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A Comparative Study on the Effectiveness of Constraint Induced Movement Therapy and Corrected Assisted Synchronized Periodic Therapy

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ABSTRACT

Background and purpose: Stroke is a leading cause of permanent disability in worldwide. It occurs when the brain's blood supply is disrupted. This may manifest as an artery blockage or as internal bleeding in the brain. Brain damage from a stroke can result in weakness, paralysis, loss of coordination, spasticity, and a reduction in limb range of motion.
Objectives: The study's objective is to evaluate the efficacy of corrected assisted synchronized periodic therapy and constraint-induced movement therapy in treating upper limb stroke.
Method: The patient received an explanation of the treatment process. Written consent was obtained in order to participate in this study voluntarily. Using the inclusion and exclusion criteria, thirty patients who had upper limb strokes were selected and divided into two groups, Group A and Group B. In order to treat upper limb stroke, Group B received corrected assisted synchronized periodic therapy, while Group A received constraint-induced movement therapy. The values of pre and post interventions are assessed through Fugl Meyer Assessment scale and Wolf Motor Function test.
Result: Group A and Group B participants are included in the study and completed the 15 sessions of constraint induced movement therapy and Corrected assisted synchronized periodic therapy and they were evaluated at three -month follow up. The study's findings demonstrated that both groups had significantly improved. The subject who participated in experimental Group A had shown good improvement on motor ability, reducing spasticity and activities of daily living than the Group B.
Conclusion: This study concluded that those who received Constraint Induced Movement Therapy resulted in improvement on motor ability, reducing spasticity and activities of daily living than those who received Corrected Assisted Synchronized Periodic therapy.
Keywords: Constraint Induced Movement therapy, Corrected Assisted Synchronized Periodic therapy, Wolf Motor Function test, Fugl Meyer Assessment scale.

INTRODUCTION

A stroke is a rapidly progressing loss of brain function brought on by disruption of the blood supply to the brain. It is a prevalent neurological condition that is a major contributor to long-term disability worldwide.[1] The World Health Organization defines stroke as an acute onset of

neurological dysfunction brought on by an anomaly in cerebral circulation, accompanied by signs and symptoms that indicate involvement of a focal area of the brain and last longer than twenty-four hours. Depending on the area of the brain that is affected, stroke can result in different degrees of impairments in motor, sensory, cognitive, and communication abilities.[2]

By limiting the movement of the unaffected arm, the well-researched technique known as constraint-induced movement therapy promotes the use of the affected limb. By encouraging the brain to rewire itself, this therapy enhances motor function and control.[3]The idea of neuroplasticity, which enables the brain to reorganize and create new neural pathways to make up for lost function, supports this therapy. In the ipsilateral and contralateral sensorimotor cortex synapses, CIMT can improve the plasticity of dendrites and dendritic spines. Repetitive and task-oriented training, shaping, task practice, behavioral strategies, and restricting the use of the more affected upper extremities are all crucial elements of CIMT.[4]

Corrected assisted synchronized periodic therapy exercises intended to help stroke patients recover their upper limbs. These exercises place a strong emphasis on limb positioning correction, assisted movements, coordinating patient efforts with help, and performing exercises at regular intervals. It is a more recent method that uses coordinated exercises and assisted movement to aid in recovery. By guiding the affected limb's movements with external support, this technique lessens strain and improves coordination.

MATERIALS AND METHODS

METHOD

The study was conducted at JKKMMRF College of physiotherapy outpatient department. The patient was informed about the whole procedure and treatment method. A written consent was obtained from their voluntary participation in this study. They were 30 patients with upper limb stroke were selected based on the inclusion and exclusion criteria and they were divided into 2 groups, Group A and Group B. Group A was treated with constraint induced movement therapy and corrected assisted synchronized periodic therapy on upper limb stroke. Fugl Meyer assessment scale and Wolf Motor function test were used as outcome measures. each patient was given a physiotherapy program of 45 minutes for5 days per week with 3 months duration. The pre and post treatment values were measured before and after 3 months for comparison.

INCLUSION CRITERIA

Both genders
Aged between 45-60 years
At least 6 weeks after the onset of first ever stroke
Modified Ashworth scale of grade greater than 1 in at least 2 or more joints.
Active extension wrist at least 20 degrees and 10 degrees of active extension of metacarpophalangeal joints.

EXCLUSION CRITERIA

Patient suffering from severe osteoporosis
Patient with extrapyramidal movement disorders in the affected extremity
Patient with any joint contracture
Patient with psychological disorders
Significant pain in the affected extremity

PROCEDURE AND PROTOCOLS

GROUP A

Group A was treated with constraint induced movement therapy on upper limb stroke.

PROCEDURE

Sit on a chair with back support
Restraint the unaffected hand through sling or splint
Use the affected hand to picking up the objects or drawing
Task based activities like reaching activities, ball throwing activities
The affected arm is trained for 2-6 hours at an intermittent duration for a day.

Frequency :45 minutes for 5 days per week
Duration: 3 months

GROUP B

Group B was treated with corrected assisted synchronized periodic therapy on upper limb stroke.

PROCEDURE

These exercises emphasize correcting limb positioning, providing assisted movements, synchronizing patients efforts with assistance, and conducting exercise at regular intervals.

Exercises include
Shoulder flexion with assisted support
Elbow flexion or extension
Wrist rotation (pronation and supination)
Finger flexion and extension
Shoulder abduction and adduction
Combined reach and grasp activities
Passive ROM exercises
Active assisted arm lifts
Hand opening and closing
Forearm weight bearing exercises
Frequency :45 minutes for 5 days per week
Duration: 3 months.

STATISTICAL ANALYSIS

Descriptive statistics for Fugl Meyer assessment scale - Group A and Group B

Descriptive statistic for Fugl Meyer Assessment scale in Group A shows that paired 't' test values of pre vs post test values of Group A was 22.3 at 0.001% level which was greater than tabulated 't' values 2.5. Group B shows that paired 't' values of pre and post values of Group B was 19.6 at 0.0001% level which was greater than tabulated t values 2.5. This showed like there is significant difference between pre vs post test results of Group A and Group B for FMA. This exposed that there was significant reduction in post test mean values in response to FMA in Group A and Group B.

RESULT – FMA (POST TEST ANALYSIS)

Group	FMAS	Mean	Standard deviation	Paired 't' test value
GROUP A	Pre test	30.6	2.8	22.3
	post test	42.8	3.7	
GROUP B	Pre test	30.6	3.2	19.6
	Post test	39.6	3.1	

The unpaired 't' value of 2.5 was greater than the tabulated Unpaired 't' value of 2.4 which showed that there was statistically significant difference at 0.0001level between Group A and Group B. The pre vs post test mean of Group A was 42 and the pre vs post test mean of Group B was 39 and the mean difference of Group A and Group B was 3.2 which showed that there was significant reduction in FMA score for Group A than Group B.

Descriptive statistics for WMFT - Group A and Group B

FMA	Mean	Mean difference	Standard deviation	Unpaired 't' test value
Group A	42	3.2	3.7	2.5
Group B	39		3.1	

The unpaired 't' value of 2.5 was greater than the tabulated Unpaired 't' value of 2.4 which showed that there was statistically significant difference at 0.0001level between Group A and Group B. The pre vs post test mean of Group A was 42 and the pre vs post test mean of Group B was 39 and the mean difference of Group A and Group B was 3.2 which showed that there was significant reduction in FMA score for Group A than Group B.

Descriptive statistics for WMFT - Group A and Group B

GROUP	WMFT	Mean	Standard deviation	Paired 't' test value
Group A	Pre test	38.9	4.9	16
	Post test	60.9	3.8	
Group B	Pre test	39.2	4.6	14
	Post test	57.2	3.8	

Descriptive statistic for Wolf Motor Function test in Group A shows that paired 't' test values of pre vs post test values of Group A was 16 at 0.005% level which was greater than tabulated 't' values. Group B shows that paired 't' test values of pre vs post test values of Group B was 14 at 0.005% level which was greater than tabulated 't' values2.14. This showed like there is significant difference between pre vs post test results of Group A and Group B for WMFT. This exposed that there was significant reduction in post test mean values in response to WMFT in Group A and Group B.

RESULT- Wolf Motor Function test (POST TEST ANALYSIS)

WMFT	Mean	Mean difference	Standard deviation	Unpaired 't' test value
GROUP A	60	3.93	3.8	2.4
GROUP B	57		4.8	

The Unpaired 't' value of 2.4 was greater than the tabulated paired 't' value of 2.14 which showed that there was statistically significant difference at 0.0001% level between Group A and Group B. The pre vs post test mean of Group A was60 and the pre vs post test mean of Group B was 57 and the mean difference of Group A and Group B was 3.93 which showed that there was significant reduction in WMFT for Group A than Group B.

RESULT

Group A and Group B participants are included in the study and completed the 15 sessions of constraint induced movement therapy and Corrected assisted synchronized periodic therapy and they were evaluated at three -month follow up. The study's findings demonstrated that both groups had significantly improved. The subject who participated in experimental Group A had shown good improvement on motor ability, reducing spasticity and activities of daily living than the Group B.

DISCUSSION

The purpose of the study was to compare the effectiveness of Constraint Induced Movement Therapy and Corrected Assisted Synchronized Periodic Therapy in upper limb stroke. The Wolf motor function test and Fugl meyer assessment scale was taken as the parameter of quality the effectiveness of the treatment Constraint Induced Movement Therapy and Corrected Assisted Synchronized Periodic Therapy.

The study sample comprised of 30 subjects of which 15 Group A and B. The mean age of subjects was 45-60 years. Among 30 subjects, 15 were treated with Constraint Induced Movement Periodic Therapy and 15 were treated with Corrected Assisted Synchronized Periodic Therapy. The pre and post-test values were assessed by FMA and WMFT in Group A and Group B.

The paired 't' test values of FMA 19.8246 and 19.6619 and WMFT 16.0614 and 14.8684 respectively. The Unpaired 't' test values for FMA 2.2570 and WMFT 2.4691 respectively.

The results of the same parameters were recorded for comparison after 3 months of treatment. The result showed that there was statistical significant difference between Group A and Group B. The Group A who was treated with Constraint Induced Movement Therapy had shown good improvement in increasing the motor ability and activities of daily living than Group B

who were treated with Corrected Assisted Synchronized Periodic Therapy.

By analyzing the values of paired and unpaired 't' test the result showed a statistically significant results comparing with the table value with 0.05 level of significance of both groups between pretest vs post test results.

The result obtained from statistical analysis indicate that there was a statistically significant difference between two groups in showing improvement in upper limb stroke.

The reduction of spasticity and improvement of motor functions were seen in all subjects receiving Constraint Induced Movement Therapy and Corrected Assisted Synchronized Periodic Therapy, regardless of the technique.

By the result alternate hypothesis is accepted and also there is significant difference between Constraint Induced Movement Therapy and Corrected Assisted Synchronized Periodic Therapy for the improvement in motor function and reducing spasticity.

By analyzing the mean and standard deviation values the result showed the subjects who received Constraint Induced Movement Therapy is found to be more effective in improving motor function and reducing spasticity than Corrected Assisted Synchronized Periodic therapy.

While consideration of improving quality of life in patients with Upper limb stroke, the study shows there was effective and good improvement.

A study conducted by Corbetta Davide et al., 2015 validate the effectiveness of CIMT, modified CIMT, or Forced use in improving movements with upper limb stroke. This study found that when stroke patients receive Constraint Induced Movement Therapy, their arm motor function significantly improves.[6]

A study by Sunil Pradhan et al., 2018 on response to Corrected Assisted Synchronized Therapy in post stroke to reduce spasticity and improve motor function. The result of the study supports the current study where the participants functional activities are improved in terms of Barthel index .[7]

A study conducted by Sheng Bo et al.,2024 validate the Wolf Motor Function Test for assessing stroke patient's upper limb motor function. This study was analyzed using the multi-relief method and singular spectrum analysis. This study concludes that the suggested innovative scoring method can produce accurate and impartial evaluation scores.

Physiological effects of Constraint Induced Movement Therapy

CIMT helps the brain rewire itself. When the affected arm is used repeatedly, the brain forms new connections to improve control. It increases activity in the damaged part of the brain responsible for movement, improving voluntary motor control.[8] CIMT forces the patient to use the affected arm, reversing the habit of relying only on the unaffected side. Repetitive tasks build strength and endurance in weakened muscles of the affected limb. The therapy enhances coordination between the brain and the muscles, improving smoothness of movement. Active use of the affected limb improves the brain's ability to receive and interpret sensory signals like touch and position. With regular use, it may help reduce muscle stiffness or abnormal tightness.

Physiological effects of corrected assisted synchronized periodic therapy

CASPT encourages repeated, assisted movements of the affected upper limb, which helps stimulate dormant motor pathways in the brain. This can lead to improved muscle activation over time[9].The synchronized and periodic nature of the therapy helps retrain the brain to recognize and control the affected arm. This supports neuroplastic changes, which are essential for motor recovery after stroke. CASPT involves controlled and rhythmic movement patterns, which help in reducing muscle stiffness and abnormal tone. This makes voluntary movements easier and more coordinated. This prevents stiffness, contractures, and improves joint flexibility.

Repetitive motion improves local blood flow in the upper limb, which can help nourish tissues and promote healing.[10]
Based on the statistical analysis and interpretation, the result of the study was improving in motor abilities, reducing spasticity and activities of daily living. Therefore, the present study was accepting the alternate hypothesis and rejecting the null hypothesis.

CONCLUSION

This study concluded that those who received Constraint Induced Movement Therapy resulted in improvement on motor ability, reducing spasticity and activities of daily living than those who received Corrected Assisted Synchronized Periodic therapy.

Declaration by Authors

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