

Healthcare is an ever-advancing field that adapts new technologies and techniques to provide the most efficient and appropriate care for patients. Today, virtual reality (VR) may be the start of a paradigm shift for a multitude of healthcare services. VR is being studied as a safe and early intervention for rehabilitation and as a non-pharmacological analgesic option for patients recovering from accidents or motor neuron diseases. VR devices can prepare patients for physiotherapy or occupational therapy, which could significantly enhance therapeutic efficiency. As an analgesic, VR could prove to be an excellent alternative to overused medications. VR is also being employed for medical training to provide more immersive opportunities for students to practice their medical skills. This article examines how VR can contribute to these sectors of healthcare, highlights its impeding factors, and evaluates its potential.

INTRODUCTION

Imagine leaving behind your anxiety and doubts to enter into a stunning fantasy world where your steps are guided by ethereal trails. Now imagine these being the first steps you've taken since a major accident or a motor neuron disease diagnosis. Though this concept may seem outlandish, it is quickly becoming feasible for patients around the globe through virtual reality (VR) systems. Though previously limited by lack of technological innovation and high costs, the VR industry is now growing thanks to investment from companies such as Oculus VR and HTC, making VR more feasible. Beyond consumer use, this revolution has revealed a unique opportunity for VR to be used in healthcare, where it can improve patient rehabilitation, offer a new mode of treatment, and assist in education.

A WHOLE NEW WORLD – HOW IT WORKS

VR is a computer-based technology that attempts to reproduce elements of reality, including visual fields, audio output, and haptic sensations. Head-mounted displays (HMD) provide full immersion in a virtual environment (VE) and are at the forefront of the VR industry. They enclose users' full range of vision within a screen and are used in conjunction

with noise-cancelling headphones and vibrating controllers to simulate reality.¹ Alternatively, multiple screens known as a tri-screen display are also common. Although many VR systems are being tested in a clinical setting, research has yet to determine their effectiveness in other situations.²

REHABILITATION AND THERAPEUTIC USES OF VR

Rehabilitation aims to help patients recover from injury or illness, and prepare them to return to their daily routine. The predicament lies in creating a rehabilitation setup which accurately portrays daily obstacles, as they tend to be costly and challenging for patients to overcome in early stages of recovery. VR can provide a safe means of delivering a realistic environment which can bolster confidence and better prepare patients for real-world obstacles.^{3,4} In fact, therapeutic uses are the most documented medical application of VR over the last decade.¹

The three major factors of rehabilitation are early intervention, specific task training, and repetition, all of which can be addressed through VR.^{3,5} Documented observations suggest that prolonged inactivity in patients prior to rehabilitation results in greater dystrophy of muscles and nerve connections, whereas earlier interventions promote the maintenance of undamaged areas and the repair of partially damaged nerves.^{3,4} As VR requires little human assistance compared to physiotherapy or occupational therapy, it can be implemented immediately as an early intervention.³ Developers can design objectives in multidimensional environments to promote ample repetition of realistic task motions. VR's effectiveness is exemplified in a 2011 study which observed that later stage Parkinson's Disease (PD) patients often lose control of their step regulation patterns (gait), making locomotion rather difficult.^{3,4} Mirelman and his colleagues discovered that with active VR training, the patients had enhanced control over their steps, took longer and more confident strides, and more often remembered to place their foot farther away from an obstacle to avoid falls.^{4,6} Furthermore, VR showed promising clinical effectiveness as