

Abstract

Esotropia outcomes and influence of delay to wearing full hypermetropic correction

Purpose

In children presenting with an esotropia, we sought to assess whether delay to full hypermetropic correction wear might influence the outcome of a diagnosis of a fully accommodative esotropia (fully Ac-ET) versus partially accommodative esotropia (partially Ac-ET).

Methods

All children aged less than 7, referred with possible strabismus over a one-year period were assessed. A standard set of details were documented: age esotropia first noticed, age esotropia confirmed by orthoptist, age glasses prescribed, age full refractive error constantly worn. When full time hypermetropic correction was worn, the type of esotropia was determined.

Results

There were 430 children referred. Of these, 117 had a concomitant esotropia, 62 males and 55 females. Esotropia was confirmed at age range from 4 to 78 months (mean 35.47, standard deviation (SD) 16.67 months). There were 51 (43.6%) fully Ac- ET, 57 (48.7%) partially Ac- ET and 9 (7.7%) non-accommodative esotropes. Longer delays between the time esotropia was identified and the time glasses were prescribed, were associated with a reduced likelihood of an outcome of fully Ac-ET versus partially Ac-ET (Odds Ratio=0.73, 95% CI=0.58 – 0.93). Delay to glasses wear for fully Ac-ET and partially Ac-ET was 1.94 months (SD 6.4) and 6.24 months (SD 8.36) respectively. Higher average spherical correction scores were associated with a higher likelihood of being in the fully Ac-ET group (OR=1.35, 95% CI=1.07 – 1.69).

Conclusion

A child with recent onset concomitant esotropia is more likely to achieve fully Ac-ET versus partially Ac-ET if the delay to full hypermetropic corrective glasses wear is minimised.

Introduction

Partially accommodative esotropia (partially Ac-ET) continues to make up a significant proportion of a paediatric strabismus surgical workload. These children often do not demonstrate stereopsis following surgery¹. Fully accommodative esotropia (fully Ac-ET) is a diagnosis of an esotropia that is fully controlled with demonstration of stereopsis of 800" arc or more on Wirt, Frisby or Lang testing, when hypermetropic correction is worn. While the numbers of children needing surgery have reduced due to recognition that full hypermetropic correction must be prescribed,² it is not clear whether the timing of full refractive correction wear relative to the onset of an esotropia influences an outcome of fully Ac-ET versus partially Ac-ET.

We sought to determine the incidence and characteristics of esotropia in our population of children aged less than 7 years over a one- year period.

Methods

In 2013, as a service evaluation of our caseload and management we prospectively looked at all children aged less than 7 years of age referred with suspected strabismus. The study and data collection conformed to local trust rules and were compliant with the principles of the Declaration of Helsinki. In our catchment area all children are screened at birth by a paediatrician for a red reflex, at 8 weeks by a general practitioner for a red reflex, have a targeted surveillance at 2 years by a health visitor (using a questionnaire to determine if there is parental/ professional concern regarding the child's vision or the presence of a strabismus). At this surveillance stage the health visitor, in accordance with Health for All guidance³ automatically refers children with any of the following: dysmorphic syndrome, neurodevelopmental disorder, learning disability, sensory neural hearing impairment, cerebral palsy, Down syndrome, prematurity (under 32 weeks gestation) and/or

low birth weight (1500 grams or below)). A formal vision screen of children occurs at 4-5 years and is performed by a school nurse who assesses visual acuity using a LogMAR test and refers to the Orthoptist those who fail to achieve 0.20 LogMAR vision. Children with suspected strabismus can be referred outside of these staged contacts due to parental or health professional's concerns.

All children referred were assessed by an orthoptist and a standard set of details documented:

- age esotropia first noticed,
- age esotropia confirmed by orthoptist,
- age glasses prescribed,
- age full refractive error constantly worn.

When full time hypermetropic correction was worn, orthoptic tests were used to determine the type of strabismus, and the level of binocular function.

All children with an esotropia had a cycloplegic refraction and the full hypermetropic correction prescribed if they have a refractive error of more than or equal to +1.5D, (following removal of the working distance only). Children prescribed glasses were followed up 2 months later by an orthoptist. Esotropia subtypes included were non-accommodative esotropia, partially Ac-ET and fully Ac-ET. The AC/A ratio was not routinely checked.

Non-accommodative esotropia was defined as a concomitant esotropia, either associated with a refractive error less than +1.5D or an esotropia that did not alter in size by 10 prism dioptres (PD) or more following fulltime hypermetropic correction wear. A partially Ac-ET was defined as a manifest esotropia with no binocular single vision (BSV) when wearing full hypermetropic correction and the deviation was at least 10PD smaller with glasses compared to the unaided measurement. A fully Ac-ET was defined as an esotropia that became a phoria when full hypermetropic correction was worn and BSV was measurable using either a Lang stereo test, Frisby test or Wirt test. Children were deemed "normal" and discharged when age appropriate normal unocular visions had been

recorded, a cover test showed no manifest strabismus, BSV and fusional control were demonstrable and ocular movements were full.

Results

In 2013, our catchment area had 29,365 children aged less than 7 years⁴. Over a one year period 1/1/2013 – 31/12/2013, 430 children were referred with suspected strabismus. Esotropia was confirmed in 117 and 313 were excluded. (Figure 1)

Of the 117 included cases, 62 (53%) were males and 55 (47%) females. Esotropia was confirmed by an orthoptist in patients ranging from 4 to 78 months of age (Mean 35.47 months, Standard deviation (SD) 16.67 months). There were 51 (43.6%) fully accommodative esotropes, 57 (48.7%) partially accommodative esotropes and 9 (7.7%) non-accommodative esotropes. Stereopsis in the fully accommodative group ranged from 55- 600" arc for near. Three of the non-accommodative esotropes were not prescribed glasses as they had no hypermetropia $\geq +1.5D$, six of them were prescribed their full hypermetropic correction. No child was phoric for distance and esotropic for near either with or without glasses. No child had a trial of bifocals. Six children were diagnosed with essential infantile esotropia when less than 12 months old. Of these two had a non-accommodative esotropia, three a partially Ac-ET and one a fully Ac-ET. Of note, our population had 3,956 babies of less than one year old in 2013⁴, giving an incidence for essential infantile esotropia of 1 in 659 live births or 0.15%.

In our cohort, children in the fully Ac-ET group had a shorter delay between age esotropia first noticed to age glasses worn full time (mean 1.94 months, SD 6.40), compared with children in the partially Ac-ET group (mean 6.24 months, SD 8.36). The same is also observed between the age when esotropia was first confirmed by an orthoptist and the age when glasses were prescribed. The fully Ac-ET group had a mean of -1.14 months (SD 2.67) while the partially Ac- ET group had a mean of 0.30 months (SD 2.35) (Table 1).

Binary logistic regression models were used to examine the predictors of fully Ac-ET versus partially Ac-ET using average spherical correction and two time delay variables. The approach involved estimating models in which each of the predictors were specified separately and comparing the results to a model in which all three predictor models were specified simultaneously.

Results of the separate and combined regression models are summarised in Table 2. The average spherical correction was calculated by adding the spherical equivalents for each eye and dividing by two. When predictors were specified in single predictor models, higher average spherical correction scores were associated with a higher likelihood of being in the fully Ac-ET group (OR=1.35, 95% CI=1.07 – 1.69). Similarly, longer delays between age esotropia was first confirmed by an orthoptist until glasses were prescribed were associated with a reduced likelihood of achieving fully Ac-ET outcome (OR=0.73, 95% CI=0.58 – 0.93). In addition, longer delays between the age esotropia was first noticed until glasses were worn were also associated with a reduced likelihood of fully Ac-ET outcome (OR=0.91, 95% CI=0.84 – 0.98). When all three predictors were entered simultaneously as predictors, only the average spherical correction scores were uniquely predictive of Ac-ET outcome ($p < 0.05$).

Discussion

Treating strabismus can help with improving psychosocial effects, aid in visual development by preventing amblyopia and if stereoacuity is achieved help in developing good hand-eye

coordination⁵. Studies in children with esotropia conducted by Fawcett et al⁶ and Uretman et al⁷ have shown that shorter duration of constant or intermittent misalignment is associated strongly with stereoacuity preservation. Therefore, it is advocated that children with refractive accommodative esotropia should be prescribed their corrections promptly. Our study supports this view. In our 117 cases with concomitant esotropia, partially Ac-ET was the most frequent strabismus subtype with an incidence of 48.7%. This is higher than previously reported in larger population-based studies. In a Danish cohort⁵ of 645 esotropes, 39% had a partially Ac-ET and in an American cohort⁸ of 385 esotropes, 10% were partially accommodative. We identified modifiable factors associated with increasing the likelihood of a child with an esotropia achieving a fully Ac-ET status: minimising delay to prescribing and successful full-time wear of the full hypermetropic correction.

A range of non-modifiable factors that might favour an outcome of a fully accommodative versus partially accommodative esotropia have been reported. Lai et al⁹ found the angle of deviation significantly smaller in their fully accommodative group (n = 28) versus the partially accommodative group (n = 17) (p=0.004). Also, in this study, refractive error was higher in the fully accommodative esotropes (p = 0.062) but age of esotropia onset, age at first visit, presence of inferior oblique overaction were similar. Reddy et al¹⁰ and our study also found refractive error to be higher in the fully accommodative group compared to the partially accommodative group. Torp-Pedersen et al⁵ found age of onset was older for fully accommodative esotropes.

The strengths of our study include that a standard set of data was prospectively collected on all patients. We had a large number of confirmed esotropes (117 patients) for a 1-year study, with likely good catchment due to the nature of the National Health Service (NHS), with children having scheduled contacts with a healthcare professional at various ages and equal and free access to the NHS. One weakness of our study was that a verbal history from parents regarding full time glasses wear was used. This was combined with a good acuity documented at the next exam when looking through glasses, suggesting that the child had relaxed their accommodation due to habitual glasses

wear. Of the 117 children included in the study only six failed to attend their first follow up appointment. All these six children were in the partially accommodative group.

A long term study¹¹ has shown that good compliance to glasses wear is important in achieving good stereopsis and satisfactory eye alignment in children with pure refractive accommodative esotropia. However, this can be difficult to achieve. Children can refuse to wear their glasses or can overlook the frames.

Fully accommodative children may emmetropize and abandon glasses as they get older.¹² However under correcting hypermetropia in those established as fully accommodative esotropes can cause control to be lost – a study of 30 children found 20% decompensated with a 1 dioptre reduction of hypermetropic correction¹³.

In conclusion, our study suggests that children presenting with recent onset concomitant esotropia should have an immediate cycloplegic refraction and the full hypermetropic correction prescribed if the refractive error measures more than +1.5 dioptres. These glasses should be worn full time to increase the likelihood of gaining a fully Ac-ET status.

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