RESEARCH ARTICLE

# EFFECTS OF MOTOR IMAGERY TECHNIQUE ON LOWER LIMB FUNCTION AMONG STROKE PATIENTS

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## ABSTRACT

**Background:** Stroke is one of the leading causes of disability and most of the stroke survivors have limit their upper extremity functions. Motor imaginary technique is the innovative technique for engaging the brain areas either prior to or simultaneously with movement. **Objective:** To determine the effects of motor imagery technique on lower limb function. **Methods:** Randomized control trial was conducted, 20 post stroke patients included through non probability purposive sampling technique in Bibi Zahida Memorial Teaching Hospital, Peshawar, randomly allocated through sealed envelope method into control and experimental group. Conventional therapy for Control group while motor imagery plus conventional for experimental group performed 20 minutes motor imagery plus conventional therapy 3 times/week for 6 weeks, evaluation done at baseline, 2nd, 4th and 6th week.Lower Extremity Function scale (LEFS), Modified Ashworth scale (MAS), Dynamic Gait Index (DGI) and Time Up and Go test (TUG) and Stroke Specific Quality of Life Scale (SS-QOL) utilized for assessment and analysed through SPSS 22 version. **Results:** This study showed that significant improvement after 6 weeks of intervention in LEFS in experimental group was p<0.007 while in control group was p<0.494. DGI in experimental group was p<0.001 while in control group was p=0.015. TUG in experimental group was p<0.001 while in control group was p=0.007. MAS in experimental group was p=0.002 while in control group was p=0.019. SSQOL in experimental group was p=0.027 while in control group was p=0.194. **Conclusion:** Motor imagery plus conventional therapy significant improvement in lower extremity function, gait, spasticity and quality of life in stroke patient's compared conventional therapy in 6 weeks.

**Keywords:** Gait, lower extremity function, motor imagery, quality of life, stroke.

## INTRODUCTION

Stroke is a clinical syndrome caused by cerebrovascular accident, appearing sign and symptoms of local or general weakness of cerebral functions over 24 hours or causes fatality.[1,2] The mortality rates was founded 17 million per year, due to heart disease and stroke. [3] Around more than 25% of death occur in Asian population from stroke.[4] The prevalence of stroke in Khyber Pakhtun Khuwa reported 1.2% (1200 per 100,000).[5] Stroke affected the functional capacities and the state of health thus altered quality of life. (6) According to study 39.3% of people who lived at home after a stroke were unable to walk thus impacting lower limb function and gait speed. [7, 8] nearly 80% of stroke patients have an upper limb or lower limb functional deficit. [9]

Recent years, non-invasive therapeutic method (motor imagery technique) found, to improve cortical plasticity, upper limb functions while utilizing the mental rehearsal for motor abilities in conjunction with physical therapy.[10,14] Motor imagery technique was used for different duration and specifically in upper extremity hence this study aimed for impact of motor imagery techniques on lower extremity, hence the objective of the study was to determine the effects of motor imagery technique on lower extremity function, spasticity, gait and quality of life

## METHODOLOGY

A Randomized control trial (NCT04707755) was conducted n=20 stroke patients. The sample size calculated from the study conducted by Amin H. Paravlic et al [15]. Sampling technique used in study was purposive non probability sampling technique. The randomization was done through sealed envelope method into control and experimental group. The study was conducted at Bibi Zahida Memorial Teaching Hospital Peshawar from 1st January 2020 to 15 November 2020 in total duration of 10 months.

The patients having the single, both types of stroke patient (ischemic and haemorrhagic) not more than six months with between 45-65 years, were included in the study. Adult stroke without ADHD assessed with adult ADHD Self-Report Scale, spasticity of the lower limb muscles with the grade 1+ or 2 on modified Ashworth scale, Mini-mental status an outcome score more than 25, Modified Ranking scale score is 4 were also included in study.

Lesion of frontal, parietal and basal ganglia were excluded. A bed ridden patient with any musculoskeletal disorder impeding lower limb function, participating in any experimental rehabilitation or drug studies and having any psychiatric disorder, mental turmoil or dementia, neglecting his affected side or any other neurological disease or auditory or visual were excluded from study.

Approval was taken from the research ethical committee (REC) of Riphah International University (ref # Riphah/RCRS/REC/00664) and Bibi Zahida memorial teaching hospital Peshawar (ref # NCS/DPT/622/20) before conducting the study before conduction of this study. The written informed consent was taken from the participants, and also explained the procedures, potential harms, confidentiality and right to withdraw at any time during the study. A total of n=20 participants were randomly allocated through sealed envelope method to control and experimental groups equally. Data collected from the patient at baseline, 2nd week, 4$^{th}$week and 6$^{th}$ week. The treatment program delivered 3 times a week for 6 weeks.

Experimental group treated with motor imagery technique plus conventional therapy 20 minutes motor imagery technique, 3 times a week for 6weeks. First the patient will have made to sit on chair in a quiet room to observe for the knee flexion and extension ROM, Sitting to standing ability stepping, walking, climbing and descending stairs. Control group received conventional physical therapy for 30 minutes a day for 3 times a week till 6 weeks, included passive stretching, ROM exercises, training from sitting to standing, antero-posterior steps, as well as climbing and descending stairs.

A total of n=20 samples were recruited, after the assessment of n=35 individuals, on the basis of inclusion criteria which are randomly allocated into the experimental and control group through the sealed envelope method. There were drop out of 2 samples from each group due to the COVID-19 and the data from 8 samples were analyzed, who had completed the interventional duration with all four assessments including baseline, 2$^{nd}$, 4$^{th}$ and 6$^{th}$ week. The data was collected through time up and go test for functional performance, lower extremity function scale (LEFS) for lower extremity impairments in stroke patients. [16] Modified ashworth scale for spasticity and stroke specific quality of life (SS-QoL) were also measured.

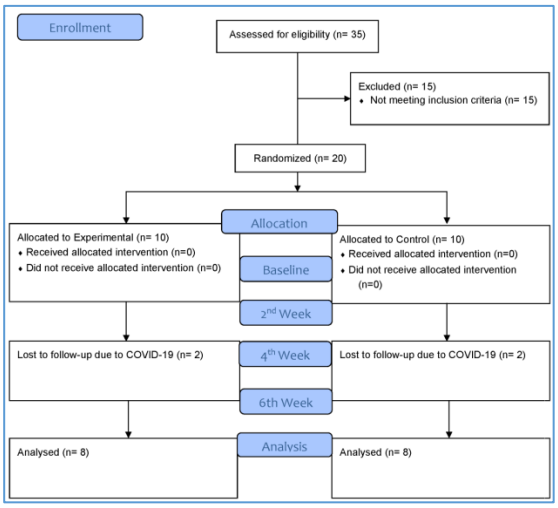


Figure 1: CONSORT diagram

As the data was normally distributed that repeated measure ANOVA for within group analysis and independent t test for between group comparisons was applied. The level of significance was set at p<0.05. The SPSS ver 22 was used for data analysis.

## RESULTS

The mean age of the control group was 61.75 ± 0.70 and in experimental group it was 61.87 ±0.83 years. A total of n=10 participants were male and remaining 6 were female. The average duration with stroke in 0.62 ±0.74 and 1.25 ± 0.88 years in both control and experimental groups respectively. A total of n=12 participants were with ischemic stroke and reaming with haemorrhagic stroke.

The time up and go test showed significant improvement in experimental (p<0.001) and control (p<0.001) group after 6 week intervention. The pairwise comparison in experimental group showed did not show significant improvement in initial 2 weeks, but from 2$^{nd}$ week to at end of 6 week significant improvement (p<0.05) was observed. The lower extremity function score in experimental group was significantly improve from baseline to 6$^{th}$ week at each level of assessment (p<0.05). The control group also showed over all significant improvement after 6 week intervention as well as from 4$^{th}$ week to 6$^{th}$ week, but no

significant improvement was observed in initial 4 weeks (p≥0.05). The spasticity on MAS and stroke specific quality of life were significantly improved in both groups through the intervention duration (p<0.05). (Table 1)

Table 1: Within the group pairwise comparison analysis (TUG, LEFS, MAS & SS-QOL)

| Variable | Duration | Experimental Group | | Control Group | |
|---|---|---|---|---|---|
| | | Mean ± SD | p-value | Mean ± SD | P-Value |
| Time up and go test | Baseline | 1.75 ± 0.46 | 0.083[a] | 2.12 ± 0.64 | 0.157[a] |
| | 2nd week | 1.37 ± 0.51 | 0.046[b]* | 1.87 ± 0.35 | 0.071[b] |
| | 4th week | 1.00 ± 0.00 | 0.008[c]** | 1.37 ± 0.51 | 0.046[c]* |
| | 6th week | 0.50 ± 0.53 | 0.00[d]*** | 1.50 ± .53 | 0.007[d]** |
| Lower extremity function scale | Baseline | 2.00 ± 1.06 | 0.001[a]** | 1.12 ± 1.35 | 0.344[a] |
| | 2nd week | 2.50 ± 0.92 | 0.00[b]*** | 1.25 ± 1.28 | 0.051[b] |
| | 4th week | 2.62 ± 0.74 | <0.001[c] | 1.25 ± 1.38 | 0.028[c]* |
| | 6th week | 2.75 ± 0.46 | 0.041[d] | 1.37 ± 1.30 | 0.007[d]** |
| Modified ashworth scale for spasticity | Baseline | 2.87 ± 1.24 | 0.00[a]*** | 2.25 ± 1.03 | 0.00[a]*** |
| | 2nd week | 3.25 ± 0.88 | 0.00[b]*** | 2.75 ± 0.88 | 0.00[b]*** |
| | 4th week | 2.62 ± 0.51 | 0.00[c]*** | 2.75 ± 0.88 | 0.00[c]*** |
| | 6th week | 2.50 ± 0.75 | 0.020[d]* | 2.62 ± 0.74 | 0.12[d] |
| Stroke specific quality of life | Baseline | 2.50 ± 1.69 | 0.004[a]** | 1.75 ± 1.75 | 0.02[a]* |
| | 2nd week | 3.00 ± 1.41 | 0.00[b]*** | 1.75 ± 1.75 | 0.02[b]* |
| | 4th week | 3.25 ± 1.16 | 0.001[c]** | 1.87 ± 1.80 | 0.02[c]* |
| | 6th week | 3.37 ± 1.06 | 0.015[d]* | 2.00 ± 1.92 | 0.02[d]* |

*[a]Baseline vs 2nd week, b 2nd week vs 4th week, [c]4th week vs 6th week, [a]Baseline vs 6th week*

*Significance Level: p<0.05*, p<0.01**, p<0.001****

The comparison of time up and go test in both groups showed significant improvement (p=0.002) in experimental group as compare to control group after 6week on intervention. The lower extremity function were also significantly improved (p<0.05) in experimental group as compare to control group from 2nd week to the end of 6 weeks. While comparing the spasticity (MAS) and stroke specific quality of life no significant different was observed throughout the treatment duration. (Table 2).

Table 2: Between The group comparison (TUG, LEFS, MAS & SS-QOL)

| Variable | Duration | Experimental Group | Control Group | |
|---|---|---|---|---|
| | | Mean ± SD | Mean ± SD | P-Value |
| Time up and go test | Baseline | 1.75 ± 0.46 | 2.12 ± 0.64 | 0.20 |
| | 2nd week | 1.37 ± 0.51 | 1.87 ± 0.35 | 0.96 |
| | 4th week | 1.00 ± 0.00 | 1.37 ± 0.51 | 0.05 |
| | 6th week | 0.50 ± 0.53 | 1.50 ± .53 | 0.002** |
| Lower extremity function scale | Baseline | 2.00 ± 1.06 | 1.12 ± 1.35 | 0.16 |
| | 2nd week | 2.50 ± 0.92 | 1.25 ± 1.28 | 0.04* |
| | 4th week | 2.62 ± 0.74 | 1.25 ± 1.38 | 0.02* |
| | 6th week | 2.75 ± 0.46 | 1.37 ± 1.30 | 0.01* |
| Modified ashworth scale for spasticity | Baseline | 2.87 ± 1.24 | 2.25 ± 1.03 | 0.29 |
| | 2nd week | 3.25 ± 0.88 | 2.75 ± 0.88 | 0.27 |
| | 4th week | 2.62 ± 0.51 | 2.75 ± 0.88 | 0.72 |
| | 6th week | 2.50 ± 0.75 | 2.62 ± 0.74 | 0.75 |
| Stroke specific quality of life | Baseline | 2.50 ± 1.69 | 1.75 ± 1.75 | 0.39 |
| | 2nd week | 3.00 ± 1.41 | 1.75 ± 1.75 | 0.13 |
| | 4th week | 3.25 ± 1.16 | 1.87 ± 1.80 | 0.08 |
| | 6th week | 3.37 ± 1.06 | 2.00 ± 1.92 | 0.09 |

*Significance Level: p<0.05*, p<0.01**, p<0.001****.

## DISCUSSION

The objective of the study was to determine the effects of motor imagery technique on lower limb function, among stroke patients. The results showed that motor imagery technique significantly improve lower extremity functions, mobility status including static and dynamic balance as well. Armin H. Paravlic et al, reported the improvement in muscle strength through motor imagery technique that leads to improve quality of life in total knee arthroplasty patients. [15] The similarity in results due to the targeted lower extremity motor functions trainings. Similar results were reported, of mental

practice (motor imagery technique) for stroke survivors when used in conjunction with conventional physical therapy for functional rehabilitation of both upper and lower limbs, as well as for the recovery of daily activities and skills, [13] may be due to adapted the adjunct therapy in the form of conventional physical therapy which reinforced by the additional motor imagery technique. Another study concluded that the motor imagination was effective in stroke patients with mild cognitive condition in comparison to mirror therapy [9] just similar to our results which has not included the cognitive dysfunction and behaviourally disturbed stroke patients. Hatwar et al concluded that motor imagery with mirror therapy is as effective as motor imagery alone in improving gait and performance in stroke patients. [14] The results of the present study support a study by Uttam M et al. by reporting that the motor imagery technique was effective in improving the quality of life and upper limb functions in stroke patients. [16] Proprioception with motor imagery training showed greater improvement than conventional proprioception training of the weight bearing ratio of the unaffected affected sides, indicating that the balance ability, postural symmetry and proprioception of the subjects were enhanced that leads to improve the quality of life in stroke patients.

Ietswaart suggested no impact of motor imagery with mental practice on motor recovery in acute phase of stroke patients [18] as of in the current study included the chronic patients. On the other side motor imagery trainings were useful in improving the dynamic balance and gait performance that reflects the lower extremity performance and quality of life as well. [19]

The limitations of this study was incapacity of motor imagery technique dose and the procedure to increase the task from simpler to complex hence it is recommended to consider the dosage of motor imagery technique to achieve the clinical benefits in chronic cases of stroke patients, additionally, one may plan the graded motor imagery technique on lower extremity.

## CONCLUSION

Motor imagery appears to be a positive intervention for stroke rehabilitation. The results of this study concluded that effects of motor imagery technique combination with conventional therapy are effective in improving lower extremity function, and quality of life of a stroke patient after six weeks of intervention as compare to conventional therapy alone.

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