

Original article

Effectiveness of proprioceptive and exteroceptive stimulation to improve motor performance in stroke

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Abstract:

Background: Stroke is third leading cause of death, long term disability which can be regarded weakness, loss of muscle tone, generalized fatigue, and loss of voluntary control or limitation in mobility, along with sensory, motor and cognitive dysfunction. Several large intervention trials targeting motor recovery report the participant's motor performance improved, strategies to improve quality and regain independence after Stroke. Hence, to find out the effectiveness of Exteroceptive and proprioceptive stimulation on basis of neuroplasticity improve motor performance of Stroke.

Methodology: Data is collected by Principal investigator with all patients of Stroke referred for PT by Department of Medicine with clinical diagnosis of Stroke. Study design is Randomized Controlled Trial with Pre and Post experimental prospective study.

Result: 148 patient were assessed with SD using Chi-square test, Student's paired an unpaired 't' test, Mann whitney 'U' test and Wilcoxon signed rank test comparison is taken from all data.

Conclusion: After intervention with outcome measures experimental group shows more improvement in Tone, balance as well as Quality of movement than control group, all the measurement shows STREAM as well as MASS significant improvement.

Keyword: Stroke, Motor, Rood's concept, Rehabilitation

Introduction:

Stroke is third leading cause of disability in all over world. Stroke is major cause of long-term neurological disability in adults with appropriately all Stroke survivors left with severe functional problem in the acute stage of Stroke. This drastically impacts on performance of functional abilities, independent, self care and quality of life. The primary goal of rehabilitation is to assist Stroke survivors to relearn the skills that are lost due to brain damage on the basis of neuroplasticity. Stroke rehabilitation can help in regaining self independence and improve the Quality of life. Most stroke survivors are burdened with physical dysfunction continue with motor deficit into chronic phase of Stroke that have large effect on daily life. The primary goal of rehabilitation interventions to maximize UL motor recovery and functional independence with Stroke. The primary goal of rehabilitation is to assist Stroke survivors to relearn the skill that are lost due to brain damage. This will maximize functional independence, minimize long term disability and increase the

activities of daily living. Stroke rehabilitation is only way to get motor and functional recovery. Rood's approach based on reflexes of muscle. Basic concept of motor pattern are developed from primitive reflexes through proper sensory stimuli to appropriate sensory receptor in normal sequential developmental pattern to improve motor performance.

Sensorimotor information from multiple sources is used by Central nervous system (CNS) to optimize functional performance. Proprioceptive, exteroceptive and vestibular stimulation, purposeful movement and repetition of movement is essential for sensorimotor reeducation. The proprioceptive and exteroceptive stimulation significantly relearn activities of daily living in post-stroke patient; which leads to improve motor performance in Stroke.

Materials and methods:

In this study pre and post experimental study was done in in both groups conventional as well as experimental group in each group 74 patient is taken with 4 weeks of follow-up period. For this study permission is taken from Institutional ethical

committee and Ctri registration obtained register no. is ctri/2020/04/02463 for 3 years. For each study was done with 4 weeks of follow-up. Amongst that 2 are drop outs ,one pt. having seizure and other having acute kidney disease. Inclusion criteria is Pt. who is diagnosed as Stroke in Dr Vitthalrao Vikhe Patil Department of Medicine as well as from Dr APJ Abdul Kalam College of Physiotherapy ,Dept. of Neurophysiotherapy between the age group of 20 to 75 years of either gender ,written informed consent form is taken before intervention. Exclusion criteria is Pt. who is comatose, with Uncontrolled Hypertension, history of repetitive stroke, hearing and visual deficit ,with seizure and metabolic disorder excluded.

STREAM is a measurement tool used to quantitatively evaluate the recovery of voluntary movement and mobility for post-stroke. It is used to assess the patient’s voluntary movement , functional mobility and ROM.

Intervention:

Group A is conventional group included Patient education, ROM exercises ,strengthening ,stretching

,weight bearing ,balance and co-ordination exercises. Group B has been performed along with conventional exercises , exercises included facilitation and inhibition with the help of exteroceptive stimulation ,proprioceptive stimulation ,vestibular stimulation and repetitive purposeful activity . For Facilitation quick stretch, resistance ,tapping quick icing, fast brushing ,light touch , joint approximation, heavy joint compression has given. For Inhibition prolonged stretch, inhibitory tendon pressure ,prolonged icing ,slow rolling ,rocking has given.

Along with stimulation patient were advised to do some repetitive purposeful activity, such as for upper limb – wipe the table for 5 min ,grasp a glass and try to open it. Touch a wall at the shoulder level and touch his or her cheek, touch hair and slide a ball with the help of extensor aspect of forearm .

For lower limb- sitting to standing with support, kick a ball ,standing to half sitting ,walk with support. After each exercises 20 rep for 2 times given for 4 weeks upto 3 months to relearn the activities of daily life.

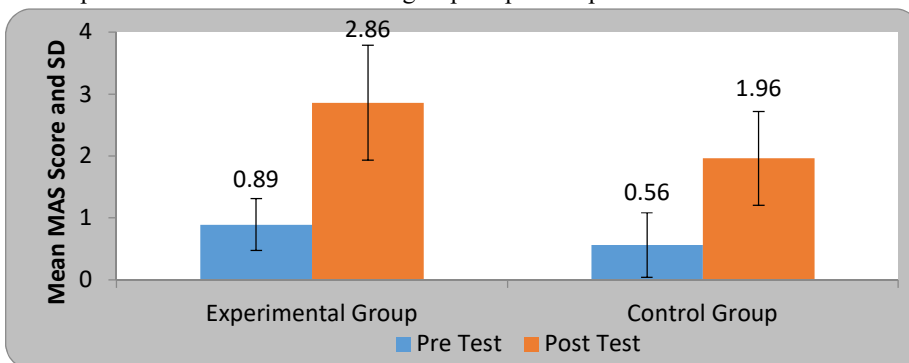
Statistical analysis:

Comparison of MASS between Pre and Post treatment group:

Comparison of MASS score in two groups at pre and post test
 Wilcoxon Signed Rank Test

Group	Pre Test	Post Test	Mean Difference	z-value	p-value
Experimental Group	0.89±0.42	2.86±0.93	1.97±0.83	20.39	0.0001,S
Control Group	0.56±0.52	1.96±0.76	1.40±0.61	19.71	0.0001,S

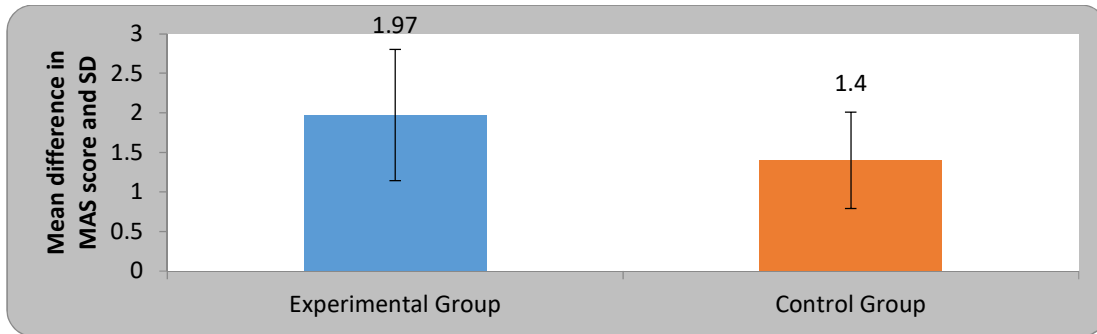
Comparison of MASS score in two groups at pre and post test



Comparison of mean difference in MASS score in two groups
 Mann Whitney U Test

Group	Mean Difference	SD	z-value	p-value
Experimental Group	1.97	0.83	4.77	0.0001,S
Control Group	1.40	0.61		

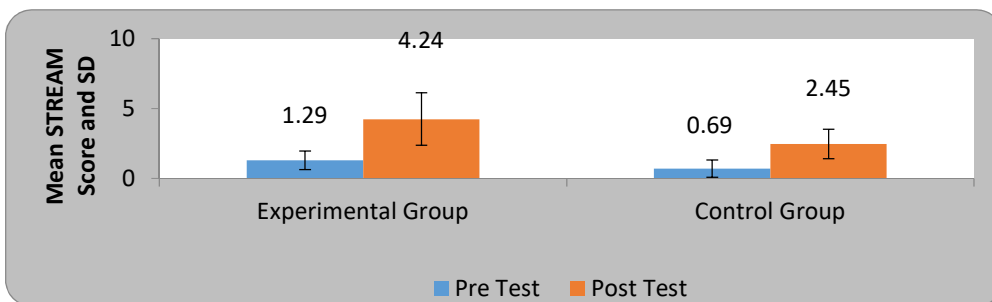
Comparison of mean difference in MAS score in two groups



Comparison of STREAM score in two group at pre and post test
 Wilcoxon Signed Rank Test

Group	Pre Test	Post Test	Mean Difference	t-value	p-value
Experimental Group	1.29±0.67	4.24±1.89	2.94±1.45	17.58	0.0001,S
Control Group	0.69±0.61	2.45±1.06	1.76±0.95	15.93	0.0001,S

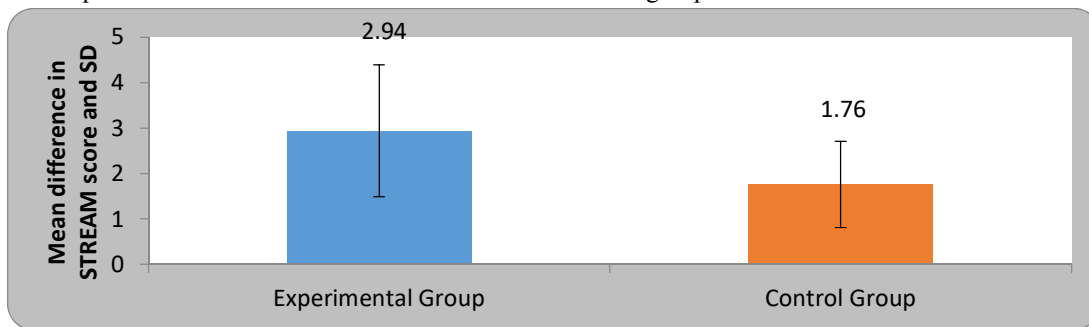
Comparison of STREAM score in two group at pre and post test



Comparison of mean difference in STREAM score in two groups
 Mann Whitney U Test

Group	Mean Difference	SD	z-value	p-value
Experimental Group	2.94	1.45	5.91	0.0001,S
Control Group	1.76	0.95		

Comparison of mean difference in STREAM score in two groups



Result: Statistical analysis was done by using descriptive and inferential statistics using Chi-square test, student's paired and unpaired t test, Mann whitney U test and Wilcoxon Signed Rank test and software used in the analysis were SPSS 27.0 version and GraphPad Prism 7.0 version and $p < 0.05$ is considered as level of significance.

Discussion:

People with Stroke have abnormal tone ,reduced sensation with difficulty in movement and have increased risk of fall compared with age match individual who not had a Stroke. Impaired tone, impaired motor control ,high rates of falls post-stroke are associated with reduced quality of life and reduced motor performance. **Rood's** concept of sensorimotor movement reeducation that seeks to optimize sensorimotor function according to capacity of individual. Research of Ikuno et al(2002), who found that somatosensory stimulation along with repetitive task specific activity helps to enhance the effect of task oriented training patient's with Subacute Stroke. Sim et al(2006), also supported the fact of sensory stimulation is advantageous for post-stroke hemiparesis and help to improve independent self care. Studies, also shown without repetition , it is difficult to gain motor recovery in motor disorder patient. Repetition , is essential for learning motor skill which can alter the cortical representation to reverse detrimental changes due to cortical lesion. Rood's approach is based on known physiological

facts in that sensory stimulation provides desired muscular response and was specially designed for patients with motor control problem. Rood's approach is based on four basic principles- 1) Normalization of tone using sensory stimulation. 2) Ontogenic development pattern 3) Repetition 4) Purposeful movement. According to, Rood sensory stimulation can activate or deactivate the Receptor by facilitation or inhibition , which makes possible to get desired muscular response. Sensory stimulation causes – 1) trophic changes by the axoplasmic flow in nerve processes over the period of time as well as 2) immediate effect by transmission of nerve impulses. According to, Rood's clarified four types of Receptor ; Proprioceptor, Exteroceptor, Vestibular and Special sense organ .According to Rood muscle in combination of light work or phasic muscle or heavy work or tonic muscles. Rood categorized all flexors and adductors muscle group and phasic or mobility muscle and all extensor and abductor are categorized as tonic or stability muscles. Facilitation or inhibition of proprioceptors,exteroceptors, vestibular and special sense organs can excite the

anterior horn cell of spinal cord in which it is help to normalize the tone of muscles and for motor recovery. In this study , appropriate sensory stimuli ,purposeful movement and Repetition component was employed in stimulating cortical area and development of motor skill. Somatosensory input to motor cortex normally plays vital role in learning new motor skill and takes crucial part in motor relearning after Stroke .

Jenett Carr and Roberta Shephard et al(2009) studied investigation of new motor assessment scale for Stroke patient and concluded that MAS to be useful for providing feedback to the patient on his progress. Researcher suggested, that the motor function is improved as there is increased recruitment of motor units because of proprioceptive stimulus. Kamaljeet Singh(2004) reported that D1 & D2 pattern of PNF for 3 days/week for 3 months were effective in treating both motor and sensory component. It improved sensorimotor control to produce better motor outcome. Ambrose et al (2003) help to improve muscle strength ,functional ability and joint position sense.

Hunter et al, Gibb et al and Kolb et al also found that exteroceptive stimulation is effective in improving muscle strength and motor recovery in Stroke rehabilitation. Chaturvedi et al indicates Rood's concept is more effective than other neurological approaches . Deekshita et al also found purposeful activity is effective in improving muscle strength and motor recovery. Carel et al (2000) have shown that proprioceptive training induces a reorganization of

sensorimotor representation in healthy subjects. Thus, increased contralateral activity in secondary sensorimotor areas may facilitate control of recovered function by simple proprioceptive integration in severely impaired patients. Repetition is essential for learning motor skill which can alter cortical representation to reverse detrimental changes as cortical lesions. Ikuno et al, who found that somatosensory stimulation along with repetitive task specific activity help to enhance the effect of task oriented training in patients with subacute Stroke.

Rood's approach a sensory stimulus is used to determine specific motor response, developmental sequences are used i.e. from lower to higher levels and practice of sensory motor response until learning is achieved. Sim et al also supported sensory stimulation for improvement of motor function of post-stroke hemiparesis and independent self care.

Conclusion: Stroke is common neurological disorder with complex process of recovery . Survivors of Stroke often left with disabilities. Rehabilitation of Stoke patient begins as soon as impairment is perceived and comprises traditional exercise program and neuropsychological approaches with the primary aim of restoring mobility and motor performance of patient.. In this study , appropriate sensory stimuli ,purposeful movement and Repetition component was employed in stimulating cortical area and development of motor skill. Somatosensory input to motor cortex normally plays vital role in learning new motor skill and takes crucial part in motor relearning after Stroke .

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