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VIRTUAL REALITY IN THE PREVENTION AND REHABILITATION OF PATIENTS

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Introduction: Virtual reality (VR) plays an important role in modern medical rehabilitation, providing innovative methods for patients to recover from various diseases. The use of VR in rehabilitation makes it possible to create a controlled and safe environment where patients can perform exercises that simulate real-life situations, which helps to improve their physical and cognitive functions. For example, research shows that VR technologies are effective in restoring motor functions and cognitive abilities in stroke patients. In addition, VR can be used to treat psychological disorders such as unilateral neglect, and to improve cognitive rehabilitation through serious games and other interactive methods. These technologies provide an opportunity for more intensive and motivating rehabilitation practice, which can contribute to a faster and better recovery of patients.

Keywords: Virtual reality (VR), modern medicine, rehabilitation, innovative method, recovery, patients, diseases.

The use of virtual reality (VR) technologies in medical rehabilitation opens up new prospects for improving the quality of life of patients. These innovative techniques enable the creation of simulated environments that can be customized to meet the individual needs of each patient. In particular, BP is used for rehabilitation of patients after strokes, where it helps to restore motor functions and cognitive abilities. With the help of VR, patients can perform various exercises in a controlled and safe environment, which contributes to their physical and psychological recovery. Research shows that VR can be effectively used to correct motor disorders, as well as to work with psychological disorders and speech therapy problems.

A significant number of stroke cases are registered in Uzbekistan every year, which is a serious public health problem. According to the latest data, more than 60 thousand people suffer from stroke every year. Rehabilitation plays a key role in returning patients to a full life. VR provides an opportunity for more intensive and targeted rehabilitation, which is especially important given the high percentage of primary disability after strokes. VR technologies can help patients cope with the effects of stroke by improving their independence and ability to self-care. In addition, VR promotes the development of skills necessary for everyday life and can significantly improve the quality of life of patients.

The use of VR in rehabilitation also allows healthcare professionals to collect real-time data on patient progress, which provides a more accurate assessment of the effectiveness of rehabilitation programs. This, in turn, allows you to make adjustments to the rehabilitation process, making it more individualized and effective. Virtual reality offers an interactive and engaging approach to rehabilitation that can increase patients' motivation and involvement in the treatment process. Thus, VR is a powerful tool that can significantly improve the rehabilitation process and contribute to a faster recovery of patients.

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Over the past 5 years, scientific interest in the topic of using VR in medicine has demonstrated an almost vertical takeoff. In particular, the following dynamics can be traced only in the PubMed library according to the keywords "VR technology in medicine": in 2019 - 106, in 2020 - 127, in 2021 - 148, in 2022 - 170, in 2023 - 191, and in the current 2024 only in the first half of the year – 218. A similar increase the number of publications devoted to various aspects of studying the application of technology Virtual reality is observed in Russian scientific medical journals. 37 publications from international journals and 28 from Russian ones were selected for this review. The focus was on the application of VR technologies in various fields of clinical medicine, training of medical personnel and patients.

The central element of VR technology is the ability of virtual reality to immerse the field of human perception in a simulated environment. This means that the user psychologically feels present in the digital world, and not in their physical reality. Despite the similar structure of VR devices, There are discrepancies in hardware and software requirements. A lot depends on the application areas or the chosen usage model. Thus, virtual reality simulators for education are focused on a three-dimensional environment and network resources. To train surgeons, virtual reality simulators are needed, which will allow them to interact with surgical instruments and the virtual anatomy of the human body. VR tools for the correction of psychological disorders are focused on emotion control and feedback.

VR IN THE TRAINING OF DOCTORS AND MEDICAL STUDENTS. VR in the field of education began its victorious offensive with the use of various simulators to demonstrate phenomena, processes and objects that are extremely difficult or impossible to visually present in real reality. They can view the smallest details of any body part using 360° CGI reconstruction.

Medical students study the structure of the body using virtual reality, which allows them to analyze the human body down to the smallest detail, starting with the skeleton, nervous system, muscles and everything else. Such training offers unique opportunities and improves the quality of knowledge of future doctors. Doctors of surgical specialties can practice practical skills of operations and/or manipulations without the risk of making mistakes; psychiatrists can see the world of patients with mental disorders; students of medical universities should learn how to perform basic procedures. Virtual reality allows you to simulate transport in space and time, as well as perform visual transformations of objects. VR applications can be used to simulate emergencies, accidents, or life-threatening situations, so that ambulance crews can be trained to operate under high pressure and acquire valuable skills in a fairly realistic atmosphere.

NEUROREHABILITATION

Neurologists were among the first to draw attention to the promising possibilities of virtual reality for rehabilitation of post-stroke patients. In some cases, when assessing brain damage, it becomes obvious that traditional methods do not always meet all the conditions of active learning, while VR simulates any required space and provides endless feedback through motivating game actions, which makes the rehabilitation program more successful, it fills in the missing elements for restoring movement, immersing the brain is in an illusory environment in which it restores neural connections using a biofeedback algorithm.

Specialists in restorative medicine have proposed the following classification of VR systems:

1. Actually, the virtual environment itself.

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2. Hardware for VR display.

3. Equipment that allows you to register head turns if a person is wearing a VR helmet.

4. Hardware that registers physiological parameters.

5. Software management and construction tools for biofeedback training.

In the treatment of patients with pathology of the central nervous system, extensive experience has been accumulated in restoring coordination of movements, such as the ability to touch an object as accurately and quickly as possible, perform some manipulations with it. Also, good results with the help of VR are shown by restoring balance in order to remove a number of typical manifestations of walking disorders that make it slow, asymmetric, unstable when moving on uneven surfaces and on turns.

New research results have been published in the scientific literature, in which the authors They presented an original technique of "3D audio visualization" using mirror therapy, which allows using VR to stimulate the reparative processes of the brain, and by stimulating motor imagination through visual feedback, develop the motor functions of the hand. In 18 out of 20 patients with ischemic stroke, restoration of the strength of the proximal muscle groups was recorded. In the future, it is planned to develop programs that include rehabilitation of the distal upper and lower extremities. Neurologists conducted an experiment with the additional use of virtual reality technologies for the rehabilitation effect on increasing the volume of hand supination in children with spastic forms of dyscirculatory encephalopathy. The study, which lasted 19 days, involved 58 people over the age of 55 in the acute period of the disease. Sessions using VR technologies were daily: the first two sessions during the adaptation period lasted 2 minutes, and the subsequent ones took 5 minutes. Measurements of the supination angles were performed before the start of the course

rehabilitation and after its completion. The proposed method significantly increased the volume of the amplitude of movements and the angle of supination of the arm.

REHABILITATION THROUGH VIDEO GAMES

The golden age of medical rehabilitation through virtual reality video games began with the launch of the Nintendo video game in 2006. Wii", which re-taught patients to control their movements. Then the company, continuing the theme of therapy of disorders of the motor system, released two more games "Wii Balance Board" and "Wii Fit". In addition to restoring the nerve connections responsible for balance, the manifestation of neuroplasticity was recorded in the positive results.

Thus, virtual video games have helped the brain adapt and create new connections between with their cells. A similar path is followed by domestic developers from the company "Motorika". The VR game on the ATTILAN digital rehabilitation platform is aimed at improving the skill of using a bionic prosthesis. Only with the proper functioning of the muscles of the remaining part of the amputated arm will the player be able to complete all levels of the game, as well as in the future it is normal and natural to use the prosthesis in everyday life. The development of the company "Istok-audio" uses a similar technology. Hardware and software multimedia complex "Devirta Delphi uses touch sensors and a virtual reality helmet in the process of remotely controlled rehabilitation of patients with an even higher degree of interactivity, forcing the patient to interact with the surrounding space.

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VR FOR PATIENTS

VR is a high–quality tool for a doctor in cases where it is necessary to explain to patients how their operations will be performed or what steps the patient should take to recover more effectively by mobilizing his internal resources. For self-use by patients, special VR applications help in eliminating chronic pain, conducting meditation sessions to overcome anxiety, or performing exercises to restore joint function. Patients who have experienced traumatic brain injuries and strokes, they can undergo rehabilitation in a light game form. This makes it more pleasant, understandable, and better involves patients in therapy.

Conclusion: Virtual reality technology is already providing high-quality care to doctors and patients, helping to treat them better and take better care of their health. One of the obstacles hindering the daily and widespread use of virtual reality technologies is limited access to high-speed networks such as 5G and low usage of 5G devices. Technologies are constantly expanding the number of areas and programs of virtual reality in healthcare. It is a fast-growing market. The peculiarity of the modern stage of studying virtual reality is that a base of empirical material is still being created, requiring both a broad and deep understanding of it. Many of the VR therapy scenarios require scientific and experimental refinement. Another problem remains the small number of medical centers equipped for virtual reality therapy and the high cost of the treatment itself. VR is still at an experimental level and in the early stages of implementation in most medical IT companies and medical institutions, but it is rapidly gaining popularity in the industry. Many domestic companies are investing heavily in this market. Specialists who are aware of the progressive and evolutionary potential will be the most competitive in the future. To strengthen the potential of introducing virtual reality technologies into our healthcare system, it is necessary to consolidate the efforts of scientists, teachers of medical universities, IT developers, healthcare organizers, doctors and the entire medical community. It is necessary to continue improving the existing regulatory framework and new laws that make it possible to use virtual reality technologies more widely in medicine, ensuring safe therapy and respect for the rights of all participants in the treatment process.

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