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Effect of Constrained Induced Movement Therapy on Functional Arm Reach Distance on Adult Hemiplegic Patients: A Pilot Study

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Abstract

Background: Stroke is an acute onset of neurological dysfunction due to an abnormal cerebral vascular circulation with resulting signs and symptoms that corresponds to focal area of brain. The most common characteristics of MCA stroke are contra lateral spastic hemiparesis, motor and sensory disturbance of face, motor weakness of upper extremity and lower extremity with upper limb more affected than lower limb. Constraint induced movement therapy (CIMT) involves ipsilesional limb restraint with training of paretic arm to overcome this learned disability by restraining the unaffected extremity and training the affected extremity.

Aims and objectives of the study: To observe and analysis the effect of Constrained Induced Movement Therapy on hand function of chronic stroke patients.

Data Analysis & Results: Shows that the pre and post intervention values of variable functional arm reach in chronic stroke patients of this study. In that mean values of pre and post intervention of functional arm reach were 19.0 cm and 23.0 cm respectively. Results of significance p value were $p \leq 0.05$ explained that after constrained induced movement therapy intervention to the subjects the functional arm reach was improved statistically.

Conclusion: This study concluded that Constraint Induced Movement Therapy (CIMT) shall have statistically significant improvement on hand function of functional arm reach distance in adult hemiplegic patients.

Keywords: Functional Arm Reach, Chronic Stroke, Spasticity, Constraint Induced Movement Therapy.

Introduction

Stroke is an acute onset of neurological dysfunction due to an abnormal cerebral vascular circulation with resulting signs and symptoms that corresponds to focal area of brain. The most common characteristics of MCA stroke are contra lateral spastic hemiparesis, motor and sensory disturbance

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of face, motor weakness of upper extremity and lower extremity with upper limb more affected than lower limb.[1] Stroke is second most frequent cause of death after coronary artery disease. In India, stroke is an important cause of premature death and disability.[2]

Spasticity usually develops slowly with antigravity 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 pronators of the elbow and wrist, the flexors and adductors of the fingers.[3] Stroke is a leading cause of long-term disability in Western countries[4]. Constraint-induced movement therapy (CIMT) is a relatively recent approach developed to promote paretic upper-limb function following sub acute and chronic stroke.[5] There is evidence in the literature that stroke patients with chronic, mild to moderately severe arm motor impairment who are given CIMT show improvement in motor ability and a marked increase in the amount of use of the more affected upper extremity.[6]

Alberts et. al. hypothesized that this lack of understanding may be partly attributable to the methods used in assessing upper-extremity functions.[7] Most studies rely on clinical tests but more objective outcome measures are necessary to understand the mechanisms underlying stroke motor deficits and CIMT - hence the need for a new evaluation method that provides a more accurate analysis of the results. In the field of gait analysis, much progress has been made with the introduction of instrumental kinematic evaluation. The validity of this method in the study of the lower limb is well known and its use is consolidated.[8] Although the study of movements of the upper limb is more complex than the study of gait, and the application of kinematic analysis is still in its earlystages,[9] studies based on this approach are increasingly frequent. Kinematic instrumental analysis is, in fact, proving to be an excellent tool for quantifying the functionality of the upper limb and thereby monitoring the effects of treatments on motor performance over time.[10]

Although traditional method for rehabilitation among patients with limited upper extremity function after stroke, such as neurodevelopmental techniques, have not been shown to be efficacious in controlled studies, more recent approaches that involve repetitive training of the paretic upper extremity on task-oriented activities give evidence of efficacy among stroke survivors who retain some ability to actively extend the fingers and wrist of their paretic upper extremity.[11] One approach, which has substantial evidence of efficacy for individuals with long-term stroke disabilities (1 year after event), involves intense functionally oriented task practice of the paretic upper extremity along with restraint of the less-impaired upper extremity for most waking hours. This approach encourages use of the paretic upper extremity in daily life[12] and is thought to help overcome what Taub[13] first described in a deafferented monkey model as "learned non use" of the paretic upper extremity. Treatment by restraining only the less-impaired upper extremity, which is typically accomplished by placing the entire arm in a sling or placing the hand in a mitt for most waking hours for 2 weeks, without supervised task practice, is referred to as "forced use" and has been applied to long-term and sub acute stroke patients. Constraint induced movement therapy (CIMT) involves ipsilesional limb restraint with training of paretic arm use conducted by a clinician following shaping and repetitive task practice principles over the same time course or less intensely over several weeks.[14] The Extremity Constraint Induced Therapy Evaluation (EXCITE) Trial represents the first national, randomized, single-blind study to systematically test a neuro rehabilitation therapy among patients with the ability to initiate extension movements at the wrist and fingers and who had experienced a first stroke within 3 to 9 months prior to enrollment.[15]

Stroke patients who initially attempt to use the affected extremity find themselves unable to do so because the process of spontaneous recovery of function has not yet proceeded sufficiently far. These results in the experience of failure or punishment for attempts to move the extremity and in positive reinforcement for compensatory movements by the unaffected extremity-a learning process that might be supported by the teaching of compensatory activity during rehabilitation.[16] This learned non use impedes attempts to further rehabilitate the affected extremity. Based on this theoretical account, constraint-induced

(CI) movement therapy was developed. It is designed to overcome this learned disability by restraining the unaffected extremity and training the affected extremity there by leading to massed practice in the use of affected extremity for period of 2 weeks.[17]

The main aim of this study was to observe and analysis the effect of Constrained Induced Movement Therapy (CIMT) on hand function of chronic stroke patients. With this study results for chronic stroke patients, the physiotherapy treatment may include Constrained Induced Movement Therapy on hand function to treat effectively Chronic Stroke patients. By doing this study significance using CIMT to assess Functional arm reach on chronic stroke patient will be strengthened and ascertained.

Materials and Methods

Study Design: Pilot study.

Study Setting: Abhinav Physiotherapy Center, P&T Nagar, Madurai.

Study Duration: 12 months.

Study Sampling: Convenient Sampling.

Study Population: In Around Madurai District.

Study Sample: 3 to 4 subjects.

Criteria of Selection:

Inclusion Criteria:

Age- 50-75

Sex – Both Sex

Both side affected hemiplegic patients

Hemiplegic for the past 6 months

Hemiplegic can walk with or without assistance

Hemiplegic functionally limited hand functions

Exclusion Criteria:

Psychological disorder.

Severe musculoskeletal disorder.

Serious neurological and cardiorespiratory disorders

Systemic disorders

Disoriented and non cooperative patients.

Variable:

Functional Arm Reach Distance.

Intervention:

Constraint Induced Movement Therapy (CIMT) for hand.

Procedure:

13 subjects full fill the criteria of selection were selected and recruited for this study convenient sampling method. Their demographic data including vitals were collected and documented. Pre intervention functional arm reach measurements were measure and selected. By convenient sampling method patients were selected and Constrained Induced Movement Therapy (CIMT) was given on hand function, 30 minutes a session, 5 sessions a week for 12 weeks were given. Post intervention functional arm reach measurements were measured and documented. Suitable statistical methods in the form of paired student t test with descriptive analysis was done with the assistance of spss 16.0 software version for windows.

Data Analysis and Results

This study results were showing that the pre and post intervention values of variable functional arm reach distance in adult hemiplegic patients of this study. In that mean values of pre and post intervention of functional arm reach were 19.0 cm and 23.0 cm respectively. Results of significance p value were $p \leq 0.05$ explained that after constrained induced movement therapy intervention to the subjects the functional arm reach was improved statistically by using student t test.

Table 1: Comparison of Pre & Post Values of Functional Arm Reach Distance in cm.

Group	No of subjects	Mean	Standard Deviation	T Value	P Value
Pre	13	19	1	4.89898	0.004025
Post	13	23	1		

$p<0.05$

Picture 1: Patient Performing Constrained Induced Movement Therapy (CIMT) for hand

Discussion

Improvement in functional arm reach of the subjects involved in this study after the intervention of constrained induced movement therapy (CIMT) was happened might be due to the physiological response and changes in the neurons of central nervous system in response to functional exercises to the affected musculature and development of new neuron and its connections and neural plasticity as a whole.

This study results strengthened the concept of A.Siebers 2010 stated that Our study suggests that modified CIMT in an outpatients clinic may reduce spasticity and increase functional use of the affected arm in spastic chronic hemiplegia ,with improvement persisting six months.[18]

And also the study results of Annett Kunkel 1999 stated that Based on the large effects produced by CI therapy in chronic stroke patients, there is a need for application of CI therapy with acute and sub acute stroke patients where it might be possible to avoid completely the development of a portion of the chronic motor deficit that would otherwise develop19 was also ascertained.

On the basis of this study results it can be referred that Constrained Induced Movement Therapy (CIMT) to the chronic stroke patient to improve their functional arm reach. As a whole CIMT was improving functional activities of chronic stroke patients in their various day to day activities has been proved by this study results.

Conclusion

This study concluded that Constraint Induced Movement Therapy (CIMT) shall have statistically significant improvement on hand function of functional arm reach distance in adult hemiplegic patients.

Ethical Clearance: Taken from Institutional Ethical Review Board, Santosh College of Physiotherapy, Madurai.

Conflict of Interest: Nil

Source of Funding: Self

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