



COMPARING EFFECTIVENESS OF CONSTRAINED INDUCED MOVEMENT THERAPY & MIRROR THERAPY ON UPPER EXTREMITY FUNCTION OF SUBACUTE STROKE PATIENTS

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ABSTRACT

Stroke is known to be common globally and it is estimated that around 30% of world population will suffer from stroke in next decade. During the event of stroke, circulation to either side of hemisphere is compromised that leads to weakness of opposite side of body. Lower extremity has better chances of spontaneous recovery than upper extremity (UE). UE being majorly used in activities of daily livings (ADLs) must have extensive rehabilitation plan for better function. The objective of the study was to compare effectiveness of constrain induced movement therapy (CIMT) and Mirror therapy (MT) on UE function in subacute stage of post stroke patients. It is a single blinded randomized clinical trial conducted in Physiotherapy Department of DHQ hospital Kasur. Total of thirty patients were including in the study after written consent. These patients were divided equally into two groups by even odd method. In addition to baseline treatment Group A was treated with CIMT and Group B was treated with MT for four weeks. Fugl Meyer Assessment (FMA) for UE is used as an outcome measure. FMA score was conducted pre and post treatment. Pre treatment assessment of FMA score had no significant difference between the two groups which means that the groups are comparable i.e. 34.65 ± 9.24 for Group A and 35.75 ± 7.65 for Group B. in post treatment score of FMA it is found that both treatment approaches have good result of functional outcome but Group B has shown better improvement on FMA scale than Group A which is

48.7 ± 8.57 in comparison to 38.5 ± 9.67. It is concluded that MT is better treatment approach to gain improvement in hand function in subacute stage of stroke patients.

Keywords: upper extremity (UE), activities of daily livings (ADLs) constrained induced movement therapy (CIMT), Mirror therapy (MT), Fugl Meyer Assessment (FMA)

INTRODUCTION

According to World Stroke Organization, One in six people in world will suffer from stroke in their life [1]. Stroke is described in certain clinical stages: acute stage is of initial two weeks, patients 3-11 weeks post stroke are in subacute stage, chronic stage is further divided into two i.e. 12-24 weeks after stroke is early chronic and more than 24 weeks is chronic [2, 3, 4]. Even with traditional treatment, 55% to 75% of patients after stroke show accelerating weakness of affected upper extremity (UE) and within six months learned nonuse is improved [5, 6, 7]. Impairment of UE causes difficulty in performing activities of daily living ADLs [8]. Patient sufferings from stroke develop learned non-use that leads to progressive neuromuscular dysfunction [9]. After stroke, role of non effected side of brain is not apparent and instinctive neurological recovery of paralytic limb is managed by opposite side of brain by extrapyramidal tracts [10]. Rehabilitation is the multidirectional treatment approach that helps the patient to get knowledge about maximum physical, psychological and social

functions one can achieve after pathology [11]. For better results of rehabilitation it is important to establish goals of behavioral restoration and performance of ADLs by using musculoskeletal units that are not affected without neural repair [12]. It is observed that functionally lower extremity shows better and early prognosis than UE in post stroke cases [13]. Certain novel treatment protocols are in practice for treatment of paralytic patients [14]. Muscle strengthening techniques are progressive active exercises against resistance for the paralytic limb. These exercises performed by both manually and mechanically. Muscle strengthening and endurance training in stroke treatment are integral aspects of rehabilitation program [15]. Out of different task oriented rehabilitation approaches, constrained induced movement therapy (CIMT) is indicated by inhibiting the use of non affected limb and continuous task oriented training of affected UE. The aim of CIMT is to treat learned nonuse of paralytic UE and gain maximum possible functional recovery [16]. CIMT restore the use of

affected UE with the goal of maximizing motor function [5]. Influential conditioning is gained by repetitive performance of ADLs like arranging the books, making a stack of file, is a series of trials. The aim of shaping is to alter motor behaviors by doing basic ADLs with increasing levels of difficulties [17]. It is observed that for improving hand function certain intensive training programs have better functional outcome as compared to CIMT [18]. Mirror Therapy (MT) is one of the intensive training programs proposed by Ramachandran and Rogers-Ramachandran in 1996 [19]. MT works by making an illusion of healthy limb with the help of mirror. In the beginning MT was used for treating phantom limb pain but in recent years it shows good results in post stroke rehabilitation [20]. In MT, patients are instructed to perform bilateral flexion-extension movements of wrist and fingers, with paralytic limb hidden behind the mirror and patient's brain sees the reflection of healthy limb as his affected limb. MT provides better motor capacity and improves functionality of ADLs [21]. It is also observed that MT increase range of motion (ROM), velocity and accuracy of motion in stroke rehabilitation [22]. Patient reported outcome tools are essential part of evaluation used in clinical studies [23]. Fugl-Meyer Assessment (FMA) is used for

measure of body function impairment after stroke [24]. FMA has well established five major area including motor, sensory, balance, ROM and joint pain that assess both UE and lower extremity. Moreover FMA scale has well recognized validity and reliability as an indicator to measure body function and is in use across the globe for assessment of stroke patients [25, 26].

METHODOLOGY

Study design: It was a Randomized clinical trial study conducted in Physiotherapy Department of DHQ hospital Kasur.

Study size & grouping: Total 30 patients were divided in two groups randomly by even odd method. **Figure 1** shows frequency of female and male patients included in study.

Group A: CIMT with baseline treatment

Group B: MT with baseline treatment

Sampling technique: Non-probability purposive sampling technique was used to collect the data.

Sample selection:

Inclusion criteria:

- Ischemic or hemorrhagic first time stroke in subacute phase
- Patient aged 50 years or more
- Middle cerebral artery involvement of dominant hemisphere

- having at least 10° of active extension of each meta-carpophalangeal joints, inter-phalangeal joints of at least two digits and 10° wrist extension of the affected limb [13]
- Patient can maintain sitting position for at least 30 minutes.
- spasticity grade ≥ 1 according to Modified Ashworth Scale

Exclusion criteria:

- Patients with severe aphasia
- Shoulder pain of affected limb with visual analog scale (VAS) of 7 or more
- patients who have complex regional pain syndrome
- Any other comorbid condition restricting task related training.

Data collection tools:

- VAS [27]
- Modified Ashworth scale for spasticity [28]
- Goniometry for range of motion [29]
- Fugl-Meyer (FM) UE [24]

Randomization:

Potential patients that fill the criteria are requested to participate in the study. Written consent was taken from either patients or their attendants. Each participant was requested to draw either number one or number two from a box. Number one was

allocated to Group A and number two was allocated to Group B.

Procedural Intervention:

After completing the demographic data, all of the patients underwent Fugl-Meyer Assessment (UE, total score) to evaluate the motor functions of the hemiplegic UE. For the evaluation of the interventions groups, above mentioned tests was performed prior to the treatment and four weeks thereafter, and the results were compared between the two groups by the blinded observers. Group A was given CIMT treatment protocol and Group B was treated by MT. Both the groups were also treated with baseline treatment i.e. Muscle strengthening techniques.

Dosage intervention:

Patients treated with CIMT in **Group A**, wore a specially designed orthosis to suppress the motion of the unaffected UE for a total of four weeks. The patients received intensive training for five days a week except for the weekend, for a total of six hours (2 hours in the therapy room and 4 hours under supervision of attendants) a day except for sleeping hours, with baseline treatment. Patients in **Group B** were treated with MT was to perform protocol for 30 minutes a day for five days a week, for four weeks with baseline treatment. For MT the affected hand was positioned behind the mirror and to

improve the focus on non affected hand a cover was placed on affected hand. After four weeks of planned treatment Fugl-Meyer Assessment was evaluated again for comparison of both treatment protocols.

Data Analysis Procedure:

The data was analyzed using SPSS for Windows software, version 20. Statistical significance was set at $P = 0.05$. Quantitative variables were presented in the form of mean \pm SD along its range (max-min). T-test was applied to compare the mean differences of quantitative variables.

RESULTS

The purpose of this study was to compare the effectiveness of CIMT and MT in rehabilitation of paralytic arm of stroke patients in subacute phase. 30 Patients were included in this study after completing inclusion and exclusion criteria and divided into two groups. Both groups have 15

patients in them. The mean age of participants was 57.43 ± 8.9 in Group A and 61.00 ± 7.37 in Group B. Both genders are equally divided into two groups. Group A was treated with CIMT with baseline treatment and Group B was treated with MT with baseline treatment. Pre treatment assessment of FMA score had no significant difference between the two groups which means that the groups are comparable as showed in **Table 1**. It was noticed that UE function was improved on the basis of pre and post intervention within the groups by FMA score. It means that both of treatment approaches have good results in terms of improvement of UE function, as shown in **Table 2**. Moreover a significant post intervention difference was seen between two groups, with significant improvement in MT group, as shown in **Table 3**.

Table 1: demographic and clinical characteristics of participants

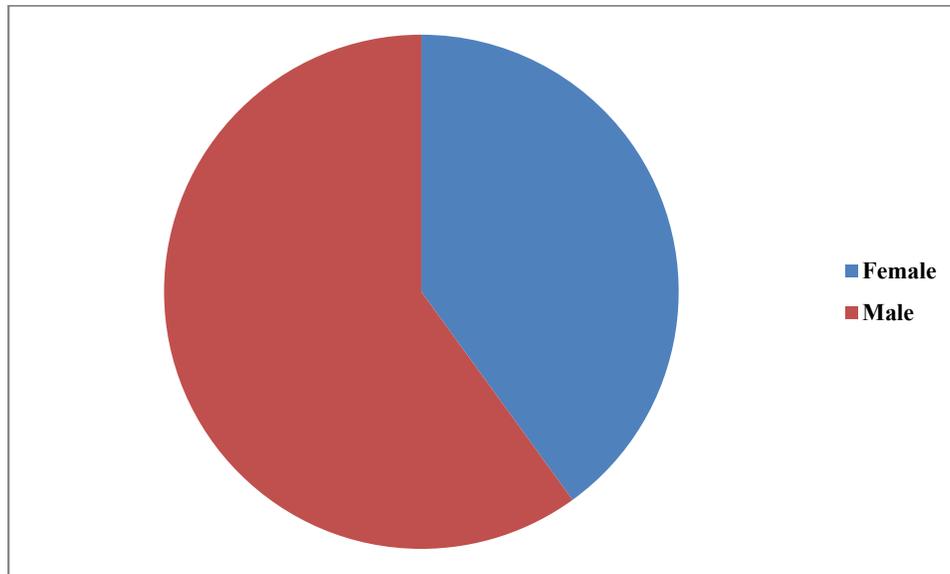
characteristics	CIMT group (n=15) (mean \pm SD)	MT group (n=15) (mean \pm SD)	df	t	p value
Age (years)	57.43 \pm 8.9	61.00 \pm 7.37			
Male, n (%)	7(49.5)	8 (50.5)			
Female, n (%)	8(50.7)	7(49.3)			
Baseline FMA score	34.65 \pm 9.24	35.75 \pm 7.65	26	0.66	0.482

Table 2: Comparison of upper limb FMA scores in both group pre and post treatment

score	mean \pm SD	Df	t	p value
CIMT group				
Pre test	34.65 \pm 9.24	14	-10.2	0.000
Post test	38.5 \pm 9.67			
MT group				
Pre test	35.75 \pm 7.65	14	-10.8	0.000
Post test	48.7 \pm 8.57			

Table 3: Comparison of post treatment FMA scores of two groups

Groups	mean \pm SD	df	t	p value
CIMT	38.5 \pm 9.67	28	-2.7	0.002
MT	48.7 \pm 8.57			

**Figure 1: frequency of female and male patients included in study**

DISCUSSION

According to World Health Organization, the incidence of stroke will be 30% world wide by 2025 [30]. Weakness in opposite side of body is very common after stroke that 80% of patients have in acute phase and 40% in chronic phase [31]. Signs of UL motor impairment include muscle weakness or contracture, changes in muscle tone, joint laxity, and impaired motor control. Because of these complication patients are not able to perform their activities of daily livings (ADLs) properly [32]. Functionally, the motor problems resulting from sensory deficits after stroke can be seen as (a) poor processing of sensory information, (b) uncoordinated motor tasks performance

requiring somatosensory information, and (c) decreased UE rehabilitation results [33]. It is found that if affected limb is not kept in use, it will lose its functional independent capacity that leads to learned nonuse and hence strict ADLs. Early intensive training increase the chance of better rehab and decrease the events of disuse atrophy both is musculoskeletal and neurological functioning of affected limb [34]. A Cochrane systemic review shows the benefits of certain new intensive training techniques in stroke rehab which include CIMT, mental practice, and virtual reality [35]. All of these treatment approaches shows promising results in post stroke rehabilitation. Furthermore there are numerous publications that illustrate the

extent of motor recovery promoted by MT in post stroke cases [36, 37]. Certain researchers also explain that motor imagery and visual feedback produced by MT results in better functioning of affected UE [22, 38]. In this study we have found that MT produce better and long term understanding for motor functioning of post stroke limb and that consequently improve ADLs and functional independence of patient.

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