



ROLE OF VIRTUAL REALITY AS A THERAPEUTIC APPROACH AND ITS IMPACT ON QUALITY OF LIFE AND FUNCTIONAL INDEPENDENCE IN STROKE SURVIVOR: A REVIEW

Ajeet Mandal¹, Dr. J. Alice Jeba², Dr. Sedhunivas³

¹Master of physiotherapy student, Garden City University, Bengaluru

²Professor, Garden City University, Bengaluru

³Assistant Professor, Garden City University, Bengaluru

Address for Correspondence: Ajeet Mandal, Master of Physiotherapy Student, School of Health Science, Department of Physiotherapy, Garden City University, Bangalore, Karnataka, India

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ABSTRACT

Objective: The purpose of this literature review is to determine the role of virtual reality as a therapeutic approach in stroke survivors.

Method: The articles were selected from various authentic platforms like Google Scholar, PubMed and Science Direct. The articles were selected from the year 2012-2023. The total articles selected were around 72 and only 16 articles were included in the study according to the criteria of the study.

Results: According to study stroke is a serious worldwide health issue that contributes significantly to death and morbidity in industrialised nations as well as a rising number of low- and middle-income nations. Virtual Reality conjunction with traditional physiotherapy shows significant result in upper and lower limb function after stroke

Conclusion: The effect of virtual reality as therapeutic approach in post stroke survivor was evaluated in this review. This study concluded that virtual reality compared to conventional therapy shows the effect in post stroke survivors.

KEYWORDS: Stroke, Virtual Reality, Therapeutic approach, Review, Stroke Rehabilitation, Post stroke.

INTRODUCTION

An abrupt, localised loss of brain function triggered by vascular damage (haemorrhage, infarction) to the central nervous system is recognised as a stroke, a form of neurological condition. In the world, stroke ranks as the second most common cause of death and disability. Stroke is a result of multiple risk factors, illness processes, and disease mechanisms rather than a single illness.(1) Considering stroke has neurological repercussions which influence the motor, cognitive, and sensory systems, it has been deemed the leading cause of disability globally.(2)

The two primary forms of strokes are haemorrhagic and ischemic, with several subtypes providing further classification. Haemorrhagic strokes are caused by bleeding into the cerebral cavity from a ruptured blood artery in the brain, whereas ischemic strokes are caused by limited blood flow to the brain as a consequence of an obstructed blood artery. Face numbness and weakness, vision issues, unilateral upper or lower limb weakness, poor balance, nausea, abrupt, strong headaches without a known reason, and trouble speaking are the most common signs of a stroke. According to reports, men and women experience these basic symptoms of stroke equally, but women are inclined to experience non-traditional symptoms such as unconsciousness and dizziness.(3)

Stroke-related disability and mortality have important ramifications for individuals as well as society. Stroke constitutes between 2% to 4% of global health care expenses, with industrialised nations demonstrating that stroke accounts for more than 4% of direct health care costs(4). In order to improve patients' quality of life, rehabilitation is an essential part of addressing post-stroke problems. A multidisciplinary strategy is used in rehabilitation with the goal of improving and restoring normal physiological processes in different body parts(5).

The ultimate result of a stroke is mainly determined by its complications. Complications encompass long-term functional disability and cognitive impairment frequently accompany patients. After a stroke, the fatal outcome rate is roughly 15% at one month and 50% after five years. Worldwide, stroke is the primary cause of long-term impairment, and the most prevalent post-stroke damage is dyskinesia, which affects 85% individuals who have had an acute stroke. An estimated 55% to 75% of stroke survivors experience functional restrictions in their upper and lower extremities. Despite a stroke, 50% to 60% of individuals have distinct levels of motor impairment. Two thirds of stroke patients experience a deterioration in their cognitive abilities, such as memory, attention, and executive function. Post-stroke patients have limited daily activities and



functional tasks due to their cognitive and functional disability; this can end up in an overall decline in health-related quality of life(6).

One of the most popular advanced neurorehabilitation technologies for improving stroke patients' physical and cognitive abilities is virtual reality (VR). With the use of computer-based technology, virtual reality (VR) developers may produce interactive simulations that submerge users in multisensory, simulated environments and offer real-time performance feedback. It provides a distinctive and immersive rehabilitation experience by enabling stroke victims to participate in activities that mimic real-world objects and events. Virtual reality has been shown to have potential advantages in neurorehabilitation, especially in stroke rehabilitation(7). A virtual reality system replicates the intricacies of the actual world within a regulated setting. Additionally, VR can offer a therapeutic setting that enables users to execute several exercises with sufficient motivation and assessments, all of which are acknowledged as crucial elements in rehabilitation(8).

Three essential components—duplication, feedback, and motivation—are involved in the scientific underpinnings and benefits of using VR technology in rehabilitation therapy. Practicing is the first step towards learning a motor skill. However, constant practice alone is insufficient. Patients need to gradually receive feedback and success stories(9). Because of its many well-known advantages, virtual reality is a great tool for rehabilitation interventions. These advantages include the chance for hands-on, active learning as well as the capacity

to measure behaviour objectively in demanding, secure, and ecologically sound settings while upholding stringent experimental control over the distribution and measurement of stimuli. Additionally, VR allows for the customisation of treatment plans while progressively raising task complexity and lowering clinician support(10).

METHODOLOGY

Materials and method

An extensive search was carried out across electronic databases, such as PubMed and Google Scholar.

Keywords such as Stroke, Virtual Reality, Therapeutic approach, Review, Stroke Rehabilitation, Post stroke.

Research examining the potential of virtual reality as a therapeutic intervention for stroke survivors. All of the articles were collected together. Only 16 of the 76 publications that were compiled are used in this research study.

Study Selection

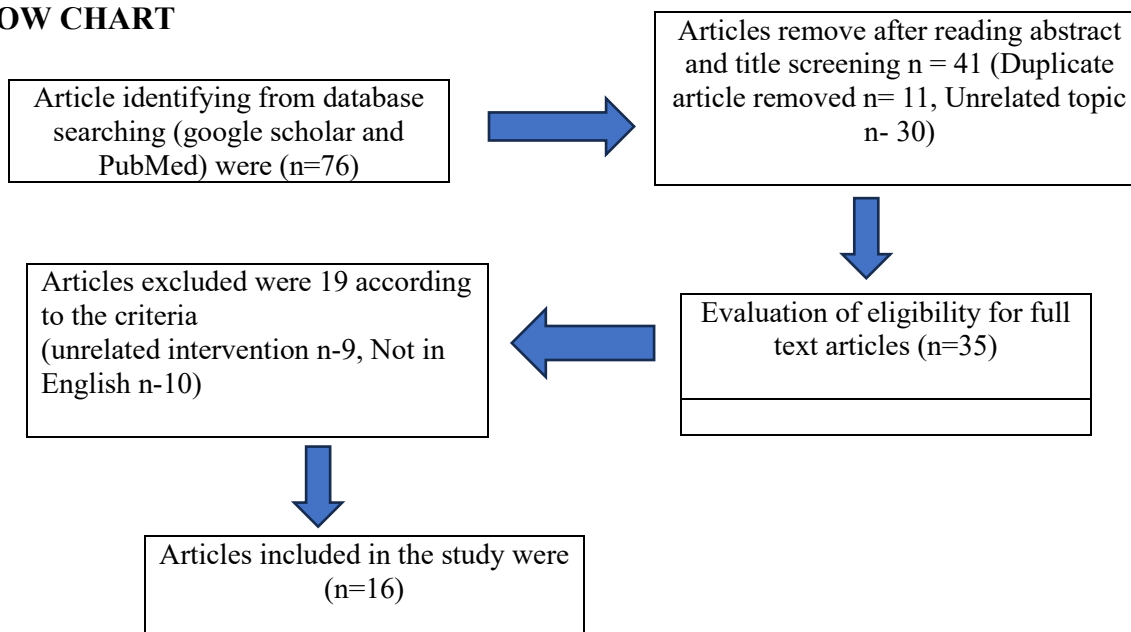
Inclusion Criteria

- The included articles ranged from 2012 to 2023.
- Articles include the effect of virtual reality in stroke survivors.

Exclusion Criteria:

- Articles published prior to 2012 are not included.
- Person's inability to speak and any other neurological disorders are excluded.
- Articles which is not in English.

FLOW CHART





REVIEW OF LITREATURE

Sr. No	Author & year	Methods	Conclusion
1.	Carlos luque-Moreno et al, 2021	The study involved 20 patients in total, split into 2 groups: VR + CP and CP. Result were measured by Fugel Meyer scale, Functional ambulatory category and Functional independence measurement.	The use of a VR treatment through boosted feedback in conjunction with a CP programme has been shown to be more useful than a comparable quantity of CP treatment for optimising the functional recovery of the LE and gait adhering to a stroke. (11).
2.	Jinlong Wu et al, 2021	10 studies totalling nearly 550 stroke patients were obtained after adjusting for overlap. The impact of virtual reality instruction on stroke sufferers' motor abilities	an analysis of the latest information, virtual reality (VR) has a medium to significant impact size and helps stroke patients with their balance and motor function, particularly with their upper extremities(12).
3.	Roxana steliana miclaus et al, 2021	Of the 76 inpatients that were initially identified, fifty-nine were enrolled in the study. While the control group (n = 28) received normal physiotherapy, the experimental group (n = 31) received both MT and VR therapy. For 10 days, each group received therapy for seventy minutes each day.	The outcomes of our investigation demonstrate that VR rehabilitation technology, when coupled with MT exercises, optimises the environment for chronic stroke patients' lower extremity rehabilitation by including diverse feedback sources with a greater influence on neuroplasticity.(13)
4.	Roxana miclaus et al, 2020	A total of fifty-five inpatients were assigned at random to control and experimental groups. Subacute groups were created from the two groups. At baseline and two weeks into treatment, the following standardised tests were administered:	When addressing success metrics, the duration of virtual reality therapy, and other peculiar features of the post-stroke population, such as moderate impairments, aphasia, or cognitive impairment, it may be advantageous to use certain NVIRs for upper extremity rehabilitation in post-stroke patients. (14).
5.	Pawel kyper et al, 2020	59 stroke inpatients in all, whose average age is 60.3 years and 14 months, were divided into two groups: subacute and chronic. Before and after treatment, a variety of clinical scales were used.	When VR therapy is used with conventional physiotherapy following a stroke, at the subacute and chronic stages, it can assist enhance functional outcomes(15).
6.	Mohd azzuan ahmed et al, 2019	In this study, 36 volunteers with mean ages of 57 and 63 years, respectively, were split up into two groups, with 18 people in the control group and 18 people in the experimental group.	It has been proved that using virtual reality games in conjunction to conventional physiotherapy is equally advantageous for the recovery from upper limb strokes as using standard physiotherapy alone. Our study's utilisation of VR games was not meant to take the place of the existing therapy strategy(16).
7.	Jigna patel et al, 2019	Along with their inpatient rehabilitation, seven individuals underwent eight to one hour sessions of upper limb virtual reality and robotic training. The only therapy given to the six participants was inpatient care.	When compared to standard care alone, an additional 8 hours of intense VR/robotic based upper limb training started within the first month after a stroke may yield greater gains in impairment. Importantly, it was possible to address behavioural, neurophysiological, and disability issues in the early phases after a stroke.(17)
8.	Albero luiz aramai et al, 2019	This was a mixed-methods study. For forty minutes a day, three days a week, ten stroke patients—both subacute and chronic—participated in a 12-week rehabilitation programme through non-immersive virtual reality games.	Virtual reality (VR) presents a promising avenue for improving the functional outcomes of stroke patients, particularly in terms of job satisfaction and occupational performance(18).



9.	Jeffrey M rogers et al, 2019	Twenty-one persons (aged 42–94) who had subacute strokes were randomised to receive treatment as usual alone or to get four weeks of virtual rehabilitation from Elements in addition to their regular care. Before and after inpatient training, as well as a month later.	Following a stroke, both motor and cognitive recovery are aided by an Elements virtual rehabilitation programme that uses goal-directed and exploratory upper-limb movement tasks(19).
10.	Kynan Eng, et al.2018	In a multi-center, parallel-group, randomised controlled study, patients who had suffered a stroke at least six months prior were randomly assigned to either the experimental group or the control group, which had standard therapy (16 sessions of 45 minutes per week for four weeks). The virtual reality-based training system replicated the movements of the patients' upper limbs in real-time, enabling them to manipulate virtual objects.	The majority of the advantages occurred in the first two weeks and continued into the two-month follow-up period, with identical results for patients in the experimental and control groups. At admission, the study cohort's motor function was moderately to severely deteriorated. Less impaired patients exhibited better improvement relative to the experimental group(20).
11.	Jeannine Bergmann et al. 2018	VR-enhanced RAGT (group under intervention) or conventional RAGT (control group) for twelve sessions spanned over four weeks. Individual mean walking time, patients' motivation as estimated by the Intrinsic Motivation Inventory [IMI], the acceptability of the therapies (drop-out rate, questionnaire), and the viability of prospective outcome measures (completion rate, reaction to interventions) were all analysed.	VR-augmented RAGT produced longer training times, a lower drop-out rate, and higher levels of acknowledgment and motivation than standard RAGT. This pilot study outlines guidelines for an imminent RCT on the effectiveness of VR-augmented RAGT. (21)
12.	Erika pedreira da Fonseca et al. 2017	The treatment group and the control group were randomly assigned in this blinded clinical experiment comprising post-stroke patients. The Dynamic Gait Index was applied to determine the treatment group's balance, and falls were recorded prior to and after the 20 intervention sessions.	The reduction in falls can be influenced by the use of virtual reality in stroke survivors' rehabilitation of gait and balance(22).
13.	Zhen L et al. 2015	The databases MEDLINE, CINAHL, EMBASE, Web of Science, and CENTRAL were searched in order to find studies. A couple of reviewers selected which studies to include, gathered data, and evaluated the trials' quality.	The use of virtual reality to improve balance after a stroke is validated by this meta-analysis of randomised controlled studies(4).
14.	Davide Corbetta et al. 2015	A meta-analysis in conjunction with a systematic review of randomised trials. Adults diagnosed with stroke clinically are the participants. Intervention: One of the following comparisons required to be present in eligible trials: VRBR utilised in addition to or in place of regular therapy.	When VRBR is implemented in place of some or all of a standard rehabilitation programme, stroke survivors have greater improvements in walking speed, balance, and mobility(23).
15.	Keith R lohse et al, 2014	The Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, DARE, PEDro, EMBASE, ERIC, PSYInfo, CINAHL, and MEDLINE were all used in a thorough search. Controlled trials comparing VR to conventional therapy were among them.	Virtual reality therapy exhibits a noteworthy modest effect in terms of outcomes related to bodily activity and function in relation to CT. Even while involvement effects are not well studied, early results show that VR therapy is superior to CT(24).



16.	Andrea turolla et al, 2013	were admitted to our rehabilitation centre and took part in an actual clinical study. 376 people with motor arm subscores between 1 and 3 on the Italian National Institutes of Health Stroke Scale (It-NIHSS) who did not have substantial cognitive deficits hindering their rehabilitation were recruited. Patients were split into two treatment groups: those who had VR in addition to ULC therapy or ULC therapy alone.	Virtual reality rehabilitation seems to be more effective than traditional therapy when it comes to addressing upper limb motor deficits and motor-related functional capacities in stroke survivors(25).
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DISCUSSION

There were 16 articles selected in study one systemic review, prospective controlled trial, randomized clinical trial, ranadomized control pilot study, Cohort randomized trial and control trial, three systemic review and meta analysis and comparative study, two ranadomized control trial and feasibility study. This study investigate the impact of virtual reality on stroke survivors.

A chronic experimental group and a chronic control group were distributed to patients in Roxana Miclaus et al.'s small cohort randomised control study. The investigation carried out over a period of nine months. The outcomes of the study indicate that, relative to regular physiotherapy, NIVR boosts upper extremity functional recovery in individuals with stroke, both acute and chronic.(26) For a period of nine months, Roxana Steliana Miclaus et al. conducted a prospective randomised trial in which fifty-nine patients were split into two groups: an experimental group and a control group. Each of the two groups experienced lower extremity rehabilitation lasting seventy minutes every ten days. The experimental group exercised on an ergometer, a bike, and a treadmill for 20 minutes, and they also received virtual reality therapy for 27 to 37 minutes. The finding of the study indicates that VR therapy in conjunction with MT may potentially substitute traditional physical therapy in the post-stroke rehabilitation of the lower extremities(27).

For the second research, a pilot randomised control trial, twenty patients were selected and separated into two groups, an experimental group and a control group. The experimental group underwent twelve sessions of VR-augmented RAGT, whereas the control group underwent standard RAGT. The author came to the conclusion that VR-augmented RAGT had a longer training period and a lower drop-out rate than normal RAGT, and that it was also more motivating and acceptable. Suggestions for a future RCT on the efficacy of VR-augmented RAGT have been provided by this pilot study(28). Keith R. Lohse et al.'s systemic review and meta-analysis included 26 papers that met the inclusion criteria. The chosen research demonstrates how virtual reality therapy compares to conventional therapy for adults who have had a stroke. The findings indicate that VR rehabilitation for adult stroke victims somewhat improves results when compared to standard therapy. It is not possible to assess the potential positive effects of CG given the quantity and scope of existing CG treatments. Further research in this area should define the phrases "conventional therapy," record metrics related to participation,

consider the factors that motivate therapy, and investigate commercially available technologies in larger RCTs(24).

Ten stroke patients, both subacute and chronic, participated in a 12-week rehabilitation programme by playing games in non-immersive virtual reality for forty minutes a day, three days a week, according to a feasibility study conducted by Alberto Luiz Aramaki et al. The outcome variables that were part of the sociodemographic data collection were the Participation Scale and the Canadian Occupational Performance Measure (COPM). At the end of the programme, an interview with the participants was conducted, and their frequency of attendance and adherence were recorded in a field journal. The conclusion demonstrates that virtual reality (VR) offers a potentially effective treatment option for stroke patients' functional rehabilitation, especially in terms of job satisfaction and occupational performance(29).

Use of virtual reality shown in various studies shows that virtual reality compared to convectional physiotherapy also virtual reality combine with augment robotic training shows the positive results in patient with post stroke.

CONCLUSION

As known stroke is a significant worldwide public health issue, due to which individuals upper and lower limb functional capacity is affected which lead to difficulty in doing activity of daily living. The effect of virtual reality as therapeutic approach in post stroke survivor was evaluated in this review. This study concluded that virtual reality compared to convectional therapy shows the effect in post stroke surviours in there upper and lower limb functional capacities.

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