



Effect of Task Based Mirror Box Therapy on Hand Function in Stroke Patients

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Abstract

This is a Quasi experimental Study that was conducted among 15 stroke patients who attended the OP and the wards of Physical Medicine and Rehabilitation Department at Rajah Muthiah Medical College and Hospital, Chidambaram, to assess the efficacy of task based mirror box therapy on hand function in stroke patients. The patients underwent mirror box therapy combined with conventional physical and occupational therapy sessions for a period of 6 days in a week for 4 weeks. Pre and post intervention evaluation and scores were calculated before and 4 weeks after the therapy using Fugl-Meyer (FMA-WH) assessment scale for upper extremity. The Mean and SD of FMA-WH scores at pre intervention was 1.93 and 0.79 respectively and post intervention mean and SD was 3.00 and 0.75 respectively, paired t-test was 6.959 and p-value was <0.001 both showed to have a mild improvement in hand function which implies that mirror box therapy with conventional physical and occupational therapy is a effective modality for hand function in stroke patients.

Keywords: Mirror box therapy, Stroke patients, Hand function, Fugl-Meyer assessment scale.

Introduction

WHO clinically defines stroke as “Rapidly developing clinical signs and symptoms of focal (or global) disturbance of cerebral function, with symptoms lasting 24 hrs or longer leading to death with no apparent cause other than vascular origin¹”. Stroke is a life changing event that affects not only the person who may be disabled but also their family and care givers². Stroke also makes a patient susceptible to epilepsy, falls and depression³ and 20% of stroke survivors requires institutional care after three months since stroke is one of the leading cause of functional impairment and 15% to 30% of patients get invariably disabled⁴. Hand function is the major determinant in performing a person’s activities of daily living which is impaired in stroke.

85% of stroke survivors have been reported to experience hemiparesis and 55% to 75% of stroke patients have been reported to have limitations in hand functions⁵. Ample literatures have been published regarding the efficacy of different rehabilitation programs for retrieval of the hand function, such as exercise training of the paretic hand,⁶ training of the arm according to the impairments present⁷, functional electrical stimulation of the paretic hand⁴, rehabilitation programs assisted by robotics⁸, and exercise training of bilateral arm⁹. Most of the rehabilitation programs for the upper extremity paralysis requires interaction and proper follow up with the therapists for months, which is difficult for all patients¹⁰. Therefore, mirror box (Figure-1). Therapy has been suggested to be simple, inexpensive and importantly, patient-directed treatment that may improve the

hand function. This idea of visual illusion created by a mirror was first introduced by Ramachandran and Rogers-Ramachandran¹¹ to treat phantom limb pain.

Previous studies in stroke has suggested that mirror therapy can be beneficial for recovery of motor function in the paretic hand¹²⁻¹⁴. It is said that this illusion enhances activation of the premotor and motor cortex in a way similar to action observation or motor imagery. This effect can be explained by the activation of the mirror neurons in the frontal and parietal lobes. These mirror neurons gets activated when the subject performs a movement, but also during observation of the same movement by someone else, and they seem to play a central role in the process of motor re-learning by action observation¹⁵.

The study hypothesis is that the function of the affected hand can be restored when a mirror provides a congruent visual feedback from the moving nonparetic hand. The objective of the study was to investigate whether task based mirror box therapy is effective on hand functioning which may be impaired in patients with stroke.

Methodology

This study was conducted in Department of Physical Medicine and Rehabilitation, Rajah Muthiah Medical College and Hospital, Annamalai University, Tamilnadu. All the patients of stroke with hemiparesis were examined and screened according to the inclusion and exclusion criteria. 15 patients who fulfilled the criteria were enrolled in the study after taking an informed consent.

Patients were given task based mirror box therapy (Figure-1) in addition to the conventional stroke rehabilitation program. The conventional programme consisted of neuro developmental therapy, stretching and strengthening exercises, ADL training in occupational therapy.

During the mirror box therapy session the patient’s paretic hand was placed behind the mirror and the non-involved hand in front of the mirror. The therapy consisted of various tasks (Figure-2) performed by the non-paretic side hand of the patient in occupational therapy unit. During the session, patients were instructed to imagine the reflected image as the involved hand (Figure-2). We instructed the patients to try to simulate the same movements with the paralysed hand while they watched only the mirror image of the non-paretic hand. Each patient was evaluated in terms of tools of measurement.

Inclusion criteria: i. All types of strokes with any comorbid conditions, ii. Age 40-65 years, iii. Both sex, iv. Both side involvement.

Exclusion criteria: i. Any musculoskeletal problems in the hand, ii. Impaired cognition, iii. Near vision impairment, iv. Spasticity –If modified ash worth scale > 1.

Tools of measurement: Fugl-meyer assessment scale for the upper extremity which includes subsection hand (FMA–WH) which consists of measurement of mass flexion, mass extension, flexion in Proximal interphalangeal joint and distal interphalangeal joint (digits II-V) extension in Metacarpophalangeal joint (II-V), thumb adduction, opposition, cylinder grip, spherical grip with total score of 14.



Figure-1
Mirror Box with task materials



Figure-2
Patient performing a task by observing the mirror

Table-1
Demographic variables of the Mirror group n = 15

Variables	Mirror group	Percentage
Age (<50/>50)	2/13	13.33/86.66%
Female/Male	11/4	73.33/26.66%
Dominant side (right/left)	8/7	46.66/53.33%
Diagnosis (ischaemic/ Haemorrhagic)	9/6	60/40%
Loss of consciousness	10	66.66%
Seizures	4	26.66%
Hypertension	9	60%
Diabetes	6	40%
Dyslipidemia	9	60%
Tobacco/alcohol	6/9	40/60%

Results and Discussion

15 Patients completed 4 weeks of mirror box therapy with conventional physical and occupational therapy. Pre intervention & post intervention evaluation and scores were calculated 4 weeks before and after the therapy.

Mean age of mirror group was 58 years.73% were males. Educational status of the patients varied from no education to higher secondary level. 53% of patients were of poor socio-economic status. Right and left hemiplegia was almost equally prevalent. Ischaemic stroke was more common cause of stroke. 67% of patients were having loss of consciousness. Hypertension was found to be the most common comorbid condition (60%) in these patients. Smoking and tobacco chewing was also found to be common.

The Mean and SD of FMA-WH scores for the study group at Pre intervention was 1.93 and 0.79 respectively and Post intervention mean and SD was 3.00 and 0.75 respectively. Paired t-test has been applied to compare the two mean values. The significant p-value ($p < 0.001$) indicates the post test mean Fugl-Meyer assessment score is statistically different from pre test mean score which implies that the treatment with mirror box is advantageous in improving the hand function after stroke at the end of first month (Figure-3,4).



Figure-3
Fingers in flexion of DIP and PIP before and after 4 weeks of therapy

Table-2
Mean and SD of FMA score at Pre test and Post test

Assessment	Mean	SD	Paired “t”-test	P- value
Pre test	1.93	0.79	6.959	P < 0.001
Post test	3.00	0.75		

Discussion: The study subjects comprised of 15 patients who were given mirror box therapy with conventional rehabilitation program. The present study came with the findings that mirror box therapy when added with conventional physiotherapy and occupational therapy was beneficial in improving the hand function. This advantageous effect on hand function started following mirror therapy. Similarly, Yavuzer et al¹⁵, revealed that after 4 weeks of mirror box therapy there was improvement

in the Brunnstrom and FIM scores for the hand and upper extremity.

There are many mechanisms that have been proposed for the mirror box therapy to exert influence on retrieval of hand function after stroke. Altschuler et al¹⁶ put forward the concept that the false or deceptive visual impression of normal movement of the affected hand substitutes the decreased proprioceptive information and helps with recruitment of the motor cortex lying within the frontal lobe of the brain and also assists rehabilitation by making an close connection between the deceptive visual impression and the motor cortex of the frontal lobe.

A study conducted by Garry et al¹⁷ showed the increased excitability of the primary motor cortices of a healthy individual’s hand placed behind the mirror when a transcranial magnetic stimulation was given during mirror illusions of the healthy subject.

Carson et al¹⁸, in a recent review suggested that when the normal limb performed a motor action in front of the mirror the visual illusion thrust upwards the excitation of the congruent pathways of the paralysed arm by a crossed facilitatory drive from the normal hemisphere, thereby facilitating the recovery of hand function.

Conclusion

Mirror box therapy can be a useful adjunct which when combined with conventional physiotherapy and occupational therapy can be a good tool for improving the hand function thereby increasing the patients quality of life.

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