Effectiveness of Constraint Induced Movement Therapy and Proprioceptive Neuromuscular Facilitation on Upper Extremity Functions in Stroke

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Abstract

Background: Stroke is the quickly developing clinical indication of a focal disruption of brain function that lasts more than 24 hours or results in death, with no discernible cause other than vascular origin. Despite the fact that the majority of patients are able to walk again, 30% to 60% of survivors are no longer able to use the arm that was injured. CIMT aims at improves both the motor and functional capacities of a paretic arm. PNF exercises alter the order in which muscles are stimulated, increases the efficiency of joint movement.

Purpose: To compare the effectiveness of Constraint Induced Movement Therapy and Proprioceptive Neuromuscular Facilitation for treating upper extremity functions in stroke.

Materials and Methods: A total of 30 participants were selected from Sree Annai Physiotherapy Clinic Chennai. According to the inclusion and exclusion criteria. Subjects willing to participate were allocated into two groups Constraint Induced Movement Therapy group and Proprioceptive Neuromuscular Facilitation group. The participants underwent Pre-test measurement with Fugl-Meyer Assessment Upper Extremity FMA-UE and were repeated for Post-test measurement. Study period : November 2022 to April 2023.

Results: When comparing the mean differences of the two groups, Constraint Induced Movement Therapy group displays a greater difference than Proprioceptive Neuromuscular Facilitation group. Therefore, it can be said that Constraint Induced Movement Therapy is more advantageous for the upper extremity functions than Proprioceptive Neuromuscular Facilitation.

Conclusion: The study concluded that Constraint Induced Movement Therapy is found to be more effective than Proprioceptive neuromuscular facilitation technique for upper extremity function recovery.

Key Word: Stroke, Proprioceptive Neuromuscular Facilitation, Constraint Induced Movement Therapy.

Introduction

Stroke is defined as the rapidly evolving clinical symptoms of a focused (or global) interruption of brain function that lasts for more than 24 hours or results in death and has no other apparent cause than vascular origin.1 Stroke, a leading cause of disability and death worldwide, conventionally defined as a neurological deficit results from an acute, focused injury to the central nervous system brought on by a vascular cause. Despite its widespread effects, there is no agreed upon definition of “stroke” in clinical
practice, clinical research, or public health evaluations. Understanding of CNS ischemia, infarction, and bleeding has been increased by developments in basic research, neuropathology and neuroimaging. In India, stroke is the main factor contributing to mortality and disability. The equivalent to 80% of patients with stroke survive the acute stage. Although most patients are able to walk once more, 30% to 60% of survivors are no longer able to utilize the arm that was hurt. Upper extremity function recovery is typically more difficult than lower extremity function recovery. The “learned nonuse” concept postulates that failing to successfully use the wounded arm frequently during the acute and subacute phases can have a negative reinforcement on that arm’s utilize. The degree to which motor, sensory, and cognitive functions were initially impaired determines how quickly a stroke victim recovers. Consequently, stroke recovery is essential for developing functions and activities carried out by the survivors. It is concentrated on exploiting the idea of neuroplasticity and motor learning.

Constraint Induced Movement Therapy asserts in improving both the motor and functional capacities of a paretic arm by restricting the side that is unaffected. Use of the afflicted side is mandated by CIMT. Constraint Induced Movement Therapy, or CI Therapy, is a behavioral strategy for neurorehabilitation that is based on the principles of basic neuroscience. Numerous neuroimaging and TMS demonstrated the application of CI therapy results in large configuration that expands the area of the brain engaged in the innervation of movement of the more severely damaged upper extremity.

Proprioceptive Neuromuscular Facilitation (PNF) is widely utilized as a treatment for physical dysfunction brought on by injury or illness. Studies on stroke survivors have revealed that PNF works by reducing deficits and enhances trunk and limb functions. Proprioceptive Neurophysiology serves as the foundation for neuromuscular facilitation. Through the application of neurophysiological techniques, it improves the appropriate neuromuscular stimulation and controls the activation of sensory-motor conductions and proprioceptive stimuli. Exercise and therapy are crucial to stroke recovery. Although there are several exercises for managing stroke, PNF is also one of the widely utilized methods.

Aim

The aim of the study is to compare the effectiveness of Constraint induced movement therapy and Proprioceptive neuromuscular facilitation on upper extremity functions in stroke.

Material and Method

A total of 30 participants, aged between 50-70 years were selected according to the inclusion and exclusion criteria and the informed consent form was collected from them before starting the study. All the participants were informed about the purpose and procedure of the study. Subjects willing to participate were allocated into two groups Constraint Induced Movement Therapy group (n=15) and Proprioceptive Neuromuscular Facilitation group (n=15). The participants underwent Pre-test measurement with Fugl-Meyer Assessment Upper Extremity FMA-UE and were repeated for Post-test measurement. The therapy was administered for a period of six weeks.

Inclusion criteria

- Subjects with age of 50-70 years
- Both males and females are included
- Chronic stroke subjects with mild Spasticity (score of 2 or less on Modified Ashworth Scale)
- No cognitive impairment (score of 20 or more in Mini-Mental State Examination)
- Adequate balance
- Available ROM of about 20 degree or more of fingers and wrist extension.

Exclusion criteria

- Subjects with recent occurrence of stroke
- Cognitive impairment
- Visual impairment
- Subjects with cardiac anomalies.

Outcome measure

- Fugl-Meyer Assessment Upper Extremity (FMA-UE).
Procedure

A total of 30 participants were selected according to the inclusion and exclusion criteria and the informed consent form was collected from them before starting the study. All the participants were informed about the purpose and procedure of the study, as well as the right to refuse to take part or quit from the study at any moment. Subjects willing to participate were allocated into two groups: Constraint Induced Movement Therapy group and Proprioceptive Neuromuscular Facilitation group. The participants underwent Pre-test measurement with Fugl-Meyer Assessment Upper Extremity FMA-UE and were repeated for Post-test measurement.

Constraint Induced Movement Therapy Group:

The therapy was administered to the subjects while restricting the unaffected upper limb with a mitt. Two times per week for a period of six weeks, the intervention was conducted. Constraint-induced movement treatment was applied while the subject was seated, with one hand on the table doing specified activities. The therapy involved repeatedly teaching the subject with different objects such as spoons, papers, balls, and straws. The activities were divided into smaller parts, beginning with grabbing the object and moving forward until the task was finished. The exercises were carried out seated at home, just as they had been in the past in the hospital.

Proprioceptive Neuromuscular Facilitation Group:

The exercises were administered to the subjects using a Proprioceptive neuromuscular facilitation technique. It was given to the upper limb twice daily, five days a week for a period of six weeks, for 30 minutes, starting at the proximal joints and working out to the distal. The following movement pattern were performed:

D1 Flexion Pattern of Proprioceptive Neuromuscular Facilitation

Shoulder flexion, Adduction and external rotation, Elbow flexed, Forearm supinated, Wrist flexed and radial deviated with fingers flexed. Participant positioned in supine lying and physiotherapist in walk stand position on the affected side and places one hand over the arm and the other over the hand. As the participant starts moving the extremity, the physiotherapist applies resistance.

D1 Extension Pattern of Proprioceptive Neuromuscular Facilitation

Shoulder extension, Abduction and internal rotation, Elbow extended, Forearm pronated, Wrist extended and ulnar deviated with fingers extension and abduction. Participant positioned in supine lying and physiotherapist in walk stand position on the affected side and places both the hands at the agonist muscles at the elbow and dorsal aspect of wrist. Participant was instructed to move the limb to the opposite hip joint diagonally. The resistance was applied by the physiotherapist.

D2 Flexion Pattern of Proprioceptive Neuromuscular Facilitation

Shoulder flexion, Abduction and external rotation, Elbow extended, Forearm supinated wrist flexed and ulnar deviated with fingers extension and abducted. Participant positioned in supine lying and physiotherapist in walk stand position on the affected side and places one hand over the dorsum of wrist and finger and other hand over the elbow joint. The resistance was applied by the physiotherapist.

D2 Extension Pattern of Proprioceptive Neuromuscular Facilitation

Shoulder extension, Adduction and internal rotation, Elbow flexed, Forearm pronated, Wrist flexed and ulnar deviated, fingers flexed and adducted. Participant positioned in supine lying and physiotherapist in walk stand position on the affected side and places one hand over the elbow joint and other over the palmar surface of the hand. The resistance was applied by the physiotherapist.

Data Analysis

A total of 30 subjects with chronic stroke upper extremity hemiparesis between the age group of 50-70 years were selected for the study. They were split into two groups using a random allocation method: The PNF group and the CIMT group. Evaluation by FMA-UE done in participants before and after therapy to obtain pre-test and post-test values, respectively. For both groups, the pre-test and post-test values of the FMA-UE were compared.
Result

The collected data was statistically analyzed using a paired and unpaired t-test, showing significant improvement in both Constraint induced movement group and Proprioceptive neuromuscular facilitation group. While comparing FMA-UE the Post-test mean value in the Constraint induced movement therapy group was 80.73 whereas in the Proprioceptive neuromuscular facilitation group it was 74.40.

When comparing the mean differences of the two groups, Constraint Induced Movement Therapy group displays a greater difference than Proprioceptive Neuromuscular Facilitation group. Therefore, it can be said that Constraint Induced Movement Therapy is more advantageous for the upper extremity functions than Proprioceptive Neuromuscular Facilitation.

Discussion

The current study compares the effects of proprioceptive neuromuscular facilitation and constraint-induced movement therapy on upper extremity functions in stroke subjects. The outcome results were measured by Fugl-Meyer assessment of upper extremity before and after the treatment. Using paired and unpaired t-tests, the pre-test and post-test data of parameter FMA-UE were statistically evaluated. Beneficial effects were significantly greater in constraint induced movement therapy group. The study found that proprioceptive neuromuscular facilitation approaches and constraint-induced movement therapy were both helpful for treating upper extremity functions in chronic stroke participants. The results imply that combined induced movement treatment is more advantageous for the upper extremity functions than proprioceptive neuromuscular facilitation.

In CIMT group pre-intervention mean of FMA-UE was 55.27(+3.37). After treating the subject with Constraint Induced Movement Therapy the mean value of FMA-UE is increased to 80.73(+4.92), which shows statistically significant difference between the groups.

In PNF group pre-intervention mean of FMA-UE was 55.33(+3.50). After treating the subject with Proprioceptive Neuromuscular Facilitation the mean...
value of FMA-UE is increased to 74.40(+3.02), which shows statistically significant difference between the group.

Based on the statistical analysis, both groups showed improvement in FMA-UE. However, subjects in the CIMT group who received Constraint Induced Movement Therapy showed significant improvement in FMA-UE than the subjects in the PNF group who received Proprioceptive Neuromuscular Facilitation.

Muhammad Abba et.al Although CIMT is more advantageous, PNF therapies are also helpful in enhancing upper limb function. For the treatment of persistent upper limb post-stroke deficits, CIMT might be the best option.3

Suputtitada A et.al Patients with chronic stroke may benefit from CIMT of intact upper extremities because it may be a successful method for enhancing motor activity and demonstrating learned nonuse.8

Corbetta D et.al concluded that CIMT is a multifaceted strategy in which increased activity is combined with restriction of the least affected limb according to the individual’s capacity. CIMT might be superior to conventional rehabilitation. There is little available data on CIMT long term consequences. There has to be more research into the connection between participant qualities and better results.9

Koyama T et.al stated that a statistical study reveals CI therapy is most effective for treating hand function, pointing to a useful application of this therapy.10

Limitation of this study was limited with the specific age group and the study was done with a smaller number of subjects. Further study on CIMT needed to investigate long term effects and longitudinal study are recommended.

Ethical Clearance: Taken from the institutional ethical committee. ISRB number - 03/ 018/ 2022/ ISRB/ SR/ SCPT

Funding: Self

Conflict of Interest: Nil

Conclusion

This study found that Proprioceptive neuromuscular facilitation approaches and Constraint induced movement therapy were both helpful in treating upper extremity functions in chronic stroke. The results imply that Constraint induced movement treatment is more advantageous for the upper extremity functions than Proprioceptive neuromuscular facilitation.

References