



Exclusive Modified Constraint-Induced Movement Therapy For Motor Recovery In Left Hemiplegic Patient.

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<p>Received: 11Feb 2022 Revised: 26 May 2022 Accepted: 10Aug 2022</p> <p>CC License CC-BY-NC-SA 4.0</p>	<p style="text-align: center;">Abstract:</p> <p>Chronic hemiplegics are a big challenge for the therapist to restore their motor skills and the patient survives with poor quality of life and dependency. The study reports a case study on the response of chronic left hemiplegic patient focusing on the role of unique modified Constraint-Induced Movement Therapy as an intervention that doesn't respond to the conventional approach. The detail of how the patient progressed in the motor improvement of the paralytic upper limb is discussed. A convergent association of mCIMT& Task-oriented approach has been demonstrated as a success story for post-stroke recovery in a short period of 4 weeks and in kicking off Neuroplasticity.</p> <p>Keywords: <i>Chronic Hemiplegia, Paralytic upper limb, Upper extremity, Post stroke, Rehabilitation, Physiotherapy, Modified constraint induced movement therapy, Conventional therapy, Learned nonuse, Motor recovery, Case report.</i></p>
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INTRODUCTION:

Stroke/ Cerebro-vascular Accidents is a medical emergency where there is a high mortality rate and the patient shall survive with devastating paralysis shall occur. The condition shall occur due to reduced or

obstruction of blood supply to the brain. It could be ischemic, hemorrhagic, and/ or Transient Ischemic Condition. The brain deprived of oxygen and glucose through blood shall damage due to poor nutrition. The pathology of stroke is relatively similar to the heart attack, where blood flow is disturbed due to ischemia and/ or necrosis leading to the death of peripheral tissues and so the condition is also known as Brain Attack. Mainly Stroke apart from Transient Ischemic Attacks results in enduring damage that accounts for death or severe sensory-motor deficits.

A systematic review is done by Sureshkumar Kamalakannan et al (2017) on the prevalence of Stroke in India exhibits that the incidence ranges from 105- 152/ 100000 persons yearly. This value is alarming as they are very high compared to high-income countries. The review was focused on the magnitude of stroke in the country from 2000-2008 in association to 1970-1979 studies.

Hemiplegia – contra-lateral weakness of one side upper and lower extremities is a common post Stroke presentation. Facial muscles shall also be involved in such cases. American National Stroke Association had estimated about 90% of Stroke survivors shall have Hemiplegia. One side stroke of the brain shall lead to opposite side hemiplegia as most of the motor fibers cross to the opposite side of the cerebral cortex. Restricted movement with sensory loss shall lead to reduced activity of daily living and even dependency on others. Poor musculature shall also contribute to in-coordination, poor balance, circumduction gait, difficulty to grasp, etc. these presentations could be worse by complications like Reflux Sympathetic Syndrome, Shoulder subluxation, uncontrolled Spasticity, etc.

Rehabilitation of hemiplegic patients involves a multidisciplinary team involving a Physiotherapist, Occupational therapist, Speech therapist, Nutritionist, Vocational officer, etc. There is no substitute for therapy and effective approaches shall provide promising results. Physiotherapy is one of the prime interventions that take care of the sensory-motor recovery of the hemiplegic side. Conventional therapies like ROM exercises, Coordination & balance training, Task orientation approaches and Neurodevelopment techniques shall improve the voluntary control of the patient. The latest approaches are also effective in targeted groups. These advanced techniques are Functional Electrical Stimulation, Motor Imagery, Mirror Therapy, Wii Therapy, Robotics Exercises and Bio-feed Back Therapy. Assistive devices, splints and/ or a wheelchair are administered in feebly prognostic cases.

Neuroplasticity is a phenomenon that occurs due to intense therapeutic approaches. Cortical plasticity, Brain rewiring, Neural Adaptation, etc were different terms used to describe the spontaneous alteration of the brain that takes over the functions of damaged areas and brings motor recovery or functional independence to the patient. Lots of studies are conducted to streamline the interventions and their modified protocols on enhancing Neuroplasticity in patients with Upper Motor Neuron Lesion. Though interventions stimulate, multiple mechanisms work physiologically at the brain in the process of recovery and Brain plasticity. Principles like Use it or lose it, specificity, Repetition, Intensity, Duration, Interference, Transference, etc of various interventions shall play a key role in Cortical Plasticity. Optimizing the principles of plasticity Physiotherapists can play a vital role in improving the patient's quality of life. Researches conducted on such interventions are also focused on cost-effective and early recovery competent approaches.

Chronic Hemiplegia that is more than 02 years from the onset of injury shall go to the Residual Spasticity Stage. In Upper motor neuron lesions like stroke, the muscles turn into spasticity. This shall restrict the voluntary movement and the muscles shall characterize by a velocity-dependent increase in tonic stretch reflexes. This condition gradually moves to muscle fibrosis and permanent deformity, if not rehabilitated. The development shall occur after 2 years duration. At this stage, no therapeutic interventions usually work for the patient and the chances for Neuroplasticity decline. Most of these hemiplegics suffer from upper limb impairment which shall be lifelong restraint.

Constraint-Induced Movement Therapy (CIMT) is known to the therapy community as an approach to chronic stroke patients in improving upper limb function. The technique developed by Dr.Edward Taub, a behavioral neuroscientist is studied effectively in Cerebral palsy, Brain injury and Stroke patients with hemiplegia. This technique is intended to decrease the effect of "learned Non-use". Patients who are medically stable and in a better Neuro-muscular condition shall be benefited from the program. CIMT works by constraining the normal side with splints/ POP and forced use of the affected upper limb for about 6 hours a day. The therapist needs to provide continuous feedback and the patient needs to be committed to the activity section. Limitations for CIMT are physiotherapists need to spare a lot of energy time and recourses, whereas patients shall feel worn out with intense and prolonged exercise sections. Besides, that therapist is also worried about the patients falling in line and about some patient safety issues

Modified Constraint-Induced Movement Therapy (m-CIMT) is subjectively developed by the therapist at their patient's convenience. A lot of efforts is done by physiotherapists recently to refine CIMT parameters and to advance it as per ease of hemiplegics. The duration and/or intensity of constraining the unaffected side and

that of the paralytic arm were more on focus in m-CIMT. The clinical experts around the world are working for the refined approach as m-CIMT is cost-effective and easy to intervene even in the home environment. Focus is also on patient self-motivational interventions and psychological endorsement.

OBJECTIVE OF THE STUDY:

To highlight the outcome of the unique protocol of modified Constraint-Induced Movement Therapy (m-CIMT) in upper extremity motor recovery of a hemiplegic patient.

CASE DESCRIPTION:

The subject of this study is a 66-year-old male from Central India diagnosed with right Middle Cerebral Artery (MCA) Stroke 3 ½ years before, in 2016. The patient has then admitted to the hospital had emergency medications and preliminary Physiotherapy. As he managed to walk with partial support, he got discharged and run down from further therapy.

The subject later approached the researcher for impaired hand functions, poor balance and gait. Balance and Gait of the left hemiplegic patient were an easy goal to accomplish as these purposes are already healthier. But upper limb functions were quite compromised. After 6 weeks of continued conventional therapy, the upper extremity remained almost impaired. It was a big challenge for a physiotherapist to overcome the "Learned Non-use" of the affected limb. Moreover, Middle Cerebral Artery Stroke had severe upper limb involvement related to the lower extremity. 3½ years older neglected Stroke muscle responses shall be underprivileged. "But I have promises to keep, And miles to go before I sleep." The lines of Robert Frost remind you to take a leap ahead and to explore unheeded to keep the promise to the patient.

On examination, superficial sensations and proprioception of the affected hand were almost intact. Passive ROMs of the Wrist and Elbow were almost full. End range restrictions were there for shoulder abduction and external rotation. Muscle power arrays from 3 to 4 in various joints. He was well oriented and the higher functions were normal. Functional evaluation was done on upper limb motor serving of Fugl Meyer Assessment Scale for Stroke. Out of 66 for upper limb motor function, the patient had scored 26, from 33 items on the pre-test.

The Intervention was finalized after a detailed review of various pieces of literature and studies; **modified Constraint-Induced Movement Therapy (m-CIMT)** was confirmed. The patient had already undergone 2 months of physiotherapy and improved Balance, coordination and Gait. But upper limb functions of the hemiplegic side don't respond well. An exclusive m-CIMT program was structured for the subject with the following parameters:

- ↳ Maximum of 1½ hours per sitting and two sections per day.
- ↳ A long pan splint was used as the constrain material for normal hand (right side).
- ↳ The restraint was recommended during the treatment duration and of additional 3 hours apart on busy hours.
- ↳ Motor Relearning Program and Task-oriented approaches were used for left upper limb (non-dominant side) rehabilitation for the said therapeutic duration.
- ↳ The participant had undergone the treatment for 6 days a week for 4 weeks.

The intervention was carried on a patient's home setup and was conducted during October- November 2019. The patient was counseled and well-motivated for active contribution during the program. The self-dive of the subject for the given target achievement time of 4 weeks was very well commendable. Continued feedback and appreciation worked with the eagerness and hard work of the patient. Post-test with upper limb portion of Fugl Meyer Assessment scale was done on the last day of the second and fourth week. The total scores were 33 and 53 respectively for the second and fourth week.

OUTCOME:

The motor response was recorded pre and post-test by Fugl Meyer Assessment Scale (FMA). Post-test was repeated at the end of the second and fourth week for the paralytic upper limb. Heaps of positive responses were recorded for the patient at the end of the fourth week, post-intervention for the patient.

FMA for upper limb motor functions score of the subject repeated on the first day (Pre-test), end of the second week (on the course) and end of the fourth week (post-test). The scores obtained were detailed on the following chart (Table 5.1):

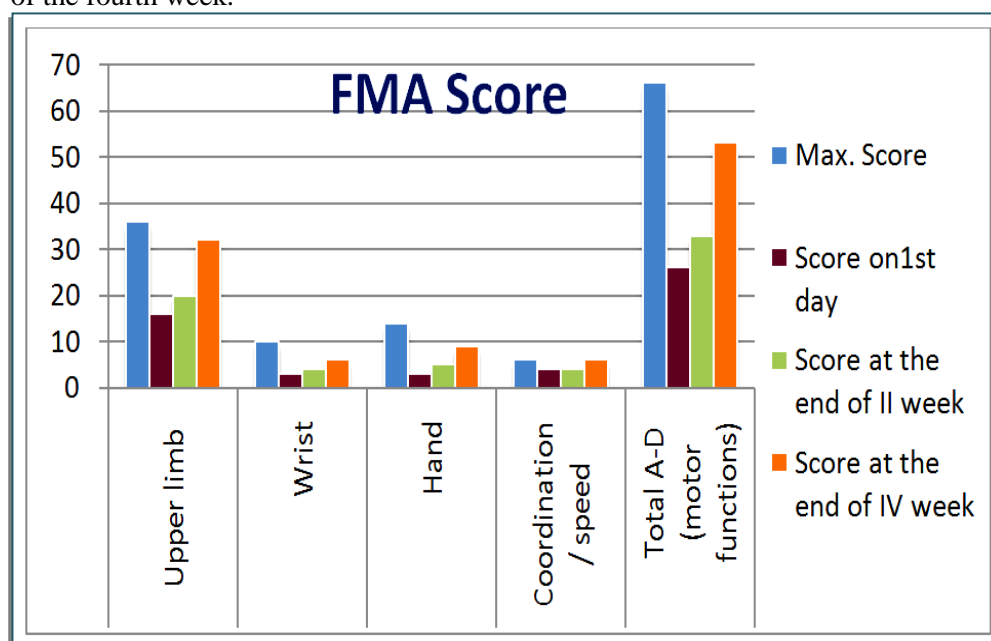
The graph of the FMA score (Fig 5.a) also displays a clear picture of how individual criteria responded to the intervention, m-CIMT, from day one to the end of the second and fourth week in comparison to maximum scores.

Sl.No	part	Max. Score	Score on 1st day	Score at the end of II week	Score at the end of IV week
A	Upper limb	36	16	20	32
B	Wrist	10	03	04	06
C	Hand	14	03	05	09
D	Coordination/ speed	06	04	04	06
A-D	Total A-D (motor functions)	66	26	33	53

⇐ **Table 5.1:**
The subject's scores on FMA

The above chart describes how the patient's condition had matured through the course of treatment. The chart displays the better prognosis in upper limb, hand and coordination categories, whereas responses were not satisfactory in wrist criteria.

Overall motor prognosis in the second week was not satisfactory, but the responses were remarkable at the end of the fourth week.



⇐ **Fig 5.a:**
comparison of FMA scores

DISCUSSION:

The prime intention of the study was to know whether exclusively designed modified Constraint-Induced Movement Therapy (m-CIMT) works for the hemiplegic patient. The subject's paralytic upper limb doesn't work for conventional Physiotherapy and then he was administered with the m-CIMT.

The entire study program of the m-CIMT was done for 4 weeks, where pre-test was done before the intervention and post-test were done on the second and fourth week by Fugl Meyer assessment scale for the post-stroke patient. The total motor portion of FMA is categorized as upper limb synergy/ activity, Wrist stability, Hand functions and Coordination & speed of the upper limb. The second week's responses in all the criteria were not satisfactory, but these picked up well by the end of the fourth week. This could be due to the patient's time taken to assume the new approach and to get actively involved. Feedback and motivation in the first phase had shown a low response.

The upper limb and coordination functions improved enormously. Whereas wrist and hand functions evolutions were comparatively poor. This could be to their complexity in motor activity and time-consuming more for the Neuroplasticity. Larger joints responded well with better coordination and/ or speed.

The subject had initially shown some distress on wearing the pan splint for about 6 hours a day. However, he had engrossed in the tactic of the program and expressed his interest in achieving maximum motor recovery. This indicates that physical intervention with psychological endorsement was working well for the patient. During the said course no side effects were reported, though the patient complained about some discomfort during the early stage which relinquish by itself in few days.

The patient before receiving m-CIMT was undergoing conventional Physiotherapy for about 2 months, which could not break "Learned nonuse". But this long-established section would have conditioned the limb to be prepared for m-CIMT. Spasticity of the limb was in control; ROMs of upper extremity joints were almost normal and the muscle power were 2-4 in most of the parts. All these had facilitated the speedy response when m-CIMT was applied.

The results demonstrate high significance of exclusively designed m-CIMT working for the subject. Utmost of 1½ hour per sitting twice a day is worthful. Long pan splint used as constraining material for sound hand (right side) managed the purpose successively. Motor Relearning Program and Task-oriented approaches were used for left upper limb rehabilitation were of enormous exercise. The total duration of the said program was of 4 weeks, 6 days in a week was result-oriented. In short, this unique protocol of m-CIMT is objective-directed for the patient.

The study concluded in 4 weeks and no further intervention and/ or follow-ups were done, which is a major deficiency in the conformation of the sustained effect of the approach. The single-subject – case report can't be comprehensive, but if it could shed new light on some researchers to carry forward with randomized control trials in large groups, then this submission shall pull off its intention.

CONCLUSION:

The clinical relevance of the study is that it has highlighted chronic hemiplegic patient's considerable response to the exclusively designed m-CIMT, which overcomes the paralysis that doesn't respond to conventional therapy. The future study shall be done on a larger group, with a randomized controlled trial for the confirmation of the effect of the unique m-CIMT program. Further such studies shall also focus on m-CIMT in a sundry environment and for conditions like Cerebral palsy, Traumatic brain injury, etc with hemiplegia.

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