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Meta-Analysis

Effects of Virtual Reality Therapy and Range of Motion Exercise on Range of Motion in Stroke Patients: Meta-Analysis

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ABSTRACT

Background: Stroke is a disease caused by interference with blood flow in the brain which is still a global problem today. Post-stroke care needs to be done to prevent worsening of the condition. One of the right interventions that can be done is virtual reality therapy and range of motion exercise. This study aims to examine, analyze and estimate changes in the range of motion of stroke patients with virtual reality therapy and range of motion exercise.
Subjects and Method: Meta-analysis was carried out according to the PRISMA flow chart and the PICO model (Population: stroke patients, Intervention: virtual reality therapy and range of motion exercise, Comparison: not performed virtual reality therapy and range of motion exercise Outcome: range of motion). The databases used are Google Scholar, PubMed, and Science Direct. The keywords used ("virtual reality" OR VR) AND (stroke OR CVD) AND ("range of motion exercise" OR ROM OR "motor exercise") AND (stroke OR CVD) AND "Randomized Control Trial". The inclusion criteria were full text articles with RCT studies published in 2012-2022, articles in English, and bivariate and multivariate analysis. Analysis was performed using ReVman 5.3.
Results: There were 20 articles with a randomized control trial design originating from Iran, Turkey, China, Egypt, Myanmar, South Korea, Spain, the Netherlands, Italy, Switzerland and Canada involving 799 people. A meta-analysis of 10 RCT studies concluded that virtual reality therapy increased the range of motion of stroke patients by 2.77 units (SMD= 2.77; 95% CI = 1.29 to 4.24; p<0.001) compared to no virtual reality therapy. In addition, the range of motion exercise intervention can also increase the stroke patient's range of motion by 0.84 units (SMD= 0.84; 95% CI= 0.35 to 1.33; p<0.001) compared to not being given range of motion exercise.
Conclusion: Virtual Reality Therapy and Range of Motion Exercise can increase the range of motion of stroke patients.

Keywords: virtual reality therapy, range of motion exercise, stroke, range of motion, meta-analisis.

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BACKGROUND

Stroke that occurs due to disturbances in blood flow in the brain is still a global problem today. Stroke is the second cause of disability and death in the world with an additional 12.2 million cases each year (Feigin et al., 20-22). According to WHO, in 2019 there were 101 million stroke patients, of which 62.4% had ischemic strokes and 37.6% had hemorrhagic strokes (Feigin et al., 2021). Whereas in Indonesia stroke cases according to RISKESDAS data for 2018 reached 10.9 cases per 1,000 population (RI Ministry of Health, 2018). In addition, deaths caused by stroke in Indonesia have currently reached 357,183 cases. This causes Indonesia to be ranked first in the number of deaths due to stroke in Southeast Asia and ranked eleventh in the world (Venketasubramanian et al., 2022). Post-stroke treatment needs to be done to prevent death and permanent nervous system dysfunction which causes disruption in carrying out daily activities and functions, social participation and reduces the patient's quality of life (Yumei et al., 2021).

Limitations in carrying out activities are the main problem of stroke patients. In someone with a post-stroke attack, 38.0% will experience disability caused by various things, and 21.3% will experience disability that comes from the sequelae of a stroke attack. Disability in stroke patients is known to cause changes in the musculoskeletal, sensory systems, and various other medical problems (Yeon et al., 2022). This is an indication that limitations in carrying out activities due to disabilities in the Musculoskeletal system and sensory system of stroke patients need to be treated accordingly so that it does not get worse.

The limitations experienced by stroke patients are also at risk of causing a worsening of the condition after 5-6 years after a stroke, even 3 years in someone who has had a stroke at the age of over 50 years (Juli et al., 2022). Psychological problems, especially stroke depression, are the main cause of the worsening of the condition. Stroke depression occurs due to sudden changes in conditions accompanied by the inability to carry out daily activities, experiences, pessimism, and feelings of anxiety that will affect the patient's nervous function (Yumei et al., 2021). Visual stimulation plays an important role in increasing neurological stimulation and increasing the range of motion of post stroke patients. Interventions given through visual stimulation for 20 minutes can increase muscle flexibility and reduce muscle spasticity in 70.1% of stroke patients (Aoyama et al., 2021). One of the visual stimulation that is currently mostly done using virtual reality technology. Virtual reality therapy is able to improve functional abilities in the form of upper extremity mobility, balance, gait, as well as cognitive and psycho-emotional aspects of stroke patients (Sevcenko et al., 2022).

Based on experimental studies conducted on stroke patients, virtual reality therapy combined with range of motion exercises can improve motor function significantly. Recovery of the neurological system occurs through a visual increase in exercise motivation obtained from virtual reality which is able to stimulate the brain, especially the cortical and subcortical parts to control the position and orientation of body movements (Young et al., 2021). Recovery activities that occur in the sensori-motor network occur due to routine exercise activities.

Post-stroke recovery requires stimulation to increase motivation in carrying out routine exercise programs. The purpose of this study was to examine, analyze and estimate changes in the range of motion of stroke patients with virtual reality therapy and range of motion exercise.

SUBJECTS AND METHOD

1. Study Design

The meta-analysis was performed with the PRISMA flowchart using the Google Scholar, PubMed, and Science Direct databases. Keywords (“virtual reality” OR VR) AND (stroke OR CVD) AND (“range of motion exercise” OR ROM OR “motor exercise”) AND (stroke OR CVD) AND “Randomized Control Trial”.

There were 19 research articles with a randomized control trial study design published in 2012-2022 that met the inclusion criteria. Analysis was performed using Revman 5.3.

2. Steps of Meta-Analysis

Meta analysis was carried out in 5 steps as follows:

1) Formulate research questions in PICO format (Population, Intervention, Comparison, Outcome).
2) Look for primary study articles from various electronic and non-electronic databases such as PubMed, ScienceDirect, Google Scholar, Scopus.
3) Perform screening to determine inclusion and exclusion criteria and carry out a critical assessment
4) Extract primary study data and synthesize effect estimates using the RevMan 5.3 application.
5) Interpret the results and draw conclusions.

3. Inclusion Criteria

Full-text paper article using a randomized control trial study. The size of the relationship used is the mean difference and standardized mean difference. The analysis uses the results of primary research from bivariate and multivariate analysis. The research subjects were stroke patients. Interventions carried out by virtual reality therapy and range of motion exercise. The article is in English. Outcome is the range of motion of stroke patients.

4. Exclusion Criteria

The articles are published before 2012 and after 2022

5. Operational Definition of Variables

Article search was carried out according to the criteria according to the PICO model. There was a PICO in this study, the population was stroke patients, with virtual reality therapy interventions and range of motion exercise, and range of motion as outcomes.

Stroke Patient Range of Motion is the maximum amount of joint movement in one of the three body parts: sagittal, frontal, and transverse that can be performed by a stroke patient with partial or total paralysis.

Virtual Reality Therapy is a visual therapy using VR glasses that are used to stimulate motor nerve stimulation of stroke patients who experience partial or total parlaysis.

Range of Motion Exercise is a range of motion exercise in stroke patients with the aim of increasing stroke patient mobilization

6. Study Instruments

Quality assessment in this study used a list of critical ratings for randomized control trial studies published by the Joanna Briggs Institute.

7. Data Analysis

The articles in this study were collected according to the PRISMA flowchart and analyzed using the Review Manager 5.3 application. The analysis was carried out by calculating the effect size and heterogeneity consistency value (I^2) of the selected research results. The results of data analysis are in the form of forest plots and funnel plots.

RESULTS

The results of the article search were obtained from the meta-analysis process using the PRISMA flowchart, which can be seen in Figure 1. The total number of articles obtained was 20 articles. The distribution of the articles comes from 10 studies with virtual reality therapy interventions and 9 articles with range of motion exercise interventions. This research article was conducted in various countries in Asia, Europe, America, and Australia.

Primary research related to virtual reality therapy on the range of motion of stroke patients consists of 10 articles originating from three continents, Asian (1 study from Iran, 1 from Turkey, 1 from

China, 1 from Egypt and 1 from South Korea), European (1 study from Spain, 1 from the Netherlands, 1 from Italy, 1 from Switzerland), and the Americas (1 study from Canada).

Primary research related to range of motion exercise on the range of motion of stroke patients consists of 10 articles originating from four continents, namely the Asian Continent (2 studies from Iran, 1 study from Egypt, and 1 study from China and 1 from Myanmar). The European continent (1 study from France), the Americas (1 study from the United States, 1 study from Alabama, and 1 study from Brazil) and the Australian continent (1 study from Queensland) in Figure 2 with details in Table 1.

Assessment of study quality was carried out quantitatively and qualitatively, this study used a critical appraisal checklist for a randomized control trial (Moola et al., 2017). Critical appraisal which consists of 13 questions. Every "yes, no, not appropriate" answer. The assessment of the quality of the studies is shown in Table 2. Based on the answers from the quality assessment, the total score of the answers ranged from 12 to 13 scores, this indicates that the quality of the articles is feasible for meta-analysis.

The study description in Table 3 shows the range of motion of stroke patients with virtual reality therapy interventions. There were 10 articles with a total sample of 229 research subjects in the intervention group and 218 in the control group.

The description of the study in Table 4 shows the range of motion of stroke patients given the range of motion exercise intervention. There were 9 articles with a total sample of 149 subjects in the intervention group and 135 subjects in the control group.

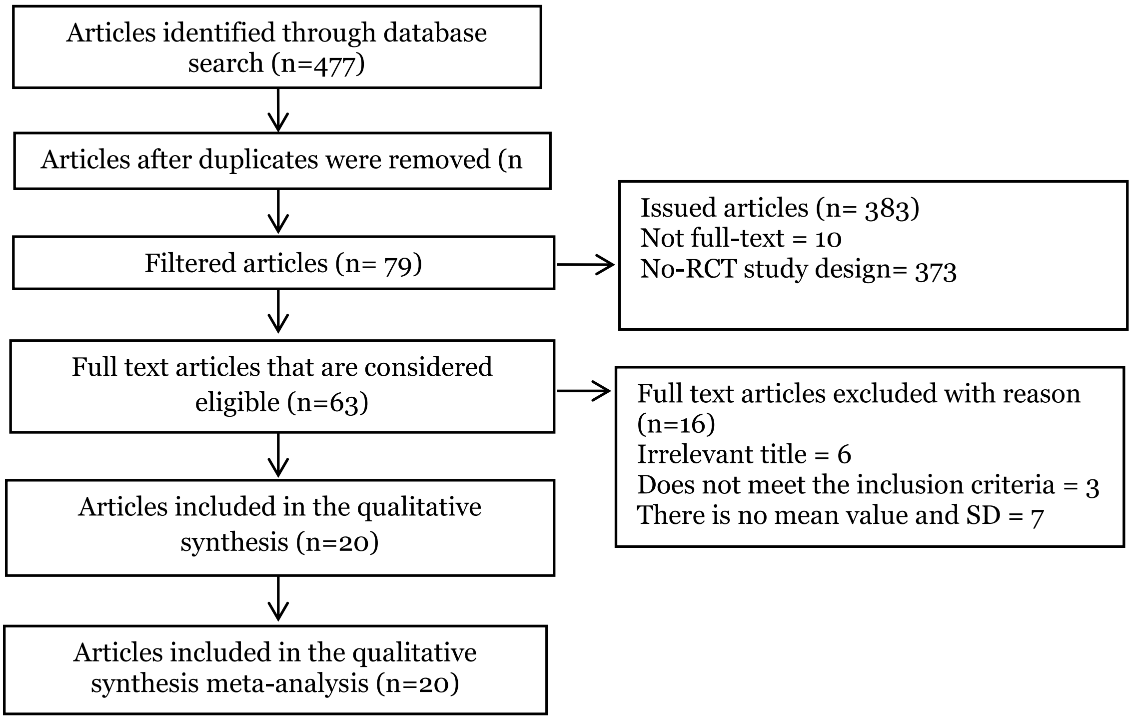

Figure 1. Results of Prisma Flow Diagrams

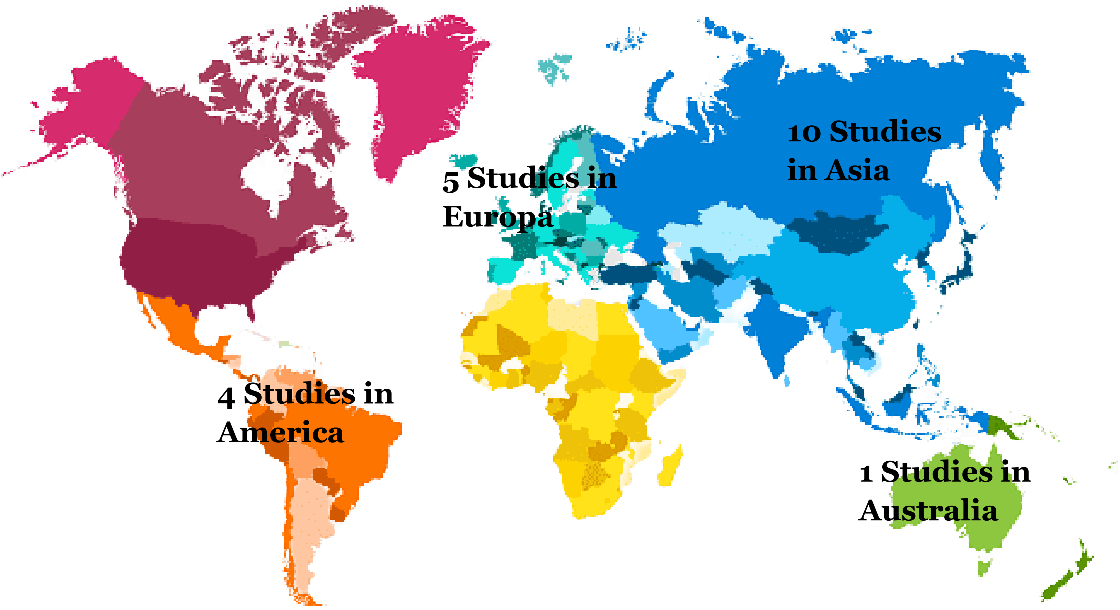

Figure 2. Resarch Distribution Map

Table 1. Assessment of the quality of virtual reality therapy articles on the range of motion of stroke patients using a randomized control trial study design

Primary Study	Criteria													
	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
Afsahi 2022	2	2	2	2	2	2	2	2	2	2	2	2	2	26
Afsar 2018	2	2	2	2	1	1	2	0	2	2	2	2	2	22
Chen 2022	2	2	2	2	1	1	2	2	2	2	2	2	2	24
Hegazy 2022	2	2	2	2	1	1	2	0	2	2	2	2	2	22
Norouzi-Gheidari 2019	2	2	2	2	2	1	2	2	2	2	2	2	2	25
Park 2019	2	2	2	2	1	1	2	2	2	2	2	2	2	24
Rodríguez Hernández 2021	2	2	2	2	2	1	2	2	2	2	2	2	2	25
Rooij 2021	2	2	2	2	2	2	2	2	2	2	2	2	2	26
Salvalaggio 2022	2	2	2	2	2	2	2	2	2	2	2	2	2	26
Schuster-Amft 2018	2	2	2	2	0	0	2	1	2	2	2	2	2	21

Answer score description:

0 = No

1 = Can't tell

2 = Yes

Table 2. Assessment of the quality of range of motion exercise articles on the range of motion of stroke patients using a randomized control trial study design

Primary Study	Criteria													
	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
Coroian 2017	2	1	2	1	2	2	2	2	2	2	2	2	2	24
Dehno 2021	2	2	2	1	2	2	2	1	2	2	2	2	2	24
Ellis 2018	2	2	2	2	1	2	2	2	2	2	2	2	2	25
Graef 2016	2	2	2	1	1	2	2	2	2	2	2	2	2	24
Horsley 2019	2	2	2	1	1	2	2	2	2	2	2	2	2	24
Hosseini et al2019	2	1	2	1	1	1	2	2	2	2	2	2	2	22
Jiang et al 2021	2	2	2	2	2	2	2	2	2	2	2	2	2	26
Khallaf et al 2017	2	2	2	2	2	1	2	2	2	2	2	2	2	25
Uswatte et al 2018	2	1	2	1	1	1	2	2	2	2	2	2	2	22
Thant et al 2019	2	1	2	1	1	1	2	2	2	2	2	2	2	22

Description of the question criteria:

1 = Was true randomization used for assigning participants to treatment groups?

2 = Are allocations to treatment groups hidden?

3 = Were the treatment groups similar at first?

4 = Were the participants blind to the treatment assignment?

5 = Are those providing care blind to the duty of medication?

6 = Were the outcome assessors blind to the treatment assignment

7 = Is the treatment group treat the same apart from interest intervention?

8 = Was follow-up complete and if not, were differences between groups in follow-up adequately explained and analyzed?

9 = Were participants analyzed in the group to which they were randomized?

10 = Were outcomes measured in the same way for the treatment groups?

11 = Are the results measured in a reliable way?

12 = Was proper statistical analysis used? Standard RCTs (randomized individuals, parallel groups)

13 = were taken into account in trial conduct and analysis?

Answer score description:

0 = No

1 = Can’t tell

2 = Yes

Table 3. Description of RCT virtual reality therapy studies on the range of motion of stroke patients (n=448)

Author (Year)	Country	Sample	P	I	C	O
Afsahi et al. (2022)	Iran	40	Ischemic stroke patient	A combination of VR and conventional therapies	conventional therapy	range of motion
Afsar et al. (2018)	Turkey	35	Stroke patient	VR practice with Xbox console	Conventional rehabilitation therapy	range of motion
Chen et al. (2022)	China	36	First attack post-stroke patient	Non-immersive VR therapy	Conventional rehabilitation therapy	Upper limb ROM
Hegazy et al. (2022)	Egypt	20	Subacute stroke patient	Practice with VR	conventional therapy	Upper limb ROM
Norouzi-Gheidari et al (2019)	Canada	18	Stroke patient	Virtual Reality Therapy	conventional therapy	Upper limb ROM
Park et al. (2019)	South Korea	26	Stroke patient	VR Therapy with Smart Board	conventional therapy	ROM and muscle strength
(Lenja et al., 2016) Rodríguez-Hernández et al. (2021)	Spanish	43	Stroke diagnosed patient	Virtual Reality Therapy	conventional therapy	Hand function and ROM
Rooij et al. (2021)	Dutch	52	Post-stroke patient	Virtual reality therapy	Non-VR therapy	ROM
Salvalaggio et al. (2022)	Italy	124	Hemiparetic stroke patient	Virtual reality therapy	conventional therapy	ROM
Schuster-Amft et al. (2018)	Switzerland	54	Stroke patient	Virtual reality therapy- based training	conventional therapy	ROM

Tabel 3. Effect estimates (Mean SD) of all primary studies performed in the meta-analysis (N=448)

Authors (year)	virtual reality therapy		not performed virtual reality therapy	
	Mean	SD	Mean	SD
Afsahi et al., (2022)	49.7	7.20	10.20	4.20
Afsar et al., (2018)	18.74	4.72	14.56	6.74
Chen et al., (2022)	4.72	0.87	3.89	1.15
Hegazy et al., (2022)	12.60	2.80	9.30	1.97
Norouzi-Gheidari et al., (2019)	3.00	4.10	0.40	1.90
Park et al., (2019)	67.10	44.3	53.9	56.5
Rodriguez-Hernandez et al.,2021)	18.50	0.90	14.2	0.80
Rooij et al., (2021)	21.06	3.18	17.7	0.69
Salvalaggio et al., (2022)	10.00	1.00	1.00	0.10
Schuster-Amft et al., (2018)	4.30	0.90	1.40	1.40

1. Forest Plot

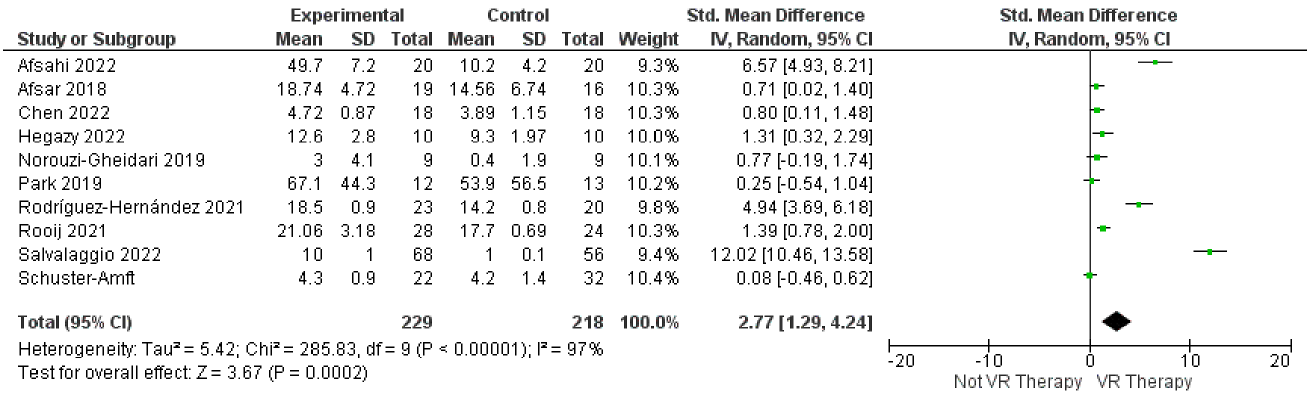

Figure 3. Forest plot of virtual reality therapy on the range of motion of stroke patients

Interpretation of the results of the meta-analysis process can be seen through the Forest plot. The forest plot in Figure 3 shows that there is an effect of virtual reality therapy on the range of motion of stroke patients and this effect is statistically significant. Stroke patients who received virtual reality therapy experienced a range of motion 2.77 units wider than those who did not receive virtual reality therapy (SMD= 2.77; 95% CI = 1.29 to 4.24; p<0.001). The forest plot also showed heterogeneity of effect estimates between studies which varied greatly (I^2 = 97%; p<0.001). Thus the calculation of effect estimation is carried out using the Random Effect Model (REM) approach.

2. Funnel Plot

The funnel plot in Figure 4 shows that the distribution of effect estimates is more to the left of the average vertical line than to the right. Thus showing publication bias, because the distribution of effects is more to the left of the average vertical line as opposed to the location of the estimated mean which is located to the right of the vertical line of the null hypothesis in the forest plot, the publication bias tends to reduce the effects of virtual reality therapy which actually (underestimated).

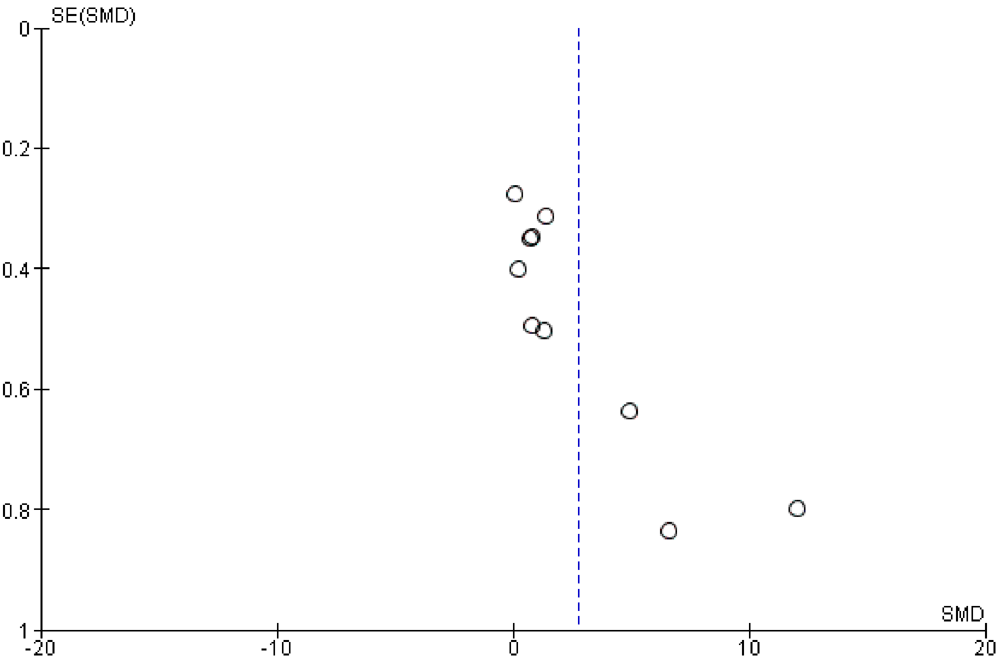

Figure 4. Funnel plot of virtual reality therapy on the range of motion of stroke patients

Table 4. Description of the RCT study of range of motion exercise on the range of motion of stroke patients (n=351)

Author (Year)	Country	Sample	P	I	C	O
Coroian et al. (2017)	France	20	Stroke patient with hemiplegia	Active ROM exercises	Passive ROM exercises	ROM
Dehno et al. (2021)	Australia	26	Subacute stroke patient	ROM and muscle strength exercises	Conventional ROM exercises	ROM and muscle strength
Ellis et al. (2018)	USA	32	Stroke patient with hemiparesis	ROM exercises with resistance	Conventional ROM exercises	Point of maximum ROM
Graef et al. (2016)	Brazil	27	Stroke patient with hemiparesis	ROM exercise program	Unprogrammed ROM exercises	ROM
Horsley et al. (2019)	Australia	50	Stroke patient	Intense exercise on the upper extremities	Exercise routine on the upper extremities	Hand ROM
Hosseini et al. (2019)	Iran	52	Ischemic stroke patient	Passive ROM exercises	No ROM exercises	ROM
Jiang et al (2021)	China	60	Chronic stroke patient with hemiplegia	Physical movement exercises	No movement exercises	range of motion
Khallaf et al. (2017)	Egypt	24	Stroke patient with hemiparesis	Scheduled ROM exercises	Passive ROM exercises	Upper limb ROM
Uswatte et al. (2018)	USA	32	Stroke patient with hemiparesis	ROM induction exercise therapy	Conventional ROM exercise therapy	ROM
Thant et al., (2019)	Myanmar	28	Post-stroke patient	Task-oriented ROM therapy	Conventional ROM therapy	ROM

Tabel 3. Effect estimates (Mean SD) of all primary studies performed in the meta-analysis (N=351)

Authors (year)	Range of motion exercise		Without rom exercise	
	Mean	SD	Mean	SD
Coroian et al., (2017)	4.00	1.30	3.10	3.10
Dehno et al., (2021)	11.9	5.54	7.46	4.92
Ellis et al., (2018)	2.30	2.90	2.10	3.10
Graef et al., (2016)	8.80	2.50	7.50	0.40
Horsley et al., (2019)	0.80	7.00	1.00	1.00
Hosseini et al., (2019)	1.03	0.68	0.62	0.62
Jiang et al., (2021)	1.67	1.28	1.50	0.10
Khallaf et al., (2017)	4.83	0.85	1.50	0.47
Thant et al., (2019)	12.65	4.46	6.57	4.50
Uswatte et al., (2018)	2.30	2.65	1.80	2.09

1. Forest Plot

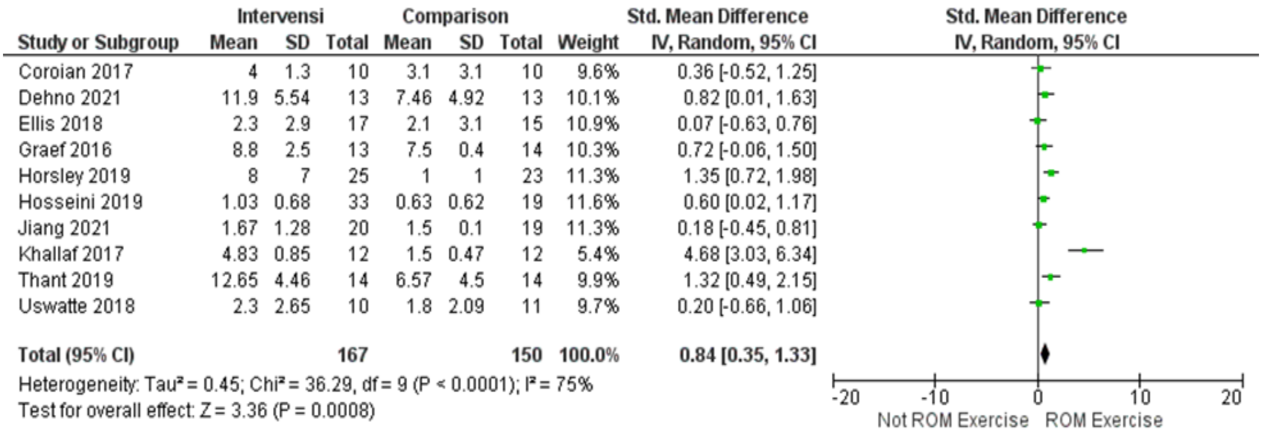

Figure 3. Forest plot of virtual reality therapy on the range of motion of stroke patients

The distribution of effects is more to the left of the average vertical line as opposed to the location of the estimated mean which is located to the right of the vertical line of the null hypothesis in the forest plot, the publication bias tends to reduce the effects of virtual reality therapy which actually (underestimated).

2. Funnel Plot

The funnel plot in Figure 6. shows that the distribution of effect estimates lies more to the left than to the right of the average vertical line, thus indicating publication bias. Because the distribution of effects is more to the left of the mean vertical line as opposed to the location of the estimated effects which are located to the right of the vertical line of the null hypothesis in the forest plot, the publication bias tends to underestimate the effect of range of motion exercise.

DISCUSSION

Virtual reality therapy is a motion rehabilitation therapy for stroke patients with a 3D (3-dimensional) environment through a device in the form of VR glasses and is controlled by software and can be displayed on an electronic device screen (Yeung et al., 2021). VR therapy is able to provide a virtual environment similar to the real world so it is safer to use because the risk of injury is smaller compared to conventional rehabilitation therapy (Aida et al., 2018). The results of this study indicate that virtual reality therapy can increase the range of motion of stroke patients, by 2.77 units wider than not being given virtual reality therapy (SMD= 2.77; 95% CI = 1.29 to 4.24; p<0.001).

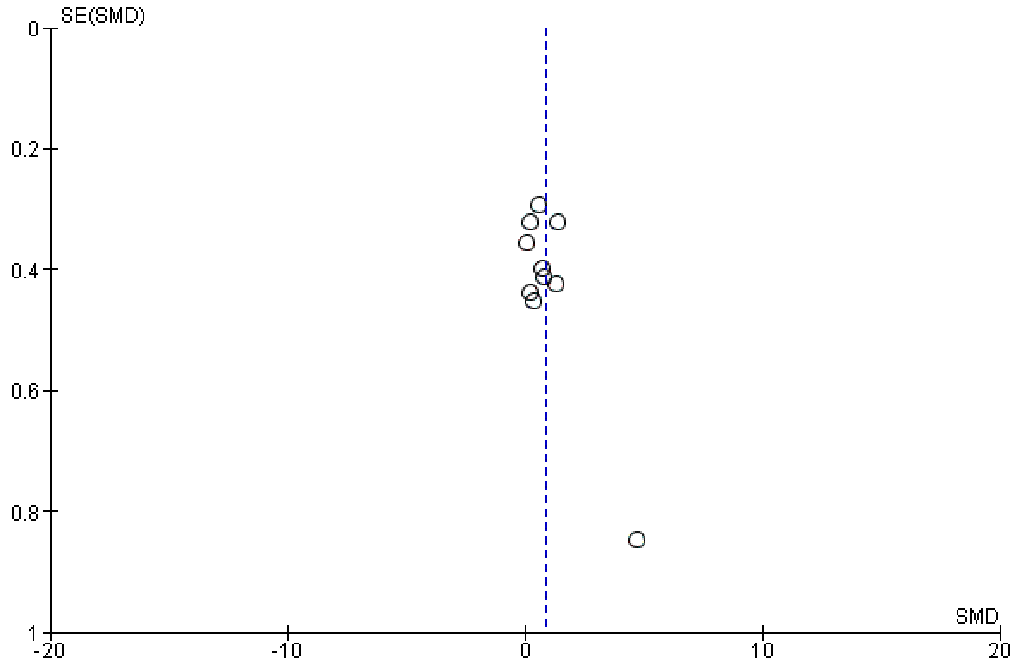

Figure 5. Forest plot of range of motion exercise on range of motion of stroke patient

Virtual Reality Therapy (VRT) is a useful rehabilitation intervention tool for the functional recovery of stroke patients (Bui et al., 2021). VR therapy, specifically designed for upper limb rehabilitation, can improve their hand dexterity, arm function, and independence in carrying out their daily activities after 4 weeks of treatment (Schuster-Amft et al., 2018). In addition, research conducted by (Hung et al., 2019) shows that VR-based exercises combined with conventional therapy can show different results when compared to conventional therapy alone with the same amount of therapy and type of therapy.

VR therapy works by increasing motivation through adjustments to environmental conditions that increase focus during exercise. According to research (Afsahi et al., 2019) this motivation arises because there is a movement mechanism in the upper extremities when VR therapy is carried out which is able to increase brain reorganization. This will provide visual and auditory biofeedback as well as increased motivation and attention from the patient. Movements performed during repeated exercises in this environment can improve motor performance and induce neural plasticity in brain areas that regulate motor planning (Calabrò et al., 2017).

Virtual reality therapy which provides various types of bilateral and repetitive visualization of movement exercises also provides positive effects of bilateral symmetrical and asymmetrical activities of upper extremity movements using virtual reality therapy which helps patients become interactive, highly responsive in carrying out routine functional tasks from exercise programs given and task-oriented (Hegazy et al., 2022).

The results of this study are in line with research (Salvalaggio et al., 2022) in stroke patients who were given virtual reality therapy, they experienced a change in their range of motion by 10 units (mean= 10; SD =1). This shows that the feedback received in VR therapy provides a significantly better motor training experience than in the real environment or in unsupervised conditions significantly (Salvalaggio et al., 2022).

The research conducted (Chen et al., 2022) also stated the same thing, where there was an increase in the range of motion of 4.72 units (mean= 4.72; SD= 0.87) in stroke patients who received virtual reality therapy. Movement exercises combined with VR have higher results than conventional therapy only due to the repetition of routine exercises. This study adopted the repetition time of virtual reality therapy exercises in both groups which is a potential reason for the difference in results (Chen et al., 2022). Increased focus during exercise due to support from the environment can also increase adherence to repeated exercises and patient emotional stability (Bevilacqua et al., 2019).

The results of this study are also in line with those carried out by (Afsahi et al., 2019) that there was a range of motion in the elbow of 49.7 units (mean= 49.7; SD= 7.2) in the group that received virtual reality therapy. Research (Afsar et al., 2018) also stated that virtual reality therapy was able to increase the range of motion by 18.7 units (mean= 18.7; SD = 7.7) in the treatment group.

As a complementary therapy, virtual reality therapy also needs to be combined with range of motion exercises as functional motion training activities with or without assistance to determine basic range of motion, assess injuries to the musculoskeletal system and determine appropriate variations of exercise movements (Abu El Kasem et al. , 2020). ROM (range of motion) exercises can increase muscle strength, increase muscle tone, increase joint mobility, increase muscle tolerance for activity, and reduce the risk of loss of bone mass (Srinayanti et al., 2021).

The results of this study showed that range of motion exercise was able to increase the range of motion of stroke patients by 0.84 units wider than not doing range of motion exercise (SMD= 0.84; 95% CI= 0.35 to 1.33; $p<0.001$).

Range of motion exercise is an exercise performed to maximize joint angles and muscle strength (Schoenfeld et al., 2020). In addition, the damage that occurs to the cerebral cortex due to stroke which causes disturbances in motor function is a potential factor that requires improvement with the mobilization training method (Hosseini et al., 2019).

ROM exercises that are carried out regularly also contribute to increasing activities of daily life. Decreased active range of motion due to stroke which causes weakness and changes in muscle structure that directly regulate movement causes a decrease in the ability to regulate stretch reflex thresholds and musle coordination which results in limitation of range of motion and affects postural stability (Graef et al., 2016).

Decreased reflexes and muscle strength that is not treated will cause contractures. In addition to the repetition of exercises needed to prevent or reduce the occurrence of contractures, the duration or intensity of the exercise also has a contribution in preventing this. Therapists also play a major role in training given that there are different levels of experience, skills and knowledge, and may have different opinions in determining which stroke patients need high-intensity exercise (Horsley et al., 2019).

The results of this study are in line with the results presented by (Khallaf et al., 2017) which stated that exercise increases the range of motion in stroke patients. Furthermore, research (Uswatte et al., 2018) also states that range of motion exercises performed at optimal intensity can increase the range of motion in stroke patients by 2.3 units.

Another study stated the same thing (Dehno et al., 2021) which stated that exercise was able to increase the range of motion and muscle strength by 0.3 times (mean= 11.92; SD = 5.54). Research (Ellis et al., 2018) states that exercises performed with weights can increase muscle strength and range of motion by 2.94 units (mean= 2.94; SD= 3.09).

AUTHOR CONTRIBUTION

Septyan Dwi Nugroho as a researcher who selects topics, searches for and collects research data. Didik Gunawan Tamtomo and Hanung Prasetya analyzed the data and reviewed research documents.

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CONFLICT OF INTEREST

There is no conflict of interest in this study.

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