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A COMPARISON OF BOBATH APPROACH AND MOTOR RELEARNING PROGRAM FOR IMPROVEMENT IN GAIT PARAMETERS IN PATIENTS WITH STROKE – A RANDOMIZED CLINICAL TRIAL

Physiotherapy

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ABSTRACT

Introduction :

Objectives: To study and compare the effect of Bobath approach and Motor relearning program on gait parameters in patients with stroke.

Design: Randomized clinical trial

Subjects: 30 patients with chronic stroke, divided equally in two groups.

Intervention: 14 days intervention for 6 days per week and 1 hour of treatment daily.

Main measures: Functional Ambulatory Category (FAC) and Gait parameters by using stop watch.

Results: Paired and unpaired 't' test was used for statistical analysis. Intra group analysis showed that there was statistically significant improvement in gait parameters and assistance required by participants while walking ($p<0.005$). Inter group comparison has shown significant improvement in stride length and cadence in group B compared to group A.

Conclusion: Bobath approach and Motor relearning program are effective in improving gait in chronic stroke patients. However, Motor relearning program proved to be more efficient compared to Bobath approach.

KEYWORDS

Stroke, Hemiplegia, Bobath approach, Motor relearning program.

BACKGROUND AND PURPOSE

Walking is a real blessing and a matter of habit. It is a natural mood elevator and those who have discovered its pleasure and its benefit to body and mind, have become addict. Among many neurological disorders, stroke or cerebrovascular accident is one of the most common disabling conditions that affect the sufferer physically, mentally, socially as well as economically. The physical problems that are encountered by stroke survivors are loss of hand function, gait impairment, postural as well as balance impairment.

Outcome studies on the rehabilitation of patients who are stroke survivors reveal that 93% of patients have difficulty walking independently in the community after being discharged from hospital.[1] Researchers have found that 30% of their surviving stroke population did not regain walking ability and that walking velocity was considerably reduced in another third of patients 3 months after stroke.[2] Biomechanical impairments that affect gait immediately following stroke are inability to generate muscle contractions and inappropriately graded muscle contractions. It leads to marked deficits in balance and gait with decrease in gait velocity, cadence, and step length which are characteristic features of gait in patients with stroke. The shorter stance and step length on paretic side compared to the non-paretic side is due to asymmetry of timing in single-limb support phase on the affected and unaffected legs, which also leads increase energy expenditure and risk of falls.[3] The diminished velocity of the hemiplegic gait, in comparison to normal, has been reported repeatedly along with associated limitation in cadence, stride length and gait cycle.[4] Slow walking velocity leads to decreased joint movement amplitudes and step lengths as well as an inability to produce selective movements in the joints of the lower limb and poor balance.[5]

Patients suffering from stroke often have difficulty in maintaining control of upper trunk over lower trunk and pelvis as body moves forward over leg during stance phase. Forward rotation of pelvis and extension of hip is difficult for patients with stroke due to inactive lower abdominal muscles. As hip moves backward together with knees, patient cannot bring his pelvis forward over hemiplegic leg. Thus, there is lack of dissociation of pelvis during walking.[6] Due to difficulty in forward progression of body; patient uses compensatory mechanism to allow hemiplegic leg to be brought forward.

Thus, improvement of gait ability is a major aspect of rehabilitation after stroke. Treatment of hemi paretic gait has seen a rather dramatic change over the last decade by use of number of physiotherapy approaches developed by many authors. One such concept is Bobath approach, also known as neurodevelopment technique, a widely used approach in the rehabilitation of hemi paretic subjects in many countries. The aim of this method is to improve quality of the affected body side's movement in order to keep both sides working as harmoniously as possible.[7] Another widely used therapeutic approach is Motor relearning program (MRP) which was developed based on movement science, biomechanics and training of functional movement. It is specific to the rehabilitation of clients following stroke. The therapist analyses each task, determines which component of the task cannot be performed, trains the patient in those components of the task and ensures carryover of this training during daily activities.[8]

Among all therapeutic approaches developed to enhance the functional recovery of patients after stroke, Bobath approach has been studied by many researchers.[9,10] But very few studies on effectiveness of MRP have been found.[11] However, all these studies were performed in acute stroke patients and emphasis was given on improvement of entire affected side.[12,13] Thus, following study was designed to study and compare the efficacy of Bobath approach and MRP only on the walking ability of chronic hemiplegic stroke patients and to find a more better and effective way of treatment.

So, purpose of the study is to find out effect of Bobath approach and MRP on gait of chronic stroke patients by giving 14 days of intervention and to compare the effect of both treatment programs on the same.

METHODS

Design

This study was a randomized clinical trial

Setting and Participants

The study took place at KLE University's Institute of Physiotherapy, Belgaum, Karnataka and was approved by the Institutional review board. Participant enrollment commenced in February 2011, and the final participant completed training in January 2012. Eligibility criteria for the study included patients diagnosed with first ever stroke, patient with chronic stroke (> 3 months), lower extremity Brunnstrom motor recovery stage 3 to 4,[14] ability to follow simple instructions and those willing to participate in the study. Exclusion criteria were any other neurological disorders, any severe musculoskeletal impairments, visual disturbances, brain tumors, behaviorally disturbed or other psychiatric conditions and any condition that lead to walking disability other than stroke.

39 patients with chronic stroke, reported to the department of physiotherapy in KLES Dr. Prabhakar Kore Hospital and MRC, Belgaum and KLES Shri. B.M. Kankanwadi Ayurveda Hospital and

MRC were screened. Out of them 5 were failed to fulfill inclusion criteria and 4 declined to participate in the study. The remaining 30 participants were briefed about the nature of the study and intervention, in their local language. Written informed consent had been obtained and they were recruited for the study.

Randomization and Interventions

Individuals were randomized consecutively into two groups using systematic assignment. The subjects were counted off and systematically placed into subsequent groups i.e. group A and B. Group A, consisting of 15 subjects, received Bobath approach and the group B, which also contained 15 subjects, underwent MRP. Demographic characteristics of all the participants in both the groups were obtained (Table I). Participants receiving the Bobath approach were treated on the affected leg 1 hour daily for 6 days in a week in the duration of 14 days; excluding sundays and holidays. The participants actively participated in the treatment that is individualized, constantly modified according to subject response, and geared toward gait training. The intervention was given on supine, sitting and standing position and focus was placed on the

Table I – Demographic characteristics of the study participants

Characteristics	Group	N	Mean± Sd	t-Value	p-Value	Result
Height	A	15	159.2000 ± 6.98	1.908	0.067	P>0.05
	B	15	163.2000±4.14			
Weight	A	15	58.0000±10	0.690	0.496	P>0.05
	B	15	56.0000±5.08			
BMI	A	15	23.1367±3.88	1.568	0.128	P>0.05
	B	15	21.4467±1.53			
Age	A	15	54.2667±10.21	0.478	0.637	P>0.05
	B	15	56.2000±11.88			

SD. Standard deviation, N. number of participants

sensation of movement. Based on Bobath concept sensory stimulation is regulated with great care and weight bearing, placing and holding, tapping and joint compression are used to activate normal movement and posture. Emphasis was placed on retraining normal alignment and normal movement patterns based on Bobath treatment principles. These patterns were facilitated through appropriate sensory and proprioceptive input, direct manual facilitation, key point control and verbal and visual feedback.[7] Group B was given MRP as treatment. Duration of treatment was same as that of Group A. Improvement in the essential component of walking was targeted such as in stance phase emphasis was given in extension of hip, lateral horizontal shift of the pelvis and trunk and flexion of the knee initiated on heel strike, followed by extension, then flexion prior to toe off. In swing phase, subjects were trained to improve flexion of hip and knee, rotation of pelvis forward on the swinging leg and dorsiflexion of the ankle. Subjects were constantly encouraged to participate actively and commands were given throughout the treatment sessions in both the groups to keep the subjects engaged in the activity.

OUTCOME MEASURE

Subjects were evaluated using outcome measures Functional Ambulatory Category (FAC) and Gait analysis using a stopwatch before initiation of intervention, on 7th day of training and immediately after completion of treatment program. The FAC is a functional walking test that evaluates ambulation ability. This 6-point scale assesses ambulation status by determining how much human support the patient requires when walking and gives detail on the physical support needed by patients, irrespective of the technical aids used. Level 0 indicates a patient who cannot walk at all or needs the help of two therapists. Level 5 indicates a patient who can walk everywhere, including stairs, independently.[15] Afterwards gait was analyzed using a stopwatch in which the subjects were instructed to walk a distance of 10m. The time needed for the 10m distance were measured with a simple stopwatch. They were instructed to walk at their maximum velocity to exclude the influence of external factors. 2 trials were taken and mean value was calculated. To calculate mean cadence number of steps during 10 m test was counted. Mean stride length was calculated according to the following formula: velocity ($m.min^{-1}$) divided by cadence (steps min^{-1}) multiplied by 2.[15]

DATA ANALYSIS

After completion of the study statistical analysis was done by using SPSS 13 software. Statistical analysis of various statistical measures such as mean, standard deviation (SD) and test of significance such as' t' test were utilized.

RESULTS

30 of the 39 participants who were randomly assigned to training groups completed the study. Gender ratio of sampled male to female was 1:1 that is 15 males and 15 females participated in the study. Group A consisted 6 males and 9 female. Group B consisted of 9 males and 6 females. There were no significant difference among the 2 training groups in demographic characteristics (Table I), baseline FAC, cadence, stride length and velocity of gait (Table II).The duration of onset of stroke varied from 4 months to 63 months.

Although the participants of both the groups did not show any significant difference in FAC score in the first week of training, the improvement was seen at the end of 2nd week i.e. from 7th to 14th day assessment. Overall, there was significant improvement in the assistance required by the participant during walking in both the groups ($p< 0.05$)(Table II). However, on comparison, the participants in group B showed better improvement than group A ($p= 0.03$)(Table III).

The improvement of mean cadence was found to increase in both the groups throughout the intervention session. The results were significant in 1st to 7th day and 7th to 14th day assessment in both the groups ($p<0.05$). And overall, there was reduction in the steps required to cover the 10m distance. The improvement was again found to be more prominent in group B compared to group A at the end of study ($p=0.00$).

The improvement in the mean stride length was not found to be effective in 1st to 7th day assessment in group A. But there was significant increase in the stride length in 7th to 14th day assessment and thus, overall improvement was present.

Table III : Inter group comparison of FAC, Cadence, Stride length and Velocity.

Characteristics	t value			p value		
	1-7 day	1-14 day	7-14	1-7 day	1-14 day	7-14 day
FAC	1.46	2.26	1.18	0.15	0.03*	0.24
Cadence	6.70	6.95	2.14	0.00*	0.00*	0.04*
Stride length	-2.97	-3.11	-2.25	0.006*	0.004*	0.032*
Velocity	0.70	0.34	0.02	0.08	0.73	0.09

*significant at $p<0.05$

In group B, however, the improvement was effective in throughout the intervention session i.e. from 1st day to 7th day and from 7th to 14th day. Again, the group B showed more significant improvement compared to group A at the end of study ($p=0.004$).

Overall, there was a significant time effect of training on walking speed ($p<0.05$). The improvement was statistically significant in 7th to 14th day assessment in both the groups. Although the groups had different pretest- posttest intervention changes in walking speed, it did not reach statistical significance on comparison ($p=0.730$, $p>0.05$)

DISCUSSION

Gait problem had been evident in most of the stroke patients, often making them dependent in their day to day activity. Thus, this study was aimed to observe the effects of Bobath approach and MRP on gait improvement in chronic stroke patients. 30 participants were randomly divided into two groups viz. group A, receiving Bobath approach and group B, receiving MRP.Focus was placed on improvement of gait parameters such as cadence, stride length and velocity as well as improvement of assistance required by the participant for ambulation. It was noticed that there was improvement in all the above parameters in both the experimental groups but group receiving MRP had statistically better improvement compared to the group receiving Bobath approach.

In this study, the age group was in the range of 42 to 84 years. The presence of younger age in the sample is supported by a previous study done to find the incidence and prognosis of stroke in young adults stating that in people aged 15-44 years, a first ever stroke was

diagnosed in 39 patients with mean annual crude incidence rate of 12.1 cases per 100, 000 over the period 2002 -2007. [16] Also, studies have proved that nearly three quarters of all strokes occurs in people over the age of 65 and the risk of having a stroke more than doubles each decade after the age of 55.[17]

The sample of the present study consisted of 15 males and 15 females. Thus, the findings doesn't correlated with the findings of several other authors who stated that males are (1.25 times) more prone than females for occurrence of stroke.[18] The height, weight and BMI of the participants showed no significant difference in both the groups. None of the previous studies have taken height, weight and BMI as consideration for stroke rehabilitation.

The duration of onset of stroke in this study ranged from 3 months to 5 years. As per result, all these patients showed significant improvement in gait. It suggests that the duration of hemiplegia doesn't interfere with functional outcome. This is supported by study in which it was elaborated that the duration of hemiplegia is not crucial for functional recovery relative to the gait pattern of recovery.[19] The electromyography biofeedback applied in a task-oriented approach based on principles of motor learning to increase peak ankle power of the affected leg and gait velocity in patients with chronic mild to moderate hemiparesis, showed significant improvement in outcome measures.[20]

In this study, Bobath approach and MRP showed significance difference in the outcome measures. It was noticed that there was statistical improvement in both of the parameters viz. FAC and Gait analysis with stop watch, in both the intervention groups. But the improvement was relatively more in group B .

MRP was found to be effective for enhancing functional recovery of patients who had a stroke but did not appear to have a significant additional effect on improving the patients' functional balance status in terms of speed and outdoor mobility.[11] In our study there was significant reduction in the assistance required by the participants while walking which is suggestive of improvement in balance. Also in the given study the patients recruited were on average in the third to fourth months after their strokes thus the findings of our study further support the notion that recovery of function could occur beyond the first three months after the stroke and extend to at least six months after the stroke.[21]

In the present study there is significant improvement in cadence throughout the treatment duration in both the groups but again on comparison group B showed better improvement than group A ($p< 0.05$). Similarly the stride length had also increased in a better way in group B although there was significant pre to post changes in both the groups. The change in velocity was found to be more significant from pre to post assessment and 7th day to post assessment. There was no improvement in velocity from pre assessment to 7th day assessment in both the groups. However, on comparison there was no significant difference found to be present between group A and group B ($p > 0.05$).

In normal gait, pelvic rotation is important determinant of gait which occur on swing side to prevent excessive drop in body's centre of gravity (COG). Pelvic rotation on swing side is brought about by lower abdominals, lattissimus dorsi, psoas major and hip internal rotators.[6] In present study, improvement in stride length and cadence could be due to enhanced activation of lower abdominals and trunk extensors which facilitate pelvic dissociation and rotation leading to improved advancement of swinging leg. As participants were constantly asked to maintain their balance and to keep their body as straight as possible during treatment session, it helped to activate their trunk muscles in a better way. Also, the specific techniques used in the training sessions increased the strength of muscles surrounding pelvis, providing stability to pelvis which lead to increased in stance length and cadence.

Although Bobath approach provides a framework for the treatment of neurological patients, quantitative evidence for its value has yet to be provided. Several investigators have examined the effects of Bobath therapy as well as other forms of therapeutic intervention typically for patients with hemiparesis.[22-25] Although careful measurements of progress in motor and neurological functions were made in these studies, none of the investigators found statistically significant findings for the use of Bobath therapy.

The MRP promotes the regaining of normal motor skills through task-oriented practice with appropriate feedback and the active participation of the patients. In our study, the motor relearning program was designed in such a way that participants were able to gain this experience. The training was more anticipatory for the patients and hence was more self-initiated, targeted and effective. This is in contrast to the strategy used in the Bobath approach, which focused solely on controlling the abnormal movement pattern.

In the present study gait speed has increased significantly in both the groups. The reason for increase in velocity could be increase in stride length and cadence. Although a marginal difference is seen on improvement of velocity when both the groups were compared, it was not statistically significant.

14 days duration was considered for training period in this study and when results were compared for gait parameters and assistance required by the participants, there was significant improvements seen which correlates with a study in which two stroke survivors participated in a 15-day gait training program each with active leg exoskeleton. The results show that by the end of the training the gait pattern of the patients was improved towards healthy subjects gait pattern.[26]

Limitations of current study include small sample size and short duration of study. Also, there was no follow up after the intervention, so carry over effect could not be seen. In the present study both young and older aged patients with chronic stroke were included. Further studies can consider young and older stroke population separately along with matched pairs. Also, the assistive devices used by the patients are not considered in this study, which can be included in further research.

Conclusion

The study concluded that Bobath approach and MRP are effective in improving gait in chronic stroke patients. However, MRP produced more statistically significant improvement in the outcome measures compared to Bobath approach. Thus, MRP can be incorporated in daily rehabilitation and should be considered during gait training of chronic stroke patients.

Table II : Mean values(± standard deviation) and intra group comparison of FAC, Cadence, Stride length and Velocity.

Characteristics	Mean± SD						Average improvement						p- value					
	A			B			1-7 day		1-14 day		7-14 day		1-7 day		1-14 day		7-14 day	
	1 DAY	7 DAY	14 DAY	1 DAY	7 DAY	14 DAY	A	B	A	B	A	B	A	B	A	B	A	B
FAC	1.26±1.22	1.26±1.22	1.86±1.3	1.93±1.38	2.06±1.38	2.86±1.3	0	0.13	0.6	0.93	0.6	0.80	1.0	0.16	0.0*	0.0*	0.0*	0.0*
Cadence	52.6±15.6	51.2±15.7	48.9±15.5	44.1±13.8	40.1±13.9	36.8±14.0	1.4	4.0	3.6	7.2	2.2	3.2	0.0*	0.0*	0.0*	0.0*	0.0*	0.0*
Stride Length	0.53±0.64	0.56±0.65	0.63±0.68	0.74±0.61	0.89±0.69	1.07±0.80	0.03	-0.14	0.09	0.32	0.06	0.17	0.07	0.0*	0.0*	0.0*	0.0*	0.0*
Velocity	11.9±12.4	12.2±12.3	13.1±12.2	14.3±9.6	14.8±9.4	15.8±9.3	0.29	0.49	1.22	1.41	0.93	0.91	0.09	0.05	0.0*	0.0*	0.03*	0.02*

Declaration of conflict – None declaired

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