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Longitudinal Effects and Retention of Gains after Intensive Task-Oriented Training in Subacute Stroke: A Randomized Controlled Trial

[1]Dr.Sakshi Runwal, [2] Rutuja Jadhav , [3]Shivam Gire, [4] Vaibhav Kandekar, [5] Akshay Tayade

[1] Post Graduate, Department of Neuro Physiotherapy, MGM School of Physiotherapy, Chh Sambhaji Nagar, A Constituent Unit of MGMIHS, Navi Mumbai, Maharashtra.

[2]BPT Intern ,Department of Physiotherapy ,Aurangabad college of physiotherapy

[3]Final year student ,MGM School of Physiotherapy, Chh Sambhaji Nagar, A Constituent Unit of MGMIHS, Navi Mumbai, Maharashtra.

4Intern ,MGM School of Physiotherapy, Chh Sambhaji Nagar, A Constituent Unit of MGMIHS, Navi Mumbai, Maharashtra.

[5] Intern ,MGM School of Physiotherapy, Chh Sambhaji Nagar, A Constituent Unit of MGMIHS, Navi Mumbai, Maharashtra.

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ABSTRACT

Background: Stroke often leaves survivors with significant challenges in mobility, balance, and independence. Rehabilitation that focuses on meaningful, real-life activities may help the brain recover more effectively through neuroplasticity.

Objective: This study aimed to examine the longitudinal effects and retention of gains following intensive task-oriented training in individuals with subacute stroke.

Methods: Thirty participants with subacute stroke were randomly assigned to either an experimental group receiving intensive task-oriented training or a control group receiving conventional physiotherapy. Training was provided for 4 weeks, 5 days per week. Outcome measures included the Fugl-Meyer Assessment (FMA), Berg Balance Scale (BBS), Timed Up and Go Test (TUG), Functional Independence Measure (FIM), and Modified Ashworth Scale (MAS), assessed at baseline, post-intervention, and at 3-month follow-up.

Results: The experimental group showed significant improvements in motor recovery, balance, and functional independence compared to the control group ($p < 0.05$). Participants retained most of these gains at the 3-month follow-up, indicating lasting benefits. A small decline in some scores was observed but was not clinically significant.

Conclusion: Intensive task-oriented training leads to meaningful and sustained improvements in motor function and daily living after stroke. By engaging patients in purposeful activities, rehabilitation becomes not only a process of physical recovery but also a pathway to renewed confidence and independence.

Keywords : Stroke, Task oriented Training.

I. INTRODUCTION

Acute and localized neurological impairment, clinically identified as a stroke, results from vascular harm to the CNS. Globally, it stands as one of the main reason for death in addition to impairment. Stroke isn't just one condition—it develops from a combination of factors, complex biological processes, and various health issues. High blood pressure plays a key role in its development, although its impact differs depending on the type of stroke. The most frequent type of ischemic strokes (85%) stems from large artery atherothromboembolism, cardioembolism, and small vessel arteriolosclerosis. For younger people, ischemic strokes can result from multiple factors such as extracranial dissection. Intracerebral hemorrhage makes up 15% of strokes worldwide. Deep (basal ganglia, brainstem), cerebellar, or lobar regions are where these strokes occur. Deep cerebral hemorrhages are most often attributable to deep perforator (hypertensive) arteriopathy (arteriolosclerosis), while lobar hemorrhages stem more so from cerebral amyloid angiopathy or arteriolosclerosis (1).

The word 'stroke' was first documented as an everyday term in 1599, where it described the acute onset of symptoms as a 'stroke of God's hande'. But it did not feature in medical terminology then, since doctors employed the term 'apoplexy', a disease that went back to the days of Hippocratic works. Although the Greek word "apoplexia" means to be struck by a mortal blow, to equate it directly with contemporary definitions of stroke would be misleading [2].

Stroke is an increasing global health burden. It is the 2nd most prevalent cause of death in middle-to high-income nations and the most prevalent reason for adult-acquired physical disability in the world [1]

Stroke is a significant general health issue throughout the world. As per the GBD study, stroke was the second most controlling cause of death around the globe in 1990. Further extensions to the GBD study informed us about increased stroke deaths rising from 4.66 million in 1990 to some 5.87 million in the year 2010, corresponding to an overall 26% increase across twenty years. [3]

Stroke is charectarized as a sudden neurological disturbance caused by impaired blood flow to the brain. Ischemic stroke occurs due to decreased oxygen and blood supply to the brain, and in hemorrhagic stroke occurs as a reason of bleeding or vascular rupture. Approximately 85% of stroke cases involve ischemic occlusions, while intracerebral hem0rrhage accounts for the remaining cases. Ischemic occlusions lead to thrombotic and embolic conditions within the brain(4).

The two main types of cerebrovascular accidents are ischemic and hemorrhagic strokes. In ischemic strokes, cerebral artery obstruction results in at least 80% blockage of the vessel. Conversely, hemorrhagic strokes occur due to vascular rupture [6] Hemorrhagic strokes are further classified into SAH and ICH. Factors such as myocardial infarctions, hypertension, and thrombolytic use significantly enhance the hazard of hemorrhagic stroke. Patients often present with severe headaches, vomiting, and elevated blood pressure. These acute symptoms are primarily associated with hemorrhagic strokes, though they may occasionally appear in other stroke types(5).

Ischemic strokes arise from three primary mechanisms: embolism, hypoperfusion, and thrombosis, with thrombosis being the most common. Symptoms of ischemic strokes develop gradually over several hours, differing from the acute onset of hemorrhagic strokes. Patients may exhibit paresthesia, ataxia, paralysis, vomiting, and visual disturbances, with symptom severity varying based on lesion location [6]

Nonmodifiable risk indicators for stroke are sex, length of life, race, and hereditary, as stroke is often linked to aging. Modifiable risk factors can be grouped into behavioral and medical types. Common examples of these include smoking, high blood sugar levels (as seen in diabetes), elevated blood pressure, and abnormal cholesterol levels [7].

Post-stroke fatigue is a prevalent issue, affects almost 29- 72% of stroke patients. (1) The most common type, peripheral fatigue, impairs sensory-motor functions, impacting muscles and motor units. Stroke survivors frequently experience dependency on others for daily activities due to fatigue. Additionally, fatigue affects their ability to drive, engage in social activities, sleep, and return to work. Research suggests that exercise alleviates post-stroke fatigue and other related issues. Extensive training is necessary for optimal rehabilitation outcomes; however, patient motivation, a main factor in motor skill learning, often declines during rehabilitation. Fatigue may therefore hinder recovery progress [8].

Stroke can lead to fatigue, stiffness, muscle weakness, and motor impairments in the upper extremities (UE), affecting coordination during bimanual object manipulation. Coordination deficits result in dependency for Activities of Daily Living (ADLs). UE coordination exercises,,utilizes the healthy limb to support the retrieval of the weakened limb. Since hand-eye coordination is critical for daily tasks, UE coordination exercises carries crucial importance in stroke rehabilitation. However, current UE exercise designs do not consider fatigue prediction. Anticipating fatigue could improve the duration and intensity of rehabilitation exercises. Motor learning principles suggest that increased repetitions enhance motor learning and its consolidation. Predicting fatigue during rehabilitation and adjusting exercise types could improve recovery outcomes. Consequently, this study intended to evaluate the effects of UE task oriented activities incorporating tiredness estimation on UE sensory, motor abilities and ADLs in long duration stroke survivors [9].

Research Question -What are the longitudinal effects and retention of functional gains following intensive task-oriented training in individuals with subacute stroke?

Aim-

1. To determine the effectiveness of intensive task-oriented training on motor function, gait, balance, and upper/lower limb performance in subacute stroke patients immediately after the

intervention and at 3, 6, and 12 months follow-up.

Research Methodology

1. Study Design: Randomized Controlled
2. Study Type: Experimental
3. Source of Data: Institutional units
4. Sampling Method: Convenient
5. Sample Size: 20
6. Study Duration: 12 months
7. Study Setting: Institutional units, Chhatrapati Sambhajinagar

Inclusion Criteria:

1. Adults with subacute stroke (1–6 months post-onset)
2. Medically stable and able to participate
3. Brunnstorm stage 3 ,4 or 5 of affected side

1. Willing to consent

Exclusion Criteria:

1. Severe cognitive impairment or aphasia
2. Other neurological/orthopedic conditions
3. Uncontrolled medical conditions (e.g., cardiac, hypertension)
4. Previous stroke or recurrent neurological disorder

OUTCOME MEASURES-

1. • Fugl-Meyer Assessment (FMA) – This helped us see how much control and coordination patients regained in their arms and legs. Every small increase here represents a real step toward independence — the ability to hold a cup, comb hair, or walk confidently again.
1. • Berg Balance Scale (BBS) – Balance is often the first thing people lose after a stroke and the hardest to regain. The BBS allowed us to measure how safely and confidently our participants could stand, reach, and move without losing stability.
1. • Timed Up and Go Test (TUG) – This simple test, where patients stand up, walk a few steps, and sit back down, tells us a lot about mobility and confidence. A few seconds less on this test can mean a huge difference in daily life — being able to go to the bathroom alone or move safely in the kitchen.
1. • Functional Independence Measure (FIM) – This captured how independent our participants were in doing everyday tasks like dressing, bathing, or walking. It's not just about physical recovery; it's about living again.
1. • Modified Ashworth Scale (MAS) – We used this to check muscle stiffness. Lower scores here meant more relaxed, controlled movement — making it easier for participants to move without discomfort or resistance.

II. RESULTS -

After 4 weeks of intensive, focused, and meaningful task-oriented training, our participants showed remarkable improvements in both physical ability and functional independence.

1. Motor Recovery: Their arm and leg control improved significantly. Movements that were once slow and uncertain became smoother and more purposeful.
2. Balance: There was a visible boost in stability — participants stood taller, moved with more confidence, and experienced fewer moments of unsteadiness.
3. Mobility: The time it took to perform basic walking tests (TUG) dropped, meaning faster, more natural movement.
4. Independence: Daily activities became easier. Patients reported feeling more capable of handling their routines, from getting out of bed to performing household chores.
5. Spasticity: Muscle stiffness reduced, making movement more fluid and comfortable.

Even more inspiring — these improvements lasted. When we checked again after three months, most participants retained their gains. Some even continued to get better, showing that the brain keeps learning and adapting long after formal therapy ends.

The control group, which received traditional physiotherapy, also improved but not as quickly or as consistently as those who underwent task-oriented training.

III. DISCUSSION

The findings of this study highlight the significant role of intensive task-oriented training in enhancing functional recovery and promoting long-term improvement among individuals with subacute stroke. Participants who engaged in purposeful, repetitive, and meaningful activities demonstrated greater gains in motor performance, balance, and independence compared to those who underwent conventional physiotherapy.

This improvement can be attributed to the principles of neuroplasticity—the brain's ability to reorganize and form new neural connections following injury. When patients repeatedly practice real-life functional movements such as reaching, standing, or walking, the nervous system begins to "relearn" these activities. Over time, these repeated and goal-directed movements reinforce efficient motor patterns, allowing individuals to regain control and coordination in a more natural way.

Beyond the measurable outcomes, many participants reported feeling more confident and independent in their daily lives. Engaging in tasks that were both familiar and meaningful seemed to boost motivation and emotional well-being, which are crucial for long-term adherence to rehabilitation. The improvement observed in their Functional Independence Measure (FIM) scores reflects this transition—from being dependent on assistance to performing activities with greater autonomy.

The retention of improvements seen at the 3-month follow-up further strengthens the idea that functional training leads to lasting change. Even after formal therapy ended, participants maintained most of their progress, suggesting that the benefits of such interventions extend well beyond the therapy setting. The slight decline observed in some measures likely reflects the absence of continued supervised practice, emphasizing the importance of ongoing home exercise and community participation to sustain progress.

Overall, these findings suggest that when rehabilitation is designed to mimic the challenges of everyday life, it becomes not only more effective but also more meaningful. Task-oriented training turns therapy into a journey of rediscovery—helping patients rebuild not just strength and balance, but confidence, identity, and independence.