

## Effect of Motor Re-Learning Program with Motor Imagery on Sit-To-Stand Activity in Stroke

Hitha Sherin U<sup>1\*</sup> and Prem Kumar BN<sup>2</sup>

### Abstract

Sit-to-stand (STS) activity being the prerequisite for transfer & ADL, it is necessary to restore upright standing in stroke patients. The cognitive & goal-oriented approaches, Motor imagery (MI) and motor re-learning program (MRP) have been effective to enhance STS activity in stroke patients. However, the effect of MI with MRP for better outcome is not known. The current research aimed to evaluate the integrated result of MI & MRP on STS activity in stroke. Thirty-six acute ischemic stroke patients were enrolled. Patients received MI for 30 minutes/day followed by MRP for 45 minutes/day, five times/week for 3 weeks. The pre & post intervention was assessed with outcome measures like Fugl-Myer Assessment-Lower Extremity (FMA-LE), Motor Assessment Scale (MAS), Kinesthetic & Visual Imagery Questionnaire (KVIQ) and 5-times sit-to-stand (5-times STS). The results showed reduction in sensory & motor impairment (FMA-LE: t-value=397.00), improvement in motor function (MAS: t-value=289.00), better clarity in sensation & image (KVIQ: t-value= 137.358 & 132.355 respectively) & ability to perform STS activity improved (5-times STS: t-value=107.00) with  $P < 0.001$ . The combined approach of MI & MRP designed to improve STS activity in stroke patients was viable in the study. This clinically innovative strategy is effective approach in improving motor functions affecting transfer activities & ADL.

**Keywords:** Motor; Stroke; Motor re-learning programme; Motor assessment scale (MAS).

### Introduction

Ischaemic stroke, caused by occlusion of the blood vessel supplying to a part of the brain resulting in sudden loss of function [1]. After an acute ischemic stroke, the ability to do STS independently is difficult for the individuals. STS, the basis for the transfer activities is an essential for the transition

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in activities like bed-to-chair and the chair-to-toilet [2]. In 41-45% of stroke patients, chronic motor impairments and limitations in activities of daily living are observed even after rehabilitation [3].

Motor imagery is an active process within working memory during which, without any actual movements a specific action is reproduced [4]. The neural activity incorporated in imagining the movement are equivalent to those in a physical performance. This practice has found to be successful in improving skills in performing the given tasks [5]. Motor re-learning program is a task specific learning approach which aids in development of active movement control through adequate use of biofeedback and practice [6]. Restoration of motor function of patients with scientific motor and learning methods is the main aim of this approach [7]. MRP has been found to enhance functional recovery after stroke [6].

MI and MRP have been effective on improving STS activity in stroke patients. However, the effect of MI with MRP for better outcome is not known. The current research aimed to evaluate the integrated result of MI & MRP on STS activity in stroke.

## Materials and methods

The study was conducted in KIMS hospital, Bengaluru, where 36 patients in accordance to the inclusion criteria were recruited. This was an assessment clinical evaluation study with purposive sampling done for duration of 12 months. The study included patients with acute ischemic stroke (<1 month of stroke) with Mini-Mental State Examination score of

25 points or higher and Brunnstrom recovery stage of four.

Patients with history of orthopedic, vestibular, neurological condition or degenerative disease affecting balance in standing posture, perceptual and cognitive deficits like hemi-spatial neglect, attention and memory deficits, spinal and lower extremity deformity, terminal illness or medically unstable and severe cardio pulmonary disease were excluded from the study. The outcome measures were assessed pre and post intervention. To assess lower extremity motor function which includes reflex response, movements within and outside synergy, and coordination, the FMA-LE scale, the most comprehensive quantitative measures of body function impairment after stroke, was used [8,9]. The ability to perform functional tasks was assessed by MAS which is based on the principles of the Motor Relearning Programme for the treatment of stroke patients [10]. Assessment of the cognitive aspect of imagining a movement can be done with the help of KVIQ [11]. KVIQ was used to assess both visual and kinesthetic components of Motor Imagery [12].

The ability to perform STS was assessed by Five Times STS Test. The patient was asked to sit with arms crossed over chest in a chair. Then the patient was asked to stand up right and return to sitting position for 5 repetitions, performing as fast as possible [13-15].

## Intervention

Patient was asked to sit comfortably on an arm rest chair and was relaxed with

Progressive muscle relaxation technique (Figure 1). Later patient had to imagine the sit-to-stand activity focusing on all the movements occurring in the joints of the lower limbs with the help of audio cues for duration of 30 minutes per day (Figure 2). Then the patient was taught backward foot placement followed by forward bending of trunk. Physiotherapist aided by holding the affected side shoulder and hand, followed by

which patient was told to perform forward bending of trunk quickly in case the patient was unable or was performing STS in wrong way. Later the patient had to push down through paretic foot and stand up quickly bringing the hips forward and the procedure repeated for the duration of 45 minutes per day (Figure 3). The treatment was given for five sessions per week for 3 weeks.



**Figure 1:** Relaxation technique.



**Figure 2:** Motor imagery.



**Figure 3:** Motor re-learning program.

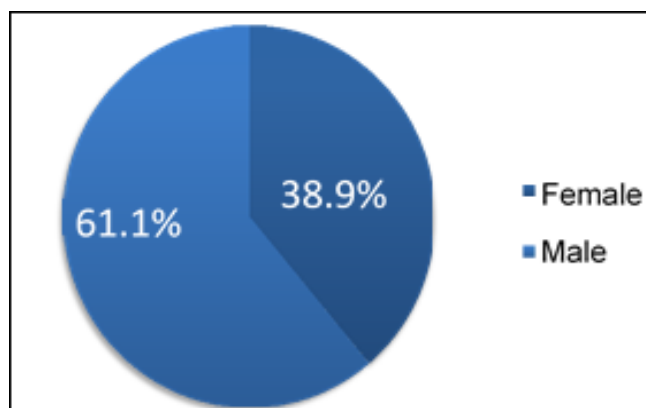
## Result

In the present study, 36 stroke patients were recruited. Among them, 38.9% of the subjects included 14 female and 61.1% of them included 22 male patients (Table 1) (Figure 4). The analysis of frequency distribution of

patients based on age showed Mean  $\pm$  SD values  $55.47 \pm 12.08$ . 4 subjects were less than 40 years, of about 11.1%, 9 subjects were in between 40-50 years of about 25.0%, 12 subjects were in between 50-60 years of about 33.3% and 11 subjects were more than 60 years of about 30.6% of age category (Table 2).

Gender	No. of patients	%
Female	14	38.9
Male	22	61.1
Total	36	100

**Table 1:** Gender distribution of patients.



**Figure 4:** Gender distribution of patients.

Age in years	No. of patients	%
<40	4	11.1
40-50	9	25
51-60	12	33.3
>60	11	30.6
Total	36	100

**Table 2:** Age category.

FMA-LE was used to assess sensory-motor impairment. The baseline values of Mean  $\pm$  SD was  $68.5 \pm 0.51$ . The analysis post intervention showed a difference of 11.00

(Mean  $\pm$  SD:  $79.5 \pm 0.51$ ) with 95% CI (10.97 to 11.08) and t-value of about 397.00 ( $P < 0.001$ ) (Table 3) (Figure 5).

Variables	Pre	Post	Difference	95%CI	t Value	P Value
FMA-LE	$68.5 \pm 0.51$	$79.5 \pm 0.51$	11	10.97-11.08	397	$<0.001^{**}$
MAS	$30.5 \pm 0.51$	$38.5 \pm 0.51$	8	7.97-8.08	289	$<0.001^{**}$
KVIQ	$28.5 \pm 0.51$	$39.47 \pm 0.51$	-10.972	10.84-11.09	-174.66	$<0.001^{**}$
KINESTHETIC	$13.31 \pm 0.47$	$24.00 \pm 0.79$	10.69	10.53-10.85	137.358	$<0.001^{**}$
VISUAL	$12.30 \pm 0.46$	$22.61 \pm 0.49$	10.31	10.14-10.47	132.355	$<0.001^{**}$
5times sit-to-stand	$0.47 \pm 0.51$	$3.47 \pm 0.51$	2.9	2.91-3.03	107	$<0.001^{**}$

**Table 3:** Comparison of outcome variables at pre and post assessment of patients.

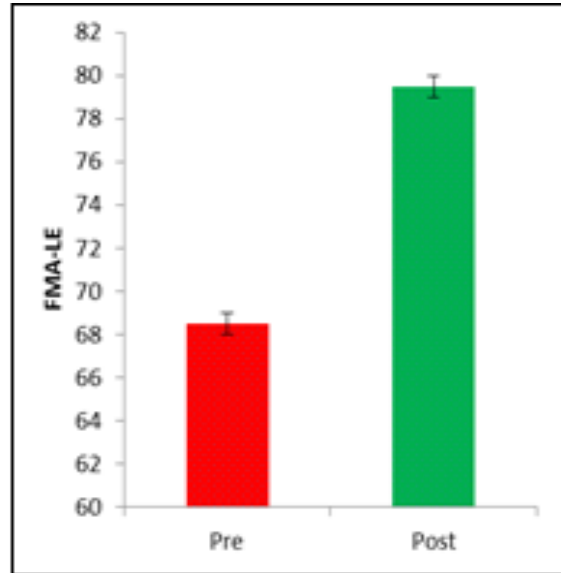


Figure 5: FMA-LE.

MAS was used to assess the motor function. The baseline values of Mean ± SD was 30.5 ± 0.51. The analysis post intervention showed a

difference of 8.00 (Mean ± SD: 38.5 ± 0.51) with 95% CI (7.97 to 8.08) and t-value of about 289.00 (P=<0.001) (Table 3) (Figure 6).

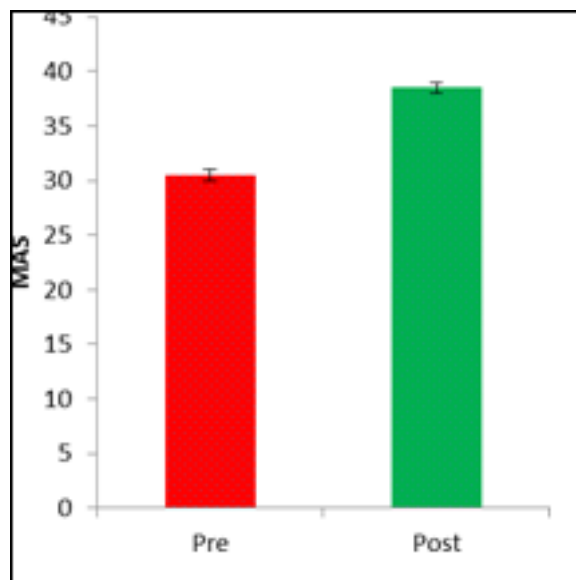


Figure 6: MAS.

KVIQ was used to assess clarity of image (visual imagery) and clarity of sensations (kinesthetic imagery). The baseline values of Mean ± SD was 13.31 ± 0.47 and 12.30 ± 0.46 for

kinesthetic and visual imagery respectively. The post-test values of Mean ± SD was 24.00 ± 0.79 and 22.61 ± 0.49 for kinesthetic and visual imagery respectively. The analysis post

intervention showed a difference of 10.69 and 10.31 with 95% CI (10.53 to 10.85 and 10.14 to

10.47) and t-value of about 137.358 and 132.355 ( $P < 0.001$ ) (Table 3) (Figure 7 and 8).

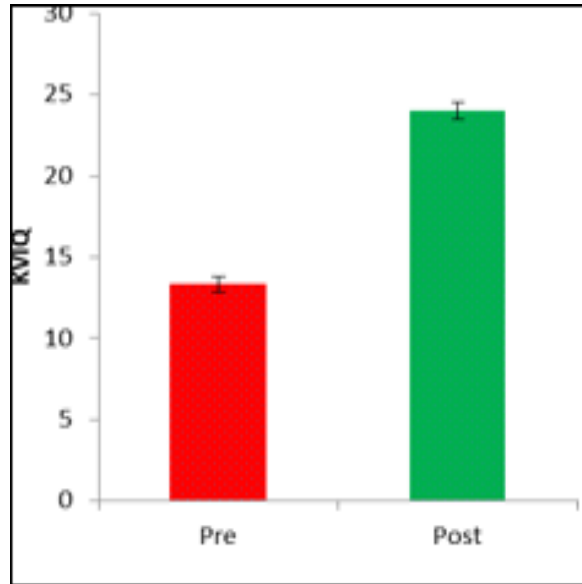


Figure 7: KVIQ (Kinesthetic).

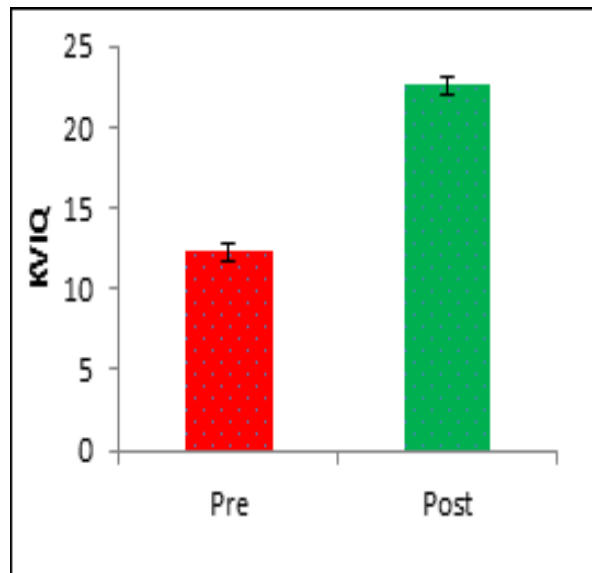
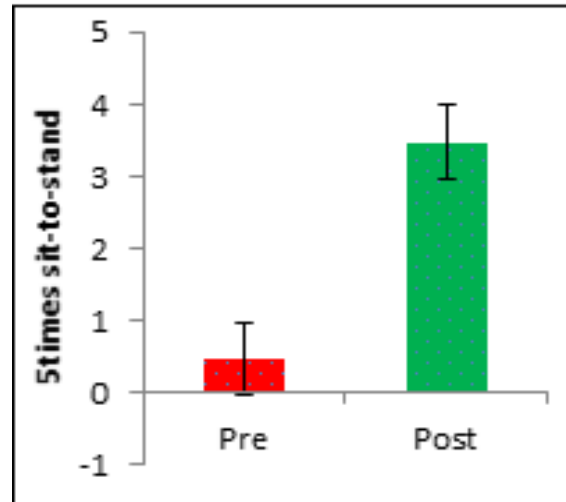


Figure 8: KIVQ (Visual).

5-Times STS test was implemented to measure the transfer skill. The baseline values of Mean  $\pm$  SD was  $0.47 \pm 0.51$ . The analysis post intervention showed a difference of 2.90

(Mean  $\pm$  SD:  $3.47 \pm 0.51$ ) with 95% CI (2.91 to 3.03) and t-value of about 107.00 ( $P < 0.001$ ) (Table 3) (Figure 9).



**Figure 9:** 5 Times STS.

## Discussion

Stroke is described as a neurological deficit associated to acute focal injury of the central nervous system due to a vascular cause. The STS task is the change in body posture from sitting to standing. Stroke can have a profound effect on the execution of the STS movement. A crossover interventional study (2012) on the effect of motor imagery to perform STS task and perform reach and grasp by stroke patients showed a significant decrease in the values of STS duration [16].

The findings of a clinical trial (2010) on the outcome of MI training on symmetrical use of knee extensors for STS activity in stroke patients showed increased EMG activation during STS task. The findings suggested that MI improved symmetrical use of knee extensors while performing STS [17]. The findings of a comparative study (2017) showed significant results in Motor re-learning program group than Proprioceptive neuromuscular facilitation group. MRP improved fundamental mobility of STS and

ambulation in chronic stroke subjects according to the results [6]. The present study was performed to compare outcome of MI and MRP on STS activity in stroke.

The impact of motor re-learning program with motor imagery was analyzed by the outcome measures and greater reduction in sensory-motor impairment, a significant improvement in motor function, better clarity of the image and the intensity of sensation of movements, also the patients were able to perform sit-to-stand activity which enhanced their transfer skill.

The study was unable to provide better evidence as it was carried out on small sample size. Since there was no comparison with other methods of treatment, this study can lead to underestimation or overestimation of the effects of the intervention. Further studies are needed to compare with other methods of treatment in order to find the feasible program of rehabilitation. This integrated approach can also be used as an intervention for other conditions like Parkinsonism,



multiple sclerosis as well as upper limb rehabilitations of stroke.

## Conclusion

The combined program of MI & MRP was designed to improve STS activity in stroke

patients. Improvement was seen in motor function and the patient's potential to carry out STS. The use of cognitive & goal-oriented approach found to restore upright standing in patients with stroke which also aided in transfer activities and ADL.

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