

ON THE ROLE OF MICROANISOMETROPIA (THE "BUTTERFLY" EFFECT) IN THE OCCURRENCE OF ESOTROPIA IN CHILDREN

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Abstract:

Purpose: This report presents 3 cases of esotropia in children and an attempt is made to explain the cause of the development of esotropia in these children.

Methods: A comprehensive ophthalmic examination was carried out in the following order: photorefractometry using the Plusoptix A09 photoscreener without cycloplegia; orthoptic examination with the alternate prism cover test; anterior segment assessment using a slit lamp; fundus examination and cycloplegic retinoscopy; and, for autorefractometry measurements, Sure-Sight.

Results: Three cases of esotropia in children are presented. In all cases, a slight microanisometropia was observed along with the cylindrical component of the squinting eye.

Conclusion: Our three examples show how a slight degree of ametropia can cause a deviation of the eyeball. Therefore, case-by-case analysis can be more informative than large statistical studies. Thus, it is appropriate to evaluate each case from these new perspectives. The timely elimination of a small degree of anisometropia in the astigmatic or spherical components can lead to the restoration of the symmetrical position of the eyes.

Keywords: esotropia, infantile esotropia, strabismus, amblyopia, microanisometropia

Infantile esotropia (IE) is classically defined as an esotropia with an onset before the age of 6 months, with a large angle of strabismus, no or mild amblyopia, small to moderate hypermetropia, latent nystagmus, dissociated vertical deviation, limited abduction, and absent or reduced binocular vision in the absence of neurological disorders.^{1,2} IE affects between 0.25 and 0.5% of the population,³⁻⁵ depending on the degree to which children with neurological disorders are excluded. IE may have different causes, ranging from an interruption of binocular vision by eye muscle palsy to perinatal hypoxia and similar brain damage. Prematurity, low birth weight, and low Apgar scores are significant risk factors for IE.⁶ The ability to translate information about the disparity of the images of the two eyes into a vergence command to facilitate stereopsis is a complex cerebral function that may well falter in neurological disorders, explaining the bad outcome of strabismus surgery at a young age in such cases.⁷

Some cases of IE result exclusively from a motor disorder, such as eye muscle palsy or an anatomical anomaly of an eye muscle or bony orbit. In principle, such cases are more amenable to early surgery to restore or retain binocular vision.⁸ Thus, the pathogenesis of esotropia and infantile esotropia is associated with a congenital disorder in the anatomical development of muscles and bones of the orbit, which leads to a disturbance in binocular vision. We noted that microanisometropia may be the cause of esotropia. In this report, we present the cases of 3 patients with early-onset esotropia.

Case Reports

Case 1

A 2-year-old child presented with esotropia noticed since four months of age [Figure.1.]. On the alternate prism cover test for distance, there was an esotropia of 35 prism diopters (pd) in the primary position in the right eye. The patient was otherwise healthy and neurologically normal. No family history of strabismus, amblyopia, or myopia was reported.

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A comprehensive ophthalmic examination was carried out in the following order: photorefractometry using the Plusoptix A09 photoscreener without cycloplegia; orthoptic examination with the alternate prism cover test; anterior segment assessment using a slit lamp; fundus examination and cycloplegic retinoscopy; and, for autorefractometry measurements, Sure-Sight. Extraocular motility was full and free in all directions of gaze.

Plusoptix(baseline): OD Sph + 1, 25 Cyl +1.5. ax = 74° OS Sph +1.0 Cyl +1.25 ax = 115°

Retinoscopy: Cycloplegic refraction OD Sph + 1.0 Cyl +1.5 OS Sph + 1.0 Cyl +1.0

Anterior segment findings in both eyes were normal.

In both eyes, dilated fundus examination was normal. The difference in the astigmatic component between the right eye and the left eye was 0.25-0.5 diopters. Apparently, this small difference in the astigmatic component (microanisometropia) was the triggering factor for the development of esotropia of the right eye. Wearing glasses did not work. He turned late. Therefore, he was operated on.



Figure 1. Esotropia of the right eye in a 2-year-old child.

Case 2

A 7-month-old child presented with esotropia noticed since three months of age [Fig. 2.]. On the alternate prism cover test for distance, there was an esotropia of 40 prism diopters in the primary position in the right eye. Anterior segment findings in both eyes were normal. Dilated fundus examination was normal in both eyes.



Figure 2. Child 7 months before wearing glasses

Plus optic OD Sph + 1,5 Cyl -0.75 ax = 3°

OS Sph +1.25 Cyl -0.25 ax = 45°

SureSight OD Sph +1.75 Cyl -0.75 ax = 6°

OS Sph + 1.5 Cyl -0.5 ax = 70°

Retinoscopy OD Sph E Cyl +1.0

OS Sph. ECyl 0

A small degree of astigmatism was confirmed by three methods of determining refraction. A slight blurring of the image on the retina was apparently the cause of the inadequate formation of binocular vision and led to deviation of the eye. The blurring of the image on the retina on one of the eyes is what interfered with the fusion of images. Spectacle correction assigned. Rp. OD Cyl +0.5 D OS Planum. Re-examination of the child after 6 months showed that the symmetrical position of the eyes had been restored [Figure. 3.].



Figure 3. Child 7 months after wearing glasses.

Case 3

A 7-month-old child presented with esotropia noticed since three months of age. On the alternate prism cover test for distance, there was an esotropia of 35 prism diopters in the primary position in the right eye. Anterior segment findings in both eyes were normal. Dilated fundus examination was normal in both eyes.

Plus optic OD Sph + 1,5 Cyl -1.5 ax = 176

OS Sph +1.25 Cyl -0.75 ax = 15

Sure Sight OD Sph +2.75 Cyl -1.25 ax = 178

OS Sph + 2.25 Cyl -0,75 ax = 10

Retinoscopy OD Sph + 0.75 Cyl +1.0

OS Sph +0.5 Cyl 0 (0.5)

This example shows that both eyes have almost the same spherical component. The spherical component did not affect the clarity of the image, as it is compensated by strong accommodation in the child. At the same time, microanisometropia along the cylindrical component can lead to some blurring of the image on the retina. This blurring is what seemed to cause the deviation of the eye. Spectacle correction assigned. Rp. OD Cyl +1.25 D ax = 177 OS Cyl + 0.5 D ax = 12 After 6 months, the child's eyes assumed a symmetrical position.



Figure. 5. *Child 7 months before and after wearing glass*

Discussion

The research devoted to refractive studies of strabismus by different authors is based on a large volume of clinical material. This material is subjected to statistical processing. However, statistical processing does not consider the minimum degree of anisotropy in the spherical and astigmatic components of refraction. Our three examples show how a slight degree of ametropia can cause a deviation of the eyeball. Therefore, case-by-case analysis can be more informative than large statistical studies. Thus, it is appropriate to evaluate each case from these

new perspectives. The timely elimination of a small degree of anisotropy in the astigmatic or spherical components can lead to the restoration of the symmetrical position of the eyes. The above examples consider the most insignificant changes in the degree of astigmatism with infantile esotropia. Usually, these changes are classified as physiological, and ophthalmologists do not take them into account. Microanisometropia is one of the main factors in the occurrence of esotropia. Timely elimination of this microanisometropia can lead to the disappearance of esotropia. Similar studies have been conducted by Azerbaijani ophthalmologists.⁹⁻¹⁰

Conflict of interests

The author declares that there is no conflict of interests.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Study association

This study is not associated with any thesis or dissertation work

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