

The non-surgical management of accommodative esotropia – a personal reflection

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This paper will be a personal reflection on the current methods of diagnosis and management of accommodative esotropia and a brief look into the future and how refractive surgery may affect the condition.

INTRODUCTION

Accommodative esotropia generally occurs between the age of 1 and 4 years although it may present at either an earlier or later age. It is diagnosed when correction of a hypermetropic refractive error or use of hypermetropic lenses in the near position results in a decrease in the esotropia, the convergent deviation being affected by the state of the accommodation, which is a significant factor in the aetiology of the condition. There are essentially three different types of accommodative esotropia. *Partially accommodative esotropia or esotropia with an accommodative element*, where correction of the hypermetropia results in a reduction in the esotropia but does not result in binocular single vision (BSV); *Convergence excess esotropia* where there is binocular single vision on distance fixation and esotropia for near and *Fully accommodative*, where the correction of the refractive error results in binocular single vision with the spectacle correction in situ. Unfortunately the terminology is not universally accepted which can lead to difficulties when reviewing the literature where there seems to be a wide variation as to what constitutes accommodative esotropia. This has resulted in lengthy discussions on the ethics of surgical intervention, whilst ignoring the important role of orthoptic or non-surgical management.

The management of accommodative esotropia is dependant from the outset on accurate cycloplegic refraction and early and full correction of hypermetropia and astigmatism. The presence of any amblyopia requires occlusion therapy regardless of the possibility of provoking decompensation of the binocular single vision. However, it must be recognised that each case is different and needs to be approached individually as the child may respond to therapy in a variety of ways.

PARTIALLY ACCOMMODATIVE ESOTROPIA

This common type of accommodative esotropia has a multi-factorial aetiology. It is imperative that the cause is established from the outset as this will have

an important effect on the prognosis. The more common causes are:

1. Superimposed accommodative squint on
 - i) pre-existing microtropia
 - ii) previously operated infantile esotropia¹
 - iii) hypermetropic anisometropic amblyopia²
2. Accommodative esotropia secondary to anomalies of the oblique muscles ('A' and 'V' patterns)³
3. Inherited absence of or defective binocular vision
4. Decompensated fully accommodative or convergence excess esotropia⁴

Therapeutic modalities

As a general rule these children are not expected to achieve normal BSV after treatment. Most patients with partially accommodative esotropia will demonstrate some type of anomalous BV with a variable amount of fusion and stereoacuity. Cases which initially appear to have a fully accommodative and convergence excess esotropia but later present with a constant esotropia frequently turn out to have an underlying microtropia or poor fusion potential. However, in these cases, it is important to establish that there is no uncorrected hypermetropia after the initial refraction so a repeat cycloplegic refraction should be carried out after about 3 month's glasses wear. Occasionally more hypermetropia may be unrevealed and its correction may result in the establishment of BSV at times with the glasses.⁵ Either part-time or partial occlusion may be necessary to maintain equal visual acuity.

The use of *anti-suppression and/or fusion treatment* for partially accommodative esotropias has long been questioned. Synoptophore exercises are very much a treatment of the past. However, it is likely that aggressive occlusion therapy has a beneficial effect on any amblyopia rather than the binocular potential.⁶ A weekly visit to the orthoptist is an excellent way of ensuring compliance with occlusion.

Fresnel prisms are frequently suggested as an ideal method of determining binocular potential and as a predictor for the amount of surgery needed to realign the visual axes.⁷ However, they are poorly tolerated in most children and as Kulnig⁸ has shown, a 20 PD Fresnel prism can significantly reduce the acuity by as much as 4 Snellen lines and may give rise to the development of meridional amblyopia. If prisms are to be used, then, in the presence of equal visual acuity, it is probably preferable to divide the required prismatic correction between the two eyes. If there is any amblyopia, then the prism should be attached to the lens of the fixing eye in order to discourage any further suppression and amblyopia in the strabismic eye.

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The majority of children with partially accommodative esotropia will need surgery. When deciding on the extent of operative correction consideration must be given to the amount of hypermetropia present and whether it is possible that the child will be wearing a reduced correction following the surgery or whether the glasses may be discarded at some future time. It is unfair to condemn a child to constant use of a low hypermetropic correction for the rest of his/ her life simply because a tolerable cosmesis with glasses becomes unacceptable without the glasses. However surgery designed to dispense with a moderate to high hypermetropic correction may well result in complications. For instance a consecutive exotropia may occur which may not be reversible by reduction in the hypermetropic correction post-operatively⁹ or when the glasses become necessary for vision at the onset of presbyopia, which may be in their early 20's in hypermetropes. The presence of alphabet patterns and the role of the oblique muscles will also need to be considered when planning surgery.³

CONVERGENCE EXCESS ESOTROPIA

The most common type of convergence excess esotropia is that associated with a *high AC/A* ratio where an anomaly in the ratio between accommodative convergence and accommodation results in an esotropia for near fixation. The addition of a convex lens of +3 DS for near results in a marked decrease in the esodeviation and may result in BSV.

Patients may also be identified as having convergence excess esotropia with a *low or normal AC/A ratio*. The addition of a +3 DS for near may result in a small decrease in the deviation but not in binocularity. It should be noted that some authors may include patients in this category who have a distance deviation of < 10PD but not BSV.¹⁰ The aetiology of the condition is thought to be hyper-innervation of the medial recti. Children with convergence excess esotropia who do not have a high AC/A ratio will not respond to non-surgical treatment and early operation to weaken both medial recti is indicated.

Convergence excess esotropia has been described in association with emmetropia¹¹ in bright hyper-active children, and associated with myopia.^{12,13} It is possible though that both these latter types may fall into the category of *hypo-accommodative convergence excess esotropia* originally hypothesised by Costenbader¹⁴ and later expanded by von Noorden¹⁵ and Muhlendyck.¹⁶ These children appear to have a pre-existing hypo-accommodative state and are unable to exert the necessary accommodation needed to see clearly at near. The existence of this condition underlines the importance of testing not only the AC/A ratio in children with convergence excess esotropia but also estimating either objectively or subjectively the monocular and binocular accommodation.¹⁷

Opinion with regard to the management of high AC/A ratio convergence excess esotropia is firmly divided between the exponents of surgery as an initial and sometimes only treatment and those who use it as

a last resort.¹⁷ In general surgery is probably contra-indicated in infancy¹⁰ and as true convergence excess esotropia is rarely seen in adults, should anything be done except eliminating the amblyopia, repeating the refraction, correcting all the hypermetropia, and waiting for normalisation of the AC/A ratio and the resolution of the esodeviation?

Therapeutic modalities

- 1 **Bifocals** with an addition of up to +3 DS for near frequently result in stable binocularity for near fixation. It is important that the glasses are properly fitted and every effort should be made to effect a reduction in the correction every six months. Some authors¹⁸ suggest that they should be worn until the age of 10 years and then discarded, others suggest that long-term use may cause defective accommodation.^{15,19} The point at which further reduction in the near addition is no longer possible may be the stimulus to attempt another form of therapy. Careful monitoring of the monocular and binocular accommodation is advisable during bifocal use. As a general rule it is probably advisable to limit bifocal use to a period of no more than 3 years.
- 2 **Contact lenses** form a viable alternative to bifocals²⁰ particularly with the advent of daily wear disposable lenses, and may obviate the necessity for surgery. In moderate to high hypermetropia there would be less peripheral blur with contact lenses and therefore more binocular cues with larger corresponding retinal areas stimulated, so improved peripheral as well as central fusion. At the beginning it may be helpful to use a small overcorrection of the hypermetropia although the visual acuity should not be reduced to <6/9. It is necessary to use a large diameter soft lens and helpful to have a contact lens wearer in the family. Careful patient selection is indicated with girls tolerating the lenses better than boys, although a talent for sport may provide the stimulus to contact lens wear in both sexes. Progressive reduction in the hypermetropic correction should be attempted once the condition is stabilised.
- 3 **Fresnel prisms** are an acceptable alternative to bifocals although rarely used. They have the advantage of not interfering with accommodation and convergence but do produce a decrease in visual acuity⁴ even if the prisms are divided between the two eyes. There may be a slight risk of causing bilateral amblyopia if the prisms are used for long periods.
- 4 **Miotics** such as Phospholine Iodide are rarely used and may not be available except on a named patient basis. Miotics are sometimes helpful as a short term treatment for recent onset smaller decompensating near deviations.²¹
- 5 **Botox**²² injected into both medial recti simultaneously can result in the resolution of high AC/A ratio convergence excess esotropia.
- 6 **Surgery** Children with low or normal AC/A ratio convergence excess esotropia need early surgical realignment, but for those with a high AC/A ratio

it can be safely postponed until all other treatment has been tried. It is worth remembering that there is a risk to surgery, however slight, and some parents may not wish for operative treatment for their children as the near esotropia may not be noticeable under normal conditions.

Non-surgical management is not simply postponing the inevitable operation but maintaining BSV in an unstable condition whilst normalisation of the AC/A ratio takes place. Whilst it may be suggested that the distance BSV is sufficient to maintain the development of normal binocularity, fusing comfortably for near as well, ensures that suppression and amblyopia do not erode the fragile binocular reflexes.

The condition of hypo-accommodative convergence excess esotropia is uncommon. It tends to occur at a later age with the diagnosis reliant on the detailed assessment of the monocular and binocular accommodation.^{14, 15, 16, 19} The identification of this condition is important as these children are unable to accommodate sufficiently to see for near and will therefore have to use bifocal or multifocal glasses for the whole of their life.

FULLY ACCOMMODATIVE ESOTROPIA

Whatever happened to orthoptic treatment?

Patients with fully accommodative esotropia were always identified as the perfect orthoptic patient. However, it is unusual in the 21st Century to witness children being taught to control the esodeviation without their glasses. It seems to be accepted that if there is good and stable BSV with the refractive correction in place then the fact that there is an esotropia without the glasses is irrelevant. However, it should not be forgotten that this situation is a problem for the parents who will inevitably see the child without glasses albeit only for brief periods, and may be a problem for the child in later years, if spontaneous control does not ensue.

Children who will benefit from orthoptic therapy may be easily identified by measurement of the AC/A ratio.¹⁷ Most patients with fully accommodative esotropia will have an AC/A ratio within normal limits but those with a high AC/A ratio are those who are likely to decompensate in the long term. Fully accommodative esotropia which deteriorate into an esotropia whilst wearing their glasses are an unusual condition which may be related as much to the state of the binocular reflexes as the AC/A ratio. They usually respond well to surgery. Occasionally though an infant may present with an apparently fully accommodative esotropia within the first eighteen months of life, which later decompensates for near and results in a diagnosis of convergence excess esotropia. Careful observation of babies with fully accommodative esotropia will identify these cases.

Therapeutic modalities

The classical teaching has always been:

- 1 Eliminate suppression
- 2 Teach diplopia when squinting
- 3 Show control of diplopia by relaxation of accommodation

- 4 Teach dissociation of accommodation and convergence
- 5 Bar reading
- 6 Progressive reduction of glasses
- 7 Patient discharged with comfortable BSV with glasses and with -3 DS added to theoretical hypermetropic correction.

Experience indicates that most children, who have been shown how to appreciate diplopia when squinting, have little difficulty in establishing control of the esotropia without glasses. Lengthy courses of exercises are rarely necessary although periods of bar reading at home are helpful from both an orthoptic and educational standpoint.

Contact lenses may be used as an alternative to glasses in the management of fully accommodative esotropia.^{5, 20, 23} They are especially useful in patients who are poorly tolerant of spectacles, children with high hypermetropic errors and in cases where glasses wear is problematic such as for gymnastics, ballet and some contact sports.

The rationale for attempting to reduce the hypermetropic correction progressively in fully accommodative esotropia has always been that the non squinting hypermetrope rarely tolerates full correction of the error. Current theories suggest that full correction of hypermetropia into teenage years may affect the normal process of emmetropisation and result in the patient being a glasses wearer in adult life. This should be the stimulus to resuming active therapy for fully accommodative esotropia. In fact Lambert²⁴ has shown that progressive reduction of the hypermetropic correction may stimulate emmetropisation, although others would suggest that hypermetropic esotropic children may be predestined to remain hypermetropic.²⁵

SUMMARY

In *partially accommodative esotropia* the prognosis for the restitution of normal BSV is rarely good. The best that most of these patients can achieve is satisfactory cosmesis with some fusional ability with anomalous correspondence. It is probably fair to say that those who do achieve BSV after treatment may well have had a wrong diagnosis initially. Early surgical alignment may well constitute their best chance of satisfactory treatment so the use of therapy other than pre-operative occlusion may well have a detrimental effect.

Children with *convergence excess esotropia* frequently do require surgery at some stage, but properly directed treatment to stabilise the deviation, and stimulate normal binocular function for near by the use of contact lenses or bifocals in the early stages results in a much improved response to surgery. No patient should require more than one procedure on the medial recti in order to re-establish full binocularity if stability is obtained prior to operation.

It has to be accepted that there is a group of children with hypo accommodation who will require long term use of bifocal or multifocal glasses in order to use BSV for near.

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Cases of fully accommodative esotropia with normal or near normal AC/A ratio should be treated aggressively in order to establish control without glasses and every effort should be made to reduce their spectacle correction in order to stimulate emmetropisation. However we must accept that there are a group of children who may need surgery in order to produce constant BSV.

THE PRESENT AND FUTURE

Early results in adults with accommodative esotropia who have had laser surgery to reduce or eliminate their hypermetropic error suggest that there is a significant reduction in the esodeviation following the procedure.²⁶ This is unlikely to cause serious problems in those with normal BSV, although a change from esophoria to exophoria may be symptom producing in the short term. However there is a diplopia risk in the group of treated partially accommodative esotropes, as many may have been subjected to intensive anti-suppression and 'fusion' treatment over long periods during childhood and need complex investigation and counselling prior to consideration of laser refractive surgery.²⁷ It is important that there is careful selection of strabismic cases and close monitoring before and after treatment so that a protocol can be established. It is unlikely that laser refractive surgery will become an established treatment modality in children in the immediate future.

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