COMPARISON OF UPPER LIMB FUNCTIONAL OUTCOMES IN STROKE PATIENTS RECEIVING MOTOR RELEARNING PROGRAMME (MRP) VS. PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION (PNF)

A PROJECT WORK SUBMITTED IN PARTIAL FULFILLMENT

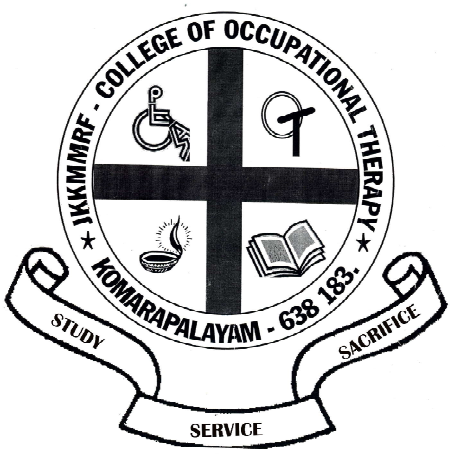
OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF OCCUPATIONAL THERAPY

(ADVANCED O.T. IN NEUROLOGY)

Submitted By

Reg.No. 41081209



JKK MUNIRAJAH MEDICAL RESEARCH FOUNDATION
COLLEGE OF OCCUPATIONAL THERAPY
KOMARAPALAYAM - 638 183.

Affiliated To

THE TAMILNADU DR.M.G.R. MEDICAL UNIVERSITY,
CHENNAI - 600 032.

MARCH - 2011

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PRINCIPAL **EXTERNAL EXAMINER**

GUIDE **INTERNAL EXAMINER**

CERTIFICATE

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Mr.M.SARAVANA ROENTGEN MANI, M.O.Th.,
PRINCIPAL
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Reg.No. 41081209

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ABSTRACT

BACK GROUND OF THE STUDY:

The patients affected by stroke have been found to experience variety of difficulties. These disabilities produce physical, psychological and functional limitations in their day to day life. The major disruptive factor impending rehabilitation is the functional limitations of affected extremities. This study aims to compare two different concepts in clinical rehabilitation- First the specific reflex based neuro- facilitation technique of 1960's **PNF** and Second motor control and motor learning concept based technique of 1980's **MRP** on the upper extremity functions in stroke patients.

AIM:

The aim of the study was to compare the two techniques- the Poprioceptive Neuromuscular Facilitation **(PNF)** and Motor Relearning Program **(MRP)** on the upper limb functions in stroke patients.

METHODOLOGY:

A total of 30 patients suffering from stroke were selected and randomly allocated to two experimental groups **(Group I and Group II)** till the number of 15 subjects were reached in each group. Assessments were done to measure level of upper extremity function using **MAS** (Motor Assessment Scale), functional independence using **FIM** (Functional Independence Measures) and Spasticity using Modified Ashworth scale. A structured- Occupational therapy protocols were tailored on **PNF** and **MRP** techniques and implemented. Group I is treated with **MRP** protocol and Group II is treated with **PNF** protocol.

RESULT:

After the implementation there is no significant improvement in **MRP** protocol than **PNF** protocol in improving upper limb functions.

DISCUSSION:

Occupational therapy activities are always graded and goal directed which depends primarily in the training of task parameters and functional adaptation. These occupational Therapy strategies have yielded improvements of in both PNF and MRP techniques. And there is no significant improvement in MRP than PNF. The result shows that no technique could show 100% improvement but they work on different aspects of disability. Therefore altogether these techniques will help in the improvement of the functional status of the stroke patients and there by reducing the disability related to stroke

INTRODUCTION

In modern times, life is not very predictable. Anything can occur to anybody at anytime catastrophes hang like, Damocle's sword over our heads. When catastrophes strike in the form of disease, man faces disabilities and becomes handicapped, and that may entail frustration or even despair. In this state of crisis an Occupational therapist plays a vital role in helping the patient bring his life to normalcy. Since the beginning of the profession Occupational therapy practitioners have attempted to motivate the performance of clients by engaging them in meaningful activities (AJOTA, 1995, Duton, 1925, Fidler, 1981, Florey, 1969, Humphery, 1925, Sands, 1928, Trombly, 1995

.

Common goals of Occupational therapy is to improve the quality of life of person who through trauma, developmental delay, disease or pathology have experienced a decreased ability to perform tasks; fulfill roles or otherwise engage in life experiences to the degree they desire (Nagel, Rice, 2001) population frequency treated by Occupational therapy practitioners include those with unilateral impairment of an upper extremity (Nage, Rice, 2001).

A major concern of Occupational therapy is the identification of effective treatment approaches that facilities performance and encourages the development of skill (Ma.H, Trombly, C.A. and robinson_Podolski, 1999).

Some of the impairments related to the stroke are motor and sensory dysfunction, aphasia or dysarthria, visual field defects and mental and intellectual impairments. Impairments that interfere with functional movement of the limbs are the changes in muscle strength, tone and activation. Impairment of upper limb functions contributes greatly to functional disability after stroke. The incidence of dependence in ADL is highest immediately after stroke.

Recovery of functional skills may be attributable to neurological recovery or behavioral compensation or both. Example: In behavioral compensation the unaffected extremity may compensate for the reduced function of the affected extremities or the patient may learn to maximize residual motor control in the affected extremities[1].

Most stroke patients show considerable recovery of function over the first few months, although the exact extent and duration of this recovery is less certain[3]. In general neurological recovery occurs within the first 1-3 months following stroke[1,3,4,6]. Further motor and sensory recovery may continue to occur after six months to one year however these changes may not reach statistical or clinical significance[1]. Detailed knowledge of the time course of recovery is indispensable to rational planning of rehabilitation, discharge time, discharge placement and to informing patient and family about the prognosis and the possibility of further recovery[4]. Studies[7] analyzing the acute recovery patterns in stroke patients present results concerning the critical factors, influencing functional outcome, like age, hemisphere involved, artery involved. Since a stroke commonly occurs in the later stage of life, there is often possibility of independent intellectual decline, related to a dementing process, quite separate from the effect of the vascular lesion[2], a poorer

outcome is associated with right hemisphere lesion subjects and is commonly attributed to constructional apraxia and Visio spatial difficulties[2,18]. There are specific deficits commonly associated with a middle cerebral artery (MCA) occlusion, which have been intimated as being associated with poor functional outcome from a stroke.

The timing, intensity and accuracy of rehabilitation also influence the recovery patterns in stroke and also how much specialized rehabilitation using different treatment approaches in Occupational Therapy is provided to the patient either as inpatient or post discharge outpatient. The independence in basic ADL function (including feeding and grooming) is the main goal of stroke rehabilitation.

Nowadays there are unlimited numbers of treatment approach are available in Occupational Therapy for treatment of the hemiplegia. The techniques differ in their basic concepts and the treatment effects. The Proprioceptive Neuromuscular Facilitation (PNF) technique is based on the neurophysiologic` aspect of the human body and promotes or hastens the response of the neuromuscular mechanism through stimulation of the proprioceptors. These techniques help in the movements of the extremities in patterns used in the daily activities and therefore facilitate movement. On the other hand Motor Relearning Program (MRP) is the most widely used technique nowadays, is based on the new concepts of motor control and motor learning and emphasizes in the correct and constant practice of tasks involving the extremities which are useful for the patient in their ADL and discourage the compensatory techniques which the patient tend to develop after stroke attack. The two techniques are quite different in their concepts but are considered to be effective in treating the same disorder.

AIM

The aim of the current study is to compare effectiveness of the Proprioceptive Neuromuscular Facilitation (PNF) approach and the Motor Relearning Program(MRP) on the upper limb functions in stroke patients.

HYPOTHESIS

NULL HYPOTHESIS

The null hypothesis states that the functional training technique MRP will not significantly improve upper limb function compared to use of PNF in patients following stroke.

ALTERNATE HYPOTHESIS

The alternate hypothesis states that the functional training technique MRP will significantly improve upper limb function compared to use of PNF in patients following stroke.

1. Birgitta Langhammer[1], Johan K. Stanghelle[2] MAY 2010: Can physiotherapy after stroke based on the Bobath concept result in improved quality of movement compared to the motor relearning program. The primary aim of the present study was to investigate, based on data from our study in 2000, whether the Bobath approach enhanced quality of movement better than the Motor Relearning Programme (MRP) during rehabilitation of stroke patients. The results shows the items arm (p = 0.02–0.04) sitting (p = 0.04) and hand (p = 0.01–0.03) were significantly better in the Motor Relearning Programme group than in the Bobath group, in both Sødring Motor Evaluation Scale and Motor Assessment Scale. Leg function, balance, transfer, walking and stair climbing did not differ between the groups. The Movement Quality Model and the movement qualities biomechanical, physiological and psycho-socio-cultural showed higher scoring in the Motor Relearning Programme group, indicating better quality of movement in all items. Regression models established the relationship with significant models of motor performance and self reported physical mobility (adjusted R^2 0.30–0.68, $p < 0.0001$), energy (adjusted R^2 0.13–0.14, p = 0.03–0.04, emotion (adjusted R^2 0.30–0.38, $p < 0.0001$) and social interaction (arm function, adjusted R^2 0.25, p = 0.0001). These analyses confirm that task oriented exercises of the Motor Relearning Program type are preferable regarding quality of movement in the acute rehabilitation of patients with stroke.

2. Poole .J.L. 1. Am J Occup Ther. 1991 Jun; 45(6):531-7. Application of motor learning principles in occupational therapy. Department of Health, Physical, and Recreation Education, University of Pittsburgh, Pennsylvania 15261. The processes underlying skill acquisition depend on the nature of the task and the stage of the learner. In addition, feedback and practice are two potent learning variables when used appropriately in the instruction of motor tasks. Occupational therapists involved in the training and retraining of motor skills can benefit from knowledge of instructional methods used by coaches and physical educators. This paper reviews commonly accepted principles of motor learning and applies these principles to occupational therapy treatment. The stage of the learner, type of task, feedback, practice, and facilitation of skill acquisition are emphasized. Specific examples of how occupational therapists can use motor learning principles in treatment are given.

3. In a study by Woldag[28] et al in 2003 determined whether a repetitive training of the complex movements of the arm and hand contributes to functional recovery in stroke patients when compared with functionally based physio- and occupational therapy. 21 patients with stroke in MCA territory were given a baseline phase of 'house-typical' occupational and physiotherapy and then with the training phase of the 'house-typical' therapy supplemented by repetitive training of grasp and transport movements over 10 mins. each, twice daily. The repetitive training of the complex movements does not further enhance the functional recovery of the affected arm and hand in stroke patients compared with functionally based physio- and occupational therapy.

4. A placebo-controlled study by Armagan [29] et al in 2003 EMG Biofeedback was used in treatment of hemiplegic hand in which both the groups were also given exercise program according to Brunnstrom neurophysiological approach. The results showed that there were statistically significant improvements in both groups but the improvements in active ROM and surface EMG potentials were significantly greater in the EMG group at the end of the treatment. The study demonstrates the potential benefits of the EMG Biofeedback in conjunction with neurophysiological rehabilitation techniques to maximize the hand functions.

5. The study done by Wang [30] etal in 2002 examines the FES applied on patients with hemiplegia for the purpose of upper limb motor recovery and increasing shoulder ROM. the experimental group received FES on supraspinatus and posterior deltoid for 6-hr a day for 6 week. The experimental group with sub-acute hemiplegia showed significant improvements in motor recovery as indicated by Fugl- Meyer score compared with the control group. it was not found to be effective in increasing the ROM of the shoulder joint.

6. A study done by Langhammer [31]et al in 2000 compares between Bobath and MRP in outcomes after acute stroke variables being length of stay (LOS), Barthel Index and MAS and it was found that motor improvement was slightly better in MRP group. The two groups improved in ADL and the differences were non-significant. However women treated by MRP group improved in ADL more than the women in

Bobath. The patients treated with MRP stayed fewer days in Hospital than those treated according to Bobath.

7. The study done by Alexander [32]et al in 2000 implemented the CIMT within 2 weeks after stroke and whether it is more effective than the traditional upper limb therapies in this period. After completing the 14-day treatment it was seen that CIMT was feasible in acute stroke and it was associated with less arm impairment at the end of the treatment. A long follow up is needed to see its long-term effect and its superiority on other therapies.

8. Joanna Powell [33]et al in 1999 investigated the effect of electrical stimulation (ES) of the wrist extensors on impairments of wrist function and on upper limb disability in patients after acute stroke. The ES of wrist extensors was given 3 times 30 minutes daily for 8 weeks. The isometric strength and ARA test was assessed. They concluded that ES of the wrist extensors enhance recovery of isometric wrist extensor strength in patients after acute stroke. Upper limb disability was reduced after 8 weeks of ES therapy, with benefits most apparent in those with some residual motor function at the wrist. However it is not clear how long the improvements in upper limb disability are maintained after ES is discontinued.

9. Sarah [34]et al in 1999 demonstrates the application of CIMT with an individual with upper limb hemiparesis within 4 months of stroke. The patient's less involved hand was constrained in a mitten so that she could not use the hand during walking hours except during

bathing and toileting and she was supervised for 6 hrs while performing tasks using the paretic upper limb. Following 2-week treatment, the patient's motor abilities improved and she was able to move out of the flexion synergy into extension.

10. Butefisch [35]et al in 1995 studies the effect of a standardized training on movements of the affected hand. The training consisted of repetitive hand and finger flexions and extensions against various loads and was carried out twice daily during 15 min periods. Grip strength, peak force of isometric hand extensions, peak acceleration of isotonic hand extensions improved significantly during the training period. In contrast to this, other group received therapeutic strategies following the Bobath concept aiming at reducing enhanced muscle tone without reinforcing the activity in centrally paretic distal muscle groups directly but experienced no significant improvement in the motor capacity of the hand. Therefore the results in the study emphasize the importance of frequent movement repetition for the motor rehabilitation of the centrally paretic hand and challenge traditional physiotherapeutic strategies that focus on spasticity reduction instead of early initiation of active movements.

11. Kraft [36]et al in 1992 evaluated functional improvement in the upper limb functions of chronic stroke patients in groups who received NMES combined with voluntary contractions for wrist extensors, EMG Stimulation for wrist extensors, PNF and no treatment. The subjects were evaluated by Fugl- Meyer motor recovery test and grip strength. The FM scores of subjects receiving PNF improved 18%, NMES improved 25%,

EMG Stimulation improved 42% and the grip strength was also maintained but the control group showed no such improvement even over 3 and 9 month follow up.

12. In a study done by Wagenaar [37]et al in 1990 compares functional recovery in stroke patients through Bobath and Brunnstrom in an alternating treatment design (B-C-B-C). The recovery was assessed every week using BI and the ARA test. The results showed no differences in the efficacy between "neurological" exercise therapies.

13. In a study done by Jongbloed [38]et al in 1989, the two occupational therapy approaches were compared on their effectiveness in treating sub-acute stroke patients. First the functional training based on compensation, adaptation, some physical functional training and splinting and the other is the sensori-motor integrated approach, which combines sensorimotor theories by Bobath, Rood and Ayres. The subjects were evaluated on self-care, ADL and mobility. No significant differences in the functional outcome were identified.

14. A study done by Basmajian [39]et al in 1987 compares between Bobath and Integrated Behavior-Physical therapy including EMGBF in treatment of upper limb functions after stroke suggested that the two approaches are comparable in getting the functional recovery. This study result of "hands-on" versus "hands-off" therapy does not advocate dropping one therapy for another.

15. Ince et al in 1987 [40]did a study to difference in recovery of function following stroke between patients who receive EMG biofeedback to their upper limb as part of their total rehabilitation program and patients who receive only traditional rehabilitation therapies. After 3 months then the patients were re-evaluated and control group had biofeedback added to their program. After end of second 3-month period all assessments were performed again. Data indicate that stroke patients who have biofeedback as part of their rehabilitation program improve far more in regaining activity of the involved musculature and in functional use of that extremity than patients receiving only traditional rehabilitation program.

16. A study by Dickstein [41]**et al in 1986** compared the efficacy of three exercise approaches in stroke rehabilitation namely traditional exercises and functional activities (conventional group), PNF techniques and Bobath approach. The improvement of each patient was evaluated after six weeks of treatment in terms of ADL (BI), muscle tone, muscle strength and ROM and changes in patient's ambulatory status. No substantiate advantage could be attributed to any one of the three therapeutic approaches.

17. In a study done by Lord and Hall [42]**in 1986** comparison of traditional functional retraining (TFR) with neuromuscular retraining techniques (NRT) after stroke the results showed that difference in self-feeding with its greater independence in NRT group was found otherwise there were no statistically significant differences in skill levels. It was noted that rehabilitation hospitalization was significantly longer in NRT

group.

20. Logigian [43]et al in 1983 compares Bobath with traditional PT in a clinical trial; for stroke patients in which BI and MMT were administered at admission and discharge both facilitation and traditional exercise therapies improved functional and motor performance but there were no significant differences in these approaches.Bowman [44]et al in 1979 combined positional feedback and electrical stimulation (PFES) for facilitating the wrist extension in stroke patients. The control group received the conventional treatment and the study group received the PFES unvarying addition to conventional treatment. At the end of 4 week treatment, the patients made 200% improvements in ROM over their starting levels while controls made a 50% increase.

21. In a study done by Stern [51]et al in 1970 a group of patients receiving comprehensive treatment including neuromuscular facilitation techniques of Knott and Voss (PNF) and Brunnstrom was compared with a control group obtaining a conventional PT program consisting of passive, assistive, active and progressive resisted exercises. No significant differences were found between groups using Motility index, Kenny rehabilitation self-care Evaluation and knee flexion and extension measurements.

RELATED LITERATURE

A **stroke**, previously known medically as a **cerebrovascular accident (CVA)**, is the rapidly developing loss of brain function(s) due to disturbance in the blood supply to the brain. This can be due to ischemia (lack of blood flow) caused by blockage (thrombosis, arterial embolism), or a hemorrhage (leakage of blood). As a result, the affected area of the brain is unable to function, leading to inability to move one or more limbs on one side of the body, inability to understand or formulate speech, or an inability to see one side of the visual field. A stroke is a medical emergency and can cause permanent neurological damage, complications, and even death. It is the leading cause of adult disability and it is the number two cause of death worldwide.

W.H.O.DEFINITION

The traditional definition of stroke, devised by the World Health Organization in the 1970s, is a "neurological deficit of cerebrovascular cause that persists beyond 24 hours or is interrupted by death within 24 hours". This definition was supposed to reflect the reversibility of tissue damage and was devised for the purpose, with the time frame of 24 hours being chosen arbitrarily.

CLASSIFICATION

Strokes can be classified into two major categories: ischemic and hemorrhagic.[7] Ischemic strokes are those that are caused by interruption of the blood supply, while hemorrhagic strokes are the ones which result

from rupture of a blood vessel or an abnormal vascular structure. About 87% of strokes are caused by ischemia, and the remainder by hemorrhage. Some hemorrhages develop inside areas of ischemia ("hemorrhagic transformation"). It is unknown how many hemorrhages actually start as ischemic stroke.

CAUSES

ISCHEMIC STROKE

Almost 90 percent of strokes are ischemic strokes. They occur when the arteries to your brain are narrowed or blocked, causing severely reduced blood flow (ischemia). Lack of blood flow deprives your brain cells of oxygen and nutrients, and cells may begin to die within minutes. The most common ischemic strokes are:

- **Thrombotic stroke:** This type of stroke occurs when a blood clot (thrombus) forms in one of the arteries that supply blood to your brain. A clot usually forms in areas damaged by atherosclerosis - a disease in which the arteries are clogged by fatty deposits (plaques).

- **Embolic stroke:** An embolic stroke occurs when a blood clot or other debris forms in a blood vessel away from your brain - commonly in your heart - and is swept through your bloodstream to lodge in narrower brain arteries. This type of blood clot is called an embolus. It's often caused by irregular beating in the heart's two upper chambers (atrial fibrillation).

HEMORRHAGIC STROKE

Hemorrhagic stroke occurs when a blood vessel in your brain leaks or ruptures. Brain haemorrhages can result from a number of conditions that affect your blood vessels, including uncontrolled high blood pressure (hypertension) and weak spots in your blood vessel walls (aneurysms). Types of hemorrhagic stroke:

- **Intracerebral haemorrhage:** In this type of stroke, a blood vessel in the brain bursts and spills into the surrounding brain tissue, damaging cells. Brain cells beyond the leak are deprived of blood and are also damaged. High blood pressure is the most common cause of this type of hemorrhagic stroke.

- **Subarachnoid haemorrhage:** In this type of stroke, bleeding starts in an artery on or near the surface of the brain and spills into the space between the surface of your brain and your skull. This bleeding is often signalled by a sudden, severe "thunderclap" headache.

TRANSIENT ISCHEMIC ATTACK (TIA)

A transient ischemic attack (TIA) — sometimes called a ministroke — is a brief episode of symptoms similar to those you'd have in a stroke. The cause of a transient ischemic attack is a temporary decrease in blood supply to part of your brain. Many TIAs last less than five minutes.

Like an ischemic stroke, a TIA occurs when a clot or debris blocks blood flow to part of your brain. But unlike a stroke, which involves a

more prolonged lack of blood supply and causes permanent tissue damage, a TIA doesn't leave lasting effects because the blockage is temporary.

REHABILITATION

Stroke rehabilitation is the process by which patients with disabling strokes undergo treatment to help them return to normal life as much as possible by regaining and relearning the skills of everyday living. It also aims to help the survivor understand and adapt to difficulties, prevent secondary complications and educate family members to play a supporting role.

A rehabilitation team is usually multidisciplinary as it involves staff with different skills working together to help the patient. These include nursing staff, physiotherapy, occupational therapy, speech and language therapy, and usually a physician trained in rehabilitation medicine. Some teams may also include psychologists, social workers, and pharmacists since at least one third of the patients manifest post stroke depression. Validated instruments such as the Barthel scale may be used to assess the likelihood of a stroke patient being able to manage at home with or without support subsequent to discharge from hospital.

For most stroke patients, physical therapy (PT) and occupational therapy (OT), speech-language pathology (SLP) are the cornerstones of the rehabilitation process. Often, assistive technology such as a wheelchair, walkers, canes, and orthosis may be beneficial. PT and OT have overlapping areas of working but their main attention fields are; PT involves re-learning functions as transferring, walking and other gross

motor functions. OT focusses on exercises and training to help relearn everyday activities known as the Activities of daily living (ADLs) such as eating, drinking, dressing, bathing, cooking, reading and writing, and toileting. Speech and language therapy is appropriate for patients with the speech production disorders: dysarthria and apraxia of speech, aphasia, cognitive-communication impairments and/or dysphagia (problems with swallowing).

DISABILITY AFTER STROKE

Exact estimate of disability following stroke are difficult since it depends on many factors- type of study, outcomes measures, time period during the recovery, severity and type of stroke and pre- & co-morbid conditions[1].Gresham et al [8] examined the IADL and the quality of life in stroke survivors by comparing with age matched controls. The stroke survivors were more limited in several areas including household activities, recreational activities, social interaction and public transportation usage, 75% of stroke patients (N= 292) were dependent in ADL at onset of stroke from which 20% were dependent before stroke. In a prospective study done by Wade et al [6] found that the incidence of total dependence in ADL decreased from 58% at first week to 9% at six months after an acute stroke. Dependency in ADL may vary by function making a summated ADL score less representative of limitations in individual activities. e.g. the dependence in more complex functions such as bathing is much greater than that in less complex activities such as grooming. Partial recovery in upper limb function does not usually translate into functional use. A large element of adaptation by the patient

to his disability does not necessarily reflect neuronal recovery. The lower extremity can however, function with less motor control than the upper extremity. Thus partial motor recovery in the lower extremity may permit many patients with stroke to ambulate independently although the pattern will not be "normal" in pattern or velocity. For any given patient, the process of disablement may be profound and complex so a broader prospective is needed. It is difficult to completely distinguish between recovery from impairments and recovery from disability[1].

SPONTANEOUS RECOVERY

In general the neurological recovery occurs in the first 1 to 3 months following stroke[1,3,4,6]. Spontaneous recovery of the upper limb after stroke was fastest in the first few weeks[3]. The best possible recovery was achieved by 80% of the patients within 3 weeks after stroke onset and by 95% within 9 weeks; in patients with mild upper extremity paresis function was achieved within 3 and 6 weeks respectively and in patients with severe upper extremity paresis within 6 and 11 weeks respectively. A valid prognosis of upper extremity function can be made within 3 and 6 weeks in patients with mild and severe upper extremity paresis respectively. Further recovery of upper extremity function should not be expected after 6 and 11 weeks respectively. **Bonita and Beaglehole[6]** assessed the natural history of motor recovery for patients with stroke and reported 88% of subjects had motor deficits and the proportion that had persistent motor deficits at 6 months post stroke had declined to 62% and the majority of these motor deficits were mild.

FACTORS INFLUENCING RECOVERY & FUNCTIONAL OUTCOME AFTER STROKE

Hypertension as a risk factor on admission has never favored any stroke type[14] & no specific guidelines are there to manage BP in acute phase. Hypertensive drugs may reduce the pressure dependent CBF to the ischemic penumbra or conversely post stroke hypertension may be deleterious and facilitate edema formation in the ischemic tissue.

Incontinence present between 7-10 days after stroke was important adverse prognostic factor for recovery of function.

Hemorrhagic or Infarct-hemorrhagic lesions have a better prognosis compared to ischemic ones due to better neurological recovery[15,16]. This is because the mechanisms for neurological deficit from hemorrhagic lesions may be caused by brain compression, as the hematoma resolves, neurological functions recover and the functional status improves. Severity of lesion – the time course of recovery and the outcomes of stroke seem determined not by the nature of the cerebrovascular injury but only by its initial severity. Stroke severity[14] affects the time required to obtain maximal recovery. Length of stay in a rehabilitation unit is directly related to the severity of paresis on admission[18].

Artery involved- There are specific deficits commonly associated with a middle cerebral artery (MCA) occlusion, which have been intimated as being associated with poor functional outcome from a stroke.

FACTORS INFLUENCING REHABILITATION OUTCOMES

Associated deficits- motor, sensory, psychological, behavioral, and perceptual- Clearly having identified neglect as a problem, the next step is to evaluate the efficacy of rehabilitation methods or treatments[2]. Hemi sensory loses were found predominantly in patients with poor functional results particularly those whose sensory deficit consisted of a combination of all three modalities examined (vibration, two point discrimination and visual field)[23]. Hyman found that feelings of stigma impair motivation and functional improvement. Stroke rehabilitation must aim not at the elimination of impairments but rather at the preparation of the patient for renewed social participation despite it.

Age is the important factor[6,11]. The aged patient may not be capable of learning the retraining programs or may be unable to adapt sufficiently to novel situations to compensate for reduced independence. In such a case realistic limits need to be planned in the patient's rehabilitation management. It was suggested that rehabilitative therapy should be concentrated less on physical function and more on cognitive ability. It is possible that the neurophysiologic or adaptive recovery is counterbalanced by a gradual deterioration in function associated with ageing.

Family support[11] – availability of family support and involvement in the rehabilitation process clearly predicts disposition. The majority of patients with supportive families were living outside institutions at follow-up and most frequently within the family unit. The therapeutic intervention specifically to enlist family support for the patient may significantly modify his ultimate disposition.

REHABILITATION AND OUTCOMES

Timing / Early vs. late/acute rehabilitation[25] - A specific intervention during the acute phase after improved motor recovery, this was apparent 1 year later. Part of the rehabilitation program should focus on the post-acute phase, which is when the patient and the family have had the time to consider the treatment priorities. The improvement in functional tasks can be attained with therapy[26] during the post-acute phase and the gains are maintained for at least 6 month following the intervention. Factors such as early onset of therapy, better education of staff members, better organization of stroke care and family participation may explain difference in better outcome of stroke rehabilitation ward. Treatment days, frequency of treatment, or amount of treatment without correction for duration of admission are only rough indicators for intensity of therapy.

Enhanced/focused rehabilitation[48] programs of focused stroke rehabilitation might improve functional performance for some patients who have sustained a stroke. Occupational Therapy is usually given to enhance recovery and some studies have shown that a specific rehabilitation program can increase the rate of arm motor recovery. Secondly, the relation between impairment of limb use and functional use of that arm is not linear or even similar between the limbs; people can walk on minimally recovered legs but cannot use an arm unless it is well recovered. Thirdly, the rate of recovery may vary between limbs. The most important issue to address is whether therapy that is aimed primarily at reducing impairment is any more or less effective or efficient than therapy aimed primarily at improvement of function by any means usually practice. This difference between therapies can be difficult to

define but conceptually the difference is important. The evidence from studies on mobility supports a task-oriented approach. Improvement in motor function and dexterity of the arm with the leg rehabilitation training may be due to the facilitation of arm function during gait training.

Specialized rehabilitation centers even patients with poor prognostic signs frequently improved with short term, intensive multi-disciplinary treatment provided in a regional stroke rehabilitation unit. The easiest way to improve outcome is to begin rehabilitation in the acute hospital within first 2-3 days after the onset of the so and/or to refer patients to regional rehabilitation centers when they are medically stable[21]. Sensitivity analysis revealed that the organizational setting in which the Occupational Therapy was delivered was an important confounding factor. Studies in which the experimental and control conditions were applied in different settings resulted in smaller overall treatment effect than studies carried out in one setting. In number of critical reviews it has been suggested that an early start of intensive rehabilitation may be an important part of expert care in stroke patients[19].

BASIC CONCEPTS OF PNF & MRP TECHNIQUES[52,53,54,55]

Proprioceptive Neuromuscular Facilitation (PNF) is more than a technique; it is a philosophy of treatment. The basis of this philosophy is the idea that all human beings, including those with disabilities have untapped existing potential. In keeping with this philosophy, there are certain principles that are basic to PNF. (1) Treatment approach is always positive, reinforcing and using that, which the patient can do, on a physical and psychological level. (2) The primary goal of all treatment is

to help patients achieve their highest level of function. (3) PNF is an integrated approach: each treatment is directed at a total human being, not at a specific problem or body segment.

The patterns of motion for PNF are mass movement patterns. Mass movement is a characteristic of normal motor activity and is in keeping with Beevor's axiom that the brain nothing of individual muscle action but knows only of movement. Mass movement that is to be means of placing a specific demand must be a specific combination of motion that is optimum for the specific sequence of muscles primarily responsible for the movement and it must allow these muscles to contribute their components of action consistently. The movements are spiral and diagonal in character and closely resemble the movements used in sports and in work activities. This character is in keeping with the spiral and rotatory characteristics of the skeletal system of bones and joints and the ligamentous structures. The motion is in harmony with topographical alignment of the muscle from origin and insertion and with the structural characteristics of the individual muscle. There are two diagonals each is antagonistic to each other one has flexion and the other has extension as a major component. In the motion the components move toward and across the midline or away and across the midline rotation.

There are basic certain procedures that are considered basic to the approach. These basic procedures become a part of the treatment of every patient insofar as his medical condition permits their use. In the broader sense, the basic procedures may be used with or without the patient's complete cooperation, if the patient moves; the physical therapist's maneuvers guide and influence the patient's response. The procedures have to do with how the therapist approaches the patient, how manual

concepts are made effective, how the therapist communicates with the patient, how the therapist opposes the patient's effort and at the same time becomes a part of his effort, how coordination is brought about through timing, and how reinforcement is used to increase response and to circumvent fatigue.

There is a battery of specific techniques, which are, for the most part dependent upon the patient's cooperation and his voluntary effort. Whenever and wherever possible the patient's voluntary effort is used to promote volitional control of movement and posture. The specific techniques are rarely used singly. The diversity of patients' problems, the degree of involvement and the presence of pain are the factors that influence selection.

The Motor Relearning Programme (MRP) emphasizes specific training of motor control in everyday activities commenced as soon as the person's medical condition is stable. It involves specific training of muscle activity and functional movement of the affected limbs and the prevention of the compensatory activity by either the affected or the intact side. The techniques used require the patient to concentrate and to use his cognitive abilities.

The Programme assumes that the brain's capacity for recovery is dynamic and is capable of reorganization and adaptation and functional training may itself be remedial. The training of the motor control is based on an understanding of the kinetics and kinematics of normal movement, motor control processes and motor learning.

The emphasis of this new model is on the practice of specific motor

tasks, the training of controlled muscle action and control over the movement components of these tasks. Rehabilitation will therefore involve relearning of the real-life activities, which have meaning for the patients and not facilitation or practice of non-specific exercises.

Basically learning a motor skill is dependent on four factors- elimination of unnecessary muscle activity, feedback, practice and interrelationship between postural adjustment and movement. There is a major shift from exercises or facilitation therapy to the relearning of motor control.

METHODOLOGY

PROGRAM DESIGN

SAMPLING:

30 stroke patients were recruited mainly from Annai JKK Sampoorani Ammal Trust Hospital, Komarapalayam. Convenient sampling was taken to compare the effectiveness of the MRP and PNF techniques on the improvement in upper limb functions.

Population: Both male and female patients were taken for the study.

The subjects met the following criteria:

INCLUSION CRITERIA

1. First ever stroke involving an ischemic infarct in the territory of the middle cerebral artery (MCA) as revealed by CAT or MRI scanning;
2. Impaired motor function of upper extremity;
3. Informed consent to participate.

EXCLUSION CRITERIA

1. No complicated medical history such as cardiac, pulmonary, orthopedic or other neurological disorder unrelated to stroke;
2. No deficit in conscience, orientation, memory, understanding and no sensory aphasia.

STUDY DESIGN

The present study is an experimental study, with 30 subjects randomly assigned to two experimental groups (=15 each) - Group I that is treated with the MRP technique and Group II that is treated with the PNF technique. The two subject group is compared on the improvement in upper limb functions after the completion of the 3 weeks of the treatment.

INSTRUMENTATION

The scales used in the study are FIM and MAS.

MAS included the sub-sections on Upper Extremity Functions as

Upper arm functions - 6-point scale
Hand Movements - 6-point scale
Advanced Hand Movements - 6-point scale

Scores were added for all 3sub-categories and total was presented. The maximum total score what subject could achieve was 18 (=6X3) and minimum can be 0(zero).

Similarly FIM included the sub-sections on Self-care as Feeding, Grooming, Bathing, Dressing (upper), Dressing (lower) and Toileting.

All the categories had grading from complete independence (7) to total dependence (1) making it 7-point scale. Scores were added for all 6 sub-categories and total was presented. The maximum total score that subject could achieve was 42(=7X6) and minimum is 6(=1X6).

Validity and reliability of scales used in study:

The functional independence measure (FIM) is an often-used instrument for the assessment of disability. The instrument describes the person's need for assistance to accomplish daily activities to predict burden of care or length of stay and to measure outcome of rehabilitation. The structure and stability of FIM was studied and it was concluded that functions the same way at admission and discharge and has extremely small standard errors[56]. A study on the reliability of FIM concluded that it has high inter-rater agreement and improved reproducibility of the FIM assessments might be achieved by clarifying the levels and content of the seven-step scale and a more structured assessment procedure with stringent and demarcated questions and ADL situations[57]. A study on functional scales concluded that it is easy to use but require some training on the part of the interviewer[58]. A study checks the concurrent validity and inter-rater reliability for MAS and concluded that it is a reliable and validated test of motor function in stroke patients. The reliability coefficients for the total and sub-scores of the items were high and significant[59]. A study comments on the sensitivity of MAS in assessing recovery of upper limb functions in stroke inpatients concluding that indices of change are moderate and change of disability is closely related to change at the impairment level in relation to arm function[60]. A study determines the inter-rater reliability of modified Ashworth Scale and found it to be good but encourages further trials[61].

PROCEDURE

All patients were assessed by a neurologist confirming the diagnosis as ‘stroke’ within first 48 hours of onset. The subjects were randomly assigned on the basis of their order of recruitment in the study, for two protocols of treatment consisting of MRP and PNF techniques and the initial detailed neurological assessment including the tonal assessment on Modified Ashworths Scale was done. The baseline and outcome measures of ADL were taken on the Motor Assessment Scale (MAS) using the 3 sub-sections on Upper Extremity Functions and the Functional Independence Measure (FIM) using sub-sections on self-care.

PROTOCOLS

Written signed informed consent was obtained and patients were sufficiently motivated to participate in the research protocol. After taking the baseline scores on FIM and MAS scales the treatment to groups I and II was given on basis of the techniques of MRP and PNF (Appendix B) for the upper limb respectively. All the subjects were given the treatment for the lower limb on the basis of Bobath for three consecutive weeks, five days a week making it 15 sessions in total. The time duration was variable according to the fatigue level of the patient and was seen to increase from an initial of 10 minutes to a maximum of 40 mins for the upper limb. The researcher herself assessed all outcome variables weekly. The repeated measurements were taken on MAS and FIM scales. The final outcome was measured at the end of 3rd week after completion of the 15 sessions. The patient for the purpose of assessment performed all the activities on the MAS and FIM in presence of the researcher.

PATIENT RECEIVING PNF PROTOCOL

PATIENT RECEIVING MRP PROTOCOL

DATA ANALYSIS & RESULTS

DATA ANALYSIS

Inferential and descriptive statistics were used to analyze the results. The unpaired t-test was used to study the significant differences between groups. The repeated measure ANOVA with post-hoc analysis on Bonferroni was used to see the within group differences. The data were analyzed under the supervision of an experienced and qualified statistician using STATA (8.0 versions).

RESULTS

Subject Information

Age Distribution

Group I contains 15 patients age (in yrs.) ranging from 38-80. The mean is 59.26 and SD= 13.87 Group II contains 15 patients age (in yrs.) ranging from 17-80. The mean is 61.53and SD= 14.46. There was no significant difference for age distribution between the two groups. (p = 0.6648)

Sex Distribution

Group I contains 15 patients males = 6 and females = 9.

Group II contains 15 patients males = 10 and females = 5.

There was no significant difference for sex distribution between the two groups.

p = .143)

Side Distribution (Involved)

Group I contains 15 patients left = 7 and right = 8.

Group II contains 15 patients left = 4 and right = 11.

There was no significant difference for involved side distribution between the two groups. (p = 0.256)

FIM Scale Results

Between group analysis

A comparison was made between both the groups for total at 0,1,2,3 weeks. The results are as follows:

Total

0^{th}

Group I -> mean = 6.73, SD = 1.53

Group II -> mean = 7.66, SD= 1.75

The baseline score has no significant difference (p=1.54)

1^{st}

Group I -> mean = 10.26, SD = 4.25

Group II -> mean = 12.20, SD= 4.53

Scores after 1^{st} week of treatment has no significant difference (p=1.20).

2^{nd}

Group I -> mean = 12.93, SD = 5.17

Group II -> mean = 16.00, SD= 4.65

Scores after 2^{nd} week of treatment has no significant difference (p=1.70).

3rd

Group I -> mean = 17.20, SD = 6.23

Group II -> mean = 21.60, SD= 6.92

Scores after 3rd week of treatment has no significant difference (p=1.82).

A comparison was made between both the groups for feeding at 0,1,2,3 weeks. The results are as follows:

Feeding

0th

Group I -> mean = 1.06, SD = .25

Group II -> mean = 1.00, SD= 0.00

The baseline score has no significant difference (p=1.00)

1st

Group I -> mean = 1.40, SD = 0.50

Group II -> mean = 1.53, SD= 0.63

Scores after 1st week of treatment has no significant difference (p=0.63).

2nd

Group I -> mean = 1.93, SD = 1.09

Group II -> mean = 2.13, SD= 0.99

Scores after 2nd week of treatment has no significant difference (p=0.52).

3rd

Group I -> mean = 2.46, SD = 1.30

Group II -> mean = 2.86, SD= 1.06

Scores after 3rd week of treatment has no significant difference (p=0.92).

A comparison was made between both the groups for grooming at 0,1,2,3 weeks. The results are as follows:

Grooming

0^{th}

Group I -> mean = 1.06, SD = 0.25

Group II -> mean = 1.00, SD= 0.00

The baseline score has no significant difference (p=1.00)

1^{st}

Group I -> mean = 1.66, SD = 0.89

Group II -> mean = 1.80, SD= 0.77

Scores after 1^{st} week of treatment has no significant difference (p=0.43).

2^{nd}

Group I -> mean = 1.86, SD = 0.99

Group II -> mean = 2.33, SD= 0.72

Scores after 2^{nd} week of treatment has no significant difference (p=1.47).

3^{rd}

Group I -> mean = 2.60, SD = 1.45

Group II -> mean = 3.40, SD= 1.24

Scores after 3^{rd} week of treatment has no significant difference (p=1.62).

A comparison was made between both the groups for bathing at 0,1,2,3 weeks. The results are as follows:

Bathing

0^{th}

Group I -> mean = 1.06, SD = 0.25

Group II -> mean = 1.20, SD= 0.41

The baseline score has no significant difference (p=1.05)

1^{st}

Group I -> mean = 1.66, SD = 0.89

Group II -> mean = 1.93, SD= 1.16

Scores after 1^{st} week of treatment has no significant difference (p=0.70).

2^{nd}

Group I -> mean = 2.00, SD = 1.19

Group II -> mean = 2.46, SD= 1.06

Scores after 2^{nd} week of treatment has no significant difference (p=1.13).

3^{rd}

Group I -> mean = 2.73, SD = 1.53

Group II -> mean = 3.46, SD= 1.64

Scores after 3^{rd} week of treatment has no significant difference (p=1.26).

A comparison was made between both the groups for dressing (upper) at 0,1,2,3 weeks. The results are as follows:

Dressing (upper)

0^{th}

Group I -> mean = 1.06, SD = 0.25

Group II -> mean = 1.46, SD= 0.63

The baseline score has significant difference (p=2.24)

1st

Group I -> mean = 1.80, SD = 0.56

Group II -> mean = 2.26, SD= 1.09

Scores after 1st week of treatment has no significant difference (p=1.46).

2nd

Group I -> mean = 2.33, SD = 0.61

Group II -> mean = 2.86, SD= 0.91

Scores after 2nd week of treatment has no significant difference (p=1.87).

3rd

Group I -> mean = 2.93, SD = 0.59

Group II -> mean = 3.80, SD= 1.14

Scores after 3rd week of treatment has no significant difference (p=2.60).

A comparison was made between both the groups for dressing (lower) at 0,1,2,3 weeks. The results are as follows:

Dressing (lower)

0th

Group I -> mean = 1.06, SD = 0.25

Group II -> mean = 1.40, SD= 0.50

The baseline score has significant difference (p=2.26)

1st

Group I -> mean = 1.60, SD = 0.50

Group II -> mean = 1.93, SD= 0.88

Scores after 1st week of treatment has no significant difference (p=1.26).

2nd

Group I -> mean = 2.06, SD = 0.45

Group II -> mean = 2.73, SD= 0.88

Scores after 2nd week of treatment has no significant difference (p=2.59).

3rd

Group I -> mean = 3.00, SD = 0.65

Group II -> mean = 3.53, SD= 1.24

Scores after 3rd week of treatment has no significant difference (p=1.46).

A comparison was made between both the groups for toileting at 0,1,2,3 weeks. The results are as follows:

Toileting

0th

Group I -> mean = 1.40, SD = 0.50

Group II -> mean = 1.60, SD= 0.50

The baseline score has no significant difference (p=1.08)

1st

Group I -> mean = 2.13, SD = 1.40

Group II -> mean = 2.73, SD= 1.16

Scores after 1st week of treatment has no significant difference (p=1.27).

2nd

Group I -> mean = 2.73, SD = 1.43

Group II -> mean = 3.46, SD= 1.30

Scores after 2nd week of treatment has no significant difference (p=1.46).

3rd

Group I -> mean = 3.46, SD = 1.64

Group II -> mean = 4.53, SD= 1.64

Scores after 3rd week of treatment has no significant difference (p=1.77).

Within Group analysis

A comparison was made within the individual groups for total for week 0-1, 1-2, 2-3 and 0-3.

Total

0 - 1

Group I – (p= 0.01) significant

Group II – (p= 0.00) significant

1 – 2

Group I – (p= 0.00) significant

Group II – (p= 0.00) significant

2 – 3

Group I – (p= 0.00) significant

Group II – (p= 0.00) significant

0 – 3

Group I – (p= 0.00) significant

Group II – (p= 0.00) significant

A comparison was made within the individual groups for feeding for week 0-1, 1-2, 2-3 and 0-3.

Feeding

0 - 1

Group I – (p= 0.11) non-significant

Group II – (p= 0.03) significant

1 – 2

Group I – (p= 0.08) non-significant

Group II – (p= 0.01) significant

2 – 3

Group I – (p= 0.00) significant

Group II – (p= 0.00) significant

0 – 3

Group I – (p= 0.00) significant

Group II – (p= 0.00) significant

A comparison was made within the individual groups for grooming for week 0-1, 1-2, 2-3 and 0-3.

Grooming

0 - 1

Group I – (p= 0.08) non-significant

Group II – (p= 0.00) significant

1 – 2

Group I – (p= 0.49) non-significant

Group II – (p= 0.00) significant

2 – 3

Group I – (p= 0.00) significant

Group II – (p= 0.00) significant

0 – 3

Group I – (p= 0.00) significant

Group II – (p= 0.00) significant

A comparison was made within the individual groups for bathing for week 0-1, 1-2, 2-3 and 0-3.

Bathing

0 - 1

Group I – (p= 0.08) non-significant

Group II – (p= 0.03) significant

1 – 2

Group I – (p= 0.57) non-significant

Group II – (p= 0.03) significant

2 – 3

Group I – (p= 0.00) significant

Group II – (p= 0.00) significant

0 – 3

Group I – (p= 0.00) significant

Group II – (p= 0.00) significant

A comparison was made within the individual groups for dressing (upper) for week 0-1, 1-2, 2-3 and 0-3.

Dressing (upper)

0 - 1

Group I – (p= 0.00) significant

Group II – (p= 0.00) significant

1 – 2

Group I – (p= 0.00) significant

Group II – (p= 0.00) significant

2 – 3

Group I – (p= 0.00) significant

Group II – (p= 0.00) significant

0 – 3

Group I – (p= 0.00) significant

Group II – (p= 0.00) significant

A comparison was made within the individual groups for dressing (lower) for week 0-1, 1-2, 2-3 and 0-3.

Dressing (lower)

0 - 1

Group I – (p= 0.00) significant

Group II – (p= 0.00) significant

1 – 2

Group I – (p= 0.24) non-significant

Group II – (p= 0.08) non-significant

2 – 3

Group I – (p= 0.00) significant

Group II – (p= 0.00) significant

0 – 3

Group I – (p= 0.00) significant

Group II – (p= 0.00) significant

A comparison was made within the individual groups for toileting for week 0-1, 1-2, 2-3 and 0-3.

Toileting

0 - 1

Group I – (p= 0.06) non-significant

Group II – (p= 0.00) significant

1 – 2

Group I – (p= 0.01) significant

Group II – (p= 0.00) significant

2 – 3

Group I – (p= 0.00) significant

Group II – (p= 0.00) significant

0 – 3

Group I – (p= 0.00) significant

Group II – (p= 0.00) significant

MAS Scale Results

Between group analysis

A comparison was made between both the groups for total at 0,1,2,3 weeks. The results are as follows:

Total

0^{th}

Group I -> mean = 1.13, SD = 1.76

Group II -> mean = 1.66, SD= 1.49

The baseline score has no significant difference (p=0.81)

1^{st}

Group I -> mean = 2.80, SD = 2.17

Group II -> mean = 4.06, SD= 1.98

Scores after 1^{st} week of treatment has no significant difference (p=0.94).

2^{nd}

Group I -> mean = 5.60, SD = 3.06

Group II -> mean = 7.60, SD= 2.87

Scores after 2^{nd} week of treatment has no significant difference (p=0.96).

3rd

Group I -> mean = 8.93, SD = 3.39

Group II -> mean = 10.40, SD= 3.37

Scores after 3rd week of treatment has no significant difference (p=0.87).

A comparison was made between both the groups for upper arm at 0,1,2,3 weeks. The results are as follows:

Upper Arm movements

0th

Group I -> mean = 0.6, SD = 0.91

Group II -> mean = 1.00, SD= 0.84

The baseline score has no significant difference (p=0.88)

1st

Group I -> mean = 1.53, SD = 1.35

Group II -> mean = 2.33, SD= 1.17

Scores after 1st week of treatment has no significant difference (p=0.95).

2nd

Group I -> mean = 2.66, SD = 1.23

Group II -> mean = 3.40, SD= 1.35

Scores after 2nd week of treatment has no significant difference (p=0.93).

3rd

Group I -> mean = 3.86, SD = 1.35

Group II -> mean = 4.33, SD= 1.29

Scores after 3rd week of treatment has no significant difference (p=0.82).

A comparison was made between both the groups for hand movements at 0,1,2,3 weeks. The results are as follows:

Hand movements

0^{th}

Group I -> mean = 0.53, SD = 0.99

Group II -> mean = 0.60, SD= 0.91

The baseline score has no significant difference (p=0.57)

1^{st}

Group I -> mean = 1.26, SD = 1.03

Group II -> mean = 1.46, SD= 0.83

Scores after 1^{st} week of treatment has no significant difference (p=0.71).

2^{nd}

Group I -> mean = 2.33, SD = 1.49

Group II -> mean = 2.86, SD= 1.06

Scores after 2^{nd} week of treatment has no significant difference (p=0.86).

3^{rd}

Group I -> mean = 3.53, SD = 1.30

Group II -> mean = 4.00, SD= 1.00

Scores after 3^{rd} week of treatment has no significant difference (p=0.85).

A comparison was made between both the groups for advanced hand movements at 0,1,2,3 weeks. The results are as follows:

Advance Hand movements

0^{th}

Group I -> mean = 0.00, SD = 0.00

Group II -> mean = 0.06, SD= 0.25

The baseline score has no significant difference (p=0.83)

1^{st}

Group I -> mean = 0.00, SD = 0.00

Group II -> mean = 0.26, SD= 0.59

Scores after 1^{st} week of treatment has no significant difference (p=0.95).

2^{nd}

Group I -> mean = 0.60, SD =0.50

Group II -> mean = 1.33, SD= 1.11

Scores after 2^{nd} week of treatment has no significant difference (p=0.98).

3^{rd}

Group I -> mean = 1.53, SD = 0.91

Group II -> mean = 2.06, SD= 1.43

Scores after 3^{rd} week of treatment has no significant difference (p=0.88).

Within Group analysis

A comparison was made within the individual groups for total for week 0-1, 1-2, 2-3 and 0-3.

Total

0 - 1

Group I – (p= 0.00) significant

Group II – (p= 0.00) significant

1 – 2

Group I – (p= 0.01) significant

Group II – (p= 0.00) significant

2 – 3

Group I – (p= 0.02) significant

Group II – (p= 0.02) significant

0 – 3

Group I – (p= 0.00) significant

Group II – (p= 0.00) significant

A comparison was made within the individual groups for upper arm movements for week 0-1, 1-2, 2-3 and 0-3.

Upper Arm movements

0 - 1

Group I – (p= 0.00) significant

Group II – (p= 0.00) significant

1 – 2

Group I – (p= 0.05) significant

Group II – (p= 0.00) significant

2 – 3

Group I – (p= 0.07) non-significant

Group II – (p= 0.08) non-significant

0 – 3

Group I – (p= 0.00) significant

Group II – (p= 0.00) significant

A comparison was made within the individual groups for hand movements for week 0-1, 1-2, 2-3 and 0-3.

Hand movements

0 - 1

Group I – (p= 0.01) significant

Group II – (p= 0.00) significant

1 – 2

Group I – (p= 0.07) non-significant

Group II – (p= 0.00) significant

2 – 3

Group I – (p= 0.04) significant

Group II – (p= 0.00) significant

0 – 3

Group I – (p= 0.25) non-significant

Group II – (p= 0.00) significant

A comparison was made within the individual groups for advance hand movements for week 0-1, 1-2, 2-3 and 0-3.

Advance Hand movements

0 - 1

Group I – (p= 0.00) significant

Group II – (p= 1.00) non-significant

1 – 2

Group I – (p= 0.00) significant

Group II – (p= 0.04) significant

2 – 3

Group I – (p= 0.02) significant

Group II – (p= 0.81) non-significant

0 – 3

Group I – (p= 0.00) significant

Group II – (p= 0.00) significant

Table 1: Subject information

Character	Description	Group I	Group II
Age (in yrs.)	Mean (SD)	59.26 (13.87)	61.53 (14.46)
	Male	6	10
	Female	9	5
	Right	8	11
	Left	7	4

Table 2 : FIM between groups

Sub-scale	Observation	Group I		Group II		t-value	p-value	Result
		Mean	SD	Mean	SD			
Feeding	**0**	1.06	.25	1	0	0.32	1.00	NS
	1	1.4	.50	1.53	.63	0.73	0.63	NS
	2	1.93	1.09	2.13	.99	0.69	0.52	NS
	3	2.46	1.30	2.86	1.06	0.81	0.92	NS
Grooming	**0**	1.06	.25	1	0	0.32	1.00	NS
	1	1.66	.89	1.8	.77	0.66	0.43	NS
	2	1.86	.99	2.33	.72	0.92	1.47	NS
	3	2.6	1.45	3.4	1.24	0.94	1.62	NS
Bathing	**0**	1.06	.25	1.2	.41	0.29	1.05	NS
	1	1.66	.89	1.93	1.16	0.75	0.70	NS
	2	2	1.19	2.46	1.06	0.86	1.13	NS
	3	2.73	1.53	3.46	1.64	0.89	1.26	NS
Dressing (u)	**0**	1.06	.25	1.46	.63	0.03	2.24	*
	1	1.8	.56	2.26	1.09	0.92	1.46	NS
	2	2.33	.61	2.86	.91	0.96	1.87	NS
	3	2.93	.59	3.8	1.14	0.99	2.60	NS
Dressing (L)	**0**	1.06	.25	1.4	.50	0.03	2.26	*
	1	1.6	.50	1.93	.88	0.89	1.26	NS
	2	2.06	.45	2.73	.88	0.99	2.59	NS
	3	3	.65	3.53	1.24	0.92	1.46	NS
Toileting	**0**	1.4	.50	1.6	.50	0.28	1.08	NS
	1	2.13	1.40	2.73	1.16	0.89	1.27	NS
	2	2.73	1.43	3.46	1.30	0.92	1.46	NS
	3	3.46	1.64	4.53	1.64	0.95	1.77	NS
Total	**0**	6.73	1.53	7.66	1.75	0.13	1.54	NS
	1	10.26	4.25	12.2	4.53	0.88	1.20	NS
	2	12.93	5.17	16	4.65	0.95	1.70	NS
	3	17.2	6.23	21.6	6.92	0.96	1.82	NS

* - Significant at < 0.05

NS - non significant

Table 3 :MAS between groups

Sub-scale	Obser-vation	Group I		Group II		t-value	p-value	Results
		Mean	SD	Mean	SD			
Upper arm	**0**	.6	.91	1	.84	1.24	0.88	NS
	1	1.53	1.35	2.33	1.17	1.72	0.95	NS
	2	2.66	1.23	3.4	1.35	1.55	0.93	NS
	3	3.86	1.35	4.33	1.29	0.96	0.82	NS
Hand	**0**	.53	.99	.6	.91	0.19	0.57	NS
	1	1.26	1.03	1.46	.83	0.58	0.71	NS
	2	2.33	1.49	2.86	1.06	1.12	0.86	NS
	3	3.53	1.30	4	1	1.10	0.85	NS
Advanced hand	**0**	0	0	.06	.25	1.00	0.83	NS
	1	0	0	.26	.59	1.73	0.95	NS
	2	.6	.50	1.33	1.11	2.32	0.98	NS
	3	1.53	.91	2.06	1.43	1.21	0.88	NS
Total	**0**	1.13	1.76	1.66	1.49	0.89	0.81	NS
	1	2.8	2.17	4.06	1.98	1.66	0.94	NS
	2	5.6	3.06	7.60	2.87	1.84	0.96	NS
	3	8.93	3.39	10.40	3.37	1.18	0.87	NS

* - Significant at < 0.05

NS- non significant

Table 4 :FIM Within Group I and Group II

Scale	Obser-vation	Group I			Group II		
		f-value	p-value	Result	f-value	p-value	Result
Feeding	**0-1**	0.333	0.11	NS	0.533	0.03	*
	1-2	0.533	0.08	NS	0.600	0.01	*
	2-3	0.533	0.00	*	0.733	0.00	*
	0-3	1.4	0.00	*	1.867	0.00	*
Grooming	**0-1**	0.600	0.08	NS	0.800	0.00	*
	1-2	0.200	0.49	NS	0.533	0.00	*
	2-3	0.733	0.00	*	1.067	0.00	*
	0-3	1.533	0.00	*	2.400	0.00	*
Bathing	**0-1**	0.600	0.08	NS	0.733	0.03	*
	1-2	0.333	0.57	NS	0.533	0.03	*
	2-3	0.733	0.00	*	1.000	0.00	*
	0-3	1.667	0.00	*	2.267	0.00	*
Dressing(U)	**0-1**	0.733	0.00	*	0.800	0.00	*
	1-2	0.533	0.00	*	0.600	0.00	*
	2-3	0.600	0.00	*	0.933	0.00	*
	0-3	1.867	0.00	*	2.333	0.00	*
Dressing(L)	**0-1**	0.733	0.00	*	0.867	0.00	*
	1-2	0.267	0.24	NS	0.467	0.08	NS
	2-3	0.867	0.00	*	1.067	0.00	*
	0-3	1.867	0.00	*	2.400	0.00	*
Toileting	**0-1**	0.733	0.06	NS	1.133	0.00	*
	1-2	0.600	0.01	*	0.733	0.00	*
	2-3	0.733	0.00	*	1.067	0.00	*
	0-3	2.067	0.00	*	2.933	0.00	*
Total	**0-1**	3.533	0.01	*	4.533	0.00	*
	1-2	0.444	0.00	*	3.800	0.00	*
	2-3	4.267	0.00	*	5.600	0.00	*
	0-3	10.467	0.00	*	13.933	0.00	*

* - Significant at < 0.05

NS- non significant

Table 5: MAS Within Group I and Group II

Scale	Obser-vation	Group I			Group II		
		f-value	p-value	Result	f-value	p-value	Result
Upper arm	**0-1**	0.93	0.00	*	1.33	0.00	*
	1-2	1.13	0.05	NS	1.06	0.00	*
	2-3	1.20	0.07	NS	0.93	0.08	NS
	0-3	3.26	0.00	*	3.33	0.00	*
Hand	**0-1**	0.73	0.01	*	0.86	0.00	*
	1-2	1.06	0.07	NS	1.40	0.00	*
	2-3	1.20	0.04	*	1.13	0.01	*
	0-3	3.00	0.25	NS	3.40	0.00	*
Advance hand	**0-1**	0.00	0.00	*	0.20	1.00	NS
	1-2	0.60	0.00	*	1.06	0.04	*
	2-3	0.93	0.02	*	0.73	0.81	NS
	0-3	1.53	0.00	*	2.00	0.00	*
Total	**0-1**	1.66	0.00	*	2.40	0.00	*
	1-2	2.80	0.01	*	3.53	0.00	*
	2-3	3.33	0.02	*	2.80	0.02	*
	0-3	7.80	0.00	*	8.73	0.00	*

* - Significant at < 0.05

NS- non significant

FIG.1: SIDE DISTRIBUTION

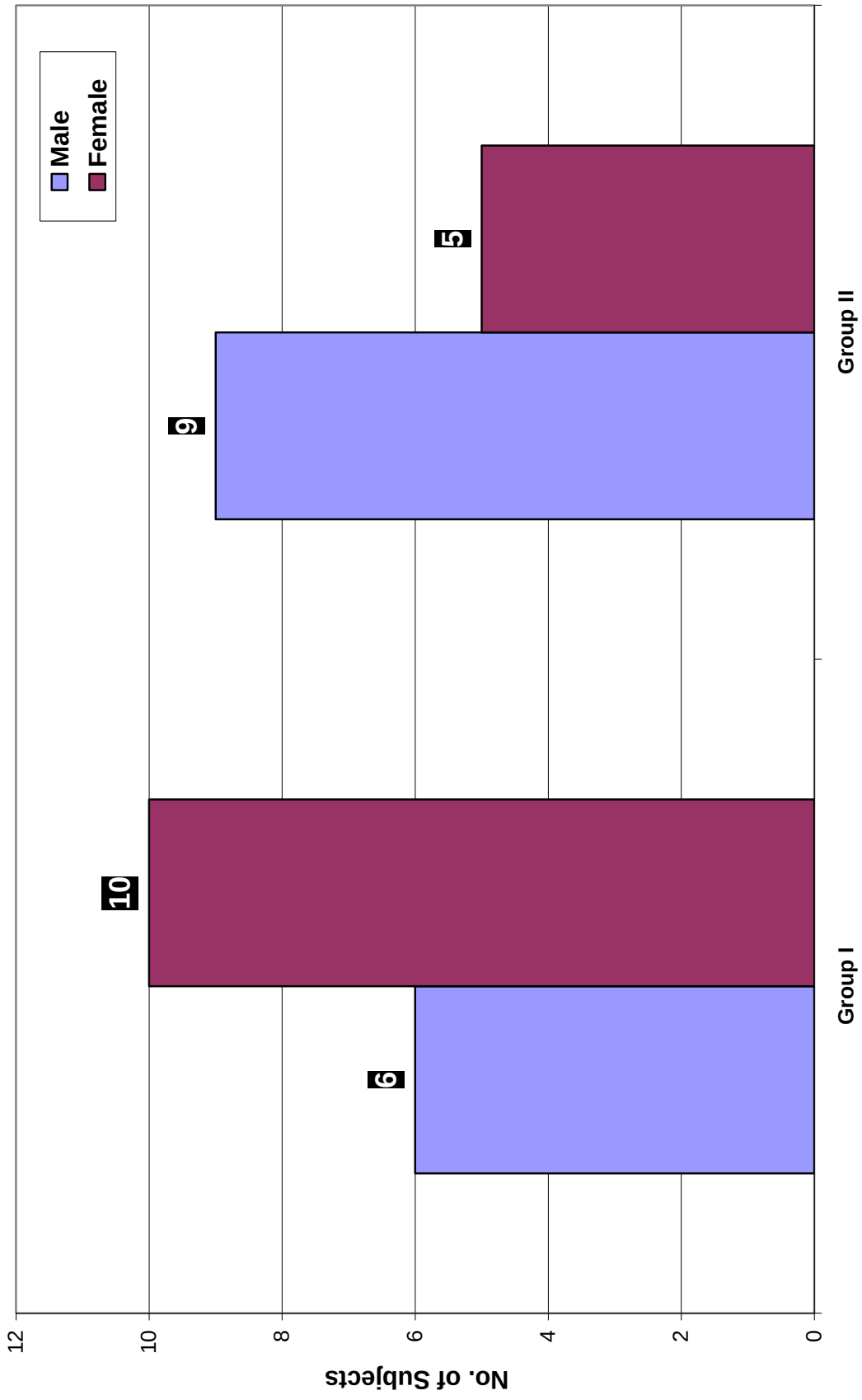
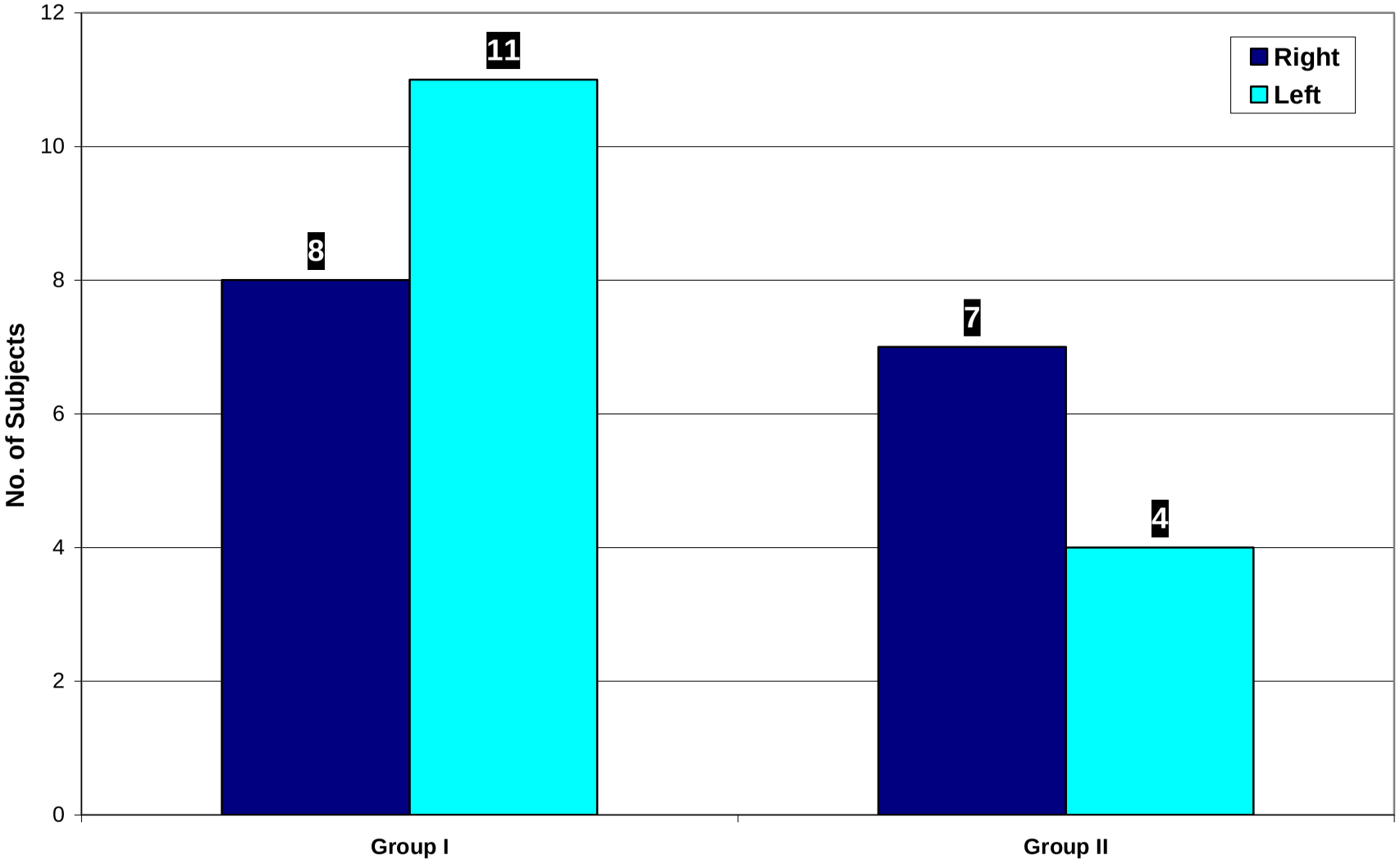


FIG.1: SIDE INVOLVED DISTRIBUTION



DISCUSSION

The present study was conducted to compare to two concepts in clinical rehabilitation -first specific reflex based neurofacilitation technique Proprioceptive Neuromuscular Facilitation (PNF) and second motor control and motor learning concept based technique Motor Relearning program (MRP) on the upper limb functions in stroke patients.

The patients were randomly selected and assigned the two treatment groups. The results show that there are no significant differences found in the distribution of age, sex and side involved between the groups. So these aspects can be considered to have no influence on the results of the present study.

Patient outcomes were measured on the FIM and MAS. For the results of within group analysis when we compare the improvements the findings are as follows. For the FIM total scores there was a significant improvement in both the groups with every week treatment i.e. for Group I FIM total scores for week 1 were significantly better than 0; week 2 better than week1 and week 3 better than week 2.Similarly For the Group II total scores after each week treatment. (Table 4)Considering the sub-sections of FIM it was found that scores for the first two weeks for feeding, grooming and bathing and also the score for first week of toileting there was significant improvement in group of subjects treated with the PNF but no such significant improvement was seen in the MRP group during the same time frame. Activities like feeding, grooming,

bathing and toileting requires manipulation as well as transportation of the objects from one place to another so therefore PNF techniques have been shown to improve impairment range of motion, co-ordination, strength and even endurance. The technique incorporates the motion of the body segments in the full range at all the joints into patterns that are useful in daily activities. The extremity work as a whole and the specific timing of recruitment of muscles helps in improving co-ordination and the diagonal patterns help in breaking the synergy patterns. So it altogether helps in improvement in motor performance. Improvement in strength and range of motion helps the subjects to become more independent in the usage of the extremities in their ADL.

When the final scores were considered for these sub-sections i.e. observation 0-3 in table 4. So it can be inferred the PNF techniques are rightly more effective in the initial stage as it works on the impairment level.

If we see the total functional scores as measured by the MAS, significant improvement at weekly repeated measures is found to be there i.e. for Group I MAS total scores for week 1 were significantly better than 0 ; week 2 better than week1 and week 3 better than week 2.Similarly For the Group II total scores after each week treatment.(Table 5).

The improvement in sub-sections shows that for upper arm and hand movements there was significant improvement every week in the PNF group but the MRP group showed significant improvement for the weekly repeated measure for the last sub-section on advanced hand movements. This can be explained as this sub-section of MAS has

activities that are more task-oriented and require the learning of motor skill along with the motor performance for the completion of task. Since the MRP technique relates more to the learning of motor skill and control through the practice of the hand activities of daily living and requires cognition and concentration on the part of the patient therefore it helped in the improvement in the fine hand motor skills.

This effect can be further explained by the role of the scale chosen in measuring outcomes. The summary effect size for outcome variables defined on the neuromuscular level is almost three times high as for functional outcome parameters. This finding may reflect the higher responsiveness of assessment instruments for neuromuscular functioning and supports the assumptions that improvements on an impairment level are not unequivocally related to improvements in disability.

For the results between groups the results of the two scales show no significant improvement on the total scores at all repeated measures i.e. the total scores of FIM and MAS of group I when compared to Group II there was no significant differences. (Table 2,3) If we consider the individual sub-section also no such finding is there which may depict any better effect of one treatment technique over the other.

We know that MRP deals with the upper limb tasks related to reaching, balancing, manipulation and dexterity. Our hands require placement at the appropriate place for manipulation in the working environment and to transport the objects from one place to another. The muscle forces produced and the timing and sequencing of joint movement involved in a specific action are a function of the task being performed, the object, the individual's position relative to the object and the

constraints of the environment. Training is designed to help the patient regain the ability to harness the degrees of freedom available so the limb functions as a coordinated unit in functional actions with many different goals. Skilled motor actions are characterized by the patterns of segmental movement which best address the spatiotemporal demands of the action. PNF techniques have been shown to improve impairment range of motion, co-ordination, strength and even endurance since the technique incorporates the motion of the body segments in the full range at all the joints into patterns that are useful in daily activities. As the results show greater improvements with the PNF in the initial weeks therefore it can be used with MRP to work on the impairment level so that the patient will be able to improve on the impairment as well as functional limitation like feeding, grooming etc. Finally the results show that no technique could show 100% improvement but they work on different aspects of disability.

CONCLUSION

The conclusion of the present study is that no one technique is found to be more effective over the other and the hypothesis that MRP is more effective in treatment of upper limb functions in stoke patients is found to be wrong. Both the treatment techniques were found to improve the upper limb functions in one or the other aspect and there fore it is more beneficial if the techniques will be used in adjunct to each other for rehabilitation so that the overall all improvement could be achieved.

LIMITATIONS AND RECOMMENDATIONS

LIMITATIONS

1. Subjects taken in study are too less. (n = 30)
2. The participants are the interested candidates seeking treatment and are not taken from the general population.
3. The sample comprises of the subjects who fulfilled the inclusion criteria so many subjects were excluded from the study.
4. The number of days (3 weeks) for which the treatment was given is too short for case like hemiplegia.

RECOMMENDATIONS

- Further study can be done with larger groups.
- Further study can be done with other standardized profiles.
- Further study can be done with extended intervention duration.

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APPENDIX A

PROTOCOLS

Protocol for the Motor Relearning Program (MRP) Treatment used in the study.

A. To maintain the length of muscles

Stretching and positioning

a) Brief stretches- 20s stretch, relax and repeat 4-5 mins.

1. Long flexors of fingers, wrist, thumb adductors- either by keeping hand against wall or on tabletop and stretching it manually.
2. Forearm pronators- with forearm on tabletop and lengthening of pronator teres.
3. Adductor and internal rotators of GH joint- in supine with hands behind head; in sitting with arms on the table; in sitting with arm abducted, externally rotated, elbow extended.

b) Prolonged stretches- 20-30mins

1. Adductor pollicis and web space- active grasping of large objects in the hand stretches the web space and holds the thumb in palmar abduction.
2. Adductors and internal rotators of GH joint- In supine with hands behind head and arm supported at 90˚ abduction on tabletop, elbow extended, forearm supinated. In sitting with hands on the bed behind.

B. To elicit muscle activity and train muscle control

For reaching and pointing

Supine

The therapist lifts arm and supports it in flexion patient attempts various simple actions.

1. Attempts to reach up toward ceiling.
2. Takes palm of hand to head
3. Takes palm above head to touch pillow
4. Takes palm to the opposite shoulder
5. Takes palm to reach for the therapist hand in different direction
6. To hold the hand on forehead, move elbow down to pillow and up.

Sitting

The patient sits in front of the table and practices various activities.

1. Forearm supported, shoulder shrugging.
2. Elbow flexion and extension.
3. Arms supported on table top- reaching forward and upwards, elbow flexion and extension with a glass in hand, arm on tabletop, slide glass forward in different directions to touch targets, keeping forearm in mid-position.
4. Arm off the table at 90˚ shoulder flexion- reaching and pointing within controllable range above 90˚, gradually increasing in different directions.
5. Sitting on stool, reaching forward, sideways, backwards, upwards and pick up object.
6. Transport the object to another place and pick it again.

Standing

The above-mentioned activities can also be performed in standing position.

C. For manipulation and dexterity

a) For wrist extension, ulnar and radial deviation.

The patient sitting with arm supported on table, forearm in mid-position

1. Hold cylindrical object in hand- glass
2. Lifting it up-extending wrist
3. Keeping it down-flexing wrist
4. To move the object on table by moving his hand back so he touches an object.

b) For supination

Fingers around a cylindrical object, patient attempts

1. To supinated forearm so that end of object touches the tabletop.
2. To make an impression on the putty with 3rd metacarpal.

c) Opposition

Therapist holds the forearm in mid-position and wrist in extension while patient attempts

1. To grasp and release a glass.
2. Release bandage, extending the thumb instead of abducting it.
3. Counting fingers- touching each fingertip to thumb in sequence (increasing speed, no. of times)
4. Pick objects between finger and thumb-pen caps, beans

d) Cupping of hand

1. Hold the coin between fingers
2. Joining the finger tips and thumb
3. Holding beans in palm and same time pouring into dish
4. Picking up pencil, small objects from inside of cup
5. Holding cup from the outside edges from above.
6. Hold dish from below
7. Hold lid of large jar

e) Increasing complexity

1. Grasping and releasing an object with arm stretched out behind
2. Bimanual tasks- pouring water from one cup to another, turning pages of newspaper while holding it.
3. Increasing the size, weight of the objects that has to be picked
4. Distance can be increased
5. Movements of throwing, catching the ball.
6. Manipulation of objects of different sizes.
7. Use of cutlery (spoon), comb- drinking with spoon.

Note: For every activity notes were made to perform the activity appropriately. The patient was directed at every point with instructions. The checks were made for trick and unwanted movements.

Protocol for Proprioceptive Neuromuscular Facilitation (PNF) Treatment used in the study.

1. **<u>Patterns of movement</u>:**

(a) UE D1 Flexion pattern

Scapular elevation, abduction and upward rotation

Shoulder flexion, adduction and external rotation

Elbow in flexion or extension

Forearm supination

Wrist flexion to the radial side

Finger flexion and adduction

Thumb adduction

(b) UE D1 Extension pattern

Scapular depression, adduction and downward rotation

Shoulder extension, abduction and internal rotation

Elbow in flexion or extension

Forearm pronation

Wrist extension to the ulnar side

Finger extension and abduction

Thumb palmar abduction

(c) UE D2 Flexion pattern

Scapular elevation, adduction and upward rotation

Shoulder flexion, abduction and external rotation

Elbow in flexion or extension

Forearm supination

Wrist extension to the radial side

Finger extension and abduction

Thumb extension

(d) UE D2 Extension pattern

Scapular depression, abduction and downward rotation

Shoulder extension, adduction and internal rotation

Elbow in flexion or extension

Forearm pronation

Wrist flexion to the ulnar side

Finger flexion and adduction

Thumb opposition

2. <u>Techniques</u>:

(b) Rhythmic initiation is used to improve the ability to initiate movement. This technique involves voluntary relaxation, passive movement and repeated isotonic contractions of the major muscle components of the agonistic pattern. Using Rhythmic initiation is helpful to those patients who lack the ability to initiate movement because of rigidity or severe spasticity.

(c) Slow Reversal used to increase ROM and strength. The technique involves active motion (may incorporate resistance) changing in the

direction in agonist and antagonist several times without relaxation. This technique is helpful in weakness of agonist muscles and where there is decreased ability to change direction of motion.

(d) Combination of isotonics is used to improve coordination, eccentric control and strength. It involves concentric, eccentric and stabilizing contractions of the agonist muscle groups without relaxation. This technique is

helpful in lack of effective coordination in a desired range and direction and lack of eccentric control.

(e) Repeated contractions- repetition of activity is necessary to the learning process and to the development of the strength and endurance.

(i) Stretch at beginning of range – stretch reflex elicited from muscles under the tension of elongation. It facilitate the initiation of motion and increase active ROM

(ii) Repeated stretch throughout the range-stretch reflex elicited from muscles under the tension of contraction. It increases active range of motion and increase strength.

3. <u>Basic procedures:</u>

a) Position of the patient- the patient is positioned in supine lying close to the edge of the treatment table. The patient's head and neck should be supported in a comfortable position as close to neutral as possible. Before beginning an upper extremity pattern, place the patient's in a middle position where the lines of the two diagonals cross. The shoulder and the forearm should be in neutral rotation. From this midline position, move the extremity into the elongated rang of the pattern. Progression can be done from supine to sitting position.

b) Position of the therapist- the therapist stands on the side of the table relative to the side to be treated facing the line of the diagonal and arms & hands aligned with the motion.

c) Manual contact- the manual contact is through therapist's

hands using a lumbrical grip. The basic grip opposes the direction of movement. The two-hand grip is used when the therapist stands next to the moving upper extremity. The basic grip is described for each straight-arm pattern. The grips also change when the therapist can use only one hand while the other hand controls another pattern or extremity. The grip of the hand contacts the active surface, dorsal or palmar and holds the sides of the hand to resist the rotatory components. Using lumbrical grip will prevent squeezing or pinching the patient's head, which may otherwise produce pain inhibiting effective motion.

d) Resistance- the resistance applied should be optimal and variable to obtain a smooth and coordinated movement. There can be assistance or resistance, depending upon the necessity. The maximal resistance as applied in techniques of PNF may be defined as the greatest amount of resistance that can be applied to isotonic or active contraction allowing full ROM to occur. It therefore is necessary for the physical therapist to feel and sense the ability of the patient and to grade resistance accordingly.

e) Timing of emphasis- this provides the means for increasing response and stimulating action at a specific pivot within a pattern, a specific component in relation to that pivot and a specific part of the range of motion of that pivot. Timing may be accomplished by using either the stronger distal part or proximal muscle groups. The process produces irradiation from one group of muscles to the other.

f) Verbal cueing- Preparatory instructions given should be clear and concise. These combined with passive movements teach the desired motion. The action command is repeated to urge greater effort or redirect the motion. The tone is louder when a strong muscle contraction is desired and use of softer and calmer tone is done when the goal is relaxation or relief of pain.

g) Visual cueing- vision is used and this helped the patient to control and correct his/her position and motion.

h) Stretch- stretch stimulus is used immediately and gently after the targeted muscle is elongated but before the subject started to move.

APPENDIX B

NEUROLOGICAL ASSESSMENT PERFORMA

Date- Place- Regd. No.-

Subject No.- Age/sex-

Dominance- Occupation-

Address-

Phone No.-

Chief Complaints-

Diagnosis-

History-

Treatment History-

On Examination

General examination

Consciousness-

Orientation-

Attention-

Cognition & Communication-

Sensory Examination Rt. Lt.

Superficial Sensations-

Pain

Touch

Pressure

Temperature

Deep Sensations

Proprioception

Kinesthesia

Combined Cortical Sensations

2- point discrimination

Stereognosis

Motor Examination

Involuntary movements

Bulk

Attitude of limb

Upper limb

Lower limb

Tone (appendix IV)

Shoulder

Flexion

Extension

Abduction

Adduction

External Rotation

Rt. Lt.

Internal Rotation

Elbow

Flexion

		Rt.	Lt.
	Extension		
Forearm			
	Supination		
	Pronation		
Wrist			
	Flexion		
	Extension		
Finger			
	Flexion		
	Extension		
Hip			
	Flexion		
	Extension		
	Abduction		
	Adduction		
	External Rotation		
	Internal Rotation		
Knee			
	Flexion		
	Extension		
Ankle			
	Dorsiflexion		
	Plantar flexion		
	Eversion		
	Inversion		
Toes			
	Flexion		
	Extension		

Synergy pattern

Power

Shoulder

Elbow

Wrist

Grip

Hip

Knee

Ankle

0-no movement 1-flicker 2 – gravity eliminated 3 – movement against gravity 4 - movement against some resistance 5 - normal

Deep tendon Reflexes

Biceps

Triceps

Brachioradialis

Knee

Ankle

Plantar

0-absent 1+ -hyporeflexia 2+ - normal 3+ - brisk

4+ - exaggerated 5 + - clonus

4. MAS Scoring (appendix V)

Scale / Weeks	0	1	2	3
1. Upper Arm functions				
2. Hand Movements				
3. Advanced Hand Activities				

5. FIM Scoring (appendix VI)

SELF-CARE*

Scale/Weeks	0	1	2	3
1. Feeding				
2. Grooming				
3. Bathing				
4. Dressing-upper				
5. Dressing-lower				
6. Toileting				

*Leave no blanks. Enter 1, if not testable due to risk.

APPENDIX C

SCALES

Motor Assessment Scale (MAS)

Upper arm function

1. Lying, protract shoulder girdle with arm in elevation. (Therapist places arm in position and supports it with elbow in extension)
2. Lying, hold extended arm, in elevation for 2 seconds. (Therapist should place arm in position and patient must maintain position with some external rotation. Elbow must be held within 20˚ of full extension)
3. Flexion and extension of elbow to take palm to forehead with arms as in 2. (Therapist may assist supination of forearm.)
4. Sitting, hold extended arm in forward flexion at 90˚ to body for 2 seconds. (Therapist should place arm in position and patient must maintain position shoulder external rotation and elbow extension. do not allow excess shoulder elevation)
5. Sitting, patient lifts arm to above position, holds it there for 10 seconds, and then lowers it. (Patient must maintain position with some external rotation. do not allow pronation.)
6. Standing, hand against wall. Maintain arm position while turning body towards wall. (Have arm abducted to 90˚ with palm flat against the wall).

Hand movements

1. Sitting, extension of wrist. (Therapist should have patient sitting on the table with forearm resting on the table. Therapist places cylindrical object in palm of patient's hand. Patient asked to lift the

object off the table by extending the wrist. Do not allow elbow flexion.)

2. Sitting, radial deviation of wrist. (Therapist should place the forearm in midpronation-supination, i.e. resting on ulnar side, thumb in line with forearm and wrist n extension, fingers around a cylindrical object. Patient is asked to lift hand off the table. Do not allow elbow flexion or pronation.)
3. Sitting, elbow into side, pronation and supination. (Elbow supported and at a right angle. three quarter range is acceptable.)
4. Reach forward, pick up a large ball of 14 cm (5 in) diameter with both hands and put it down. (Ball should be on table so far in front of patient that has to extend arms to fully reach it. Shoulders must be protracted, elbows extended, wrist neutral or extended. Palms should be kept in contact with the ball.)
5. Pick up a polystyrene cup from table and put it on the table across other side of the body. (Do not allow alteration in the shape of the cup.)
6. Continuous opposition of the thumb and each finger more than 14 times in 10 seconds. (Each finger in turn taps the thumb, starting with the index finger. Do not allow thumb to slide from one finger to the other or to go backwards.)

<u>Advanced hand activities</u>

1. Picking up the top of the pen and putting it down again. (Patient stretches arm forward, picks up pen top, releases it on table close to body.)
2. Picking up one jellybean from a cup and placing it in the other cup. (Teacup contains 8 jellybeans. Both cups must be at arms length. Left hand takes jellybean from cup on right and releases it in cup

on left.)

3. Drawing horizontal line to stop at a vertical line 10 times in 20 seconds. (At least 5 lines must touch and stop at the vertical line.)
4. Holding a pencil, making rapid consecutive dots on a sheet of paper. (Patient must do at least 2 dots per second for 5 seconds. Patient picks up a pencil and positions it without assistance. Patient must hold pen as for writing. Patient must make a dot not a stroke.)
5. Taking a dessertspoon of liquid to the mouth. (Do not allow head to lower towards spoon. Do not allow liquid to spill.)
6. Holding a comb and combing hair at the back of the head. Functional Independence Measure (FIM)

Self Care

Feeding: Includes all aspects of eating and drinking, such as opening containers, pouring liquids, cutting meat, buttering bread, chewing and swallowing.

Grooming: includes oral care, hair grooming, washing hands and face, shaving and applying makeup.

Bathing: includes bathing body from the neck down.

Dressing: upper body. Includes dressing above the waist as well as donning and removing prosthesis or orthosis when applicable.

Dressing: lower body. Includes dressing from the waist down as well as donning and removing orthosis when applicable.

Toileting: includes maintaining perineal hygiene and adjusting clothing after toileting.

FIM Description of General Levels of Function

Degree of dependency	Level of functioning	Description
	7.Complete independence	No helper
	6.Modified independence	No helper, some modifications (assistive device)
	5.Supervision	By the helper
	4.Minimal Assistance	At least 75% independence
	3.Moderate Assistance	At least 50% independence
	2. Maximal Assistance	At least 25% independence
	1.Total Assistance	Less than 25% independence

Modified Ashworth Scale

Grade	Description
0	No increase in muscle tone
1	Slight increase in muscle tone, manifested by a catch or release or by minimal resistance at the end of the ROM when the affected part is moved in flexion or extension
1+	Slight increase in muscle tone, manifested by a catch followed by minimal resistance throughout the remainder (less than half) of the ROM
2	More marked increase in muscle tone through most of the ROM, but affected part easily moved.
3	Considerable increase in muscle tone, passive movement difficult
3+	Affected part rigid in flexion or extension

APPENDIX D

CONSENT FORM

A comparison of the upper limb functional outcomes in treating in stroke patients receiving MRP versus PNF.

Purpose of study

I, Mrs M.CHARULATHA, a Master of Occupational Therapy (Neurology) student of JKKMMRF College of Occupational Therapy, under TamilNadu Dr.M.G.R.Medical University, am conducting a study to compare the effect of training using MRP and PNF in treating upper limb in stroke patients.

Description of study

A neurological assessment & evaluation through various tests will be conducted. You will be allotted to one of the treatment groups MRP i.e. activities of daily living are done with hand or PNF in which you will perform certain movement patterns under my supervision.

Risks and benefits

The risks involved in this study are insignificant. The benefit of this study lies in its application to Occupational Therapy to hemiplegics. Occupational therapists will incorporate the treatment protocols in the therapy for upper limb functions and will be better able to treat the patients effectively in future.

Confidentiality

Your name will not be associated with the measures obtained in the study. The measures will be both used for teaching and research purposes.

Voluntary participation

I understand that participation in this study is voluntary. I may withdraw from this study at anytime and for any reason without penalty. The following are the name, and telephone number of the person to contact if required.

Name: Mrs. M. Charulatha
Phone: 09789073646

This study has been explained to me, I have read the consent form and I agree to participate. I have been given a copy of this signed consent form.

Mrs. M. Charulatha	Signature of the participant
Principal Investigator	Address
	Date

Proposed Guide

APPENDIX E

DATA ANALYSIS SAMPLE

Between group analysis using unpaired t-test

FIM

ttest bath1,by(group)

Two-sample t test with equal variances

Group|Obs Mean Std. Err. Std. Dev. [95% Conf. Interval]

-----+----------

1 | 15 1.666667 .2323107 .8997354 1.16841 2.164924

2 | 15 1.933333 .3002644 1.162919 1.28933 2.577336

-----+----------

combine30 1.8 .188155 1.030567 1.41518 2.18482

-----+----------

diff | -.2666667 .3796406 -1.044325 .5109918

Degrees of freedom: 28

Ho: mean(1) - mean(2) = diff = 0

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

t = -0.7024 t = -0.7024 t = -0.7024

P < t = 0.2441 P > |t| = 0.4882 P > t = 0.7559

MAS

-> ttest hm1,by(group)

Two-sample t test with equal variances

Group |Obs Mean Std. Err. Std. Dev. [95% Conf. Interval]

------+--

1 |15 1.266667 .2666667 1.032796 .6947236 1.83861

2 |15 1.466667 .2152887 .8338094 1.004918 1.928415

------+--combine30

1.366667 .1694028 .9278575 1.020199 1.713134

------+--

diff | -.2 .3427248 -.90204 .50204

Degrees of freedom: 28

Ho: mean(1) - mean(2) = diff = 0

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

t = -0.5836 t = -0.5836 t = -0.5836

P < t = 0.2821 P > |t| = 0.5642 P > t = 0.7179

Within group analysis using repeated measure ANOVA with post-hoc analysis on Bonferroni

MAS

Within-Subjects Factors Measure: MEASURE_1	
FACTOR1	**Dependent Variable**
1	UA0
2	UA1
3	UA2
4	UA3

Descriptive Statistics(a)			
	Mean	**Std. Deviation**	**N**
UA0	.60	.91	15
UA1	1.53	1.36	15
UA2	2.67	1.23	15
UA3	3.87	1.36	15
a GROUP = 1			

Descriptive Statistics(a)			
	Mean	**Std. Deviation**	**N**
UA0	1.00	.85	15
UA1	2.33	1.18	15
UA2	3.40	1.35	15
UA3	4.33	1.29	15
a GROUP = 2			

Pairwise Comparisons(b)						
Measure: MEASURE_1						
					95% Confidence Interval for Difference(a)	
(I) FACTOR 1	(J) FACTOR 1				Lower Bound	Upper Bound
	2	-.933(*)	.182	.001	-1.491	-.376
	3	-2.067(*)	.345	.000	-3.124	-1.009
	4	-3.267(*)	.248	.000	-4.028	-2.505
	1	.933(*)	.182	.001	.376	1.491
	3	-1.133	.376	.056	-2.288	2.139E-02
	4	-2.333(*)	.187	.000	-2.907	-1.760
	1	2.067(*)	.345	.000	1.009	3.124
	2	1.133	.376	.056	-2.139E-02	2.288
	4	-1.200	.416	.072	-2.478	7.763E-02
	1	3.267(*)	.248	.000	2.505	4.028
	2	2.333(*)	.187	.000	1.760	2.907
	3	1.200	.416	.072	-7.763E-02	2.478
Based on estimated marginal means						
* The mean difference is significant at the .05 level.						
a Adjustment for multiple comparisons: Bonferroni.						
b GROUP = 1						

Pairwise Comparisons(b)						
Measure: MEASURE_1						
					95% Confidence Interval for Difference(a)	
(I) FACTOR 1	(J) FACTOR 1				Lower Bound	Upper Bound
	2	-1.333(*)	.187	.000	-1.907	-.760
	3	-2.400(*)	.273	.000	-3.236	-1.564
	4	-3.333(*)	.211	.000	-3.980	-2.686
	1	1.333(*)	.187	.000	.760	1.907
	3	-1.067(*)	.248	.004	-1.828	-.305
	4	-2.000(*)	.195	.000	-2.599	-1.401
	1	2.400(*)	.273	.000	1.564	3.236
	2	1.067(*)	.248	.004	.305	1.828
	4	-.933	.330	.081	-1.947	8.079E-02
	1	3.333(*)	.211	.000	2.686	3.980
	2	2.000(*)	.195	.000	1.401	2.599
	3	.933	.330	.081	-8.079E-02	1.947
Based on estimated marginal means						
* The mean difference is significant at the .05 level.						
a Adjustment for multiple comparisons: Bonferroni.						
b GROUP = 2						

FIM

Within-Subjects Factors Measure: MEASURE_1	
FACTOR1	**Dependent Variable**
1	GROOM0
2	GROOM1
3	GROOM2
4	GROOM3

GROUP = 1

Descriptive Statistics(a)			
	Mean	**Std. Deviation**	**N**
GROOM0	1.07	.26	15
GROOM1	1.67	.90	15
GROOM2	1.87	.99	15
GROOM3	2.60	1.45	15
a GROUP = 1			

Descriptive Statistics(a)			
	Mean	**Std. Deviation**	**N**
GROOM0	1.00	.00	15
GROOM1	1.80	.77	15
GROOM2	2.33	.72	15
GROOM3	3.40	1.24	15
a GROUP = 2			

Pairwise Comparisons(b)						
Measure: MEASURE_1						
					95% Confidence Interval for Difference(a)	
(I) FACTOR 1	(J) FACTOR 1				Lower Bound	Upper Bound
	2	-.600	.214	.084	-1.256	5.613E-02
	3	-.800(*)	.243	.032	-1.546	-5.430E-02
	4	-1.533(*)	.363	.005	-2.649	-.418
	1	.600	.214	.084	-5.613E-02	1.256
	3	-.200	.107	.495	-.528	.128
	4	-.933(*)	.206	.003	-1.566	-.300
	1	.800(*)	.243	.032	5.430E-02	1.546
	2	.200	.107	.495	-.128	.528
	4	-.733(*)	.182	.007	-1.291	-.176
	1	1.533(*)	.363	.005	.418	2.649
	2	.933(*)	.206	.003	.300	1.566
	3	.733(*)	.182	.007	.176	1.291
Based on estimated marginal means						
* The mean difference is significant at the .05 level.						
a Adjustment for multiple comparisons: Bonferroni.						
b GROUP = 1						

Pairwise Comparisons(b)						
Measure: MEASURE_1						
					95% Confidence Interval for Difference(a)	
(I) FACTOR 1	(J) FACTOR 1				Lower Bound	Upper Bound
	2	-.800(*)	.200	.008	-1.414	-.186
	3	-1.333(*)	.187	.000	-1.907	-.760
	4	-2.400(*)	.321	.000	-3.384	-1.416
	1	.800(*)	.200	.008	.186	1.414
	3	-.533(*)	.133	.008	-.943	-.124
	4	-1.600(*)	.190	.000	-2.184	-1.016
	1	1.333(*)	.187	.000	.760	1.907
	2	.533(*)	.133	.008	.124	.943
	4	-1.067(*)	.182	.000	-1.624	-.509
	1	2.400(*)	.321	.000	1.416	3.384
	2	1.600(*)	.190	.000	1.016	2.184
	3	1.067(*)	.182	.000	.509	1.624
Based on estimated marginal means						
* The mean difference is significant at the .05 level.						
a Adjustment for multiple comparisons: Bonferroni.						
b GROUP = 2						

MAS SCALE SCORE SHEET																					
Patient details						**MAS Score-0**				**MAS Score-1**				**MAS Score-2**				**MAS Score-3**			
id	grp	age	gen	inv	dom	ua0	hm0	ah0	tl0	ua1	hm1	ah1	tl1	ua2	hm2	ah2	tl2	ua3	hm3	ah3	tl3
1	1	50	M	R	R	1	0	0	**1**	3	1	0	**4**	3	4	1	**8**	5	5	2	**12**
2	1	65	M	L	R	1	3	0	**4**	3	3	0	**6**	4	4	1	**9**	5	5	2	**12**
3	1	65	M	L	R	0	0	0	**0**	1	2	0	**3**	3	3	1	**7**	5	4	2	**11**
4	1	38	F	L	R	2	2	0	**4**	4	3	0	**7**	5	5	1	**11**	6	6	2	**14**
5	1	38	F	R	R	0	0	0	**0**	1	0	0	**1**	2	1	0	**3**	3	3	1	**7**
6	1	70	F	R	R	0	0	0	**0**	0	0	0	**0**	2	1	0	**3**	3	2	0	**5**
7	1	60	M	R	R	0	0	0	**0**	1	2	0	**3**	1	0	0	**1**	5	4	2	**11**
8	1	70	F	L	R	0	0	0	**0**	1	0	0	**1**	3	3	1	**7**	3	3	1	**7**
9	1	80	F	R	R	1	1	0	**2**	1	1	0	**2**	2	1	1	**4**	3	3	1	**7**
10	1	79	M	R	R	0	0	0	**0**	1	0	0	**1**	2	2	1	**5**	3	2	1	**6**
11	1	50	M	L	R	3	2	0	**5**	4	2	0	**6**	2	1	0	**3**	6	5	4	**15**
12	1	59	F	L	R	0	0	0	**0**	0	1	0	**1**	5	4	1	**10**	2	2	1	**5**
13	1	40	F	L	R	1	0	0	**1**	2	2	0	**4**	3	3	1	**7**	4	4	2	**10**
14	1	70	F	R	R	0	0	0	**0**	1	1	0	**2**	2	2	0	**4**	3	3	1	**7**
15	1	55	F	R	R	0	0	0	**0**	0	1	0	**1**	1	1	0	**2**	2	2	1	**5**
1	2	70	M	R	R	2	0	0	**2**	3	2	0	**5**	5	4	1	**10**	5	5	2	**12**
2	2	17	F	R	R	2	0	1	**3**	4	1	1	**6**	5	4	2	**11**	6	5	3	**14**
3	2	80	M	R	R	3	2	0	**5**	4	2	0	**6**	5	4	1	**10**	6	5	4	**15**
4	2	60	F	R	R	1	0	0	**1**	3	2	0	**5**	4	3	1	**8**	5	4	2	**11**
5	2	65	M	L	R	1	1	0	**2**	3	2	2	**7**	4	3	1	**8**	5	5	6	**16**
6	2	65	M	L	R	1	0	0	**1**	3	1	0	**4**	4	3	5	**12**	5	5	2	**12**
7	2	50	F	R	R	1	0	0	**1**	3	2	0	**5**	3	4	1	**8**	5	4	2	**11**
8	2	70	F	R	R	0	0	0	**0**	1	0	0	**1**	4	3	1	**8**	2	2	0	**4**
9	2	60	M	R	R	1	1	0	**2**	2	2	1	**5**	1	1	0	**2**	5	4	2	**11**
10	2	55	M	R	R	1	3	0	**4**	3	3	0	**6**	4	3	2	**9**	5	5	2	**12**
11	2	70	M	R	R	1	1	0	**2**	2	1	0	**3**	4	4	1	**9**	4	3	1	**8**
12	2	70	F	L	R	0	0	0	**0**	2	1	0	**3**	3	2	1	**6**	3	3	1	**7**
13	2	56	M	R	R	0	0	0	**0**	0	1	0	**1**	2	2	1	**5**	4	4	1	**9**
14	2	65	M	L	R	0	0	0	**0**	1	0	0	**1**	1	1	1	**3**	2	3	1	**6**
15	2	70	M	R	R	1	1	0	**2**	1	2	0	**3**	2	2	1	**5**	3	3	2	**8**