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The Effect of Motor Relearning Program in Improving Upper Limb Functions in Stroke – A Literature Review

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ABSTRACT:

This review was conducted to critically evaluate the existing literature on the application of motor relearning programs in rehabilitation programs for stroke survivors, providing evidence-based insights that can lead to more individualized rehabilitation interventions and potentially improve upper limb function in stroke survivors.

Databases, including the Cochrane Library, Google Scholar, and PubMed, were searched for published papers from 2017 to 2023. We evaluated the effect of a motor relearning program on the improvement of upper limb function in patients with chronic stroke. The review covered 78 articles, 4 of which were obtained from PubMed and Cochrane, comprising 4 randomised controlled trials. The motor relearning program led to notable improvements in upper limb functions among post-stroke patients. Research indicates that MRP significantly improves upper limb activities, reduces upper limb spasticity more effectively than proprioceptive neuromuscular facilitation. These findings affirm MRP's valuable role in stroke rehabilitation, promoting better recovery and functional independence. However, the findings are limited by the study's small sample size and narrow age range.

Keywords: Motor Relearning Programme, Neurological Rehabilitation, Stroke Survivors, CVA, Upper limb functions.

Introduction:

Acute neurological events such as strokes are brought on by changes in blood flow to the brain (Abbott et al., 2017). The World Health Organization defines stroke as a neurological deficit resulting from a cerebrovascular cause that lasts longer than 24 hours or results in death within that time (Murphy & Werring, 2020). Stroke claims the lives of about 5.5 million people annually, with South Asia accounting for 20% of recorded cases (Donkor, 2018). It remains the third most common cause of death and disability worldwide and the second leading cause of mortality overall (Donkor, 2018; GBD 2019 Stroke Collaborators, 2021). Ischemic stroke, the most prevalent type, requires both a clinical neurological deficit and evidence of central nervous system infarction attributable to ischemia (Gaillard et al., 2025). Stroke has emerged as a major health concern in the United States, affecting over 795,000 individuals annually and resulting in over 140,000 deaths—nearly one in every twenty deaths nationwide (Mang et al., 2013; Jørgensen et al., 1995; Warraich & Kleim, 2010). As with older populations, ischemic stroke typically accounts for the highest proportion of stroke cases among younger individuals (44–65%), followed by intracerebral hemorrhage (17–39%) and subarachnoid hemorrhage (16–20%) (Balci et al., 2011; Renna et al., 2014; Putaala, 2020). Etiologically, most premature ischemic strokes are classified as cryptogenic (24–53%), followed by cardioembolism (10–34%), large artery atherosclerosis (4–29%), and small vessel disease (12–26%) (Balci et al., 2011; Renna et al., 2014; Putaala, 2020). Cervicospinal dissection is particularly significant, causing up to 35% of ischemic strokes among young individuals (Ebrahimi et al., 2011; Leys et al., 2002; Kappelle et al., 1994). Among young patients with cryptogenic strokes, a patent foramen ovale (PFO) is present in 40–56% of cases, alongside high rates of hyperlipidemia, hormonal contraceptive use, and migraines with aura—all of which may interact with PFO to elevate stroke risk (Hart et al., 2017; Freilinger et al., 2012; Putaala et al., 2025).

A motor relearning program is a stroke rehabilitation approach designed to retrain patients in controlled muscle actions and movement components through task-specific practice aimed at improving motor control. This method focuses on fostering active movement control via repetitive practice and constructive feedback. The methodology consists of four key phases: (1) analyzing the fundamental components of the task, (2) practicing the missing component when the patient lacks control over necessary muscles—this component is worked on separately before integration, (3) practicing the complete task, and (4) facilitating the transfer of skills to real-life settings. Recovery of lost motor functions is supported by engaging in context-specific motor tasks, such as reaching for a glass, paired with performance feedback. Additionally, practicing these activities in environments where sensory input influences performance is essential (Carr & Shepherd, 1998; Carr & Shepherd, 1989).

Materials and Methods:

In this literature review, the selection of studies was collected from Cochrane Library trials, PubMed Central, and Google Scholar. Results Yielded from PubMed Central –(1)

Google Scholar (3). Totally 78 Articles ended up with a Keywords-Motor relearning Programme, balance and posture, stroke, rehabilitation, and activities of daily living. All articles are scrolled between the years 2017 to 2023

Inclusion and Exclusion Criteria

Studies such as Clinical trials, randomized-controlled trials have been included, excluding reviews, case reports, and Meta-analysis articles. Only the population of stroke survivors has been included, which is of both ischemic/hemorrhage type of onset. Any location of lesion was included, provided there should not be cognitive and visuospatial deficit. Survivors at acute, sub-acute and chronic stages of stroke were included. Study was selected based on type of study design, title and abstract with relevance to review, participants of stroke survivors, inclusion, and exclusion criteria was focused and finally the refined article was completely assessed for reviewing. Article that does not full fill the criteria with this review were excluded. Reports, which are free to assess, were examined.

Types of intervention

Studies that involved MRP exercise were included. Any other exercises combined with MRP were also included, excluding studies where the modalities are combined.

Results:

Table-1: Demographic Characteristics of Population

Author	Population with Upper Limb Spasticity	Intervention Group	Controle Group
Syed Ali et al.,	Age, 45 to 70, including both males and females who have had a right MCA stroke for reducing the spasticity of the upper limb, have been for the study	N=80, This group received the Motor Relearning Program(MRP) along with routine physiotherapy for an 8 week with sessions 3 times per week each lasting 45 mins.	N = 80, This group received Neurodevelopmental Treatment (NDT) along with the same baseline physiotherapy for 8 weeks .
Uswatun et al .,	Sample size from the age category of 35 to 65 including both males and females who has haemmorhagic and non haemmprhagic stroke for improving the ADL,s has taken for the study	N=20 All patients underwent the MRP with ADL abilities measured before and after the intervention.	No patients were assigned to alternate treatment or no treatment
Suraj B et al.,	Subjects who were Stroke cases, impaired functional mobility like flexibility and dependency, Deficits in upper limb and lower limb functions, with both the gender and any side was included in this study.	N=30, This group received task specific neuro physiologically based motor relearning{MRP} for six weeks and four sessions per week	N=30, this group received conventional training like standard rehabilitation ,passive movements , gym exercises, assisted training, weight bearing exercises, electrical stimulation, for six weeks and four sessions per week
Anmol Narang et al.,	Patients aged 40–65 years, both males and females diagnosed with ischemic and hemorrhagic stroke, with unilateral stroke, duration between 1 to 6 months,MMSE score >23 and Brunnstrom stage 4 and 5, were included in the study.	N=15, this group received motor relearning program{MRP} combined with conventional therapy . N=15,this group received mirror therapy combined with CPT for 8 weeks 1 hour per session and 5 sessions per week.	N=15,this group received only conventional physiotherapy for 8 weeks 1 hour per session and 5 sessions per week

Author	Outcome measure	Results	P-value significant/non-significant	Effect of stroke
Syed Ali et al.,	Modified Ashworth Scale (MAS)	The pretest Mean Modified Ashworth Scale spasticity level patients is 2.73±0.640 and after 4 weeks it has reduced to the mean spasticity of MRP group was 1.48±0.640	significant	Upper limb spasticity in stroke patients
Uswatun et al .,	Modified barthel index (MBI)	Pre Intervention (80%) were moderately dependent in daily activities, after 12 MRP sessions, dependency levels improved significantly. Only 30% remained moderately dependent, while 50% minimally dependent and 20% achieved full independence.	significant	ADLs in post stroke patients
Suraj B et al.,	Modified barthel index (MBI), Motor assessment scale for stroke	Improving funtional mobility of upper and lower limb in post stroke patients. the Motor Relearning Programme (MRP) group showed a statistically significant improvement in functional mobility compared to the conventional training group (p < 0.001). Both groups improved, but MRP had greater effectiveness based on Modified Barthel Index and Motor Assessment Scale scores.	significant	functional mobility, flexibility of upper and lower limb of stroke patients
Anmol Narang et al.,	Motor assesment scale(MAS),Chedoke Arm And Hand Activity InventoryScale (CAHAI), Fugl Meyer Assessment of physical performance of UpperExtremity (FMA-UE) Scale.	functional ability and sensorimotor impairment in post-stroke patients. after 8 weeks of MRP	significant	Upper extremity motor function, and sensorimotor impairment in post-stroke patients

DISCUSSION:

The main focus of the review was to investigate the effects of the motor relearning programme in stroke patients. The research discussed various rehabilitation approaches aimed at enhancing upper limb function and daily living activities in poststroke patients. Studies compared the Motor Relearning Program (MRP) with other techniques such as Neurodevelopmental Treatment (NDT), conventional training, and combinations like mirror therapy with MRP.

Uswatun Hasanah and colleagues explored the impact of a motor relearning program (MRP) on the daily living activities of post-stroke patients in Makassar. The study highlighted that the MRP significantly improved patients' abilities to perform daily tasks independently. This program focuses on repetitive task-specific training which enhances motor control and coordination. Patients showed marked improvement in their functional abilities, suggesting that MRP is an effective rehabilitation strategy for enhancing the quality of life in post-stroke patients (uswatun hasanah et al .,2019)

Syed Ali Behram Subazwari and his team conducted a randomized control trial to compare the effects of Neurodevelopmental Treatment (NDT) and Motor Relearning Program (MRP) on upper limb spasticity in chronic stroke patients. The results indicated that both NDT and MRP effectively reduced

spasticity, but MRP showed a slightly superior impact in enhancing upper limb function. The study concluded that incorporating MRP into rehabilitation plans could be more beneficial for managing spasticity and improving motor function in chronic stroke patients(syed ali et al .,2022)

Suraj B. Kanase examined the effects of the Motor Relearning Programme (MRP) compared to conventional training on functional mobility in post-stroke patients. The study demonstrated that patients undergoing MRP showed greater improvement in mobility and functional performance compared to those receiving conventional training. The results underscore the advantage of MRP in post-stroke rehabilitation, emphasizing its role in facilitating faster and more effective recovery of functional mobility(suraj b kinase et al.,2020)

Anmol Narang and team tell that the Stroke affects not only physical and neurological functions but also causes emotional distress. This study aimed to enhance upper limb abilities to improve quality of life. Unlike earlier small-scale studies, this research with a larger sample (n=45) found the Motor Relearning Programme (MRP) more effective than Mirror Therapy (MT) or conventional methods. The findings align with previous studies showing MRP's superiority in improving hand function and reducing disability in stroke patients(anmol narang et al .,2023)

CONCLUSION:

The studies collectively highlight the efficacy of the Motor Relearning Program (MRP) in enhancing upper limb functions in stroke patients. Research indicates that MRP significantly improves upper limb activities, reduces upper limb spasticity more effectively than Neurodevelopmental Treatment, and enhances mobility better than conventional therapy.

Additionally, MRP demonstrates superior outcomes compared to conventional training in boosting functional mobility. The combination of MRP with other techniques like conventional therapy and mirror technique also shows greater improvements in upper limb functions than either approach alone. These findings affirm MRP's valuable role in stroke rehabilitation, promoting better recovery and functional independence.

CONFLICT OF INTEREST:

The authors declare no conflict of interest related to this study.

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