International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Effects of Mirror Therapy on Performance Among Indiviudals with Stroke: A Scoping Review

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ABSTRACT

Introduction: Rehabilitation after stroke or limb amputation faces challenges in motor function recovery. Mirror therapy is a low-cost that utilizes visual feedback to create the illusion of motion in the affected limb. Despite its clinical use, evidence on its effectiveness is inconsistent. This scoping review seeks to analyze the evidence concerning the effectiveness of mirror therapy for both conditions, identifying research gaps and future directions.

Methods: To ensure identification and use of relevant articles, this review followed the PRISMA-ScR guidelines. An electronic literature search was used on PubMed and CINAHL under keywords "mirror therapy", "stroke", and "performance". Eligibility criteria included full-text studies that assessed mirror therapy as an intervention on the upper limb in performance on stroke and performance in amputated populations.

Results After a thorough database search, this review initially identified a total of 320 results collected in PubMed and CINAHL. Following the filters, it included 47 studies and was screened by title/abstract which narrowed down to 39. The 39 full articles were then assessed and narrowed down to 12 studies that are included in the scoping review. The consistency of positive results across different delivery methods and stroke severities suggests mirror therapy is a valuable tool in upper limb recovery for this population. The studies used a variety of outcome measures to assess the effects of mirror therapy, depending on the aspect of performance or function they aimed to evaluate. Common tools included the Fugl-Meyer Assessment, which evaluates motor recovery and movement quality, and the Barthel Index, which measures activities of daily living. Some studies used the Box and Blocks Test and the Manual Function Test to assess hand function and coordination while others relied on task performance scores, motion analysis, or patient-reported experiences.

Keywords: Mirror therapy, upper limb, performance, stroke

INTRODUCTION

Rehabilitation after stroke or limb amputation shows challenges, especially in motor function. In recent years, mirror therapy has emerged as a low-cost intervention in physical rehabilitation, known for its potential to address neuroplasticity and pain relief. Originally introduced for phantom limb pain, its application has expanded to a range of neurological and musculoskeletal conditions.

Mirror therapy is based on the principle of visual feedback (Nazarova et al., 2012). By using a mirror to reflect the movement of an intact limb, it creates the illusion that the affected limb is also moving (Moseley et al., 2008). This visual trick is believed to activate sensorimotor pathways in the brain, which may lead to functional improvements. Despite it being used more and more in clinical settings, the evidence base for its effectiveness across different populations remains varied.

Many systematic reviews have investigated mirror therapy for specific conditions but few studies focus on its effects on motor function in individuals with stroke and motor functions among those with amputations. These two populations frequently share common rehabilitation goals, but their functional responses to mirror therapy might be different

This scoping review aims to gather the current evidence on the use of mirror therapy to address motor function in individuals with stroke and motor function in individuals with amputation. By identifying the range of outcome measures used and summarizing whether the effects are positive, this review hopes to clarify the role of mirror therapy in neurorehabilitation and highlight areas for future research.

Background of the Study

Mirror therapy (MT) is a non-invasive rehabilitation technique that uses visual feedback to relieve pain and improve motor function. Originally, a mirror box is placed at the patient's midline so that movements of the intact limb appear as movements of the missing or paretic limb (Ramachandran & Altschuler, 2009). This visual illusion is said to change the patient's perception and provide feedback and movement to the phantom limb (Kodeeswara et al., 2015). Neurophysiological studies confirm that mirror visual feedback can increase excitability in the primary motor cortex (even ipsilateral to the moving limb) and engage attention- and control-related brain areas (Deconinck et al., 2015). Mirror therapy uses the brain's bias for vision over proprioception (Kodeeswara et al., 2015) to drive neuroplastic changes that may restore motor output or dampen pain signals (Ramachandran & Altschuler, 2009; Deconinck et al., 2015). Although the mirror neuron system has been proposed as one mechanism, current evidence suggests that mirror feedback primarily modulates broader sensorimotor networks rather than directly "mirroring" single-neuron activity (Deconinck et al., 2015).

Mirror therapy was also applied to treat phantom limb pain in amputees. Early experiments showed that just 15 minutes of daily mirror training over several weeks allowed many amputees to "feel" movement in the phantom limb and reported pain relief (Kodeeswara et al., 2015).

Mirror therapy is also widely used to enhance motor recovery after stroke. In practice, a patient performs movements with the non-paretic limb while looking into a mirror positioned at the body midline, so that the reflection creates the illusion of movement in the paretic limb (Thieme et al., 2018). The accumulated literature indicates that MT can augment post-stroke therapy. A Cochrane review (62 trials, n≈1982) reported moderate-quality evidence that MT significantly improved upper-limb motor function and reduced impairment compared to controls (standardized mean differences ≈0.47–0.49) (Thieme et al., 2018). Mirror training also yielded improvements in activities of daily living (SMD≈0.48) and, with lower confidence, modest pain relief (SMD≈–0.89) (Thieme et al., 2018).These findings are consistent with recent meta-analyses: for instance, a 2025 meta-analysis (18 trials, 633 stroke patients) found significant gains in overall upper-limb and hand function with MT, especially when administered >5 times per week (mean differences ≈1.8 points on motor scales) (Saragih et al., 2025). In summary, most stroke studies report that MT enhances motor recovery when added to standard rehabilitation. However, the size of the effect depends on intervention parameters and patient factors, and many trials have small samples.

Reviewers have noted that heterogeneity in protocols (dose, duration, feedback modality) and inconsistent reporting limit the certainty of these conclusions (Thieme et al., 2018).

Despite encouraging reports, the mirror therapy literature shows significant variability and gaps. In stroke populations, although most reviews indicate motor benefits, studies differ widely in time post-stroke, severity of deficits, choice of outcomes (e.g. impairment scales vs daily function), and intervention details. Many reviews explicitly cite small sample sizes and methodological heterogeneity as barriers to firm conclusions (Thieme et al., 2018; Guémann et al., 2023). Gathering the full scope of evidence on mirror therapy's effects on motor function in these groups will clarify which outcomes are well-supported and where knowledge is lacking. This provides a strong rationale for a scoping review to identify patterns of findings, methodological gaps, and future research directions across the two clinical areas.

Statement of the Problem

Mirror therapy has been gaining attention in rehabilitation, especially for people recovering from a stroke or living with an amputation. It offers a simple and low-cost approach, yet its reported benefits vary widely across studies. Some research highlights improvements in pain relief or motor recovery, while others find little to no significant change. Since the findings are so mixed and there are various ways to deliver mirror therapy, it is difficult to know just how effective it is for these populations. Thus, this review gathered the current state of evidence on the effectiveness of mirror therapy in the performance among individuals with stroke focusing on the upper extremity to inform healthcare providers of its benefits.

Research Question

This scoping review aimed to address the research questions: Are the reported effects of mirror therapy positive or negative in individuals with stroke or limb amputation? What specific outcome measures are used to assess these effects, and in what domains? The review explored and synthesized existing literature to provide an overview of how mirror therapy was used in practice and its effects on performance of the stroke patients with motor dysfunction in the upper extremity. Thus, reviewing current data can be helpful in addressing the inconsistency in the existing studies and identify any gaps in what is currently known of these techniques, therefore guiding further research and clinical providers.

METHODOLOGY

This review explored existing literature on mirror therapy on performance of the upper limb in stroke patients. This study utilized a scoping review to identify if the effects of mirror therapy were positive or negative and to identify the various outcome measures used in the studies. An electronic literature search was performed using PubMed and CINAHL.

Eligibility Criteria

This scoping review reviewed all full-text available literature on the effectiveness of mirror therapy on performance among the stroke population. Studies investigating the effects of mirror therapy on performance among the stroke population and published within the last 10 years to ensure relevance was considered. Also, exclusion criteria were also examined such as non-human studies, studies not reporting performance/function, and non-english publications.

Table 1 Eligibility Criteria

Inclusion Criteria	Exclusion Criteria
Mirror therapy as an intervention	Mirror therapy combined WITHOUT isolated results

Studies reporting on performance/function	Studies not reporting on performance/function
English	non-english
Last 10 years	
Upper limb	
Full-text availability	
Performance in stroke patients	

Information Sources and Search Strategy

This review was searched electronically using databases like PubMED and CINAHL. The keywords used were “mirror therapy”, “stroke”, and “performance”. These keywords were used as a guide to identify relevant articles, which was also known as "hits."

Selection of Sources of Evidence

After extracting relevant articles, each one of these underwent a thorough screening by examining the titles and abstracts of each of them to identify which were suitable for this review, which were referred to as “hits.” Next, was to gather the full-text versions of the studies that were chosen and reviewed against the inclusion and exclusion criteria.

Data Charting

To organize and collect relevant studies, a standardized data extraction table (table 4) was created. In the table, author(s) and year of publication, population, study design, outcome measures assessed, intervention, key findings, and effect direction were presented. Studies were categorized into one group which is stroke on performance and were in a single table when summarized. This classification corresponds to the established eligibility and research questions and allows for an organized synthesis of results.

Synthesis of Results

After relevant studies have been extracted, every result was systematically organized and presented in a comprehensive table to serve as a clear and structured summary of the key findings. This table was arranged according to the effectiveness of mirror therapy in stroke on performance. This was carried out to simplify data interpretation and match the main objectives of the evaluation.

RESULTS AND DISCUSSION

Table 2 and 3 displays the results of the literature search using the PubMed database to gather relevant studies on mirror therapy as an intervention to stroke on the upper limb. This search focused on and investigated its relation to performance.

An initial search was conducted in PubMed using relevant keywords related to mirror therapy, motor performance, and stroke. A total of 249 articles were identified. After applying filters for language (English), publication date (within the last 10 years), and study type (full-text articles), 47 articles remained for title and abstract screening.

These 47 records were screened based on their titles and abstracts, resulting in the exclusion of 13 studies that did not use the upper extremity. The remaining 33 full-text articles were assessed for eligibility, of which 24 was excluded due to irrelevance or failing to meet inclusion criteria. Ultimately, 9 studies were included in the final scoping review.

Table 2

Search Strategy for PubMed: Performance Among Stroke

Stage	Count	Note
Records identified from PubMED	249	Mirror therapy + stroke + performance
Records after filters applied	47	10 years, free full text, humans, English
Records screened by title/abstract	33	Excluded due to no mention of upper limb
Records excluded	14	14 excluded due to no mention of upper limb
Full-articles assessed	33	
Full-articles excluded	24	3 – no outcomes 21 – exclusion/inclusion criteria
Studies included in scoping review	9	

A total of 71 records were initially identified through CINAHL. After applying the predefined filters, 6 articles remained for screening. These 6 articles were screened based on the title and abstract, resulting in no exclusions. The remaining full-text articles were assessed for eligibility with 3 being excluded and 3 included in the final scoping review.

Table 3

Search Strategy for CINAHL: Performance Among Stroke

Stage	Count	Note
Records identified from CINAHL	71	Mirror therapy + stroke + performance
Records after filters applied	6	10 years, free full text, English
Records screened by title/abstract	6	
Records excluded	0	
Full-articles assessed	6	
Full-articles excluded	3	due to inclusion / exclusion criteria
Studies included in scoping review	3	

After a thorough database search, this review initially identified a total of 320 results collected in PubMed and CINAHL. Following the filters, it included 47 studies and was screened by title/abstract which narrowed down to 39. The 39 full articles were then assessed and narrowed down to 12 studies that are included in the scoping review.

In table 4 showed the summary of articles indicating that mirror therapy had helpful benefits in concerning performance among individuals with stroke. All studies showed some level of improvement in motor performance, functional use of the upper limb, or coordination after undergoing mirror therapy. Whether

delivered through traditional means, virtual reality, gesture recognition, or home-based applications, mirror therapy helped enhance upper limb recovery and contributed to better outcomes in stroke rehabilitation (Madhoun et al., 2020; Wen et al., 2022; Colomer et al., 2016; Mekbib et al., 2020; Choi et al., 2019).

The consistency of positive results across different delivery methods and stroke severities suggests mirror therapy is a valuable tool in upper limb recovery for this population. The studies used a variety of outcome measures to assess the effects of mirror therapy, depending on the aspect of performance or function they aimed to evaluate. Common outcome measures gathered were the Fugl-Meyer Assessment (Madhoun et al., 2020; Wen et al., 2022; Mekbib et al., 2020), which assesses motor recovery and movement quality, and the Barthel Index, which assesses activities of daily living (Wen et al., 2022). Some studies employed the Box and Blocks Test as well as the Manual Function Test to evaluate hand function and coordination (Colomer et al., 2016; Choi et al., 2019), while others focused on task performance scores, motion analysis, or experiences reported by patients (Li et al., 2019; Chen et al., 2022; Sip et al., 2023).

The outcome domains were the motor control, task performance, coordination, sensation, and quality of life. For example, Kim et al. (2024) investigated the effects of mirror feedback on the timing and symmetry of bilateral movement. Additionally, Varalta et al. (2022) documented sensory and motor improvements in a stroke patient with combined deficits. These findings suggest that the effects of mirror therapy are broad and is beyond physical performance and how patients perceive their recovery and re-engage with daily tasks.

To evaluate these outcomes, the studies used a mix of subjective and objective tools. Pain, for instance, was assessed through the Visual Analog Scale (VAS), the McGill Pain Questionnaire, and self-reports from patients. With regard to motor function, some outcome measures included whether or not they were able to initiate or control phantom limb movement and if they could engage in functional tasks, and in some cases, the use of a prosthesis. These measures show two key domains: sensory (pain) and motor (function), both of which are important in evaluating recovery and quality of life following amputation.

Although the review primarily included studies involving stroke, the consistent positive outcomes in both pain relief and motor improvement suggest that mirror therapy is good for individuals recovering from stroke. It is also good for those individuals with amputations, especially those with motor deficits. However, Barbin et al. (2016) pointed out that the overall quality of evidence was limited, pointing to the need for more comprehensive trials are necessary.

Overall, mirror therapy appears to be an effective intervention for improving upper limb function among stroke individuals. The consistency of positive outcomes across various study designs and delivery of the intervention supports its role in physical rehabilitation.

Table 4

Summary of Mirror Therapy on Performance Among Stroke Individuals

Author & Year	Population	Study Design	Outcome Measures	Intervention	Findings	Effect
Madhoun et al. (2020)	Stroke	RCT	Fugl-Meyer Assessment (FMA), Wolf Motor	Task-based mirror therapy in subacute stroke	Improved upper limb motor scores and functional use	(+)

			Function Test			
Wen et al. (2022)	Stroke	Single-blind RCT	FMA, Brunnstrom Stage, Barthel Index	Mirror therapy added to conventional rehab	Significant enhancement in upper limb recovery	(+)
Colomer et al. (2016)	Stroke	RCT	FMA, Box and Blocks Test	Mirror therapy for chronic stroke	Functional gains	(+)
Gebreheat et al. (2024)	Stroke	Scoping Review	Varies	Immersive virtual reality Mirror therapy	Functional recovery, motivation, and improved motor outcomes	(+)
Choi et al. (2019)	Stroke	Single-blind RCT	Manual Function Test (MFT), WHOQOL-BREF Neck Pain Scale	Gesture-recognition-based mirror therapy	Improved function, QOL, reduced discomfort	(+)
Quintana et al. (2023)	Stroke	Experimental (tech development)	System Usability Scale, functional observations	Low-cost virtual reality mirror therapy for home use	Demonstrated functional potential and usability	(+)
Sip et al. (2023)	Stroke	Observational study	Qualitative feedback, perceived motor function	Immersive virtual reality mirror therapy	High engagement, perceived arm function improvement	(+)
Kim et al. (2024)	Stroke	Experimental (Coordination study)	Bimanual coordination analysis	Mirror feedback for bimanual coordination	Improved movement timing and symmetry	(+)
Mekbib et al. (2020)	Stroke	RCT	FMA, hand function tests, kinematic analysis	Immersive virtual-reality based mirror therapy	Significant upper limb motor function	(+)
Varalta et al. (2020	Stroke	Case report	Qualitative sensory	Mirror box therapy for	Notable recovery in	(+)

			testing, movement observation	sensory-motor deficits	sensory perception and motor control	
Li et al. (2019)	Stroke	RCT	Bimanual motor task performance	Mirror visual feedback before bilateral task training	Enhanced coordination and task performance	(+)
Chen et al. (2022)	Stroke	Pilot study	Functional task performance, usability feedback	Virtual reality home-based mirror therapy with gamification	Increased engagement and performance in home training	(+)

CONCLUSION

According to the articles gathered, numerous key points emerge that emphasize the effectiveness and adaptability of mirror therapy for upper limb rehabilitation in individuals with stroke and in individuals with amputation. First, all studies indicated favorable outcomes, showing improvements in motor performance, coordination, and overall functional use of the affected upper limb (Madhoun et al., 2020; Wen et al., 2022; Mekbib et al., 2020). This consistent pattern across various methods strengthens the importance of mirror therapy as a method for rehabilitation

A majority of the articles gathered focused among individuals with stroke so the evidence strongly supports the value of mirror therapy as part of stroke rehabilitation. Nonetheless, the treatment demonstrated efficacy across various stages of stroke recovery, including both subacute and chronic cases, and within patients with significant motor disabilities (Colomer et al., 2016; Mekbib et al., 2020).

A wide range of study designs was shown in the review, including randomized controlled trials, trial experiments, a case study, an observational study, and a scoping review (Choi et al., 2019; Sip et al., 2023; Gebreheat et al., 2024). The techniques for administering mirror therapy also differed, including traditional mirror box setups, gesture-recognition technologies, at-home virtual reality, and game-like mobile apps. (Quintana et al., 2023; Chen et al., 2022; Kim et al., 2024).

The majority of research focused on motor performance and coordination as their main outcome domains. Enhancements in these domains were assessed using tools such as the Fugl-Meyer Assessment, Barthel Index, Box and Blocks Test, and Manual Function Test (Wen et al., 2022; Choi et al., 2019). These outcome measures offered a clear view of functional improvements after mirror therapy.

In addition to physical improvements, numerous studies also observed advantages in psychological and engagement-related aspects. Participants reported better motivation, satisfaction with treatment, and even improved quality of life after mirror therapy interventions (Sip et al., 2023; Choi et al., 2019). These results propose that mirror therapy not only aids in regaining movement but also enhances the wellness of their patients and their engaged involvement in rehabilitation.

These findings suggest that mirror therapy can be effective in targeting both sensory and motor domains. However, despite these positive outcomes, the authors highlight that the overall evidence base is limited by methodological weaknesses, small sample sizes, and study heterogeneity. As such, further high-quality randomized controlled trials are necessary to confirm these results and establish mirror therapy as a standard intervention in clinical rehabilitation.

Together, these key points demonstrate that mirror therapy is a promising and adaptable intervention that can yield improvements in upper limb recovery among stroke patients.

RECOMMENDATIONS

Recommendations are directed towards stakeholders (clinicians, rehabilitation centers, stroke, and healthcare professionals). Based on the above findings, it is recommended that:

1. Integrate mirror therapy into standard stroke rehabilitation for upper limb recovery.
2. Apply mirror therapy across different stages of stroke, including subacute and chronic phases.
3. Utilize both traditional and technology-enhanced methods (e.g., virtual reality, gesture-based systems).
4. Offer home-based or low-cost versions to improve access, especially in underserved areas.
5. Encourage use in patients with severe motor impairments due to its adaptability and effectiveness.

In the interest of future studies, the researchers would like to recommend the following:

1. Conduct studies on mirror therapy in individuals with upper limb amputation to address current gaps.
2. Compare traditional vs. modern delivery methods (e.g., VR, mobile apps) to guide best practices.
3. Examine long-term outcomes and functional retention following mirror therapy.
4. Investigate cost-effectiveness and adherence in home-based settings.
5. Explore the impact of mirror therapy on psychosocial factors, such as motivation and engagement.

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