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Determination and Analysis of the development reasons of refraction disorders in children

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Abstract: In article were discussed some issues and factors leading **to** visual acuity. Different types of surveys were conducted and special questionnaire was created to identify risk factors that affect the visual ability of young school-children and to assess the level of impact on their health. The aim of the research was to identify external factors that affect the visual ability of young school-age students and to assess their level of impact. It was found that a decrease in visual acuity was found in 110 (13.44%) of primary school-age students. Twelve factors related to school and home conditions that could negatively affect visual acuity in primary school-age students were identified, including 3 factors that negatively affected visual acuity: lighting in the classroom at home; do the lesson at home on the floor or at the table; the distance between the eye and the object is not normal when writing, drawing, reading

Keywords: young school-age children, refractive disorders, risk factors, factors that negatively affect visual acuity

The visual organ, along with other organs and systems of the human body, is one of the organs that support human life activities and provides the ability to see. Decreased vision under the influence of various external and internal factors can lead to a decline in human quality of life, especially in children, which causes great difficulties in their subsequent life and work activities [1, 4, 6, 7, 11].

One of the external factors that negatively affect vision is the fact that school-age children are educated in educational institutions. The fact that this process is not organized at the level of normative requirements reduces a child's ability to see, which has a negative impact on his lifestyle, social activities [2, 3, 5, 8, 9, 10].

The aim of the study is to identify risk factors that affect the visual ability of young school-children and to assess the level of impact.

Materials and methods. To achieve this goal, a survey was conducted among 818 primary school students aged 6-12 and their parents, living in urban and rural areas of Khorezm region, studying in secondary schools. The children of the studied primary school age were distributed by age as follows: 6 years - 7 people (0.86% of all surveyed); 7 years - 186 people (22.74%); 8 years - 176 people (21.51%); 9 years - 128 people (15.65%); 10 years - 116 people (14.18%); 11 years old 199 people (24.33%); 12 years - 6 people (0.73%). When these studies were distributed by sex, it was observed that they were nearly equal with each other: boys accounted for 52.08 ± 1.75% (n = 426) and girls for 47.92 ± 1.75% (n = 392).

In order to achieve the validity of the results obtained, the studied school children were also classified by place of permanent residence (urban or rural). The distribution showed that the results for this parameter did not differ significantly: the urban population was 47.31 ± 1.75% (n = 387), while the rural population was 52.69

± 1.75% (n = 431). It was found that 75.67 ± 1.50% of all students (n = 619) were studying in the 1st shift, and 24.33 ± 1.50% (n = 199) were studying in the 2nd shift.

School-age children studying in different schools involved in the study were divided into age groups based on random selection, with the compared groups being representative to each other. All studies were randomized. Questionnaires were completed with the direct participation of head teachers of children in selected schools, without interfering with the learning process. When it was necessary, with the permission of the parents, the homework section was completed in their homes. The survey-interview method was used to collect data from the studied contingent. A special questionnaire was created, approved and formalized for this purpose. A total of 50 questions were included in the questionnaire, which included general information about the respondent (student), the study conditions created for his / her preparation for the lessons and independent practice in secondary school, academic lyceum and at home.

As a result, risk factors that negatively affect visual acuity were identified, evaluated, and the extent of their impact on visual acuity was indicated.

In the process of conducting the research work, all ethical principles on human involvement in medical research were strictly adhered to, based on the 1964 Helsinki Declaration of the World Medical Association (the latest amendment was adopted at the 59th General Assembly of the World Medical Association in Seoul in 2008).

Statistical processing of the obtained results was carried out using traditional variation statistical methods. It determined the arithmetic mean (M), the mean quantity error (m), and the reliability criterion (R). All tests were performed on personal computers using a special programme "Excel" for medical and biological tests. The organization and conduct of the research was based on the principles of evidence-based medicine.

The obtained results and their discussion It was found during the study, that the majority of mothers of small school-children were workers (35.94 ± 1.68%, n = 294) and housewives (25.67 ± 1.53%, n = 210), and that most of their fathers were workers (57.82). ± 1.74%, n = 466) and temporarily unemployed (17.61 ± 1.34%, n = 142). Among mothers, the majority of mothers have secondary education (60.88%), and the majority of fathers have secondary education (46.15%) too. Higher education was dominated by fathers - 28.54% vs. 17.48%.

In the mothers of the small school-aged children studied, no harmful habits were observed at all, with smoking occurring in 42.93 ± 1.74% (n = 346) and alcohol consumption in 39.33 ± 1.72% (n = 317) among the fathers. Close kinship between parents was also rare (3.06 ± 0.60%, n = 25), diseases in the first trimester of pregnancy were less common 3.06 ± 0.60% (n = 25), and maternal morbidity during the second period was 3.30 ± 0.62% (n = 27). In the remaining cases, the mothers did not develop any diseases during pregnancy.

Based on the above, the studied contingent's ability to see was not affected by risk factors such as harmful habits of parents, heredity, maternal diseases during pregnancy, to prevent students' visual impairment we would like to conclude that these risk factors can be ignored in organizing preventive measures.

The results showed that 708 (86.56 ± 1.19%) of all students (n = 818) were found to have normal vision, while 110 (13.44 ± 1.19%) of them had negative changes in vision (Figure 1). In 59 of them (7.21 ± 0.90%) there was a decrease in visual acuity, in 1 (0.12 ± 0.11%) there was a sharp decrease in visual acuity, in 33 (4.03 ± 0.69%) there was a myopia, in 17 (2.08 ± 0.50%) were diagnosed with pathological conditions such as hyperopia.

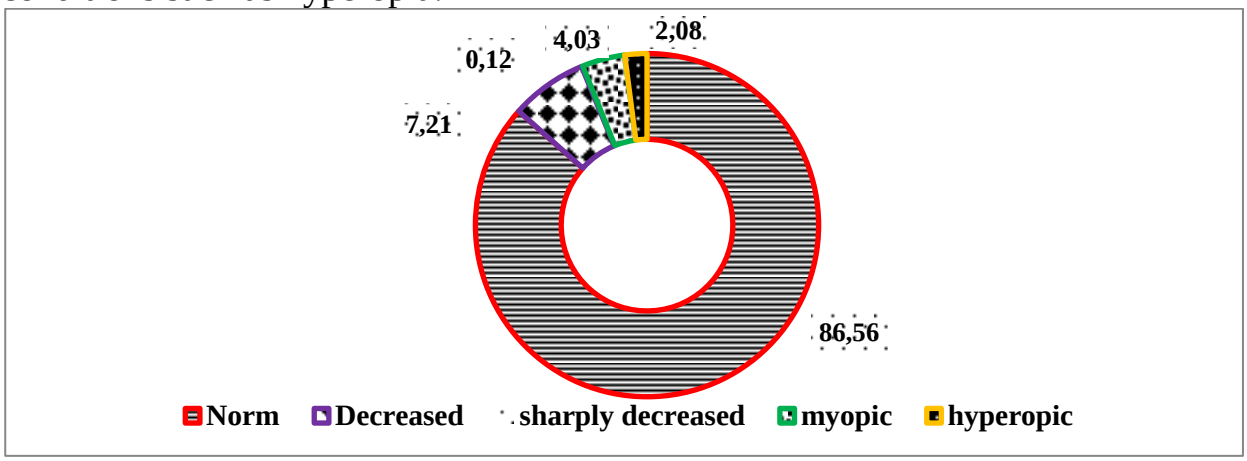

Figure1. Results of the study of vision in children of primary school age, %

When parents were asked, they attributed their children's decreased vision to various factors (Figure 2). Among these factors indicated by parents, the factor of playing computer games was the leading factor - 25.45 ± 4.15% (n = 28), followed by the child reading a lot of books (9.09 ± 2.74%, n = 10), and another factor was writing and drawing a lot (6.36 ± 2.74%, n = 7). Decreased visual acuity was also observed in 2 children as a result of eye trauma (1.82 ± 1.27%).

Most notably, parents of all younger school children (n = 110) who were diagnosed with eye diseases were found to be unaware of the cause of the diseases (57.27 ± 4.72%, n = 63). They answered "I don't know" to this question in the survey. When these parents were asked why they did not know, 2/3 of the respondents said that they had no idea about eye diseases and the factors that cause them, and were not interested in this information.

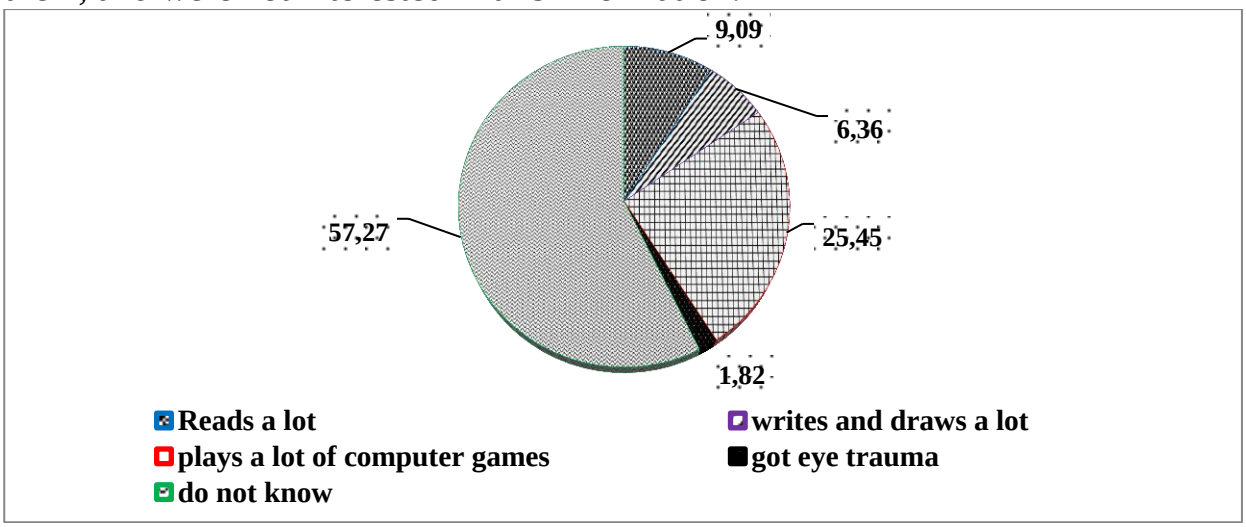

Figure2. Indicators of parents commenting on the origin of this pathology in children with visual impairment, %

In our opinion, this was not a neglect of the child, but a practical lack of imagination on understanding of eye diseases and their symptoms, which prevented the timely detection and prophylactics of this condition.

This situation has once again proved the importance of primary prophylactics in the prevention of eye diseases.

In a comparative study of the onset time of the diseases associated with decreased visual acuity, the majority of parents told that the disease began 1 year ago (23.64 ± 4.05%, n = 26), 2 years ago in (30.91 ± 4.41%, n = 34). Also, those who said it started 3 years ago reported 19.09 ± 3.75% (n = 21), those who said it started 4 or 5 years ago 10.90 ± 2.97% (n = 12) and 11, 82 ± 3.08% (n = 13) respectively. When the frequency of visual acuity decreases in families with all studied children (n = 818), the incidence of these pathologies was found in their different relatives (Table 1)

Table 1

The incidence rate of visual acuity decrease among close relatives of the studied children contingent, n = 818

Kinship	Absolute	%
Father	16	1,96±0,48
Mother	28	3,42±0,64
Brothers	16	1,96±0,48
Sisters	13	1,59±0,44
The norm in all family members	745	91,07±1,0

It can be seen from Table 1 that there was no decrease in visual acuity among close relatives of the majority of children (91.07 ± 1.0%, n = 745), only 8.93% (n = 73) were diagnosed with this pathology among close relatives. This situation is consistent with all figures cited in the literature data and reflects the current trend.

The need to correct eye acuity is high, and spectacle wear is important, so when children were asked to wear glasses during class, only 34 (4.16 ± 0.70%) of them reported wearing them regularly, compared to 9 (1.10 ± 0) 36%) said, they did not wear it all the time. Only 43 (39.09 ± 1.71%) of 110 children with reduced visual acuity and identified by us, wore glasses regularly, not always, and the remaining 60.91% of children surveyed did not wear them during class for various reasons, in other words, they did not use glasses.

In extracurricular use, 60 of the total surveyed (7.33%) used glasses, especially when watching TV (4.16 ± 1.6%, n = 34), when using various gadgets (smartphones, tablets, etc.) (2.08 ± 0, 50%, n = 17) used more glasses. However, this indicator should not be taken as a definite rule, because the use of glasses is individual and subjective. The next phase of the research was a comparative study and analysis of various factors occurred in school and home environment that may adversely affect eye acuity.

When analyzing the factors related to the learning process in the school, it was first studied the correct planning of the existing learning process, the lesson schedule and the correct distribution of complex subjects during the week.

As it turned out, in 99.27 ± 0.30% of the education institutions we studied, we found that the lesson schedule was structured correctly, taking into account all the factors. The distribution of complex subjects during the day was as follows: based on the curriculum, in 25.55 ± 1.53% of cases they were once a day, in 25.67 ± 1.53% were placed 2 times and 48.78 ± 1.75% were placed 3 times. It was determined, that the distribution of specific sciences (mathematics, etc.) during the day meets all the requirements, we studied the distribution of their number in complex sciences during the week. It can be seen that all the complex sciences were evenly distributed throughout the week, and no deviations from the permissible norm were observed in this regard. We observed a similar situation in terms of more or less numbers of subjects during the week.

Given that extracurricular reading by grades can strain visual activity, we focused and analyzed its duration. In total 32.40 ± 1.64%, extracurricular activities lasted 30 minutes, in 58.07 ± 1.73% 1 hour, in 8.31 ± 0.97% 2 hours, in 1.22 ± 0.38% it lasted 3 hours. These figures show that there was no deviation from the norm in the organization and conduct of this part of the educational process.

These factors, which may adversely affect visual performance, were also not included in the risk factors in the analysis of the above figures. This condition prevents a decrease in visual acuity in organized groups of children is a sign that all primary prevention programs are being implemented properly.

Another factor that can negatively affect children's ability to see is the lighting of classrooms. The inspections showed, that in only 0.37 ± 0.21% of the classrooms where the students were studying the lighting was below the norm, in other cases the illumination was normal. These results were obtained on the basis of data from sanitary-hygienic inspections, the Department of Sanitary-Epidemiological Tranquility and Public Health Departments.

In the next phase of the study, data on the performance of homework by small school-age students at home were analyzed. Given that this is also one of the factors that negatively affect visual acuity, it is clear how important the numbers obtained are.

A very small proportion of children (3.92 ± 0.67%, n = 32) reported that they prepare their homework on the floor, while most children were at the table (41.56 ± 1.72%, n = 340) and at the small table (54.52). ± 1.72%, n = 446). When asked for convenience for the lesson, they indicated that they were uncomfortable on the small table or on the floor, and that it was impossible to maintain the distance between the book or notebook and the eye. With this in mind, we cite that doing homework on the floor or at the small table as a risk factor for decreased visual acuity.

The amount of time children spend doing homework is also an important factor, as eye time is also an important factor, as it is also a source of eye strain. The study found that the majority of children (60.76 ± 1.71%, n = 497) spent 1 hour on doing homework. Students who spend 2 hours on homework are less likely to be deficient (8.31 ± 0.97%, n = 68), and children who spend 30 minutes are less likely to spend less time (22.37 ± 1.46%, n = 183).

Another important aspect is when students do their homework. The later the homework is prepared by the student at home, the more stressful it will be on the

eyes, so we found it necessary to study this aspect. It was found that the majority of children start doing homework between 16.00-17.00 (44.01 ± 1.74%, n = 360), but between 18.00-19.00 (28.24 ± 1.57%, n = 231) and there are also those who perform it at 20.00-21.00 (26.89 ± 1.55%, n = 220).

The negative effects of computers, smartphones, and other gadgets on visual acuity have been proven by many researchers, so we analyzed data provided by parents on the level of computer use at home.

While 93.03 ± 0.99% (n = 761) of the respondents confirmed that they have a computer / smartphone in their home, 6.97 ± 0.89% (n = 57) of the respondents answered that they don't possess these gadgets at home or not allowed to be used by their parents.

When the results were studied for the purpose of using computers at home, the majority of respondents confirmed that they were intended for computer games - 55.26 ± 1.74% (n = 452). 31.17 ± 1.62% (n = 255) of children were found to use a computer to prepare for homework, and other cases were also rare. When it became known that a child played mostly games on computers at home, there was a need to learn how long it would last. According to parents, the time children spent using computers at home was mainly 30 minutes and 1 hour - 43.89 ± 1.74% (n = 359) and 42.54 ± 1.73% (n = 348), respectively. Computer use of 2 hours or more was less common - 6.72 ± 0.77% (n = 55) and 6.85 ± 0.88% (n = 56), respectively. The majority of respondents said they did not wear goggles when using a computer - 76.04 ± 1.49% (n = 622), but 1/5 (20.78 ± 1.42%, n = 170) of those surveyed said they always wear these goggles. This condition is a sign of a reaction to health, including visual acuity.

One of the factors that can negatively affect visual acuity is the distance between the notebook (or book) and the eye when a student reads a book at school or at home, when writing in a notebook or drawing. It is important to adhere to this distance, because going too close to or away from an object (notebook, book, or album) can lead to a decrease in visual acuity. Only when this distance is optimal (distance 30-35 cm) the visual organ is not strained, which in turn leads to pathology and the development of pathological conditions.

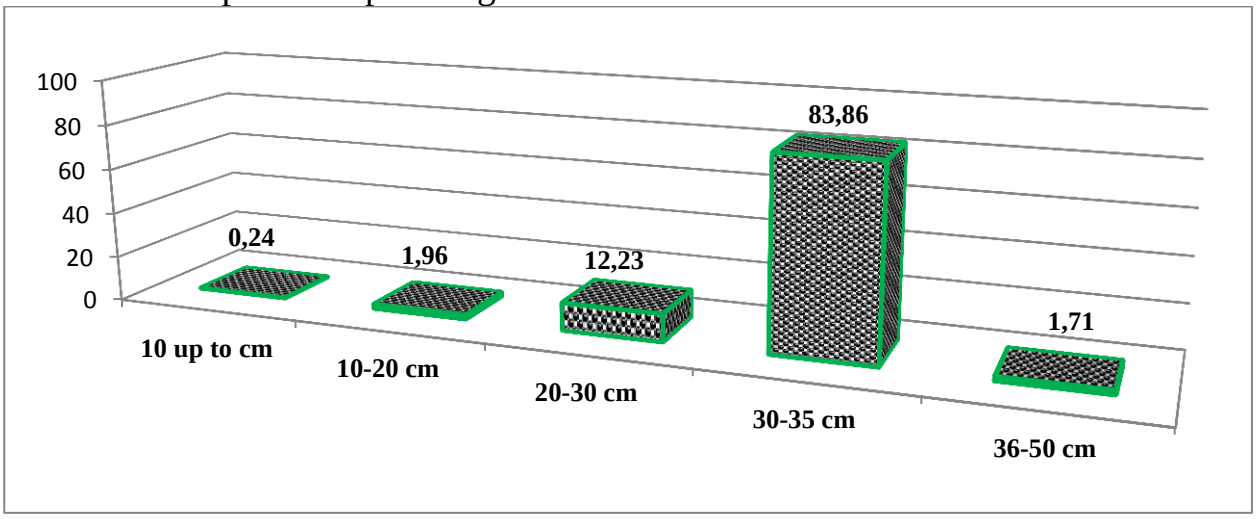

Figure3. Comparative indicators of the distance between the eye and the notebook during the lesson in children of primary school age, %

The results obtained (Figure 3.7) show that in most children, the distance between the object (notebook, book or album) and its visual organ was 30–35 cm (83.86 ± 1.29%, n = 686). In cases where this distance is less than the norm (30-35 cm) (up to 10 cm, respectively - 0.2 ± 0.17%, n = 2; 10-20 cm - 1.96 ± 0.48%, n = 16 ; 20-30 cm - 12.23 ± 1.15%, n = 100, R <0.001), as well as many cases (36-50 cm - 1.71 ± 0.45%, n = 14, R <0.001). If it is known that 16.14% (n = 132) of children do not maintain the distance between the eye and the object, we consider that 110 students with decreased visual acuity are correlated with detection.

To date, 12 factors related to school and home conditions that may negatively affect students 'visual acuity have been identified: harmful habits of students and parents (smoking, drinking); hereditary factor (marriage of close relatives); diseases of the mother during pregnancy; number of children in the family; how many children the child has in the family; psychological climate in the family; the lighting of the classroom; sitting in the classroom on the sides of the classroom and in the rows of desks; weekly distribution of complex subjects; many classes on certain days of the week; do the lesson at home on the floor or at the table; the distance between the eye and the object is not maintained when reading, writing, drawing.

From the above factors, we cite 3 factors that negatively affect the visual acuity of small school-age students during the study and should be considered when planning preventive measures, and interpret them as a risk factor: the light of the classroom at home; doing the homework at home on the floor or at small table; the distance between the eye and the object is not normal when writing, drawing, reading.

During the course of the lesson, it was proved that insufficient light in the room can lead to a decrease in its sharpness as well as strain on the visual organ.

It has been proved that it is impossible to maintain the distance between the eye and the object when the lesson is done on the ground, to ensure that the light falls on a flat object. When taught on a desk, the natural position of the body is disturbed, and the distance and angle of view between the organ of vision and the object change. This imbalance has been shown to have a negative effect on visual acuity. Based on the above substantiated features, all 3 factors listed were also recognized as risk factors that negatively affect visual acuity in young school-age children.

Conclusions:

1. Decreased visual acuity was found in 110 (13.44%) of primary school-age students, among whom visual acuity decreased (7.21%) and near vision (4.03%) were relatively common, as was distant vision (2.08%) was rare. Parents attributed this pathological condition in their children to excessive use of computer games (25.45%), excessive reading (9.09%) and excessive writing, drawing (6.36%), but the most significant is that 57.27% of them they answered "I don't know." The ignorance of the parents was not a disregard for the child, but a practical lack of understanding of eye diseases, which prevented the timely detection and prevention of this condition.

2. Twelve factors related to school and home conditions that could negatively affect visual acuity in primary school-age students were identified: harmful habits of

the student and parent (smoking, drinking); hereditary factor (marriage of close relatives); diseases of the mother during pregnancy; number of children in the family; how many children the child has in the family; psychological climate in the family; the lighting of the classroom; sitting in the classroom on the sides of the classroom and in the rows of desks; weekly distribution of complex subjects; many classes on certain days of the week; do the lesson at home on the floor or at the table; the distance between the eye and the object is not maintained when reading, writing, drawing.

3. We list 3 factors that negatively affect the visual acuity of primary school students and should be taken into account when planning preventive measures, and interpret them as a risk factor: the lighting of the classroom at home; do the lesson at home on the floor or at the table; the distance between the eye and the object is not normal when writing, drawing, reading.

4. It has been proved that it is impossible to maintain the distance between the eye and the object when the lesson is done on the ground, to ensure that the light falls on a flat object. When taught on a desk, the natural position of the body is disturbed, and the distance and angle of view between the organ of vision and the object change. This imbalance has been found to have a negative effect on visual acuity.

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