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ORIGINAL ARTICLE

COMPARATIVE STUDY OF COMBINED EFFECT OF TASK ORIENTED MOTOR RELEARNING PROGRAMME (MRP) AND THERMAL STIMULATION OVER ITS INDIVIDUAL EFFECTS TO IMPROVE UPPER LIMB MOTOR FUNCTION OF MIDDLE CEREBRAL ARTERY(MCA) STROKE SUBJECTS

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Abstract

Background and Objectives: *Functional recovery is one of the major causes of concern in stroke subjects with performing activities of daily living. Upper limb impairment affects the performance of many activities of daily living. Our major objective of the study is to investigate the effectiveness of the individual and combined effect of motor relearning programme and Thermal stimulation to improve upper limb motor function.* ***Methods:*** *A random sampling method is used to select subjects with right MCA stroke. Thirty subjects were included and randomly divided into three groups by using lottery method, with ten in each group A, B and C. Group A, B and C had underwent a MRP,Thermal Stimulation and combination of these two techniques respectively. The outcomes are measured by the MMAS, and STREAM scale.* ***Results:*** *Analysis of variance has been used to find the significance of study parameters between different groups. Paired t' test has been used to find the significance of the study within each group. According to Results Group A shows better improvement than group B and It shows that upper limb motor function improved significantly higher in Group C (P<0.001**) when compared to Group A and Group B in MMAS and STREAM scale evaluation.* ***Conclusion:*** *The present study indicates that physiotherapy treatment showed that the use of individual effect of motor relearning programme is more effective than Thermal Stimulation technique but the combined effect of these two techniques is more effective than the individual effect can bring out significant changes in the upper limb motor function of MCA Stroke subjects.*

Keywords: *Stroke, Motor Relearning Progrm,Thermal Stimulation,* Stroke Rehabilitation Assessment of Movement (STREAM)*, Modified Motor Assessment Scalele (MMAS).*

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INTRODUCTION

Stroke is an acute onset of neurological dysfunction due to an abnormality in cerebral vascular circulation with resulting signs and symptoms that corresponds to focal areas of brain (WHO) [1].

The prevalence of stroke is more common among people with low-socio economic status than among the high- economic status. A typical estimate of prevalence is about 5/1000 but this depends on many factors including population age structure (Wade, Lang Hever et al). Stroke is one of the leading causes of adult disability and institutionalization.

About 25% of stroke occurs below the age of 65 and about 50% cases occur below the age of 75. With age standardized stroke mortality rate was reported on 1990 as 60 for men and 45 for women per 100,000 (Bonita et al)[2]. The global burden of stroke needs to be defined for both developing and developed nations. India will face an enormous socio-economic burden to meet the costs of caring for stroke victims. This is because the most affected in the age group 45 to 70 years are mostly the breadwinners of the family. Each year, about 700,000 people suffer from strokes. Of those, 500,000 are first–time strokes, and 200,000 are recurrent.

In India the incidence of cerebrovascular disease was found to 13/100,000 population/year. Stoke prevalence varies in different regions of country and ranges from 40 to 270/100,000 in rural population and the stroke prevalence rates in urban areas are much lower than in metropolitan cities in India[3].

The incidence of stroke is about 19%higher for males than females. Compared to whites, African - Americans have a 2 or 3 fold risk of ischemic stroke and 2-5times hence likely to die because of stroke[1].

Focal cerebral damage of vascular origin is in most cases the result of either infarct formation or hemorrhage. An infarct results from interruption of the blood supply; this may be due to thrombus formation[4]. Strokes can be ischemic, the result of a thrombus, embolism or conditions that produce low systemic perfusion pressures.

Transient ischemic attacks are episodes of focal neurological symptoms due to inadequate blood supply to the brain. Attacks are sudden onset, resolve within 24 hours or less and leave no residual deficit. These attacks are as important as warning episodes or precursors of cerebral infarction. Focal cerebral damage of vascular origin is in most cases the result of either infarct formation or hemorrhage. An infarct results from interruption of the blood supply; this may be due to thrombus formation.

Atherosclerosis is a major contributory factor in cerebro vascular disease. The most common sites for lesions to occur are at the origin of the common carotid artery, the middle cerebral artery, and at the main bifurcation of the middle cerebral artery and at the junction of the vertebral arteries with the basilar artery. Strokes can be ischemic, the result of a thrombus, embolism or conditions that produce low systemic perfusion pressures.

Occlusion of the middle cerebral artery or its branches is the most common type of anterior circulation infarct, accounting for approximately 90% of infarcts and 2/3 of all first strokes of middle cerebral artery territory, 10% involve superficial and deep Middle cerebral artery territories, and over 50% involve the superficial Middle cerebral artery territory.

The most common characteristics of MCA stroke are contra lateral spastic hemi paresis and sensory loss of the face, upper extremity and lower extremity, with upper limb is more affected than lower limb. Spastic hemi paresis is due to lack of inhibitory control over his movements. Spasticity emerges in about 90% of the cases and occurs on the side of the body opposite the lesion. According to Lance, Spasticity has been defined as an increase in muscle tone due to hyper excitability of stretch reflex and is characterized by a velocity-dependent increase in tonic stretch reflex.

Spasticity usually develops slowly with flexor muscles of the upper extremity and usually affects the depressors of the shoulder girdle and arm; the fixators and retractors of the scapula, the side flexors of the trunk the adductors and internal rotators of the arm, the flexors and pronators of the elbow and wrist, and the flexors and adductors of the fingers[5].

Physiotherapy interventions for stroke subjects are represented by various approaches, for example, Proprioceptive neuromuscular facilitation, Brunnstrom, bobath and motor relearning programme. There is a general opinion that physiotherapy improves the function of the stroke subjects. But the benefit seems to be statistically small and limited. In few controlled studies on this subject, there is no documentation showing that one of the above mentioned physiotherapy approaches gives better result than the other approches[6,7].

Motor relearning programme was developed by Carr and Shepherd for stroke that incorporates many aspects of motor learning theory and provides practical guidelines for retraining functional skills. The learning of task is best to stimulate the brain to adopt and reorganize generalizations and transfer training from the rehabilitation setting into everyday life[8].

MRP is made up of seven sections representing the essential function of everyday life, most of which are grouped together for case of reference of upper limb function, orofacial function, motor task performed in sitting and standing etc. In MRP the method of activating muscles and training task which provide auditory or visual feedback of muscle contraction which assist the subject to turn off an overactive muscle. In MRP training, the passive movement should be avoided because the interfering of this activity is difficult for the therapist to recognize the eliciting muscular activity. Passive movement also plays little part in promoting motor learning and for positioning of the limb by the therapist.

The MRP approach is based on four distinct steps they are analysis of task, practice of the missing component, practice of task and transference of training. Complex activity of upper limb is seen in all the day to day activities. In daily life the goal of upper limb movement is often the placement of the hand, for example in pointing, reaching or in transporting a grasped object[9].

Objectives: The objectives of the study was :

To find out the individual effect of motor relearning programme to improve upper limb motor function following stroke.

To find out the individual effect of thermal stimulation to improve upper limb motor function following stroke.

To find out the incremental effect of combined MRP and thermal stimulation over its individual effect to improve upper limb motor function following stroke.

Hypothesis

Alternate hypothesis: Combined Motor Relearning Program and thermal stimulation to improve upper limb motor function following stroke may have any statistically significant difference as compared to the individual effects of Motor Relearning Programme or Thermal stimulation.

METHODOLOGY

Methodology is the most important part of any research study, which enables to form a plan for the study, which is undertaken. The research methodology involves the systematic procedure from identification of initial problem to the final conclusion.

Methodology includes the research approach, the setting, and population, sampling technique, selection of tool, intervention procedure, data collection and plan for analysis.

Research approach

Research approach is the most significant part of any research. For this research experimental comparative approach was considered. Experimental approach is characterized by much greater control over the research environment and in this case some variables are manipulated to observe their effect on other variables. It is a qualitative approach that involves the generation of data in qualitative form that can be subjected to rigorous qualitative analysis in a formal and rigid fashion.

Population:

A population is defined as the group of people to whom the research results are generalized. All the subjects who were suffering from MCA stroke were the population for this study.

Setting of study:

The study was conducted in the Department of Physiotherapy, Florence Rehabilitation Centre, Kalyan Nagar, Bangalore.

Sample and sampling technique:

Those subjects who were screened as MCA stroke with upper limb motor function impairment and satisfied the selection criteria were included in the study. 23 male and 18 female subjects have participated and out of these 2 subjects had cognitive deterioration, 5 of them were not willing to participate in the study and 4 subjects had musculo-skeletal impairments, hence they were excluded from the study. 30 subjects only met the inclusion criteria and were willing to participate in the study.

Simple random sampling was selected so that each and every unit in the population has an equal probability of being selected in the sample. Lottery method was used to randomly divide the selected 30 subjects into three groups with 10 subjects in each group. Total sample included both the gender for this study.

Inclusion criteria:

Subjects with right MCA infract having left side stroke.
Subjects with age group between 50 to 70 years of both genders.
Duration of the stroke between 6weeks to 6months.
Subject having 20 or more than 20 score in Stroke Rehabilitation Assessment of Movement (STREAM).

Exclusion criteria:

Subjects with Disorientation.
Hemorrhagic stroke.
Stroke due to progressive lesion like tumors.
Stroke due to trauma.
Significant musculotendinous or bony restrictions of the affected upper limb.

Method of collection of data:

Thirty subjects were referred to the out subject department of Florence College of Physiotherapy. The referring physician was informed about the inclusion and exclusion criteria. Written informed consent was taken from the subjects after explaining about the study.

Subjects diagnosed with MCA stroke with upper limb involvement satisfying inclusion criteria were selected for the study. The subjects were randomly divided into 3 groups namely A, B and C. Group A was comprised of 5 male and 5 female subjects. The minimum age was 55 and maximum age was 65. The subjects in group A were given MRP treatment.

Group B was comprised of 6 male and 4 female subjects**.** The minimum age was 55 and the maximum age was 66 years. These subjects were given Thermal stimulation as treatment.

Group c was also comprised of 6 male and 4 female subjects. The minimum age was 54 and the maximum age was 63 years. These subjects were given Motor Relearning Programme in task oriented manner and TS as treatment. The intervention was applied for a period of 6weeks continuously, comprising total of 30 sessions. Each week had 5 sessions of intervention and each session was given for 30 minutes for all three groups.

Selection of tools

Measurement tools: The MMAS is comprised of 8 items corresponding to 8 areas of motor function. Subjects perform each task 3 times and the best performance is recorded.

Supine to side lying, Supine to sitting over the edge of a bed, Balanced sitting, Sitting to standing, Walking, Upper-arm function, Hand movements, Advanced hand activities.

Scoring: The major difference of scoring between the MAS and MMAS is that the general tonus item is not assessing in the MMAS.(There are no guidelines regarding the testing of tone, where it should be tested or how to score the item when the tone varies between the leg, arm, and trunk (Poole & Whitney, 1988). For this reason, this item is often omitted (Malouin et al., 1994; Loewen & Anderson, 1990); it leads to the formation of MMAS.)

In this study we are assessing only the upper limb function, so we are assessing only Upper-arm function, Hand movements and advanced hand activities.

All items are assessed using a 7-point scale from 0 - 6. A score of 6 indicates optimal motor behavior.

STREAM Scale:

The reliability of the STREAM scores was demonstrated by generalizability coefficients of .99 for total scores and of .96 to .99 for subscale scores. The internal consistency of the STREAM score was greater than .98 on the subscales and overall.

The STREAM and MMAS provides a useful measure about the progression of the disease. This tool was selected for this study to evaluate the changes in motor function followed intervention in all the three groups.

Materials Used : Stopwatch, Jellybeans, Polystyrene cup, Rubber ball, stool , Comb, Spoon, Pen, Teacups, Water, Prepared sheet for drawing lines, Cylindrical object like a jar, Table and couch.

Pen, jelly bean, polystyrene cup, Prepared sheet for drawing lines, Spoon and Comb are using for assessing Advanced hand activities in MMAS.

Procedure:

Pen, jelly bean, polystyrene cup, Prepared sheet for drawing lines, Spoon and Comb are using for assessing Advanced hand activities in MMAS.

Treatment programme:

Group: A. The 10 subjects of group A were randomly selected for MRP interventions. They were made to lie down on the low couch comfortably and assessed thoroughly. The subjects were clearly explained about the treatment. The treatment frequency was 5 sessions/week for 6 consecutive weeks, the treatment duration being 30 minutes in each session.

Group: B. The 10 subjects of group B were randomly selected for thermal stimulation. They were made to lie down on the low couch comfortably and assessed thoroughly. The subjects were clearly explained about the treatment. The treatment frequency was 5 sessions/week for 6 consecutive weeks, the treatment duration being 30 minutes in each session.

Group: C. The 10 subjects of group C were randomly selected for combined MRP and Thermal stimulation. They were made to lie down on the low couch comfortably and assessed thoroughly. The subjects were clearly explained about the treatment. The treatment frequency was 5 sessions/week for 6 consecutive weeks, the treatment duration being 30 minutes for each treatment per session.

Exercise programme:

Group A was treated with MRP. The following exercises were given.

In supine the subjects were asked to lift the arm and supported it in forward flexion. Then the subjects were made to attempt to reach up towards ceiling (Figure 1).

Figure 1: Subject Performing Lift the Arm and Supported It in Forward Flexion.

In supine the subjects arm was supported it in forward flexion. The subjects were helped to elicit muscle activity by asking them to attempt parts of various tasks. Subjects were asked to take the hand above the pillow. During this procedure subjects were advised to elicit to muscle activity of deltoid and triceps, in particular.

Subjects were asked to practice their arm in forward flexion and moved it within an ever increasing range, in all directions, with maintaining control always.

The subjects were made to sit at a table, and then subjects were asked to practice reaching forward and upward. Subjects were asked to work within the range and advised to control the shoulder above 9degrees, and subjects were asked to practicing below 90 degrees
The subject sits with his hands flat on the bed behind him and assistance was provided.

The treatment frequency was 5 sessions/week for 6 consecutive weeks, the treatment duration being 30 minutes in each session.

Group B was treated with Thermal stimulation. Following treatment was given:- Subject comfortably sat in a quiet room with their hands placed on a table. Thermal agents was made by general hot (75^{0}C) or cold (<0^{0}C) pack wrapped with 2 towels, which buffered the thermal conduction .The thermal agent was placed over the region of hand and wrist.

A thermal agents couple was placed in between the hand and thermal agent to measure the skin temperature. To avoid tissue damage, ceiling durations of heating and cooling stimulation on the paretic hand were limited by 15 seconds and 30 seconds, respectively. During the development of uncomfortable sensation, subject were encouraged to actively move there paretic hands away from the stimuli or generate a reflex. Thus the thermal agent could produce thermal sensation followed by voluntary/reflex behavior(Figure 2 and 3).

Figure 2: Application of Cold Packs over the Forearm.

During TS intervention, heating agent was first placed over the non paretic hand, the subject was asked to feel change of skin temperature. The subject learned to move the hand away from the heating agent when unpleasantness developed. In turn, the heating agent was put on the paretic hand 10 times and interleaved with a 30 second pause.

Figure 3: Application of Hot Packs over the Forearm.

Subjects were encouraged to move the paretic hand away from the heating agent if they felt uncomfortable or accepted 15-seconds stimulation. When skin temperature of the paretic hand dropped to baseline after 10-time heating stimulation, and an identical procedure was used for 30 second cooling agent. A session of TS includes two alternative cycles of heating and cooling stimulation, was performed once daily. The treatment frequency was 5 sessions per week for 6 consecutive weeks.

Group C was treated with MRP and Thermal Stimulation. The treatment frequency was 5 sessions/week for 6 consecutive weeks, the treatment duration being 30 minutes for each treatment per session.

Plan for Statistical analysis

This chapter deals with the most important and crucial aspect of investigating the data to answer the research question through suitable statistical treatment. Analysis is a method of rendering meaningful and intelligible information.

Group C was administered with combined effect of Motor relearning programme and TS; the other two groups A&B was treated with MRP and TS technique. The data were carefully measured on MMAS and STREAM to perform functional task by reliable and valid tools, so as to ensure the accuracy.

Emphasis has been given on examining data and various analytical techniques to synthesis the research data. The data were put into suitable statistical techniques such as descriptive and inferential, especially parametric and non parametric tests.

Statistical Methods:

Analysis of variance (ANOVA) has been used to find the significance of study parameters between different groups and also used to find the significance of outcome between three groups. Student t test has been used to find the significance of study parameters between pre and post assessment with in each group.

Analysis of variance (ANOVA) has been used to find the significance of study parameters between different groups and also used to find the significance of outcome between three groups. Paired t test has been used to find the significance of study parameters between pre and post assessment with in each group.

Limitations: It is assumed that populations are normally distributed and have equal variance. It is also assumed that samples are independent of each other.

Method. Let the jth sample contain nj elements (j=1, 2,…K). Then the total number of elements is

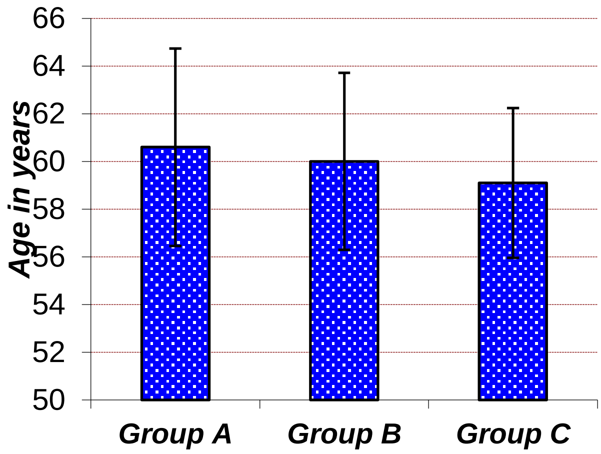
RESULTS

SECTION-1: Analysis to find out the individual effect and incremental effect of MRP and Thermal Stimulation for improving motor function within the group. (Intra group analysis)

SECTION-2: Analysis to find out the individual effect of MRP and Thermal Stimulation over combined effect of MRP and Thermal Stimulation for improving motor function within the group. (Inter group analysis)

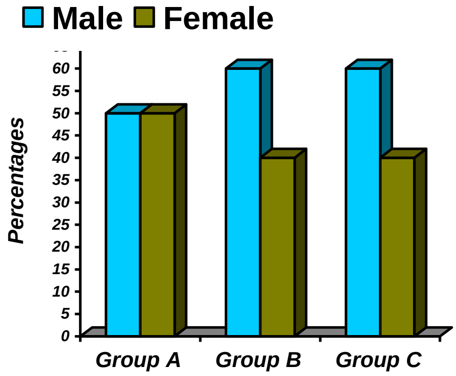
Basic Features	*Group A*	Group B	Group C	P value
Age in years; Mean ± SD	60.60± 4.14	60.00± 3.71	59.10± 3.14	0.66
Sex; Male: Female	5:5	6:4	6:4	0.87

Table1: Basic characteristics of the subjects studied.



Graph 1: Age distribution of subjects studied.

Group A was comprised of 5 male and 5 female subjects. The minimum age was 55 and maximum age was 65. Group B was comprised of 6 male and 4 female subjects. The minimum age was 55 and the maximum age was 66 years. Group C was also comprised of 6 male and 4 female subjects. The minimum age was 54 and the maximum age was 63 years.



Graph 2: Sex distribution.

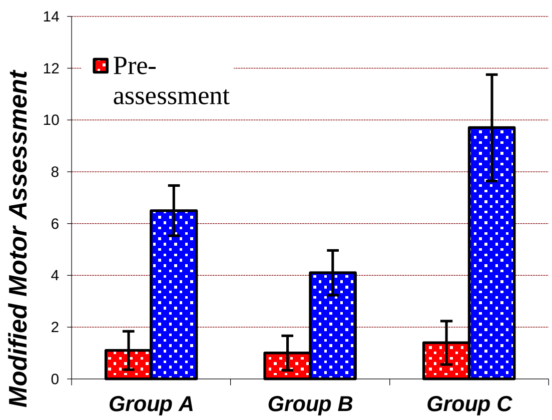
The table 2 has revealed that Group A, the pre-assessment MMAS score Mean was 1.10 (SD: 0.74) ranging from 0 to 2 was increased significantly in post-assessment Mean to 6.50 (SD:0. 97) ranging from 5 to 8. The calculated value by Student t-test score was 17.678. Computed data analysis showed that MMAS score improved significantly following intervention. P<0.001**).

Modified-Motor Assessment scale	*Group A*	Group B	Group C	P value
Pre-assessment	1.10±0.74 (0-2)	1.00±0.67 (0-2)	1.40±0.84 (0-2)	F=0.705 (P=0.475)
Post assessment	6.50±0.97 (5-8)	4.10±0.87 (3-5)	9.70±2.06 (6-13)	F=39.836 **(P<0.001**)**
% Change	490.1%	310.0%	592.9%	-
P value	t=17.678 **(P<0.001**)**	t=9.858 **(P<0.001**)**	t=17.563 **(P<0.001**)**	-

Table 2: Comparison of Scores of Modified Motor Assessment scale.

In group B, the pre-assessment MMAS score(Mean)was 1.00(SD:0.67)ranging from 0-2 was increased in post assessment to 4.10 (Mean), SD:0.87) ranging from 3 to 5 with 310.0% increase(Student t-test score was 9.858,<0.001**).

In Group C, the Pre-assessement MMAS score(Mean)was 1.40(SD=0.84)ranging from 0-2 was increased significantly in Post assessement to 9.70(Mean) ,(SD:2.06)ranging from 6 to 13 with 592.9% increase(Student t-test score was 17.563,P<0.001**).



Graph 3: Comparison of Scores of MMAS scale.

Inter-group Analysis:-The table(2) has revealed that, the pre-assessment MMAS score between three groups is not statistically significant (P=0.475) while in post – assessment it was statistically significant between the three groups (P<0.001**).

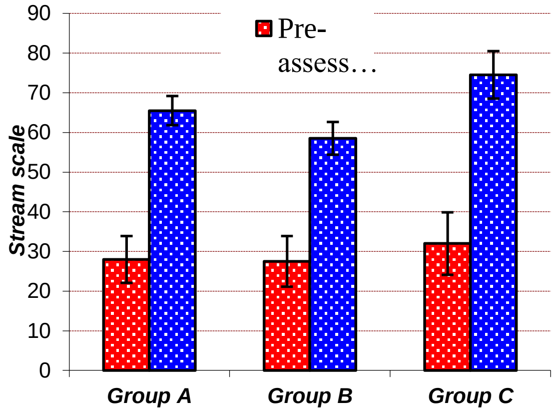
STREAM scale	Group A	Group B	Group C	P value
Pre-assessment	28.00±5.87 (20-35)	27.50±6.35 (20-40)	32.00±7.89 (20-40)	F=1.333 (P=0.281)
Post assessment	65.50±3.69 (60-70)	58.50±4.12 (50-65)	74.50±5.99 (65-85)	F=29.071 (P<0.001**)
% Change	133.9%	112.7%	132.8%	-
P value	t=24.405 P<0.001**	t=18.984 P<0.001**	t=22.808 P<0.001**	-

Table 3: Comparison(between the groups) of Stream scale.

Intra-group Analysis: -In The Table 3 has revealed that, Group A, the pre-assessment Stream scale score was (Mean) 28.00, (SD: 5.87) ranging from 20 to 35 was increased significantly in post-assessment to 65.50(Mean),(SD:3.69) ranging from 60 to 70 with 133.9% increase (Student t-test score was 24.405, P<0.001**).

In group B, the pre-assessment Stream scale score(Mean) was 27.50, (SD:6.35)ranging from20-40 was increased in post assessment to 58.50(Mean), (SD:4.12)ranging from 50 to 65 with 112.7% increase(Student t-test score was 18.984,<0.001**).

In Group C,the pre-assessment Stream scale score(Mean) was 32.00(SD=7.89)ranging from20-40 was increased significantly in post assessment to 74.50(Mean),(SD: 5.99)ranging from 65 to 85 with 132.8% increase(Student t-test score was 22.808,P<0.001**).



Graph 4: Comparison of Stream scale.

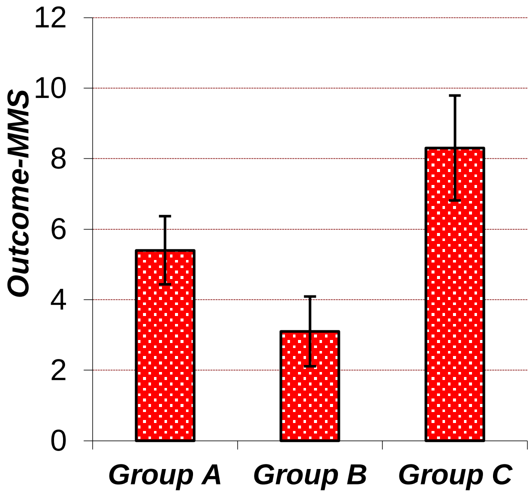
Inter-group Analysis:-The pre-assessment Stream scale score between three groups is not statistically significant (P=0.281) while in post –assessment it was statistically significant between the three groups (P<0.001**)

Outcome	Group A	Group B	Group C	P value
Modified Motor Assessment scale	5.40±0.97	3.10±0.99	8.30±1.49	F=49.019 (P<0.001**)
STREAM scale	37.50±4.86	31.00±5.16	42.50±5.89	F=11.735 (P<0.001**)

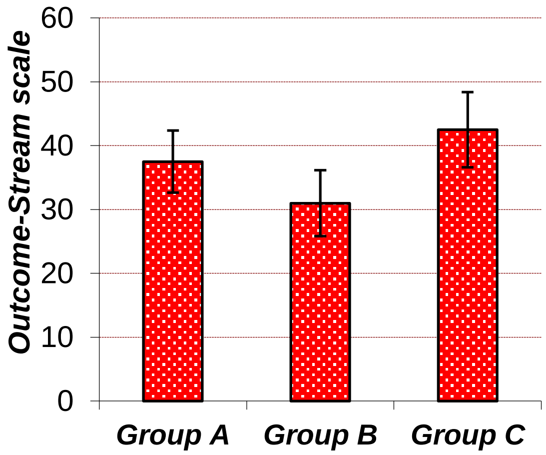
Table 4: Comparison of Outcome (difference score of Pre and Post).

In The table (4) has revealed that:- The outcome is significantly higher in Group C(difference score of 8.30, P<0.001**) when compared to Group A (5.40) and Group B (3.10) in MMAS evaluation.

The outcome is significantly higher in Group C (difference score of 42.50, P<0.001**) when compared to Group A (37.50) and Group B (31.00) in Stream scale evaluation.



Graph 5: Comparison of Outcome –Modified Motor Assessment scale.



Graph 6: Comparison of Outcome –Stream scale.

DISCUSSION

MCA stroke describes the sudden onset of focal neurological deficit resulting from brain infarction or ischemia in the territory supplied by the MCA. Neurological damage and stroke in particular, is the leading cause of long-term disability [10,11].

This study analyzed the individual effects of Motor Relearning Programme and Thermal stimulation and the incremental effect of these two techniques which were analyzed using MMAS and STREAM Scale[12].

The individual effects of Motor Relearning Programme, Thermal Stimulation and combined effect of both analyzed with regard to motor functional improvement of the upper extremity. It was analyzed statistically by Paired “t “ Test and ANOVA, The test to find the significance of MMAS, STREAM scale between and within the three groups respectively.

According to assessment with MMAS and STREAM group A shows that subjects got significant(P<0.001**) improvement in motor function following MRP sessions.

So statically, it was proved that the individual effect of Motor Relearning Programme was found to be significant in improving motor function. In the present study, Motor Relearning Programme showed significant improvement in improving functional activities of upper limb in right MCA stroke. This view was well supported by the recent research study conducted by Ceravolo MG, Provinciali.L[30] He has proved that Motor Relearning Programme improved motor functions of stroke subjects[13,14].

Group B shows that subjects got improvement in motor function on MMAS, and STREAM following Thermal Stimulation (P<0.001**).So statically, it was proved that the individual effect of Thermal Stimulation was found to be significant in improving motor function.

The result of the study suggests that TS was effective for improving motor function. The same view was proved earlier by, Jia- Ching chen et al, In this study he proved that the performance of Brunnstrom stage, wrist extension and sensation were improved significantly after thermal stimulation in stroke subjects[15].

Group C shows that motor functional improvement significantly higher in Group C (P<0.001**) when compared to Group A and Group B in MMAS evaluation. The motor functional improvement is significantly higher in Group C (P<0.001**) when compared to Group A and Group B in Stream scale.

So statically it was proved that the combined Effect of Motor Relearning Programme and Thermal stimulation was found to be strongly significant (P<0.001**) for improvement of motor function. The ‘p’ value for the post test of all the three groups in MMAS and STREAM was <0.001**,it shows that there was significant difference in improvement of motor function. The study accepted the alternative hypothesis and rejected the null hypothesis.

It proves that combined effect of Motor Relearning Programme and Thermal stimulation shows more significant than other two groups. So statistically, it suggests that even though all the three interventions have demonstrated that there was improvement in motor function following treatment session, comparison of groups A&B showed that MRP shows more significant effect than Thermal stimulation, but the combined effect shows more significant effect than other two individual groups in improving motor function. So, the alternate hypothesis is accepted and null hypothesis is reflected.

This present study has shown that combination of MRP and TS techniques in treating the stroke subjects has an added benefit for the stroke subjects to improve motor function. The finding of the study is supported by previous studies.

CONCLUSION

This study supports the use of combined effect of these two techniques of motor relearning programme and TS to improve the upper limb motor function with mild to moderate impairment.

The results showed that the use of individual effect of motor relearning programme was more effective than TS . Combined effect of these two techniques was more effective than the individual effect can bring out significant changes in the functional recovery of the upper limb in the right MCA stroke.

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