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Violation of Accommodation and Biomechanical Parameters in Scleromalacia is a Complication of Myopia Developing in Adolescents

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Annotation. Progressive myopia in adolescents according to scientific Macaulay risk factors, problems, the development of the disease and problems in diagnosis, the results of the examination are indicated in the form of complications of scleromalacia, accommodation disorders and biomechanical indicators. In young people and with the complication of scleromalacia myopia, which develops after puberty, there is a violation of the indicators of accommodation and biomechanics, and it is shown that the achemic nature of social blindness is very high.

Key words: VZST, OKT, PZO, DZN.

Relevance. Scleromalacia is an increasingly common indicator of adolescent myopia. This remains one of the most urgent problems of modern ophthalmology. This is related to the widespread prevalence of myopia, its early manifestation and development - the deterioration of vision up to the limitation of professional choice, the onset of blindness and, as a result, visual disability.

The prevalence of myopia in the world is 1.6 billion people, and its growth will reach 2.5 billion by 2021. person, by 2050 - this indicator will make the world's population 4758 million, i.e. - 49.8%. (Tarutta E.P. et al., 2018; BA Golden., 2016). While it is 30-55% in developed countries, myopia among students in Taiwan is 95.9%, in China - 95.5% (Fan D. S., Lam D. S., 2004; Wang T. J., Chiang T. H ., Wang T. H., Lin L. L. et al., 2009). In Singapore, 79.3% are myopic; 41.6% in the US. in Uzbekistanm. developing between smirsAn important aspect of the complications of myopia is the steady growth of blindness and low vision as a result of the development of scleromalacia. In the general structure of disability, myopia takes the 3rd place (18%) and the 2nd place in children. Failure to timely and complete control of myopia at school age develops amblyopia, strabismus, binocular vision is impaired (Markova E. Yu., 2015; 2018; Proskurina O. V. et al., 2018). According to the results of the All-Russian medical examination, the number of children and adolescents with myopia increased 10 times in 1.5 years (Katargina L. A., Tarutta E. P., 2012). Among graduates, the frequency of myopia at the end of school is 26%, gymnasiums and lyceums - 50%, and the growth of high myopia is 10-12%. Insufficient visual acuity in childhood leads to social adaptation, reduces the quality of life of the child, and myopia at an older age can affect the choice of future profession and work. (Petukhov V. M., Medvedov A. V., 2004; Strakhov V. V., 2007). Epidemiological nature of the spread of myopia shows that prevention, treatment and rehabilitation measures are insufficient. In this regard, the attention of ophthalmologists around the world is now focused on a deeper search for the causes of the appearance and development of myopia among teenagers (Avetisov E. S., 2002; Lutskevich E. E., Plexova L. Yu. Borodina N. V. , 2002; Volkova E. M., Strakhov V. V., 2005; Tarruta E. P., 2005; Jarov V. V. et al., 2007), as well as therapeutic and preventive measures to prevent therapeutic complications and carrying out preventive measures will be appropriate. (E.V.

Brusakova et al., 2007; Obrubov S. A. et al. 2008; Pashtaev N. P., Arsyutov D. G., 2009; Fabrikantov O. L., Tarutta E. P., Tarasova N. A., 2015).

The main risk factors for the appearance and development of myopia are a weakened retina, hereditary predisposition and weakening of the strength properties of the sclera, as well as an increase in intraocular pressure in the upper limits of the norm. (Avetisov E. S., 2002; Tarruta E. P., 2005; Iomdina E. H. et al. 2010; Markova E. Yu. 2012; Starikova D. I., 2014). In myopia, three types of retinal disorders are distinguished: retinal weakness, length of the anterior orca axis, and hyperactive state in spasmodic asthenopia. At the same time, the types of retinal disorders in stationary and developing myopia, the level of intraocular pressure, biomechanical properties of the sclera, and scleromalacia in the development of myopia Questions about the connection between the retina in pathogenesis and prognosis have not been fully studied.

The purpose and task is to develop a complex modified technology of clinical and functional diagnosis, monitoring and forecasting of scleromalacia in developing myopia in adolescents based on the study of biomechanical parameters of the corneoscleral membrane and retinal disorders.

1. To study the biomechanical properties of the corneoscleral membrane in relation to the level of intraocular pressure in patients with stationary and developing myopia.
2. To determine the main types of retinal disorders in patients with stationary and developing myopia in relation to the degree of ophthalmotonus.
3. To study the tension of the sclera in stationary and progressive myopia, its value in assessing the course of myopia based on the study of the level of intraocular pressure measured taking into account the biometric indicators and the hardness of the corneoscleral membrane.
4. To conduct a multifactorial correlational analysis in general diseases of the body, to determine the indicators of the biomechanical properties of the cornoscleral membrane, the level of intraocular pressure in children with stationary and progressive myopia, and diagnostic criteria predicting the progressive course of myopia
5. Development of a comprehensive system for predicting the development of myopia in children using a mathematical model based on regression analysis and evaluation of changes in the biomechanical properties of the corneoscleral membrane, ophthalmotonus and accommodation disorders. was held in the hospital.

- Group 1. 105 patients (210 eyes) with adolescent progressive myopia were examined

Group 2 included 100 patients (198 eyes) with stationary myopia.

Group 3 included 36 patients with emmetropia (72 eyes) - the control group. A total of 241 patients (479 eyes) were examined. The age of the patients ranged from 7 to 20 years. The average age is 13.26 years. 105 patients with progressive and stationary myopia (210 eyes) were divided according to the degree of myopia: mild (89 eyes -30.3%), moderate (116 eyes -39.4%) and high (89 eyes - 30.3%). Patients with a clinical refraction value of -0.5 to -3.0 dptr, an average level of -3.25 to -6.0 dptr, and a high myopia of -6.25 dptr and above were referred to mild myopia. All patients underwent a complex ophthalmological examination: visiometry, refractometry, ultrasound biometry, perimetry, tonometry, measurement of the hardness of the corneoscleral membrane by computer differential tonometry according to Friedenwald. Study of clinical refraction against the background of drug cycloplegia, it was also carried out using a "Canon RK-F1" (Canon, Japan) autorefractometer with dynamic monitoring of patients. Biomicroscopy of the anterior segment of the eye was performed. Gonioscopy and fundus biomicroscopy were performed using Goldmann lenses.

The method of differential tonometry according to Friedenwald was used to study the biomechanical properties of the corneoscleral membrane of the eye in the examined individuals. This method made it possible to determine the value of intraocular pressure, taking into account the stiffness index of the corneoscleral membrane, which increased the accuracy of tonometry, taking into account the individual characteristics of the eye. Scleral thickness was measured using UBM of the eye in the projection of the ciliary part of the ciliary body (Ts1) and at the border of the transition of the flat part of the ciliary body to

the choroid (Ts2). TC2-the thickness of the sclera measured in the transition projection of the flat part of the ciliary body to the choroid (mm).

Inspection results. In order to study the influence of the main risk factors on the development of myopia, the relationship between the biomechanical properties of the sclera, the level of intraocular pressure and the position of the eye was studied. In 105 patients with progressive myopia (205 eyes), the average value of the annual gradient of myopia progression with a change in refractive index was -0.764, with a change in anteroposterior eye size of 0.259 mm / year (from 0.13 mm / year to 0.74 mm / year), which confirmed the progressive course of myopia in this group of patients. It should be noted that in patients with mild progressive myopia, in contrast to patients with emmetropia, there was not only a significant increase in the anteroposterior size of the eyeball, but also a significant decrease in the thickness of the sclera (TC2) measured in the transition projection of the ciliary plane body for the choroid ($t=3.1$; $p < 0.01$). Reduction of scleral thickness (TC2) in patients with mild myopia, emmetropia ($t=4.3$; $p<0.01$). With progressive myopia, an increase in the eye OOO' and a decrease in the thickness of the sclera was accompanied by a significant increase in the scleral tension index, in contrast to patients with emmetropia. An increase in the degree of myopia was characterized by an increase in the scleral tension index. In patients with stationary myopia (210 eyes), the maximum values of the scleral stress index were determined taking into account the degree of myopia, which was considered as the upper limits of its norm: for mild myopia, 299 mm Hg, for moderate myopia, 336 mm Hg and for high myopia, 390 mmhg. St With progressive myopia, an increase in the eye OOO' and a decrease in the thickness of the sclera was accompanied by a significant increase in the scleral tension index, in contrast to patients with emmetropia. An increase in the degree of myopia was characterized by an increase in the scleral tension index. In patients with stationary myopia (210 eyes), the maximum values of the scleral stress index were determined taking into account the degree of myopia, which was considered as the upper limits of its norm: for mild myopia, 299 mm Hg, for moderate myopia, 336 mm Hg and for high myopia, 390 mmhg. St With progressive myopia, an increase in the eye OOO' and a decrease in the thickness of the sclera was accompanied by a significant increase in the scleral tension index, in contrast to patients with emmetropia. An increase in the degree of myopia was characterized by an increase in the scleral tension index. In patients with stationary myopia (210 eyes), the maximum values of the scleral stress index were determined taking into account the degree of myopia, which was considered as the upper limits of its norm: for mild myopia, 299 mm Hg, for moderate myopia, 336 mm Hg and for high myopia, 390 mmhg. St In patients with stationary myopia (210 eyes), the maximum values of the scleral stress index were determined taking into account the degree of myopia, which was considered as the upper limits of its norm: for mild myopia, 299 mm Hg, for moderate myopia, 336 mm Hg and for high myopia, 390 mmhg. St In patients with stationary myopia (210 eyes), the maximum values of the scleral stress index were determined taking into account the degree of myopia, which was considered as the upper limits of its norm: for mild myopia, 299 mm Hg, for moderate myopia, 336 mm Hg and for high myopia, 390 mmhg. St when the obtained values of scleral stress of the control indicators exceeded, the development of myopia was noted for each patient, taking into account the degree of myopia. In stationary myopia (152 eyes), in contrast to patients with emmetropia (46 eyes), sclera (TC2) thickness ($t=4.7$; $p<0.001$) and the hardness index of the corneoscleral membrane of the eye decreased significantly ($t=9.7$; $p<0.001$).), a decrease in intraocular pressure ($t=2.2$; $p<0.05$) and an increase in the scleral tension index ($t=4.27$; $p<0.001$), taking into account the stiffness index of the corneoscleral membrane of the eye. The actual IOP values exceeding 21 mm Hg only in stationary observed in 6 patients (6 eyes) with myopia (3.9% of cases). In contrast to patients with progressive myopia (210 eyes) and stationary myopia (100 eyes), A significant decrease in the thickness of the sclera (TC2) was found ($t=4.7$; $p<0.001$), the increase in the level of intraocular pressure was measured taking into account the rigidity. The difference between the average values of the hardness index of the corneoscleral membrane of the eye between progressive and stationary myopia was also statistically significant ($t = 3.2$; $p<0.01$).

Summary

1. 100 patients (198 eyes) with stationary myopia (210 eyes). In stationary myopia, Pina was combined with retinal weakness in 11.8% of cases (18 eyes), retinal weakness in 44.1% of cases (67 eyes), and retinal weakness in 21% of cases (32 eyes). In combination with retinal weakness and spasmodic asthenopia, it was detected in only 1 eye (0.7%).

2. Combined types of retinal disorders were found in patients with progressive myopia: a combination of PIN and retinal weakness, as well as a combination of PIN, retinal weakness and spasmodic retinal weakness asthenopia. In stationary myopia, combined types of retinal disorders were recorded only in the form of a combination of PIN and retinal weakness and occurred in 21% of cases against the background of normal values of ophthalmotonus.
3. A significant relationship between sclera and ocular OOO' tension, thickness of sclera (Ts2) measured in the transition projection of the flat part of the ciliary body to the choroid, and the actual level was found in adolescents with progressive myopia. High values of scleral tension in patients with stationary myopia were determined taking into account the degree of myopia: low - 299 mm Hg, medium - 366 mm Hg and high - 390 mm Hg; when these values are exceeded, the development of myopia is predicted.
4. A comprehensive technology of clinical and functional diagnosis and monitoring of children with progressive myopia has been developed, which includes a diagnostic algorithm for assessing the values of biometric indicators and the condition of the biomechanical properties of the corneoscleral membrane, and for determining accommodation disorders in relation to the level of ophthalmotonus.

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