

Review

The Effectiveness of Mirror Therapy on Muscle Strength Rehabilitation in Non-Haemorrhagic Stroke Patients: Literature Review

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ABSTRACT

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Background: Stroke remains one of the significant problems of long-term disability. Most stroke patients have difficulty performing daily activities due to paresis of the upper limbs, resulting in impaired activities of daily living (ADL) and decreased quality of life. The purpose of this literature review is to find out the Application of Mirror Therapy to Muscle Strength Rehabilitation in non-homorrhagic stroke Patients.

Methods: The method used is literature review (PRISMA) using journal databases from PubMed, Science Direct, and Google Scholar in the range 2020-2024 with the keywords "Mirror Therapy", "Muscle Strength Rehabilitation," and "Non-Hemorrhagic Stroke" and stroke obtained as many as 1276 articles.

Results: The search for articles according to the criteria and obtained 9 articles that are ready to be reviewed. These articles explain the application of mirror therapy to muscle strength rehabilitation in non-hemorrhagic stroke patients.

Conclusion: It is hoped that patients with stroke will endeavor to control mirror therapy.

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Introduction

Stroke is referred to as a "Brain Attack" which is a description of the neurological transition that arises due to ineffective blood circulation to parts of the brain or when the rupture of blood vessels in the brain resulting in brain cells having difficulty supplying oxygen and nutrients that can cause cellular damage, so that stroke can cause death or disability forever. (Sari et al., 2023). Stroke remains one of the major risks of prolonged

disability. Most stroke survivors face barriers to activities of daily living due to upper extremity haemiparesis and lower limb impairment, which hampers activities of daily living (ADLs) and poor quality of life. (Liao et al., 2020).

According to the World Stroke Organisation, 12 million new cases of stroke occur every year. Globally, one in four people over the age of 25 years can have a stroke and around 5.5 million lose their lives due to stroke. In Indonesia, the



prevalence of stroke in 2018 for the population aged ≥ 15 years was recorded at 10.9% or an estimated 2,120,362. East Kalimantan (14.7%) and Yogyakarta (14.6%) are the provinces with the highest prevalence of stroke cases in Indonesia. According to data obtained from the Basic Health Research (Riskesdas, 2013), the incidence of stroke with hemiparesis and hemiplegia has reached 80-90% throughout Indonesia (Riskesdas 2013) dalam (Tamba et al., 2023)

The barriers that can occur in stroke survivors can be complex, leading to sensory and motor deficits. This can lead to problems with body equilibrium due to haemiparesis which can lead to muscle weakness and spasticity. The effects of a lack of blood supply to the brain can lead to haemiparesis, if this occurs it can result in damage to the brain tissue which can result in irreversible damage, leading to permanent paralysis (Zuliawati et al., 2023). The suffering of stroke is not due to a case of musculoskeletal disease, but the problem of stroke is the abnormality of the brain as the central nervous system that controls and explains the motion of the neuromusculoskeletal system. Clinically, the most common symptom in stroke patients is haemiparesis. Hemiparesis is a disorder that often occurs after a stroke. Hemiparesis interventions are aimed at optimising motor function and blocking contractures, so it is necessary to carry out appropriate interventions so as not to inhibit motor function and contracture damage in stroke patients (Istianah et al., 2021).

Mirror Therapy is a rehabilitation mechanism that provides the positive benefits of visual illusions in order to improve motor function in people who have experienced stroke, limb

impairment, or limb damage. This therapy involves the use of mirrors to create the illusion that the affected limb is functioning again. The mirror is positioned to expose the unaffected limb, while the affected limb remains hidden behind it. Performing movements on the non-hemiparesised part of the body will create a reflection in the mirror, while performing movements on the affected part of the body, tricks the brain into understanding that the affected part is not a hemiparesised part (Solana et al., 2024). Mirror therapy is a procedure that has been used to maximise neuroplasticity. The main goal of mirror therapy is the implementation of visual reflections created in the mirror (May et al., 2020). The method of increasing muscle strength in stroke clients with mirror therapy begins with observation of reflections or reflections that are raised by the mirror will be captured by the patient so that it stimulates the primary motor cortex so that cortex reform occurs in functional rehabilitation (Arifah et al., 2023).

Methods

The method used in this research is using the Systematic Literature Review method. Article searches were conducted in February-March 2024 using journal databases from Science Direct, PubMed, and Google Scholar. The search for journal articles was carried out systematically from the last 5 years, namely 2020-2024 with the search keywords namely "Mirror Therapy", "Non-hemorrhagic stroke", "Muscle strength rehabilitation". For relevant searches. The researcher will filter the articles as a whole from the selected references without exception of the title

and abstract, so that more and more relevant articles are obtained.

The inclusion criteria in this systematic review are 1) Respondents are non-hemorrhagic stroke patients, 2) the intervention focuses on Mirror Therapy, 3) Selection of articles does not limit the methodology, population and results. While the exclusion criteria for this systematic review are 1) research that is not related to rom therapy and warm water compresses, 2) research that is not conducted on stroke patients, 3) unpublished research such as final scientific papers (theses, theses and dissertations), abstracts, conferences and case reports.

Articles that have been obtained from the database will be assessed using the PICO method in accordance with the inclusion and exclusion criteria, which contains 1) article title, 2) author and year of publication of the article, 3) research methodology (population, sample, intervention and analysis).

Results

The search for international research articles was obtained from Science Direct, Google Scholar and Pubmed. The search results were further identified according to the inclusion and exclusion criteria and 9 articles were obtaine

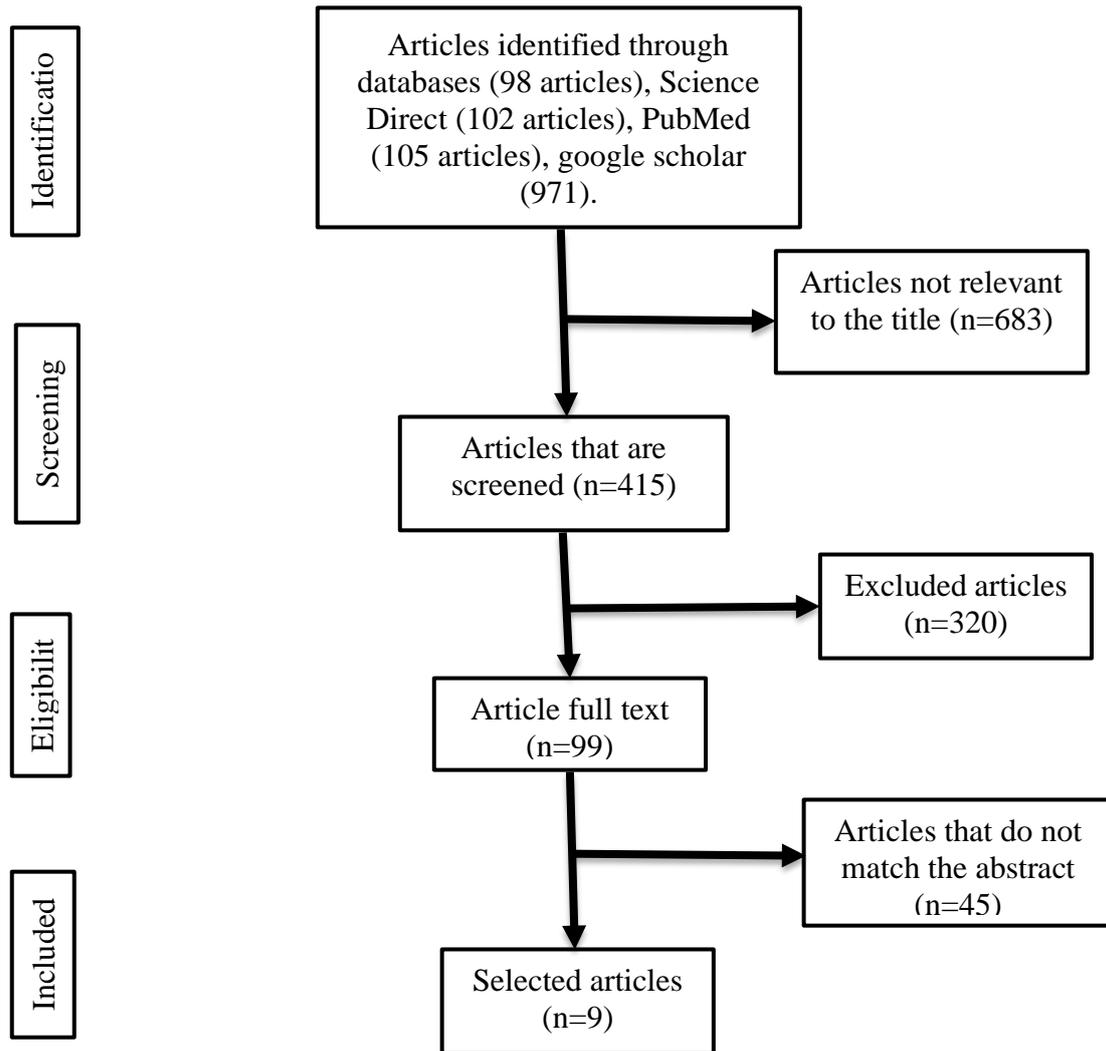


Figure 1: Literature Search Flow Diagram.

Table 1. Data Distraction Method

No	Title, Author and Year of Publication	Research Methodology	Research Results
1.	Enhancing Upper Limb Functionality, Gross and Fine Motor Skills, Autonomy, and Quality of Life in Acute Stroke Patients: A Mirror Therapy, Cognitive Therapeutic Exercise, and Task-Oriented Training (Solana et al., 2024).	Design : Quasi Experiment Sample : 120 people Independen:Functionality,Gross and Fine Motor Skills, Autonomy,and Quality of Life. Dependen : A Mirror Therapy, Cognitive Therapeutic Exercise, and Task-Oriented Training. Analysis: ANCOVA	ANCOVA analysis was conducted,revealing statistically significant differences between assessments in the CG compared to the experimental groups (GEs), indicating a notable improvement in overall functionality, fine and gross motor skills, autonomy, and QoL in the latter. However, there were no significant differences between the GEs. Therefore, the application of either of these experimental combinations is crucial for the motor recovery, functionality,and improvement of the quality of life of individuals who have suffered a stroke.
2.	Pengaruh Mirror Therapy Terhadap Kekuatan Otot Pada Pasien Stroke Non Hemoragik di Rumah Sakit Umum Sembiring (Zuliawati et al., 2023)	Design: quasy experiment with one group pre test post test research design. Sample: 11 persons Independent: The Effect of Mirror Therapy. Dependent: Muscle Strength Analysis: Analysis test using Wilcoxon Signed Ranks Test	The results of the impact of mirror therapy interventions to increase muscle strength in non-hemorrhagic stroke patients. Mirror therapy is useful for increasing muscle strength in parts of the body that experience weakness
3.	Efektivitas Mirror Therapy Terhadap Peningkatan Kekuatan Otot Pada Pasien Stroke (Tamba et al., 2023)	Design: Thematic analysis Independent: Effectiveness of Mirror Therapy Dependent: Muscle Strength	Mirror therapy as one of the non-pharmacological therapies that can be used in assisting the functional recovery of upper and lower extremity motor control in stroke patients.
4.	Penerapan Mirror Therapy Terhadap Kekuatan Otot Ekstremitas Atas Pada Pasien Stroke Non Hemoragik Di Ruang Syaraf Rsud Jend. Ahmad Yani Metro (Sari et al., 2023).	Design: case study Sample: 2 persons Independen: Mirror Therapy Dependent: Upper extremity muscle strength.	Application results At the time of the last day of the assessment, the muscle strength of subject 1 showed a change, namely muscle strength increased to 10.6 from before the assessment of muscle strength 6.6 weak and subject 2 increased from muscle strength 4.8 weak to 7.4 weak.
5.	Timing-dependent effects of transcranial direct current stimulation with mirror therapy on daily function and motor control in chronic stroke: a randomized controlled pilot study (Liao et al., 2020).	Desain: Double-Blinded Randomized Controlled Trial Sample : 34 V. Independen: Effects Of Transcranial Direct Current Stimulation With Mirror Therapy. Dependen: Daily Function And Motor Control. Analisis: Chi-Square Test	There were significant differences in daily function between the three groups. The SEQ group had greater improvement in daily function than the CON and SHAM groups. Kinematic analyses showed that movement time of the paretic hand significantly reduced in the SEQ group after interventions. All three groups had significant improvement in motor function from pre-intervention to post-intervention.
6.	The effect of mirror therapy on lower extremity motor function and ambulation in post-stroke patients: A prospective, randomized-controlled study (May et al., 2020).	Desain: Randomized-Controlled Sample: 42 pasien V. Independen: Mirror Therapy. Dependen: Lower Extremity Motor Function And Ambulation.	There were significant differences in all parameters between the groups, except for the degree of ankle plantar flexion spasticity, and in all time points between Week 0 and 4 and between Week 0 and 12 (p<0.05).
7.	Effects of home-based mirror therapy and cognitive therapeutic exercise on the improvement of the upper	Desain: Single-Blinded, Controlled, Randomised clinical trial with three parallel arms (control) Sample: 154 patients	The results will be disseminated through open-access peer-reviewed journals, conference presentation, broadcast media and a presentation to



No	Title, Author and Year of Publication	Research Methodology	Research Results
	extremity functions in patients with severe hemiparesis after a stroke: a protocol for a pilot randomised clinical trial (Gonzalez-Santos et al., 2020).	V. Independen: Effects Of Home-Based Mirror Therapy And Cognitive Therapeutic Exercise Dependen: Improvement Of The Upper Extremity Functions In Patients With Severe Hemiparesis	stakeholders. These study results will provide relevant and novel information on effective neurorehabilitation strategies and improve the quality of intervention programmes aimed at patients after a stroke.
8.	Efektifitas Mirror Therapy terhadap Kekuatan Otot dan Status Fungsional Pasien Stroke Non Hemoragik (Istianah et al., 2021).	Design: Pre Experiment with One Group Pre Test And Post Test Design Approach. Sample: 16 responden V. Independent: Effectiveness of Mirror Therapy. Dependent: Muscle Strength and Functional Status. A. uji willcoxon.	The results showed that the average muscle strength before the intervention was 2.69 and after the intervention 3.63, while the average functional status before the intervention was 42.5 and after the intervention became 72.5. The results of the analysis with the willcoxon test obtained a p value for muscle strength of 0.000<0.05.
9.	Penerapan Mirror Therapy Untuk Meningkatkan Kekuatan Otot Pasien Stroke Ruang Angrek 2 Rsud Dr.Moewardi Surakarta	Design: Descriptive Case Study Sample: 2 patients V. Independen: Mirror Therapy. Dependent: Muscle strength.	The results of the difference in muscle strength increase in the two respondents after being given mirror therapy intervention for four days and six consecutive days where the increase in muscle strength in Mrs.D faster than Mrs.P this was influenced by age and history of hypertension experienced by Mrs.P. There was an increase in muscle strength after mirror therapy.

Discussion

The results of research from 9 journals reviewed proved that the Application of Mirror Therapy is very useful and effective for Rehabilitation of Increased Muscle Strength in non-hemorrhagic stroke patients.

Stroke requires prompt neurological management and is the leading cause of physical disability in adults. It is estimated that one-third of stroke survivors remain dependent on others for care as they are affected in performing activities of daily living, including daily physical mobility and instrumental activities of daily living, due to sensory-based motor problems, perceptual problems, language and communication impairments, and emotional, psychological, and behavioural barriers (Gonzalez-Santos et al., 2020). One of the non-pharmacological treatments for the

recovery of hemiparesis is mirror therapy, which is carried out using optical illusions of mirrors that can provide visual stimulation to the brain so as to restore increased motor function of the extremities. Mirror therapy for stroke patients is very easy to do and only requires very short training without making it difficult for clients. Mirror therapy is a therapy for stroke patients by linking the mirror neuron system in the cerebral cortex area which is useful in motor treatment of hand and mouth movements (Abdul Herman Syah Thalib, 2021)

Based on research that has been conducted by Valentina et al., (2022) After being given the application of Mirror Therapy for 5 days, there was an increase in muscle strength from the previous one in Mrs S's right hand worth 4444 to 5555. In subject II Mrs E before and after the application of mirror therapy the left hand muscle strength

was 0000 to 2222. In addition, the range of motion of the joints of both subjects also increased. The results of applying mirror therapy are proven to increase muscle strength and expand joint range of motion. One of the non-pharmacological therapies to overcome hemiparesis / weakness in muscles, namely, mirror therapy which is given using a mirror optical illusion that provides visual stimulation to the brain so (Fajar Susilowati et al., 2024) The results successfully showed that there was an increase in muscle strength at the third meeting. Mirror therapy implementation was carried out for 3 days with 2x meetings per day with the duration of each session of 15 minutes.

The state of haemiparesis is one of the causes of the loss of normal postural reflex methods, e.g. adjusting the elbows for movement, controlling head movements for equilibrium, body circulation for functional movements in the extremities (Fery Agusman M & Kusgiarti, 2017). Based on the results of previous studies, it shows that mirror therapy is effective for increasing limb muscle strength in stroke patients because the case study in respondent I, the upper limb muscle strength scale on the first day with scale 1 became scale 4 on the sixth day, while the muscle strength scale in the lower extremities with scale 2 became 5. In respondent II, the upper limb muscle strength scale on the first day with scale 1 became scale 3 on the sixth day, while the muscle strength scale in the lower extremities with scale 2 became 5. (Luluk Cahyanti, 2022). This research is in accordance with research from (Evelyn et al., 2021) showed that muscle strength in post-stroke patients after being given mirror therapy intervention experienced

an increase in muscle in the body parts that experienced hemiparesis.

Conclusion

Mirror application may include the premotor cortex for motor recovery. There are a number of specificities in the premotor cortex that provide involvement between mirror images and stroke motor recovery, for example: the premotor cortex has an uneasy role regarding the lack of corticospinal tract function, the premotor cortex controls more bilateral movements than the motor cortex itself and the close involvement between the premotor and visual input. In addition to neurological and psychological levels, mirror therapy can support the restoration of components to the paresised limb. Hemiparesis in stroke is the cause of permanent damage in the internal capsule. Another possibility is that the lesion is not always complete, perhaps there are residues of mirror nerve cells that remain but are inactive or their activity is blocked and does not reach the threshold (Laus et al., 2020).

Authors Contributions

The authors' contributions to this literature review encompassed various stages of the research process: one author conceptualized the study framework, developed search protocols, and curated a comprehensive database of literature; another author critically evaluated the selected sources, synthesized key findings, and identified emerging themes and research gaps; while a third author meticulously structured the manuscript, integrated diverse perspectives, and ensured coherence and logical progression of arguments.

Conflicts of Interest

I hereby declare that there are no financial, personal, or professional conflicts of interest that have influenced the design, implementation, or interpretation of this research.

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