Original Research Paper

Volume - 15 | Issue - 02 | February - 2025 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Healthcare

TO COMPARE THE EFFECTIVENESS OF TASK ORIENTED TRAINING VERSUS MAT EXERCISES ON MUSCLE STRENGTH AND BALANCE IN POST STROKE PATIENTS

Gurung Rupali MPT-Neurology, Assistant Professor, Department of Physiotherapy, Dolphin (PG) Institute of Biomedical and Natural Sciences, Dehradun, Uttarakhand, India.

Yadav Deepak Heart-Lungs Transplant Physical Therapist, MPT-Cardiopulmonary, Assistant Professor, Department of Physiotherapy, Dolphin (PG) Institute of Biomedical and Natural Sciences, Dehradun, Uttarakhand, India.

Dr Deptee Warikoo HOD, Department of Physiotherapy, DIBNS, Dehradun.

ABSTRACT **Background:** Stroke results in functional impairments across motor, cognitive, and sensory domains, often leading to significant residual deficits. Motor impairment, the most common consequence, is a major focus of rehabilitation, with many new therapeutic strategies emerging for recovery. While research has largely concentrated on lower limb motor recovery due to ease of intervention and mobility considerations, upper limb motor impairment remains a significant challenge that requires continued attention in rehabilitation efforts. **Objectives:** The study aimed to compare the effectiveness of Task Oriented Training with Conventional Therapy versus Mat Exercises with Conventional Therapy to Improve Muscle Strength and Balance in Post Stroke Patients. **Methods:** Thirty acute and sub-acute stroke patients, with stroke onset < 2 weeks, were randomly assigned to two groups (15 each). Group A received task-oriented training with conventional therapy, and Group B underwent MAT exercises with conventional therapy. Muscle strength and balance were assessed using the MAS and BBS. Both groups participated in 45-minute sessions, six days a week, for 8 weeks. Pre- and post-intervention data were compared to evaluate improvements in muscle strength and balance. **Result:** Both groups showed significant improvements, but Group A (task-oriented training with conventional therapy) demonstrated greater gains in muscle strength and balance compared to Group B (MAT exercises with conventional therapy)($p<0.05$). **Conclusion:** Both task-oriented training with conventional therapy and MAT exercises with conventional therapy improved muscle strength and balance in sub-acute stroke patients. However, task-oriented training with conventional therapy resulted in greater improvements in reaching forward, grasping, muscle strength, and balance after 8 weeks of intervention.

KEYWORDS : MAT exercises, Stroke, Task oriented training, Muscle strength, Balance

INTRODUCTION

William Cole introduced the term "stroke" in the 17th century, relating an acute, central nervous system injury producing neurological impairment. Stroke is a leading cause of disability universally.[2]

Stroke is a leading cause of disability universal, with about half of stroke survivors suffering some form of disability. Besides, approximately one-third of all stroke patients experience severe weakness in the arm.[3]

Stroke is the fifth leading cause of disability worldwide, though this ranking likely underestimates the full extent of functional loss, chiefly in low-income countries. It leads to disability through the loss of motor, cognitive, or sensory functions, either individually or in combination.[4] While stroke survivors may familiarize to some deficits, they often face noteworthy residual impairments. Among these, motor damage is the most prevalent and pays the most to functional limitations.[5]

As a consequence, motor recovery has become a primary focus of rehabilitation, with numerous innovative therapeutic strategies emerging in recent years.[6] Research has principally concentrated on lower limb motor impairments, as these interventions are easier to define, outcomes are more easily measured, and mobility is a critical functional goal post-stroke.[7]

There is currently no commonly accepted definition of the task-oriented approach in the literature. This approach views movement as a result of connections between various brain systems, organized around a goal and influenced by environmental constraints.[8] Task-oriented training encompasses a diversity of interventions, including treadmill and walking training, cycling programs, endurance and circuit training, sit-to-stand exercises, and reaching tasks to improve balance.[9] It also includes arm training through functional tasks like grasping objects, constraint-induced movement therapy (CIMT), and mental imagery. This type of training is focused on the task and the patient, rather than the therapist.[10]

The MAT program involves patients in activities that associating both movement and stability.[11,12] These activities range from simple movements, such as unilateral scapular motions, to more complex blending that require both stabilization and movement. Conservative treatment techniques for stroke patients often include principles from Bobath Neurodevelopmental Therapy, Rood's techniques, Brunnstorm Movement Therapy, and Proprioceptive Neuromuscular Facilitation, as established by Knott and Voss.[13,14]

METHODOLOGY

Sample: 30 subjects were included in the study on the basis of inclusion and exclusion criteria.

Source of Subjects: Shri Mahant Indiresh Hospital, Patel Nagar, Dehradun.

Method of sampling: Random sampling

Research Design: Experimental study

Inclusion Criteria

- Age group 40-65 years
- Both male and female
- Survivors of hemorrhagic stroke
- Type of stroke: acute and subacute
- Patients with hemiparesis

Exclusion criteria

- Transient Ischemic Attack
- Patients with hemiplegia
- Parkinson's disease
- Patients with cardiovascular disease like myocardial infarction
- Cognitive impaired patients
- Patients with road traffic accidents.
- Medically unstable patients
- Patients with any orthopedic pathological condition and fracture.
- Patients with other peripheral and CNS dysfunctions.

Outcome Measures:

- Motor Assessment Scale (MAS)
- Berg Balance Scale (BBS)

PROCEDURE

All the participants were explained about the purpose of study. An informed consent was taken from the patients who were willing to participate in the study. Eligible subjects were randomly allocated into two groups.

Group A participants receiving Task Oriented training with

conventional therapy. Group B participants receiving MAT exercises with conventional therapy. MAS & BBS were taken before treatment session and after 8 weeks of therapy. Therapy was given 6 times per week of 45 min for 8 weeks. Therapy for group A and Group B along with conventional therapy included following exercises.

In the task-oriented approach, movement emerges as an interaction between many systems in the brain and is organized around a goal and constrained by the environment (Shumway Cook & Woollcott 2001).

GROUP A: Task oriented training includes a wide range of interventions such as walking, sit-to-stand exercises, and reaching tasks for improving balance.

1. THE REACHING EXERCISE[15,16]
2. THE CYLINDER GRIP EXERCISE[17]
3. THE GRASP EXERCISE[18,19]
4. SIT TO STAND EXERCISES[20,21,22,]
A. Shift Weight Side to Side
B. Seated Leg Lifts
C. Seated Leg Knee Extensions
D. Reaching With Clasped Hands
5. MUSCLE STRENGTH EXERCISES[23,24,25,26]
6. BALANCE EXERCISES

Use of specific activities and movements to maintain, enhance or restore balance. Task-oriented training involves:
- Lifting and maintaining the lower extremity
- Lifting the heels
- Lifting the lower extremity over the footstool followed by lowering
- lifting the lower extremity and lowering in onto a footstool
- Step-ups and down
- Balance beam
- Kicking a ball
- Standing with the base of support constrained, with feet in parallel and tandem conditions reaching for objects, including down to the floor, to improve standing balance
- Reciprocal leg flexion and extension

Ambulation Exercises Promotion and assistance with walking to maintain or restore autonomic and voluntary body functions.
- Walking back and forth over a 3-m distance to a chair; and going back and forth at a constant pace over 10-m distance
- Stand up and walk
- Walk and carry
- Speed walk
- Walk backwards

GROUP B: MAT EXERCISES:
Therapeutic effects of this exercise are to facilitate balance, promote stability, mobilize and strengthen the trunk and limb and train for functional activities.[27]
A. Rolling[28]
B. Prone on elbow[27]
C. Prone on hands[27]:
D. Supine on elbow[28]
E. Pull ups[28]
F. Sitting27[28]
G. Lifting[28]
H. Quadruped Position[27,28]
I. Kneeling[28]

CONVENTIONAL EXERCISES
Conventional occupational therapy included techniques based on Bobath approach. Weight bearing for upper limb, reflex inhibiting patterns, trunk rotation, and scapular protraction were used to reduce spasticity. All the participants were then engaged in performing functional activities. Intervention in both the groups, post treatment evaluation was done by using all the outcome measures. Exercises in conventional therapy included ADL training, stretching, ROM exercises, Strengthening exercise to the affected site.[27]

Data Analysis:
data was analysed with SPSS software, version 23.

RESULTS:
Within group analysis of motor assessment scale showed significant difference when both the Groups were assessed. Between group analysis of berg balance scale showed significant improvement for both the groups individually. When between the group analysis was done on post intervention data Group A had significantly been better than Group B(p=0.32 for MAS, p=0.045 for BBS)

Tab 1. Within Group Analysis For Group A For Both Outcome Measures

		MEAN	N	SD	p VALUE
MAS	PRE	8.93	15	0.489	0.002
	POST	17.80			
BBS	PRE	8.60	15	0.669	0.006
	POST	12.93			

Tab 2. Within Group Analysis For Group B For Both Outcome Measures

		MEAN	N	SD	p VALUE
MAS	PRE	17.80	15	0.489	0.007
	POST	12			
BBS	PRE	20.13	15	2.416	0.003
	POST	26.20			

Tab 3. Between The Group Analysis Of Outcome Measure After 8 Weeks

	GROUP	t	p Value
MAS	GROUP A	0.675	0.032
	GROUP B		
BBS	GROUP A	0.777	0.045
	GROUP B		

DISCUSSION
This study is aimed to assess "The effectiveness of task-oriented training with conventional therapy versus MAT exercises with conventional therapy to improve muscle strength and balance in post stroke patients". The main problems of the hemiparetic patient were considered to be abnormal coordination of movement patterns combined with abnormal posture tone caused by neurophysiologic dysfunction. Trunk comprises a major part of the body mass which explains why good trunk control is essential when maintaining balance.

Recent studies on postural-graphic analysis observed that stroke patients tend to avoid shifting their center of pressure towards hemiparetic side in sitting and standing.

In patients with poor alignment is improved by a position of the patient and facilitation with key points of control along with task-oriented approach. In sitting, balance is improved by a lumbar stabilization exercise and reaches out in anterior, left and right side and also facilitation of the trunk. Co-ordination movements of the trunk are rotation in both sides. Abdominal muscles are improved by abdominal strengthening exercise like pelvic bridging, isometrics.

Pre and post assessment of muscle strength and balance was evaluated with the Motor Assessment Scale and Berg Balance scale.

Improvement in hand function is one of the most important aims during stroke rehabilitation so that patient is able to perform his or her activities of daily living and not to depend on others. Based on the six studies identified in this systematic review, there is some evidence of a potentially beneficial effect of task-oriented practice in upper extremity motor recovery after stroke.

This research examined various interventions that significantly impact patient outcomes in stroke rehabilitation. It has been established that exercise tasks must be specific and meaningful to be effective.[29,30] A positive correlation exists between improved physical fitness and functional performance, making fitness training an essential component of stroke rehabilitation. Stroke survivors often experience compromised endurance, limiting basic daily functioning, which underscores the importance of including fitness training in rehabilitation programs.[31]

The American Heart Association recommends incorporating circuit training and balance activities into rehabilitation, emphasizing the importance of stimulating stroke survivors and providing opportunities for practice.[33] In particular, many exercises in circuit training are task-related, such as standing up from a chair, which can help improve functional mobility.[29]

Strength training is a key factor in improving functional outcomes after stroke. However, it is noteworthy that strength training is often not fully integrated into stroke rehabilitation programs.[34] Additionally, it remains uncertain whether enhanced therapy improves upper arm function in patients with minimal voluntary arm movement.[34] On the other hand, training both the arm and lower extremities simultaneously with integrated meaningful tasks, such as meal preparation or housework, has shown to enhance specific functional activities.[35] The use of familiar tasks, such as using a favourite drink in arm-reaching exercises, can lead to better performance, further emphasizing the importance of meaningful task engagement.[36]

In our study, we directly compared task-oriented training with conventional therapy versus MAT exercises with conventional therapy. Both groups demonstrated significant improvements in muscle strength and balance, as assessed through pre- and post-intervention data. However, task-oriented training with conventional therapy resulted in more substantial improvements in these outcome measures. These findings support the efficacy of task-oriented training, which focuses on meaningful, goal-directed tasks that promote functional recovery.

Based on these results, we accept the alternative hypothesis and reject the null hypothesis, suggesting that task-oriented training with conventional therapy is more effective in improving muscle strength and balance in post-stroke patients. This study provides additional support for the incorporation of task-oriented training with conventional therapy during the acute and sub-acute rehabilitation periods, offering a promising approach for enhancing recovery in stroke survivors. Future research should continue to explore the long-term benefits and effectiveness of such interventions, ideally with larger sample sizes and diverse patient populations.

CONCLUSION

Both task-oriented training in combination with conventional therapy and mat exercises with conventional therapy showed significant improvements based on outcome measures. However, the group that received task-oriented training alongside conventional therapy demonstrated greater progress in muscle strength and balance in post-stroke patients. This improvement was observed particularly in tasks such as reaching forward, grasping, and maintaining both static and dynamic balance.

Task-oriented rehabilitation after stroke has proven to be both effective and pertinent. Traditionally, improving impairments is considered a necessary step toward achieving functional movement. It is essential to continue developing and customizing interventions like functional balance training during reaching, standing up, walking exercises, arm training, and overall physical fitness, all in close cooperation with other healthcare professionals. Moreover, it is crucial to assess the effects of task-oriented training programs in conjunction with other healthcare services. Present evidence suggests that incorporating task-oriented training into the daily care routines of stroke survivors can significantly improve functional outcomes and overall health-related quality of life for these individuals.

LIMITATIONS AND FUTURE SCOPES

The study duration was limited to 8 weeks, which restricted the ability to assess long-term benefits and outcomes. The sample size was small, consisting of only 30 participants (15 in each group), and proper follow-up was not feasible due to restrictions related to the COVID-19 pandemic. Moreover, the study focused exclusively on muscle strength and balance.

To build on these findings, future research should aim to include larger sample sizes with both male and female participants across various age groups. Extending the duration of the study could offer valuable insights into long-term effects. Additionally, incorporating a broader set of outcome measures could provide a more comprehensive evaluation of functional independence. Further studies could also explore the overall improvements in body function resulting from the interventions.

REFERENCES:

1. Puthenpurakal A, Crussell J. Stroke 1: definition, burden, risk factors, and diagnosis. Nurs Times. 2017;113:30-4.
2. Murphy SJ, Werring DJ. Stroke: causes and clinical features. Medicine (Abingdon). 2020 Sep;48(9):561-566. doi: 10.1016/j.mpmed.2020.06.002. Epub 2020 Aug 6. PMID: 32837228; PMCID: PMC7409792.
3. Feigin VL, Norrving B, Mensah GA, et al. Global, regional, and national burden of stroke and its risk factors, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet Neurol. 2021;20(10):795-820.
4. Jorgenson HS, Nakkaama H, et al. Outcome and time course of recovery in stroke. Part 1: Outcome. The Copenhagen Stroke Study. Arch Phys Med Rehabil. 1995;76(9):895-900.
5. Pan Y, Li Z, Li J, Jin A, Lin J, Jing J, Li H, Meng X, Wang Y, Wang Y. Residual Risk and Its Risk Factors for Ischemic Stroke with Adherence to Guideline-Based Secondary Stroke Prevention. J Stroke. 2021 Jan;23(1):51-60. doi: 10.5853/jos.2020.03391. Epub 2021 Jan 31. PMID: 33600702; PMCID: PMC7900402.
6. Hatem SM, Saussez G, Della Faille M, Prist V, Zhang X, Dispa D, Bleyenheuft Y. Rehabilitation of Motor Function after Stroke: A Multiple Systematic Review Focused on Techniques to Stimulate Upper Extremity Recovery. Front Hum Neurosci. 2016 Sep 13;10:442. doi: 10.3389/fnhum.2016.00442. PMID: 27679565; PMCID: PMC5020059.
7. Bosch J, O'Donnell MJ, Barreca S, Thabane L, Wishart L. Stroke rehabilitation: an overview. School of Rehabilitation Science, Population Health Research Institute, McMaster University. 2014 Feb 18.
8. Choi W. The Effect of Task-Oriented Training on Upper-Limb Function, Visual Perception, and Activities of Daily Living in Acute Stroke Patients: A Pilot Study. Int J Environ Res Public Health. 2022 Mar 8;19(6):3186. doi: 10.3390/ijerph19063186. PMID: 35328874; PMCID: PMC8954660.
9. Schurrmans MJ, Hafsteinsdottir TB. Task-oriented training in rehabilitation after stroke. Univ Med Centre Utrecht. 2009 Mar;1(1):5-12.
10. Sethy D, Sahoo S, Kujur ES, Bajpai P. Stroke upper extremity rehabilitation: effect of bilateral arm training. Int J Health Allied Sci. 2018;7(2):93-9.
11. Roh S, Gil HJ, Yoon S. Effects of 8 weeks of mat-based Pilates exercise on gait in chronic stroke patients. J Phys Ther Sci. 2016 Sep;28(9):2615-2619. doi: 10.1589/jpts.28.2615. Epub 2016 Sep 29. PMID: 27799706; PMCID: PMC5080188.
12. Prajapat P, Mehta S. To compare the effect of MAT exercise and gym ball exercise regimens on trunk control and functional balance in patients with chronic stroke. 2021 Jul 2;1.
13. Shahid J, Kashif A, Shahid MK. A Comprehensive Review of Physical Therapy Interventions for Stroke Rehabilitation: Impairment-Based Approaches and Functional Goals. Brain Sci. 2023 Apr 25;13(5):717. doi: 10.3390/brainsci13050717. PMID: 37239189; PMCID: PMC10216461.
14. Pollock A, Baer GD, Langhorne P, Pomeroy VM. Physiotherapy treatment approaches for stroke. Stroke. 2008;39(2):519-20. doi:10.1161/STROKEAHA.107.492710.
15. Jeon SH, Lee SM, Kim JH. Therapeutic effects of reaching with forward bending of trunk on postural stability, dynamic balance, and gait in individuals with chronic hemiparetic stroke. J Phys Ther Sci. 2015 Aug;27(8):2447-51. doi: 10.1589/jpts.27.2447. Epub 2015 Aug 21. PMID: 26357423; PMCID: PMC4563287.
16. Chung SM, Lee KB, Kim YD. Effects of shoulder reaching exercise on the balance of patients with hemiplegia after stroke. J Phys Ther Sci. 2016 Jul;28(7):2151-3. doi: 10.1589/jpts.28.2151. Epub 2016 Jul 29. PMID: 27512286; PMCID: PMC4968526.
17. Santoso MB, Puspita G. Effect of active cylindrical exercise on the grip power in stroke patients. *J Nurs Care*. 2021 Jun 20;4(2). DOI: 10.24198/jnc.v4i2.22904.
18. Rymer MM. Hemorrhagic stroke: intracerebral hemorrhage. Mo Med. 2011 Jan-Feb;108(1):50-4. PMID: 21462612; PMCID: PMC6188453.
19. Sethy D, Bajpai P, Kujur ES, Mohakud K, Sahoo S. Effectiveness of modified constraint induced movement therapy and bilateral arm training on upper extremity function after chronic stroke: a comparative study. *Open J Ther Rehabil*. 2016;4:1-9. doi: 10.4236/ojtr.2016.41001.
20. Pollock A, Gray C, Culham E, Durward BR, Langhorne P. Interventions for improving sit-to-stand ability following stroke. Cochrane Database Syst Rev. 2014 May 26;2014(5):CD007232. doi: 10.1002/14651858.CD007232.pub4. PMID: 24859467; PMCID: PMC6464916.
21. Kim K, Kim YM, Kang DY. Repetitive sit-to-stand training with the step-foot position on the non-paretic side, and its effects on the balance and foot pressure of chronic stroke subjects. J Phys Ther Sci. 2015 Aug;27(8):2621-4. doi: 10.1589/jpts.27.2621. Epub 2015 Aug 21. PMID: 26357448; PMCID: PMC4563328.
22. Logan A, Freeman J, Kent B, Pooler J, Creanor S, Vickery J, Enki D, Barton A, Marsden J. Standing Practice In Rehabilitation Early after Stroke (SPIRES): a functional standing frame programme (prolonged standing and repeated sit to stand) to improve function and quality of life and reduce neuromuscular impairment in people with severe sub-acute stroke-a protocol for a feasibility randomised controlled trial. Pilot Feasibility Stud. 2018 Mar 23;4:66. doi: 10.1186/s40814-018-0254-z. PMID: 29588861; PMCID: PMC5865293.
23. Eng JJ. Strength Training in Individuals with Stroke. Physiother Can. 2004 Aug;56(4):189-201. doi: 10.2310/6640.2004.00025. PMID: 23255839; PMCID: PMC3524263.
24. Hatem SM, Saussez G, Della Faille M, Prist V, Zhang X, Dispa D, Bleyenheuft Y. Rehabilitation of Motor Function after Stroke: A Multiple Systematic Review Focused on Techniques to Stimulate Upper Extremity Recovery. Front Hum Neurosci. 2016 Sep 13;10:442. doi: 10.3389/fnhum.2016.00442. PMID: 27679565; PMCID: PMC5020059.
25. Eng JJ, Tang PF. Gait training strategies to optimize walking ability in people with stroke: a synthesis of the evidence. Expert Rev Neurother. 2007 Oct;7(10):1417-36. doi: 10.1586/14737175.7.10.1417. PMID: 17939776; PMCID: PMC3196659.
26. Teodoro J, Fernandes S, Castro C, Fernandes JB. Current Trends in Gait Rehabilitation for Stroke Survivors: A Scoping Review of Randomized Controlled Trials. J Clin Med. 2024 Feb 27;13(5):1358. doi: 10.3390/jcm13051358. PMID: 38592172; PMCID: PMC10932333.
27. Lee KE, Choi M, Jeoung B. Effectiveness of Rehabilitation Exercise in Improving Physical Function of Stroke Patients: A Systematic Review. Int J Environ Res Public Health. 2022 Oct 5;19(19):12739. doi: 10.3390/ijerph191912739. PMID: 36232038; PMCID: PMC9566624.
28. O'Sullivan SB, Schmitz TJ, Fulk GD. *Physical rehabilitation*. 7th ed. Philadelphia: F.A. Davis Company; 2019. p. 592-612.
29. Van Pippen R, et al. Effectiveness of task-specific rehabilitation after stroke. Neurorehabil Neural Repair. 2004;18(3):175-82.
30. Van de Port IG, et al. Task-specific training in stroke rehabilitation: review of evidence. Stroke. 2007;38(9):2556-64.
31. Pang MY, et al. The role of fitness training in stroke rehabilitation. Stroke. 2006;37(8):1931-8.
32. Marigold DS, et al. Agility training and its effect on falls in stroke survivors. Neurorehabil Neural Repair. 2005;19(2):112-20.
33. Gordon NF, et al. American Heart Association guidelines for stroke rehabilitation. Stroke. 2004;35(3):151-9.
34. Teasell RW, et al. Strength training and functional recovery in post-stroke patients. Clin Rehabil. 2006;20(5):435-45.
35. Higgins J, et al. Integrated task training for upper and lower extremities post-stroke. Neurorehabil Neural Repair. 2005;19(4):308-13.
36. Wu C, et al. Use of meaningful tasks in stroke rehabilitation: improving arm function. Neurorehabil Neural Repair. 2001;15(1):32-8.