

# VIRTUAL CONVENTIONAL THERAPY FOR MOTOR REHABILITATION IN STROKE PATIENTS: A SYSTEMATIC REVIEW

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## ABSTRACT

**Background:** Stroke is a leading cause of disability worldwide, significantly impacting motor function, sensory, visual, and cognitive abilities. Conventional physical therapy has traditionally been used for stroke rehabilitation. However, technological advances have introduced virtual reality (VR) as a rehabilitation tool. Research has highlighted the therapeutic value of VR in improving motor functions, with some studies suggesting superior outcomes compared to traditional therapy. Despite this, the literature presents varied results, necessitating a systematic review to evaluate the breadth of evidence.

**Objective:** This study aims to compare the effectiveness of VR therapy with conventional physical therapy in extremity function among stroke patients.

**Methods:** A primary search was conducted across PubMed, Scopus, and ProQuest databases using keywords related to stroke, VR, and conventional therapy. Studies will be included if they compare the efficacy of VR with conventional therapy in stroke rehabilitation. Non-comparative studies, non-English publications, and irrelevant topics will be excluded.

**Results:** A literature search yielded 15 eligible journals using a randomized clinical trial. Analysis showed that 4 out of 15 articles found VR therapy not superior to conventional therapy, while the other 11 articles demonstrated that VR therapy statistically improved patient conditions compared to conventional therapy.

**Conclusion:** VR-based exercises stimulate cortical reorganization and strengthen neural systems involved in motor planning, learning, and execution. Most studies indicate that VR therapy is more effective in enhancing motor recovery, balance, and limb function in stroke patients and increasing patient motivation and engagement than conventional training.

**Keywords:** conventional physical therapy, motoric rehabilitation, stroke, virtual reality



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## Introduction

Stroke is one of the leading causes of death and long-term disability worldwide, often resulting in extremity dysfunction that significantly impairs functional independence and quality of life.<sup>1,2</sup> Stroke is a leading cause of long-term disability. After a stroke, neurological symptoms can vary depending on the location and extent of the brain lesion, but motor weakness is the most commonly reported. Up to 85%

of stroke survivors initially experience some degree of extremity impairment. Although many may see improvements within the first few weeks post-stroke, a significant portion, between 55% and 75%, experience persistent functional limitations in their extremities, affecting their independence in daily activities.<sup>3,4</sup>

Conventional therapy for stroke typically includes various physical therapy techniques aimed at improving motor function in patients who have experienced a stroke. Conventional physiotherapy for

stroke rehabilitation focuses on exercises that help restore movement and strength in affected limbs, enhance balance and coordination, and relearn daily activities.<sup>5</sup> Conventional therapy is therapist-based training involving traditional rehabilitation methods carried out by physical or occupational therapists. This therapy focuses on exercises to improve function, strength, flexibility, and range of motion in the upper limbs affected by the stroke.<sup>6,7</sup>

Conventional therapy typically includes exercises and techniques to restore motor function and strengthen muscles after a stroke. This may involve range-of-motion exercises such as strengthening exercises, task-specific training for daily activities, manual therapy techniques, stretching exercises to improve flexibility, and balance and coordination activities. The treatment procedures usually involve one-on-one sessions with a therapist and may include assistive devices to aid movement and function.<sup>1,8</sup>

Another rehabilitation therapy currently being developed is Virtual Reality (VR). VR is a form of rehabilitation that uses virtual reality technology. This type of therapy involves interactive exercises in a virtual environment that can simulate real-life tasks and scenarios. VR therapy is increasingly used for post-stroke rehabilitation of the extremities because it allows for more intensive and repetitive training, which is crucial for rehabilitation and neural plasticity improvement. The benefits of VR include real-time feedback, adaptability, and a safe environment that can encourage active participation, positive emotions, and patient engagement. Consequently, VR therapy can help improve function, range of motion, and quality of life for stroke survivors.<sup>9-11</sup> VR interventions provide interactive tasks in a computer-generated virtual environment, incorporating auditory and visual feedback. These interventions aim to enhance user motivation by offering high-intensity repetitive tasks.<sup>12,13</sup>

Several previous studies have highlighted significant differences in outcomes between conventional therapy and VR therapy for motor rehabilitation in stroke patients. These findings suggest that each method may offer unique advantages and limitations. However, the existing literature lacks a comprehensive synthesis that systematically compares these approaches across various studies. The population in this study includes patients undergoing rehabilitation for motor recovery, particularly those with stroke infarction. The intervention focuses on Virtual Reality (VR)-based therapy, incorporating spatial transformation, unlinked eye-hand movements, and interactive environments to enhance rehabilitation outcomes. The comparison is between conventional therapy and standard rehabilitation practices, and the outcome includes improvements in motor recovery,

joint range of motion, patient motivation, and balance. Therefore, this systematic review aims to bridge this gap by providing an in-depth analysis and comparison between conventional and VR therapy.

## Methods

The journal search on VR Therapy and Conventional Therapy for Motor Rehabilitation in Stroke Patients in this review is a collaborative effort by the research team. The journals selected for review were based on discussions with co-authors, who acted as supervisors for the researchers. The research findings are presented using descriptive analysis.

The journal selection was conducted using PubMed, Scopus, and ProQuest search engines with keyword groups including "Motor Recovery," "Stroke Infarction," "Virtual Reality," and "Conventional Therapy." Inclusion criteria comprised peer-reviewed articles published in international English-language journals between 1994 and 2024. Exclusion criteria for this study included predatory journals or publishers and grey literature. Additionally, journals were excluded if they did not mention "Motor Recovery," "Stroke Infarction," "Virtual Reality," and "Conventional Therapy" together. The final selection comprised 15 journals to be discussed in this study, with details outlined in the PRISMA protocol. An ethical review was not required for this review.

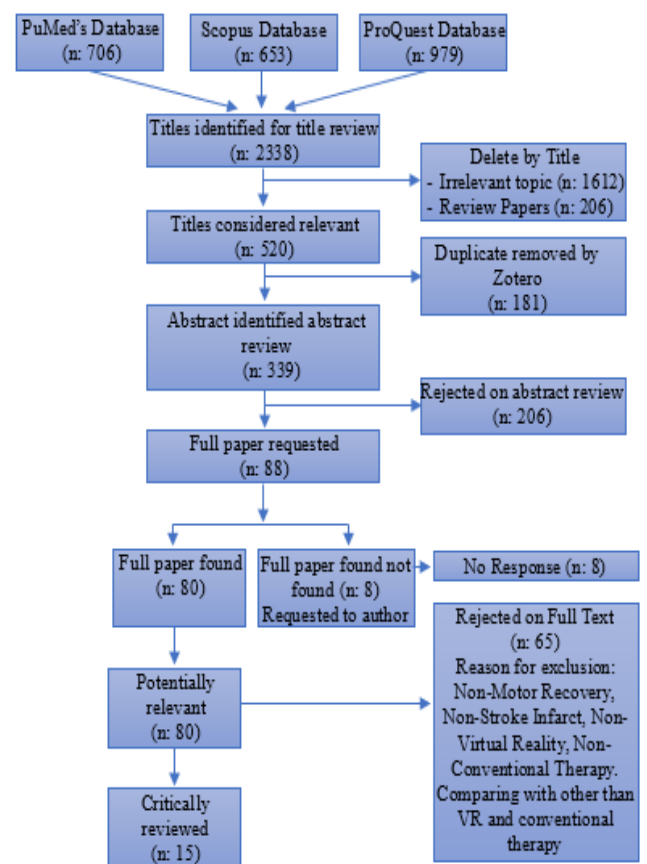


Figure 1. PRISMA Protocol

## Results

### Article Selection Process

Figure 1 shows the article search results, yielding 2338 journals. This search used predefined keyword groups in search engines such as PubMed, Scopus, and ProQuest. The initial selection was made by reviewing the titles of each search engine result. Of these, 1612 journals were found irrelevant, and 206 others were not selected because they were review journals, leaving 520 journals. Subsequently, 181 journals were removed due to duplication, leaving 339 for further screening. From this number, 251 journals were not selected after abstract-based selection. Of the remaining 88 journals, 65 were not chosen because they compared things other than VR and conventional therapy, thus identifying 15 articles eligible for review.

The analysis of 15 journals (Table 1) found that six journals (5, 12, 14, 18, 21, 22) have a high risk of bias. The high risk of bias in these journals is due to several critical methodological factors. In journals 21 and 22, there was no allocation concealment, a procedure that prevents bias in assigning participants to intervention or control groups. Journals 14, 5, and 22 did not implement blinding of participants and personnel,

which is crucial to reduce bias that may arise if participants or study personnel know the intervention group assignment. Additionally, journals 12, 5, 21, and 22 did not perform blinding of outcome assessment, meaning that preconceived expectations about the results could influence outcome assessors. Lastly, journals 12, 14, and 18 had incomplete outcome data, where data from some participants were unavailable for the final analysis, which potentially biased the results. These combined factors result in a high risk of bias in these six journals (Figure 2).

Out of the 15 selected journals for analysis, all journals employed a Randomized Clinical Trial design (3, 5, 6, 9, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23). Each journal also featured one experimental group (VR) and one control group (conventional therapy) (3, 5, 6, 9, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23).

Among the 15 articles, four articles indicated that VR therapy was not superior to conventional therapy (3, 6, 14, 20), while 11 other articles statistically demonstrated improvement in VR patients compared to conventional therapy (5, 9, 12, 15, 16, 17, 18, 19, 21, 22, 23). These differences stem from various factors, which will be discussed in detail in the discussion section.

(Bian Minji, et al), 2022 (14)	+	+	-	+	-	+	+
(Xie Haoyu, et al), 2021 (12)	+	+	+	-	-	+	+
(Anwar Naveed, et al), 2021(15)	+	+	+	+	+	+	+
(Bai Yu, et al), 2022 (16)	+	+	+	+	+	+	+
(Hung Jen-Weng, et al), 2019 (6)	+	+	+	+	+	+	+
(Gueye Tereza, et al), 2021 (5)	+	+	-	-	+	+	+
(Ogun Muhammed, et al), 2021 (17)	+	+	+	+	+	+	+
(Choi Jun, et al), 2014 (3)	+	+	+	+	+	+	+
(Kuo Fen-Ling, et al), 2023 (18)	+	+	+	+	-	+	+
(Huang Chien-Yu, et al), 2022 (19)	+	+	+	+	+	+	+
(Park Mina, et al), 2019 (9)	+	+	+	+	+	+	+
(Wieczorek Michael), 2021 (20)	?	?	?	?	+	+	+
(Kiper Paweb, et al), 2014 (21)	+	-	+	-	+	+	+
(Kiper Paweb, et al), 2011 (22)	+	-	-	-	+	+	?
(Naveed Anwar, et al), 2022 (23)	+	+	+	+	+	+	+
	Randomized Sequence Generation	Allocation Concealment	Blinding of participants and personnel	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Other bias




**Key**  
 Low risk of bias  
 High risk of bias  
 Unclear risk of bias

Figure 2. Bias Assessment

**Table 1.** Study Characteristics

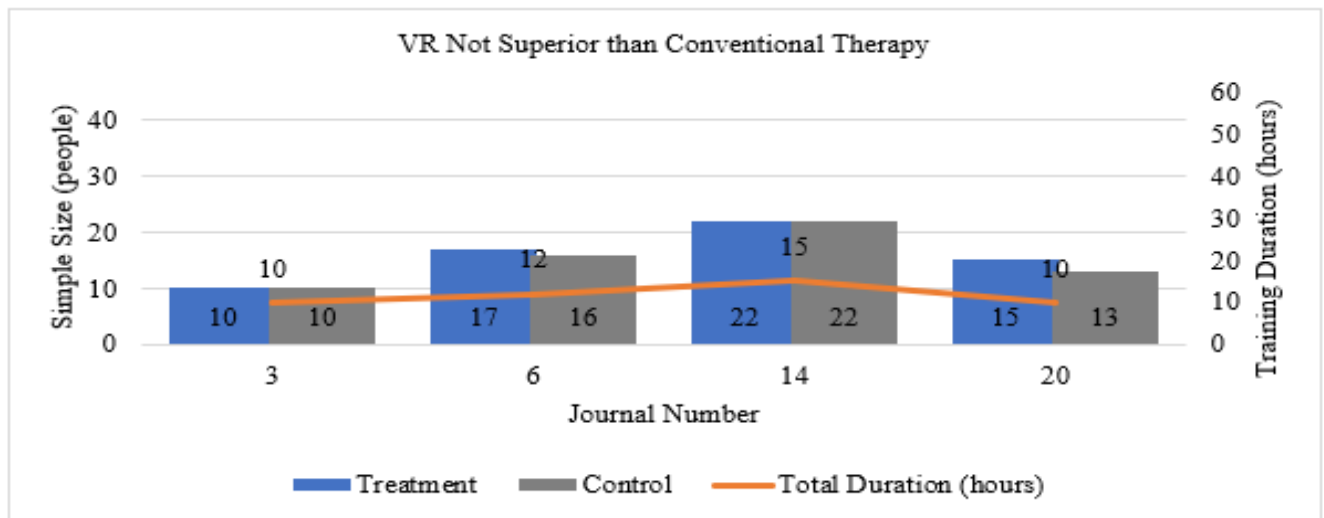
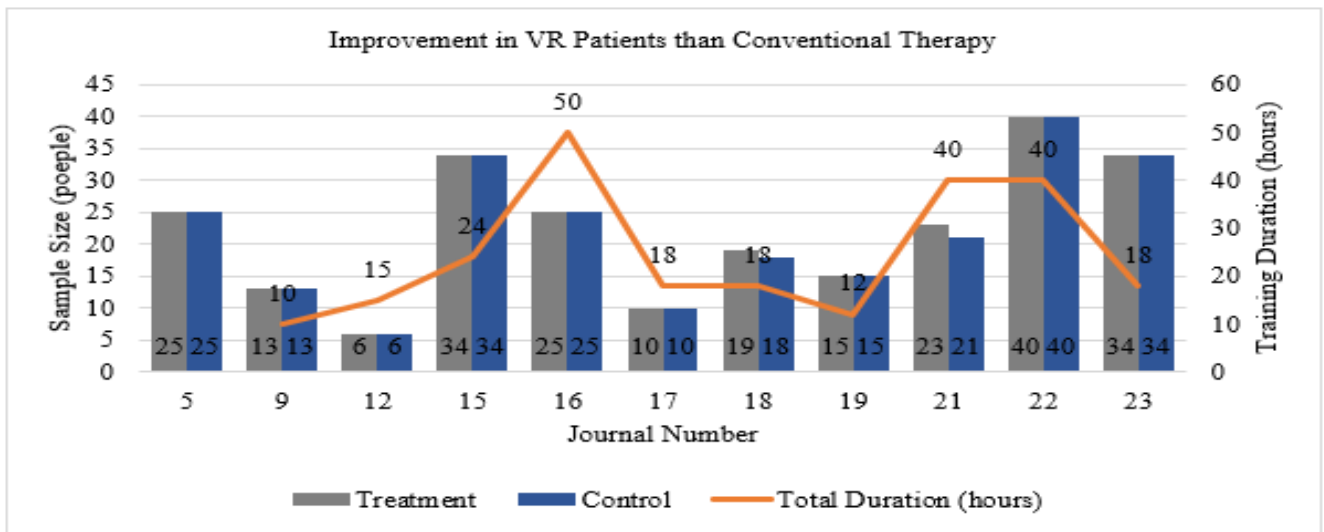
Author, Year	Aims	Study Design	Inclusion	Methods	Setting	Finding
(Bian Minji, et al), 2022. <sup>14</sup>	Understanding the effectiveness of VR compared to conventional therapy in cerebral infarction is crucial	Randomized Clinical Trial	<ol style="list-style-type: none"> <li>1. First-time stroke occurrence</li> <li>2. Between one and twelve months post-stroke onset</li> <li>3. Extremity function with Brunnstrom Classification III</li> <li>4. Age between 35 and 70 years</li> <li>5. Able to sit independently without assistance</li> </ol>		Intervention and conventional groups = 60 minutes of exercise per day for 3 weeks, with five sessions each week	VR therapy is not superior to conventional therapy
(Xie Haoyu, et al), 2021. <sup>12</sup>	Understanding the effectiveness of VR compared to conventional therapy in cerebral infarction is crucial	Randomized Clinical Trial	<ol style="list-style-type: none"> <li>1. Diagnosed with a first episode of ischemic stroke</li> <li>2. Male or female</li> <li>3. Age 40-60 years</li> <li>4. Unilateral extremity involvement with a minimum score of 2 on the Medical Research Council (MRC) scale</li> </ol>		Intervention and conventional groups = exercise for 60 minutes per day, 4 times a week, for 6 weeks	Statistics show improvement in VR patients compared to conventional therapy
(Anwar Naveed, et al), 2021. <sup>15</sup>	Understanding the effects of VR training compared to conventional therapy on extremity function	Randomized Clinical Trial	<ol style="list-style-type: none"> <li>1. Diagnosed with a first episode of ischemic stroke</li> <li>2. Male or female</li> <li>3. Age 40-60 years</li> <li>4. Unilateral extremity involvement with a minimum score of 2 on the Medical Research Council (MRC) scale</li> </ol>		Intervention and conventional groups = exercise for 60 minutes per day, 4 times a week, for 6 weeks	Statistics show improvement in VR patients compared to conventional therapy
(Bai Yu, et al), 2022. <sup>16</sup>	Understanding the effects of Kinect2scratch game training compared to conventional exercise for stroke patients	Randomized Clinical Trial	<ol style="list-style-type: none"> <li>1. Diagnosed with a first episode of ischemic stroke</li> <li>2. Male or female</li> <li>3. Age 40-60 years</li> <li>4. Unilateral extremity involvement with a minimum score of 2 on the Medical Research Council (MRC) scale</li> </ol>		Intervention and conventional groups = exercises for 60 minutes per day, 5 times a week, for 10 weeks	Statistics show improvement in VR patients compared to conventional therapy

Author, Year	Aims	Study Design	Inclusion	Setting	Finding
(Hung Jen-Weng, et al), 2019. <sup>6</sup>	Understanding the effects of VR use compared to conventional therapy on extremity function	Randomized controlled single-blinded trial	<ol style="list-style-type: none"> <li>Stroke diagnosis based on clinical evaluation and imaging more than 6 months before the trial</li> <li>MMSE score greater than 20</li> <li>Age over 18 years</li> </ol>	Intervention and conventional groups = exercises for 30 minutes per day, 2 times a week, for 12 weeks	VR therapy is not superior to conventional therapy
(Gueye Tereza, et al), 2021. <sup>5</sup>	Understanding the effect of VR on upper extremity function post-stroke	Randomized Clinical Trial	<ol style="list-style-type: none"> <li>First-time stroke</li> <li>Ability to cooperate</li> <li>Upper extremity functional deficit post-stroke</li> </ol>	Intervention and conventional groups = exercises for 60 minutes per day	Statistics show improvement in VR patients compared to conventional therapy
Ogun Muhammed, et al), 2021. <sup>17</sup>	Understanding the impact of VR on extremity function in stroke patients	Randomized, controlled, double-masked study	<ol style="list-style-type: none"> <li>Mini-Mental State Examination (MMSE) score <math>\geq 25</math></li> <li>Stroke onset between 6 and 24 months</li> <li>Modified Ashworth Scale score <math>&lt; 3</math></li> </ol> Extremity strength with Brunnstrom score $\geq 4$	Intervention and control groups = exercises for 60 minutes per day, 3 times a week, for 6 weeks	Statistics show improvement in VR patients compared to conventional therapy
(Park JH, et al), 2016. <sup>3</sup>	Comparing VR therapy with conventional therapy for stroke recovery in patients	randomized, single-masked study	<ol style="list-style-type: none"> <li>Clinical diagnosis of stroke confirmed by CT scan or MRI</li> <li>Hemiparesis of the extremities (Fugl-Meyer Assessment upper extremity score <math>&lt; 50</math>)</li> <li>Manual Muscle Test (MMT) score greater than 2/5 in the shoulder</li> <li>Ability to follow instructions involving more than one step</li> </ol>	Intervention and control groups = exercises for 30 minutes per day, 5 times a week, for 4 weeks	VR therapy is not superior to conventional therapy
(Kuo Fen-Ling, et al), 2023. <sup>18</sup>	Understanding the effectiveness of using VR exercises for post-stroke patients is essential	Single-Blind Randomized Design	<ol style="list-style-type: none"> <li>First-time stroke with hemiplegia</li> <li>Chronic condition lasting <math>&gt; 6</math> months</li> <li>Ability to understand instructions</li> <li>Brunnstrom score <math>\geq IV</math></li> </ol>	Intervention and control groups = twice a week, 60-minute sessions for 9 weeks	Statistics show improvement in VR patients compared to conventional therapy

Author, Year	Aims	Study Design	Inclusion	Methods	Setting	Finding
(Huang Chien-Yu, et al), 2022. <sup>19</sup>	Understanding the effectiveness of VR training on motor function in stroke patients.	Assessor-blinded Randomized Controlled Trial	<ol style="list-style-type: none"> <li>1. Age between 20 and 75 years</li> <li>2. Stroke onset &gt; 3 months</li> <li>3. Brunstrom score &gt; 3</li> <li>4. Stroke diagnosis confirmed by CT/MRI</li> <li>5. MMSE score &gt; 18</li> <li>6. No other neurological disorders as comorbid conditions</li> </ol>		Intervention and control groups = 60 minutes per day, 3 times a week, for 4 weeks	Statistics show improvement in VR patients compared to conventional therapy
(Park Mina et al.), 2019. <sup>9</sup>	Understanding the effectiveness of VR-based motion exercises post-stroke.	Single-Blind Randomized Controlled Trial	<ol style="list-style-type: none"> <li>1. First stroke diagnosis resulting in unilateral extremity deficit at least 3 months prior</li> <li>2. Ability to understand instructions, demonstrated by a score <math>\geq 25</math> on the MMSE</li> <li>3. MRC scale score of 2 or 3</li> </ol>		Intervention and control groups = 30 minutes daily, 5 times a week, for 4 weeks	Statistics show improvement in VR patients compared to conventional therapy
(Wieczorek Michael), 2021. <sup>20</sup>	Understanding the effectiveness of post-stroke extremity rehabilitation with VR.	Randomized Clinical Trial	<ol style="list-style-type: none"> <li>1. Ischemic stroke</li> <li>2. Hand function limitation</li> <li>3. Minimum MMSE score of 25 points</li> <li>4. Patient is stable</li> </ol>		Intervention and control groups = 30 minutes daily, 5 times a week, for 4 weeks	VR therapy is not superior to conventional therapy.
(Kiper Paweb, et al), 2014. <sup>21</sup>	Understanding the effectiveness of VR compared to conventional therapy for post-stroke extremity recovery.	Single-Blind Randomized Clinical Trial	<ol style="list-style-type: none"> <li>1. First-time stroke diagnosis occurring within the last year</li> <li>2. No prior treatment with VR</li> </ol>		Intervention and control groups = 2 hours per day, 5 times a week, for 4 weeks	Statistics show improvement in VR patients compared to conventional therapy
(Kiper Paweb, et al), 2011. <sup>22</sup>	Understanding the effectiveness of VR compared to conventional therapy.	Randomized Clinical Trial	<ol style="list-style-type: none"> <li>1. First-time stroke patient</li> <li>2. MMSE score &gt; 24 points</li> <li>3. No prior VR therapy</li> </ol>		Intervention and control groups = 2 hours per day, 5 times a week, for 4 weeks	Statistics show improvement in VR patients compared to conventional therapy
(Naveed Anwar, et al), 2022. <sup>23</sup>	Understanding the effectiveness of VR in improving motor strength in post-stroke patients.	Single Assessor-Blinded Randomized Clinical Trial	<ol style="list-style-type: none"> <li>1. Aged 40-60 years, male or female</li> <li>2. Involvement of extremities and first-time stroke episode</li> <li>3. Minimum score of 2 on the Medical Research Council Scale</li> <li>4. Stable patient, conscious, and able to follow the therapist's instructions</li> </ol>		Intervention and control groups = 60 minutes per day, 3 times a week, for 6 weeks	Statistics show improvement in VR patients compared to conventional therapy

**Table 2.** Sample Size

Authors, Year	Total	VR	Control
(Bian Minji, et al), 2022 (14)	44	22	22
(Xie Haoyu, et al), 2021 (12)	12	6	6
(Anwar Naveed, et al), 2021 (15)	68	34	34
(Bai Yu, et al), 2022 (16)	50	25	25
(Hung Jen-Weng, et al), 2019 (6)	33	17	16
(Gueye Tereza, et al), 2021 (5)	50	25	25
(Ogun Muhammed, et al), 2021 (17)	65	33	32
(Choi Jun, et al), 2014 (3)	20	10	10
(Kuo Fen-Ling, et al), 2023 (18)	37	19	18
(Huang Chien-Yu, et al), 2022 (19)	30	15	15
(Park Mina, et al), 2019 (9)	26	13	13
(Wieczorek Michael), 2021 (20)	28	15	13
(Kiper Paweb, et al), 2014 (21)	44	23	21
(Kiper Paweb, et al), 2011 (22)	80	40	40
(Naveed Anwar, et al), 2022 (23)	68	34	34



**Figure 3.** Comparing the effectiveness of VR and Conventional Therapy

## Discussion

In most of the included studies, VR-based therapy shows notable effectiveness in improving joint range of motion, motor recovery, and patient motivation. Specifically, 10 of 15 journals reported that VR therapy was superior to conventional therapy in motor recovery and rehabilitation outcomes, particularly when implemented with sufficient training duration and engaging VR environments (Figure 3).

Journals 5, 12, 14, 18, 21, and 22 demonstrated strong support for VR therapy, significantly improving treatment groups compared to control groups. The effectiveness was particularly pronounced in studies with larger sample sizes and longer training durations. However, Journals 3, 6, 14, and 20 reported no significant differences between VR and conventional therapy. These studies often featured shorter training durations or less interactive VR environments, which may have limited their potential to enhance patient motivation and outcomes (Table 2).

VR-based training can enhance neuroplasticity and motor learning by activating related brain regions, inducing cortical reorganization, and strengthening the neuronal systems involved in motor planning, learning, and execution.<sup>14,22</sup> Training with VR can induce cortical reorganization of neural pathways, crucial for motor recovery post-stroke.<sup>22</sup>

The findings of studies on the effectiveness of VR therapy compared to conventional therapy for limb rehabilitation in stroke patients show some evidence, indicating its benefits for motor recovery of limbs, improving balance, and motor function of limbs, which are crucial in post-stroke rehabilitation.<sup>23</sup> The study shows significant outcomes in improving joint range of motion for patients in the VR group, indicating that VR exercises can enhance fine hand movements, active range of motion, and balance.<sup>23</sup> Specifically, VR therapy combines additional spatial transformation, unlinked eye-hand movements, and entertaining environments, enhancing patient motivation and potentially yielding better rehabilitation outcomes than traditional therapy.<sup>23</sup>

VR enhances motivation and exercise engagement by reducing the perception of effort, supporting sustained training, and improving motor recovery outcomes.<sup>14</sup> VR exercises' interactive and entertaining nature can enrich training and boost motivation, which is crucial for motor control training.<sup>19</sup> Reinforced feedback in the virtual environment, comprising repetitive movements, can support the acquisition of new motor skills and enhance cortical changes, contributing to motor recovery.<sup>22</sup>

VR-based motor control training has shown significant improvements in upper limb function and active range of motion post-intervention, indicating its

effectiveness in motor recovery.<sup>19</sup> VR training has been associated with significantly reducing inflammatory markers (e.g., IL-6) and oxidative stress markers (e.g., HO-1 and 8-OHdG), which are beneficial for motor recovery post-stroke.<sup>19</sup>

The variation in research outcomes is due to differences in sample sizes and participant demographics, which can significantly affect study results (2). Smaller sample sizes may not capture the full range of benefits or limitations of VR therapy, leading to inconclusive results.<sup>12,15</sup>

The duration and frequency of VR therapy sessions vary across studies. Some studies with shorter or less frequent sessions may not show significant improvements compared to conventional therapy, while studies with more intensive VR therapy regimens may yield better outcomes.<sup>18,20</sup> Various studies employ different VR systems and protocols, which can lead to varying outcomes. For example, the effectiveness of VR therapy may depend on the specific technology used, as well as the type of exercises performed.<sup>15,18</sup>

The choice of outcome measures and assessment tools can influence the study's conclusions. Studies using comprehensive and sensitive measures and tools such as FMA-UL, BBS, and FMS-UE may detect subtle improvements in VR therapy, while others may not capture these nuances.<sup>3</sup> The initial condition and severity of patients' impairments can affect the effectiveness of VR therapy. Studies involving patients with severe impairments may show less improvement than those with mild to moderate impairments.<sup>3,16</sup>

The activities performed by the control group in various studies may vary, affecting the comparison outcomes. Suppose the control group receives highly effective conventional therapy. In that case, the relative benefits of VR therapy may appear less significant.<sup>3,15</sup> Differences in study designs, such as randomized controlled trials compared to observational studies and methodological rigor, can result in varied outcomes. Studies with strong designs and methodologies are more likely to demonstrate clear benefits of VR therapy.<sup>20,23</sup>

The level of engagement and motivation of participants can influence the effectiveness of VR therapy. Studies reporting higher levels of engagement and enjoyment in VR therapy sessions often show better outcomes than studies where participants find the therapy less engaging.<sup>3,24</sup> Taking these factors into account, we can understand why some studies report VR therapy as superior to conventional therapy while others do not.

VR is a relatively new form of exercise, posing challenges for patients unfamiliar with technology.<sup>14,24</sup> Exercises with VR may cause mild side effects such as

eye discomfort and sweating, which can be managed with appropriate breaks and monitoring. Trainers should ensure the safety of participants during motor recovery training.<sup>19,24</sup> The reported number of adverse events in VR-based rehabilitation studies is small, indicating that this is a safe method for motor recovery training.<sup>18,25</sup>

The potential benefits of virtual reality therapy for stroke rehabilitation are promising. However, it is essential to acknowledge the limitations of this research. One limitation is the small sample sizes of many studies, which may limit the generalizability of the findings. Another limitation is the lack of long-term follow-up in many studies, making it difficult to determine the lasting effects of virtual reality therapy for stroke patients. Furthermore, a lack of standardized protocols and interventions in virtual reality therapy studies makes comparing the findings across different studies challenging. These limitations highlight the need for larger, long-term studies with standardized protocols and comprehensive outcome measures to fully understand the potential benefits of virtual reality therapy for stroke rehabilitation.

## Conclusion

VR-based training demonstrates significant potential as an innovative approach to enhance motor recovery, joint range of motion, and patient motivation compared to conventional therapy. The findings from this review suggest that VR therapy can provide additional benefits when implemented with adequate training duration and engaging environments. VR-based training stimulates cortical reorganization and strengthens neural systems involved in motor planning, learning, and execution. Most studies indicate that VR therapy is more effective in enhancing motor recovery, balance, and limb function in stroke patients and increasing patient motivation and engagement in exercises than conventional training. However, the results of these studies vary depending on sample size, duration, and frequency of therapy, technology used, and assessment tools applied. More intensive studies using advanced technology tend to show better results. Other factors, such as patients' initial conditions, control group activities, study design, and level of patient engagement, also influence outcomes. Although some side effects, such as eye discomfort and sweating, are reported, the low number of adverse events indicates that VR therapy is a safe and effective method for motor rehabilitation.

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