COMSERVA: Jurnal Penelitian dan Pengabdian Masyarakat
Volume 3 No. 10 Februari 2024 (4336-4345)
e-ISSN: 2798-5210
p-ISSN: 2798-5652

The Effectiveness of Mirror Therapy on Stroke Patients: Literature Review

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DOI: 10.59141/comserva.v3i10.1225

ABSTRACT

Stroke is a disease that attacks the nervous system due to loss of blood supply to the brain and causes interference in carrying out daily activities with a prevalence of 10.9% in Indonesia. Stroke on average affects people aged 56 years. Mirror therapy is a therapeutic exercise that involves moving the body while observing the unaffected part to provide visual stimulation to the brain. The approach used in this study is a literature review or Literature Review. This study used a literature review approach, using a PICO search in various databases including Pubmed, Google Scholar, and Science Direct. 5 journals met the criteria and showed the results that Mirror Therapy performed once a day for 15-50 minutes lasting for 2 months with a p-value <0.005 showed a significant impact in improving muscle and motor function of stroke patients. It can be concluded that mirror therapy is effective in strengthening muscles and can facilitate the recovery of motor function in stroke patients.

Keywords: *Stroke, Mirror Therapy, Muscle Strength*

INTRODUCTION

Stroke or cerebrovascular disease is a condition in which nerve changes occur due to loss of blood supply to certain parts of the brain. Disruption of blood supply to the brain will cause difficulties in carrying out daily activities (Feske, 2021).

Stroke is one of the leading causes of death after the heart and lungs. The World Stroke Organization (WSO) reports that by 2020 an estimated 7.6 million people will die from stroke.

According to the American Heart Association in 2015, the incidence of stroke at each age varies, with men at 0.2% and women at 0.7% in the age group 40-59 years, compared to women is 5.2% and men around 6.1% in age 60-79 years. Data from the World Health Organization (WHO) shows stroke is ranked first in Indonesia as a cause of death with a rate of 131.8 cases per 100 thousand population in 2019. Stroke prevalence data in Indonesia based on Riskasdes in 2018 shows an increase between 2013 to 2018, 7.0% to 10.9%. In 2015, the prevalence of stroke in the Semarang city area was 1,146 (while the incidence of stroke in Mataram continues to increase from year to year, increasing to 228 in 2016 and 684 in 2017).

This non-communicable disease is also a disease that often causes disabilities such as paralysis of the limbs, speech disorders, thought processes, memory, and other disabilities due to brain dysfunction (Muttaqin, 2008) The effect of stroke is a form of motor disorder in the form of hemiplegia (weakness) or hemiparesis (paralysis) (Susanti &; Bistara, 2019). Hemiparesis contributes to the loss of normal postural reflex mechanisms, such as elbow control, control of head motion, balance, and body rotation for function.

Problems that often occur in stroke patients are muscle weakness in one part of the body and impaired motor function in the limbs. Therefore, treatment is needed as much as possible to improve muscle strength and motor function.

The barriers that can occur in stroke patients are complex and include motor dysfunction. This can create body balance problems due to hemiparesis. This will reduce the body's ability to support and balance the body when moving (Geiger et al., 2017).

Muscle strength is the ability of muscles to work that has the function of producing resistance. Strong muscles can keep surrounding joints and reduce the risk of injury due to physical exertion. Therefore, it is necessary to exercise to have muscle strength. Muscle strength is the ability to utilize opposite pressure as much as possible (Istianah et al., 2020)

One of the new treatments in the rehabilitation of stroke patients is mirror therapy. Mirror therapy is an image where the mirror is used to move the body by looking at the unaffected part to provide visual stimulation to the brain. This has the aim of creating a visual illusion of repairing parts of the body whose muscle strength is reduced. According to (Irawandi, 2018), the purpose of Mirror Therapy is to add muscle strength and mobility to stroke patients who experience weakness. This therapy aims to improve functional status, is easy to apply, and only requires a short exercise time without burdening the patient (Olivia et al., 2021).

Research by (Valentina et al., 2021) showed that after several days of applying mirror therapy, it was found that by using the MMT scale and range of motion on the use of a goniometer, there was an increase in muscle strength from a scale of 4444 to 5555. This study was designed to determine the effectiveness of mirror therapy in stroke patients.

METHOD

The approach used in this study is a literature review or Literature Review. According to (Ulhaq & Rahmayanti, 2020), the literature review is a systematic, explicit, and repeatable way to identify, evaluate, and integrate findings and ideas generated by researchers and practitioners. The research questions followed the PICO format: (P = Population) patients who had a Stroke, (I = Intervention) Mirror Therapy, (C = Comparison) no comparison, (O = Outcome) the effectiveness of mirror therapy in patients who had a Stroke. The research journal articles reviewed are limited by inclusion and exclusion criteria, with journal retrieval having a period for the last 10 years, namely 2013-2023. Articles will be reviewed if they meet the following inclusion criteria: (i) the subject of the study must be patients who have stroke or other conditions related to muscle strength, age range 20-85 years. Research articles will be rejected if they have the following exclusion criteria (i) research with systematic review methods, (ii) research journals under 2013.

For data synthesis, the authors summarized the article based on the research subject, age and sex of participants, the type of intervention given (both from frequency, duration, and tools to measure the effectiveness of the intervention), the effectiveness of the intervention, and the conclusion. This research instrument uses Standard Operating Procedures Mirror Therapy, MMT scale (Manual Muscle Test), Visual Scale (VIS), Fulg Major Assessment (FMA), Barthel Index (Istianah et al., 2020) (Kiran et al., 2022) (Ginting et al., 2022) (Hamzah et al., 2020).

RESULTS AND DISCUSSION

Standard Operating Procedure of Mirror Therapy: A common procedure of mirror therapy is that the patient sits facing a mirror parallel to the center line of the mirror parallel to himself, thus blocking the view of the affected body part, which is located behind the mirror. Looking in the mirror, the patient sees a reflection of the healthy limb instead of the affected limb. The patient moves the normal limb while looking at the mirror reflection superimposed over the disturbed limb (Sengkey & Pandeiroth, 2014).

Manual Muscle Test (MMT): This test is an assessment of muscle strength and consists of 5 scales, namely (i) Value 0: No contraction in the muscle; (ii) Value 1: Contraction, but minimal movement; (iii) Value 2: Can move but cannot resist gravity; (iv) Value 3: full ROM and capable of resisting gravity; (v) Value 4: Can move fully through gravity and minimal resistance; (vi) Value 5: Normal muscle strength.

Visual Scale (VIS): The Visual Scale allows the patient's ability to visualize motor movements through a mirror to be graded on a scale of 1 to 5 (Kusgiarti, 2017).

Fulg Major Assessment (FMA): FMA is an important measurement for assessing motor function in the shoulder, wrist, forearm, hand, and fingers post-stroke. The maximum index for the upper extremities is 66 which is divided into 36 for the upper arms and 30 for the hands and wrists. Each component can get a score of 0 to 2 so that 0, 1, and 2 respectively means no performance, partial performance, and complete performance (García et al., 2017).

Barthel Index (BI): The Barthel Index is used to assess activities of daily living in patients with musculoskeletal or neuromuscular conditions with multiple items of daily activity, a combined score ranging from 0 to 100. A score of 100 represents total independence.

Mirror Therapy: Mirror therapy is a therapeutic intervention used to focus attention on the affected part of the body.

Mirror therapy includes several movements such as abduction-adduction, basic movement, elbow flexion-extension, and internal and external rotation of the shoulder (Afifah, 2023). Mirror therapy in the lower extremities includes several movements, namely dorsiflexion and plantarflexion in the ankle, abductions in the knee, and flexions in the knee.

Mirror Movement Therapy in the Upper Extremities:

Figure 1. Elbow Extension (Bieniok et al, *Spiegeltherapic in der Neurorehabilitation in the* Effect of *Mirror Therapy* on Extremity Muscle Strength in Stroke Patients, 2022).

Figure 2. Elbow Flexion (Bieniok et al, *Spiegeltherapic in der Neurorehabilitation* in the Effect of *Mirror Therapy* on Extremity Muscle Strength in Stroke Patients, 2022).

Figure 3. Internal and External Rotation of the Shoulder Joint (Bieniok et al, *Spiegeltherapic in der Neurorehabilitation* in the Effect of *Mirror Therapy* on Extremity Muscle Strength in Stroke Patients, 2022).

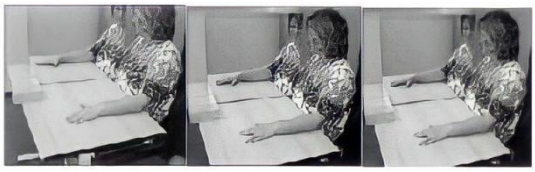

Figure 4. Finger Abduction (Bieniok et al, *Spiegeltherapic in der Neurorehabilitation* in the Effect of *Mirror Therapy* on Extremity Muscle Strength in Stroke Patients, 2022).
Mirror Movement Therapy on the Lower Extremities:

Figure 5. Dorso flexion-plantar flexion in *"Proven effective stroke Therapy|Mirror Therapy"*

Figure 5. Dorso flexion-plantar flexion in *"Proven effective stroke Therapy|Mirror Therapy*

Figure 5. Dorso flexion-plantar flexion in *"Proven effective stroke Therapy|Mirror Therapy"*

Of the 8 journals obtained, only 5 journals were studied after going through the screening, eligibility, and inclusion stages. Mirror Therapy is an exercise therapy used as an effective research method to train muscle strength. Based on the articles that have been obtained and analyzed by the author, it was found that mirror therapy provides significant results in increasing muscle strength.

Table 1 Comparison of Experimental and Control Groups

Reviewer	Participant		Intervention		Measurement	Results	Design Study
	Intervention Grup	Control Grup	Experimental Group	Control Group			
Kiran, et al (2022)	n= 28 45-60 tahun	n= 28 45-60 tahun	*Mirror Therapy*	PNF (*Proprioceptive Neuromuscular Facilitation*)	*Fulg Mayor Assessment* (FMA)	p<0,005	Quasi Experimental
Zuliawati, et al (2022)	n=11 45-74 tahun	-	MT	-	MMT (*Manual Muscle Testing*)	0,003 < 0,05	Quasi Experiment
Istianah, et al (2020)	n= 16 48-68 tahun	-	MT	-	*Barthel Index*	0,000<0,05	Pre Experimental
Hamza, et al (2020)	n= 15 20 - 85 tahun	n=15 20-85 tahun	MT	*Occupational Therapy without a mirror*	FMA	p=0,005	RCT
Agusman & Kusgiarti (2017)	n=10 unknown	n= 10 unknown	MT	*No intervention*	MMT	0,015	Quasi-Experimental

Based on a literature review study, the authors found that of the 133 sample results, the average sample was dominated by the age of <=60 years. Of the many kinds of literature found, most literature uses Quasi-Experimental research design and measurement FMA, MMT, and Barthel Index with p<0.05. The experimental group used Mirror Therapy intervention while the control group used occupational therapy without a mirror and PNF.

Table 2. Dosage Intervention *Mirror Therapy*

Reviewer	Type of Intervention	Therapeutic Dosage			Duration Therapy
		Frekuensi	Type	Time	
Kiran, et al (2022)	Continuous	5 times/week	Mirror Therapy	50 minutes	6 weeks
Zuliawati, et al (2022)	Continuous	1 times/day	MT	30 minutes	7 day
Istianah, et al (2020)	Continuous	2 times/day	MT	15 minutes	7 day
Hamza, et al (2020)	Continuous	Every day	MT	25 minutes	25 day
Agusman & Kusgiarti (2017)	-	-	MT	-	2 day

Based on the research that has been done, researchers found that interventions carried out with *mirror therapy* were given continuously with a frequency of 1-5 times/week and the time given for 15-50 minutes in a period of a week - 2 months.

Table 3. *Mean of Study Characteristics*

Reviewer	Measurement	Group Experiment		Control Group		Significant
		Pre	Post	Pre	Post	
Kiran, et al (2022)	FMA	36,7±11,25	49,47±9,48	31,47±9,67	238,53±10,72	p<0,001
Zuliawati, et al (2022)	MMT (Manual Muscle Testing)	2.36±2.00	3.18 ± 3.00	-	-	0,003
Istianah, et al (2020)	Barthel Index	42,5±50	72,5±80	-	-	p 0,001<0,05
Hamza, et al (2020)	FMA	19.33±7.62	31.40±8.19	20.60±12.07	27.07±12.49	p=0,005
Agusman & Kusgiarti (2017)	MMT	1.600	2.600	unknown	unknown	0,015

Based on the table above, both groups, namely the *intervention group and the* control group, *experienced a good and significant increase.*

Stroke is a common disease in people aged 45 years and causes loss of muscle function. Age is an indicator of a person's risk of stroke. Based on the results of this study, it was found that stroke does not only occur in elderly people but now occurs at the productive age of under 40 years.

A study conducted by (Istianah et al., 2020) showed that the average age of respondents was 55.75 (56 years), the highest incidence of stroke was the first attack of 12 respondents (75%) and all respondents (100%) had suffered from hypertension for more than one year. The intervention group

underwent therapy for 7 days with a frequency of twice per day for 15 minutes. When analyzed, it was found that there was a significant improvement in functional status with an average before the intervention of 42.5 and after the intervention to 72.5. The results analyzed using the Willcoxon test obtained a p-value for functional status of 0.001<0.05.

After the intervention, the patient's FMA score became much better. This was evident for both groups (19.33±7.62 to 31.40±8.19 with p<0.001 in the TBMT group and from 20.60±12.07 to 27.07±12.49 in the control group with p=0.001). Furthermore, the cure rate was greater in the TBMT group than in the CT group with p = 0.005 (Hamza, et al., 2020).

Based on the results of research by Zuliawati et al 2022, it was found that the average value obtained was 2.36 (before) and 3.18 (after the intervention). The results of Wilcoxon's statistical test showed that the significance level was 0.003<0.05, indicating that mirror therapy affected the development of muscle strength in stroke patients. This is in line with the research of (Istianah et al., 2020) (significant p-value 0.000<0.005).

As a result of the 6-week Mirror Therapy intervention, both groups experienced improvements in motor functionality with an average control group of 31.47±9.67 (before the intervention), 238.53±10.72 (after the intervention), and the intervention group 36.07±11.25 (before the intervention), 49.47±9.48 (after the intervention) The mean difference between the upper limb pretest and posttest scores in the control group and the intervention group was 0.072.4 and 13.42.95 (p = 0.00), respectively. resulted in a significant difference between the average scores of the two groups. It was found that PNF and MT were effective in increasing motor function scores but MT was found to have a better effect compared to PNF (Kiran et al., 2022).

The results of (Kusgiarti, 2017) can said that non-hemorrhagic stroke patients choose to limit their activities due to exercise limitations caused by stroke complications, the results of this study show that most stroke patients have a low muscle strength score, which is 0-2 points. After the intervention, the results of this study showed that with the right therapy and exercise and meeting the needs of stroke patients, they can overcome movement limitations well.

The results of these observations when viewed as a whole prove the positive influence of mirror therapy; The application of mirror therapy at least 2 times a week can help to increase the muscle strength and motor function of stroke patients after doing some mirror therapy movements.

CONCLUSION

Based on the results of research from the 5 journals above, mirror therapy provides significant effectiveness with a p-value of <0.05 in improving muscle strength and motor function. With an average age of 55.75 (56 years), the risk of stroke attacks in the elderly is higher than in people under the age of 56 years. The research highlights the effectiveness of mirror therapy in improving muscle strength and motor function in stroke patients. This implies that mirror therapy can be considered a valuable intervention in rehabilitation programs for stroke survivors. The inclusion of diverse outcome measures such as FMA, MMT, and Barthel Index in the research suggests a comprehensive assessment of the impact of mirror therapy. Future studies should continue to employ a range of outcome measures to capture the multidimensional effects of mirror therapy on stroke patients' overall well-being. The positive outcomes observed in the studies imply that mirror therapy can be integrated into existing rehabilitation programs for stroke patients. Healthcare providers and rehabilitation specialists may consider incorporating mirror therapy as part of a holistic approach to improve functional status and

quality of life for stroke survivors. While the studies demonstrate short-term improvements in muscle strength and motor function, the long-term effects of mirror therapy remain unclear. Future research should explore the sustainability of these improvements over extended periods to guide the development of long-term rehabilitation strategies. In conclusion, the research on mirror therapy for stroke patients provides valuable insights into its effectiveness, potential applications, and areas for further investigation. Integrating these implications into clinical practice and future research endeavors can contribute to enhancing stroke rehabilitation strategies and improving the quality of life for individuals affected by stroke.

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