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Anisometry in Patients with Congenital Myopia Spectacle Correction

Khamrakulov S. B. [1], **Boboev S. A.** [2]

[1, 2] Samarkand State Medical University

Abstract: Congenital ametropia leads to amblyopia (functional reduction of vision in the absence of organic eye pathology), strabismus. That is why it is necessary to detect timely any refractive error, to use adequate correction in the form of glasses and contact lenses and, in decompensated forms of the disease, to carry out treatment measures for achieving high visual acuity, creating good binocular and stereoscopic vision and preventing progressive development of eye anomaly.

Keywords: Congenital ametropia, amblyopia, spectacle correction.

Introduction. Amblyopia, or "lazy eye", is a developmental anomaly of the nervous system, usually caused by eye deviation (strabismus), chronic optical blurring due to unequal refractive errors in both eyes (anisometropia) or a combination of strabismus and anisometropia during early childhood. Amblyopia is classically defined on the basis of poor visual acuity, loss of contrast sensitivity and impaired binocular function (e.g. loss of depth perception). These deficits are thought to result from changes in neuronal properties in the early visual cortical areas, V1 1-7 and V2 However, several studies show that the extrastriate cortex in amblyopia is also affected. These functional deficits include contour integration, global motion processing, and global shape processing. Electrophysiological studies and neuroimaging studies have also found extrastriar abnormalities; For example, discriminating directional cinematograms with high-level random dots causes less activation in V3A, MT+ and posterior parietal cortex (PPC) in both eyes of children with amblyopia compared to control subjects. These extrastriatal deficits appear to be more pronounced in those with strabismic amblyopia than in those with anisometropic amblyopia. and cannot be explained by the functional losses in V1 and V2 reported in physiological studies of amblyopia in animals. Anisometropia is an eye disease characterised by an interocular difference in refractive error. It is a special refractive state where two human eyes may have asymmetric eye growth. This condition can occur with myopia, hyperopia or astigmatic asymmetry and is closely related to the development of other eye changes such as aniseeconia, amblyopia, diplopia and strabismus. Anisometropia with a small difference in refraction between the eyes - one of the manifestations of asymmetry in the paired organ of vision - is widespread. According to various studies, its frequency fluctuates, but within small limits. Although there is no uniform definition of dioptric value for its clinical classification, for most authors, a spherical equivalent (SE) IOD of 1 diopter or more is accepted as the threshold value. However, even using this limit, the scientific literature presents significant differences in the prevalence of anisometropia depending on age, gender, and ethnicity. Lifestyle and educational factors are also referred to as risk factors for anisometropia. Anisometropia is one of the refractive errors of the eye, in which the difference between the refractive powers of the two eyeballs exceeds 2 dptr. Patients with high anisometropia are a heavy medico-social contingent due to rapid development of deep amblyopia of the "worst" eye, strabismus and binocular dysfunctions in the absence of timely adequate correction. The frequency of anisometropia among the population, according to different authors, ranges from 2.5% to 54.8%. Refractive and anisometropic amblyopia occur in 2.3 % of pre-school and school children.

Anisometric amblyopia is understood to be a one-sided vision loss, more often without any visible lesions explaining the loss, when refraction anomalies cause blurred images on the retina. At the

same time, the normal neurophysiological development of the visual pathways and visual cortical centres is impaired.

Robert W. Arnold published the results of several studies determining the incidence of anisometropia greater than 1.5 D as a risk factor for amblyopia. Ottar et al. reported anisometropia in 0.9% of cases. The MEPEDS study reported anisometropia in 1.6% of subjects, BPEDS in 1.5% and VIPS in 2.3%. Donohue found anisometropia of 1.0D or more in 0.66 per cent of preschool children surveyed. G.K. von Noorden et al. believe that hyperopic anisometropia is the most common risk factor for amblyopia. Portuguese researchers Nunes AF, Batista M, Monteiro P (2021) present a study and prevalence estimation of anisometropia in Portuguese children and adolescents at different educational stages, examining its relationship with socio-demographic variables. An observational cross-sectional study involving 749 children and adolescents (3 to 16 years) from the central region of Portugal. Refraction was performed using a pediatric open-field autorefractometer (PlusOptix) without cycloplegia and under binocular conditions to determine the frequency of anisometropia and its association with gender, school cycle and area of residence. The prevalence of anisometropia in the study sample was 6.1%, ranging from 2.9% in pre-school to 9.4% in cycle 3. Myopic anisometropia was the most common, while hyperopic and astigmatic anisometropia showed similar proportions of occurrence. No statistical differences were found between sexes or between areas of residence regarding the frequency of anisometropia. Regarding spherical equivalent anisometropia, there was a pattern of variation that increased with the study cycle ($p = 0.012$), with myopic anisometropia making the main contribution to this variation. This study found an increase in anisometropia during the learning phase. The high level of anisometropia found in adolescents (9.4%) and the progressive increase throughout schooling (from 2.9% to 9.4%) indicate the need to expand strategies for detecting this condition beyond childhood. The literature presents amblyopia (refractive and/or strabismic) and uncorrected refractive anomalies without amblyopia as the main cause of reduced visual acuity in childhood, and these anomalies have a negative impact on child development, particularly at the educational level. Reduced VA interferes with a number of key tasks in the learning process. Thus, it is important to maintain a running programme to identify these deficits and lead to their correction before the school phase begins. These relationships are difficult to assess in children because the relative chronology of these conditions is not always obvious. This is especially true for patients with anisometropia and amblyopia, because these conditions are often first detected long after either anisometropia or amblyopia has developed. Refraction was performed using a pediatric open-field autorefractometer (PlusOptix) without cycloplegia and under binocular conditions to determine the frequency of anisometropia and its association with gender, school cycle and area of residence. The prevalence of anisometropia in the study sample was 6.1%, ranging from 2.9% in pre-school to 9.4% in cycle 3. Myopic anisometropia was the most common, while hyperopic and astigmatic anisometropia showed similar proportions of occurrence. No statistical differences were found between sexes or between areas of residence regarding the frequency of anisometropia. Regarding spherical equivalent anisometropia, there was a pattern of variation that increased with the study cycle ($p = 0.012$), with myopic anisometropia making the main contribution to this variation. This study found an increase in anisometropia during the learning phase. The high level of anisometropia found in adolescents (9.4%) and the progressive increase throughout schooling (from 2.9% to 9.4%) indicate the need to expand strategies for detecting this condition beyond childhood. The literature presents amblyopia (refractive and/or strabismic) and uncorrected refractive anomalies without amblyopia as the main cause of reduced visual acuity in childhood, and these anomalies have a negative impact on child development, particularly at the educational level. Reduced VA interferes with a number of key tasks in the learning process. Thus, it is important to maintain a running programme to identify these deficits and lead to their correction before the school phase begins. These relationships are difficult to assess in children because the relative chronology of these conditions is not always obvious. This is especially true for patients with anisometropia and amblyopia, because these conditions are often first detected long after either anisometropia or amblyopia has developed. In this study, the authors analysed primate data that were relevant to the coexistence of anisometropia, amblyopia and strabismus in children. They relied on interocular comparisons of spatial vision and refraction development in animals reared with 1) monocular

deprivation; 2) anisometropia caused by contact or spectacle lenses; 3) organic amblyopia caused by laser ablation of the central fossa; and 4) strabismus that was either optically superimposed with prisms or caused by surgical or pharmacological manipulations of the extraocular muscles. Hyperopic anisometropia, introduced at an early age, led to amblyopia in a dose-dependent manner. However, when potential methodological confusions were taken into account, the hypothesis that the presence of amblyopia interferes with emmetropization or contributes to farsightedness, or that the degree of image degradation determines the direction of eye growth, was not confirmed. On the contrary, there was strong evidence that amblyopic eyes were able to detect the presence of refractive anomaly and alterocular growth to correct ametropia. On the other hand, early-onset strabismus, both optically and surgically imposed, disrupted the emmetropization process, leading to anisometropia. In surgically strabismus, deviating eyes tended to be more far-sighted than their fixed-eye counterparts. The results indicate that early anisometropia farsightedness is a significant risk factor for amblyopia. Early esotropia may provoke both anisometropia and amblyopia. However, amblyopia by itself is not a significant risk factor for the development of hyperopia or anisometropia.

Anisometropia, asymmetry of refraction between the paired eyes, is an under-diagnosed cause of amblyopia, because it is not obvious to parents or the child, and as a consequence, often goes unnoticed until the child is older. If left untreated, it is a well-known amblyogenic factor. However, when detected early enough, anisometropic amblyopia can be treated effectively with glasses. Thus, assessment of the association of anisometropia with amblyopia and the type and level of refractive anomaly is important, especially in view of the increasing popularity of amblyopia photo-screening in young children instead of more traditional optometric recognition acuity assessments. The association with anisometropia has recently been reported in population studies, but the type and level of refractive anomaly has yet to be quantified in a population sample of young preschool children who are likely to benefit from early intervention and timely refractive correction.

Conclusions: The rather widespread occurrence of anisometropic amblyopia and the significant social and occupational limitations it causes is an important medical and social problem. Since the current methods for the complex treatment of this pathology using are not always sufficiently effective, the development of new methods of treatment seems to be an urgent task.

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