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Research Article

A Retrospective Study on Clinical Presentation and Features of Refractive Accommodative Esotropia among Children and Its Significance with Ocular Profile

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Abstract

Purpose: To report the ocular profile of children with refractive accommodative esotropia.

Material & Methods: It was a retrospective observational study with a sample size of 162 subjects presenting at Centre for Sight and diagnosed with refractive accommodative esotropia in the age group of 3 years and above. A thorough eye examination of the patients was done and the full cycloplegic refractive correction was prescribed. The patients were called for follow-up with prescribed glasses to assess the visual acuity and deviation with Rx.
The features studied were ocular alignment with correction in subsequent follow-ups, amblyopia, high AC/A ratio and anisometropia >1.50D. The statistical analysis was done by using Chi-square test in SPSS version 21.

Result: Demographic data of 162 subjects with refractive accommodative esotropia was collected. At presentation 33.53% of the children were amblyopic, 9.58% were having anisometropia > 1.5D, and 7.78% were having high AC/A ratio. The visual acuity and spherical error of both eyes were found to be statistically similar. At a mean follow-up of 122 days, the deviation was reassessed and a significant correlation was found between aided visual acuity and aided near Estropia, ET (74.07%) as well as aided distance ET (77.78%), & non-significant correlation was found between max spherical errors and aided near ET as well as aided distance ET.
It was also observed that few cases had an increase in deviation which may be a result of wrong refractive correction, the patient being uncooperative, delayed follow-up, or non-compliance to glass wear. All factors mentioned were found to be statistically significant ($p<0.05$) with the Chi-square test in SPSS version 21.

Conclusion: This study tells us about what should be seen in the ocular profile of children with refractive accommodative esotropia. To get a particular trend in the ocular profile of patients with refractive accommodative esotropia a prospective study with more parameters like stereopsis, near visual acuity, regular follow-up, compliance to glass wear, correction of refractive error, and change in deviation is required.

Keywords: RAET, Amblyopia, AC/A ratio, Cycloplegic refraction, Refractive error

1. Introduction

One of the most prevalent kinds of strabismus in children is accommodating esotropia, characterized by mild hyperopia and an active accommodation reflex [1]. The over-convergence caused by accommodation to correct a hyperopic refractive defect can impair binocular coordination and result in esotropia [2]. Both fully refractive and moderately accommodative categories apply to it.

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Manifest esodeviations caused by uncorrected hyperopia, an elevated AC/A ratio, or a combination of the two are considered accommodating esotropia.
The development of convergence and accommodation together results in the perception of a single, distinct image. The relationship between the amount of convergence produced by an accommodating stimulus and the degree of accommodation that causes that convergence is shown by the ratio of accommodating convergence (AC) over accommodating (A). A 1 metre angle of convergence between the two eyes and 1 diopter of accommodation are required to see something clearly and separately at that distance. The 1:1 relationship is what is meant by this.

Clinically, however, assessing convergence in prism diopters (PD) makes it easier to compare one person to another.

When the interpupillary distance (IPD) is 60 mm, 6PD = 1 metre angle. To see clearly as a single image at one metre, 6PD of convergence and 1 diopter of accommodation are used. The AC/A ratio increase to 4:1 due to the accommodating nature of two-thirds of this convergence (4 PD). However, this is simply a theoretical possibility. Even in healthy people, the AC/A ratio has been seen to change in practice.[3]

Accommodative effort produces an excessively strong convergence response, as measured by the AC/A ratio. The excess convergence tonus is more apparent at close range because more accommodation takes place there, resulting in a bigger near esodeviation than at a distance. High AC/A ratio accommodative esotropia in children typically manifests between the ages of 2 and 3. This condition can have hyperopic, emmetropic, or myopic refractive status. Refractive error is typically +2.25 D [2].

Normal AC/A ratios range from 3 to 5 prism diopters to 1 diopter. The AC/A ratio is primarily measured using three approaches: the heterophoria and gradient methods, as well as clinical evaluation of distance and near deviation. The following are the measurement methods for the heterophoria and gradient approaches:

The distance and close measurements are used to calculate the AC/A ratio; if the near esotropia is larger than 10 PD, the AC/A ratio is deemed excessive.

Refractive accommodative esotropia, in which the AC/A ratio is normal and the esotropia ranges from +2.00 D to +7.00 D, typically develops following a history of acquired intermittent or constant esotropia. Sometimes children under the age of one year olds will exhibit all the symptoms of refractive accommodating esotropia.

Children's eyes can be straight at times, but when they are tired or attempting to focus up close, one or both of their eyes may cross inward. Younger children may first demonstrate increased eye rubbing or squinting. Older children may experience asthenopic symptoms such as headaches or diplopia. However, as the esotropia worsens and aberrant retinal correspondence arises, these symptoms subside.[2]

By optically correcting hyperopia, fully accommodating esotropia can be completely eradicated, allowing for binocular single vision (BSV) at all distances when wearing glasses, and deviation when they aren't worn.

Even after complete hyperopic correction, accommodative esotropias, whether refractive or non-refractive, do not always demonstrate a decrease in esodeviations. These are examples of partial accommodating esotropia. Partially accommodating esotropia is esotropia that was previously fully accommodating but has since decompensated.

Amblyopia and bilateral superior oblique weakness are common symptoms of partially accommodating esotropia (PAET). A large deviation for distance, a moderate hyperopic refractive error, a young age at first prescription, and amblyopia are all risk factors for functional alignment failure with hyperopic correction alone. Furthermore, patients with accommodative esotropias with a high AC/A ratio are more likely to acquire a non-accommodative component that demands surgery.

The entire hyperopic error must be addressed as the first line of treatment for partially accommodating esotropia. If, after 4 to 6 weeks of prescribing the entire spectacle correction, there is residual esotropia of more than 10 prism diopters for distant and close, and the patient is not achieving fusion, surgery is indicated. The best treatment for partially accommodating esotropia is bilateral medial rectus recession.

2. Materials and Methods

Study design:

It was a retrospective observational study conducted at Centre for Sight, New Delhi from August 2020 to July 2021. The study included 162 subjects.

This was retrospective study in which the record files of 162 subjects (with age group of 3 years and above) with refractive accommodative esotropia visited Centre for Sight were reviewed and analyzed.

This study included convenience-sampling methods to collect the data by adopted records file.

Subjects with accommodative esotropia, age group- 3 years and above as well as subjects below the age of 3 years, those with history of strabismic surgery were included in the study, VA taken with TAC (Teller Acuity Chart), those files having improper squint documentation were excluded from the study.

Thorough eye examination protocol of the patient was studied, which included:

1. History taking (chief complaints, history of present illness, history of past illness, family history, detailed birth history, if under any medication, any surgical procedure done, allergies),
2. Visual acuity testing (with Cardiff, HOTV and pictorial chart),
3. Objective refraction (retinoscopy) pre and post cycloplegic drug,
4. Subjective refraction,
5. External examination (facial symmetry, head posture, ocular position and alignment)
6. Stereopsis (using Titmus fly test),
7. Ocular alignment test (Hirschberg test, Modified Krimsky test and ocular motility test),
8. Slit lamp examination,
9. IOP check (GAT or iCare) and then
10. Instillation of cycloplegic eye drops depending on if the child is having any history of fits and seizures, and
11. According to post cycloplegic refraction, full cycloplegic refractive corrections was given and were called for follow-up.

The features studied were ocular alignment with correction in subsequent follow-ups, amblyopia, high AC/A ratio and anisometropia>1.5.

Statistical analysis:

The Statistical Programme of Social Sciences (SPSS) version 21 was used to collect and analyse data. Values including frequencies, means, standard deviations, ranges, cross tabulations, and percentages of the acquired data were examined using descriptive statistics.

The Chi-square test was used to investigate the association between background features and relevant parameters and refractive accommodating esotropia. A p-value of 0.05 was considered statistically significant.

Results

In this study, the demographic data of total 162 subjects was collected from the record file and the mean and standard deviation (SD) of the age of the patients on first visit was found to be 6.89±3.91. At presentation the mean and SD for both right and left eye visual acuity was found to be 0.46±0.27 and 0.51±0.26 respectively.

There was no such finding of one eye having better or worse visual acuity than the other eye and was found to be statistically similar to each other; p=0.09. From the total 162 cases 56 (34.56%) were having amblyopia in which 24 were having strabismic amblyopia, 11 were having anisometropic amblyopia and 21 were other amblyopia which could not be identified at presentation. Anisometropia of >1.5D was also found in 16 of the 162 cases (9.8%).

The mean and SD for right and left eye spherical error was found to be 4.08±2.28 and 4.17±2.15 respectively and the spherical error was also found statistically similar; p=0.14. Initially 13 of the 162 cases (8.02%) were having high AC/A ratio. At a mean follow-up after 122 days the visual acuity with the prescribed full cycloplegic refractive correction was assessed and the mean and SD for right and left eye was found to be 0.34±0.21 and 0.38±0.21 respectively and was also found statistically similar; p=0.09 same as the initial visit.

A significant correlation was found between aided visual acuity and aided ET for near (74.07%); p=0.07 and between aided visual acuity and aided ET for distance (77.78%); p=0.12. Correlation between max spherical error and aided ET for near and between max spherical error and aided ET for distance; p=-0.17 and p=-0.16 was inversely proportional but not significant.

As seen in cover test the mean change in deviation from first visit to second visit was 16.72±12.78. In few cases it was also observed that the deviation increased (not significantly) in follow up visit which may be due to the error in glass prescription, uncooperative patient, delayed follow-up or non-compliance to wearing glasses.

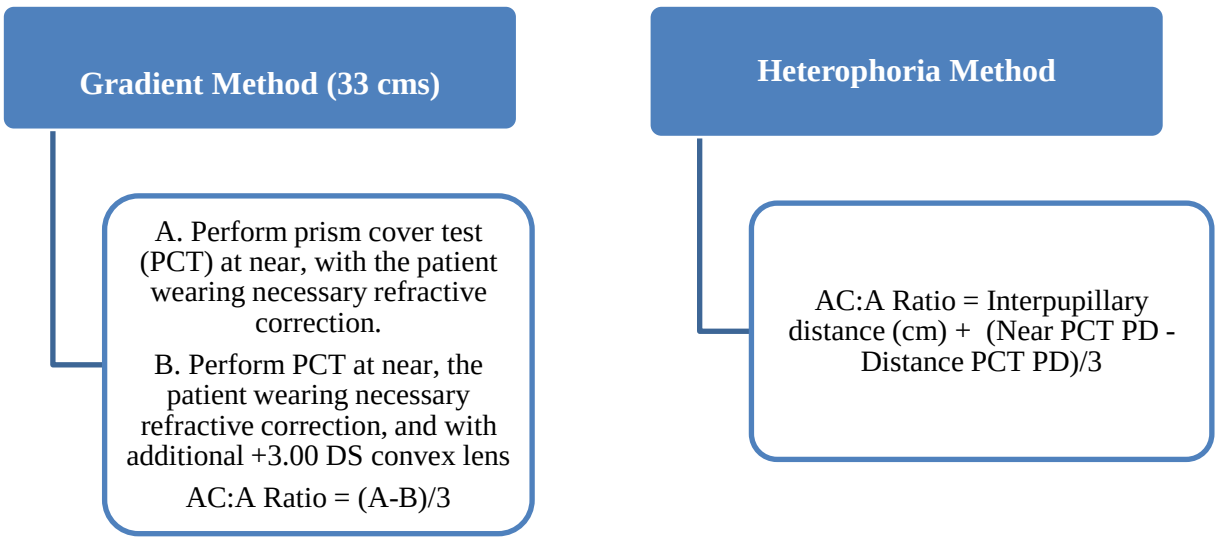

Fig 1: Methods of measurement of AC/A ratio

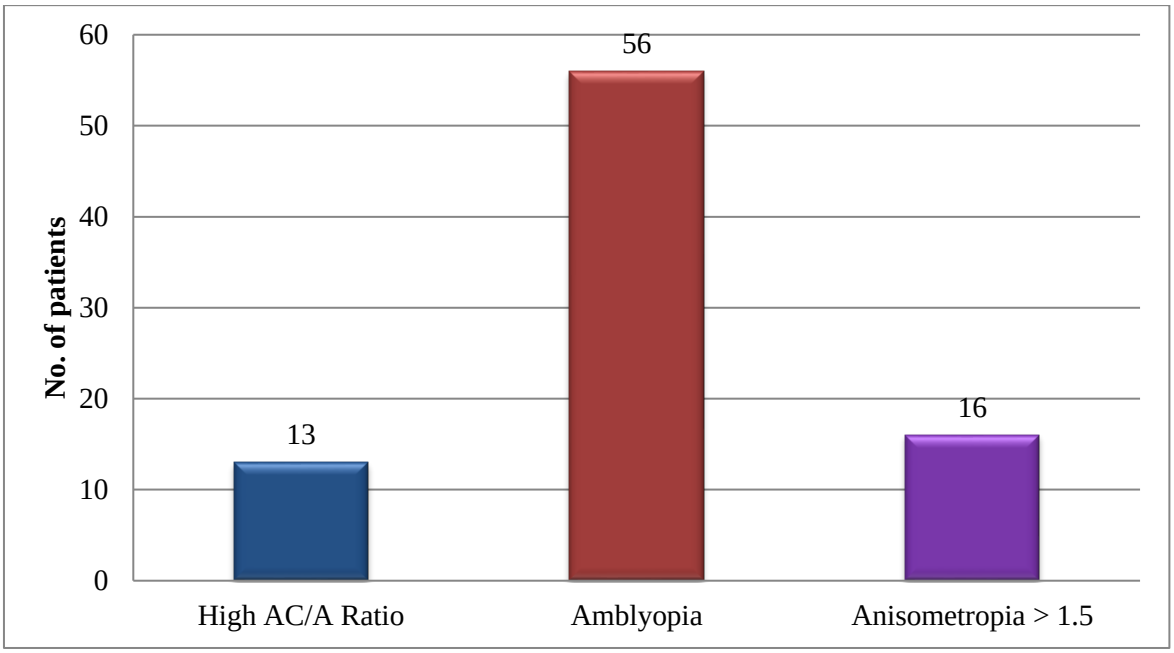

Fig 2: Distribution of ocular conditions among the children

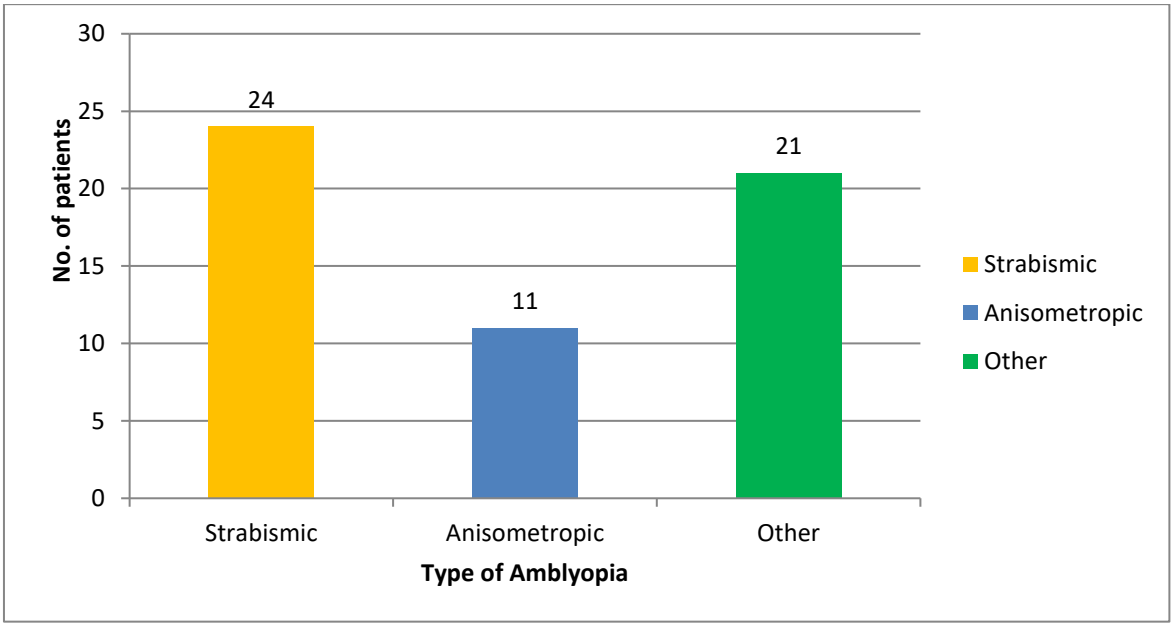

Fig 3: Fig showing the categorization of amblyopia

4. Discussion

This observational study was conducted to report the ocular profile of children with refractive accommodative esotropia presented to an Eye OPD. Our study has given similar results to the previous studies that show that with proper refractive error correction the esotropia recedes over time.

Bradley Charles Black conducted the study to determine the impact of refractive error management on the natural progression of accommodative esotropia and the efficacy of treatment. The researchers also investigated how refractive error management affects the resolution of accommodative esotropia, the worsening of accommodative esotropia, and the development of hypermetropia in accommodative esotropia over time.

Individuals with untreated accommodative esotropia who met the following criteria were chosen: hypermetropia; distance esodeviation 10 PD with full cycloplegic refraction correction on first follow-up examination; and at least two years of follow-up. The link between hyperopia and esotropia was revealed in this study. The study's findings show that accommodating esotropia is often stable, but that younger age at diagnosis, oblique muscle weakness, and an incorrect distance-near connection are associated with deterioration.

According to research by Preslan MW et al. that looked at current theories and debates, treating accommodative esotropia necessitates a complete assessment at the time of presentation in order to clarify all pertinent variables. In the initial care of these patients, it is crucial to consider the severity of the hypermetropia, the kind of esodeviation (i.e., intermittent or persistent), whether amblyopia is present or not, and the AC/A ratio.

Contrary to conventional belief, a study conducted in 1984 on hypermetropia in accommodative esodeviation by Raab EL found that hypermetropia in children grows over the first seven years of life and then declines. Regarding these traits in patients with accommodative esodeviation, there is no universal agreement. The mean annual change in hypermetropia up to the seventh birthday was an increase of +0.190.36 D in 68 patients (136 eyes). Changes in accommodative deviation among subjects were similar in size.

In a previously published age-matched sample that was unselected for strabismus, the equivalent mean annual change was +0.28 D. Between the ages of 7 and 13 years, there was a mean annual decline in hypermetropia in accommodative esodeviation of -0.180.25 D. The matching result in the overall population of children was -0.22 D. Although there are occasionally clinically significant individual deviations from these findings, most cases of either controlled or deteriorating accommodative esodeviation do not exhibit an accelerated rate of progression in hypermetropia.[8]

The effectiveness of all-time wear of full cycloplegic correction in the management of refractive accommodative esotropia was established in a 2013 study by Iqbal MS and et.al on Refractive accommodative esotropia; Management and Results. At Nishtar Hospital in Multan, Pakistan, from October 2009 to September 2010, a descriptive study using a non-probability purposive sampling technique was conducted. The study included all kids with accommodative esotropia linked to hyperopia.

Eye alignment, the relationship between anisometropia, strabismus, and amblyopia, improvements in squint deviation after amblyopia therapy, full cycloplegic hyperopia correction and restoration of binocular single vision, and the need for surgery in patients with accommodative esotropia and hyperopia were all examined. It was discovered that 44 children had refractive accommodating esotropia. A full cycloplegic correction was administered after cycloplegic refraction on all patients. Anisotropic hypermetropia was present in 36.4% of children at presentation, and most of them had amblyopia in one or both eyes.

The more hypermetropia-prone eye had esotropia. 25% of the patients achieved straightness following amblyopia treatment, while 63.6% of the patients achieved straightness with just glasses. In 75% of patients, fusion with gross stereopsis was seen. The following period saw no change in the cycloplegic refraction. None of these patients managed to stop wearing their glasses while keeping their alignment. Among all patients, only 11.4% required surgery.

They concluded that the glasses benefit the majority of children with refractive accommodative esotropia in terms of visual acuity, ocular alignment, and binocular single vision. Full cycloplegic correction and amblyopia therapy dramatically reduced squint deviation and increased visual acuity in the amblyopic eye when compared to the prevalence at presentation. The chances of no longer needing glasses are slim, and the degree of hyperopia remains unchanged.[9]

According to a study by Bradley Charles Black on the effects of refractive error management on the natural course of accommodative esotropia and the success of treatment, there is no evidence that under-correcting hypermetropia hastens its recovery. Even though accommodating esotropia is typically stable, there is a correlation between diagnosis age, oblique muscle weakness, and an unfavourable distance-near ratio and progression. Under-correcting hypermetropia can cause an aberrant distance-near relationship, exacerbating the accommodative esotropia. Aggressive under-correction for hypermetropia should be done with caution because the risks can occasionally exceed the benefits.

A majority of studies have shown that hyperopia increased before esotropia started. According to reports, youngsters who are esotropic and have full-correction glasses on experience delayed hyperopia improvements. In this study, we discovered that RAET patients are more likely to become amblyopic. We failed to discover a connection between the participants' ocular deviation and refractive error.

We have only taken cases with RAET, but in this cohort, the need for surgery in cases with RAET could not be achieved. This study was done retrospectively and has limitations of lack of sample size, minimal measurement of ocular parameters like stereopsis, and documentation of present spectacle prescription.

LIMITATIONS

It would have been a better study with more concrete results and conclusions if the refractive correction of the patient at the second would have been reassessed and data on stereopsis and near visual acuity would

have been collected. Due to the pandemic Covid-19, the sample size was also limited.

CONCLUSION

This study tells us about the ocular profile of the subjects with refractive accommodative esotropia who visited Eye OPD at the Centre for Sight. A detailed trend in the ocular profile of patients with refractive accommodative esotropia can be achieved by a prospective study with more parameters like stereopsis, near visual acuity, regular follow-up, compliance to glass wear, correction of refractive error, and change in deviation.
Most kids with refractive accommodating esotropia do better in terms of binocular single vision and visual performance. The prevalence of amblyopia was significantly lower in this study's observation of current therapeutic techniques for this illness than it was at presentation.

Conflict of interest: Author declares that there is no conflict of interest.

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