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The Relationship of Functional and Anatomica-Optical Parameters of the Eye with Congenital Myopia

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Abstract: The value of visual acuity with correction in patients with congenital myopia did not correlate with the degree of myopia. Between the magnitude of visual acuity on the one hand and the age of the patient on the other, a high positive correlation

(ζ =0,54, p<0,001).The most intensive increase in eye FRA length occurs approximatelyuntil the age of 12-15 years. Then the rate of increase in eye's FRA is significantly reduced even with further progression of myopia. The weakening of the value of physical refraction in congenital myopia is due to reduce the refraction of the lens, there is a high negative correlation between the increase in the length of the eye FRA length and decrease of refractive lens power (r = - 0.545). Adverse factors in prognostic relation for progression of congenital myopia are: relatively small eye axis length, its irregular shape and the presence of astigmatism.

Key words: congenital myopia, front rear axle, refraction, progressive myopia

Introduction: Congenital progressive complicated myopia continues to be one of the topical problems of modern ophthalmology, often leading to limited professional choice, disability and blindness[1,2,3,7,8]. According to Yusupov A.A. (2004) congenital myopia in children of the first year of life averages 1.4%-4.0%, among children of primary school age it ranges from 0.1%-3% [2,4]. Information concerning visual acuity and its influence on the dynamics of anatomo-optical eye parameters and the course of congenital myopia has not been sufficiently studied [1,4,7,6,9,11]. Visual acuity in congenital myopia with correction is most often low because it is combined with retinal and optic nerve pathology. Low visual acuity could occur both in high degree myopia and in mild degree myopia[8]. It is known that its clinical course can reach very high degrees already in early childhood.

However, cases of congenital myopia of mild to moderate degree are not uncommon even in adult patients [5]. It is now established that the course of congenital myopia differs from acquired myopia both in the final result of the process and in the nature of its development [8]. Recurrent and constant increase in the degree of congenital myopia characterizes its unfavorable course, requiring more careful attention from ophthalmologists. The influence of visual acuity on age-related changes in the anatomo-optical elements of the eye in congenital myopia and x correlation are insufficiently studied.

Research aim: To study parallelism of functional and anatomo-optical eye parameters in congenital myopia and the factors influencing this process.

Material and methods: We studied 180 patients (345 eyes) with congenital myopia from 3 to 20 years old at 1 clinic of Samarkand State Medical Institute. We classified as congenital myopia any myopia detected at the age of 2-4 years. To differentiate congenital myopia from early-onset myopia we used the method proposed by Yusupov A.A. (1992).

Standard ophthalmological research methods were carried out: determination of visual acuity, degree of myopia was determined by cycloplegia, skeascopy under atropine cycloplegia and autorefractometry, determination of corneal refraction and radius of curvature on ophthalmometer, ultrasound biometry, as well as determination of the shape of the eyeball, total refraction of the optical system of the eye and refraction of the lens, condition of the fundus was studied by fundus camera ophthalmoscopy and retinal OCT examination was performed.

Results of the study. We studied visual acuity in congenital myopia and the factors influencing this process. We found out the main factors influencing the state of visual acuity in patients with congenital myopia. For this purpose 154 eyes of patients with congenital myopia aged from 3 to 20 years were examined. All patients were prescribed full correction based on objective data. Refraction was determined skiscopically after three-day atropinization and by refractometry. It should be noted that, as a rule, all patients, regardless of the degree of myopia, easily tolerated spectacle correction. Some patients had slight dizziness and discomfort in the area of the brow, which we eliminated by reducing the spectacle correction by 1-2-D less than the true degree of myopia.

Table 1

Distribution of patients with congenital myopia by visual acuity (with full spectacle correction) .

Number of patients with some visual acuity								Total eyes examined
0,04-0,1		0,2-0,3		0,4-0,7		0,8-1,0		
Abs.	%	Abs..	%	Abs.	%	Abs..	%	
8	5,2	52	33,7	94	61	-	-	154

As can be seen from the table, high visual acuity (0.8-1.0) was not present in any of the examined patients. A significant number of the patients' eyes (61%) had visual acuity in the range of 0.4-0.7, i.e. in the range slightly limiting their professional ability. Decrease of high visual acuity (from 0.04 to 0.1) was noted only in 5.2% of the eyes. In 33,7% of the eyes the value of visual acuity corresponded to amblyopia of medium degree (0,2-0,3). The average value of visual acuity in the total group of patients was 0,519±0,02. Contact correction contributed to a relatively greater increase in visual acuity than spectacle correction. We tracked the effect of contact correction on visual acuity in 62 eyes of 31

patients. In 34,5% of the eyes where visual acuity with spectacles did not exceed 0,6 contact lens correction contributed to restoration of visual acuity to 0,8-1,0. The number of patients with a visual acuity of 0.2-0.3 decreased significantly when contact lenses were prescribed. The average corrected visual acuity in patients with contact correction was 0.719±0.06. The high effect of contact correction can probably be explained by the elimination of eye aberration by correcting corneal nonsphericity as well as by increasing the image on the retina. In order to find out the reasons influencing the visual acuity of patients with congenital myopia we made a correlation analysis of the relation between visual acuity value and anatomico-optical indices and clinical eye condition.

Table 2

Degree of influence of various factors on visual acuity in patients with congenital myopia

Factors affecting visual acuity	Statistical indicators			
	Degree of freedom (K)	Correlation coefficient (ζ)	The t-test of the Student's t-test	Level of significance (p)
Eye shape	30	-0,685	-4,099	0,001
Age of patient	30	0,54	5,441	0,001
Myopia degree in dptr.	30	-0,304	-5,385	0,001
Degree of astigmatism in dptr.	30	-0,282	-5,385	0,001
PZO length in mm.	30	-0,085	-5,385	0,001

As can be seen from the table, the shape of the eyeball is the most significant factor influencing visual acuity in patients with congenital myopia. The correlation coefficient between visual acuity and the shape of the eye was -0.685, $p<0.001$. This means that as the shape of the eye moves from a compressed ellipse to an elongated ellipse, the value of visual acuity decreases. As noted above, the shape of the eye was judged by the ratio of the length of the PZO to the arithmetic mean of the horizontal and vertical diameters of the eye. Eye shape-RPD: (GD+VD)/2. Contrary to our expectations, the influence of the eye length on visual acuity status was minimal ($ζ=-0,085, p<0,001$).

The second most important factor influencing visual acuity was the patient's age. There was a high positive correlation ($ζ=0,54$, $p<0,001$) between visual acuity value on the one hand and the patient's age on the other hand. This correlation indicates that the patients' corrected visual acuity increases with age. The results suggest that the formation of visual functions in patients with congenital myopia is completed somewhat later than in the norm.

This fact can be explained as follows. Congenital myopia is known to be polymorphic. There are cases where there are significant changes in the retina with a relatively low degree of myopia and vice versa, cases of high myopia with a relatively benign state of the eye fundus. The state of the retina in congenital myopia is evidently influenced not only by the absolute length of the ROP and the degree of myopia, but also by the degree of eyeball deformation from globular to ellipsoidal shape. Also note a

lower correlation between the eye axis length and the degree of ametropia in congenital myopia (ح =0.5) than in all myopia in adults (according to the literature, in these cases it ranges from 0.8 to 0.97).

A significant factor influencing visual acuity was the degree of astigmatism. There was revealed the negative correlation interdependence between this parameter and visual acuity value (ح =-0,282,p<0,001), i.e. the higher the degree of astigmatism the lower the visual acuity value.

The table shows that significance level of correlation relations for all studied factors turned out to be rather high (p<0,001).

Study of anatomo-optical eye elements in patients of different age groups showed that the degree of congenital myopia did not directly depend on the patient's age. If in the group of patients aged 3-7 years the mean degree of myopia was 8,38±0,70, in the age group (8-11 years) it was 7,23±0,59. In the following groups of patients there was an increase in the average static refraction. While studying refraction according to the data of "longitudinal section" it was found that refraction remained stable in 127 eyes (36,8%) during the period of observation (3-6 years) but in the remaining eyes it changed more often (11 eyes - 32,4%). Although in some cases there was even some weakening (107 eyes - 31.0%), which is not observed in patients with acquired myopia.

The process of refraction weakening was mostly observed in younger patients (from 3 to 11 years old), which is associated with a decrease in refraction of the crystalline lens. The average value of the anteroposterior axis length of the eyes with age undergoes changes in the direction of strengthening, regardless of the course of the process.

The refraction of the optical system of the eye in patients with congenital myopia at the age of 12-15 years undergoes changes towards weakening. After the age of 15 it becomes stronger [7]. This change is associated with a change in refraction of the crystalline lens. A high negative correlation between the increase of the RPE of the eye, on the one hand, and a decrease of the crystalline lens refractive power, on the other hand, was found (h=-0.545 in non-progressive, and low h=-0.24 in progressive).

The average increase in PPC length during the period of observation depends on its initial value, i.e., the smaller was the initial value of PPC, the greater was its degree of increase. Thus, with the initial length of RPC up to 24 mm, its average increase for 3 years was 1.52±0.28 mm, with the initial length of RPC of 24-26 mm - 0.87±0.17 mm and with the initial length of RPC of 27 mm and more - only 0.35±0.08 mm.

In congenital myopia, all 3 eye shapes are observed, with the shapes of a compressed ellipse and ball prevailing at low and medium degrees, and an elongated ellipsoid becomes the most frequent form of the eye at high degrees, although a spherical form is also often found. In order to study the influence of astigmatism on the congenital myopia we followed the refraction dynamics in 96 patients (170 eyes) aged from 7 to 16 years for 3-6 years. Progression of myopia was seen in 98 (57.6%) eyes during the observation period. Refraction was stable in 72 (42.3%) eyes.

The average degree of astigmatism was higher in patients with a progressive course of the disease (2.98 ± 1.46 dpts) than in patients with a nonprogressive course (1.94 ± 1.02 dpts).

Analyses showed a high correlation between the degree of astigmatism and the rate of myopia progression: h=0.64. A high correlation was found between the degree of astigmatism on the one hand and the PZO length on the other: h= 0.67.

Uniform strengthening of refraction in the main eye meridians was noted in 27.1% of cases; the degree of astigmatism did not change in these patients. In 62.7% of the eyes there was an increase in the

degree of astigmatism due to refraction enhancement of the strong eye meridian, and in 10.2% of the eyes the progression of myopia was accompanied by a decrease in the degree of astigmatism, which was associated with a predominant increase in refraction of the weak eye meridian.

In congenital myopia there is uneven stretching of the eyeball, the horizontal meridian of the eye increases, as indicated by a predominant increase in refraction along the vertical meridian of the eye.

Echobiometric measurement showed that in patients with progressive myopia the average value of the horizontal diameter of the eye was greater than the vertical diameter. So if the average value of the eye horizontal meridian in our examined patients was 25,8±0,24 mm, in the vertical it was 24,8±0,11 mm. In patients with non-progressive course it was 25.6±0.31 mm and 25.7±0.33 mm, respectively. Comparative short length of the eye axis, its irregular shape and astigmatism in congenital myopia refer to the prognostic tests of the unfavorable course of the process.

Conclusions.

1. The magnitude of corrected visual acuity in patients with congenital myopia did not correlate with the degree of myopia. There was a high positive correlation (ζ=0,54, p<0,001) between visual acuity value on the one hand and the patient's age on the other hand.

2. In congenital myopia three kinds of dynamics were observed: in 1/3 of patients (36,8%) myopia degree didn't change - it stabilized, in 1/3 of patients (32,4%) it increased - progressed, in 1/3 of patients (31,1%) it weakened - regressed which was never seen in acquired myopia.

3. The factors leading to worsening of congenital myopia course, according to our data, are: relatively small initial length of ROP, irregular shape of the eyeball, as well as the presence of astigmatism.

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