

## CORRECTIVE AND PREVENTIVE MEASURES FOR THE PREVENTION OF MYOPIA IN STUDENTS IN A UNIVERSITY ENVIRONMENT

Viktoriia I. Horoshko<sup>1</sup>, Yevheniia G. Khomenko<sup>1</sup>, Andrii I. Horoshko<sup>2</sup>

1 – National University «Yuri Kondratyuk Poltava Polytechnic», Poltava, Ukraine

2 – Graz University of Technology, Graz, Austria

### Summary

**Introduction.** The relevance of the conducted research is determined, on the one hand, by the unfavorable epidemiological situation regarding myopia among students, and on the other hand, by extremely incomplete knowledge of the mechanisms that mediate its development, progression, and stabilization.

**The aim of this study** is to carry out a comprehensive analysis of factors that contribute to the development of myopia, as well as the development of methods for assessing the risk of its occurrence, prevention of progression and psychological correction of myopia, research on the role of physical exertion in the prevention of visual fatigue and psychological correction of myopia with the help of therapeutic exercises.

**Materials and methods.** The study covered a representative sample of students from different regions of Ukraine. The number of participants was determined on the basis of statistical calculations to achieve sufficient representativeness of the results – 62 first- and second-year students of the Yuri Kondratyuk Poltava Polytechnic National University. The study of the peculiarities of the stability of attention and the speed of attention switching of myopic and normally ophthalmologically healthy students using the «Correction test» method by B. Burdon.

**Results and discussion.** Analyzing the results of the projective method, we can note that myopic individuals have more often (25 %) the influence of the family in their lives, in contrast to healthy individuals (10 %). Differences are also observed in the indicators of anxiety, in particular, myopic people show more anxiety in relation to society and feel insecurity (41 %), in contrast to healthy people (23 %). At the same time, there are insignificant differences in openness to communication – myopic people show a high level (56 %) in contrast to healthy people (67 %). Among students with a reduced relative reserve of accommodation, a decrease in the static endurance of the back muscles was more often observed. It was 17.74 % for boys and 22.58 % for girls. 32.25 % of boys and 77.41 % of girls had incorrect postures. To increase the static endurance of the muscles of the back, neck, and press, a technique was developed that included two repetitions of 2-3 exercises for each muscle group with a short interval between repetitions.

**Conclusions.** 1. Refractive disorders corresponding to mild and moderate myopia include restructuring of function at the level of the retina, visual pathways, and cerebral cortex. 2. Under conditions of the presence of myopia in a person, changes occur in the functioning of both the visual sensory system and higher nervous activity, in particular, attention. 3. The presence of myopia is also related to the psychological characteristics of the individual, in particular, the level of anxiety, the degree of independence and the feeling of attachment to the family, the search for protection from society and a safe environment for self-development. 4. Corrective and preventive measures should include a set of measures, such as psychophysiological stimulation of visual analyzers, selection of individual modes of performance of visual loads, increasing the variety of methods of intra-family interaction. 5. The analysis of the results of the study in the university environment of the impact of physical exercises on the problem of myopia among students showed the high effectiveness of physical activity and adapted physical exercises for the prevention of the development of myopia among students.

**Keywords:** myopia, psychocorrection, physical activity

## INTRODUCTION

The adaptability of the human psyche and body to the conditions of modern civilization is largely determined by a sharp increase in the load on the sensory system. The intensification of intellectual tasks, the increase in the volume of incoming information, the increase in requirements for the speed and accuracy of its processing are closely related to the development of sensory skills and the development of new sensory perception strategies. Effective adaptation of the analyzer to the features of the information environment will undoubtedly affect the development of the human sensory perception system. At least for the visual system, there are good reasons to believe that changes in the nature and intensity of visual load in developed countries may be accompanied by an increase in the frequency of myopia. There are about 13 million myopic people in Ukraine. 17 % of cases resulted in vision loss due to progressive myopia, and 15.7 % resulted in visual impairment due to progressive myopia [1, 2].

Chronologically, it has been shown that the increase in the incidence of refractive myopia coincides with the beginning of schooling. The observed dependence is explained by a sharp increase in the intensity of visual tasks at a close distance, which causes the formation of myopic refraction. Many authors note that myopia is more common in mental workers. It should be noted the increase in the incidence of myopia and the degree of myopia among students of higher educational institutions. To explain these facts, the concept of the harmful effect of visual load on the condition of the visual analyzer was widely used. However, the mechanisms of transformation of visual load into stable myopic refraction are clearly poorly studied. Solving this problem becomes especially relevant in connection with the need to develop optimal modes of intellectual (primarily educational) activity in the conditions of ever-increasing complexity and information saturation of modern educational programs [3].

Until now, correctional psychology has accumulated a wealth of scientific material and practical experience in the compensation of violations and the development of sensory processes during the general education of people with visual impairments. At the same time, the issue of relationships between the morpho-functional formation of the visual system, mental and social development, and the conditions of students' educational activities have been investigated to a much lesser extent. To solve these problems, it is necessary to scientifically build an effective system aimed at preventing the occurrence and progression of myopia [4].

Thus, the relevance of the conducted research is determined, on the one hand, by the unfavorable epidemiological situation regarding myopia among students, and on the other hand, by extremely incomplete knowledge of the mechanisms that mediate its development, progression, and stabilization.

The latest studies and publications on this topic are devoted to various aspects of the prevention of myopia.

Some of them emphasize genetic and environmental factors that contribute to the development of myopia. Thus, studies of genetic predisposition to myopia study hereditary factors that can influence the development of this disease in the population. Other studies are aimed at evaluating the effectiveness of pharmacological drugs or methods of controlling visual strain to reduce the risk of myopia progression. Thus, a study was conducted on the use of atypical contact lenses and pharmacological drugs to preserve normal visual accommodation and reduce the progression of myopia in children and adolescents. These studies make a significant contribution to the understanding of the mechanisms of the development of myopia and the development of prevention strategies. However, it is important to note that the problem of prevention of myopia is complex and multifaceted, so some aspects of this issue still remain unresolved. For example, a deeper understanding of the impact of physical activity, especially specially selected exercises for the eyes, on the prevention of the development of myopia requires additional research [5, 6].

The main *hypothesis of the study* was that the development of myopia is caused by a combination of a number of factors, not only genetic predisposition, organization of the visual perceptual system, but also features of cognitive and personal spheres, microsocial conditions.

## THE AIM OF THIS STUDY

To carry out a comprehensive analysis of factors that contribute to the development of myopia, as well as the development of methods for assessing the risk of its occurrence, prevention of progression and psychological correction of myopia, research on the role of physical exertion in the prevention of visual fatigue and psychological correction of myopia with the help of therapeutic exercises.

## MATERIALS AND METHODS

1. To achieve the set goal, the following specific research tasks were formulated:

2. To study the features of psychomotor and perceptual-cognitive functions in students with myopia and with the ophthalmological norm.

3. To identify personal characteristics in students with myopia using the «House-tree-man» test. The study of the peculiarities of the stability of attention and the speed of attention switching of myopic and normally ophthalmologically healthy students using the «Correction test» method by B. Burdon.

The influence of therapeutic exercises on the stabilization of the pathological process and the prevention of the occurrence of the disease.

The methodological basis of the study was the concept of the system dynamic organization of mental

functions, the determinism of their development and the mediation of the social and cultural environment, the basic concepts of the holistic sensor-perceptual organization of a person, and the system understanding of the function. A comprehensive, multidisciplinary approach was applied. Peculiarities of visual information processing and cognitive functions were revealed. The personal and micro-social characteristics of students with myopia compared to the ophthalmological norm were established. The research covered a wide range of diagnostic methods, and data collection on visual problems among students of the National University «Yuri Kondratyuk Poltava Polytechnic», who came to study from different regions of Ukraine. In addition, risk factors such as the duration of working at a close distance (for example, time spent in front of a computer or smartphone screen), lighting conditions, and hygiene factors that may affect students' vision were analyzed. A separate aspect of the research is devoted to the study of the impact of physical exertion on the visual system and the effectiveness of their use in the prevention of visual fatigue and prevention of myopia. Special tests and analyses of the results were conducted to find out the relationship between the level of physical activity and the state of visual health in the studied groups.

The following methods and organizational principles were used to conduct a study of visual problems among students:

1. The study covered a representative sample of students from different regions of Ukraine. The number of participants was determined on the basis of statistical calculations to achieve sufficient representativeness of the results – 62 first- and second-year students of the Faculty of Physical Culture and Sports and the Faculty of Humanities of the National University «Yuri Kondratyuk Poltava Polytechnic». The study includes students aged 17 to 18 years.

4. Data collection through questionnaires, analysis of medical examinations, and objective evaluations of the visual analyzer (such as visual acuity measurements, refractometry, etc.).

5. The collected data were processed and analyzed using statistical methods. The results are presented in the form of diagrams, tables, and scientific reports.

## RESULTS

The occurrence of myopia during learning has become a very common phenomenon in the modern civilized world. This situation has created an entire industry of corrective instruments that designs, improves, and manufactures products with the ultimate goal of correcting vision impairments. This has led to the development of clinical practice using a variety of methods to improve myopia, ranging from acclimatization training methods to surgical correction of major refractive errors using lasers.

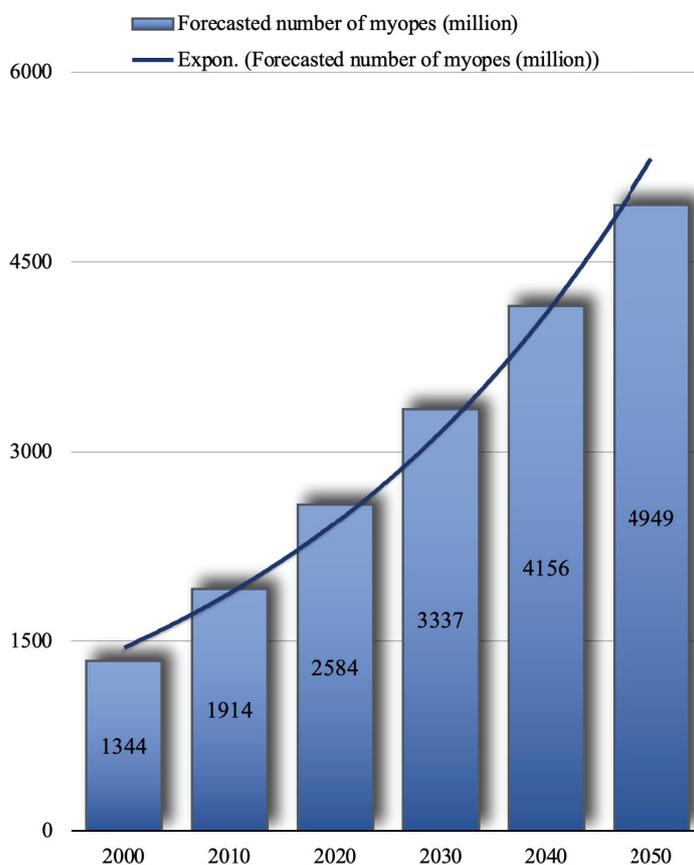


Figure 1. Forecasted number of myopes (developed by the authors based on the studied materials)

A paradoxical situation arises when all the technical means of correction of vision limitations associated with acquired simple myopia are ideal, and the problem of progression is firmly fixed in a number of local problems of ophthalmology. The above data on research in the world indicate that the phenomenon of myopia is not limited to the formation of myopic refraction in the peripheral part of the visual analyzer, but is related to the entire hierarchical system of processing and using visual information. Differences between myopic and ophthalmologically healthy groups combine the morphological and functional features of the retina, visual pathways, cortical neural networks, visual behavior, and cognitive activity into a single and internally consistent system. This indicates the presence of individual typological features of the visual function. Visual acuity has a non-linear dependence on the severity of the refractive error, and the effectiveness of optical correction is related to retinal activity and the severity of the astigmatic component of refraction. Asymmetry of the morphofunctional features of the eye was noted, which was absent in the ophthalmologically healthy group [7, 8].

Myopia is characterized by an increase in the critical frequency of flicker fusion and a lower threshold for its occurrence compared to the ophthalmological standard. This combination of signs indicates an increased rate of fading of the excitatory imprint at the level of nerve elements in the myopic visual system.

Compared to normal patients, myopic patients had a greater expression of late components of the evoked potential, a smaller number of early components, a shift of the focus of maximum activity of early components to the left hemisphere, and late components to the front hemisphere bark. This points to the growing role of programming and activity control units as potential compensators for their functional difficulties in acquiring, processing, and storing information in myopic individuals. Myopic individuals are usually characterized by a predominance of the right eye, bundles of contralateral visual pathways, and a high level of interocular interference, especially from right to left. These data show the spread of information passing from the right eye to the projection of the left hemisphere [9, 10].

Scientists have proven that in the processing of all information coming from the environment (80-90 %), the activity of the visual analyzer is of the greatest importance. When perceiving information, the individual features of attention become of great importance, as a dynamic characteristic of the flow of any mental activity, which affects the distribution of resources of the human information processing system and ensures the effectiveness of its activity. Some psychophysiological studies have shown that under conditions of the presence of myopia in a person, changes occur in the functioning of both the visual sensory system and higher nervous

activity, in particular, attention. Myopic students showed a combination of reduced stability of voluntary attention and increased switching ability, with no change in attentional ability compared to controls. The obtained data may indicate different ways of organizing attention functions in the studied groups [11, 12].

There are a number of publications on the interrelationship of psychological features, in particular character properties and features of human eye health. However, their authors, not always making certain assumptions, prove their statements with the data of their scientific research. Despite this, we have enough facts in the literature about the dependence of visual impairment on psychological factors, and vice versa. Investigating the personal characteristics of myopic and healthy people, significant differences were found using projective methods. In particular, one should pay attention to the fact that myopic people more often show insecurity in their own abilities, have problems in socialization, in particular, with reference groups (peers), are more closed and focused on their own experiences, do not feel stable, «ground under their feet» – or simply poorly oriented in real life. The sense of belonging to a group, in particular the family, is important for short-sighted people, so they demonstrate greater dependence, warm family relationships and openness to communication, search for a comfortable environment, and a sense of acceptance by society. Short-sighted people feel a fear of aggression, are more closed to society, because of this there is inner anxiety, and a strong desire to protect themselves [13].

In the myopic group, a decrease in the speed of learning sensorimotor skills and the accuracy of task performance was found, which indicates a slower course of sensorimotor learning in myopic people. Drawings made by myopic subjects were characterized by poor design and inconsistency with intentions more often than ophthalmologically healthy subjects. The identified features of graphic activity suggest that the level of conceptual structure is highly developed, possibly compensating for the insufficiently developed level of motor architecture at a lower level. At the age of 17-18, the difference in perceptual activity between myopic and ophthalmologically healthy students decreased sharply. This phenomenon may underlie the susceptibility of this age period to the onset and/or progression of myopia. The presence of myopia, as evidenced by the graphic and substantive features of the DDD-test results, was associated with a slow increase in personal anxiety and a limitation of its manifestations. Due to the revealed connection, myopia can be considered a way to modify (limit) anxiety. Parents of such students (from the words of those who participated in the experiment) are characterized by an increased level of control and a reduced level of demands for the complete satisfaction of their children's needs. The identified differences

indicate that myopic people have a special microsocial environment that can limit their independence and, as a result, adaptability of behavior to changes in the social environment. The identified features of the functions of the visual analyzer, sensory perception, and individual mental organization of myopic patients testify to the systematic nature of myopic changes. From this follows the need for a comprehensive approach to preventing the development of myopia and preventing the progression of myopia in the sensitive period [14, 15, 16].

## DISCUSSION

Studies have shown that among the students who participated in the experiment, the prevalence of visual problems is high. It was found that about 60 % of the participants have certain deviations in the visual state, such as myopia, astigmatism, or farsightedness. The main factors that contribute to visual problems among students are the long-term use of electronic devices, insufficient lighting on the premises, poor hygienic conditions, improper organization of the workplace, and the lack of regular breaks during close-sighted work. The obtained results confirm the importance of understanding the causes and prevention of visual problems among students.

In the course of the study, three groups of students were selected from 62 students aged 17-18 years who were examined by a family doctor and an ophthalmologist. The first group consisted of students who were objectively healthy and had no complaints about vision – 40.32 %. The second group included students with a weak degree of myopia and a reduced level of accommodation – 11.3 %. The third group consisted of students who had ophthalmological problems – 48.38 % of all experiment participants [17].

Investigating the main characteristics of attention, it was found that under normal testing conditions, the main indicators of attention of myopic people were higher than the data of the control group: total productivity by 7.5 %, volume of visual information by 5.4 %, speed of information processing by 8.7 %, level of attention concentration by 3.1 %. During repeated testing, significant differences were also found – the total number of revised signs and the general productivity index in myopic people increased from the initial level by 37.3 % and 34.5 %, in the control group by 56 % and 47 %, respectively; the speed of information processing increased from the initial level by 48.2 %, in the control group – by 62.3 %. The number of errors and the accuracy rate in people with myopia decreased by 25.4 % and 4.1 %, respectively, in the control group. The level of concentration of attention of myopic people against the background of internal inhibition decreased by 8.6 %, and in the group of practically healthy people – by 19.6 %. This indicates significant differences in the development

of attention in myopic and healthy people. According to our experiment, myopes are able to concentrate faster and keep objects in the field of attention longer, which may be related to physiological features and compensation phenomena.

Analyzing the results of the projective method, we can note that myopic individuals have more often (25 %) the influence of the family in their lives, in contrast to healthy individuals (10 %), which indicates a feeling of dependence and a search for protection from society through a sense of unity and belonging. Differences are also observed in the indicators of anxiety, in particular, myopic people show more anxiety in relation to society and feel insecurity (41 %), in contrast to healthy people (23 %), which may be related to a feeling of otherness, inferiority among peers, considering that the subjects are in their youth and communication with peers plays an important role in the formation of their personality. At the same time, there are insignificant differences in openness to communication – myopic people show a high level (56 %) in contrast to healthy people (67 %).

Among students with a reduced relative reserve of accommodation, a decrease in the static endurance of the back muscles was more often observed. It was 17.74 % for boys and 22.58 % for girls. There were also problems with the working position during lectures and practical classes. 32.25 % of boys and 77.41 % of girls had incorrect postures.

To increase the static endurance of the muscles of the back, neck, and press, a technique was developed that included two repetitions of 2-3 exercises for each muscle group with a short interval between repetitions. The time to hold the static effort was 5-6 seconds, the interval between repetitions was 20 seconds, and the interval between exercises was 1 minute.

During the experiment, it was found that training the apparatus of accommodation and peripheral vision with the help of adapted sports games and game exercises is effective. Training included passes and tricks with a ball or shuttlecock to train eye accommodation and external eye muscles.

In the course of the study, a comprehensive method of prevention of myopia was developed, aimed at three groups of students: without myopia, with mild myopia, and with medium and high myopia. The methodology included special exercises to strengthen and relax the accommodation force, special games, adapted sports games, exercises to correct posture disorders, strength static endurance training, and aerobic training.

Educational experiments showed that the group with reduced mild myopia showed significant changes in the relative indices of accommodation. Progression of myopia was not observed in the group with weak myopia

but decreased to 76 %. A significant increase in muscular endurance was also observed in boys by 42 % and in girls by 46 %. Postural abnormalities and arching were also reduced by up to 60 % in these groups. These results testify to the effectiveness of the proposed method of training and prevention of myopia in students.

Regarding the role of physical activity, studies show the beneficial effect of an active lifestyle on visual health. Playing sports and regular exercise help improve blood circulation in the eyes, reduce visual fatigue, and reduce the risk of developing myopia. Also, the results of the improvement in psychological well-being turned out to be favorable. After all, students engaged in physical activity became more open, began to express themselves in the team, feel their importance, and show confidence, which is favorable for professional training and youth self-determination. The level of anxiety also decreased (by 10 %), which is favorable for the development of personal confidence. The obtained scientific results confirm the need for a comprehensive approach to the prevention and treatment of vision problems in adolescents and students. They provide scientific support for the development of programs and activities aimed at improving the visual health of young people. Also, the results of the study confirmed the beneficial effect of physical activity on the prevention of visual fatigue and myopia. This emphasizes the importance of incorporating exercise and an active lifestyle into the daily routine of teenagers and students. Based on the obtained results, it is possible to recommend the introduction of complex measures for the prevention and control of visual problems among students of higher education institutions. This includes the development of educational programs for the conscious use of technology, the regulation of conditions of visual fatigue, the support of physical activity, and the promotion of an active lifestyle.

In general, this study contributes to the deepening of the understanding of the problem of visual problems among students in Ukraine and provides a basis for further research and the development of effective strategies for the prevention and treatment of these problems.

## CONCLUSIONS

1. Refractive disorders corresponding to mild and moderate myopia include remodeling of function at the level of the retina, visual pathways, and cerebral cortex. Functional rearrangement of information processing mechanisms in the visual-perceptual system determines the features of myopic cognitive areas.

2. Under the conditions of the presence of myopia in a person, there are changes in the functioning of both the visual sensory system and higher nervous activity, in particular, attention. Myopic students show a combination of reduced stability of voluntary attention

and increased ability to switch while exhibiting higher levels of attentional focus. The obtained data may indicate different ways of organizing attention functions in myopic and healthy students.

3. The presence of myopia is also related to the psychological characteristics of the individual, in particular, the level of anxiety, the degree of independence and the feeling of attachment to the family, the search for protection from society and a safe environment for self-development.

4. Corrective and preventive measures should include a set of measures, such as psychophysiological stimulation of visual analyzers, selection of individual modes of performing visual loads, increasing the variety of methods of intra-family interaction.

5. The analysis of the results of the study in the university environment of the impact of physical exercises on the problem of myopia among students showed the high effectiveness of physical activity and adapted physical exercises for the prevention of the development of myopia among students.

**Prospects for further research.** This study is part of a comprehensive study of the relationship between visual fatigue and changes in the central nervous system, as well as the development of a method for diagnosing the early stages of stress conditions by determining the level of visual fatigue.

## FUNDING AND CONFLICT OF INTEREST

The authors declare that they have no conflict of interest. This study received no external funding.

## COMPLIANCE WITH ETHICAL REQUIREMENTS

The research followed the basic principles of bioethics, in particular, the principles of integrity, confidentiality, fairness, and consent of research participants. The research was conducted taking into account ethical standards that guarantee the protection of the rights and well-being of research participants. All actions and procedures related to the research were in accordance with the principles of bioethics and the legislation of Ukraine, which regulates the conduct of scientific research. The study was carried out in compliance with the basic provisions of the «Rules of ethical principles of scientific medical research with human participation», approved by the Declaration of Helsinki (1964-2013), ICH GCP (1996), EEC Directive No. 609 (dated 24.11.1986), Orders of the Ministry of Health of Ukraine No. 690 (dated 23.09.2009), No. 944 (dated 14.12.2009), No. 616 (dated 03.08.2012). All the participants were informed about the goals, organization, methods of examination and signed an informed consent to participate in the completely anonymous study.

## REFERENCES

1. Bourne, R., Steinmetz, J. D., Flaxman, S., Briant, P. S., Taylor, H. R., Resnikoff, S., ... & Tareque, M. I. (2021). Trends in prevalence of blindness and distance and near vision impairment over 30 years: an analysis for the Global Burden of Disease Study. *The Lancet global health*, 9(2), e130-e143.
2. Dolgin, E. (2015). The myopia boom. *Nature*, 519(7543), 276.
3. Donovan, L., Sankaridurg, P., Ho, A., Naduvilath, T., Smith III, E. L., & Holden, B. A. (2012). Myopia progression rates in urban children wearing single-vision spectacles. *Optometry and vision science: official publication of the American Academy of Optometry*, 89(1), 27.
4. Flitcroft, D. I. (2012). The complex interactions of retinal, optical and environmental factors in myopia aetiology. *Progress in retinal and eye research*, 31(6), 622-660.
5. Fricke, T. R., Jong, M., Naidoo, K. S., Sankaridurg, P., Naduvilath, T. J., Ho, S. M., ... & Resnikoff, S. (2018). Global prevalence of visual impairment associated with myopic macular degeneration and temporal trends from 2000 through 2050: systematic review, meta-analysis and modelling. *British Journal of Ophthalmology*, 102(7), 855-862.
6. Fusar-Poli, P., Correll, C. U., Arango, C., Berk, M., Patel, V., & Ioannidis, J. P. (2021). Preventive psychiatry: a blueprint for improving the mental health of young people. *World Psychiatry*, 20(2), 200-221.
7. Guggenheim, J. A., Northstone, K., McMahon, G., Ness, A. R., Deere, K., Mattocks, C., ... & Williams, C. (2012). Time outdoors and physical activity as predictors of incident myopia in childhood: a prospective cohort study. *Investigative ophthalmology & visual science*, 53(6), 2856-2865.
8. He, X., Sankaridurg, P., Wang, J., Chen, J., Naduvilath, T., He, M., ... & Xu, X. (2022). Time outdoors in reducing myopia: a school-based cluster randomized trial with objective monitoring of outdoor time and light intensity. *Ophthalmology*, 129(11), 1245-1254.
9. Huang, J., Wen, D., Wang, Q., McAlinden, C., Flitcroft, I., Chen, H., ... & Qu, J. (2016). Efficacy comparison of 16 interventions for myopia control in children: a network meta-analysis. *Ophthalmology*, 123(4), 697-708.
10. Leng, T. S., Saimon, R., Rahman, M. M., Lian, H. S., John, N., Thai, L. L., & bin Arsad, N. (2021). Visual Health and Its Relationship with Screen Time Among School Children: A Cross-Sectional Study in Sarawak, Malaysia. *International Journal of Online & Biomedical Engineering*, 17(8).
11. Morgan, I. G., French, A. N., Ashby, R. S., Guo, X., Ding, X., He, M., & Rose, K. A. (2018). The epidemics of myopia: aetiology and prevention. *Progress in retinal and eye research*, 62, 134-149.
12. Souchet, A. D., Lourdeaux, D., Pagani, A., & Rebenitsch, L. (2023). A narrative review of immersive virtual reality's ergonomics and risks at the workplace: cybersickness, visual fatigue, muscular fatigue, acute stress, and mental overload. *Virtual Reality*, 27(1), 19-50.
13. Souchet, A. D., Philippe, S., Lourdeaux, D., & Leroy, L. (2022). Measuring visual fatigue and cognitive load via eye tracking while learning with virtual reality head-mounted displays: A review. *International Journal of Human-Computer Interaction*, 38(9), 801-824.
14. Spillmann, L. (2020). Stopping the rise of myopia in Asia. *Graefe's Archive for Clinical and Experimental Ophthalmology*, 258, 943-959.
15. Toh, S. H., Coenen, P., Howie, E. K., Mukherjee, S., Mackey, D. A., & Straker, L. M. (2019). Mobile touch screen device use and associations with musculoskeletal symptoms and visual health in a nationally representative sample of Singaporean adolescents. *Ergonomics*, 62(6), 778-793.
16. Toker, Ö. G., Elibol, N. T., Erentürk, Ö., Erdem, S., Behmen, M. B., & Bal, N. (2023). Effect of digital screen usage on the visual-vestibular system interaction. *The Egyptian Journal of Otolaryngology*, 39(1), 140.
17. Xu, T., Wang, B., Liu, H., Wang, H., Yin, P., Dong, W., ... & Zhou, M. (2020). Prevalence and causes of vision loss in China from 1990 to 2019: findings from the Global Burden of Disease Study 2019. *The Lancet Public Health*, 5(12), e682-e691.

## Резюме

### КОРЕКЦІЙНО-ПРОФІЛАКТИЧНІ ПІДХОДИ ДО МІНІМІЗАЦІЇ КОРОТКОЗОРОСТІ В УНІВЕРСИТЕТСЬКОМУ СЕРЕДОВИЩІ

Вікторія І. Горошко<sup>1</sup>, Євгенія Г. Хоменко<sup>1</sup>, Андрій І. Горошко<sup>2</sup>

1 – Національний Університет «Полтавська політехніка імені Юрія Кондратюка, м. Полтава, Україна

2 – Технічний Університет Граца, м. Грац, Австрія

**Вступ.** Актуальність проведених досліджень зумовлена, з одного боку, несприятливою епідеміологічною ситуацією щодо короткозорості у студентів, а з іншого боку, вкрай неповним знанням про механізми, які опосередковують її розвиток, прогресування та стабілізацію.

**Метою даного дослідження** є проведення комплексного аналізу факторів, що сприяють розвитку короткозорості, а також розробці методів оцінки ризику її виникнення, профілактики прогресування та психологічної корекції короткозорості, дослідження ролі фізичних навантажень в профілактиці зорової втоми.

**Матеріали та методи.** Дослідження охопило репрезентативну вибірку студентів з різних регіонів України. Кількість учасників визначена на основі статистичних розрахунків для досягнення достатньої репрезентативності результатів – 62 (124 ока) студенти першого та другого курсу (17-18 років) факультету фізичної культури та спорту і гуманітарного факультету Національного університету «Полтавська політехніка імені Юрія Кондратюка».

**Результати дослідження та їх обговорення.** Аналізуючи результати проективного методу, можна відзначити, що короткозорі особи частіше (25 %) мають вплив сім'ї на своє життя, на відміну від здорових осіб (10 %). Відмінності спостерігаються і в показниках тривожності, зокрема короткозорі виявляють більше тривоги по відношенню до суспільства та відчувають незахищеність (41 %), на відміну від здорових (23 %). При цьому відмінності у відкритості до спілкування є несуттєвими – короткозорі демонструють високий рівень (56 %) на відміну від здорових (67 %). У студентів зі зниженим відносним резервом акомодативної частіше спостерігалось зниження статичної витривалості м'язів спини. У хлопців – 17,74 %, у дівчат – 22,58 %. Неправильну поставу мали 32,25 % хлопців і 77,41 % дівчат. Для підвищення статичної витривалості м'язів спини, шиї і преса розроблена методика, що включає дворазове повторення по 2-3 вправи на кожну групу м'язів з невеликим інтервалом між повторами.

**Висновки.** 1. Порушення рефракції включають перебудову функції на рівні сітківки, зорових шляхів і кори головного мозку. 2. За умов наявності стану короткозорості у людини відбуваються зміни у вищій нервовій діяльності. 3. Наявність короткозорості пов'язана з психологічними особливостями особистості. 4. Корекційно-профілактичні заходи повинні включати комплексну терапію. 5. Аналіз результатів дослідження показав високу ефективність фізичного навантаження та адаптованих фізичних вправ на профілактику розвитку короткозорості серед студентів.

**Ключові слова:** короткозорість, міопія, психокорекція, фізична активність