

Current use of virtual reality in physiotherapy

Abstract

Virtual Reality (VR) can be defined as a real or imaginary environment that is manipulated and created through a computer interface. VR systems offer advantages such as immediate stimulus-based feedback, simple to more complex stimulus adjustment, easy recording of progress in individuals, and a safe learning environment. It also provides feedback that can increase the effectiveness of learning-based education by detecting and correcting motor problems. In physiotherapy, VR is becoming widespread as an alternative treatment method and its evidentiary benefits are shown in different patient groups. In this short review, we tried to explain the current use and contributions of VR in physiotherapy.

Keywords: virtual reality, physiotherapy, rehabilitation, serious games, geriatry, stroke

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Introduction

Virtual Reality (VR) can be defined as a real or imaginary environment that is manipulated and created through the computer interface. VR systems have advantages such as instant feedback, stimulus-based control, simpler to more complex stimulus settings, easy registration of individuals and a safe learning environment. Another important feature is the detection and treatment of motor disorders, providing online feedback that can increase efficiency with learning-based training in VR. The important feature of VR in terms of rehabilitation is the ability to handle more than one basic feature in different diagnosed populations.^{1,2}

The main feature of all VR applications is interaction. Virtual environments are created and allow the user to interact not only with the virtual environment, but also with virtual objects in the environment. Although VR started to gain popularity in the late 1990s, VR technologies have been in this discipline in the last decade, evaluation and It has begun to be developed and studied as a possible tool for treatment.²

The use of virtual reality applications for postural control, clinical functional analysis and rehabilitation, walking training, daily life activity rehabilitation and rehabilitation in the elderly population has been confirmed by researches.^{2,3}

In recent years, various studies have been conducted on the use of virtual reality in motor rehabilitation. Vision-based games and virtual reality systems are increasingly used for motor rehabilitation and function enhancement. In VR, it has been determined that the natural interaction of the patient facilitates their participation in the determined task and increases their motivation to the activity. VR is useful in visual, auditory and motor learning applications; It has a positive effect on personal motivation. "The term" virtual reality "includes a large number of technological devices and systems with different features that can be divided into two groups according to the patient level. VR systems can also be combined with the use of treadmills, bionic gloves, and / or robot exoskeletons, providing more user feedback. VR devices are game-based applications whose content, duration, intensity and feedback can be adjusted to create an adequate exercise recipe. In addition, it is seen as an advantage that VR leads to improvements with motivation, which patients see as a fun exercise game rather than treatment, compared to conventional treatment.^{2,4}

With the advances in technology, VR system technology has also changed, the cost of the devices has decreased, and with the use of

fast internet connection, there has been an increase in the use of VR systems. Accordingly, VR has reinvented itself in some technological areas, especially in video games. Such games have become popular in different commercial platforms such as Play-Station, Xbox, Mac and PC. In order to improve hand and upper extremity functions, its virtual image can be created on a computer screen on which individuals need to move according to their intended activities.³⁻⁵

VR games have been shown to be beneficial in improving upper limb function and activities of daily living. New video games have also been created for upper limb rehabilitation, focused on meeting the different goals recommended by healthcare professionals.³⁻⁵

VR systems have been developed based on sensor technologies. The most popular of these are Nintendo Wii™ and Microsoft Kinect™. However, these devices focus on all bodily functions and are lacking in functions such as fine hand skills.^{1,2}

Use of VR in neurological problems

Stroke is the most common cause of physical disability in adults and the second most common cause of dementia. In post-stroke rehabilitation, VR has been shown to be more effective in combination with traditional physiotherapy, especially in maintaining balance. One of the biggest problems after stroke is distraction in patients and its negative effects on learning. Therefore, VR technologies provide a great advantage as the patient's attention can be fully focused on the task. Again, treatments with VR have been shown to increase functionality in the elderly, children with Cerebral Palsy and other neurological involvement.⁴⁻⁶

It was concluded that VR is an effective treatment method in increasing upper extremity motor function and quality of life after stroke, and it is explained that video games used to increase both participation and success in treatment make treatment more effective.^{5,7}

Recent studies suggest that VR can be useful and effective in the treatment of motor and cognitive symptoms in rehabilitation treatment, in different neurological disorders such as traumatic brain injury, multiple sclerosis, parkinson's, and progressive supranuclear palsy.^{6,8}

Effects of VR training on general cognitive and psychological rehabilitation in individuals with neuro-cognitive disorders; It has been found to contribute more to memory, dual task and visual attention, reduction of anxiety, higher levels of well-being, and increased use of coping strategies.^{6,7}

Use of VR in cardiovascular problems

Pulmonary rehabilitation program supported by VR training has been shown to be a useful application to increase physical fitness in COPD patients. In the comparison between the exercise training group and the VR groups, VR was shown to be statistically significant. It was also shown that in the group that received only exercise training, they stopped working due to strain, and the VR group completed the studies with a 95% participation.^{9,10}

With VR treatment, when parameters such as heart rate, heart reserve, respiratory rate, peripheral oxygen saturation (SpO₂), perceived effort assessment (RPE), systolic blood pressure (SBP), diastolic blood pressure (DBP) are considered; As a result of follow-up, RPE, SBP, SpO₂ values were increased compared to before treatment. In virtual reality-based therapy, improvements in aerobic capacity were also shown in patients with anaerobic threshold and cardiac function. It has been shown that the level of physical effort spent during virtual reality training is similar to that produced during training on a treadmill. During VR training using the Nintendo Wii system, significant changes were observed in heart rate, O₂ saturation and dyspnea. It has been concluded that VR training is also safe and comfortable for the patient. In pulmonary rehabilitation programs, long-term programs of at least 6-8 weeks with VR are recommended.^{9,10}

The effect of VR on hand grip strength

After 8 weeks of VR training for the affected hand, significantly better results were obtained in Jebsen-Taylor Hand Function Test, writing, card flipping, light object lifting and heavy object lifting, palmar grasping, triple grasping, end grasping compared to before treatment. There was no significant difference between the groups in terms of key concept. The effect of VR on hand functions in healthy individuals was also examined, and significant improvements were observed in speed, coordination, grip strength and functional abilities as a result of the 8-week rehabilitation program.^{2,3,5}

Conclusion

Future research should aim to investigate promising VR technology with larger data and long-follow-up study models to evaluate clinical effects in patients with different diagnoses. In addition, the comparative studies of VR with traditional physiotherapy and the cost for health management systems are issues that need to be determined. In addition, since VR systems can be easily adapted in environments such as home, it should be considered that they can be beneficial in terms of continuity of treatment. Home-based VR can offer a promising addition or alternative to existing rehabilitation programs and further improve clinical outcomes by offering the chance to provide and / or maintain the required treatment in a more accessible setting after discharge. It is important to determine the games suitable for the exercise program to be given in VR.

Physiotherapists, according to the clinical characteristics of the patient in VR; It should focus on individualized treatment planning with different feedback, varying the duration, intensity and difficulty level of the treatment.

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Conflicts of interest

The author declares there is no conflict of interest.

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