ORIGINAL RESEARCH

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EFFECT OF MODIFIED CONSTRAINT INDUCED THERAPY ON UPPERLIMB FUNCTIONAL RECOVERY IN YOUNG STROKE SUBJECTS

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ABSTRACT

Background: The aim of this study is to evaluate the effect of modified constraint induced therapy on upper limb functional recovery in young stroke subjects. Most of the stroke rehabilitation units following conventional rehabilitation methods for treatment of the stroke patients where these methods have been proved to be less useful especially in the young stroke subjects. Hence the purpose of this study is to see the effect of modified constraint induced therapy which is a task specific training method for upperlimb in young stroke subjects.

Methods: Total of 40 young stroke subjects who is having minimal motor criterion and met other inclusion criteria were recruited from department of physiotherapy, g.s.l.general hospital. Pre and post intervention measures were taken using Wolf motor function test and Jebsen Taylor hand function test.

Results: In this study had shown significant improvements in the modified constraint induced therapy group when compared to the conventional rehabilitation alone. P value between groups was < 0.05.

Conclusion: In this study concludes that addition of 15 minutes modified constraint induced movement therapy to conventional physiotherapy is a useful adjunct in functional recovery of upper limb among young stroke subjects.

Key words: Modified constraint induced therapy, minimal motor criteria, young stroke, MCA syndrome

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INTRODUCTION

The WHO clinically defines stroke as 'the rapid development of clinical signs and symptoms of a focal neurological disturbance lasting more than 24 hours or leading to death with no apparent cause other than vascular origin' WHO 2005. Stroke is becoming the major concern for the health care providers globally as it is the major problem creating morbidity and mortality across the world next to cancer. More than 2/3 of the global burden of stroke is born by developing countries. Cerebro vascular stroke occurring in the young adults of age below 45 is common 0.5% of all stoke patients are younger than 45.[1] The increasing prevalence of risk factors like hypertension , dyslipedemia , diabetes , drug abuse among young adults have placed these group at a risk of developing stroke. Incidence rates globally for young strokes ranging from 3 – 44.3/100,000.[1] According to koul etal ,India shown that stroke prevalence was 143/100,00 and between 15 – 39 41/100,00.[1]

Among the myriad of stroke squeale hemi paresis is one of the most pervasive and disabling impairment[2] in which recovery of arm function is poor in significant number of patients and leg function has proven to be a less problem.[3] 85% of the stroke showed an initial deficit in the arm,3-6 months later, problem remains in 55% -75% of patients following discharge[4] 75-83%of stroke survivors learn to walk again.

Stroke resulting in hemiplegia can have devastating effect on a person's capacity to perform activities of daily living.[5] Three quarters of stroke occurs in the region supplied by middle cerebral artery, as a consequence the upper limb is affected, in large number of patients.

Impairment of upper limb function is among the most common motor disturbance and it has a great impact on functional and social independence of patients.[6] So recovery of upper extremity function is the major issue of post stroke rehabilitation and therapies concentrating on the upper extremity recovery has grown now a days.

Functional recovery of arm includes grasping , holding, manipulating objects which requires the recruitment and complex integration of complex muscle activity from shoulder to fingers Conversely improvements in upper extremity movements are strongly related to increased daily function.[7] Conventional rehabilitation has shown negligible effect in upper extremity recovery there is usually restoration of motor ability but it has not turned into functional recovery.[8] Task specific training, motor relearning program, mirror therapy roods, cimt are the few rehabilitation strategies which has shown worth in motor and functional recovery than neuromuscular re-education approaches.[9,10]

Rehabilitation strategies used in elder clients where stroke is more common are not always applicable for younger patients.[10] Therefore rehabilitation of young stroke patients need to be intensive and innovative for the future needs and functional outcomes. Constraint induced movement therapy which is one of the task specific activity given by Taub et al became a promising approach in stroke rehabilitation and showed its effect in motor and functional recovery in all stages of stroke, by utilising the redundant pathways in the brain through neuro plasticity.[11] Although Constraint induced therapy has shown it effect, because of certain limitation like lack of clinical feasibility, clinicians and patients are unable to follow this regimen in clinical setting.[11] Stefen Page has given modified version of constraint induced movement therapy which is a 30 min. application of therapy providing an opportunity to render this technique in out patient rehabilitation. And lot of studies in this approach explained cortical plasticity in sub acute and chronic stroke patients.[12]

There have been no studies till date in Modified constraint induced exploring the Middle Cerebral Artery strokes and in younger adults. So in this study I have taken 15min modified constraint induced movement therapy which can meet rehabilitation needs of the young stroke subjects.

METHODOLOGY

Subjects are recruited from department of physiotherapy, general wards, neurology department GSL general hospital, Rajahmundry. A total of 60 young stroke patients were taken, out of that a sample of 40 subjects were recruited who are willing to participate in the study after obtaining the consent from the patients who met the inclusion criteria. These 40 subjects were randomised into two groups by simple random sampling subjects were selected by lottery method. Subjects were recruited based upon following inclusion criteria History of no more than one stroke, Age 18-45 years, Ability of selectively actively extend at least 10 degrees at metacarpo phalangeal joints and inter phalangeal joints and 20degrees at wrist, MCA stroke subjects, Ischemic or haemorrhage stroke conformed by ct scan, Duration less than 1 year. Subjects were excluded if they exhibiting rapidly improving motor function, Hemi spatial neglect, Previous stroke, Severe aphasia, cognitive impairment, Other neurological conditions, Shoulder subluxation, Severe cardiac failure, Severe spasticity 2 or more

on modified Acworth's scale, Excessive upper extremity pain more than 5 on VAS.

All the 40 members in two groups were screened for pre test measures using wolf motor function test and Jebsen's Taylor hand function test. The experimental group received 15 min of mcit occurring 3 days per week for 10 weeks along with conventional rehabilitation. During the treatment sessions subjects used their affected arm by constraining the un affected hand with cotton sling. Practiced tasks includes Holding glass and taking it to mouth, Eating with spoon, Eating finger foods, Writing(using pen for drawing circles, squares), Folding towel. These activities are selected based on functional needs and abilities of the subjects. As a second component of MCIT intervention, during the same 10 week period, subjects un affected arm were restrained every day for 5 hours. Their arm was restrained using a cotton hemi sling.

Group 2 (control):

The subjects in the control group are only receiving regular physiotherapy regimen as per stroke rehabilitation unit guidelines. These subjects received Upper extremity strength & range of motion exercises , Proprioceptive Neuro muscular facilitation techniques, PNF stretches and weight bearing exercises, Emphasis on functional tasks whenever possible. Post test measures were taken after 10 weeks of treatment.

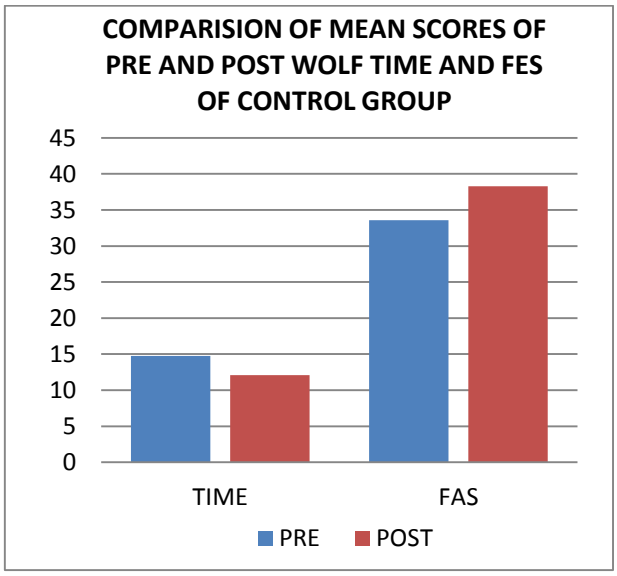
RESULTS

Statistical analysis was done using the statistical software SPSS 16.0 version for this purpose the data was entered into Microsoft Excel spreadsheet, tabulated and subjected to statistical analysis. All 40 subjects completed the entire study protocol as defined by 10 weeks in the training session. To observe the treatment impact before and after the treatment in the groups, analysis is carried out by using paired t- test, the outcome measure – time, Functional Ability Scale of WMFT, Jebson's-Taylor Hand function Test.

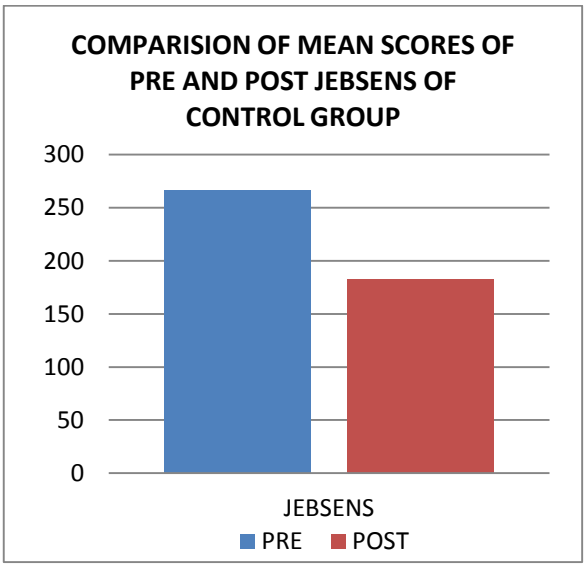
TABLE-I: Analysis of control group with Pre and Post Exercises:

To compare Pre – Post exercises of the parameters, the t-test for paired sample observations has been utilized. It is observed that the post exercises have shown some significant impact on the subjects.

PARAMETERS	N	MEAN	Standard Deviation	t-value	Df	p-value
WOLF TIME PRE	20	14.75	5.126	11.201	19	< 0.05
WOLF TIME POST	20	12.095	4.588			
WOLF FAS PRE	20	33.6	4.5	9.541	19	< 0.05
WOLF FAS POST	20	38.3	4.736			
JEBSENS PRE	20	266.35	50.492	12.3803	19	< 0.05
JEBSENS POST	20	182.1	39.264			



Graph -1



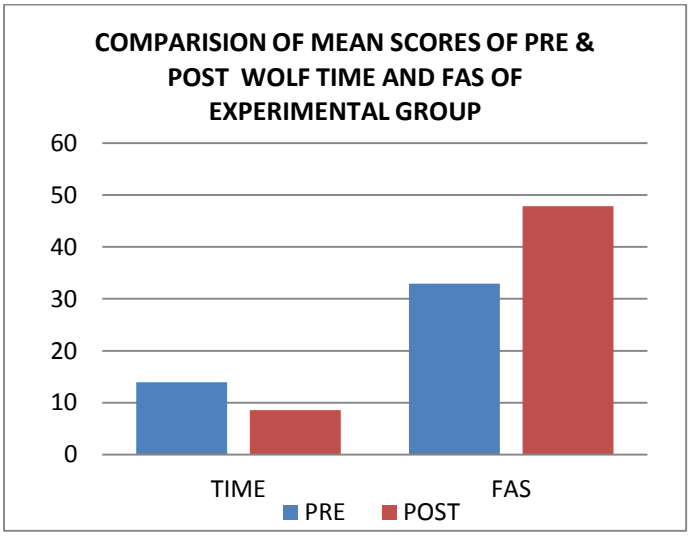
Graph 2

TABLE - II:

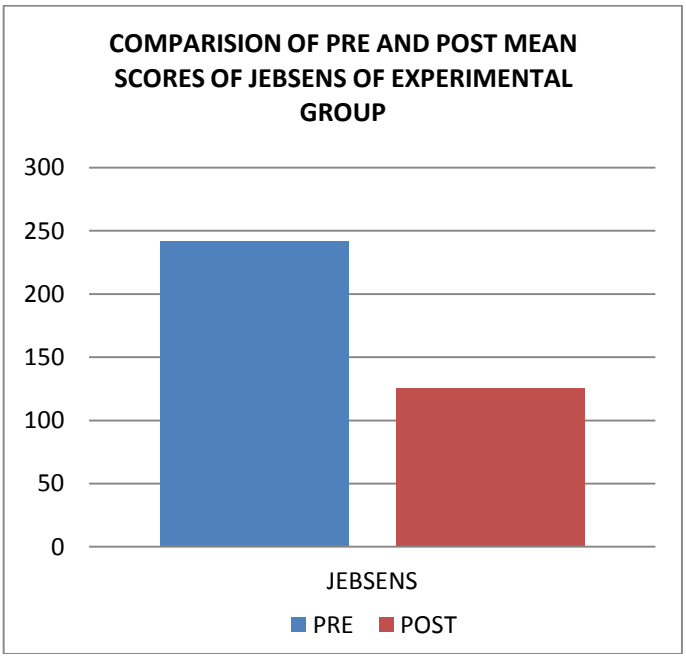
Analysis of EXPERIMENTAL GROUP with Pre and Post Exercises:

PARAMETERS	N	MEAN	Standard Deviation	t-value	Df	p-value
WOLF TIME PRE	20	13.935	5.077	9.124	19	< 0.05
WOLF TIME POST	20	8.605	3.753			
WOLF FAS PRE	20	32.95	5.145	6.842	19	< 0.05
WOLF FAS POST	20	47.85	11.721			
JEBSENS PRE	20	242.1	49.920	10.817	19	< 0.05
JEBSENS POST	20	125.3	46.344			

To compare Pre – Post exercises of the parameters, the t-test for paired sample observations has been utilized. It is observed that the post exercises have shown some significant impact on the subjects.



Graph 3



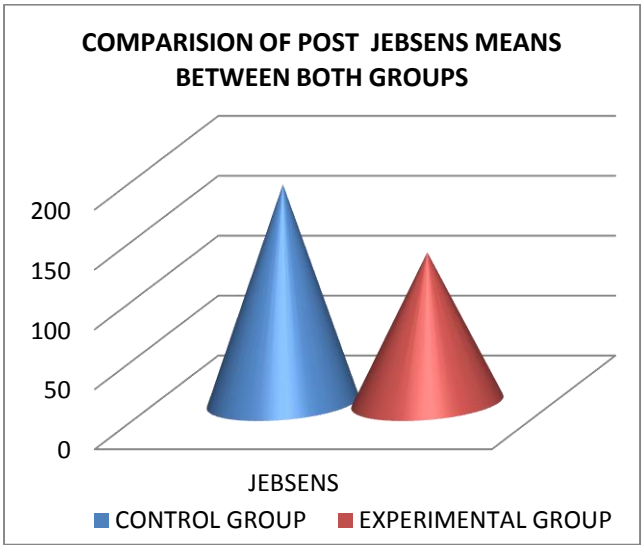
Graph 4

TABLE – III

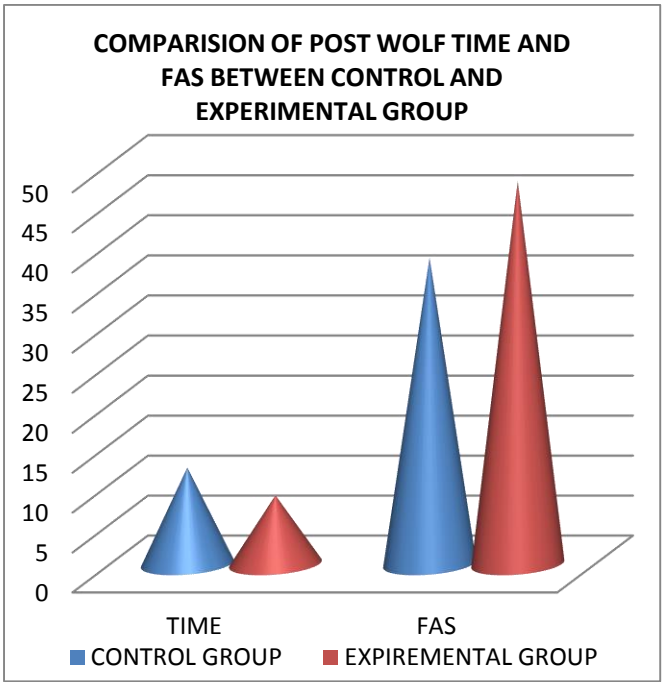
ANALYSIS OF EFFECTIVENESS OF THE TREATMENT AMONG TWO GROUPS OF THE PARAMETERS

PARAMETERS	N	MEAN	Standard Deviation	t-value	Df	p-value
CONTROL WOLF TIME POST	20	12.095	4.588	2.63	38	< 0.05
EXP WOLF TIME POST	20	8.605	3.753			
CONT WOLF FAS POST	20	38.3	4.736	3.38	38	< 0.05
EXP WOLF FAS POST	20	47.85	11.721			
CONT JEBSENS POST	20	182.1	39.264	4.18	38	< 0.05
EXP JEBSENS POST	20	125.3	46.344			

On observing the means of post-test parameters of control and experimental groups, independent t-test was done and the p-value is < 0.05. It shows a significant difference between the two groups.



Graph 5



Graph 6

The demographic variant like age is also compared between the groups. The mean age of the control group is 41.9 and experimental group is 42.3, which does not affect the outcomes. While coming to male to female ratio, control group consist of 14 males and 6 females whereas experimental group had 12 males and 8 females.

Overall results of the present study were analysed which shows a significant improvement in experimental group when compared to control group. It is important to note that every parameter in both groups, when compared post to pre values, had shown significant improvement.

DISCUSSION

The aim of the study is to evaluate the effectiveness of modified constraint induced movement therapy on upper limb functional recovery in young stroke subjects. This study results has shown a substantial improvement in the functional recovery in Modified constraint induced therapy group than the subjects in the traditional rehabilitation group where we followed certain routine rehabilitation strategies like stretching, range of motion, strength and weight bearing. Whereas the Modified constraint induced therapy group involved in practicing daily functional activities like Taking glass to the mouth, Eating finger foods, Writing Folding a towel etc. by constraining the unaffected extremity. Most of the Stroke research has elaborated the significance of functional training, so we have included this particular Modified constraint induced therapy protocol which intensively encourages the patient to use his affected extremity thus improving the functional outcome of our experimental group. Several previous literature of Constraint Induced Movement Therapy has advocated that the motor or functional recovery of constraint induced therapy group is because of the enhanced neural plasticity and Cortical Reorganization of the learned function in the undamaged surrounding cortices and even in the opposite hemisphere. Ramon Cajal one of the neuro biologist in the olden days believed that human brain is immutable structure if it is damaged cannot be taken back. Most of the neuro scientist believed this and continued with compensatory training for lost part due to any neurological lesion.[13] But modern neuro science is no more encouraging this notion as the human brain responds to training through its special ability called neural plasticity, which is the ability of neural circuits to undergo changes in function or organisation due to previous activity and change in response to environmental cues, experience, injury or disease.[14]

Neuroplasticity changes of human brain are evident through LONG TERM POTENTIATION which enhances the post synaptic potential facilitation in the neurons that are activated repeatedly through task specific activity. [14]

In the study conducted by Stephen Page, Peter Levine et. al. the conclusions pointed that even the Modified constraint induced therapy given for 30 mins per day showed significant improvement in the functional outcome of the upper limb and further they suggested that even a therapy session as less as 15 mins of task specific training is sufficient for Cortical Reorganization and Motor learning to occur. Butefischc, Hummelsheim H emphasised that importance of frequent movement repetition for 15 min can also show the changes in the motor rehabilitation,[15] Joseph classen ,believed that Rapid plasticity of human

cortical movement representation can be induced by as less time as 15 min per day.[16] So basing upon these above findings, In this study we have taken a therapy session of 15 mins to know the effect of shortened protocol as in the young people neuronal plasticity changes are faster. Following intervention subjects in the control group showed nominal changes on both wolf motor function test and jebsens tests. But the subjects in the Modified constraint induced therapy group, however displayed greater changes, suggesting increased use of the affected arm for activities of daily living confirming our hypothesis. The improvements in the MCIT group may relate to, short term learning changes at the central level. Intensive practice of the affected upper extremity and restraint of the unaffected upper extremity under a variety of functional tasks may provide opportunity for patients to explore optimal ways to achieve various functional tasks. Therefore intensive practice may improve motor planning and promote experience related adaptations of brain functions leading to more pre planned movement.[17] Explanation for these improvements could possibly be obtained by relating these measured changes to measurements of changes in cortical reorganization through functional MRI studies, which are responsible for motor changes.[18] We hypothesised that similar mechanisms were responsible for the functional gains observed in this study. There are few studies and pilot studies showing the Modified constraint induced therapy efficacy in various stroke types particularly targeting the elderly population as this age is vulnerable for Stroke but the recent raise in proportion of young stroke due to certain etiological and risk factors has shifted my view from elderly population to young stoke subjects whose recovery can be prudent for their family and their social life.

Certain studies already proved that MCA territory stroke which occur more commonly can have devastating effects on upper limb functional recovery because of involvement of motor Homunculus confined in having more representation of the hand and the upper limb. There were no studies till date in MCIT confined to MCA involvement particularly in young stroke subjects. Therefore I have taken Middle Cerebral Artery young stroke subjects in whom rehabilitation needs are essential.[19] The subjects in this study are young subjects of age less than 45 years, where cortical plasticity is more pronounced than older counter parts. The results gained in this study showed that task specific activity as less as 15 min. is enough to get substantial functional gains. So here age group selected and their faster plasticity changes also had helped to regain their functional capabilities. In this study our protocol permitted us to include subjects according to the minimal motor criterion and active finger extension which made this regimen suitable for chronic conditions. Future studies need to happen to see whether active finger motor function is a useful adjunct or not in modified constraint induced movement therapy. One study on Modified constraint induced therapy has shown its efficacy in Parkinson's patients. But most of the Modified constraint induced therapy concentrates on stroke population. So studies need to happen in exploring the effect of Modified constraint induced therapy in other neurological conditions.[20]

My study included subjects with MCA strokes which involved both cortical and sub cortical strokes, but few studies have shown that few of the strokes in the regions like internal capsule can have more involvement of the upper limb than other cortical stroke varieties. Future studies need to concentrate on one of the stroke subtypes. This study has shown that a 15 min modified constraint induced movement therapy in addition to the normal rehabilitation is beneficial in improving the functional tasks in young stroke subjects. Now it is easy to apply in outpatient rehabilitation unit which is one of the benefits of modified constraint induced movement therapy approach. This is a therapist friendly, time saving and even cost effective procedure in clinical environment. This study concludes that addition of 15 min. modified constraint induced movement therapy to conventional physiotherapy is a useful adjunct in functional recovery of upper limb among young stroke subjects.

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