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Research Article

To Compare The Effect Of Mental Imagery Technique And Conventional Rehabilitation On Upper Limb Function In Patients With Stroke.

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ABSTRACT

Background: Paresis of the upper extremity after a stroke limits the overall function of patients. Mental imagery involves the active process through which individuals relive sensations, whether prompted by external stimuli or occurring spontaneously. The incorporation of mental imagery, based on the concept of neuroplasticity, presents itself as a hopeful complement to traditional physiotherapy.

Objective: To compare the effectiveness of mental imagery training and conventional rehabilitation in patients with stroke**.**

Method: In the present study, 32 participants of age group 50 ± 10 years, medically diagnosed with stroke were included. Random sampling was done in two group, group A (n=16) and group B (n=16) giving mental imagery training and conventional rehabilitation respectively. Outcome measures used were FMA, ARAT, STREAM, FIM.

Results: In present study, mental imagery training was more effective than conventional rehabilitation statistically proved with unpaired t test of FMA (p=0.0455) and STREAM (p=0.0337). When comparison was done within the groups, all outcome measures showed significant values at pre and post intervention, FMA (p= <0.0001in A & B), ARAT (p=<0.0001 in A and 0.0006 in B), STREAM (p=<0.0001in A & B) And FIM (p=<0.0001in A & B).

Conclusion: Mental imagery training showed more effect than conventional rehabilitation in stroke patients. MI training was able to generalize what they had learned to the new situation better than the CR group and also showed enhancement in relearning potential of people.

Introduction:

Stroke is a sudden disruption of blood supply to the brain. It is the second leading cause of death worldwide and was responsible for an estimated 6.5 million deaths and 113 million Disability Adjusted Life Years (DALYs) in 2013.[1] In a recent study published by the ICMR, stroke ranked fifth in terms of (DALY) in 2016. [2] Stroke, remains a significant global health concern, contributing to substantial morbidity and mortality. Among its many aftereffects, upper limb impairment is a common and profound challenge faced by stroke survivors. [2-5] Stroke-induced upper limb dysfunction arises from the complex interplay of neurological and musculoskeletal impairments. Ischemic or haemorrhagic strokes can damage specific regions of the brain responsible for motor control and coordination, leading to weakness, spasticity, and altered muscle tone in the upper extremities.

This impairment not only impedes basic activities of daily living but also hinders social participation and engagement.[6,7] Physiotherapy plays a pivotal role in the multidisciplinary management of stroke, focusing on restoring motor function, improving mobility, and enhancing overall quality of life. Various physiotherapeutic approaches are employed to address upper limb impairments are Task-Specific Training, Neuromuscular Electrical Stimulation, Constraint-Induced Movement Therapy, Mirror Therapy etc.[7-13] Following a stroke, these therapies can restore upper limb function when used methodically. However, the quest for more effective and holistic approaches to rehabilitation has led to the exploration of adjunctive therapies, and mental imagery has emerged as a promising avenue.

Mental Imagery is the representation and corresponding sensory experience of information without a direct external stimulus.[14] Such representations are recalled from memory and lead one to re-experience a version of the original stimulus or some novel combination of stimuli. Mental imagery engages neural networks associated with motor planning and execution, offering a unique avenue to stimulate brain plasticity and enhance motor recovery. The process of mental imagery involves the creation and manipulation of mental images related to a specific movement or task. Stroke survivors can mentally visualize themselves performing activities that challenge their upper limb function. This cognitive rehearsal activates the same neural pathways involved in actual motor execution, fostering neuroplastic changes that support functional recovery. Several studies have underscored the potential benefits of incorporating mental imagery into stroke rehabilitation programs. [14-19] For example, a randomized controlled trial demonstrated mental imagery combined with traditional physiotherapy led to greater improvements in upper limb function compared to conventional physiotherapy alone[14].Similarly, an investigation by Braun et al. highlighted the positive impact of mental imagery on motor function and daily living activities in stroke survivors [20]. The integration of mental imagery into stroke rehabilitation programs holds the potential to amplify the benefits of traditional interventions. The study aims on assessing the effects of mental imagery techniques in comparison to traditional rehabilitation methods on the movement of the upper limb in individuals recovering from a stroke.

Methodology:

The study was designed as a randomized trial, incorporating both male and female participants (32 individuals medically diagnosed with stroke). The research objective was clearly communicated, and participants underwent a comprehensive screening process based on predetermined inclusion and exclusion criteria - First episode of stroke, an age range of 50 ± 10 years, and a specific Action Research Arm Test (ARAT) score criteria between 3 and 51, with a maximum score of 57, indicating persistent motor weakness with preserved ability to make some movement with the affected arm. On the other hand, exclusion criteria were- individuals with alcohol dependency or substance abuse, severe cognitive impairment as indicated by a Mini-Mental Score of less than 20, severe aphasia, and those with bilateral stroke.

Subsequently, the participants were categorized into two groups: Group A (Mental Imagery Group) and Group B (Control Group), through a randomized allocation process. Written consent was then obtained from all participants after their inclusion and before the initiation of the treatment sessions. An assessment of the ability to engage in mental practice was conducted using MMSE.

Procedure:

Both the groups received treatment session for 45 min per session, 5 sessions per week for 3 weeks. Before the commencement of the study written consent was obtained from the participants. For Group A an introductory session was given covering theoretical background and demonstration of standardized techniques used in mental imagery. In the treatment sessions the participants were encouraged to 1) Analyse the task i.e Break down the targeted tasks into components for a detailed understanding. 2)Identify the problem i.e Identify specific issues or challenges associated with the tasks. 3)Task Performance through Mental Imagery: Engage participants in mentally rehearsing tasks and visualizing task performance. This was followed by performing tasks that included basic movements, goal-directed actions, and daily activities. For group B conventional session included focusing on spasticity reduction, range of motion exercises peg board activities followed by goal-directed actions and daily activities.

Table 1: Group Intervention

PROTOCOL	Group A	Group B
Duration	3 weeks of training, 5 sessions per week, each lasting 45 minutes	3 weeks of training, 5 sessions per week, each lasting 45 minutes
Task	• Training focused on task analysis, problem identification, and task performance through mental imagery. • Tasks included basic movements, goal-directed actions, and daily activities.	• Treatment included muscle relaxation, proprioceptive neuromuscular facilitation. Active range of motion exercises and peg board activities. • Followed by basic movements, goal-directed actions, and daily activities.

Discussion:

Stroke, a leading cause of long-term disability, demands innovative rehabilitation strategies to optimize recovery. This study aimed to compare the effects of mental imagery combined with task-oriented exercises (Group A) against conventional physiotherapy, including task-oriented exercises (Group B), on stroke patients' recovery. The comprehensive analysis of the results provides valuable insights into the potential benefits and mechanisms underlying the observed improvements.
Demographic Characteristics: The demographic information revealed a well-distributed sample across both groups, enhancing the generalizability of the findings. The mean age, gender distribution, and dominance characteristics were balanced, minimizing confounding factors related to these demographic variables.

Group A:

FMA[21] and ARAT[22]: The observed significant improvements in the Fugl-Meyer Assessment (FMA) and Action Research Arm Test (ARAT) scores in Group A indicate enhanced motor function. Mental imagery's role in activating neural substrates related to motor planning and execution likely contributed to these improvements.
STREAM[23] and FIM[24]: The statistically significant improvements in Stroke Rehabilitation Assessment of Movement (STREAM) and Functional Independence Measure (FIM) scores further support the overall enhancement in motor and functional abilities in Group A. Mental imagery's influence on task-related brain activity may have facilitated the re-establishment of motor patterns, leading to improved functional independence.[25-28]

Group B:

MMSE: Group B's improvement in MMSE scores suggests that conventional physiotherapy, with task-oriented exercises, also positively influenced cognitive function. Task-oriented exercises, focusing on real-world activities, may have contributed to cognitive gains. [29-34]
FMA, ARAT, STREAM, and FIM: The significant improvements in FMA, ARAT, STREAM, and FIM scores in Group B highlight the effectiveness of conventional physiotherapy in promoting motor and functional recovery. Task-oriented exercises are known to engage multiple brain regions, promoting neural plasticity and functional adaptation. [25,35-37]

Comparison between Group A and Group B:

Paired t-Test: Both groups demonstrated statistically significant improvements in all outcome measures, emphasizing the effectiveness of their respective interventions. The within-group analysis underscores the positive impact of mental imagery in Group A and conventional physiotherapy in Group B.
Unpaired t-Test: While no significant differences were found in the pre-treatment values between the groups, post-treatment comparisons revealed that Group A showed more significant improvements in FMA and ARAT scores. This suggests that the combination of mental imagery with task-oriented exercises may offer additional benefits in specific aspects of motor recovery.

Mechanisms of Improvement:

Mental Imagery and Task-Oriented Exercises (Group A): The improvement observed in Group A could be attributed to several factors. Mental imagery engages brain regions associated with motor planning and execution, activating the same neural pathways as physical movement. [33,37-40] The synergy between mental imagery and task-oriented exercises likely led to enhanced neural activation, facilitating the relearning of motor skills and improving overall motor and cognitive functions. [41-44]

Conventional Physiotherapy with Task-Oriented Exercises (Group B): Group B's improvements may be explained by the principles of neuroplasticity. Task-oriented exercises stimulate the brain by replicating real-world activities, promoting the reorganization of neural networks and functional adaptation. [22,44-47] The engagement of motor-related brain regions during physical practice contributes to the observed motor and functional gains.

Clinical Implications: Mental imagery, when combined with task-oriented exercises, emerges as a promising adjunct to conventional physiotherapy. The integration of mental imagery into rehabilitation protocols may provide a neurologically enriched environment, potentially accelerating recovery and improving overall outcomes.

Limitations and Future Scope: Despite the promising results, certain limitations should be acknowledged. The study's duration and follow-up period were relatively short, limiting the understanding of long-term effects. Future research with extended follow-up periods could elucidate the sustainability of observed improvements. Additionally, exploring the individualized responses to mental imagery and task-oriented exercises may guide personalized rehabilitation approaches.

Conclusion:

In conclusion, this study contributes valuable insights into the comparative effectiveness of mental imagery with task-oriented exercises and conventional physiotherapy with task-oriented exercises in stroke rehabilitation. Both interventions demonstrated significant improvements, highlighting their potential in enhancing cognitive, motor, and functional outcomes. The observed superiority of Group A in certain motor aspects suggests the added value of mental imagery. Integrating mental imagery into rehabilitation protocols holds promise for optimizing stroke recovery, but further research is warranted to refine protocols and establish long-term efficacy.

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