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Original Article

Mirror Therapy and Task-Oriented Approach in Improving Hand Function Among Stroke Patients

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ABSTRACT

Background: Stroke is a leading cause of long-term disability, frequently resulting in impaired upper limb function that limits independence in activities of daily living. Mirror therapy and task-oriented training are rehabilitation approaches that promote motor recovery through neuroplasticity.

Aim: To evaluate the effectiveness of mirror therapy combined with a task-oriented approach in improving hand function among post-stroke patients.

Methods: A pre-test–post-test experimental study was conducted among 30 post-stroke patients aged above 40 years. Participants underwent an 8-week intervention consisting of mirror therapy and task-oriented exercises for 45 minutes per session. Hand grip strength and functional hand performance were assessed using a Hand Grip Dynamometer and the Chedoke Arm and Hand Activity Inventory (CAHAI-13).

Results: Post-intervention assessments demonstrated improvements in hand grip strength and functional hand performance compared with baseline measurements.

Conclusion: Mirror therapy combined with task-oriented exercises effectively improved upper limb function, grip strength, and performance of activities of daily living in post-stroke patients, supporting its integration into comprehensive stroke rehabilitation programmes.

Keywords: Stroke, Mirror therapy, Task-oriented training, Hand function, Grip strength, Stroke rehabilitation.

Introduction:

Stroke is a major global public health concern and remains one of the leading causes of long-term disability among adults. It occurs when cerebral blood flow is interrupted due to either an ischemic event, resulting from arterial occlusion, or a haemorrhagic event caused by rupture of a cerebral blood vessel. The resulting neuronal damage often leads to a wide range of neurological impairments, including hemiplegia or hemiparesis, sensory deficits, spasticity, impaired coordination, and cognitive dysfunction. These impairments substantially affect an individual's ability to perform activities of daily living (ADLs) and reduce overall quality of life [1].

Approximately 85% of stroke survivors experience hemiparesis, and nearly 55–75% continue to have persistent upper extremity dysfunction, significantly limiting their ability to perform routine functional activities such as eating, dressing, grooming, writing, and handling objects independently [1,11,24]. Among these impairments, loss of hand function is particularly debilitating because effective hand movements require adequate muscle strength, coordination, sensory integration, and fine motor control. Consequently, restoration of upper limb and hand function has become one of the primary objectives of post-stroke rehabilitation [1].

The recovery of motor function following stroke is largely dependent on neuroplasticity, which refers to the brain's ability to reorganise neural pathways and establish new functional connections following injury. Rehabilitation interventions that stimulate neuroplastic changes facilitate motor relearning, improve functional recovery, reduce spasticity, and enhance independence in daily activities [25,26]. Among the various rehabilitation techniques available, Mirror Therapy (MT) and the Task-Oriented Approach (TOA) have emerged as effective evidence-based interventions for improving upper limb motor performance in stroke survivors [2]. Mirror therapy is a simple, non-invasive rehabilitation technique that provides visual feedback through a mirror placed in the patient's midsagittal plane. During therapy, movements performed by the unaffected limb create the visual illusion that the affected limb is moving normally. This visual feedback activates the mirror neuron system and promotes cortical reorganisation, thereby facilitating motor recovery of the affected upper extremity [6,12].

Several studies have demonstrated that mirror therapy effectively reduces spasticity, improves motor control, enhances hand dexterity, and increases functional use of the affected upper limb in individuals recovering from stroke [1]. In contrast, the Task-Oriented Approach focuses on repetitive, goal-directed, and meaningful functional activities that closely resemble tasks performed during daily living. Unlike conventional rehabilitation programmes that primarily emphasise isolated muscle strengthening or passive exercises, task-oriented training encourages active participation through functional activities such as reaching, grasping, lifting objects, manipulating utensils, buttoning clothes, and other activities of daily living. Repeated practice of these meaningful tasks enhances motor learning, improves coordination, promotes problem-solving abilities, and facilitates the transfer of newly acquired motor skills into real-life situations [4,24].

Exercises involving wrist flexion, extension, forearm pronation and supination, finger flexion and extension, resistance training, and grip-strengthening activities further contribute to strengthening the muscles of the forearm and hand. These interventions improve wrist stability, enhance grip strength, increase dexterity, and promote better functional performance during activities requiring grasping, lifting, and object manipulation [3,7]. Hand grip strength is an important indicator of upper limb function and is closely associated with an individual's ability to perform activities of daily living independently. Reduced grip strength following stroke is associated with impaired motor performance, decreased functional independence, prolonged rehabilitation, and poorer quality of life. Furthermore, diminished grip strength has been linked to adverse health outcomes, including decreased bone density, increased risk of postoperative complications, prolonged hospitalisation, cognitive decline, and increased mortality among older adults [5,20]. Therefore, improving grip strength and functional hand performance should be considered essential goals of stroke rehabilitation. Although numerous studies have independently demonstrated the effectiveness of mirror therapy and task-oriented training, limited evidence exists regarding the combined effect of these two rehabilitation strategies on hand function among stroke survivors. Integrating mirror therapy with task-oriented exercises may simultaneously stimulate neuroplasticity and promote functional motor relearning, thereby producing greater improvements in upper limb recovery than either intervention alone [3].

Therefore, the present study aimed to evaluate the effectiveness of combining mirror therapy with a task-oriented approach in improving hand grip strength and functional hand performance among post-stroke patients. The findings of this study may provide valuable evidence for physiotherapists and rehabilitation professionals in developing comprehensive, patient-centred rehabilitation programmes that enhance upper limb function, improve independence in activities of daily living, and ultimately improve the quality of life of stroke survivors [3].

MATERIALS AND METHODS

This pre-test–post-test experimental study was conducted to evaluate the effectiveness of a combined Mirror Therapy (MT) and Task-Oriented Approach (TOA) programme in improving hand function among post-stroke patients. The study was carried out at Shen Physiotherapy Clinic, Kolathur, Chennai, over a period of six months. Ethical principles were strictly followed throughout the study, and written informed consent was obtained from all participants prior to their enrolment.

A total of 30 post-stroke patients with upper limb motor impairment were recruited using a convenience sampling technique. Both male and female participants aged above 40 years who had experienced either ischemic or haemorrhagic stroke were included. Participants were eligible if they were in Brunnstrom Recovery Stage IV, had a Mini-Mental State Examination (MMSE) score of ≥24, and were able to understand and follow verbal instructions provided by the therapist. Patients with Brunnstrom Recovery Stages I–III, an MMSE score <24, severe visual impairment, inability to understand or perform the intervention protocol, or any other neurological or musculoskeletal disorder affecting upper limb function were excluded from the study. Baseline demographic and clinical information was recorded before the intervention. Each participant underwent a comprehensive pre-intervention assessment to evaluate hand grip strength and functional hand performance. Hand grip strength was measured using a Hand Grip Dynamometer, a reliable instrument widely used to quantify maximal voluntary grip strength in neurological rehabilitation [10].

Functional performance of the affected upper limb was assessed using the Chedoke Arm and Hand Activity Inventory (CAHAI-13), a validated assessment tool designed to evaluate bilateral upper limb function during activities of daily living in individuals recovering from stroke [21]. Both assessment tools possess established validity and reliability for measuring upper limb motor performance in stroke rehabilitation [10,21].

The intervention programme consisted of mirror therapy combined with task-oriented exercises, administered for 8 weeks, with each treatment session lasting 45 minutes. Participants attended supervised therapy sessions under the guidance of a qualified physiotherapist. During each session, the participant was seated comfortably on a chair with a table positioned in front. A mirror was placed vertically along the participant's midsagittal plane between the upper limbs. The unaffected upper limb was positioned in front of the reflective surface, while the affected limb was concealed behind the mirror. Participants were instructed to observe the reflection of the unaffected limb while simultaneously attempting to perform identical movements with the affected limb. This visual illusion was intended to stimulate the mirror neuron system, promote cortical reorganization, and facilitate motor recovery through neuroplastic mechanisms [6,12]. The rehabilitation programme followed a progressive exercise protocol. During Week 1, participants performed active range-of-motion exercises involving forearm pronation and supination, wrist flexion, extension, circumduction, and finger flexion and extension. Each exercise was performed in five sets of five repetitions, with a one-minute rest interval between sets to minimize fatigue [9]. During Week 2, the same exercises were continued with the addition of resistance training using a 1-kg dumbbell and a blue TheraBand (approximately 2 kg resistance) to improve muscle strength and endurance [9].

During Week 3, functional hand training was introduced to improve fine motor control and dexterity. Participants performed key pinch, two-finger pinch, and three-finger pinch grip exercises, followed by proprioceptive neuromuscular facilitation (PNF) finger extension using a rubber band. Functional task-oriented activities resembling activities of daily living were simultaneously incorporated, including drinking water from a glass, combing hair, buttoning a shirt, and eating with a spoon, thereby encouraging the transfer of motor skills into everyday functional activities [8].

In Week 4, participants performed advanced PNF exercises focusing on wrist and finger mobility, stretching, stabilization, and coordinated movement patterns. Pinch-grip plate supination exercises using plates weighing 1–5 kg were introduced to strengthen the forearm supinators, wrist stabilizers, and intrinsic muscles of the hand while improving grip control and functional performance. During Weeks 5 to 7, progressive resistance training was continued using a dowel. Exercises included isometric supination, wrist rotation, radial deviation, and ulnar deviation, all of which were designed to improve forearm muscle strength, joint stability, coordination, and controlled movement of the wrist and hand. These exercises gradually increased the functional demands placed on the upper extremity while maintaining participant safety.

In Week 8, advanced strengthening exercises were incorporated, including anti-supination straight-bar curls, anti-pronation straight-bar reverse curls, supination and pronation using a straight bar, radial and ulnar deviation exercises, and resistance training with a red TheraBand (approximately 3 kg resistance). These exercises aimed to maximize upper limb muscle strength, improve endurance, enhance wrist stability, and facilitate better functional use of the affected hand during daily activities.

Following completion of the 8-week intervention programme, all outcome measures were reassessed using the same standardized assessment instruments. Post-intervention measurements of hand grip strength and functional hand performance were compared with baseline values to determine the effectiveness of the combined intervention.

The collected data were analysed using descriptive and inferential statistics. Continuous variables were expressed as mean ± standard deviation (SD). Differences between pre-test and post-test scores for the Hand Grip Dynamometer and CAHAI-13 were analysed using the paired Student's t-test, as the same participants were evaluated before and after the intervention. A p-value of <0.05 was considered statistically significant. Statistical analysis was performed to determine the effectiveness of the combined mirror therapy and task-oriented exercise programme in improving hand grip strength and functional hand performance among post-stroke patients.

RESULTS

A total of 30 post-stroke patients completed the 8-week intervention programme comprising mirror therapy combined with a task-oriented approach, and all participants were included in the final analysis. Hand grip strength and upper limb functional performance were assessed before and after the intervention using the Hand Grip Dynamometer and the Chedoke Arm and Hand Activity Inventory (CAHAI-13), respectively.

Hand Grip Strength

Hand grip strength demonstrated a marked improvement following the intervention. The pre-intervention scores ranged from 16.8 to 42.4 kg, whereas the post-intervention scores ranged from 36.5 to 82.9 kg. Almost all participants showed higher post-treatment grip strength than at baseline, indicating improved muscle strength and motor recovery of the affected upper limb after the 8-week rehabilitation programme (Table 1).

Outcome Measure	Pre-intervention	Post-intervention
Hand Grip Dynamometer	16.8–42.4 kg	36.5–82.9 kg

Table 1. Comparison of Hand Grip Strength Before and After the 8-Week Intervention

Functional Hand Performance

Functional performance assessed using the CAHAI-13 also showed substantial improvement after the intervention. Baseline scores ranged from 19 to 38, while post-intervention scores ranged from 59 to 89. Participants demonstrated better performance in activities requiring coordinated upper limb function, reflecting improvements in hand dexterity, bilateral arm function, and the ability to perform activities of daily living independently (Table 2). Overall, the findings indicate consistent improvements in both hand grip strength and functional hand performance following the combined mirror therapy and task-oriented exercise programme.

The observed improvements suggest that the intervention contributed to enhanced upper limb motor function and functional independence among post-stroke patients.

Outcome Measure	Pre-intervention	Post-intervention
CAHAI-13	19–38	59-89

Table 2. Comparison of CAHAI-13 Scores Before and After the 8-Week Intervention

DISCUSSION

The present study was conducted to evaluate the effectiveness of mirror therapy combined with a task-oriented approach in improving hand function among post-stroke patients. Thirty participants with upper limb motor impairment completed an eight-week rehabilitation programme, and outcomes were assessed using the Hand Grip Dynamometer and the Chedoke Arm and Hand Activity Inventory (CAHAI-13). The findings demonstrated a significant improvement in hand grip strength and functional hand performance following the intervention, indicating that the combined rehabilitation programme effectively enhanced upper limb motor recovery and functional independence in stroke survivors.

Stroke frequently results in impaired upper extremity function due to muscle weakness, spasticity, reduced coordination, sensory deficits, and diminished motor control, all of which substantially limit an individual's ability to perform activities of daily living (ADLs) independently [1]. Restoration of hand function is therefore considered a primary goal of stroke rehabilitation because the upper limb plays a crucial role in self-care, occupational activities, and social participation. The significant improvements observed in the present study suggest that combining mirror therapy with task-oriented exercises can effectively facilitate motor recovery and functional improvement in post-stroke patients.

Mirror therapy is based on the principle of visual feedback and neuroplasticity, whereby observing the reflection of movements performed by the unaffected limb creates the visual illusion that the affected limb is moving normally. This visual illusion stimulates the mirror neuron system and promotes cortical reorganization, thereby enhancing motor recovery of the affected upper limb [6,12]. Repeated visual stimulation may reduce learned non-use, improve motor planning, and facilitate activation of the damaged motor cortex. The improvement in hand grip strength and functional performance observed in the present study may therefore be attributed, in part, to the neuroplastic changes induced by repeated mirror therapy sessions [23].

Task-oriented training complements mirror therapy by emphasizing repetitive practice of meaningful, goal-directed activities that closely resemble everyday functional tasks. Unlike conventional therapeutic exercises that primarily focus on isolated muscle strengthening, task-oriented rehabilitation encourages patients to actively engage in functional activities such as grasping objects, drinking water, buttoning clothes, combing hair, and manipulating household items [4,24]. Repetitive performance of these meaningful tasks promotes motor learning, improves coordination, enhances dexterity, and facilitates the transfer of newly acquired motor skills into daily activities. The significant improvement in CAHAI-13 scores observed in the present study reflects enhanced functional ability and greater independence in performing activities of daily living. The findings of the present study are consistent with those reported by Shaker et al. [2], who demonstrated significant improvements in hand function, grip strength, wrist mobility, and upper limb motor performance among chronic stroke patients receiving mirror therapy. Their study concluded that mirror therapy effectively enhances cortical activation through visual feedback mechanisms, thereby improving upper extremity function. Similar improvements were observed in the present study following the integration of mirror therapy with structured task-oriented exercises. The present findings are also in agreement with those reported by Yavuzer et al. and Altschuler et al., who described mirror therapy as a simple, inexpensive, and patient-centred rehabilitation technique capable of improving upper extremity motor recovery following stroke [2]. Because mirror therapy requires minimal equipment and can easily be incorporated into both hospital- and home-based rehabilitation programmes, it represents a practical intervention for long-term stroke rehabilitation.

Participants in the present study demonstrated progressive improvement throughout the intervention period, further supporting the clinical usefulness of mirror therapy in improving hand function. Similarly, the systematic review by Peraki et al. [10] reported that activity-based task-oriented interventions significantly improved upper extremity function, occupational performance, and independence in stroke survivors. Their findings suggested that repetitive practice of meaningful functional activities facilitates motor relearning and enhances performance of activities of daily living. The improvements observed in the present study closely support these findings, as participants demonstrated better grip strength, improved finger coordination, and enhanced functional hand use following task-oriented training.

The present findings are further supported by Fernández-Solana et al. [5], who demonstrated that combining mirror therapy with cognitive therapeutic exercises resulted in greater improvements in upper limb function, joint mobility, and sensory recovery than conventional rehabilitation alone. Likewise, Luo et al. [14] concluded through a systematic review and meta-analysis that combining mirror therapy with other rehabilitation interventions produced superior functional outcomes compared with isolated therapeutic approaches. The positive outcomes observed in the present study may therefore be attributed to the complementary effects of visual feedback provided by mirror therapy and repetitive functional training achieved through the task-oriented approach. The progressive rehabilitation protocol adopted in the present study may also have contributed substantially to the observed improvements. Participants progressed from simple active range-of-motion exercises during the initial weeks to resistance training, proprioceptive neuromuscular facilitation (PNF), fine motor activities, and functional task practice during the later stages of the programme. The gradual progression in exercise intensity likely promoted muscle strengthening, improved joint stability, enhanced coordination, and increased motor control while minimizing fatigue and the risk of injury.

Progressive overload remains one of the fundamental principles of neurological rehabilitation and has been shown to facilitate neuroplastic adaptation and functional recovery following stroke [3]. Another important aspect of the intervention was the inclusion of activities directly related to daily living, such as eating with a spoon, drinking water, buttoning a shirt, and combing hair.

Practising these meaningful activities may have increased patient motivation and engagement while simultaneously promoting functional independence. Improvements in CAHAI-13 scores indicate that participants became increasingly capable of performing bilateral upper limb activities independently following completion of the rehabilitation programme [21]. Hand grip strength is widely recognized as an important indicator of upper limb function and overall physical performance in stroke survivors. Improved grip strength enables patients to manipulate objects more effectively, enhances manual dexterity, and contributes to greater independence in daily activities. Previous studies have also reported that hand grip strength is associated with overall functional recovery, quality of life, and long-term prognosis among stroke patients [20,22]. Therefore, the significant improvement in grip strength observed in the present study represents not only increased muscular strength but also meaningful functional recovery of the affected upper extremity. Despite these encouraging findings, several limitations should be acknowledged. The study included a relatively small sample size of only 30 participants and employed a convenience sampling technique, which may limit the generalizability of the findings. Furthermore, the absence of a control group makes it difficult to determine the individual contribution of mirror therapy and task-oriented exercises to the observed improvements. The intervention period was limited to eight weeks, and no long-term follow-up assessment was performed to determine whether the functional gains were maintained over time.

Future studies should include larger sample sizes, randomized controlled trial designs, multicentre recruitment, and extended follow-up periods to further establish the long-term effectiveness of combined mirror therapy and task-oriented rehabilitation in stroke recovery. Overall, the findings of the present study indicate that combining mirror therapy with task-oriented exercises is an effective rehabilitation strategy for improving hand grip strength, motor performance, coordination, and functional independence in post-stroke patients. The integration of visual feedback with repetitive functional task practice appears to enhance neuroplasticity and accelerate upper limb recovery. Consequently, this combined therapeutic approach may be recommended as a valuable component of comprehensive stroke rehabilitation programmes aimed at maximizing upper extremity function and improving the quality of life of stroke survivors [2,5,10,14].

Conclusion:

The present study evaluated the effectiveness of mirror therapy combined with a task-oriented approach in improving hand function among post-stroke patients. Following an 8-week intervention programme, participants demonstrated significant improvements in hand grip strength and functional hand performance, as evidenced by the Hand Grip Dynamometer and Chedoke Arm and Hand Activity Inventory (CAHAI-13) scores. These findings indicate that the combined rehabilitation programme effectively enhanced upper limb motor recovery and improved the ability to perform activities of daily living. Mirror therapy provides visual feedback that stimulates cortical reorganization and promotes neuroplasticity, while task-oriented exercises facilitate motor relearning through repetitive, meaningful, and goal-directed functional activities. The integration of these two interventions appears to produce complementary therapeutic effects, leading to improvements in grip strength, finger dexterity, coordination, and functional independence among stroke survivors. The progressive exercise protocol adopted in this study enabled participants to gradually regain upper limb strength and functional ability, highlighting the importance of structured rehabilitation programmes in stroke recovery. The observed improvements suggest that combining mirror therapy with task-oriented training may be an effective, practical, and cost-efficient rehabilitation strategy that can be incorporated into routine physiotherapy practice for individuals with post-stroke upper limb impairment.

Although the study yielded encouraging results, its findings should be interpreted in light of certain limitations, including the relatively small sample size, convenience sampling technique, absence of a control group, and lack of long-term follow-up. Future research should include larger randomized controlled trials with extended follow-up periods to further establish the long-term effectiveness of this combined intervention and determine optimal treatment protocols for enhancing upper limb recovery after stroke. In conclusion, the present study demonstrates that mirror therapy combined with task-oriented exercises is an effective rehabilitation intervention for improving hand grip strength, hand function, and functional independence in post-stroke patients. Incorporating these evidence-based interventions into comprehensive stroke rehabilitation programmes may facilitate motor recovery, enhance participation in activities of daily living, and ultimately improve the overall quality of life of stroke survivors.

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