Research Article

Sensorimotor Approach To Improve Balance And Functional Activity In Stroke Rehabilitation.

Dr Ketaki Patani[1*], Dr Sudhir Tungikar[2]

[1*]BPT, MPT, PhD SCHOLAR, Associate Professor, Department of Neurophysiotherapy, Dr APJAK COPT, PIMS, LONI
[2]HOD & Professor, Department of Medicine, PIMS, LONI

ARTICLE INFO	ABSTRACT
	INTRODUCTION: Decreased balance is a common problem associated with people following Stroke. Poor dynamic balance may hinder individual from independent walking , one of the critical factor to achieve functional independence in activities of daily living. Stroke is third leading cause of death ,long term disability which can be regarded weakness , loss of muscle tone ,generalized fatigue ,loss of voluntary control or limitation in mobility ,loss of balance,loss of functional activity along with sensory and cognitive dysfunction. Sensorimotor approach mainly focused on to improve functional activity and regain balance after Stroke. **AIM**: Sensorimotor approach to improve balance and functional activity in Stroke Rehabilitation. **Methods:** 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 study. **Result :** All 74 patient were assessed with SD using Chi-square test, Student's paired an unpaired 't' test ,Wilcoxon signed rank test, Mann Whitney U 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 Berg balance scale ,FIM and as well as MASS significant improvement. **Keyword:** Stroke, balance , functional activity , Rood's concept, Rehabilitation.

Introduction :

Decreased balance is common problem following associated with Stroke. Poor dynamic balance may hinder individuals from independent walking , one of the critical factor to achieve functional independence in activities of daily living. 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. 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 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 .

Sensorimotor approach 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 extroceptive stimulation significantly improves motor recovery in post-stroke patient ; which leads to improve ability of independent self care.

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 kindney 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.

Berg balance scale – It is a test of functional balance . It is commonly applied for ADL's. It is objectively determine patient's inability to safely balance during a series of predetermined tasks.

FIM(Functional Independence Measure) – It includes measures of independence of self-care, including sphincter control ,transfer,locomotion , communication and social cognition. It uses the level of assistance for an individual needs to grade functional status from total independence to total assistance. The tool is used to assess patient's level of disability as well as change in response to rehabilitation to carry out ADL's.

Intervention : Group A is conventional group included ROM exercises ,strengthening ,stretching ,weight bearing ,balance retraining and co-ordination exercises. Weight bearing exercise -10 repetition per day. Upper limb weight bearing exercise – sit on bed with hand placed on bed. For lower limb –weight bearing exercise – the patient were made stand with support. In the experimental group it is

For Group B Rood's approach –

For Facilitation: Quick stretch : 10 repetition for each stretch .

Resistance : 20 repetition for each movement ,Tapping: 5 repitition during each time,Quick icing: 3 quick stroke for each muscle belly.Fast brushing: Apply 5 sec and repeat for 30 sec . Ten repetition for each muscle. Light touch: Apply 5 stroke with light brush and give rest for 30 sec into 10 repetition. Approximation : 20 repetition. Heavy joint compression : 10 repetition

For inhibition: Inhibitory stimulus for desired group and facilitatory for opposite group.

Prolonged stretch : 10 min,Inhibitory tendon pressure: 10 repetition, Prolonged ice : 10 min, Slow rolling: 10 repetition. For balance Vestibular stimulation & repititve purposeful activity. Along with sensorimotor stimulation , patients were advised to do some purposeful activity such as; for upper limb – Wipe tables for 5 minutes, grasp a glass and try to open it , touch a wall at shoulder level and touch his/her cheek , touch hair and slide a with the extensor aspect of forearm .for lower limb- sitting to standing with support, kick a ball ,standing to half sitting, perturbations , walk with support and then unsupported.

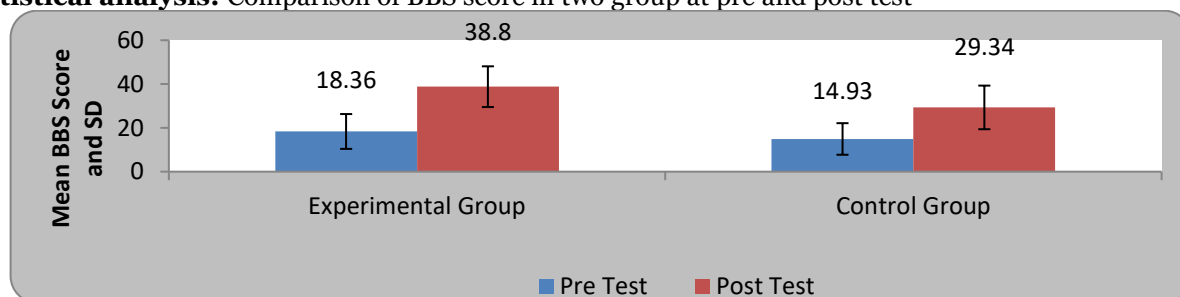**Statistical analysis:** Comparison of BBS score in two group at pre and post test
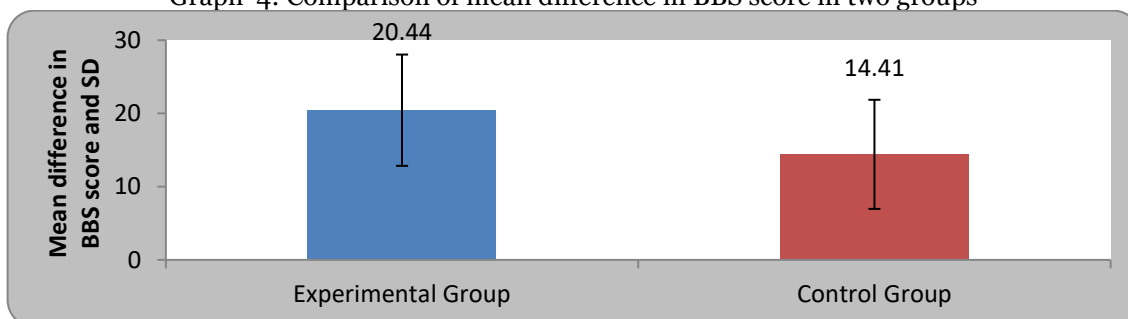
Table 4: Comparison of mean difference in BBS score in two groups Student's Unpaired t test

Group	Mean Difference	SD	t-value	p-value
Experimental Group	20.44	7.60	4.89	0.0001,S
Control Group	14.41	7.45		

Graph 4: Comparison of mean difference in BBS score in two groups

Comparison of Berg balance scale between Pre and Post treatment group :

Group	Pre Test	Post Test	Mean Difference	Student's paired t test t- value
Experimental Group	18.16 ±9.64	41.50 ±9.16	23.33 ± 4.94	16.35 P= 0.0001,S
Control Group	13.69±7.04	27.23 ±10.06	13.53 ± 6.41	7.61 P= 0.0001,S
Comparison between two groups (Student's unpaired t test)				
t-value	1.33 P= 0.19,NS	3.69 P= 0.001,S		
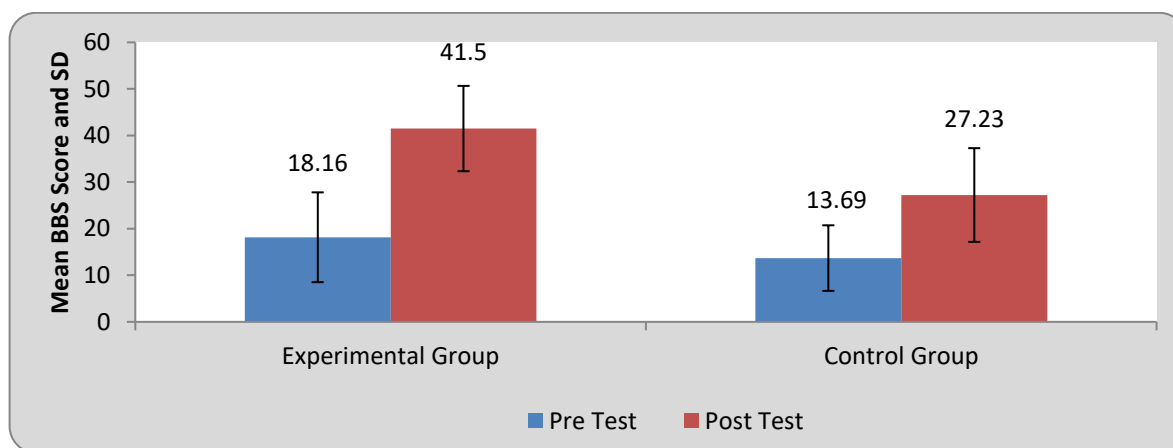
Comparison of MASS pre and post experiment group :

| Experimental group	Experimental group	0.85±0.53	2.71±1.06	1.85±0.86
Control group	Control group	0.71±0.46	2.35±0.84	1.64±0.63
Comparison between two groups (Student's unpaired 't' test)	Comparison between two groups (Student's unpaired t test)			
t- value	t-value	1.08 P = 0.28,NS	1.45 P = 0.15 ,NS	
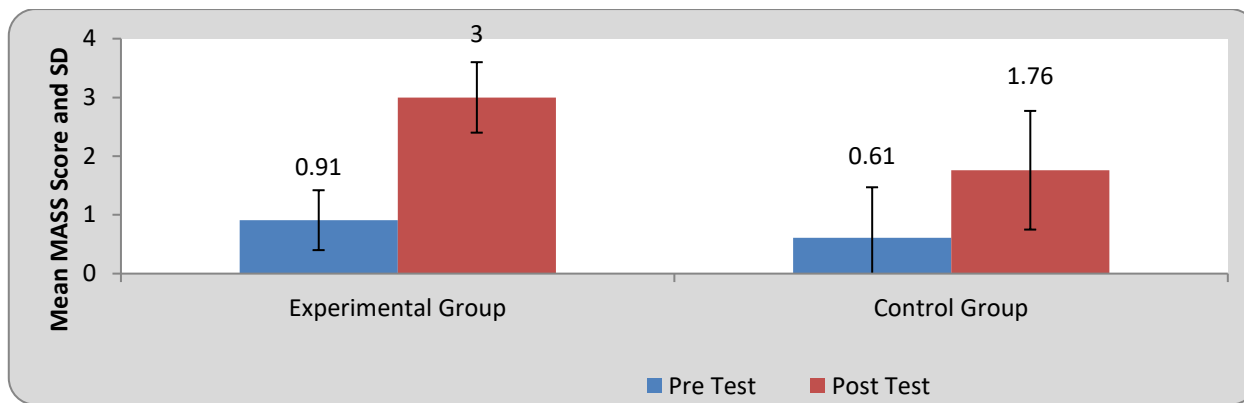
COMPARISON OF MASS IN PRE AND POST EXPERIMENT GROUP
Comparison of FIM IN PRE AND POST EXPERIMENT GROUP:

Group	Pre Test	Post Test	Mean Difference	Student's paired test t-value
Experimental Group	53.85±18.07	94.66±13.35	41.08±12.28	11.58 P= 0.0001,S
Control Group	42.53±9.22	58.76±13.19	16.23±10.40	5.62 P = 0.0001,S
Comparison between two groups (Student's unpaired t test)				
t-value	1.94 P= 0.06,NS	6.75 P= 0.0001,s		

Mean FIM SCORE
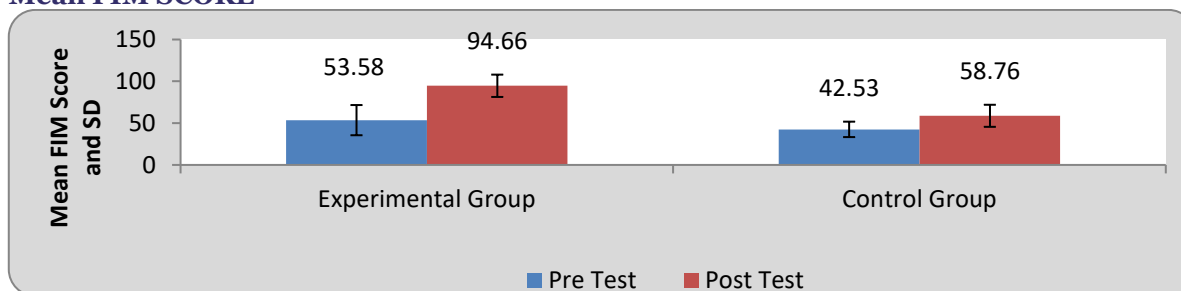
RESULT:

Statistical analysis was done by using descriptive and inferential statistics using Chisquare 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. Rehabilitation for patient with Stroke as early as possible which improves mobility, joint integrity and also basic limb positioning and compression of joints will help to improve balance and functional activity of patient.

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 ,impaired balance and functional activity high rates of falls post-stroke are associated to reduced quality of life . The role of sensory stimulation is complex process of neuroplasticity and improves functional recovery. Direct effect of sensory stimulation is determined by activation of neuronal tissue during ischemia ,vascular response and balance of demand and supply of oxygen nutrients.

Rood's concept of sensorimotor movement reeducation that seeks to optimize sensorimotor function according to capacity of individual. Research of Ikuno et al, 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, 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.

Jenett Carr and Roberta Shephard et al 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 reported that D1 & D2 patterns of PNF for 3 days /3 weeks for 3 months were effective in treating both motor and sensory component. Sensorimotor exercise produce better motor outcome.

Gustaven et al indicates high corelationship found between MAS and BBS. It also suggested when patient compared on the basis of presence or absence of syndromes of neglect or aphasia after damage to Rt or Lt Hemisphere ,respectively significant difference is noted on FIM. Chaturvedi et al indicates Rood's concept is more effective than other neurological approaches . Bohanann and Leary et al reported a positive correlation between BBS & FIM. Berg Balance Scale is measure postural control in Stroke patient and poor balance associated with falls.

Simpson et al reported an association between the number of falls and Berg balance score in Stroke patient and useful for prediction of falls. 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 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 .

BBS (Berg balance scale) in terms of clinical practicality and efficiency. Wong et al and La porta et al (2006) evaluated overall items in correlation of standing look behind ,transfer and standing to sitting. Additionally Hunter et al (2008) ,Gibb et al (2010) & Kolb et al (2010) also found that exteroceptive stimulation effective in improving muscle strength and motor recovery in Stroke patient.

Rood's approach a sensory stimulus is used to determine specific motor response,developmetal sequences are used i.e. from lower to higher levels and practice of sensory motor response until learning is achieved.

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 ,retraining balance and functional activity in individuals.

Abbreviations: Berg Balance Scale (BBS), Functional Independence Measure(FIM), MASS (Modified Ashworth spasticity scale).

Conflict of Interest: None

Source of funding : Self

Ethical clearance : It was approved by Institutional ethical committee.

REFERENCES:

1. Dr Rup Sekhar Dekha et al Effectivenss of HEPwith modified Rood's approach can muscle strength in post cerebral hemorrhagic individuals: RCT ; Oct. 2019; Int. J. Phy ,6(5) : 231-239
2. Ratanpat Chanubol et al . A randomized controlled trial of cognitive sensory motor training therapy on recovery of arm function in acute Stroke patient .Jr of Clinical Rehabilitation ; 2012 , 0(0) :1-9
3. Physical Rehabilitation ,5th edition ,Susan B O' Sullivan ; Thomas J Schmitz.
4. Rood M. S. et al Neurophysiological mechanism utilized in the treatment of neuromuscular dysfunction, American journal of occupational therapy; 1968; 10 : 220-225

5. Jung –Ho-Lee et al Effect of proprioceptive sensation and feedback required for motor learning on function ,activities & daily life behavior of patients after nerve injury. ;World journal of Advanced Research & Reviewrs; Sep 2021; 11(03) :474-481
6. Jacqueline M. Winter et al .Effects of mobilization and tactile stimulation on chronic upper limb sensorimotor dysfunction after Stroke; Archives of physical medicine & rehabilitation ; 2012; 94:693-702
7. Marit Gastaven et al .Measuring balance in sub-acute Stroke Rehabilitation ; Advances in Physiotherapy ; 2006;08:15-22
8. Adam Saso,Rolf Moe- Nilssen et al . Responsiveness of Berg Balance Scale in patients early after Stroke ; Int. Journal of Physiotherapy ; 2016; 32(4) : 251-261.
9. Katan M ,Luft A et al. Global burden of Stroke. Jr. of Neurology and Neural repair 2018; 38(2) : 208-211
10. Jia-ching-chen ,Fu-zen-shaw et al Progress in sensorimotor rehabilitative physical therapy programs for Stroke patient ;World Journal of Clinical Cases; 2014 ;16; 2(8): 316-326
11. K Bordoloi et al . Scientific reconciliation of the concept and principles of Rood's approach .Int. J Health Sci Res. 2018;8(9) : 225-234.
12. Brisbane et al, Australia .Gamification of proprioceptive training ; Journal of central nervous system Disease .2019; 11: 1-7.
13. Sangei V. Adamovich et al .Sensorimotor training in virtual reality .2009; 29-44
14. Ya-yun-Lee et al.Combining afferent stimulation and Mirror therapy for improving muscular, sensorimotor and daily function after Chronic Stroke.2015,00;1-10.
15. Banerjee P. Kumar et al .Epidemology of Stroke in India Journal of Neurology Asia. 2006 ,11 ; 14-20
16. Lamotte RH et al .Disorders in somestetis in parietal lobe .Journal of Neurophysiology .1979 ,42:400(Pubmed)