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VIRTUAL REALITY IN REHABILITATION: THE TYPES, POSSIBILITIES AND CHALLENGES

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Traditional rehabilitation practice has often been monotonous, repetitive and lacked engagement, leading to reduced motivation of the patients. However, the landscape of rehabilitation field is being currently changed by the means of modern technology, with the significant role of virtual reality modalities.

Virtual reality (VR) is the use of computer modeling and simulation that enables a person to interact with an artificial three-dimensional (3-D) visual or other sensory environment. The term was coined in 1987 by Jaron Lanier, whose research and engineering contributed a number of products to the nascent VR industry [1].

Virtual reality technology was primarily used in gaming and entertainment. However, its functionality has significantly expanded over recent years, finding a valuable place in the field of healthcare, specifically within the domain of VR based physical therapy treatment.

Over the past several years, the body of evidence on the effectiveness of virtual reality in rehabilitation has significantly expanded. VR has been studied for a variety of diagnoses including stroke, Parkinson's disease, multiple sclerosis, dementia, burns, pain, and total knee arthroplasty. VR helps enhance patient involvement and motivation while increasing the repetitions and duration of exercise [2].

Despite much attention being already focused on various healthcare aspects [3; 4; 5; 6; 7; 8; 9], the issue of virtual reality in rehabilitation increasingly gains actuality, thus becoming ***the purpose of the study***.

Due to monitoring and comparative analysis of internet resources [1; 2; 10; 11; 12], the types, possibilities and challenges of virtual reality in rehabilitation appear to be as follows.

The key types.

Non-immersive VR – allows the user to view and interact with a computer-generated image of themselves on a screen. The user can see and experience the real world outside of the screen and is not immersed completely in a virtual world.

Semi-immersive VR – a more advanced visual display (panoramic or curved screens to create a greater sense of immersion) is used. Similar to non-immersive technology, the user can see the real world either side of the screen.

Immersive VR – a head mounted display unit is used, this offers a multi-sensory experience for the user. Additional equipment may include; gesture-sensing gloves, wands, vibro-tactile platforms and multidirectional treadmills. All this makes it possible for the user to explore and interact with the virtual world as an avatar (a virtual character that represents the individual within the virtual world)

The major possibilities.

Increased patient engagement. Patients may often struggle with maintaining a consistent level of engagement, especially when treatment protocols stretch over months. Virtual reality rehabilitation offers immersive and interactive experiences that make rehabilitation engaging and enjoyable. Patients can embark on virtual adventures, play games, or participate in sports simulations, making the recovery period more exciting and motivating.

Personalized rehabilitation. Using VR therapy allows for an individualized approach to treatment. VR exercise platforms allow physiotherapists to tailor rehabilitation programs to each patient's unique needs and abilities. Whether it's focusing on regaining balance, improving coordination, or enhancing fine motor skills, VR can provide personalized workouts that adapt as patients progress, ensuring they receive targeted and effective therapy.

Real-time data tracking. The advanced VR systems are equipped with algorithms that analyze patient data on the fly, adjusting task difficulty and providing personalized feedback. Physiotherapists can use VR technology to track patient progress and adjust rehabilitation plans accordingly. This provides an additional motivational tool as individuals with disabilities can monitor their progress and set goals.

The main challenges.

VR equipment costs. The budget of purchasing VR systems can be prohibitive, especially for small-scale physical therapy clinics. Additionally, regular maintenance costs, potential repairs, and periodic updates can add to the ongoing expenses. Therefore, the financial possibility of implementing virtual reality in physical therapy should be carefully estimated.

Patients adaptability to VR. Even though many patients find VR based rehabilitation exciting, it may not suit everyone. Some patients struggle with motion sickness or disorientation when using a VR system, while others may find it difficult to adapt to the virtual environment. Therefore, patient tolerance and comfort must be considered during VR therapy.

Additional training of therapists. VR technology requires a unique skill set to operate and interpret, with therapists needing a significant learning curve. Thus, adequate training and educational resources should be provided to ensure therapists can effectively use virtual reality for patient treatment. Moreover, the prospect of adding technological knowledge to clinical expertise can place extra stress on therapists.

Summing up, the use and potential of virtual reality in healthcare is increasingly supported by research evidence. The question should no longer be if virtual reality should be part of an individual's rehabilitation, but instead how to individualize and progress the therapeutic exercise and activities performed with this technology to best reach the patient's optimal functional outcomes.

Virtual reality is a groundbreaking approach to patients rehabilitation, offering engagement, customization and a pathway to enhanced recovery. Therapists should embrace this innovation to provide patients with a more enjoyable and effective rehabilitation experience, ultimately helping them to regain their independence and improve their quality of life.

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