

HYGIENIC ASSESSMENT OF THE MODE OF USING MOBILE ELECTRONIC DEVICES BY MEDICAL STUDENTS

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The hygienic assessment of the mode of using mobile electronic devices (ED) was carried out to develop preventive activities aimed at education of medical students. A total of 518 medical students were surveyed. The survey was created in Google Forms. The obtained data were processed with Statistica 13 PL. The study was conducted in accordance with the principles of biomedical ethics and did not expose the participants to any danger. Data on a habitual mode of using mobile electronic devices by medical students during their traditional educational process were obtained through the survey: half of them never did eye gymnastics, over 75.0% reported holding their mobile ED very close to the eyes, 75.0% of those surveyed used mobile ED in the lack of light. While assessing the mode of ED use by medical students, it was established that the visual organ sustained the largest burden. Preventive activities are necessary to avoid negative consequences and produce useful skills of using ED during education of future doctors at a university.

Keywords: medical students, electronic devices, hygienic education.

Author contributions: levleva OV — literature analysis, study design, data collection, statistical processing, writing an article.

Compliance with ethical standards: the study was approved by the Local Ethics Committee of Pirogov Russian National Research Medical University (Protocol No. 203 dated December 20, 2020). Voluntary informed consent was obtained from every participant. Online interview was carried out on a voluntary basis using online services. The study corresponded to ethical guidelines for biomedical research and did not expose the participants to any danger.

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ГИГИЕНИЧЕСКАЯ ОЦЕНКА РЕЖИМА ИСПОЛЬЗОВАНИЯ МОБИЛЬНЫХ ЭЛЕКТРОННЫХ УСТРОЙСТВ СТУДЕНТАМИ-МЕДИКАМИ

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Для разработки профилактических мероприятий с целью воспитания студентов медицинского ВУЗа проведена гигиеническая оценка режима использования мобильных электронных устройств (ЭУ). Проведен опрос, в котором приняли участие 518 студентов-медиков. Опрос проводился с помощью онлайн-сервиса Google Forms. Полученные данные обрабатывались с помощью пакета статистического анализа Statistica 13 PL. Исследование соответствовало требованиям биомедицинской этики и не подвергало опасности участников. С помощью анкетирования получены данные о привычном режиме использования мобильных электронных устройств в период проведения традиционного образовательного процесса студентами-медиками: половина студентов-медиков никогда не делают гимнастику для глаз, более 75,0% студентов-медиков отметили, что во время работы держат мобильное электронное устройство очень близко к глазам, 75,0% респондентов отметили, что часто работают с мобильным электронным устройствам в условиях недостаточной освещенности. При оценке режима использования ЭУ студентами-медиками установлено, что наибольшую нагрузку получает зрительный анализатор, чтобы избежать негативных последствий необходимо проводить профилактические мероприятия и выработать полезные навыки использования ЭУ на этапе обучения будущих врачей в ВУЗе.

Ключевые слова: студенты-медики, электронные устройства, гигиеническое воспитание.

Вклад автора: Иевлева О. В. — анализ литературы, дизайн исследования, сбор материала, статистическая обработка, написание статьи.

Соблюдение этических стандартов: данное исследование было одобрено ЛЭК РНИМУ им. Н. И. Пирогова (Протокол № 203 от 20.12.2020 года). Добровольное информированное согласие было получено для каждого участника. Проведение онлайн-опроса проводилось на добровольной основе с использованием онлайн-сервиса. Исследование соответствовало требованиям биомедицинской этики и не подвергало опасности участников.

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The use of digital tools in educational environment has increased over the last decades. This is accompanied by growing risks of using mobile electronic devices (ED). Domestic and foreign publications indicate that the influence of modes of using mobile electronic devices on young adult health is shown insignificantly [1, 2, 3].

These aspects are essential for development of prophylactic measures to reduce risks associated with the use of ED in medical students as future specialists dealing with population-based preventive issues [4, 5, 6, 7, 8, 9].

Purpose: to assess the mode of ED use in order to provide medical students with hygienic education.

MATERIALS AND METHODS

For this study, Google Forms Questionnaires have been created [7, 10]. The questionnaires were compiled by staff members of Hygiene Department of Faculty of Pediatrics of Pirogov Russian National Research Medical University, Moscow, Russia, certified as specialists in 'Hygienic Education', 'Epidemiology', 'Hygiene of Children and Adolescents', 'General Hygiene'.

Data on a habitual mode of using mobile electronic devices by medical students getting traditional education are obtained with the help of a questionnaire survey, as those surveyed have been using the electronic devices since 9.5 ± 1.3 years.

No difference in age and gender are found between the groups.

The obtained data were processed using Statistica 13 PL (StatSoft, USA) software. Charts and diagrams were created using Microsoft Excel.

The study did not infringe upon any human rights, did not expose those surveyed to danger, corresponded to the principles of biomedical ethics, and was reviewed and approved by the Ethics Committee of Pirogov Russian National Research Medical University, Russia, in accordance with the principles of GCP (Protocol No. 203 as of December 20, 2020). Voluntary informed consent was obtained from every participant. Online interview was conducted on a voluntary basis using online services. All the trials were performed observing ethical standards set out in the Declaration of Helsinki and Directives of the European Community (8/609EC).

RESULTS

Examination of the habitual mode of using mobile electronic devices by medical students showed that half of the students never did eye gymnastics or any other type of gymnastics after working with mobile electronic devices, which is contrary to hygienic recommendations (Fig. 1).

Over 75.0% of medical students noted that they held a mobile electronic device very close to eyes while working, which doesn't correspond to hygienic recommendations (in accordance with par. 3.5.7 of Sanitary Rules and Regulations 2.4.3648–20 'Sanitary and Epidemiological Requirements for

Upbringing and Education, Rest and Health Improvement of Children and Adolescents') (Fig. 2).

While working with mobile electronic devices, 9.5% of medical students use local lighting only, which is contrary to hygienic recommendations (in accordance with par. 3.5.5 of Sanitary Rules and Regulations 2.4.3648–20 'Sanitary and Epidemiological Requirements for Upbringing and Education, Rest and Health Improvement of Children and Adolescents'), 33.4% use general lighting, whereas the rest use mixed lighting. Over 75.0% of those surveyed noted that they frequently used mobile electronic devices in the lack of light. 85.0% make use of their mobile electronic devices while in transport (in accordance with par. 3.5.5 of Sanitary Rules and Regulations 2.4.3648–20 'Sanitary and Epidemiological Requirements for Upbringing and Education, Rest and Health Improvement of Children and Adolescents').

65.0% of medical students continue exploiting mobile electronic devices during meals.

According to the survey among medical students, the accumulated operation time ($M \pm \sigma$) is 413.5 ± 14.0 minutes per day for a smartphone, and 227.1 ± 8.0 minutes per day for a pad. This almost coincides with objective data of a special healthy lifestyle application for individual smartphones (Screen Time).

According to Screen Time, a smartphone ($M \pm \sigma$) was used for 336.4 ± 15.0 minutes per day, i.e., about 5.6 hours per a regular day; a pad ($M \pm \sigma$) was utilized for 259.0 ± 10.0 minutes per day, i.e., about 4.4 hours per a regular day. 61.5% of the time (208.6 ± 15.0) is spent on using social media for a smartphone and 56.3% (146.1 ± 18.0) for a pad (Fig. 3).

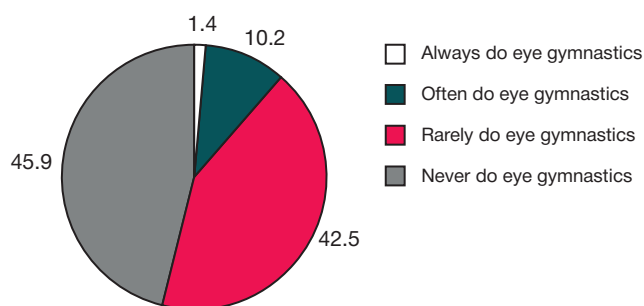


Fig. 1. Eye gymnastics performed by medical students after working with mobile electronic devices (a pad and a smartphone),%

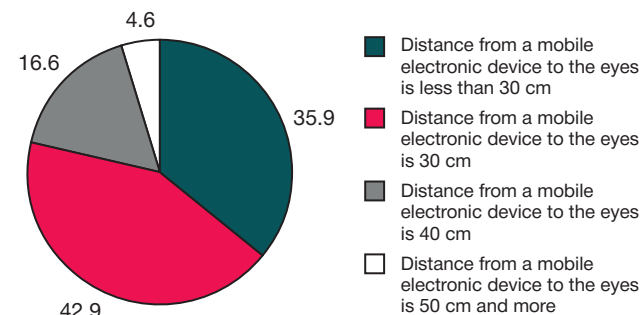


Fig. 2. Distance from a mobile electronic device (a pad and a smartphone) to the eyes while working, %

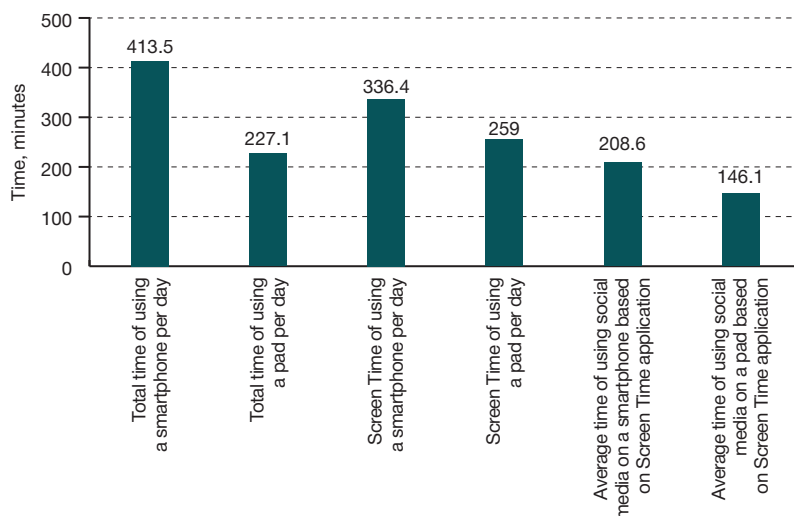


Fig. 3. Time spent on using mobile electronic devices (a pad and a smartphone) by medical students per day, the average time of using social media per day considering the data obtained during a week, $M \pm m$, minutes

Table 1. Hygienic assessment of the influence produced by the mode of use of mobile electronic devices on occurrence of eye complaints in medical students

Factors associated with the mode of use of mobile electronic devices	Pearson coefficient		
	Value	p	Correlation
Use of mobile electronic devices at night	0.71	p≤0.05	high
How much time before sleep are mobile electronic devices stopped being used?	0.72	p≤0.05	high
Lighting (local, general) used while dealing with mobile electronic devices	0.71	p≤0.05	high
Distance at which a mobile electronic device is located from the eyes	0.73	p≤0.05	high
How often (how many times a day) time is checked on a smartphone	0.72	p≤0.05	high
How often (how many times a day) social media are viewed	0.72	p≤0.05	high
How often mobile electronic devices are used to perform urgent and not urgent tasks (replies to letters, messages, etc.)	0.72	p≤0.05	high
Screen Time is installed on a mobile electronic device and used to control working time	0.74	p≤0.05	high

Sanitary Rules and Regulations 1.2.3685–21 'Hygienic Standards and Requirements for Ensuring the Safety and (or) Harmlessness of Environmental Factors for Humans' indicate the total duration of using a pad per day at an educational institution and at home; they also state that when two or more electronic devices are used, the total operation per day should not exceed the limit value for each of them. Based on the results of our study, medical students used both a pad, and a smartphone. The total time of using these electronic devices is exceeded more than twice, and was probably spent not on education, but on leisure (communication in social media).

Medical students working with mobile electronic devices also have different complaints (computer vascular syndrome and carpal tunnel syndrome).

When using mobile electronic devices and after that, medical students often report difficulties when changing their eye focus from near to distant objects, apparently changed color of objects, double vision, skin crawling sensation and darkened vision, excessive light sensitivity, impaired visual performance, visual fatigue in 16.0% of cases; the complaints are never found in 38.0% of cases. When using mobile electronic devices and after that, medical students often have pain in the eye sockets and forehead, pain during eye movement, red eyes, gritty eyes, eye watering, smarting eyes, eye dryness and burning eyes in a quarter of cases; the complaints never occur in 25.0% of cases only.

When using mobile electronic devices and after that, medical students often have pain with decreased sensitivity and paresthesia in the palmar surface of the I–IV fingers, certain weakness and discomfort during hand movement in 9.0% of cases.

Research results of the influence produced by the mode of use of mobile electronic devices on the eye of medical students are found in table 1.

Based on the obtained data it was established that such factors as lighting mode, posture (distance to the eyes) and frequency of ED use per day produced a significant effect on eye complaints in medical students.

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DISCUSSION

Thus, the study enabled to find pressing issues for hygienic education of medical students such as organization of lighting when working with mobile electronic devices; posture with an optimal distance to the eye; time count using Screen Time.

Based on domestic and foreign literature it can be stated that in recent decades, the influence of gadgets on a modern person has been increased [11, 12]. Thus, time of using gadgets is progressing with age. Increased use of ED produces an increased negative effect on human health, as hygienic skills of using ED are not established in adolescents [13, 14, 15].

Today, the educational process includes the use of digital technologies influencing general health of the younger generation. A correct inclusion of these technologies into the life of medical students requires a structured and elaborated scheme with an explanation and development of useful skills to decrease a negative influence of information technologies on students' health [14, 15].

It was followed by simple but easily accomplished rules included into health protection check list. The check lists were offered to medical students to be used within the program of hygienic education.

CONCLUSIONS

Vision protection check lists were developed and approved to ensure hygienic education of medical students. They contain simple and easily accomplished recommendations:

1. When working with electronic devices, observe the schedule of work and rest: do not forget about intervals. After working for 30–60 minutes have a rest for 5–10 minutes. Do not use any other gadgets during that time!
2. Do not put a strain on your eyes when going home. Just stay offline while in transport.
3. Do eye gymnastics. To understand how to do it, use gadget-based application, for instance, *Relaxation*.
4. If you are busy for gymnastics, just close your eyes and relax, thinking about something good.

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