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Comparison Of Two Physiotherapy Approaches In Acute Stroke Rehabilitation: Motor Relearning Program Versus Bobath Approach.

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ABSTRACT

Objective: To evaluate the efficacy of two rehabilitative approaches to restore function in subjects with acute middle cerebral artery stroke.

Study design: Nonblinded, randomized clinical intervention trial

Method: 22 subjects with first unilateral stroke (middle cerebral artery territory involvement) participated in the study. Group 1 (12 subjects) and group 2 (10 subjects) received Motor Relearning Program (MRP) and Bobath approach respectively for a period of six weeks.

Outcome measures: Fugl Meyer (FM), Motor assessment scale (MAS), Barthel index (BI), Functional independence measure (FIM), Functional ambulation category (FAC) and Dynamic gait index (DGI).

Results: The magnitude of change on all our primary outcome measures except FM, was greater in the MRP group as compared to Bobath group ($p<0.05$) & inclination of higher trend of change starting at 2weeks seen in MRP.

Conclusion: This study indicates that the physiotherapy treatment using MRP shows early & better improvement in functional mobility and activities of daily living than Bobath approach. Subject in MRP were able to walk early.

Key words: Stroke rehabilitation, Motor relearning program, Bobath approach, efficacy

INTRODUCTION

Stroke is the leading cause of adult disability and the second leading cause of mortality worldwide[1]. It is a global health problem with an annual incidence of 0.2 to 2.5 per 1000 population[2]. In India, annual incidence of stroke is 33 per 100,000 and mortality rate is 73 per 100,000[3]. Stroke is responsible for three million deaths and this number is on a continous rise in developing countries[4]. In the developing world, stroke affects individuals in the most productive part of their lives. Two-thirds of strokes occur in low- and middle-income countries, where the average age of patients with stroke is 15 years younger than that in high-income countries[5]. The cost of stroke rehabilitation is considerable to both the individual and to the society, and consequently effective treatment of stroke victims is of extreme importance.

Early intervention in acute stroke rehabilitation plays major role in restoration of function & reducing the degree of disability[6]. Richards C L et al.[7], reported that most clinical studies have described recovery as occurring mainly in the first 3 months post stroke with plateau at about 6 months post stroke. The assumption has been followed that intervention should be initiated early when the system is most receptive to change. This has been further supported by studies using animal models[8]. Consequently physical therapy administration soon after stroke is becoming usual practice. On the basis of a meta-analysis of 36 trials (between 1960-1990) that investigated the effectiveness of stroke rehabilitation program in improving functional status and discharge destination, Ottenbacher and Jannell[9] found that improvement in performance appears to be related to early initiation of treatment, age, and study design but not to the duration of intervention.

Two widely practiced treatment approaches are: the Bobath approach[10] and a framework based on the movement sciences termed "Motor relearning program" (MRP), outlined by Carr and Shepherd[11,12]. Bobath approach is based on hierarchical model of motor control that is a problem-solving approach to the assessment and treatment of individuals with disturbances of function, movement and postural control due to a lesion of the central nervous system. Motor Relearning Program (MRP) on the other hand believes in the brain's capacity to recover since it is dynamic and is capable of reorganization and adaptation. The assumptions are derived from a systems model of motor control, system theories of motor development, current concepts of plasticity, biomechanics and recent motor learning theories. Functional training (that is-training of motor tasks) therefore may in itself be remedial.

Langhammer and Stanghelle[13] carried out a randomized controlled trial, which compared the Bobath approach and the Motor Relearning Programme in stroke rehabilitation. The results showed that both groups improved but improvement in motor function was significantly greater in the MRP group.

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The same authors further conducted a follow up study to investigate whether the initial physiotherapy approach has any long-term effects on mortality, motor function, postural control, activities of daily living, quality of life, follow-up from community services and living conditions of subjects with stroke[14]. Their data suggested that the initial physiotherapy approach did not seem to have a major influence on the subjects' long-term functional ability.

Van Vliet ET al.[15] evaluated the effect of Bobath based and movement science based treatment on movement abilities and functional independence in subjects with stroke with less than 2 weeks onset. Outcome assessments were completed at one, three and six month's post- intervention. Primary outcome measures were the Rivermead Motor Assessment and the Motor Assessment Scale. Secondary measures assessed were functional independence, walking speed, arm function, muscle tone, and sensation. In this study between groups, comparison did not yield any significant differences on the outcome measures used.

Krutulyte G ET al.[16] has studied the effectiveness of physical therapy methods (Bobath and motor relearning program) in rehabilitation of stroke patients. The mobility of the study participants was evaluated according to European Federation for Research in Rehabilitation (EFRR) scale. Activities of daily living were evaluated by Barthel index. They concluded that physiotherapy with task-oriented strategies represented by MRP is preferable to physiotherapy with facilitation/inhibition strategies, such as the Bobath programme in the rehabilitation of patients with stroke.

The results from the previous studies have been equivocal as far as the efficacy of one approach over the other is concerned. Also little is known about the optimal duration of active rehabilitation, the maintenance of therapeutic gains over time or therapeutic regimes to encourage carryover of therapeutic gains [6, 7]. So the purpose of our study is to evaluate the efficacy of MRP based program versus Bobath approach in subjects with acute onset of stroke.

Method

Participants

Participants with clinical diagnosis of stroke were recruited from local hospitals in Pune, India, during the period from April 2005 to August 2006. Eligibility criteria included 1) first-time unilateral stroke in the region of middle cerebral artery (MCA) circulation confirmed by magnetic resonance imaging or computed axial tomography scan 2) Medically stable, 3) Conscious, 4) Oriented and 5) with onset of stroke two weeks before study entry. Participants were excluded if they had peripheral nerve or orthopedic conditions that interfered with movement, had cardiac disease that limited function by exertional dyspnea, angina or severe fatigue, had subarachnoid or extradural hemorrhage, progressive hydrocephalus, previous history of brain injury, neglect, agitation, depression or perceptual problems. All subjects provided informed consent in accordance with Declaration of Helsinki. Pune University Institutional review board approved all aspects of the study. Demographics are enumerated in Table 1.

STUDY DESIGN

Our study is a nonblinded randomized clinical intervention trial. After the eligibility criteria were met, participants were randomly assigned to any one of the two groups through the use of a random-number generator with A-B-A-B method. Group one received motor relearning program (MRP) and group two received Bobath approach based training (Fig 1). At baseline, both the groups were similar on all outcome measures (Table 1). Subjects in both the groups participated in a six weeks training program after baseline tests. Participants were tested and treated by a single therapist (GVB).

OUTCOME MEASURES

The primary outcome measures used were Fugl Meyer (FM) [17, 18] Motor assessment scale (MAS)[19,20,21,] Barthel index (BI)18,22, Functional Independence Measure (FIM)[18,23], Functional ambulation category (FAC) [24] & Dynamic gait index (DGI) [25,26],. These assessments were performed at baseline, 2 weeks, 4 weeks and 6 weeks (immediate post intervention). The data presented in this study is pre and post intervention measurements and comparison of trend of change in the scores when checked at every two interval.

Figure 1

FUGL-MEYER ASSESSMENT SCALE (FM SCALE)

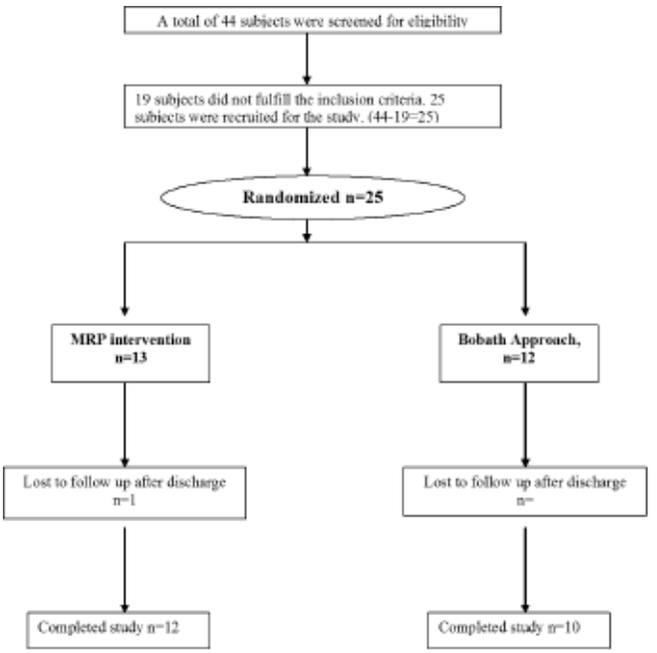


Table 1: Demographics: Baseline characteristics, stroke history and functional evaluation of our study participants

		MRP (n=10) Mean (SD)	Bobath (n=8) Mean (SD)	p value
Age (years)		52.27(8.06)	53.67 (8.46)	p> 0.05*
Gender:	Male	8	6	
	Female	4	4	
Dominance	Right	10	8	
	Left	2	2	
Side affected	Right	7	5	
	Left	5	5	
Time since onset (Mean &SD)		4(1.5)	5(2.3)	P > 0.051
Fugl Meyer		109.20(8.4)	105.13(14.4)	P > 0.052
Motor assessment scale		6(0.47)	6.375(1.19)	P > 0.052
Barthel index		17(6.75)	16.9 (3.72)	P > 0.052
Functional Independence Measure		50(4.69)	45.38(11.44)	P > 0.052
Functional ambulation category		0(0)	0(0)	-
Dynamic gait index		0	0	-

Statistically there was no difference in two groups
1-unpaired t test, 2- Mann-Whitney U-test

A method for evaluation of physical performance. It evaluates the voluntary control of motor function of upper & lower limb. Notes the impairment of sensation, joint range of movements & pain, scores are 0, 1 & 2 for each item. Upper limb has score of 36, hand 30 & lower limb 34, maximum total score of motor function 100. Other items have score of: balance 14, sensation 24, joint range of motion 44 & pain 44. Total score of Fugl Meyer is 226. It is a valid & reliable test.

MOTOR ASSESSMENT SCALE (MAS)

MAS are a test of motor function. MAS registers eight functional activities: turning in bed, sitting, standing up, walking, balance in sitting, activities of upper arm, the wrist and the hand. The ninth item notes the general tone of body. Each item is scaled from 0-6. Hence score between 0-54(normal function). MAS are supposed to be test on disability level according to the WHO criteria. The MAS was found to be highly reliable with an average interrater correlation of .95 and an average test-retest correlation of 98.

BARTHEL INDEX (BI)

The Barthel index measures the degree of assistance required by an individual on 10 items of mobility & activities of daily leaving on widely used for stroke. A single global score ranging from 0- 100, is calculated from the sum of all weighted individual item score. So that '0' equals to complete dependence for all 10 activities. It has excellent validity and reliability, low sensitivity for high-level functioning and takes 5-10 minutes min to complete the test.

FUNCTIONAL INDEPENDENCE MEASURE (FIM)

FIM is an 18 item scale and it measures physical, psychological, & social function. It uses the level of assistance an individual needs to grade functional status from total independence to total assistance. The instrument lists: a) six self-care activities: feeding, grooming, bathing, upper body dressing, lower body dressing & toileting. b) Bowel & bladder control. Functional mobility is tested through tree items on transfers. Under the category of locomotion, walking & stair climbing. FIM also includes two items on communication and three on social cognition. The interrater reliability of FIM has been established at an acceptable level of psychometric performance (interclass correlation coefficients ranging from, 0.86 to 0.88). The face & content validity of FIM has been determined.

FUNCTIONAL AMBULATION CATEGORIES (FAC)

It is a points scale (score 0-5), in which the categorization is designed to give details on the physical support needed by patients who are walking particularly in physiotherapy department. Therefore, it is most useful in active rehabilitation rather than as a measure of actual disability. validity & reliability established. It is simple to use and sensitive to change during the transition form being immobile to walking. The category includes:

Non functional (unstable) - Patient cannot walk or requires

help of two or people.

Dependent level 2- Patient requires firm continuous support from one person who helps carrying weight and with balance.

Dependent Level 1- Patient requires firm continuous or intermittent support from one person to help with balance or co-ordination.

Dependent Supervision- Patient requires verbal supervision or stand by help from one person without physical contact.

Independent on level ground: Patient can walk independently on level ground, but requires help to stair, slopes or uneven.

Independent: -Patient can walk independently anywhere.

DYNAMIC GAIT INDEX (DGI)

The Dynamic Gait Index (DGI) was developed to assess postural stability during gait tasks in the older adult (greater than 60 years of age) at risk for falling. This scale consists of 8 tasks with varying demands, such as walking at different speeds, walking while turning the head, ambulating over and around obstacles, ascending and descending stairs, and making quick turns. Each item is scored on a 4-level ordinal scale with a maximum possible score on the entire DGI of 24. A score of 19 or less indicates an increased risk of falling in older adults. The DGI format provides simple patient instructions for performance of every item with operational definitions for each of the possible grading options. However, it does not provide additional instructions for administering the test or decision rules for scoring items. Preliminary research has shown that the test has good interrater & test-retest reliability & can be used as a predictor of fall among the elderly.

INTERVENTION

The subjects in both groups received physiotherapy 1hr/day, 6d/wk for 6weeks (total therapy dose was 36 hours) of training on an inpatient basis. Once discharged from acute care set-up, subjects continued their assigned training programs on an out patient basis or were given the therapy at their homes. Besides physiotherapy, all subjects received the same multidisciplinary treatment.

Table 2: Principles of treatment followed in training of subject in MRP and Bobath intervention.

MRP	BOBATH
Task specific training in a given environment according to task demands (angle and range specificity). Training of postural adjustment/weight shift required for the particular task.	Training of normal movement in functional patterns.
Postural control	Isolated weight shift & during movement
. Emphasis was given to adaptive & anticipatory postural control.	Training of normal postures & movement patterns
Each task requires a specific postural adjustment in different environment.	Postural control
Progress	Emphasis was laid on testing & training of response to handling.
No developmental sequence was followed. Each posture & movement was individually trained. Progression was made by increasing the complexity in each posture.	Training of reactive postural control, protective reactions & equilibrium without task specific
Analysis and correction of movement	Progress
Therapist and patients both participated in analysis and correction of the movements	Developmental sequences were followed as guidelines for progress.
Emphasis on impairments	Such as supine - Sit –Stand – Walking – Stair climbing.
Negative components: Weakness, Inco-ordination, Imbalance of inter segmental coordination	Analysis and correction of movement
Training	Therapist analyzed and corrected the movements. Subjects followed therapist guidelines.
Task specific strategies were trained. Essential components of the task at hand were practiced. Strength training was a part of the program	Emphasis on impairments
	Positive components: Spasticity reduction, Avoidance of abnormal patterns of movement.
	Training
	Training was limited to specific strategies of movement and posture
	Strength training was avoided

In Motor Relearning Program, seven sections of everyday life were selected: sitting up from supine, sitting, standing, sit-to-stand, walking, & upper limb function. The four steps as enumerated by Carr and Shepherd 11 guided the treatment over the six-week period. These four steps included 1) Analysis of the task, 2) Practice of missing components, 3) Practice of whole task and 4) Transfer of training. In subjects treated with Bobath approach10 reflex inhibiting patterns with techniques of facilitation and inhibition were used. The details of each of the programs are as shown in Table 2.

Data Analysis

Stat plus 2006 software was used for data analysis. Baseline characteristics of the two study groups were compared using unpaired't' test for continuous/interval level data and Mann-U Whitney test for ordinal level data. All our outcome measures were ordinal level measures. Therefore, post therapy gains between groups and within groups were compared using non-parametric tests such as Mann-Whitney U-test and Wilcoxson signed ranks test respectively. Repeated measure ANOVA used for comparison of trend of change in the scores when checked at every two intervals. Level of significance was set at 0.05.

RESULTS

Within Group Comparison

In the present study, within group comparison indicated that post therapy both the groups showed significant improvement on all scales of motor function & functional mobility as shown in Table 3. [MRP ($p<0.001$) & Bobath ($p<0.005$)]

Table 3: Comparison of pre & post treatment scores within two groups

S. No.	Test	Groups	Pre treatment Mean (SD)	Post treatment Mean (SD)	P value
a.	Fugl Meyer				
	(FM) (226)	MRP	109.20(8.4)	148.90(14.3)	P< 0.05*
		BOBATH	105.13(14.4))	143(11.8)	P< 0.05*
b.	Motor Assessment Scale (MAS) (48)	MRP	6(0.47)	30.8(2.95)	P< 0.05*
		BOBATH	6.37(1.18)	23.25(3.1)	P< 0.05*
c.	Barthel index (100)	MRP	17(6.75)	86.5(12.03)	P< 0.05*
		BOBATH	16.9(3.72)	64.4(1)	P< 0.05*
d.	Functional independence	MRP	50(4.68)	102(9.58)	P< 0.05*
	measure (FIM)(126)	BOBATH	45.37(11.43)	79.62(16.37)	P< 0.05*
e.	Functional ambulation category	MRP	0	4.6(0.7)	P< 0.05*
	(FAC)(5)	BOBATH	0	3.5(0.53)	P< 0.05*
f.	Dynamic gait index (DGI)(24)	MRP	0(0)	9.6(6.5)	P< 0.05*
		BOBATH	0(0)	1(0.5)	P< 0.05 *

*p<0.05

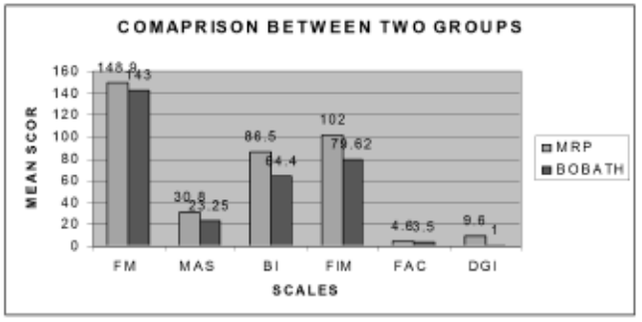
BETWEEN GROUP COMPARISON

The chief finding of our study was that the magnitude of change on our entire outcome measures except Fugl Mayer (MRP-148.90 versus Bobath-143, $p>0.05$), was greater in the MRP group as compared to Bobath group. Motor Assessment Scale (24.8 versus 16.8 points, $p<0.05$), Barthel index (69.5 versus 47.5, $p<0.001$), Functional independence measure (52 versus 34.25, $p<0.001$), Functional ambulation category (4.6 versus 3.5, $p<0.005$) and Dynamic gait index (9.6 versus 1, $p<0.005$) showed significant improvement in the MRP group as compared to the Bobath group. These results are enumerated in Table 4. On motor function scales of Fugl Mayer scale which is based on voluntary control of motor function there was no difference. This suggests that although at the end of 6 weeks training, both the groups had same improvement in voluntary control, subjects in MRP group showed significant improvement compared to Bobath group on activities of daily living and functional mobility (Motor Assessment Scale; 24.8 versus 16.8 points, Barthel Index; 69.5 versus 47.5 And Functional Independence Measure; 52 versus 34.25 Table 4) and walking performance (functional ambulation category 4.6 versus 3.5 and Dynamic Gait Index; 9.6 versus 1 Table 4)

Table 4: Post treatment changes on the outcome measures between the two groups

S. No.	TEST (Maximum possible score)	MRP Mean (SD)	BOBATH Mean (SD)	P level
a.	Fugl Meyer (226)	148.90(14.3)	143(11.8)	P=0.460
b.	MAS (48)	30.8(2.95)	23.25(3.1)	0.0001*
c.	Barthel index (100)	86.5(12.03)	64.4(1)	0.0014*
d.	FIM (126)	102(9.58)	79.62(16.37)	0.004*
e.	FAC (5)	4.6(0.7)	3.5(0.53)	0.0084*
f.	DGI (24)	9.6(6.5)	1(0.5)	0.004*

*p<0.05



GRAPH 1: There significant difference in MAS, BI, FIM FAC and DGI, no difference in FM

ON COMPARISON BETWEEN GROUP AT EVERY 2 WEEKS OF INTERVAL

When both the groups were compared at an interval of 2 weeks, MRP group showed significant difference in the improvement starting at 2 week & maintained at 4 & 6 weeks compared to Bobath group on scales of Barthel index, FIM, FAC, DGI (table 4, c, d, e, f).

But no significant difference was found on motor function (Fugl Meyer & MAS) (table 4, a, b). These findings suggest that MRP is more effective in early restoration of functional mobility & activities of daily living & ambulation performance, starting at 2 weeks of treatment.

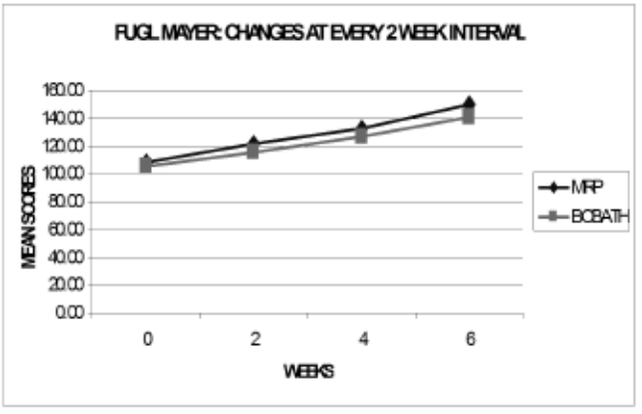
Table 5: Comparison between two groups at different interval using Mann-Whitney U Test

S N	TEST	BASELINE			AT 2 WEEKS			AT 4 WEEKS			AT 6 WEEKS		
		MRP	BOBATH	U value	MRP	BOBATH	U value	MRP	BOBATH	U value	MRP	BOBATH	U value
a	Fugal Meyer	108.6 (13.5)	105.1 (13.5)	40.5	121.6 (14.3)	115.8 (14.7)	30.5	132.6 (14.0)	127.0 (12.8)	36	148.90(14.3)	143(11.8)	29.5
b	MAS	8.09(1.8)	8.78(1.6)	36.5	15.91(4.4)	13.67(1.3)	33.5	23.0(6.0)	21.33(1.6)	47.5	30.8(2.95)	23.25(3.1)	44.5
c	Barthel index	16.36 (6.7)	16.67 (3.5)	42.5	44.55 (10.6)	16.67 (3.5)	20.5*	68.6 (11.0)	29.44 (14.9)	17.5*	86.5(12.03)	64.4(1)	7.5*
d	FIM	48.64 (4.37)	43.30(18.95)	37	73.82 (8.91)	56.00 (23.84)	13*	90.09 (13.1)	63.80 (25.3)	13*	102(9.58)	79.62(16.37)	6.5*
e	FAC	0(0)	0(0)	44	2.82(0.4)	1.6(0.7)	4.5*	3.82(0.6)	2.6(0.97)	4.5*	4.6(0.7)	3.5(0.53)	12.5*
F	DGI	0(0)	0(0)	44	0(2.02)	0(0)	22.5*	2(4.72)	0.22(0.44)	6.5*	9.6(6.5)	1(0.5)	7.5*

Critical value of U= or <23, * Results are Significant

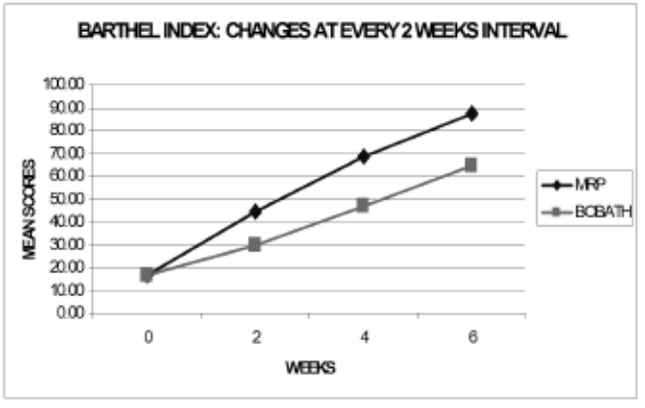
Fig: MRP (p<0.005) showed extremely significant improvement as compared to Bobath, on all functional scales (table 5, c-f) starting at 2 week of treatment and the improvement maintained till six weeks. But no significant difference was noted between groups at all the intervals in scales of motor outcomes (table 5, a & b).

TREND OF CHANGE OVER TIME IN TWO GROUPS WHEN CHECKED AT EVERY TWO WEEK INTERVAL



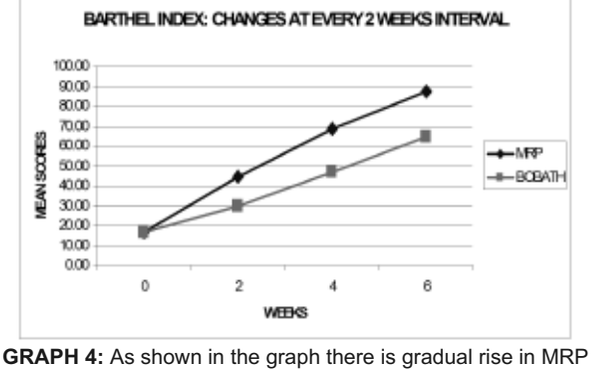
GRAPH 2: As shown in the graph there is both showed the gradual rise.

Statistically not significant p>0.05 (Table 5, a).

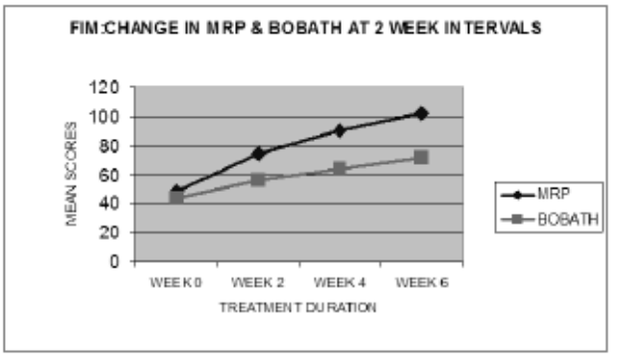


GRAPH 3: As shown in the graph there is gradual rise in MRP group at 2 week &
The rise is maintained till 6weeks. This is statistically significant p<0.05(Table 5, b).

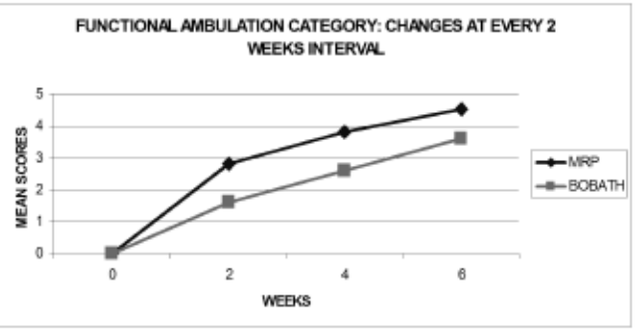
MRP is better in early restoration of motor function.



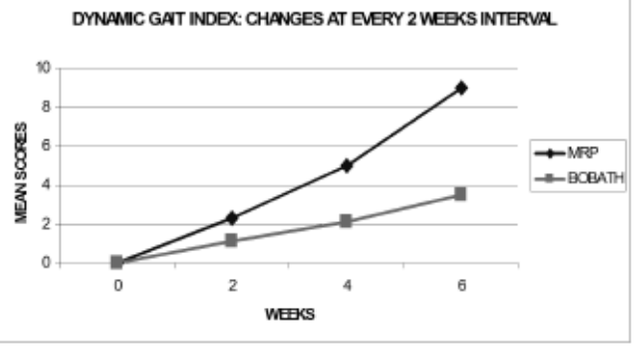
GRAPH 4: As shown in the graph there is gradual rise in MRP group at 2 week & the rise is maintained till 6 weeks. This is statistically significant. P<0.005 (Table 5, c)
MRP is better in early activities of daily living (ADL's)



GRAPH 5: As shown in the graph there is gradual rise in MRP group at 2 week & the rise is maintained till 6 weeks. This is statistically significant. P<0.005 (Table 5, d)
MRP is better in early restoration of activities of daily living (ADL's) and functional mobility



GRAPH 6: As shown in the graph there is sudden rise in MRP group at 2 week & the rise is maintained till 6 weeks. This is statistically significant. P< 0.001(Table 5, e)
MRP is better in early restoration of ambulation, starting at 2 weeks.



GRAPH 7: As shown in the graph there is slow rise in MRP group at 2 week & the rise is sharply increased till 6 weeks. This is statistically significant. P< 0.001(Table 5, f).
MRP is better in early restoration of ambulation starting at 2 weeks.

DISCUSSION

Our study included subjects with acute stroke (within two weeks of onset) with MCA territory involvement. Within group comparison indicated that both groups showed improvement on all the outcome measures. These results emphasize that early intervention is important and that both treatment approaches contribute to improvement in functional status. The profile of recovery following stroke has shown that greater percentage of functional progress occurs in the early weeks after stroke. Animal literature also suggests that there is increased potential for cortical plasticity in the first 7 to 18 days after lesion, although this might be different for humans27. These early days and weeks may be critical time for obtaining the best response to rehabilitation.

Between group comparison indicated that both groups showed equal magnitude of change on FM. MRP group had also made greater functional gains as measured by MAS, Barthel Index, FIM, DGI and FAC than the Bobath group. This suggests that in subjects who received MRP based training showed better carry over of gains made in motor function to the activities of daily living and functional mobility. There are several reasons to explain this occurrence.

1) There exist differences in the content of the two therapy regimens. As correctly identified by Van Vliet ET al28 treatment based on Bobath based approach contained more social conversation ($p = 0.004$), and more use of physiotherapy equipment ($p = 0.02$) and a physiotherapy assistant ($p = 0.01$). In the Motor Relearning Program group there was more detailed feedback given to the patient ($p = 0.002$), more use of everyday objects in training ($p = 0.001$), therapists more frequently listed specific components as the patient's smain problems ($p = 0.003$) and relatives were involved more in positioning to stretch muscles ($p = 0.03$).

2) Successful performance of functional activities requires interaction between person's abilities and environmental demands. MRP focuses on training task performance in an environmental context. For example, in our study ambulation was first trained on level surface. This activity was then progressed by training ambulation on an uneven surface or training ambulation with some cognitive activity. This allowed our subjects to get involved in active problem solving, planning and practice. On the other hand, training in the Bobath group emphasized on improving postural control in standing then progressed to practice of the different components of gait in parts. The activity was ceased if any abnormal movement pattern developed. There was also heavy reliance on therapist generated/guided movements. Bobath approach emphasizes on improving person specific competence such as normalizing tone and inhibiting abnormal movement patterns, with little attention towards task specific training and environmental demands.

3) Effective learning requires "active participation" of the subject. Subjects in MRP group were given the information of what they were supposed to do & how to achieve the desired activity. Subjects were advised to follow the essential components, detect the missing components (errors) and try to correct them on their own. This knowledge of the results (KR) gives information related to the goals of the action & is known to be one of the most potent variables in learning. KR provides guidance so that the individual knows what to do on next attempt. After all, error identification & practice of corrected motor pattern would subsequently lead to improved task performance[29]. This kind of feedback procedure was not given to subjects in Bobath group. Therapist analyzed the errors & tried to correct them with handling & facilitation. Rehabilitation of subjects with hemiplegia can be considered from standpoint of information processing, wherein feedback of performance is an essential element of the motor relearning processes[30]. Theoretically, the use of feedback with practice helps the acquisition of a motor skill so that the control process gradually shifts from a closed feedback loop to an open loop control systems[31]. The retention of skills learned with the help of feedback and/ or weaning strategies most likely to encourage carryover.

4) Task specific training is important for cortical reorganization. Klimes et al.[32] demonstrated in animal models that the organization of movement representation within the motor cortex is sensitive to skill learning but not strength training. This is consistent with notion that the motor cortex is organized to coordinate movement sequences. New brain imaging techniques are making it clear that the neural system is continuously remodeled throughout life & after injury by experience & learning in response to activity & behavior[33, 34]. Neural cortical connections can be remodeled by our experience. A study done by Jang et al. [35] on cortical reorganization induced by task oriented training, demonstrated that a 4-week task specific training program could induce functional recovery and cortical reorganization in chronic stroke patients. The main evidence of cortical reorganization was an increase in affected (contra-lateral) and a decrease in unaffected (ipsilateral) primary sensory motor cortex activity. Fisher and Sullivan [36] provided the evidence that manipulation of task intensity, specificity and the sensorimotor experiences of the task training are the necessary ingredients for maximizing the tremendous potential for recovery in patients with stroke. They concluded that rehabilitation strategies that promote recovery rather than compensation are those that provide a structured behavioral experience which incorporates a) Active participation in motor skill learning, b) Specific skills training and strengthening that is directed to the hemiplegic limbs and c) Intense Task-Specific practice that optimizes the sensorimotor experiences of task

training. So during the early phase of rehabilitation the training and remodeling of the behavioral patterns of mobility and movement of the subjects with stroke may become the foundation for early learning and restoration of functional mobility. Our results further underscore the importance of task specific training and add to the evidence for efficacy of MRP in functional restoration of subjects with stroke.

When both the group compared at intervals of 2 weeks, MRP group showed significant difference in the improvement starting at 2nd week & maintained at 4th & 6th weeks compared to Bobath group on scales of Motor assessment scale (MAS), Barthel index(BI), Functional Independence Measure (FIM), Functional ambulation catgory (FAC), Dynamic Gait Idex(DGI). (Table 5 c, d, e, f).

One of the interesting findings of our study is that the magnitude of change on FAC in the MRP group was not only greater than the Bobath group but it was achieved earlier than the Bobath group (Fig 2). At baseline, subjects in both groups were unable to walk & required maximum support for standing and stepping (FAC grade 0). At 4 weeks, 70% of subjects in MRP group were able to walk independently on level surface (FAC grade 4); where as not a single subject in the Bobath group had achieved this level of ambulation. After treatment of 6 weeks, only 50% subjects in Bobath group were able to achieve FAC score of 4 where as in MRP group 100% of subjects had achieved FAC score of 4 or above.

This early improvement in MRP 11 group than Bobath group can be explained by their planning & management of rehabilitation procedure.

i. An early start: the rehabilitation commenced early, as soon as the subject was medically stable and this involved getting the subject out of bed & standing. There are many physiological reasons for an early start to rehabilitation & these have to be done within the brains capacity for recovery.

ii. Active participation and self correction by subjects helps in motor relearning through task specific training.

iii. Rehabilitation plan: within first week, subject's day was planned to approximate to a normal routine. Subjects were encouraged to do some physical & mental practice at home for most of the day.

iv. Motivation: early experience of erect positions (sitting and standing) stimulated mental alertness & motivated subjects to participate better.

v. Education & training of relatives helped to give subject opportunity to practise, to achieve mastery & to transfer /carryover what he has been learning in training session into their everyday life.

This can be explained, as with improved functional mobility there was easy transfer of these mobility skills to activities of daily living. This earlier improvement of functional ability of patients gave them the positive feedback & motivation for reinforcement & active participation. This ultimately helped in improving overall performance. Even subjects treated with MRP showed better & earlier ambulation ability than Bobath group. This is because of patients with group are introduced earlier & given repetitive practice of ambulation. These also help in improving the motor performance of lower limb.

In MRP, patient learned bed mobility, transfer & ambulation earlier than subjects treated with Bobath group. This is because of specificity of activity & continuous practice of those activities. During this training, subjects were given opportunity to analyze themselves the missing component & to think & plan for what can be done to correct it. This task specific training helped them to have better motor planning & motor relearning. It may cause the specific recruitment of the motor units specifically required for the task.

As in Motor Relearning Program, emphasis was given on practicing a specific motor task, the training of controlled muscle action and control over the movement component of these tasks. Rehabilitation, therefore, involves the relearning of real life activities, those that have meaning for the patient, and not just facilitation or the practice of non-specific exercises.

This study has a few limitations. It was an efficacy study targeted at highly selective subjects with acute stroke and the findings of this study may not be generalizable to all stroke rehabilitation. Also the functional outcome measures used in this study such as BI and FIM were not disease-specific. The gains made on these measures post therapy only indicate the level of independence achieved by the subjects in performance of activities of daily living without giving an insight into improvement specifically related to the affected upper and/or lower extremity function. As a result it is difficult to comment on the carryover of therapy gains into everyday life especially for activities requiring use of UE. Our study had lower limb specific outcome measures (DGI, FAC) but there was lack of upper limb specific outcome measures. In the future, randomized controlled trial with a larger sample size would be recommended to further substantiate these results.

CONCLUSION:

Rehabilitation services for stroke survivors are increasingly constrained by cost concerns, with pressure to discharge individuals from acute rehabilitation earlier when recovery and function have not yet stabilized. This study demonstrates functional gains in acute rehabilitation with physiotherapy treatment using MRP showing better improvement in functional mobility & activities of daily living than Bobath approach. Subjects in MRP group showed early and better independence in walking than Bobath group. These gains are

attributed to structured program and task-specific training. Evidences of gains from Motor relearning program in acute stroke rehabilitation has substantial implications for future service planning given the degree of constraint on stroke rehabilitation services in the current healthcare environment.

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