# A Comparative Study on the Effectiveness of Graded Repetitive Arm Supplementary Programme and Modified Constraint Induced Movement Therapy in Chronic Stroke

by

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in

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Under the guidance

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2021-2023

## DECLARATION BY THE CANDIDATE

I hereby declare that this dissertation entitled "A Comparative Study on the Effectiveness of Graded Repetitive Arm Supplementary Programme and Modified Constraint Induced Movement Therapy in Chronic Stroke" is a bonafide and genuine research work carried out by me under the guidance of Dr. Sonali Soumyashree, Assistant ,professor, Abhinav Bindra Sports Medicine and Research Institute, Odisha.

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ABSMARI

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# LIST OF ABBREVIATIONS

1. **ABSMARI -** Abhinav Bindra Sports Medicine and Research Institute
2. **FMA-** Fugl Meyer Assessment
3. **WMFT -** Wolf Motor Function Test
4. **SPSS -** Statistical package for social science
5. **BMI -** Body Mass Index
6. **MAL-**Motor Activity Log
7. **AOU-**Amount Of Use
8. **QOM-** Quality Of Movement
9. **IQ -**Interquartile Range
10. **MMSE-** Mini-Mental State Examination
11. **MAS-** Modified Ashworth Scale

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# A Comparative Study on the Effectiveness of Graded Repetitive Arm Supplementary Programme and Modified Constraint Induced Movement Therapy in Chronic Stroke


## ABSTRACT

**BACKGROUND:** Rehabilitation of the severely impaired paretic arm in stroke patients is a substantial challenge, especially when motor impairment is involved. A Study was conducted to evaluate the effectiveness of and Graded repetitive arm supplementary programme (GRASP) and modified Constraint Induced Movement Therapy (mCIMT) on level of upper extremity function among post stroke hemiparetic patients.

**METHOD:** A total number of 30 subjects who met the inclusion criteria were selected and divided into two groups by randomized sampling technique. Group-A performed the given Graded repetitive arm supplementary programme (GRASP) and Group-B were given modified Constraint Induced Movement Therapy (mCIMT). These interventions are held for 3 weeks, 5 days in a week for 60 minutes. The assessment was taken at the baseline i.e. prior to intervention (Pre-test) and at the end of the protocol i.e. post-intervention by using Fugl-Meyer assessment , the wolf motor function test and motor activity log as the outcome measures in this study.

**RESULT:** The current study demonstrated that in 3 week of GRASP and Mcimt, Group A performed better than Group B in FMAU and MAL (AOU & QOM). Group B performed better than Group A in WMFT.

**CONCLUSION:** According to the findings of the current study, 3 weeks of GRASP is more effective than Mcimt , A large sample size is required. Understanding the long-term impact can guide for future recommendations. Conducting studies with extended follow-up periods to assess the maintenance of motor improvements achieved through GRASP and mCIMT.

**KEYWORDS:** Stroke, Motor Functions,Graded repetitive arm supplementary programme , modified Constraint induced movement therapy, Fugl-Meyer Assessment , Wolf Motor Function Test, Motor Activity Log.

# INTRODUCTION

# INTRODUCTION

According to the World Health Organization (WHO), stroke is the second largest cause of death and disability globally. Low- and middle-income nations are responsible for 75% of all worldwide stroke fatalities and 81% of all stroke-related disabilities. Stroke is a huge global public health concern due to the variety of impairments it causes, as well as cognitive impairment.[1]

The World Health Organization now defines stroke as "rapidly developing clinical signs of focal disturbance of cerebral function lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin."[2]

The main cause of stroke is a disturbance in blood flow to the nerves in the brain caused by clotting in the blood as blood supply to the part of the brain is cut off or when a blood vessel in the brain bursts. The stroke might be severe or small. Minor strokes impair blood circulation to some areas of the brain, while large strokes can result in death. Stroke is a medical emergency that requires immediate attention. Common symptoms include difficulties moving, disorientation, poor verbal communication, and difficulty understanding. Stroke results in long-term brain impairment as well as mortality.[3]

The great majority of stroke cases are caused by two kinds of stroke. Around 85% of stroke victims' fatalities are caused by ischemic occlusions. Ischemic stroke is a condition that affects the brain's ability to receive enough blood and oxygen. It is mostly brought on by intracranial artery stenosis and middle cerebral artery blockage. Circulating platelets are quickly drawn to the location of a blocked cerebral artery when an embolism or clot stops it.[4]

Ischemia causes thrombotic and embolic situations in the brain. Blood flow is hampered in thrombosis due to artery constriction caused by atherosclerosis.[5]

When a blood artery ruptures and bleeds into the brain, this is referred to as a hemorrhagic stroke. Brain cells begin to die within minutes. Intracranial aneurysms, arteriovenous malformations (AVMs), and burst arteries or veins are also possible causes. Hemorrhagic Strokes occur at a lower rate than ischemic strokes.[4]

About 10% to 15% of all strokes are hemorrhagic strokes, which have a significant fatality rate.Blood vessels burst as a result of internal damage and stress on the brain's interior structure. Infarction is the outcome of harmful effects it has on the vascular system.[5]

Subarachnoid and intracerebral haemorrhage are two different categories. In ICH, blood vessels burst, causing an unusual buildup of blood inside the brain. Hypertension, disturbed vasculature, overuse of anticoagulants, and thrombolytic drugs are the major causes of ICH. Blood builds up in the subarachnoid space of the brain as a result of a brain injury or cerebral aneurysm in subarachnoid haemorrhage.[5]

A TIA is typically characterised as a transient episode of localised neurological impairment lasting less than 24 hours that is not accompanied with persistent brain infarction. The blood flow to a portion of the brain is briefly blocked in TIA. It serves as a warning indication before to the actual occurrence, giving the time to adjust one's lifestyle and begin drugs to lower the risk of stroke.[5]

Stroke is often classified into three stages: acute, subacute, and chronic. The acute stage begins at the onset of a stroke and lasts for the first few hours or days. During this stage, immediate medical attention is crucial. The primary goal is to minimize further brain damage and restore blood flow to the affected area. [6]

The subacute stage follows the acute stage and typically lasts for several days to a few weeks after a stroke. During this stage, the patient's condition stabilizes, and the focus shifts to preventing complications, promoting recovery, and initiating rehabilitation. In subacute stroke care, healthcare professionals monitor the patient's vital signs, manage any remaining symptoms, and begin physical, occupational, and speech therapy as appropriate. Rehabilitation aims to help patients regain lost functions and relearn skills affected by the stroke.[6]

The chronic stage begins several weeks or months after a stroke and encompasses the long-term recovery and management of stroke-related disabilities. At this stage, the focus is on maximizing the patient's functional independence, improving quality of life, and preventing secondary complications. Rehabilitation and therapy continue, emphasizing ongoing physical, cognitive, and emotional recovery.[6]

Complications of a stroke can vary depending on the severity and location of the brain damage, as well as the individual's overall health and access to medical care. Some long term complications are physical disabilities as strokes can lead to a wide range of physical disabilities, depending on which part of the brain is affected. Common physical consequences include paralysis or weakness on one side of the body (hemiparesis or hemiplegia), difficulty with coordination and balance, muscle stiffness (spasticity)and problems with swallowing or speaking (dysphagia or dysarthria).[7]

Other complications are cognitive impairment leading to aphasia and agnosia,emotional and psychological changes such as depression and anxiety, fatigue and weakness,pain and sensory disturbances like numbness and tingling, swallowing and Communication Problems such as dysphagia,musculoskeletal complications like muscle stiffness ,contractures, joint pain, and reduced range of motion which  result in problems such as frozen shoulder, muscle spasms, and pressure sore. Stroke survivors are at increased risk of developing secondary medical conditions, including recurrent strokes, high blood pressure, heart disease, diabetes, and deep vein thrombosis . Lifestyle changes, such as adopting a healthy diet, exercising regularly, and managing risk factors, are crucial to prevent these complications.[7]

Indeed, hemiparesis resulting from a stroke can have a significant impact on the upper extremity, particularly the hand and wrist. Up to 85% of stroke victims experience immediate upper limb motor impairment and unfortunately  less than half of stroke survivors are able to regain proper arm function within six months after a stroke. The recovery process varies for each individual and factors such as the severity of the stroke, the extent of damage to the brain, and the effectiveness of rehabilitation efforts can influence the outcome.[8]

When individuals experience losses in hand function due to hemiparesis, their ability to perform daily activities and maintain functional independence is significantly impacted.The loss of hand function can also affect a stroke survivor's quality of life. The inability to engage in previously routine tasks and activities can lead to frustration, decreased self-esteem, and a sense of dependency. It is important for stroke survivors to receive appropriate rehabilitation and support to maximize their recovery potential and enhance their overall quality of life. Rehabilitation programs often include exercises and therapies targeting hand and arm function to improve mobility, strength, and coordination.[8]

There are many individually utilized interventions , such as Functional Electrical Stimulation (FES), mirror therapy, robot training,virtual reality, brain-computer interface, and repetitive transcranial magnetic stimulation that have been studied and utilized in stroke rehabilitation.[8]

Functional Electrical Stimulation (FES) involves the use of electrical currents to stimulate the muscles and improve their function. Mirror therapy utilizes mirrors to create an illusion of movement in the affected limb, which can help stimulate neural pathways and promote recovery. Robot-assisted training involves the use of robotic devices to guide and assist with movements, facilitating repetitive practice and motor learning.[8]

Virtual reality (VR) game systems create an environment that aims to provide participants with a sense of immersion and present within that virtual world. VR systems can generate realistic 3D graphics, sounds, and interactive elements that simulate a virtual environment.[9]

Brain-computer interface technology allows individuals to control external devices or robotic limbs using their brain signals, potentially aiding in motor rehabilitation. Repetitive transcranial magnetic stimulation (rTMS) uses magnetic fields to stimulate specific areas of the brain and modulate neural activity, with the aim of enhancing recovery.[8]

Graded Repetitive Arm Supplementary Program developed by Janice Eng in 2009, is a self-directed arm and hand exercise program designed to be taught and monitored by a therapist.[10]

These exercises encompass a range of activities including stretching , arm strengthening, hand strengthening, coordination and hand Skills.[10]

The GRASP program provides structured guidelines and progressions to facilitate independent practice and continuous improvement. By incorporating these exercises into their routine, stroke survivors can engage in targeted and repetitive practice, which is crucial for neuroplasticity and functional recovery.[10]

It is important for patients to work closely with their therapists to ensure proper technique and progression of exercises within the GRASP program. The therapist's role is to teach, guide, and monitor the patient's progress, making necessary adjustments and providing support throughout the program.[11]

Constraint-Induced Movement Therapy (CI Therapy) was indeed introduced by Dr. Edward Taub in the 1980s, and it is indeed based on research in behavioral psychology and neuroscience. It has shown promising results in increasing the use of an impaired upper extremity in chronic stroke patients. In CI Therapy, the unaffected limb is constrained, forcing the patient to use the affected limb during therapy and daily activities. This intensive practice of the affected limb, combined with behavioral shaping and positive reinforcement, facilitates neural reorganization and motor learning. As a result, patients often experience increased use and functional improvement in the affected limb.[12]

The traditional CIT protocol may be difficult for some stroke patients to participate in due to the intensity of the practice schedule and the duration of the restraint schedule which negatively impacts the patient’s adherence and motivation during the therapy. The long duration of sessions (6 hours) might be overwhelming and challenging for some patients, potentially leading to reduced engagement and compliance. So, Modified, shorter versions of CIMT (mCIMT) have been designed and tried to overcome such limitations.[13]

Modified Constraint Induced Movement Therapy(Mcimt) was introduced by Page and Colleagues in 2000.[13] This modified CIT protocol uses a more distributed practice schedule while still emphasizing repeated use of the affected limb.This modified approach aims to reduce upper-limb impairment and improve upper-limb use and function in stroke patients.[14]While the principles of CIMT and mCIMT are similar, they have different protocols and focuses in terms of practice schedules and the intensity of limb constraint.Both approaches, however, aim to improve motor function in individuals with neurological conditions.[15]

The purpose of the study is to focus on encouraging the use of the affected arm to overcome learned nonuse. These therapies provide opportunities for repetitive practice of functional tasks with the affected limb, helping to retrain the brain and improve motor function.[13]

# NEED OF THE STUDY

## NEED OF THE STUDY

There is a need to combine basic, accessible, and effective therapeutic strategies to improve stroke recovery. The focus or the need of this study is to know whether Mcimt and GRASP activities improve motor performance in the paretic hand of chronic stroke patients.

Previous research has shown that both CIMT and GRASP are beneficial in the rehabilitation of hand functions following a stroke. Patients with stroke utilize their damaged arm 80% less than their unaffected arm.To sustain adherence and motivation to exercise, it may be more important for patients to reverse the 'learned non-use' habit. The goal of these interventions is to reverse this learned non-use behavior by encouraging active and purposeful engagement of the affected hand in functional tasks. By Mcimt and GRASP activities, this study aims to determine their impact on motor performance in the paretic hand of chronic stroke patients. The results could provide valuable insights into the potential synergistic effects of these interventions and further support their integration into stroke rehabilitation programs to enhance recovery outcomes.

# AIM OF THE STUDY

To compare the effectiveness of graded repetitive arm supplementary programme and modified constraint induced movement therapy in chronic stroke.

# OBJECTIVE OF THE STUDY

- To observe the effect of graded repetitive arm supplementary programme (GRASP) in chronic stroke patients.
- To observe the effect of modified constraint induced movement therapy (mCIMT) in chronic stroke patients.
- To compare the effectiveness between GRASP and mCIMT in chronic stroke patients

# HYPOTHESIS

# HYPOTHESIS

- Null Hypothesis

  There will be no significant difference between graded repetitive arm supplementary programme (GRASP) and modified constraint induced movement therapy (mCIMT) in chronic stroke.

- Alternative Hypothesis

  There will be a significant difference between graded repetitive arm supplementary programme (GRASP) and modified constraint induced movement therapy (mCIMT) in chronic stroke.

# REVIEW OF LITERATURE

- **Lisa A. Simpson, Ruth Barclay , Mark T. Bayley , Sean P. Dukelow** et al.,(2022) conducted a study to evaluate the efficacy and acceptability of a virtual behavior change program coupled with wearable sensors to increase upper limb use and function in individuals who have experienced a stroke. The Virtual Arm Boot Camp (V-ABC):intervention involves a 3-week behavior change program.It utilizes a wearable device (TENZR) that provides feedback to increase upper limb use which Includes six virtual therapy sessions with a therapist.Targeted at individuals within 1 year post-stroke onset. The V-ABC program, involves a combination of traditional upper limb exercises, including activities for strengthening, fine motor skills, and task-based practice. Components are Home Version of Graded Repetitive Arm Supplementary Program (H-GRASP),Participants receive feedback from a wearable sensor called TENZR,  The program includes a total of six virtual treatment sessions delivered over a 3-week intervention period. The initial session is longer (1.5 hours), while subsequent sessions are shorter (1 hour each).During the initial session, participants are taught how to perform upper limb exercises from the Home GRASP protocol. Participants are instructed to complete the prescribed exercises twice per day or a minimum of 2 hours per day.The H-GRASP exercises and the incorporation of technology contribute to creating a comprehensive and engaging rehabilitation experience for stroke survivors . Upper limb use measured by grasp counts over 3 days using the wearable sensor (TENZR) after the 3-week intervention, Upper limb function (Arm Capacity and Movement Test) and self-reported function (Hand Function and Strength subscale from the Stroke Impact Scale).Data collection occurs at baseline, post-intervention, and a 2-month retention period. It aims to assess the feasibility and impact of using wearable sensors to facilitate behavior change in stroke rehabilitation. The study concluded to provide novel insights into the effectiveness and acceptability of virtually delivered programs for improving upper extremity recovery after stroke.

- **Chieh ling yang,maries louise bird,Janice Eng**,(2021) conducted a study to describe a process evaluation of the implementation of an evidence-based upper extremity rehabilitation intervention for stroke called the "Graded Repetitive Arm Supplementary Program." The intervention was implemented in a community setting. Twenty people were initially screened to participate in the program. Out of those screened, 14 individuals met the eligibility requirements for the intervention. Among the 14 eligible individuals, 13 consented to participate in the Graded Repetitive Arm Supplementary Program.The study found that the Graded Repetitive Arm Supplementary Program was effective in improving upper extremity function in the participants. This suggested that the intervention had a positive impact on the participants' ability to use their arms and hands after a stroke. In addition to improving upper extremity function, the intervention also showed positive effects on the participants' quality of life. This indicated that the program had broader benefits in enhancing the overall well-being and daily life activities of the stroke survivors .The intervention led to improvements in upper extremity function and quality of life, demonstrating its potential as an evidence-based approach for upper limb rehabilitation after stroke.
- **MARY ANN SMITH , MACHIKO R. TOMITA**(2020) conducted a study to examine the effectiveness of a combined modified Constraint Induced Movement Therapy (mCIMT) program using telehealth and in-person group sessions for individuals with chronic hemiparesis, which refers to weakness on one side of the body following a stroke. The intervention spanned over 6 weeks, and a total of 28 chronic stroke induced hemiparesis subjects were assessed twice during the study. The intervention used in the study was a combined modified constraint Induced Movement Therapy (mCIMT) program. The mCIMT approach involves constraining the less-affected limb and intensively training the affected limb to promote functional recovery. In this study, the mCIMT program was delivered using a combination of telehealth (remote sessions) and in-person group sessions. The study found that the combined mCIMT program, which utilized both telehealth and in-person

group sessions, was effective in improving functional ability in individuals with chronic hemiparesis after a stroke. This indicates that the intervention had a positive impact on the participants' ability to perform daily activities and tasks. The use of telehealth in combination with in-person sessions for delivering the mCIMT program offers a potentially convenient and accessible approach for stroke survivors with chronic hemiparesis to receive rehabilitation.

- **Niranjan Kumar, Niraj Kumar, Navneet Badoni , Manish Kumar Jha**(2019) conducted a study to investigate the effectiveness of modified constraint-induced movement therapy (mCIMT) on upper extremity and hand functions in individuals with stroke, based on the severity of their condition as assessed by the Upper Extremity Fugl-Meyer Assessment (UEFM) and the Action Research Arm Test (ARAT). The study used mCIMT as the treatment intervention for stroke patients. During the intervention, participants were required to wear a padded safety mitt on their less affected hand during treatment and for at least 3 hours at home. However, they were instructed to remove the mitt during specific activities that required coordinated movements of both hands, such as driving a car, riding a bike, or reading a newspaper. The study aimed to explore the effectiveness of mCIMT at different severity levels of stroke. The authors discussed the mechanism of cortical reorganization observed during mCIMT, which involves an increase in the excitability of neurons already involved in the innervation of more-affected hand movements .The study concluded that stroke patients with moderate to severe disability showed greater improvement in upper extremity and hand functions after mCIMT compared to those with mild disability. The study suggests that mCIMT can be a valuable intervention for improving upper extremity and hand functions in stroke patients, particularly those with moderate to severe disability.

- **Wing Chiu Chan, and Stephanie S.Y. Au-yeung**(2018) conducted a study to investigate the effectiveness of mirror therapy on the recovery of the severely impaired arm after stroke. The researchers enrolled patients who had a severely impaired arm within one month after experiencing a stroke. The participants were randomly assigned to two groups:

one receiving mirror therapy (n = 20) and the other receiving control therapy (n = 21). Both groups received their respective therapies for 30 minutes twice daily for a duration of 4 weeks, in addition to conventional rehabilitation.The study included individuals who had experienced a stroke and had a severely impaired arm.  The intervention being studied was mirror therapy. Mirror therapy involves the use of a mirror to create the illusion of movement in the affected limb by reflecting the image of the non-affected limb. This approach aims to promote neural reorganization and improve motor function in the affected limb.Both the mirror therapy group and the control group underwent their respective therapies for 30 minutes twice daily, totaling 1 hour of therapy each day. The intervention period lasted for 4 weeks. The researchers used the Wolf Motor Function Test to assess the participants' motor function in the affected arm.  The given information mentions that the test demonstrated excellent interrater reliability, with an ICC (Intraclass Correlation Coefficient) value of 0.97. A high ICC value indicates a high level of agreement between different raters when using the test.

- **Jong-Hoon Moon a, Kyoung-Young Park b, Hee-Jin Kim , Chang-Ho Na**(2018)Conducted a study  to investigate the effect of task-oriented circuit training (TOCT) using rehabilitation tools for upper extremity function in patients with acute stroke. The researchers used the MAL-14 item version as a testing tool to assess the impact of the training on the patients' daily life.The study involved patients with acute stroke. The intervention used in the study was task-oriented circuit training (TOCT) utilizing rehabilitation tools for upper extremity function. Task-oriented training focuses on engaging patients in meaningful tasks and activities that are relevant to their daily life and functional goal.The researchers used the MAL-14 item version to assess the impact of the task-oriented circuit training on the patients' daily life. The 14-item version of the MAL likely consists of 14 specific tasks or activities that the patients rate based on their ability to perform them and the frequency of use of the affected limb during those activities.Here, the Motor Activity Log (MAL) has high levels of reliability. Specifically, it has an internal consistency of 0.88 to 0.95, indicating that the items within the test consistently measure the same construct. The inter-rater reliability is 0.90, which means there is a high level of agreement between different raters when using the test. Additionally, the test-retest reliability is 0.94, demonstrating a high level of consistency in test results when the same patients are retested over time.

- **Kwakkel G, Winters C, Van Wegen EE, Nijland RH, Van Kuijk AA, Visser-Meily A, De Groot J, De Vlugt E, Arendzen JH, Geurts AC, Meskers CG**(2016) conducted a study to determine the effects of two interventions, modified constraint-induced movement therapy (mCIMT) and electromyography-triggered neuromuscular stimulation (EMG-NMS), on upper limb capacity in patients with early post-stroke.The study included a total of 159 patients who had experienced an ischemic stroke. These patients were divided into two groups based on their prognosis for upper limb recovery: 58 patients with a favorable prognosis (>10° of finger extension) to receive 3 weeks of mCIMT and 101 patients with an unfavorable prognosis to receive 3 weeks of EMG-NMS.The two interventions tested in the study were modified constraint-induced movement therapy (mCIMT) and electromyography-triggered neuromuscular stimulation (EMG-NMS).Both interventions were initiated within 14 days post-stroke and continued up until 5 weeks after the stroke onset.Both mCIMT and EMG-NMS interventions focused on either preserving or restoring finger extension (FE) in the affected upper limb.The study found that in patients with a favorable prognosis (>10° of finger extension), three weeks of early mCIMT was superior to usual care in terms of regaining upper limb capacity. This suggests that mCIMT was more effective in improving upper limb function and capacity in patients with a favorable prognosis for recovery. The findings of this study suggest that for stroke patients with a favorable prognosis for upper limb recovery, early implementation of modified constraint-induced movement therapy (mCIMT) may be beneficial in regaining upper limb capacity. This research highlights the potential benefits of early mCIMT as an effective intervention for improving upper limb capacity in patients with a favorable prognosis for upper limb recovery after ischemic stroke.

- **Lisa A. Simpson, Janice J. Eng, and May Chan**(2016)conducted a study to investigate the feasibility of a phone-monitored home exercise program(GRASP) for the upper limb in individuals who have experienced a stroke. The study utilized a pre-post double baseline repeated measures design to assess the effectiveness of the exercise program, which included behavioral strategies to promote greater use of the affected upper limb in daily activities. The feasibility outcomes focused on process, resources, management, and scientific aspects, while clinical outcomes included measurements of upper limb function .Eight individuals with stroke were recruited for the study, and six participants completed the 8-week home exercise program. The exercise adherence rate was high, with all but one participant meeting the exercise target of 60 minutes per day, 6 days per week. The participants showed significant improvements in upper limb function and performance as measured by the Chedoke Arm and Hand Inventory, Motor Activity Log, grip strength, and the Canadian Occupational Performance Measure. Effect sizes indicated moderate to large treatment effects. The improvements in upper limb function and performance were maintained at three and six months follow-ups after completing the exercise program.The study suggests that community-dwelling individuals with mild to moderate stroke-related upper limb impairments may benefit from this phone-monitored home exercise program, especially when the exercises provide a sufficient level of challenge. The inclusion of behavioral strategies in the program was found to promote the transfer of exercise gains into greater use of the affected upper limb during daily activities.The study demonstrates that a repetitive, task-oriented home exercise program, supervised through telephone monitoring, can be effective for improving upper limb function and performance in individuals who have experienced a stroke. The program may be particularly suitable for those with mild to moderate impairment levels who can benefit from a challenging exercise regimen.

- **Jocelyn E. Harris, Janice J. Eng, William C. Miller, Andrew S. Dawson** (2009) conducted a study to evaluate the effectiveness of a 4-week self-administered Graded

Repetitive Upper Limb Supplementary Program (GRASP) on arm recovery in stroke patients. The study involved 103 inpatients with stroke who were randomly assigned to either the experimental group (GRASP group, n=53) or the control group (education protocol, n=50).The experimental group participated in a 4-week self-administered GRASP, which likely included a series of graded repetitive upper limb exercises. The control group received an education protocol, which may have included information about stroke management but did not involve the GRASP exercises.The primary outcome measure used to assess upper limb function was the Chedoke Arm and Hand Activity Inventory (CAHAI). Secondary measures included grip strength and paretic upper limb use outside of therapy time. At the end of the 4-week intervention (approximately 7 weeks poststroke) , the GRASP group demonstrated a greater improvement in upper limb function (CAHAI) compared to the control group. The GRASP group also showed significant improvements in grip strength and paretic upper limb use compared to the control group. The intervention did not result in any serious adverse effects, suggesting that the self-administered GRASP program was safe for stroke patients.The study concludes that a self-administered homework exercise program like GRASP is a cost-effective, time-effective, and treatment-effective approach for improving upper limb recovery in subacute stroke patients. The positive outcomes in upper limb function, grip strength, and paretic limb use support the effectiveness of the program.Here,the study provides evidence that a self-administered GRASP program can lead to significant improvements in upper limb function, grip strength, and paretic limb use among subacute stroke patients. The findings suggest that this approach is safe and offers a practical and effective way to enhance upper limb recovery in stroke rehabilitation.

- **Page SJ, Sisto S, Levine P, Johnston MV, Hughes M. (**2001) conducted a study to investigate the feasibility and efficacy of a modified Constraint-Induced Therapy (CIT) protocol administered on an outpatient basis. The study focused on individuals who had experienced a stroke (CVA) between 2 and 6 months prior.The study included six patients who were in the subacute phase of stroke recovery, specifically between 2 and 6 months post-stroke. The intervention used in the study was a modified version of Constraint-Induced Therapy (CIT). CIT is a rehabilitation approach that involves constraining the unaffected limb to promote the use and rehabilitation of the affected limb. In this study, the modified CIT protocol was administered on an outpatient basis. Several outcome measures were used to assess the effectiveness of the modified CIT protocol were Fugl-Meyer Assessment of Motor Recovery After Stroke (Fugl),Action Research Arm Test (ARA),Wolf Motor Function Test (WMFT) and Motor Activity Log (MAL).The results of the study indicated that patients receiving the modified CIT protocol exhibited substantial improvements in motor function and recovery. Specifically, significant improvements were observed in the Fugl, ARA and WMFT scores, indicating better motor performance and function in the affected arm. Additionally, there were increases in both the amount and quality of use of the affected limb, as measured by the MAL. This suggests that the modified CIT protocol was effective in improving the function and use of the affected arms in patients who were exhibiting learned nonuse. The study concluded that the modified Constraint-Induced Therapy (CIT) protocol administered on an outpatient basis may be an efficacious method for improving motor function, recovery, and use of the affected arms in stroke patients who exhibit learned nonuse. The results suggest that this approach can be effective in promoting functional recovery and enhancing the utilization of the affected limb in real-life activities after stroke.

# MATERIALS AND METHODOLOGY

# MATERIALS

1. Putty
2. Towel
3. Jar
4. Chair
5. Target board
6. Shirt with button
7. Tennis ball
8. Lego pieces
9. Blocks
10. Sticks
11. Toothpicks
12. Paper clips
13. Poker chips
14. Cooking glove
15. Tray with marbles
16. Rice plate
17. Bowl
18. Tissue paper
19. Pole
20. Glass
21. Dynamometer

# METHODOLOGY

1. Study design-comparative study
2. Study population- Subjects with stroke > 6 months
3. Sample size-30 (The sample size was calculated by using G power)
4. Sampling technique-purposive technique
5. Study setting- Jharsuguda Govt. Hospital
6. Study duration- 8 months

# INCLUSION AND EXCLUSION CRITERIA

Inclusion Criteria

1. Diagnosed with stroke (> 6 months)
2. Both male and female
3. Age- 30 to 70 years
4. Mini mental status score ≥ 24
5. Active wrist extension of at least 20°, and 10° of active extension of the metacarpophalangeal joints, Proximal Interphalangeal and Distal Interphalangeal joints.
6. Balance score as measured by Berg Balance Score ≥45
7. Presence of some voluntary movement in the affected UE.
8. Spasticity in wrist flexors ≤ Grade 3 on modified Ashworth scale
9. Subject willing to take part in the study.

Exclusion Criteria

1. If participants have medical problems or cognitive deficit (mini mental status examination score < 24)
2. Excessive pain in the more affected arm, as measured by a score of ≥4 on a 10 point (VAS) visual analog scale
3. Patients with severe pain that prevented movement in the affected arm and hand.
4. Significant visual or hearing impairment.
5. Patients with poor balance.
6. Those who declined to take part in the study.

OUTCOME MEASURES

1. Fugl Meyer Assessment- Upper Extremity-

The upper extremity subtest of the Fugl-Meyer Motor Assessment (FMA) is a widely used and validated tool for assessing motor abilities in individuals who have experienced a stroke. It specifically focuses on evaluating the motor function of the affected upper extremity. The FMA is considered reliable, meaning it consistently produces consistent results when used by different evaluators.The scoring of the FMA ranges from 0 to 66 points, with each score indicating the level of active movement present in the assessed upper extremity. A score of 0 indicates that there is no active movement in the affected extremity, while a score of 66 signifies full active movement.[16]

scoring criteria:

0 points: No active movement observed.

1-34 points: Severe to moderate impairment, indicating minimal to partial active movement.

35-62 points: Mild to moderate impairment, suggesting moderate to substantial active movement.

63-66 points: Near-normal to normal movement, indicating close to or full active movement.

2. Wolf Motor Function Test-

The WMFT, which stands for the Wolf Motor Function Test, is another widely used assessment tool for evaluating motor function in individuals with stroke or other neurological conditions affecting upper extremity function. It measures task performance time, quality of movement, and strength and is known for its high reliability and consistency.

The WMFT consists of 15 functional tasks that the individual is required to perform as quickly as possible, with each task having a maximum time limit of 120 seconds. The tasks are designed to simulate daily activities and challenge various aspects of upper extremity motor function. Some examples of tasks included in the WMFT are picking up small objects, folding towels, flipping cards, and stacking checkers. The WMFT is a comprehensive and reliable assessment tool that provides valuable information about an individual's upper extremity motor function.[17]

3. Motor Activity Log-

The Motor Activity Log (MAL), is a structured interview used to assess the participant's perception of their paretic (affected) arm's quality of movement (QOM) and amount of use (AOU) during activities of daily living (ADLs). It is a self-report questionnaire that aims to capture the individual's subjective evaluation of how well they can perform specific motor tasks and how frequently they use their affected arm in daily activities.

The Motor Activity Log typically consists of a list of ADL tasks or functional movements that the participant is asked to rate based on two main dimensions:

1. Quality of Movement (QOM): This dimension assesses the participant's perception of how well they can perform each task using their affected arm. They may rate the quality of movement as "good," "fair," or "poor," depending on their level of confidence and competence while executing the task.

2. Amount of Use (AOU): This dimension evaluates the frequency with which the participant uses their affected arm during each activity. They may indicate how often they incorporate their paretic arm in the given task, ranging from "almost always" to "almost never."

By combining the Quality of Movement and Amount of Use ratings, the Motor Activity Log provides insights into how the individual perceives the functional abilities of their affected arm during real-life tasks.[18]

## Procedure:

The present study was reviewed and approved by the institutional Ethical Committee. A total of 30 samples were selected by using purposive sampling based on inclusion criteria and exclusion criteria. The demographic and clinical variables were collected from the patients. The study protocol was explained to all the participants and their informed consent was obtained .Group allocation was done by using block randomization (1 box for male and 1 box for female ,each box containing 15 pieces of paper).

15 subjects were placed in group A

15 subjects were placed in group B

Pre-test level of upper extremity function was assessed through Fugl Meyer Assessment- Upper Extremity (FMA-UE), Wolf Motor Function Test(WMFT),Motor Activity Log(MAL).

**GROUP A (GRASP)**

Participants were made to sit comfortably in a chair. The training equipments was placed on a table in front of them. The subjects were demonstrated how to use the equipments. Pre data was taken for FMA, WFMT, MAL. The participants performed a series of activities that targeted different aspects of hand and upper extremity function. The activities included in the GRASP program are as follows:

1. Total arm stretch: This involves stretching the entire arm to improve range of motion and flexibility.

2. Shoulder shrug: This exercise targeted the shoulder muscles, helping to improve shoulder strength and stability.

3. Hand and wrist stretch: Stretching the hand and wrist helps maintain or improve joint flexibility and mobility.

4. Chair push-ups: This activity involved pushing up from the chair using the arms, which helps strengthen the upper extremity muscles.

5. Shoulder exercises: Specific exercises targeting the shoulder joint and surrounding muscles to enhance strength and function.

6. Elbow exercises: Exercises aimed at improving elbow range of motion and strengthening the elbow muscles.

7. Grip power: Activities that focus on increasing grip strength, which is crucial for performing various functional tasks.

8. Finger power: Exercises to improve finger dexterity and strength, important for fine motor skills.

The training was given for 2 hours daily, 1 hour at the department & 1 hour at home for 5 days a week for 3 weeks, for a total of 15 sessions .The subjects were advised to keep a log sheet to record the time spent on home practice, to monitor adherence and progress.

**GROUP B (mCIMT)**

It is a modified version of the original Constraint-Induced Movement Therapy (CIMT) that aims to make the intervention more feasible and applicable to a wider range of patients.The patient was made to sit comfortably in a chair with arm support with their unaffected arm inside a cooking glove tied to the arm of the chair. The participants were trained in the following two main components:

a. Shaping: This involved breaking down a specific motor task into smaller, achievable steps. The patient was guided through these steps, gradually increasing the difficulty and complexity of the movements as the patient improved.

b. Task Practice: The patient was engaged in repetitive practice of functional tasks using the affected hand.

Exercises were : pushing away exercise, hand on table exercise, reaching exercise, and pole exercise.

The training was given for 2 hours daily, 1 hour at the department & 1 hour at home for 5 days a week for 3 weeks, for a total of 15 sessions .

The progress was recorded in a dairy by the participants.

Fig-1.1: Wolf Motor Function Test Box

Fig-1.2: Dynamometer

Fig-1.3: Lego Block Exercise

Fig-1.4: Pouring Water Exercise

Fig-1.5:Putty Twist Exercise

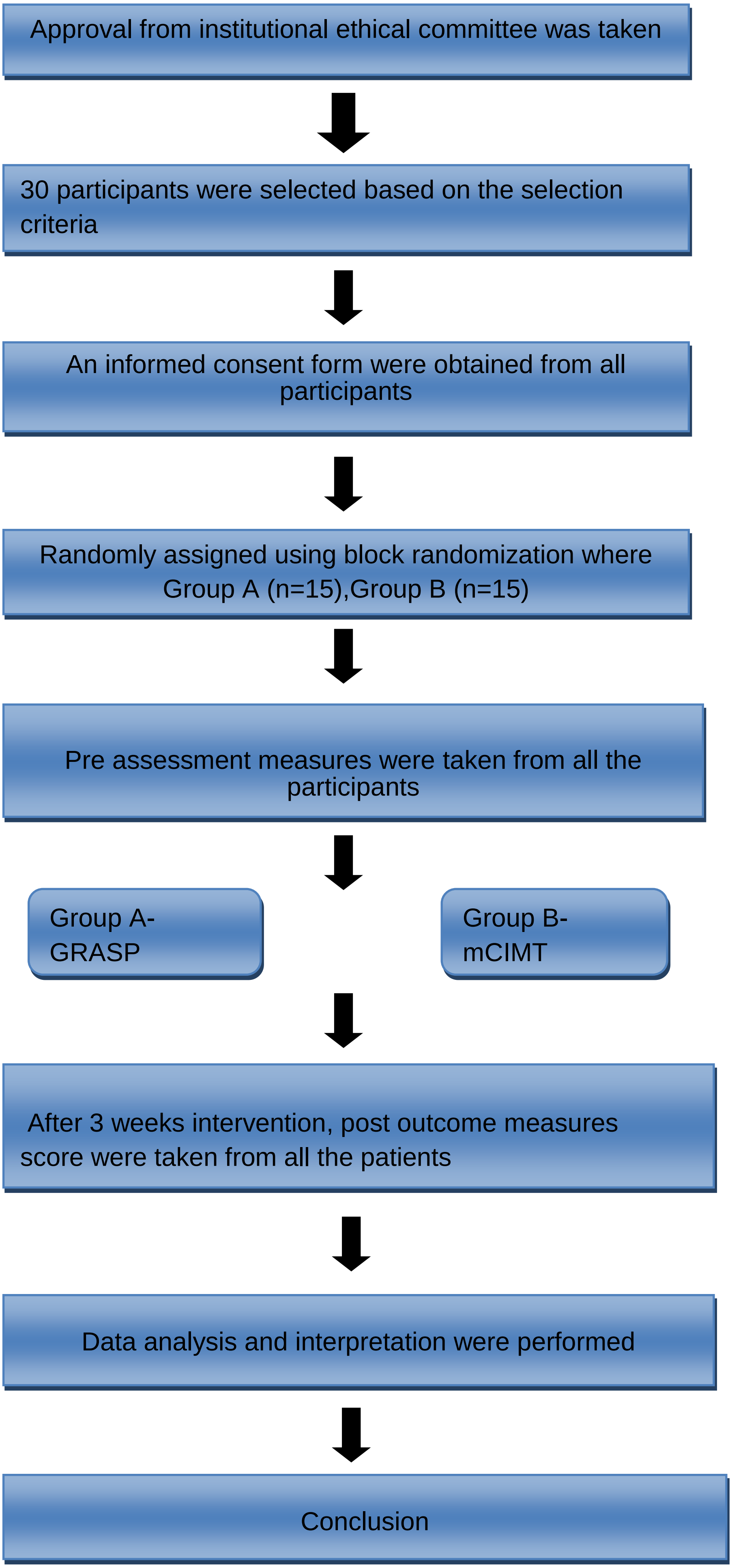
Graded Repetitive Arm Supplementary Programme (GRASP) Training

Fig-1.6: Tissue crumpling Exercise

Fig-1.7: Pinch Exercise

Fig-1.8: Marble Pick up Exercise

Fig-1.9: Flowchart



## SAMPLE SIZE ESTIMATION

A sample size of 30 subjects was estimated using a larger effect size of 1.40, a power of 0.95, and a level of significance set at 0.05. Participants were randomly assigned to either Group A or Group B.

## STATISTICAL ANALYSIS

The statistical analysis was done using Statistical Package for the Social Sciences(SPSS for Windows ,Version 29).Descriptive statistics were calculated for all the variables as mean, standard deviation and median inter quartile. Normality of the data was assessed using Shapiro Wilk test .The level of significance for the present study was fixed at a p-value of less than 0.05. Interferential statistics to find out the difference between groups was done using Wilcoxon Signed rank test and the analysis between two groups was done using the Mann-Whitney U test to find out the difference between two groups.

Table 1.1: MEAN AGE ANALYSIS

| | MEDIAN | IQ |
|---|---|---|
| GROUP A | 61 | 13 |
| GROUP B | 55 | 15 |

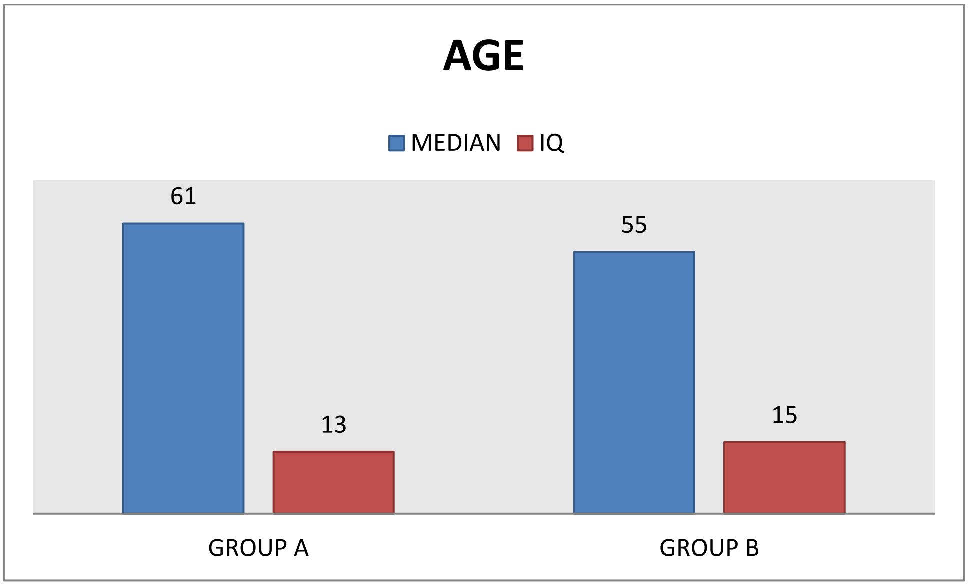



Fig: 2.0 Graphical Presentation of Mean Age Analysis

Table 1.2: MEAN BMI ANALYSIS

| | MEDIAN | IQ |
|---|---|---|
| GROUP A | 25 | 3.8 |
| GROUP B | 21.5 | 2.2 |

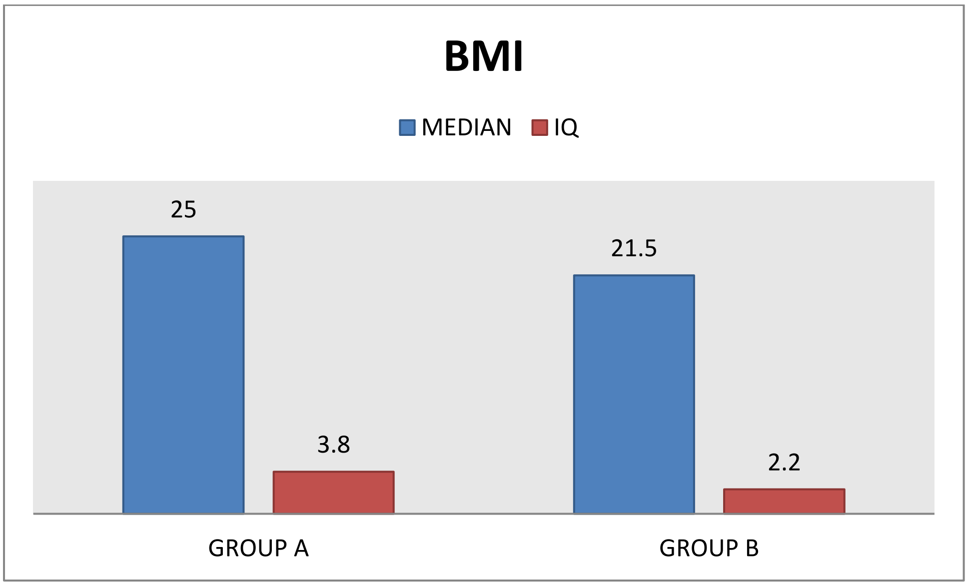



Fig: 2.1 Graphical Presentation of Mean BMI Analysis

Table 1.3: FMAU TEST WITHIN GROUP ANALYSIS

| | PRE | POST | P VALUE | MEAN DIFFERENCE |
|---|---|---|---|---|
| GROUP A | 92 | 118 | 0.001 | 26 |
| GROUP B | 95 | 116 | 0.001 | 20 |

FMAU test of within group analysis with Wilcoxon Signed rank test indicates statistically significant difference between the group in Group A ($p<0.05$), Group B ($p<0.05$). The difference in mean value was reported as follows, Group A > Group B.

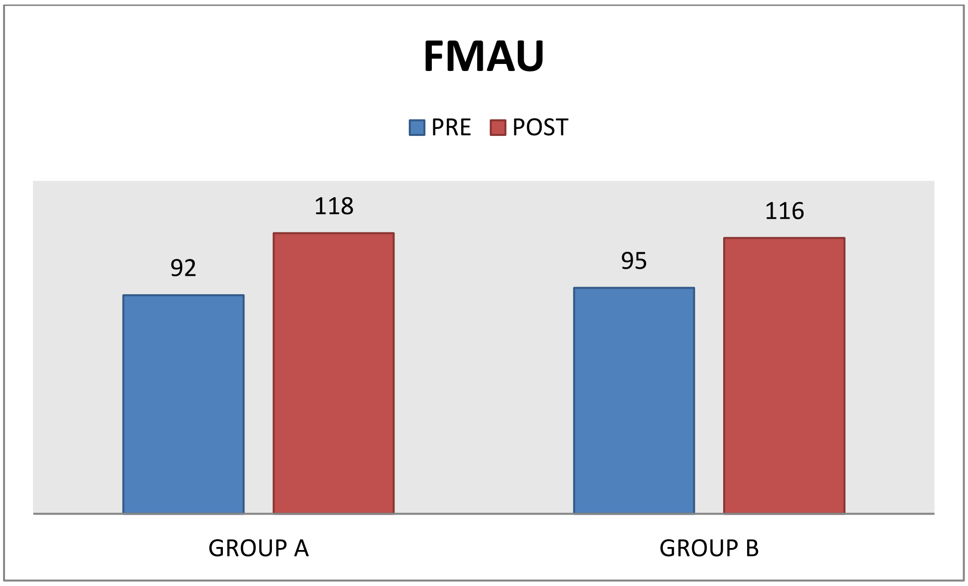



Fig: 2.2 Graphical Presentation of FMAU within Group Analysis

Table 1.4: WMFT WITHIN GROUP ANALYSIS

| | PRE | POST | P VALUE | MEAN DIFFERENCE |
|---|---|---|---|---|
| GROUP A | 28 | 54 | 0.001 | 25 |
| GROUP B | 26 | 56 | 0.001 | 31 |

WMFT of within group analysis with Wilcoxon Signed rank test indicates statistically significant difference between the group in Group A ($p<0.05$), Group B ($p<0.05$). The difference in mean value was reported as follows, Group B > Group A

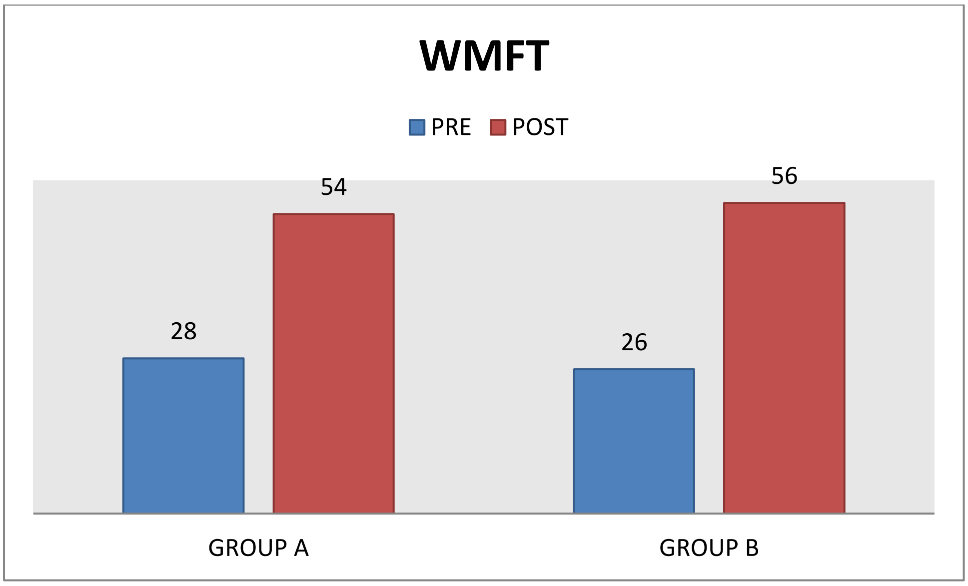



Fig: 2.3 Graphical Presentation of WMFT within Group Analysis

Table 1.5: AOU WITHIN GROUP ANALYSIS

| | PRE | POST | P VALUE | MEAN DIFFERENCE |
|---|---|---|---|---|
| GROUP A | 32 | 90 | 0.00 | 58.20 |
| GROUP B | 43 | 84 | 0.00 | 41.86 |

AOU of within group analysis with Wilcoxon Signed rank test indicates statistically significant difference between the group in Group A (p<0.05), Group B (p<0.05). The difference in mean value was reported as follows, Group A > Group B.

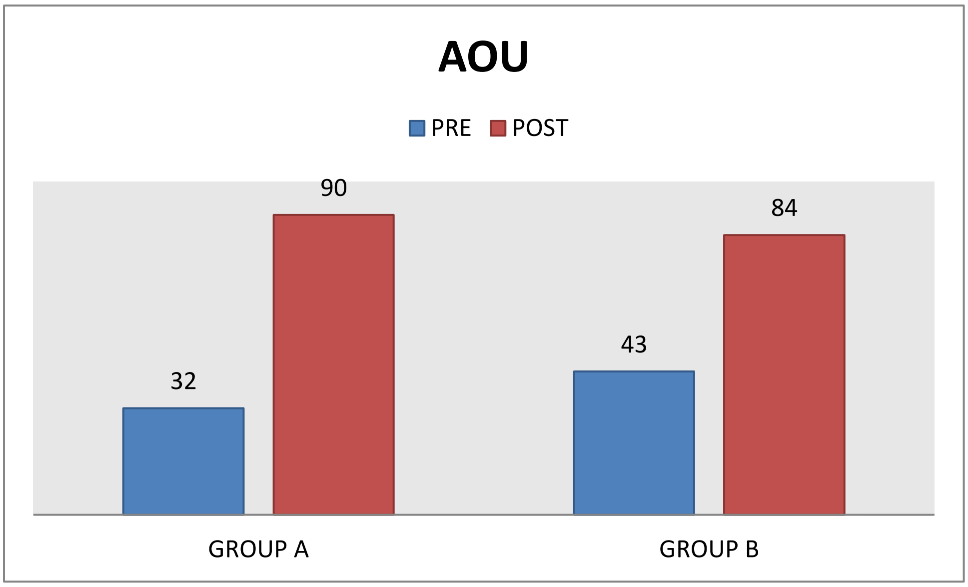



Fig: 2.4 Graphical Presentation of AOU within Group Analysis

Table 1.6: QOM WITHIN GROUP ANALYSIS

| | PRE | POST | P VALUE | MEAN DIFFERENCE |
|---|---|---|---|---|
| GROUP A | 30.53 | 88.06 | 0.00 | 57.53 |
| GROUP B | 40.53 | 82.20 | 0.00 | 41.66 |

QOM of within group analysis with Wilcoxon Signed rank test indicates statistically significant difference between the group in Group A ($p<0.05$), Group B ($p<0.05$). The difference in mean value was reported as follows, Group A > Group B.

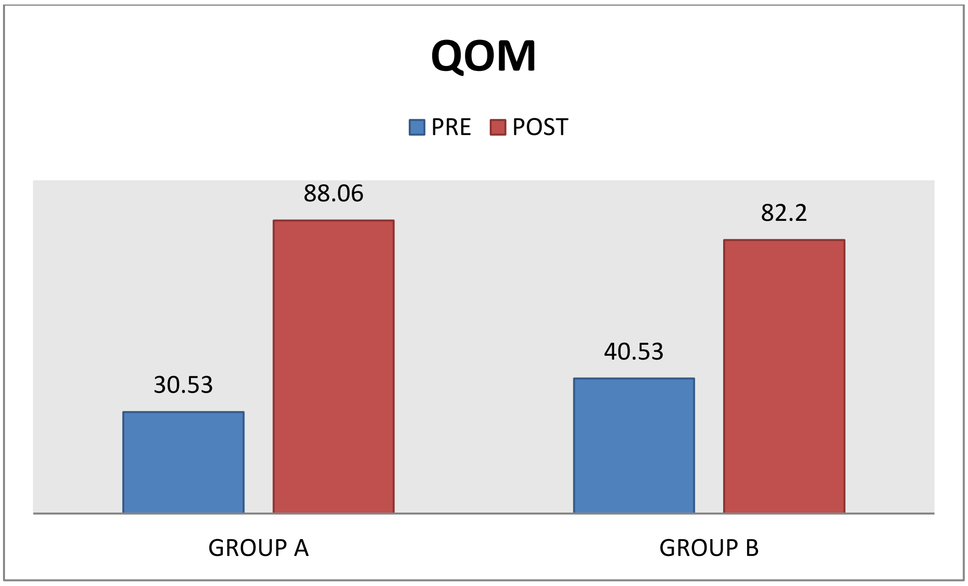



Fig: 2.5 Graphical Presentation of QOM within Group Analysis

Table 1.7: BETWEEN GROUP ANALYSIS OF OUTCOME MEASURES

| OUTCOME | POST MEAN | P VALUE |
|---|---|---|
| FMAU | 0.936 | 0.367 |
| WMFT | 2.539 | 0.010 |
| AOU | 16.33 | 0.000 |
| QOM | 15.86 | 0.001 |

There was no statistically significant difference in FMAU outcomes between groups (P > 0.05).There was statistically significant difference in WMFT outcomes between groups(P< 0.05).There was statistically significant difference in AOU and QOM outcomes between groups (P < 0.05). In FMAU Group A showed better results than Group B, WMFT Group B showed better results than Group A.  In AOU and QOM, Group A showed better results than Group B.

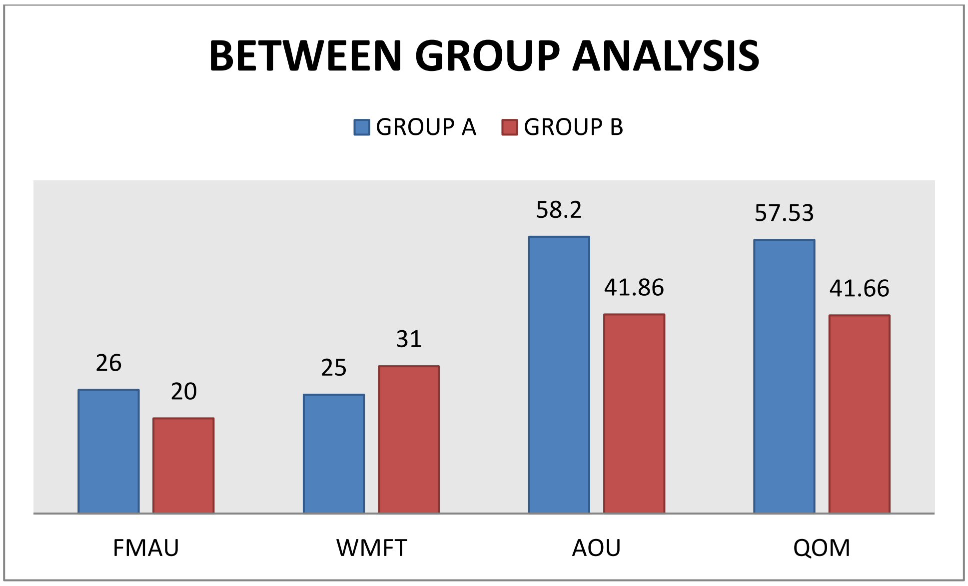



Fig: 2.6 Graphical Presentation of Between Group Analysis of outcome measures

## RESULT

Statistical difference ($p<0.05$) was found within the Group A (pre and post-intervention) for all the outcome measures i.e., FMAU,WMFT, MAL(AOU & QOM) as is expressed in table 1.3,1.4,1.5,1.6 and figure 2.2,2.3,2.4,2.5.

There was statistical difference found within the Group B for all the outcome measures i.e., FMAU,WMFT, MAL(AOU & QOM) as is expressed in table 1.3,1.4,1.5,1.6 and figure 2.2,2.3,2.4,2.5.

No statistical difference was found between Group A and Group B in FMAU as is expressed in Table 1.7 and figure 2.6.

Statistical significant difference was found between Group A and Group B for the difference calculated between two of the outcome measures WMFT and MAL(AOU & QOM) as is expressed in Table 1.7 and figure 2.6 .

Subjects in the Graded Repetitive Arm Supplementary Programme showed improvement in two outcome measures FMAU and MAL (AOU & QOM) when compared with Modified Constraint Induced Movement Therapy group. Subjects in the Modified Constraint Induced Movement Therapy group showed improvement in WMFT outcome measure when compared with Graded Repetitive Arm Supplementary Programme.

## DISCUSSION

The goal of the study was to compare the effectiveness of graded repetitive arm supplementary programme and modified constraint induced movement therapy in chronic stroke. The results of this study showed that 3 weeks of graded repetitive arm supplementary programme was more effective in comparison with modified constraint induced movement therapy in chronic stroke patients. Significant improvements were seen in the Fugl-Meyer Assessment for Upper Extremity (FMAU), Wolf Motor Function Test (WMFT), and Motor Activity Log (MAL) at post-assessment. However, these improvements indicate that both GRASP and mCIMT interventions contributed to enhanced motor function and performance of the paretic hand.

This suggests that these interventions have the potential to positively impact the recovery process in chronic stroke patients. This indicates that the changes in motor performance are not just statistically significant but also have practical implications for the patients' daily lives. These improvements could potentially lead to increased independence and improved quality of life. The practical benefits of GRASP for individuals recovering from stroke, such as increased independence in daily activities like dressing , eating, and grooming. Additionally, these improvements align with the goals of stroke rehabilitation, which often include enhancing patients' ability to participate in meaningful activities.[19]

Certainly, the modified Constraint-Induced Movement Therapy (mCIMT) is another valuable rehabilitation approach for stroke patients. It involves constraining the unaffected limb while intensively training the affected limb, encouraging the use and recovery of the paretic limb. By constraining the unaffected limb, mCIMT ensures that the patient engages the paretic limb more actively during therapy sessions.[20] This intensive use of the affected limb may enhance neural plasticity and stimulate motor recovery. Constraint-induced therapy may promote neural reorganization and relearning of motor skills by encouraging the brain to adapt and find alternative pathways for movement.[13] The constraint forces patients to rely on the affected limb, potentially increasing motivation and engagement in therapy sessions. However, using constraint during the treatment period comes with both merits and demerits.

Constraint might lead to frustration or emotional distress in some patients due to the limitations it imposes on their daily activities. The response to constraint therapy can vary widely among patients, depending on factors such as the severity of stroke, cognitive abilities, and psychological resilience. The optimal duration of constraint therapy and the patient's willingness to comply with the constraints should be carefully considered to balance potential benefits and challenges.

In FMAU, In within Group A (GRASP),post result is better than pre result as the change in FMAU scores demonstrates an objective evidence to the program's ability to induce positive neural adaptations and promote recovery after a stroke. An increase in FMAU scores from the baseline to the post-test indicates an improvement in GRASP program has led to positive changes in the individual's neural pathways, resulting in enhanced motor control, strength, coordination, and overall functional abilities of the upper limb. Previous study done by Dhanusia et al., also showed improvement in FMAU with GRASP by assessing various aspects of upper limb function and the GRASP program's comprehensive approach, which includes strength training, range of motion exercises, trunk control, hand skills, and coordination practice, likely contributes to its effectiveness in producing positive outcomes for stroke survivors with upper limb deficits .[21]

In FMAU, In within Group B(mCIMT) ,post result is better than pre result as the the change in FMAU scores demonstrates as an objective evidence of the effectiveness of the mCIMT program in improving upper limb function that the intensive, task-specific training and constraint of the unaffected limb have contributed to the individual's motor recovery. The mCIMT approach translated improvements in motor function into functional gains in everyday activities. Smith et al., also proved in his study that significant gains made by FMAU are consistent with the premise that individuals with chronic stroke suppress the use of the affected UE resulting in “learned non-use” and intensive training in the use of the affected limb in chronic  stroke survivors can indeed lead to cortical reorganization and functional improvements.[22]

In WMFT, in within Group A(GRASP),post result is better than pre result as the post-test WMFT scores show a decrease in the time taken to complete tasks compared to the baseline assessment, it indicates an improvement in upper limb motor function..The GRASP program's focus on graded exercises means that the individual progresses from simpler tasks to more complex ones. The improvement in WMFT scores demonstrates the successful adaptation of the individual's motor skills to increasingly challenging tasks. In previous study, Allman et al., showed that the GRASP focuses on task-specific training, graded exercises, and functional relevance aligns well with the WMFT's assessment of functional tasks. The reduction in task completion times indicates enhanced upper limb motor control, coordination, and overall functional ability, thereby validating the effectiveness of the GRASP program.[23]

In WMFT,in within Group B(mCIMT),post result is better than pre result as the the mCIMT approach involves task-specific training, where the individual practices activities that are relevant to their daily life. The improved WMFT scores demonstrate the successful translation of improved motor skills into functional gains. In previous study , Leung et al., suggested that the intensive nature of mCIMT requires patient motivation and engagement which showed improvement in WMFT scores with the individual's enhanced ability to actively perform functional tasks.[24]

In MAL(AOU and QOM),in within Group A(GRASP), post result is better than pre result as the the improvement in MAL scores indicates that the individual's upper limb function has improved in a way that translates into their daily life and they perceive increased use of the affected limb during functional activities. The self-reported data from the MAL provides insight into specific tasks that the individual perceives as improved. In previous study, Simpson et al, showed that the self-reported changes captured by the MAL suggest that in GRASP, improved upper limb function can positively impact the individual's overall quality of life by increasing independence and participation in daily activities and the benefits gained from the GRASP program are being perceived by the individual even beyond the therapy sessions.[25]

In MAL(AOU and QOM),in within Group B(mCIMT),post result is better than pre result as the scores on the post-test MAL show an increase compared to the initial assessment, it indicates a positive change in the individual's perception of upper limb use and functional ability. Thus, mCIMT emphasizes task-specific training, which means that the individual practices activities that are relevant to their daily life. This approach helps to translate improvements in motor function into functional gains. In previous study, Kwakkel et al.,concluded that improved MAL scores reflect the individual's enhanced ability to perform functional tasks using the affected limb where mCIMT focus on task-specific training and functional gains with the goals of the MAL showing positive impact of the mCIMT program on the individual's upper limb function and daily life.[26]

In between group , Group A (GRASP) is better than Group B(mCIMT) in FMAU and MAL(AOU & QOM).FMAU specifically focuses on evaluating the motor function of the upper limb (shoulder, elbow, forearm, wrist, and hand) in individuals who have suffered a stroke or other neurological conditions. It assesses various aspects of motor control, coordination, strength, and reflexes. Previous study done by Dhanusia et al., also showed improvement in FMAU with GRASP.[21]
In previous study, FMAU provides a hierarchical scale of motor impairment severity, making it a valuable clinical tool for assessing and tracking the functional status of individuals with neurological impairments, particularly after stroke. This may explain the reason for performance of better results of Group A (GRASP) in FMAU. S Dhanusia et al., concluded that FMAU demonstrated an improved result in GRASP group than virtual reality group.[21]The MAL provides insights into how the individual perceives their own functional recovery and the extent to which they have regained the ability to incorporate their affected limb into daily activities. Previous study done by Simpson et al., also showed improvement in MAL with GRASP.[25]

In previous study, MAL's self-report nature, specifically capturing the patient's subjective perception of their own abilities offered valuable insights into various psychological and emotional factors that play a significant role in the rehabilitation process. This may explain the reason for performance of better results of Group A(GRASP) in MAL(AOU & QOM). Simpson et al., concluded that MAL has been identified as clinically meaningful as it represents use of the affected limb without assistance from the other limb which led to the success of the H-GRASP program in positively impacting various aspects of upper limb function, use, strength, and overall daily performance.[25]In between group, Group B (mCIMT) is better than Group A (GRASP) in WMFT. The WMFT is better at detecting subtle changes or differences in motor performance among individuals with milder stroke impairments. Previous study done by Leung et al., also showed improvement in WMFT with mCIMT.[24] In previous study, WMFT proved to be a task-specific assessment that evaluated multiple dimensions of motor function, including task performance time, quality, and strength. It's functional relevance, and task-specific evaluation made it a valuable tool for understanding and measuring motor abilities in stroke patients. This may explain the reason for performance of better results of Group B (mCIMT) in WMFT. Leung et al., concluded that patients who were part of the mCIMT group demonstrated significant improvements, particularly in tasks related to "shaping" as assessed by the WMFT. The subjects exhibited improvements in both the speed at which they completed certain ADLs and their overall ability to perform those tasks. The specific ADLs mentioned include lifting a can, lifting a pencil, and flipping cards.[24] So , there is a significant difference between graded repetitive arm supplementary programme (GRASP) and modified constraint induced movement therapy (mCIMT) in chronic stroke.

It highlighted the potential for changes in self-perceived functional abilities to correlate with objective assessments, like the FMAUE and WMFT. It is clinically relevant as the patient-reported outcomes measured by the MAL align with the broader goals of stroke rehabilitation, such as enhancing independence, quality of life, and participation in daily activities.

The lack of earlier research comparing the effectiveness of Graded Repetitive Arm Supplementary Programme (GRASP) and modified Constraint-Induced Movement Therapy (mCIMT) in chronic stroke patients highlights the novelty and potential significance of the current study. It clearly emphasize that this study fills a critical research gap by directly comparing the effectiveness of GRASP and mCIMT in chronic stroke patients. It features the importance of this comparison in providing evidence-based guidance for clinical decision-making. Further, the outcomes of study could guide in selecting appropriate interventions for chronic stroke patients based on their specific needs, preferences, and potential for recovery. However, it is also essential to consider the study's limitations.

## Limitations

It was a short duration study.

Sample size was small.

# CONCLUSION

Both GRASP and mCIMT emphasize the importance of repetitive practice .Both interventions involve task-specific training, targeting functional activities that are relevant to the individual's daily life. By focusing on real-world activities, patients can improve their ability to perform essential tasks, leading to increased independence and quality of life. The intensive training provided by GRASP and mCIMT can stimulate neural plasticity and facilitating motor recovery. According to the findings of the current study, 3 weeks of GRASP is more effective than mCIMT. GRASP may be more suitable for a broader range of patients, including those who have difficulty tolerating constraint, those with cognitive impairments, or those with less severe motor deficits. GRASP does not involve the constraint of the unaffected limb, making it more accessible to a wider patient population.

## Future Recommendations

Further research, A large sample size is required.Understanding the long-term impact can guide for future recommendations. Conducting studies with extended follow-up periods to assess the maintenance of motor improvements achieved through GRASP and mCIMT.

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## ANNEXURES.1

## DATA COLLECTION FORM

DATA COLLECTION FORM

SUBJECT NUMBER - DATE- / /

AGE/GENDER-

HEIGHT

WEIGHT

ADDRESS-

CONTACT NO.-

| Name of the test | Pre test reading | Post test reading |
|---|---|---|
| FMAU | | |
| WMFT | | |
| MAL<br>AOU<br>QOM | | |

**ANNEXURES.2**

**CONSENT FORM**

## CONSENT FORM

## Title of the study–

**"A Comparative Study on the Effectiveness of Graded Repetitive Arm Supplementary Programme and Modified Constraint Induced Movement Therapy in Chronic Stroke"**

I have been informed by Ms Supriya Sahu ; pursuing MPT (Neuro) conducting the above-mentioned study under the guidance of Dr. Sonali Soumyashree , Assistant Professor Department of Neuro Physiotherapy ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE (ABSMARI), BHUBANESWAR.

I have no objection and will be a part of that group.I also understand that the study does not have any negative implication on my health. I understand that the information produced by the study will become a part of the institute's record and will be utilized, as per confidentiality regulations of the institute. I am also aware that the data might be used for medical literature and teaching purposes,but all my personal details will be kept confidential.

I am well informed to ask as many questions as I can to Ms. Supriya Sahu either during the study or later.

I understand that my assent is voluntary and I reserve the right to withdraw or discontinue the participation from the study at any point of time during the study.

I have explained to MR/MISS/MRS the purpose of the research,the procedure required in the language he/she could understand to the best of my ability.

(Investigator) (Date)

## ANNEXURES.3

## MASTER CHART

| | | | | | | | PRE TEST | POST TEST | POST-PRE | PRE TEST | POST TEST | POST-PRE | PRE TEST | POST TEST | POST-PRE | PRE TEST | POST TEST | POST-PRE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 54 | M | 175 | 66 | 21.6 | 1 | 98 | 118 | 20 | 27 | 57 | 30 | 52 | 107 | 55 | 50 | 100 | 50 |
| 2 | 42 | F | 145 | 43 | 20.5 | 1 | 88 | 115 | 27 | 26 | 58 | 32 | 43 | 100 | 57 | 40 | 99 | 59 |
| 3 | 43 | M | 168 | 70 | 24.8 | 1 | 92 | 120 | 28 | 27 | 54 | 27 | 35 | 105 | 70 | 32 | 102 | 70 |
| 4 | 65 | M | 172 | 75 | 25.4 | 1 | 88 | 117 | 29 | 29 | 56 | 27 | 25 | 87 | 62 | 23 | 85 | 62 |
| 5 | 65 | M | 157 | 60 | 24.3 | 1 | 87 | 113 | 26 | 22 | 56 | 34 | 26 | 94 | 68 | 25 | 92 | 67 |
| 6 | 65 | F | 147 | 48 | 22.2 | 1 | 95 | 113 | 18 | 28 | 53 | 25 | 43 | 97 | 54 | 40 | 95 | 55 |
| 7 | 63 | M | 160 | 62 | 24.2 | 1 | 103 | 118 | 15 | 30 | 54 | 24 | 35 | 91 | 56 | 33 | 89 | 56 |
| 8 | 52 | F | 155 | 60 | 25 | 1 | 99 | 122 | 23 | 28 | 55 | 27 | 32 | 101 | 69 | 30 | 99 | 69 |
| 9 | 40 | F | 142 | 45 | 22.3 | 1 | 95 | 120 | 25 | 31 | 52 | 21 | 21 | 85 | 64 | 20 | 83 | 63 |
| 10 | 65 | M | 175 | 80 | 26.1 | 1 | 87 | 115 | 28 | 29 | 53 | 24 | 39 | 75 | 36 | 36 | 73 | 37 |
| 11 | 61 | M | 163 | 70 | 26.3 | 1 | 88 | 121 | 33 | 28 | 54 | 26 | 16 | 89 | 73 | 16 | 85 | 69 |
| 12 | 65 | F | 152 | 58 | 25.1 | 1 | 96 | 113 | 17 | 28 | 48 | 20 | 30 | 96 | 66 | 28 | 94 | 66 |
| 13 | 63 | F | 173 | 78 | 26.1 | 1 | 83 | 118 | 35 | 30 | 53 | 23 | 41 | 78 | 37 | 38 | 75 | 37 |
| 14 | 57 | F | 150 | 70 | 31.1 | 1 | 82 | 177 | 95 | 45 | 69 | 24 | 19 | 83 | 64 | 17 | 80 | 63 |
| 15 | 60 | F | 157 | 62 | 25.2 | 1 | 100 | 118 | 18 | 39 | 58 | 19 | 32 | 74 | 42 | 30 | 70 | 40 |
| 16 | 45 | F | 160 | 56 | 21.9 | 2 | 89 | 116 | 27 | 26 | 56 | 30 | 51 | 83 | 32 | 49 | 82 | 33 |
| 17 | 50 | M | 180 | 60 | 18.5 | 2 | 99 | 116 | 17 | 29 | 57 | 28 | 24 | 67 | 43 | 20 | 64 | 44 |
| 18 | 61 | M | 168 | 59 | 20.9 | 2 | 98 | 117 | 19 | 25 | 56 | 31 | 19 | 69 | 50 | 17 | 66 | 49 |
| 19 | 65 | M | 157 | 53 | 21.5 | 2 | 94 | 112 | 18 | 24 | 57 | 33 | 46 | 89 | 43 | 44 | 87 | 43 |
| 20 | 55 | M | 162 | 56 | 21.3 | 2 | 100 | 114 | 14 | 24 | 50 | 26 | 47 | 72 | 25 | 45 | 70 | 25 |
| 21 | 65 | M | 171 | 63 | 21.5 | 2 | 97 | 115 | 18 | 30 | 47 | 17 | 37 | 66 | 29 | 34 | 60 | 26 |
| 22 | 38 | M | 159 | 60 | 23.7 | 2 | 100 | 117 | 17 | 25 | 60 | 35 | 44 | 82 | 38 | 40 | 81 | 41 |
| 23 | 55 | M | 164 | 52 | 19.3 | 2 | 91 | 117 | 26 | 26 | 57 | 31 | 43 | 84 | 41 | 42 | 82 | 40 |
| 24 | 60 | M | 163 | 62 | 23.3 | 2 | 95 | 118 | 23 | 28 | 56 | 28 | 65 | 100 | 35 | 63 | 97 | 34 |
| 25 | 53 | M | 157 | 58 | 23.5 | 2 | 83 | 118 | 35 | 26 | 57 | 31 | 45 | 101 | 56 | 43 | 99 | 56 |
| 26 | 58 | M | 173 | 64 | 21.4 | 2 | 98 | 120 | 22 | 28 | 56 | 28 | 48 | 82 | 34 | 45 | 79 | 34 |
| 27 | 40 | F | 155 | 72 | 30 | 2 | 65 | 108 | 43 | 23 | 55 | 32 | 20 | 82 | 62 | 18 | 80 | 62 |
| 28 | 55 | F | 153 | 50 | 21.4 | 2 | 93 | 113 | 20 | 28 | 54 | 26 | 45 | 98 | 53 | 42 | 95 | 53 |
| 29 | 42 | M | 170 | 71 | 24.6 | 2 | 95 | 115 | 20 | 25 | 56 | 31 | 63 | 99 | 36 | 60 | 94 | 34 |
| 30 | 60 | M | 180 | 70 | 21.6 | 2 | 81 | 118 | 37 | 28 | 60 | 32 | 48 | 99 | 51 | 46 | 97 | 51 |

**ANNEXURES.4**

**ETHICAL COMMITTEE CLEARANCE CERTIFICATE**

ABHINAV **BINDRA**
Sports Medicine & Research Institute
A Unit of the Abhinav Bindra Foundation Trust
Recognised by DMET, Health & FW Dept., Govt. of Odisha, Affiliated to Utkal University
Recognised by Odisha State Council for Occupational Therapy and Physiotherapy

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Reference No. – ABSMARI/IRB/15/2023
Date: 22nd June 2023

**INSTITUTIONAL REVIEW BOARD**

To
Ms Supriya Sahu,
Post Graduate student, Department of Physiotherapy,
Abhinav Bindra Sports Medicine and Research Institute (ABSMARI).

This is to certify that your proposal for the study titled "**A Comparative Study on the Effectiveness of Graded Repetitive Arm Supplementary Programme and Modified Constraint Induced Movement Therapy in Chronic Stroke**" has been taken for discussion in the meeting held on 20th May 2023. Following the meeting, the committee approves the proposal and it has no objection on the study being carried out.

You are advised to familiarize yourself with the ICMR guidelines on biomedical research in human subjects and also adhere to the principles of Good Clinical Practice. You are hereby directed to submit the final report to the committee, on completion of the study. Any case of adverse reactions should be informed to this ethics committee and action will be taken thereafter.

Any such adverse reactions during the course of the study are the sole responsibility of the Principal Investigator and there is no onus on the Ethical Committee members resulting thereof.

We wish you all the best for your study.

**Member Secretary**

ABHINAV BINDRA SPORTS MEDICINE AND RESEARCH INSTITUTE
ABSMARI
BHUBANESWAR

**Chair Person**

Utkal Signature, Plot No 273, NH-5, Pahal, Bhubaneswar, 752101
Phone: 6370703650, 6370703651