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MEASURES FOR PROTECTING VISUAL AND AUDITORY ANALYZERS IN INDIVIDUALS ENGAGED IN MENTAL LABOR

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Introduction

In recent years, the widespread implementation of digital technologies has led to increased visual load and acoustic exposure, resulting in decreased visual acuity, the development of “digital eye syndrome,” and functional impairments of the auditory analyzer. According to the World Health Organization, at least 2.2 billion people worldwide experience vision-related problems, a significant proportion of which are preventable. At the same time, more than 1 billion young individuals are exposed to hazardous levels of noise.

Mental labor represents one of the most complex forms of human activity, characterized by high levels of psycho-emotional and sensory load. Continuous work with computers and other digital devices leads to excessive strain on the visual analyzer. Scientific studies indicate that 60–90% of office workers exhibit symptoms of “digital eye syndrome” (Computer Vision Syndrome) (Rosenfield, 2016).

The auditory analyzer is primarily affected by background noise, technical devices, open-office environments, and personal audio equipment. According to the International Labour Organization, prolonged exposure to noise levels above 85 dB can result in irreversible damage to the auditory analyzer.

Alongside traditional hygienic approaches (lighting standards, noise control), there is an increasing need to integrate modern ergonomic and digital hygiene principles.

Main part

Under conditions of mental labor, the main factors affecting the visual analyzer include prolonged screen time (more than 6–8 hours per day), нарушения lighting standards (below or above the recommended 300–500 lux), and improper viewing distance from the monitor (optimal range: 50–70 cm).

For the auditory analyzer, the following risk factors have been identified: continuous background noise (60–85 dB), improper use of personal audio devices, and insufficient acoustic control in open-office environments.

According to WHO data, exposure to noise levels above 85 dB for 8 hours significantly increases the risk of developing sensorineural hearing loss.

Scientific evidence on the effectiveness of preventive measures indicates the following:

– The 20-20-20 rule (every 20 minutes, looking at a distance of 6 meters for 20 seconds) reduces eye strain by 30–40%

– Implementation of ergonomic lighting systems reduces visual load by approximately 25%

– Reducing noise levels to 55 dB increases work productivity by 10–15%

New risk factors associated with digital technologies—continuous visual focusing, exposure to blue light, and acoustic pollution—require a comprehensive approach.

From the perspective of the visual analyzer, accommodation spasm and ocular surface dryness are key pathophysiological mechanisms. In the auditory analyzer, prolonged noise exposure leads to degeneration of hair cells in the inner ear.

As innovative approaches, the following are considered promising:
– adaptive lighting systems (circadian lighting)
– active noise-cancelling technologies
– digital hygiene programs and monitoring applications
At the same time, most existing studies are based on short-term observations, and long-term cohort studies remain insufficient.

Conclusion

The protection of visual and auditory analyzers under conditions of mental labor requires a comprehensive hygienic, ergonomic, and technological approach. The main risk factors for the visual analyzer include prolonged screen exposure, improper lighting, and violation of ergonomic standards, all contributing to the development of digital eye syndrome. The primary risks for the auditory analyzer include constant background noise and high-intensity acoustic exposure, leading to sensorineural hearing loss.
Scientifically grounded preventive measures (the 20-20-20 rule, optimal lighting, and noise control) have demonstrated significant effectiveness and should be implemented as mandatory hygienic standards in workplaces. Adapting traditional hygiene principles to modern digital environments and developing individualized preventive strategies are essential for addressing this issue.

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