

Effect of movement-based priming combined with task specific training on upper limb recovery in patients after stroke

Damayanti Sethy¹ Surjeet Sahoo^{2*} Srikant Sahoo³ Kshanaprava Mohakud⁴

¹Department of Occupational Therapy, National Institute for Locomotor Disabilities (Divyangjan), Kolkata, West Bengal, India.

²Department of Psychiatry, IMS & SUM Hospital, Siksha O Anusandhan (Deemed to be University), Odisha, India.

³Department of Neurology, IMS & SUM Hospital, Siksha O Anusandhan (Deemed to be University), Bhubaneswar, Odisha, India.

⁴Swamy Vivekananda National Institute of Rehabilitation Training and Research, Olatpur, Odisha, India.

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ABSTRACT

Background: Rehabilitation of upper limb impairments and functional deficits is a top goal in stroke rehabilitation. Alternative therapeutic methods may be developed to facilitate upper limb recovery. Priming prepares the brain for better action. When some therapies accompany Priming, it results in a change in behaviour at the performance level by improving the effect of Neuro-Rehabilitation Therapies and enhancing change in the neural process.

Objectives: To investigate the efficacy of movement-based priming combined with task-specific training on upper limb recovery in patients after stroke.

Materials and methods: Twenty-four subjects in the early phase of stroke, attending the Department of Neurology in a tertiary care hospital of Bhubaneswar, Odisha participated in a single-blind randomized controlled trial. 24 subjects after stroke were recruited to the study and randomly allocated to a control group receiving task-specific training only (TST) and an experimental group receiving Movement-Based Priming with task-specific training (MBP+TST). The control group received only task-specific training for 45 minutes per session three days a week for six weeks, while the experimental group received 15 minutes of priming and 30 minutes of task-specific training. Fugl-Mayer Assessment of upper extremity (FMA-UE) was used to measure upper extremity motor recovery, and the Motor Activity Log (MAL) was used to measure the use of arm and hand during activities of daily living at baseline and after six weeks of therapy.

Results: Both the TST group and the MBP+TST group had significantly improved their capacity to move and use their upper limbs functionally ($p < 0.001$). FMA-UE and MAL scores improved more favorably in the MBP+TST group than in the TST group ($p < 0.001$).

Conclusion: Priming in combination with task-specific training results in better upper limb recovery than task-specific training alone.

Introduction

Normal functioning of the upper limb is the most important prerequisite for performing activities of daily living independently. One major factor associated with poor quality of life and reduced independence in doing daily activities is upper extremity motor deficit after stroke.¹ In stroke, recovery of motor impairment and daily function is mostly attributed to neuroplasticity. Therapy administered early with increased intensity and involving more challenge can enhance functional outcomes and

* Corresponding contributor.

Author's Address: Department of Psychiatry,
IMS & SUM Hospital, Siksha O Anusandhan
(Deemed to be University), Odisha, India.

E-mail address: surjeetsahoo@gmail.com

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influence neuroplasticity.²⁻⁵ Recent evidence suggests using motor priming to facilitate motor learning for upper limb recovery. In priming, learning occurs indirectly; the brain, primed by a prior activation method, is generally more responsive to the accompanying training. Priming is used to rehabilitate post-stroke patients to maximize motor gains of the upper extremity. Methods of priming the motor cortex that is most relevant to rehabilitation include (1) stimulation-based priming, (2) motor imagery and action observation, (3) manipulation of sensory input, (4) movement-based priming, and (5) pharmacology-based priming.⁶ The Brain's ability to react to motor rehabilitation is enhanced by regulating the excitability of cortical structures, and priming creates an appropriate environment before therapy begins.^{7,8} The manipulation of sensory input using a sensory stimulation or a sensory deprivation paradigm is known as sensory-based priming. Techniques for sensory-based priming can change how the somatosensory cortex is organized and improve motor outcomes.^{9,10} The basic sensory cortex and motor cortex have strong connections, which makes this conceivable.¹¹ Transient functional deafferentation (TFD), somatosensory electrical stimulation (SES), peripheral nerve stimulation (PNS), and vibration are all examples of sensory stimulation. Movement-based priming refers to any kind of repetitive or continuous movement carried out to enhance the effects of concurrent therapy. Bilateral or unilateral movements, mirror symmetric active or passive movements, or any kind of exercise, such as isometric, aerobic, and balance exercises, are common components of movement-based priming. Repetitive movements can be symmetrical bilateral movements of both limbs, such as bilateral wrist flexion-extension, or single-joint movements, such as repetitive unilateral wrist or elbow flexion and extension. Movement-based priming typically refers to movements that are repetitive but not skill-based.⁶ In Active Passive Bilateral Therapy, bilateral wrist flexion extension modifies the inhibitory effect within and between the hemispheres by acting as a neuromodulator that facilitates motor recovery.¹² With continuous, repetitive movements known as "motor priming" or "movement-based priming," the effectiveness of the primary therapy that comes next may be enhanced.⁶ Movement-based priming may improve the effect of associated neuro-rehabilitation therapies.¹³ Compared to stimulation-based priming, research on movement-based strategies to prime the motor system is minimal, and movement-based priming is easier to use in clinical setups like ours. Task-specific training, constraint-induced movement therapy (CIMT), robotic therapy, etc., have all been used in stroke upper limb rehabilitation alongside priming, with improved results in the recovery of motor deficits and functional usage.¹⁴⁻¹⁷

There is growing evidence that task-specific training can be used therapeutically as a neuromotor intervention in neurological rehabilitation, improving upper limb motor and functional recovery.¹⁸ Goal-directed practice and repetition have been used as the principle of task-specific training that focuses on functional improvement.¹⁵ The usefulness of task-specific training in reducing upper limb

motor deficits and enhancing daily function after stroke has been demonstrated in numerous trials.^{19,20} A comparison between stroke education and task-specific training with bilateral motor priming was made in a study by Stoykov *et al.* in 2020.²¹ Up until follow-up, the priming group outperformed the stroke education group on the FMA (UE) scale regarding progress. In another study on upper limb recovery in patients severely affected after stroke, sensory-based priming was combined with TST, and a comparison was carried out with only TST.²² Their study resulted in significant improvement in the upper limb motor function when repetitive task-oriented training was provided in combination with peripheral nerve stimulation. The contralaterally Controlled passive movement performed can produce a priming effect.²³ Active Passive Bilateral Therapy (APBT) was used on subacute stroke patients, and the result of their study concluded that APBT is a feasible priming mechanism to be used to improve upper limb recovery.²⁴ In another study, chronic stroke patients were provided passive movements and then progressed towards performing active movements.¹² The results showed improved and sustained upper extremity function of the affected hand. Another study found that Bi-manual motor priming can enhance upper extremity function in the initial stroke period after four weeks of intervention.²⁵

These studies were done mostly in chronic stroke patients using either movement-based or sensory-based priming. In the present study, movement-based priming is provided by using a simple device called the wrist roller (Figure 2) that assists symmetrical wrist flexion and extension, and it was combined with skill-based training (TST) aimed at improving recovery of upper limb in post-stroke patients. Movement-based priming is any type of continuous movement that may augment the effect of the subsequent primary therapy.⁶ Movement-based priming used simultaneous bilateral wrist movements that are mass, non-skill based, and repetitive, similar to the previous studies.²³⁻²⁵ The device used in this study provided mirror-symmetric, bilateral, wrist flexion, and extension movements. The control group received only task-specific training. As the potential of therapeutic recovery is high within weeks to months after stroke, it is necessary to facilitate the neuroplastic changes more during the early days of the stroke to have a better outcome. Recovery often reaches its plateau after three months.²⁶ Our sample included patients from 4-12 weeks after stroke to determine the maximum benefit of priming the brain. Evidence of task-specific training in improving upper limb recovery has been studied earlier. Priming the brain before task-specific training in the early phase of stroke is less in number in the literature. Thus, it is necessary to find a better therapeutic method for upper limb rehabilitation in the early stage of stroke recovery. Previous studies showed that adding a priming session before a motor-learning task improved motor learning. The expected outcome of this study will be better upper limb recovery compared to other studies of acute phase priming where patients with severe paretic upper limb were included. In this study, priming will be followed by task-specific training, further facilitating task performance.

We hypothesize that movement-based priming, when provided with task-specific training, will derive better improvement of the upper limb than task-specific training alone. The result of this study may be used to address the upper limb problems in the early phase of stroke for better upper limb recovery.

Methods

The study was a randomized controlled clinical trial having two groups. The study included baseline and post-intervention data collection. The study was conducted at the Neurology Department of Institute of Medical Sciences and SUM Hospital, Odisha, India, and The Institute Ethical Committee approved the study protocol. Participants: It has been estimated that the middle cerebral artery (MCA) was the most commonly affected vessel, and upper extremity is more affected than the lower extremity in MCA involvement.²⁷ Keeping upper limb stroke rehabilitation in view, this study included participants fulfilling the following inclusion criteria. Screening was conducted for 169 stroke patients who participated in the present study. Eligibility criteria included were: (a) 18 years of age and above; (b) at least four weeks to 12 weeks post-stroke (c) able to sit independently for 45 minutes; (d) unilateral stroke with Middle Cerebral Artery involvement; (e) can lift the affected hand from their lap to a wall mounted device. (f) A score of 24 and above in MMSE. Participants were excluded if they had the following criteria. (a) 4/5 points on Modified Ashworth Scale, (b) >5 points on the Visual Analog Scale for Upper Limb pain at rest, (c) Uncontrolled hypertension or cardiovascular disease,

(d) other neurodegenerative conditions, such as Parkinson's or Alzheimer's (e) deformities or a fracture of the wrist, (f) Aphasia, and (g) severe vision impairment. Out of 169 participants, 86 patients were excluded per the exclusion criteria. Of the rest, 83 patients who completed baseline evaluation, 59 could not meet the inclusion criteria.²⁴ patients after stroke were finally found eligible as per the inclusion criteria who completed the intervention and post-intervention assessment.

The primary investigator enrolled the study participants. The study's participants were chosen based on the criteria for inclusion. Participants recruited to the study were randomly allocated to movement based priming plus task-specific training (experimental=MBP+TST) group and Task Specific Training only (control=TST) group by another Occupational Therapist not otherwise involved in the study through block randomization (in a block of 4). Random numbers were generated by using the random numbers table. An opaque, sealed envelope held the allocation. The sample size required for this study was calculated and estimated based on previous studies.²⁸ Based on the smallest sample size needed for achieving a statistical power of 0.80 with a one-sided type I error of 0.05, a total sample size of at least 12 subjects per group was deemed sufficient. Twenty-four patients, consisting of 17 men and seven women with stroke, were finally recruited for the study. Figure No. 1 shows a flow diagram of the study procedure. The recruitment of participants was done over 13 months. Post-treatment measurement was done immediately after six weeks of intervention in both groups.

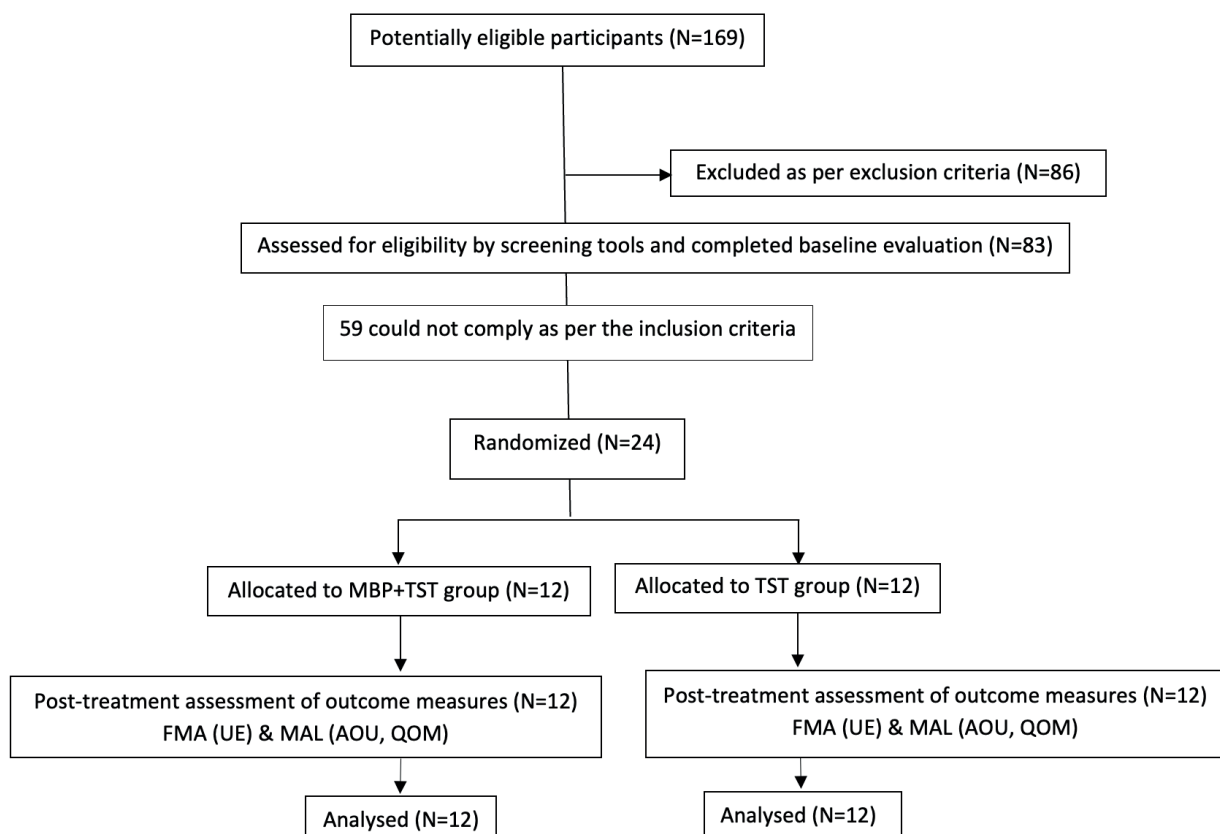


Figure 1. Study flow diagram.

Outcome measures

Motor recovery

The Fugl-Meyer Assessment (FMA) is a stroke-specific, performance-based impairment index. It is designed to assess motor functioning, sensation, balance, joint range of motion, and joint pain in patients with post-stroke hemiplegia. Scale items are scored based on ability to complete the item using a 3-point ordinal scale where 0=cannot perform, 1=performs partially, and 2=performs fully. The total possible scale score is 226. The motor section is divided into two subsections: 66 for the upper extremities (upper arm and wrist and hand) and 34 for the lower extremities. In this study, motor recovery of the upper limb was assessed by Fugl-Meyer Assessment (U/E section). The motor section of FMA-UE evaluates aspects of movement, reflexes, coordination, and speed. FMA-UE is scored out of 66, with sub-scores of 36 for the upper arm and 30 for the wrist and hand. The total motor score ranges from 0 to 66 points, and the higher the score, the less the impairment. The FMA-UE had a 0.97 intra-rater and inter-rater reliability.²⁹⁻³¹

Motor Activity Log

The Motor Activity Log (MAL) is a semi-structured interview for hemiparetic stroke patients to assess the use of their paretic arm and hand during ADL. In this study, the motor activity log (MAL) version was used to measure how well the affected upper limb performed functionally in the past seven days. It measures 30 daily activities on a six-point rating scale. Patients are scored in a range where 0 is no use, and 5 is normal use of the extremity. It comprises two subscales: the Quality of Movement (QOM) scale and the Amount of Use (AOU) scale. The total mean MAL score (ranging from 0 to 5) is calculated for both subscales (AOU and QOM) by adding the rating scores for each item and

dividing by the number of items that responded. MAL has a 0.94 score of reliability (test-retest). Internal consistency ranges from 0.88 to 0.95, while 0.90 is the inter-rater reliability.³²

Intervention

Before taking part in the trial, each subject provided written informed consent. A blinded assessor, another study's author, recorded all the measurements. Participants were instructed to observe active movement of the upper limb that was less affected and passive movement of the upper limb that was affected. Bilateral priming activity progressed from passive to active assistive movement, and then the active movement of the wrist of the side affected. In this study, instead of a priming device (Rocker) used originally, a wall-mounted wrist roller (Figure 2) was used for wrist movements.³⁰ The height of the device was 28 inches from the floor.

It was a cylindrical gripping object attached with a base to be fixed on the wall. Patients were instructed to grasp and hold the cylindrical gripping tool using the less affected and affected hand. Patients were guided by the therapist on how to perform repetitive wrist flexion-extension (Figure 3). Initially, therapist support was provided to hold the affected wrist on the roller. Later on, the patient was encouraged to do the movement independently. Movement-based priming uses simultaneous bilateral wrist movements that are mass, non-skill based, and repetitive, similar to the previous studies.³³ The device used in this study provided mirror-symmetric, bilateral, wrist flexion, and extension movements. While performing wrist movements by the less affected side, the affected side wrist automatically moved with the assistance of the device's motion, resulting in simultaneous bilateral symmetric wrist flexion and extension.



Figure 2. Wrist roller used for MBP.



Figure 3. Different phases of wrist movements during MBP. A: passive movement, B: active assistive movement, C: active movement.

Task-specific training

Task-specific training, or functional task training, involves performing tasks relevant to daily life, including part- and whole-task practice. Occupational therapists frequently use task-specific training, a form of repetitive task training, as a component of neuromotor therapies, particularly in managing post-stroke upper limbs. Reach-to-grasp exercise is a form of task-specific training, as reach-to-grasp is a common functional task performed by the upper limb.³⁴ In this study, functional tasks representing essential reaching, grasping, releasing, pointing, and manipulating were included in the task-specific training. To make the training protocol the same for all participants, Task Specific Training used in this study comprised a specific number of common tasks to be practiced by all patients. The guidelines followed for selecting the tasks are; (1) training should be relevant to the patient, (2) should be repeated, (3) provided in a randomized order, (4) contain tasks that are part of a whole task, (reconstruction) and (5) feedback should be provided (Reinforcement).³⁴ Patients in the control group had undergone task-specific training for 45 minutes. Patients in the experimental group underwent 30 minutes of task-specific training after 15 minutes of priming activity. In both groups, therapy was provided for six weeks and three days a week. Evaluations using all the outcome measures were done after six weeks of intervention. Task-specific training included the repetitive practice of selected tasks like reaching a shelf height, lifting and carrying a glass of water to mouth, grasping pegs and putting those into peg holes, manipulating a small ball within the hand, holding a water bottle and opening the lid of it, manipulating a lock and key. Activities were selected based on the patients' abilities and impairments and the tasks that could be performed in an institutional clinical setup. After completing the above tasks for 15 minutes, patients were given real-life tasks based on individual preferences/choices for the rest 15 minutes. Purposeful, real-life tasks include combing hair, drinking tea, opening and closing a door, grasping a tennis ball and releasing, manipulating coins within the hand, and manipulating the cards etc. While performing the tasks, active movements were encouraged, and compensatory movements were

avoided. Wherever required therapist's assistance was provided in guiding the movements required for completing the task. All patients were encouraged to perform the task at a faster speed they can. During task performance, intermittent rest periods of one minute were provided.

Statistical analysis

Data analysis was carried out by using IBM SPSS Statistics for Windows, Version 23.0[®] (IBM Corp., Armonk, N.Y., USA).³⁵ To compare the demographic and clinical characteristics of the two groups at baseline t-tests and Chi square test were used for continuous and categorical data respectively. Data for both groups were homogeneous at baseline. After six weeks of the intervention, all outcome variables (FMA-UE MAL AOU and QOM) were compared within each group using Paired t-tests and between groups using independent t-tests. The level of significance was established at $p < 0.05$.

Results

The present study screened 169 patients after stroke over 13 months. At the end of the screening process, only 24 subjects could be recruited for the study. Random selection was used to assign all participants to one of two groups of 12 patients. Table 1 lists the clinical and demographic characteristics of all the patients at baseline. The baseline clinical and demographic characteristics were comparable in the control and experimental groups.

All patients in both the control (TST) group and experimental (MBP+TST) group completed six weeks of intervention successfully. Upon within-group comparison, (MBP+TST) group showed statistically significant ($p < 0.05$) improvement on FMA-UE and MAL subscale of AOU and QOM scores. A statistically significant ($p < 0.05$) improvement in the FMA-UE and AOU QOM scores was also seen in the TST group. On between-group analyses, in comparison to the TST group, the MBP+TST group's post-intervention mean scores on both of the outcome measures FMA-UE and MAL demonstrated a statistically significant improvement ($p < 0.05$). Both within-group and between-group analyses showed a positive change in all outcome measures post-intervention.

Table 1 Clinical and demographic Characteristics of the subject population.

SI No.	Characteristics	Control group (TST)	Experimental group (MBP+TST)	p value
1	No of participant (N=24)	12	12	
2	Mean age (SD, years)	53.2±1.95	51.7±2.5	0.675
3	Sex (Male:Female)	8:4	9:3	0.653
4	Side affected (Rt:Lt)	5:7	8:4	0.219
5	Weeks since stroke (Mean±SD)	9.33±2.10	9.58±2.31	0.784
6	MMSE	5.36±4.78	24.89±4.92	0.443
7	FMA (UE)	14.50±2.23	14.08±2.87	0.696
8	MAL (AOU)	0.98±0.39	1.01±0.36	0.819
9	MAL (QOM)	0.45±0.33	0.63±0.33	0.855

Both groups experienced a significant increase in FMA-UE score(MBP+TST: from 14.08±2.87 to 25.83±3.48 points ($p<0.001$); TST only: from 14.50±2.23 to 21.91±04.54 points ($p<0.05$). The mean increase in the FMA-UE score was 11.750.61± points in the MBP+TST group compared to 7.412.31± points in the TST only group. Table 2 shows

there is an increase in the AOU score (MBP+TST: from 1.01±0.36 to 1.930.39±; TST only: from 0.98±0.39 to 1.42±0.47 ($p<0.001$).QOM scale of MAL had an increase in score (MBP+TST: from 0.630.32± to 1.920.43±; TST only: from 0.450.33± to 0.820.28± ($p<0.001$) in both the groups.

Table 2 Descriptive statistics showing pretest and posttest comparison of outcome measures of the control and experimental group.

Outcome measures	Control group (TST)		Mean Difference	t value	p value	95% Confidence Interval of the Difference		Experimental group (MBP+TST)	Mean Difference	t value	p value	95% Confidence Interval of the Difference	
	Pretest Mean (SD)	Posttest Mean (SD)				Lower	Upper	Pretest Mean (SD)	Post test Mean (SD)			Lower	Upper
Fugl-Mayer (U/E)	14.50 (2.23)	21.91 (4.54)	7.42 (2.31)	-7.178	0.001*	-9.690	-7.178	14.08 (2.87)	25.83 (3.48)	-20.769	0.001*	-12.995	-10.504
MAL (AOU)	0.98 (.39)	1.42 (0.47)	0.44 (0.08)	-7.233	0.001*	-0.563	-0.300	1.01 (0.36)	1.93 (0.39)	8.908	0.001*	-1.141	-0.688
MAL (QOM)	0.45 (0.33)	0.82 (0.28)	0.37 (0.05)	-2.970	0.001*	-0.631	-0.093	0.63 (0.32)	1.92 (0.43)	-8.961	0.001*	-1.611	-0.975

Note *:statistically significant, FMA (UE): Fugl-Meyer Assessment (Upper Extremity), AOU: motor activity log (amount of use), QOM: motor activity log (quality of movement).

On between-group comparison of the FMA-UE, AOU, and QOM scores, a statistically significant difference between the MBP+TST group and the TST only group was

found. The MBP+TST group improved more than the TST only group regarding the change in the mean difference score ($p < 0.05$), as shown in Table 3.

Table 3. Between-group analyses (MBP+TST and TST only group).

Outcome measure	TST Only Mean	MBP+TST Mean	Mean difference	t value	p value	95% Confidence Interval of the Difference	
						Lower	Upper
FMA (U/E)	21.91	25.83	3.92	2.370	0.027*	0.489	7.344
MAL (AOU)	1.42	1.93	0.51	2.859	0.012*	0.140	0.882
MAL (QOM)	0.82	1.92	1.1	7.318	0.001*	0.791	1.417

Note *statistically significant, FMA (UE): Fugl-Meyer Assessment (upper extremity), AOU: motor activity log (amount of use), QOM: motor activity log (quality of movement).

Discussion

The study showed that, compared to task-specific training alone, movement-based priming in combination with task-specific training was more helpful in enhancing UE recovery in the initial days after stroke. There was an improvement seen in both the intervention groups in all the outcome measures measuring motor recovery and functional use. All the outcome measures, including the FMA-UE and both subscales of MAL significantly improved within each group. The findings of this study demonstrate that combining movement-based priming with task-specific training improved post-stroke patients' motor recovery and quality and quantity of upper limb use in day-to-day activities.

The study hypothesized that additional movement-based priming with task-specific training would result in better upper limb recovery. This study found that the movement-based priming group considerably outperformed the Task-specific training only group in terms of improvements on the Fugl-Mayer assessment of the Upper Extremity scale. A significant difference in FMA-UE score was found between group analyses ($p < 0.05$). Additional movement-based priming may have resulted in better motor improvement in the primed group due to repetitive practice of bilateral movements, thus inducing better force generation in the muscles of the upper limb.³⁶⁻³⁸ Bilateral symmetrical wrist movements provided movement-based priming, which helped the brain respond more favorably to the following training. Normalization of cortical inhibition is the suggested neurobiological mechanism of bilateral priming. Both neuroplasticity and the effectiveness of therapies were improved by bilateral priming.¹² The brain is more receptive to subsequent instruction if primed by earlier activity. This might have contributed to the primed group's faster recovery. The priming theory is based on the inter-hemispheric imbalance alteration in cortico-motor excitability after stroke, which has been linked to a slower rate of motor recovery and/or a decrease in neural activation of Ipsilesional motor cortex (M1).³⁶

The score of FMA-UE increased within and between the two groups, which was statistically significant. The

study's findings were likewise significant regarding the FMA-UE's minimal clinically meaningful difference (MCID). In stroke patients who have experienced a sub-acute stroke, a mean difference score of 9 to 10 on the FMA-UE is likely to be interpreted as clinically significant.³⁹ Those with sub-acute stroke are more likely to experience a considerable and clinically meaningful decline in their level of disability than those who do not earn a score of 9 to 10 on the FM-UE.³⁹ In this study, the MBP+TST group had a mean difference of 11.75, above the MCID value of 9 to 10. This finding suggests MBP+TST group had a clinically important improvement post-intervention. Compared to the mean difference found in the FMA-UE in the MBP+TST group, the TST only group had a mean difference of 7.41, which is smaller. The study's findings suggest that, despite improvements in motor recovery in both groups, the MBP+TST group showed greater statistical and clinical improvement than the TST only group. The results of this study are in line with another study in which Fugl-Meyer Assessment showed clinically significant improvements in both the primed group and the non-primed group.³⁶ Another finding of the study demonstrated significant improvement in the AOU scale when comparing the pre (1.01 ± 0.36) to post-test mean (1.93 ± 0.39) score in MBP+TST and from (0.98 ± 0.39) to (1.42 ± 0.47) in TST groups on the within-group comparison. Use of the upper limb in day-to-day activities might have improved through the practice of tasks that target functional use. The improvement was better in the MBP+TST group than the TST group, according to the statistically significant difference in the AOU subscale of MAL between the two groups ($p < 0.001$). QOM scale of MAL had an increase in score in both the groups. This result indicates improvement in quality of movement was there in both groups post-intervention. The experimental and control groups improved significantly in AOU and QOM scores of the motor activity log. Evidence of Task-specific training in improving upper limb motor and functional recovery has already been established in the literature. The use of task-specific training might have resulted in improvement in AOU and QOM in both controls as well as in the experimental group. In a study with moderate to severe

upper limb hemiparesis, it was found that when bilateral motor priming was used as additional training with task-specific training, there was a greater improvement in the FMA-UE score in the experimental group than in the control group. However there was no difference found in the score of Chedoke Arm & Hand Activity Index 9.¹⁶ The result of this study says that priming resulted in better motor recovery in the experimental group than functional recovery.

Between-group analyses showed a significant difference in the quality of movement subscale between the two groups. Comparing the MBP+TST group to the TST group, a significant improvement was seen in the QOM sub-scale of MAL ($p < 0.001$). The findings may be attributed to the additional movement during the priming activity. The repetitive, continuous wrist flexion and extension movement improved the motor power of the flexor and extensor muscles of the wrist. Gripping the device to perform the repetitive movements might have increased the grip strength of both hands. This might have derived a change not only at the muscular level but also at the neuronal level, resulting in better neural plasticity and better improvement in the quality of movement. Many studies have been conducted to determine the outcome of various priming methods on task-oriented training in chronic stroke patients.^{12,17,25} The evidence of movement priming has a better effect size, whereas other priming methods remain inconclusive.⁴⁰ In this study, movement-based priming was provided to stroke patients in the acute stage of their recovery. It resulted in better improvement in motor as well as in functional recovery. In a study with severely impaired stroke patients in the acute phase, visual and movement-based priming resulted in significant improvements in motor recovery as measured by the Action Research Arm Test (ARAT) and the Fugl Meyer Assessment of Upper Extremity (FMA-UE) at six months post-training. As the patients were in the early phase of their recovery, the tasks provided in the task-specific training were kept simple and adapted wherever required. The study is limited in many aspects like no follow-up data could be collected. It could not be established whether the motor and functional recovery improved post-intervention due to the lack of follow-up study. It is recommended that future studies use follow-up data to examine the long-term retention impact of priming with task-specific training. The MAL is subject to experimenter bias and the patient's ability to recall upper limb use accurately.⁴¹ The improvement shown in AOU and QOM may be verified in future studies employing additional functional performance metrics to examine the additional impact of priming on recovery of upper limb functions following stroke. It is advised that additional research be conducted by enlisting a large sample to confirm the conclusion of this study.

Conclusion

This study shows that movement-based priming combined with task-specific training results in better motor recovery and improved upper limb function in stroke than

only task-specific training. Movement-based priming can be provided in hospital-based and institutional-based clinical stroke rehabilitation setups more easily than other priming methods. It is an effective and safer method of priming and can be used as restorative occupational therapy in the rehabilitation of the upper limb after a stroke. To maximize the benefits of task-specific training after stroke, movement-based priming can be utilized as a supplementary therapy.

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