Outcome in refractive accommodative esotropia

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Abstract

***Aim*—To examine outcome among children with refractive accommodative esotropia.**

***Methods*—Children with accommodative esotropia associated with hyperopia were included in the study. The features studied were ocular alignment, amblyopia, and the response to treatment, binocular single vision, requirement for surgery, and the change in refraction with age.**

***Results*—103 children with refractive accommodative esotropia were identified. Mean follow up was 4.5 years (range 2–9.5 years). 41 children (39.8%) were fully accommodative (no manifest deviation with full hyperopic correction). The remaining 62 children (60.2%) were partially accommodative. At presentation 61.2% of children were amblyopic in one eye decreasing to 15.5% at the most recent examination. Stereopsis was demonstrated in 89.3% of children at the most recent examination. Mean cycloplegic refraction (dioptres, spherical equivalent) remained stable throughout the follow up period. The mean change in refraction per year was 0.005 dioptres (D) in right eyes (95% CL −0.0098 to 0.02) and 0.001 D in left eyes (95% CL −0.018 to 0.021). No patients were able to discard their glasses and maintain alignment.**

***Conclusions*—Most children with refractive accommodative esotropia have an excellent outcome in terms of visual acuity and binocular single vision. Current management strategies for this condition result in a marked reduction in the prevalence of amblyopia compared with the prevalence at presentation. The degree of hyperopia, however, remains unchanged with poor prospects for discontinuing glasses wear. The possibility that long term full time glasses wear impedes emmetropisation must be considered. It is also conceivable, however, that these children may behave differently with normal and be predestined to remain hyperopic.**

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Refractive accommodative esotropia is one of the most common forms of childhood strabismus and is managed in similar fashion by most paediatric ophthalmologists. This management consists, in brief, of careful assessment of visual acuity, measurement of the deviation, cycloplegic refraction, and examination of the fundus. Glasses are prescribed according to the degree of hyperopia and if any amblyopia is present this is also treated. Surgical correction is reserved for those cases where the esotropia is significantly undercorrected despite full time glasses wear or following decompensation of a previously controlled deviation.[1] Some ophthalmologists, however, advocate surgical intervention at an early stage for this condition.[2]

This study was conducted to assess the efficacy of conventional management of refractive accommodative esotropia. Specifically, the following questions were addressed. What are the functional outcomes in terms of binocular function, visual acuity, and cosmesis? Did children who presented with or developed amblyopia during follow up respond to standard treatment with patching or atropinisation? Do children with accommodative esotropia "grow out of their glasses".

Subjects and methods

Children with refractive accommodative esotropia attending a paediatric ophthalmology clinic between July and September 1996 were identified. When children with convergence excess type accommodative esotropia and those with less than 24 months of follow up were excluded, 103 cases remained. Any children with additional problems such as macular scarring or optic nerve hypoplasia were excluded from the study.

All children included in the study had a reduction in the size of their esotropia on cover testing with appropriate refractive correction. Those children who showed no manifest deviation on cover testing were deemed to be fully accommodative while those with residual manifest deviation in their glasses were deemed partially accommodative.

All of the children were examined by an orthoptist and an ophthalmologist to evaluate their current status and the case notes were reviewed. The following features were assessed and recorded along with findings at previous visits.

Ocular alignment

The deviation with and without glasses was measured by prism cover test in all cases and with the synoptophore where possible.

Binocular vision

Testing for binocular single vision was conducted with the Wirt test in all children. Many children were also examined with the Frisbee and TNO tests as well as the synoptophore. Testing for suppression was conducted using the 20 dioptre base out prism test in all cases and with Bagolini lenses where cooperation was adequate.

Visual acuity

Best corrected visual acuity was measured using the Snellen chart where possible. Otherwise an age appropriate method such as forced

Table 1 Reduction in mean angle of deviation with glasses

	Fully accommodative	*Partly accommodative/BV**	*Partly accommodative/no BV**
Near	28.7	31	29.5
Distance	23.2	24.8	22.7
Near with glasses	0	7.5	9.7
Distance with glasses	0	4.9	5.3

All figures in prism dioptres (base out).
BV = binocular vision.

choice preferential looking, Kay's pictures or Sheridan-Gardiner linear or single letters was employed. A record was made of the number of amblyopic eyes, an interocular difference of two or more Snellen lines or equivalent.

Cycloplegic refraction
All children attending the department undergo cycloplegic refraction at least once a year. We prescribe the full cycloplegic correction (corrected for working distance). Refraction was repeated at the most recent clinic visit and the fundus examined.

Results

The mean age at presentation was 4.2 years/50.4 months (range 14–102 months, median 49 months). The mean follow up was 4.5 years/54 months (range 24–114 months, median 52 months).

OCULAR ALIGNMENT

Forty one children (39.8%) were fully accommodative. The mean deviation without glasses was 28.7 prism dioptres (pd) for near vision and 23.2 pd for distance vision (Table 1). The remaining 62 children (60.2%) were partially accommodative and all had a significant reduction in the angle of deviation with glasses.

Four patients (3.9%) had decompensation of a previously controlled deviation requiring surgical correction. Only one child with a fully accommodative esotropia decompensated (2.4%) while three with partially accommodative deviations decompensated (4.8%).

BINOCULAR VISION

Stereopsis was demonstrated in 92 (89.3%) of children with the Wirt or other stereotests at the most recent examination. The exact number of children with binocular vision at presentation is uncertain owing to the difficulty in determining binocularity in young, uncooperative children. Eleven children (10.7%) demonstrated no evidence of binocular function.

All children with fully accommodative deviations had binocular vision. Thirty seven out of 41 (90.2%) of these children had stereopsis of 100 seconds of arc or better. The four remaining children had between 100 and 400 seconds of arc.

Among the 62 children with partially accommodative deviations 51 (82.3%) had binocular vision while 11 (17.7%) did not. Of the 51 children with binocular vision only 22 (43.1%) had stereopsis of 100 seconds of arc or better, 14 (27.5%) were between 100 and 400 seconds of arc, and 15 (29.4%) had only gross stereopsis (1500 seconds of arc). All three patients who decompensated requiring surgery were non-binocular.

All children with partially accommodative esotropia had a significant reduction in the angle of deviation for both near and distance vision with their hyperopic correction. Those children who demonstrated binocular vision had a mean reduction in the near deviation of 23.5 pd (75.8%); children without detectable binocular function showed a mean reduction in the near deviation of 19.8 pd (67.1%) (Table 1).

When the final stereopsis was compared with age of presentation and age at which motor alignment was achieved it was found that higher levels of stereopsis were found in those children who presented later. This finding was common for both full and partially accommodative esotropes. Children who had a final stereopsis of 100 seconds of arc or better presented at a mean age of 55.3 months and were aligned at a mean age of 61.4 months. Children who had a final stereopsis between 100–400 seconds of arc or better presented at a mean age of 45.6 months and were aligned at a mean age of 54.7 months. Children who had a final stereopsis of less than 400 seconds of arc (including non-binocular patients) presented at a mean age of 42.9 months and were aligned at a mean age of 53.3 months.

VISUAL ACUITY/AMBLYOPIA

Strabismic and or anisometropic amblyopia developed in 63 children (61.2%). Anisometropia was significantly more likely to be present in amblyopic children (80%) than the group as a whole (57%), $p = 0.017$. Treatment with either occlusion and or atropine penalisation was attempted in all cases of amblyopia. At the most recent examination only 15.5% of the total (16 children) had vision of 6/12 or worse in their amblyopic eye. In other words, 47 out of 63 children (74.6%) had a maintained visual improvement in their amblyopic eye. Of 18 children with no binocular vision, 16 (88.9%) were amblyopic in one eye at the time of presentation. At the most recent examination six (33.3%) of the non-binocular children remained amblyopic.

In 91.1% of cases amblyopia was present at the initial visit while in the remaining 8.9% it developed after treatment with glasses had begun.

REFRACTION

All cycloplegic refractions that had been performed on each child were recorded. The mean refraction for right and left eyes was calculated. The mean cycloplegic refraction (dioptres, spherical equivalent) plotted against age shows that refraction remained remarkably stable during the follow up period (Fig 1). The mean change in refraction per year was 0.005 D in right eyes (95% confidence limits (CL) −0.0098 to 0.02) and 0.001 D in left eyes (95% CL −0.018 to 0.021). Most eyes showed no change in their refraction and those that did change did so by only a minute degree in nearly

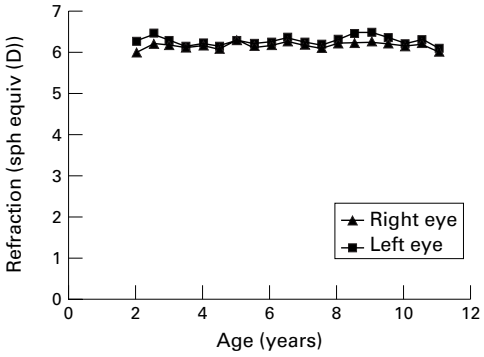

Figure 1 Graph showing the mean refraction (dioptres, spherical equivalent) of right and left eyes versus age (years). Mean refraction remains stable throughout the follow up period.

all cases (Fig 2). The overall picture was one of stability in the degree of hyperopia.

None of our patients was able to completely discard their glasses and maintain satisfactory alignment all of the time.

Discussion

OCULAR ALIGNMENT

Decompensation of a fully accommodative esotropia may occur even in the presence of apparently good binocular vision. Our finding that surgery is necessary to achieve ocular alignment in only a very small proportion (2.4%) of cases of fully accommodative refractive esotropia agrees with previous studies. Von Noorden and Avilla found that only one out of 30 patients (3.3%) showed functional deterioration requiring surgery.[3] The only exception to this lies with deviations which develop before 12 months of age where approximately 50% of initially fully corrected deviations later decompensate and need surgery.[4] In our study no children presented before the age of 14 months so we cannot verify this finding. Some authors however advocate surgery as the treatment of choice in fully accommodative esotropia.[2 5] Our findings concur with Von Noorden and Avilla and we see no reason to alter our indications for performing surgery on these children.

BINOCULAR VISION

While the functional value of stereopsis in everyday life may be in question,[6] the presence of binocular single vision (BSV) with fusion undoubtedly contributes to maintaining alignment.[7] A very high proportion of our patients (89.3%) had demonstrable binocular function which compares well with other studies where up to 90% achieve BSV.[8] As our results were achieved with an operation rate of only 3.9% we find no evidence to support Gobin's claim that 50% of children with refractive accommodative esotropia may not have BSV preoperatively and that fusion is restored in many of these children within 1 week of surgery.[9]

We found that higher grade stereopsis is associated with later presentation and motor alignment. This finding suggests better binocular vision outcome is determined before presentation. Higher grade binocular vision is associated with late presentation rather than early detection and treatment.

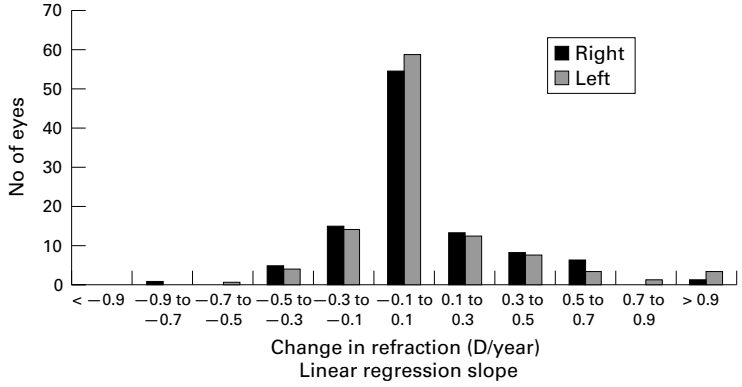

Figure 2 Histogram of the mean change in refraction per year. This demonstrates that most eyes show little or no change in refraction.

VISUAL ACUITY

Amblyopia therapy was successful at attaining a maintained improvement in visual acuity to better than 6/12 in 74.6% of cases with a substantial reduction in amblyopia from 61.2% to 15.5% at last follow up. The value of amblyopia therapy has recently been questioned since its efficacy has never been conclusively proved in clinical trials.[10] It is our experience that most amblyopic children benefit visually from treatment with patching and or atropine penalisation.

CYCLOPLEGIC REFRACTION

The relation between hyperopia and esotropia is well described. A number of articles have documented increasing hyperopia before the onset of esotropia.[11 12] It has also been shown that hyperopia changes slowly in esotropic children given their full glasses correction.[13] It has been shown that children become less hyperopic or more myopic after 7 or 8 years of age.[14–16] In a population of accommodative esotropes, Raab[17] observed from the age of 7 a reduction in hyperopia of 0.18 D per year compared with 0.22 D per year in normal hyperopic children. Other studies have indicated that esotropes may behave differently.[11 12] Several studies have provided some evidence that wearing glasses may hinder emmetropisation.[4 18–20] Our findings lend support to the theory that hyperopic glasses wear in esotropes impedes emmetropisation. In contrast, a study of partial spectacle correction in hyperopic children failed to demonstrate any impact on emmetropisation.[21] Full correction, as given to children in our study, renders children optically emmetropic whereas partial correction still leaves the eye optically hyperopic. Theoretically, only full hyperopic correction would therefore be expected to completely inhibit emmetropisation.[22] There is a growing body of evidence suggesting environmental influences in the development of refractive errors in humans.[23–26] It has been demonstrated in a range of species including primates that in the presence of a blurred retinal image eye growth is altered resulting in a shift towards myopia.[27 28] In addition, primates can display compensatory ocular refractive changes in

response to rearing with spectacle lenses.[29] It is therefore quite conceivable that eliminating retinal blur in hyperopic humans with appropriate lenses removes the stimulus for the myopic shift towards emmetropia. In view of this growing body of experimental data, the potential impact of glasses on ocular growth in clinical settings merits further study.

Conclusions

The great difficulty in evaluating the efficacy or otherwise of any form of strabismus therapy is the very long follow up period necessary in order to evaluate it accurately. This study clearly shows favourable outcome of treatment in refractive accommodative esotropia albeit with variable duration of follow up. We conclude that glasses remain the treatment of choice in accommodative esodeviations.[2 30] We do however feel that more consideration should be given to the long term effects of wearing the full hyperopic correction as the degree of hyperopia remains unchanged with poor prospects for discontinuing glasses wear. The possibility that long term glasses wear impedes emmetropisation must be considered. It is also conceivable, however, that these children may behave differently from normal and be predestined to remain hyperopic.

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