblyopia occurred in 20% before surgery, but in 80% after surgical treatment; 35% of the control group remained amblyopic after treatment. Two patients in the study group had dissociated vertical deviation (DVD) and one had inferior oblique overaction.

Inclusion in the study group of patients was based on history and physical findings. The patients would probably have been diagnosed with early infantile esotropia. It is unlikely that these patients had a heterogeneous mix of different types of esotropia. The angle of deviation in the study group was large, with no significant abnormality of the AC/A ratio or accommodative component to the esotropia. The refractive errors in the study group of patients were, for the most part, low. Most children with accommodative esotropia will remain hyperopic in adulthood.¹³ Furthermore, 13 patients had latent nystagmus, a finding consistent with a diagnosis of early infantile esotropia.

The incidence of vertical strabismus abnormalities in our patients was low; DVD occurred in 10%, whereas in other reports looking at young patients, the incidence has been as high as 76%.⁷ DVD is a variable problem and its evaluation is often highly subjective. The low incidence in our report could indicate that our patients are different from others with early onset esotropia. More likely, the natural history of DVD is one in which improvement occurs. Parks¹⁴ has commented on this possibility and noted that DVD frequently disappears by the age of 8. Harcourt *et al*¹⁵ found no change in the incidence of DVD in children followed for an average of 7.3 years. However, this study found a very low incidence (2%) of DVD requiring surgery and did not follow patients to adulthood. It may be that DVD is expressed after surgical alignment and is uncommon in untreated infantile esotropes.

Inferior oblique overaction (IOOA) was also uncommon (5%) in our study group of patients. This compared with an incidence of nearly 75% reported in other studies in which children were examined.^{7,16} Wilson and Parks¹⁶ noted that children who underwent surgery for horizontal alignment were more likely to develop IOOA. Some of our patients could have been spared IOOA by not having had prior surgery. Our study also suggests a possible decline with age in the incidence of IOOA associated with early onset, untreated esotropia.

Why was the incidence of amblyopia low in our study group compared with the control group (80% after surgery) (Table 2)? One risk factor for amblyopia could be asymmetric IOOA,¹⁷ a finding not present in our adult group. Asymmetric IOOA could lead to amblyopia, purely on the basis of motor factors. A hyper-tropic eye is at risk for amblyopia.

Amblyopia was often diagnosed by the fixation reflex in the control group of children. This test may overestimate the incidence of amblyopia

when the angle of strabismus is large, particularly if the point at which cross fixation occurs is not carefully observed.¹⁸ We only diagnosed amblyopia by cross fixation testing when cross fixation occurred beyond the midline.

Fixation reflex testing may also overestimate the incidence of amblyopia in patients with small angles of deviation. Some members of our control group were diagnosed with amblyopia via fixation reflex. Unfortunately, there is no entirely reliable method for ascertaining amblyopia in preverbal children, particularly with small angles of deviation. Visually evoked potential studies tend to be too sensitive,¹¹ and forced preferential looking techniques may underestimate the incidence of amblyopia.^{19,20}

When amblyopia was determined by Snellen acuity measurements in the untreated adult group, the incidence was low. This group showed cross fixation patterns characteristic of preverbal, presumably non-amblyopic children – that is, they cross fixated at the midline. This finding suggests that midline cross fixation (*v* off centre) is an accurate method for detecting amblyopia.

Our study shows that large angle esotropia usually protects the patient from amblyopia. Some studies have indicated a high incidence of amblyopia in young children who cross fixate.^{7,11} Our study indicates that left untreated, many develop normal, equal vision¹⁸ in their two eyes. Our explanation for this is as follows. Both maculae will experience visual stimulation in cross fixation, albeit one may be stimulated more than the other if cross fixation occurs beyond the midline. At first this situation may cause amblyopia. But note that even when vision is equal in both eyes, it is usually below average (early on) in children with early infantile esotropia.²¹ Part time visual stimulation of the amblyopic eye is analogous to part time occlusion. As time passes, the cross fixating child develops equal, bilateral vision and is more content to cross fixate at the midline position.

Macular stimulation may be pre-empted in children with small angles of esotropia. Peripheral fusion functions as a lock and may prevent one eye from obtaining adequate central macular visual stimulation. In this setting children may not cross fixate because they do not need to. Their eyes are centred and move left and right with full range of motion.

Cross fixation occurs as a result of sensory influences, but it can be overridden in two circumstances. The first circumstance occurs in the child with uneven visual input. Two of our adult patients with amblyopia had anisometropia. Anisometropia may be associated with unreversed preoperative amblyopia in congenital esotropia.²² Secondly, motor factors could force a child with early infantile esotropia to prefer to

use one eye. Amblyopia is common in children with congenital esotropia and nystagmus,²³ a situation in which abducting nystagmus may influence a child to prefer one eye.

We have already noted the many advantages to surgical alignment for early infantile esotropia. Despite the high incidence of postoperative amblyopia in our control group, the final incidence of amblyopia after treatment could be reduced to 35%. We do not recommend withholding treatment, but it is interesting to note that many of the features of early onset esotropia appear to be self correcting. Amblyopia, in particular, was uncommon in our group of untreated patients.

Christopher J Lyons was supported by a grant from the Frost Charitable Trust, London.

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