Development of a technique for preventing visual fatigue in students while working on a personal computer

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Prevention of visual fatigue among students of higher educational institutions will contribute to their improvement, increase of labor productivity and, as a result, to the improvement of the success of mastering the educational material.

Purpose: make a rational algorithm for preventing visual fatigue in students who spend most of their time at the computer.

Material & Methods: analysis of scientific papers; polls, questioning, testing of students on the basis of the physics and technology faculty of Dniprovsky National University named after Oles Honchar.

Results: the methodology for the prevention of visual fatigue involves the proper organization of the working space, the observance of a certain mode of work at the computer, as well as the performance of various sets of exercises for restoring vision. The implementation of the methodology contributed to improving the quality of sight in students.

Conclusion: systematic implementation of this technique will allow both to improve the vision lost during work at the computer, and to maintain it at a consistently high level.

Keywords: students, visual fatigue, improving vision, health, therapeutic exercises.

Introduction

A personal computer (PC) has become an integral part of the life of a modern person, however, most people do not think at all about the harm of long and continuous work at the computer, as well as the negative impact that the PC, in particular.

Unfortunately, practically in all schools and higher educational institutions students, students and teachers systematically neglect the elementary rules of working at the computer.

Thus, in the information developed in the United States and China, according to statistics for 2016, the number of people with myopia is estimated at 40% and 70% respectively (given the fact that 50 years ago, there were 10 such people in China, 20%) [6]. In Ukraine, short-sightedness manifests itself in every fourth inhabitant.

Purpose of the study: to make the most useful recommendations for the prevention of visual fatigue and for restoring vision

Material and Methods of the research

Methods of research – use of information provided by students of the Physics and Technology Faculty of the Dnepropetrovsk National University named after Oles Honchar during their questioning and interviews.

Results of the research and their discussion

In each semester of the curriculum of the Faculty of Physics and Technology, it is assumed that there are on average two subjects closely associated with the use of personal computers.

Theoretically, this amounts to 4 hours of lecture classes and about 10 hours allocated for self-study at home. Given the lack of some necessary literature in libraries, the need to make calculations using computer aids (calculating, term papers, theses), compiling abstracts and writing articles, the time for working with a PC when doing independent work increases to 20 hours per week.

Surveys and questioning of senior students of the Faculty of Physics and Technology allowed to obtain the following results: 87% of students use PC more than 5 hours a day, of which about 2 hours are spent for homework and any calculations. More than 65% of students have such complaints:

- decreased visual acuity;
- slow refocusing of vision;
- fatigue in reading;
- burning and heaviness in the eyes;
- feeling of "sand" under the centuries;
- redness of eyeballs [8; 9].

The number of those who carefully performs exercises for the eyes, is very low – about 10%.

There are several reasons for inaction in relation to one's own health:

1. Unawareness of the need to perform exercises for the eyes and the correct organization of the working space.

2. Ignorance of the correct methodology and sequence of ex-

ercises.

3. Lack of time and forgetfulness.

4. Disregard for one's own health and lack of regular eye control from an oculist.

To begin with, we will define several general provisions, following which it is possible to significantly delay the onset of myopia (provided there are no special exercises aimed at relieving tension in the eyes):

1. Compulsory 1–2-minute breaks every 30 minutes
2. When reading from the screen, you need to blink when moving to a new line, and after each paragraph – to look at the deleted object and hold it for 2–3 seconds
3. Use monitors with a refresh rate of at least 75 Hz;
4. Place the monitor screen at a distance of about 70 cm from the observer, provided that the top edge of the monitor is 10 cm below the horizontal line of sight;
5. Lighting should be located at a distance of 35–45 cm above the monitor. As a lamp, it is recommended to use "yellow" luminescent power of 40–60 W. Also, lighting should not create glare on the screen and be excessively bright.
6. The brightness ratio between the working surfaces should not exceed 3:1–5: 1, and between the working surfaces and the surfaces of walls and equipment 10:1.
7. Free area for a working place for an adult person should be at least 6 m^2, and the distance between adjacent walls – at least 1,2 m.
8. Used chairs should allow for height adjustment of about 300-400 mm, and also have armrests.

For the depreciation of the eyes of the eyes, it is recommended to use the system of E. S. Avetisov [1], including three groups of exercises:

First group. Exercises of the first group help to increase blood flow in the eyeball area and accelerate the circulation of intraocular fluid.

Exercise 1. To begin, you need to close and unlock the eyelids 6–8 times. At the same time in each position you need to do a three- or five-second pause.

Exercise 2. Quickly blink seconds 15. Stop and massage your fingers with closed eyelids.

Exercise 3. Now, 4 times, tighten the eyeballs through closed eyelids. To press it is necessary slightly and no more than 3 seconds, stopping on short respites.

Exercise 4. With your index finger, touch the brow. Imagine that you need to overcome the resistance of the surrounding muscles.

Second group. This group of exercises is aimed at strengthening the oculomotor muscles.

Exercise 1. Without moving your head, move your eyes from the ceiling to the floor 8–12 times. Be sure to focus the look at the top and bottom points.

Exercise 2. Look to the right, then on the diagonal, raise your eyes up, and on the same diagonal, lower your eyes to the left

corner below. Do everything in the opposite direction. Do not move your head. You need to do this up to 12 times.

Exercise 3. Move the view from the right fixed point to the left and back. Also do 12 repetitions.

Exercise 4. Turn your eyes clockwise and counterclockwise, not losing sight of all that you see. In total, you need to do 12 repetitions.

Third group of gymnastics exercises for the eyes is aimed at training focusing and accommodation.

Exercise 1. Select the farthest point on the horizon. Pull out your hand and point forward your index finger. 12 times move your vision from this far point to the tip of your finger.

Exercise 2. Pull out your arm and point your index finger forward. Then touch the tip of your nose with your index finger. The whole path that the elongated hand will pass does not remove the eye from the finger, constantly focusing its attention on it. This must be repeated 10 times.

Exercise 3. Similar to the previous one, only in this case it is necessary to follow the hand with one or the other eye. Each of them has 8-10 repetitions. The eye, does not participate in focusing, cover with the palm of your hand, accordingly changing the hand that stretches towards the nose.

Exercise 4. Draw a point on the transparent glass (any window is suitable, but the degree of visibility plays an important role). Focus your eyes on it, and then focus on some street object. Again, focus on the point, and then on the object from the street. This task should be performed for about 7 minutes.

You can also use the method M. D. Corbett or W. Bates (solarization, palming, etc.) [3; 2].

There are several ways to test your vision at home. The first (Amsler's method [4]) is carried out with the aid of a conventional notebook with a letter to the cell. It is necessary to select a square with 16x16 cells, in the center of which carefully turn the handle point. Then you need to close one eye with your hand, look at the drawn point with the other eye. If you can see all four grid angles with each eye, without leaving a view from the point, as well as all the lines of the grid you see are straight, without bends and bends, then you have passed the test and your organs of vision are healthy. Otherwise, you should immediately contact your doctor [10].

The second method is even simpler. It is necessary to compare the blackness of any letter or symbol both at a point close to you and at a distance, both with good and low light. With an excellent star, black color does not change at all - it does not depend on the actions you have taken. If the black looks differently black in the above actions, it means that you need to make an appointment with an ophthalmologist, since your vision is imperfect.

Let's consider some more modern methods of preventive maintenance of deterioration of sight, and also, actually, correction of sight.

For those people who do not have time for the above exercises, perhaps the only way out is to adapt the eyes to the computer,

which can be done with a special optical correction. To select appropriate glasses for each user in modern clinics, special computer tests simulating a screen image are developed. One can distinguish the following types of glasses that are qualitatively different from the standard ones: some are offered with progressive lenses in which the clear vision zone corresponds to the movement of the eye when working with the display, others assume the possibility of focusing the eyes both on the screen and on paper with text, recruitment. Some specialists offer a special color for lenses, for example, the Institute of Biochemical Physics of the Russian Academy of Sciences in conjunction with the Moscow Eye Diseases Institute named after Helmholtz developed a coating containing several narrow bandwidths in the region of the primary colors of the spectrum, which, as a result, significantly increases the contrast of the image. In general, the use of glasses with the above-described coatings in intensive PC users (designers of space technology or programmers) reduced fatigue and improved the performance of the eye muscles compared to conventional glasses, or in the absence of approximately 80%. Thus, special glasses increase the color contrast of the image, make the picture on the retina more clear, reduce the dispersion of the image on the monitor, improve the accommodation capacity, cut out the hard part of the spectrum, adjust the radiation spectrum to the most comfortable for perception with the eyes.

For those people who have already developed myopia, there are several modern methods of treatment.

For active users of PCs, which are students, is the most convenient method - the installation of special free programs such as Eyes Relaxing and Focusing. This type of software is an eye simulator designed to protect long-term users of the PC from its harmful effects with a run time of more than 2 hours. Such a program will notify the user about the need to take a break, as well as show special exercises, which in essence are training for the eyes. Thus, the problems of regular breaks are solved, as well as uncertainties in the choice of a set of exercises. It is worth noting the possibility of adding your own exercises in the settings of the program.

The next method is called NeuroVision [5] – "perceptual training". This method is a process that consists in performing a certain sequence of visual exercises, leading to an improvement in the visual perception of objects. This effect is based on changes in neural connections in the brain.

"NeuroVision" – A special educational software package is available on the Internet that is developed individually for each client. It is designed to form new or re-form the old interneuronal connections in the cortical substance of the brain. Despite the fact that this method is used to improve visual acuity and contrast sensitivity in adults with mild degrees of myopia, it does not affect the accommodation of the eye. The advantages of this method of treatment are:

• applicability in a broad age group - for children aged 9 years and older, including adults.
• absence of surgical intervention and, as a consequence, rehabilitation period;

• exclusion of medications;
• safety of the method;
• adjustment of software in accordance with the characteristics of each patient.

Actually, the technique itself is to create a doctor-ophthalmologist some list of exercises for each patient that need to be performed in 30 minutes. The implementation of these exercises is carried out at home using a computer program that trains the perception and efficiency of processing information coming from the organs of vision, the brain. The result is the facilitation of reading small print both near and at a distance. Increased visual acuity.

Another way involves the use of special glasses-simulators, which are glasses with black opaque lenses, where a large number of small holes are made. Such glasses-simulators pass only coherent rays, which have the same wavelength and synchronously reflect the maxima and minima of the intensity of light. As a result of their use, vision can improve by 10%.

The penultimate method is to use the utility for smartphones Eye Relax and the like. Such small programs that run in the background, remind the user about the need to take a break after working with a computer or, in fact, on the phone. Also in the settings you can activate the appearance of the message before the break, and the time remaining is conveniently monitored using a special progress bar in the smartphone message panel.

The latter method is an unconventional practice – Chinese medicine. For example, a set of eye exercises "Qi Qong", which were developed in 1950 in China. They are based on the assumption that massage of various acupuncture points around the eyes improves blood flow, relaxes muscles and reduces eye strain.

Conclusions

In this article, the symptoms of visual impairment in students as a result of a continuous hours of work for a PC were found. The reasons why students neglect the method of healthy handling of PCs have been established. Based on the data analyzed, both general and more specialized recommendations for the prevention and recovery of vision in active users of PCs were given. Thus, we can distinguish several basic provisions, guided by which everyone can prevent the deterioration of one's own vision due to prolonged work at the computer:

1. A healthy lifestyle.
2. Organization of the working space.
3. Regular breaks.
4. Using relaxing exercises
5. Regular visits to an ophthalmologist.

Prospects for further research. The given researches have perspective character, after all illuminate an opportunity of the prevention of problems of sight, and also, at their presence, ways and methods of non-operative rehabilitation and convalescence.

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