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EFFECTIVENESS OF MIRROR THERAPY ON HANDFUNCTIONS IN SUBACUTE STROKE PATIENTS

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ABSTRACT

Background and Objective: Mirror therapy is a relatively new therapeutic intervention that focuses on moving the unimpaired limb. In stroke patients, it involves performing movements of the unimpaired limb while watching its mirror reflection superimposed over the (unseen) impaired limb, thus creating a visual illusion of enhanced movement capability of the impaired limb. The aim of this study was to evaluate the effects of mirror therapy on upper extremity motor recovery, spasticity and hand related functions of patients with sub-acute stroke.

Methods: The clinical trial was conducted at the department of Physiotherapy (SIMS College of Physiotherapy, Guntur), for the duration of 6 weeks. Thirty patients divided into two groups: Group A: Experimental treated with mirror therapy along with conventional therapy and Group B: Control group treated with conventional physiotherapy only. Data analyzed using SPSS, Mean, SD and T test for independent samples used.

Results: Comparison of pre-treatment and post treatment scores of experimental group of Brunnstrom stages showed extremely significant; while the control groupconsidered not significant. For Modified Ashworth Scale the pretreatment and post, treatment scores of experimental and control groupswere extremely significant. In addition, Functional Independence Measure showed extremely significant for experimental group and not significant for the control group.

Conclusions: Mirror therapy shared and a predictable rehabilitation program enhanced upper-extremity motor recovery and functioning in our sub-acute stroke inpatients. It is beneficial in improving the effects and outcome on upper extremity motor recovery and function.

Keywords: MIRROR THERAPY, HAND FUNCTIONS, STROKE PATIENTS.

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INTRODUCTION

A cerebro-vascularaccident is a sudden ischemic or hemorrhagic disturbance in the blood supply to brain tissue that results in partial loss of brain function.Stroke is the third commonest cause of death worldwide. A stroke causes partial destruction of cortical tissue and results in disturbed generation and integration of neural commands. It has been reported that up to 85% of stroke survivors experience hemi paresis and 55% to 75% of stroke survivors have continued to have limitations in upper extremity functioning. A number of interventions published evaluating the effect of various rehabilitation methods in improving upper extremity motor control and functioning, such as exercise training of the paretic arm, impairment-oriented training of the arm[1], functional electric stimulation[2], robotic assisted rehabilitation[3], and bilateral arm training[4], Mirror therapy is a relatively new therapeutic intervention that focuses on moving the unimpaired limb, It was first introduced by Ramachandran and Roger-Ramachandran.[5] Patients reported that they could move and relax the often-cramped phantom limb and experienced pain relief after mirror treatment. The first clear clinical description of phantom limbs was by Silas Weir Mitchell in 1872[6], Although there have been hundreds of case studies since that time, systematic experimental work began few years ago.[7, 8] Mirror therapy in stroke patients involves performing movements of the unimpaired limb while watching its mirror reflection superimposed over the (unseen) impaired limb, thus creating a visual illusion of enhanced movement capability of the impaired limb.[9] Functional brain imaging studies of healthy subjects suggest that excitability of the primary motor cortex ipsilateral to a unilateral hand movement facilitated by viewing a mirror reflection of the moving hand.[10] Reorganization of motor functions immediately around the stroke site (ipsilesional) is likely to be important in motor recovery after stroke, and a contribution of other brain areas in the affected hemisphere is possible.[11] Furthermore, actions generated using motor imagery adhere to the same movement rules and constraints that physical movements follow, and the neural network involved in motor imagery and motor execution overlap, primarily in the premotor and parietal areas, basal ganglia, and cerebellum.[9,10,12] The concept of mirror therapy has suggested as simple, inexpensive and most importantly patient- directed treatment that may improve upper extremity function. Since this initial report, successful use of mirror therapy has reported in patients with other pain syndromes, such as complex regional pain syndrome.[13,14] In randomized crossover, study of nine chronic stroke patients Altschuler et al., in 1999 reported that range of motion (RMO), speed and accuracy of arm movement more improved after mirror therapy. The functions of the hand improved more after mirror therapy in addition to a conventional rehabilitation program compared with a control treatment directly after four weeks of treatment and at six months follow up.[16]

Rehabilitation techniques enhance learning related changes after stroke and contribute to recovery, after stroke shares common brain reorganization mechanisms.[17] Sutbeyazet al showed an improved lower extremity motor recovery and motor functioning in subacute storke patients after four weeks of mirror therapy.[18] The motor imagery itself, the mental performance of a movement without overt execution of this movement, has proven to be potentially beneficial in the rehabilitation of hemiparesis.[20] The pattern of cerebral activation as finger and elbow movements of the normal limb activates the contralateral primary sensory and motor cortices. Artificial visual feedback on the movements of the phantom limb may thus 'fool' the brain and reestablish the original hand/arm cortical representation.[21] *Furthermore,*Scott H. Johnson-Frey, reported "stimulation through simulation" mechanisms based on increased visual or mental imagery feedback, another possible mechanism for the effectiveness of the mirror therapy might be bilateral arm training.[22] The motor imagery might provide an effective means of stimulating those brain regions normally involved in planning and controlling movements of the paralyzed limb.[23] Therefore, if exercises performed to increase muscle strength on one side of the body voluntary strength could increase on the contralateral side. (Contralateral effect of 7% initial strength or one quarter of the effect on the trained side).

MATERIALS AND METHODS

The clinical trial was conducted at the department of Physiotherapy (SIMS College of Physiotherapy, Guntur), for the duration of 6 weeks. Thirty patients divided into two groups: Group A: Experimental treated with mirror therapy along with conventional therapy and Group B: Control group treated with conventional physiotherapy only.

Patients randomly selected into each group by lottery method, each group containing 15 members, both males and females. Both the experimental group and control group participated in conventional stroke program, 5 days a week, 1

to 2 hrs for 6 weeks. The conventional physiotherapy program is patient specific and consists of passive movements, active movements, stretching's, strengthening techniques, neurodevelopmental facilitation techniques. For the same period, experimental group received an additional mirror therapy program for 1hr.

During the mirror therapy, a mirror placed vertically front of the patient with painful hand hidden behind the mirror while the non-painful hand positioned so that the reflection of this hand superimposed on the painful one. The practice consists of non-paretic side wrist and finger flexion and extension movements while patients looked into the mirror, watching the image of their non-involved hand, thus seeing reflection of the hand movement projected over the involved hand. Patient could see only the non-involved hand in the mirror. The patient asked to imagine that both hands were moving. Then the patient asked to perform bilateral hand movements during which the patient observed the mirror reflection of the uninjured hand. In addition, the therapist touched the uninvolved hand while the patient focused on the mirror reflection, visually suggesting that the effected hand was stimulated. After an instructional session, the patient was given a mirror for daily practice in home and was asked to practice 3-5 times each day for approximately 15min, the patient was asked to perform repeated short 15min training sessions in order to be able to maintain concentration during the mirror sessions while achieving sufficient practice time. Data analysis done by using SPSS, Mean, SD and T test for independent samples used.

RESULTS

Table 1: Comparison of pre-treatment and post treatment scores of experimental group of Brunnstrom stages. The difference considered extremely significant.

A: Experimental group						
Test		Mean	SD	Sample Size (N)	Unpaired t' test	
					probability	P value
Brunnstrom Stages 1-3	Pre treatment	2.467	0.6399	15	< 0.0001	5.899
	Post treatment	4.2	0.9411	15		

Table 2: Comparison of pre-treatment and post treatment scores of control group of Brunnstrom stages. The difference considered not significant.

B: Control group						
Test		Mean	SD	Sample Size (N)	Unpaired t' test	
					probability	P value
Brunnstrom Stages 1-3	Pre treatment	1.933	0.7988	15	< 0.0001	5.899
	Post treatment	2.533	0.8338	15		

Table 3: Comparison of post treatment scores of experimental and control groups of Brunnstrom stages. The difference considered extremely significant.

Test	Group		Mean	SD	Unpaired t' test	
					probability	P value
Brunnstrom Stages1-3	Experimental Group (A)	Posttreatment	4.2	0.9411	< 0.0001	5.134
	Control group (B)	Post treatment	2.533	0.8338		

Table 4: Comparison of pre treatment and post treatment scores of experimental group of Modified Ashworth Scale. The difference considered extremely significant.

A: Experimental group						
Test		Mean	SD	Sample Size(N)	Unpaired t' test	
					probability	P value
Modified Ashworth Scale	Pre treatment	3	0.8452	15	< 0.0001	5.870
	Posttreatment	1.4	0.6325	15		

Table 5: Comparison of pre treatment and post treatment scores ofcontrol group of Modified Ashworth Scale. The difference considered significant.

B: Control group						
Test		Mean	SD	Sample Size(N)	Unpaired t' test	
					probability	P value
Modified Ashworth Scale	Pre treatment	2.933	0.7037	15	0.0011	3.646
	Post treatment	2.0667	0.5936	15		

Table 6: Comparison of post treatment scores of experimental and control groups of Modified Ashworth Scale. The difference considered very significant.

Test	Group		Mean	SD	Unpaired t' test	
					probability	P value
Modified Ashworth Scale	Experimental Group (A)	post treatment	1.4	0.6325	0.0060	2.977
	Control group (B)	Post treatment	2.0667	0.5936		

Table7: Comparison of pre-treatment and post treatment scores of experimental group of Functional Independence Measure. The difference considered extremely significant.

A: Experimental group						
Test		Mean	SD	Sample Size(N)	Unpaired t' test	
					probability	P value
Functional Independence Measure	Pre treatment	2.6	0.7368	15	< 0.0001	5.490
	Post treatment	4.333	0.9759	15		

Table 8: Comparison of pre-treatment and post treatment scores ofcontrol group of Functional Independence Measure. The difference considered not significant.

B: Control group						
Test		Mean	SD	Sample Size(N)	Unpaired t' test	
					probability	P value
Functional Independence Measure	Pre treatment	2.933	1.033	15	0.3305	0.9902
	Post treatment	3.333	1.175	15		

Table 9: Comparison of post treatment scores of experimentaland control groups of Functional independence measure. The difference considered significant.

Test	Group		Mean	SD	Unpaired t' test	
					probability	P value
Modified Ashworth Scale	Experimental Group (A)	Post treatment	4.333	0.9759	0.0171	2.535
	Control group (B)	Post treatment	3.333	1.175		

DISCUSSION

Hemi paresis is a blanket term for a heterogeneous condition made up of weakness, motor control abnormalities. Damage to descending pathways as occurs in stroke results in several forms of motor and sensory impairment.

Mirror therapy is a form of motor imagery in which a mirror used to convey visual stimuli to the brain through observation of one's unaffected body part as it carries out a set of movements. The underlying principle is that movement of the affected link can be stimulated via visual cues origination from the opposite side of the body. Hence, it thought that this form of therapy could prove to be useful in patients who have lost movement of an arm or leg including those who have had a stroke.

Several underlying mechanisms for the effect of mirror therapy on motor recovery after stroke have proposed. Altschuler et al. suggested that the mirror illusion of a normal movement of the affected hand might substitute for decreased proprioceptive information[12]. There by helping to recruit the premotor cortex and assisting rehabilitation through an intimate connection between visual input and premotor areas.

Stevens and Stoykov suggested that mirror therapy related to motor imagery and that the mirror creates visual feedback of successful performance of the imagined action with the impaired limb[9]. Garry performed transcranial magnetic stimulation during mirror illusions in healthy subjects and showed increased excitability of primary motor cortex (M1) of the hand behind the mirror[10]. Sathian et al suggested that the patient showed improvement in functional use of right hand in the terms of manual movement and strength when mirror therapy is used[15].Giraux and Sirigu used a virtual reality system displaying prerecorded movements of a hand to create the illusion of normal hand movement[20].In a recent review, Carson explored the potential for bilateral interactions to occur in various brain regions, giving rise to functional improvements in the control of the paretic limb when movements performed in a bimanual context[24]. He suggested that when the nonparetic limb engaged during motor training, crossed facilitatory drive from the intact hemisphere would give rise to increased excitability in the homologous motor pathways of the paretic limb, facilitating recovery of function.

This study shows that mirror therapy in addition to a conventional rehabilitation program was more beneficial in terms of motor recovery and hand related functioning than a similar treatment without mirroring.

Summary

The study conducted on 30 stroke patients to know the effectiveness of mirror therapy, divided into two groups experimental and control groups bylottery method randomly each group containing 15 samples.

Three test were conducted namely: Brunnstrom of motor recovery, spasticity assessed by the Modified Ashworth Scale and hand related functions on Functional Independence Measure

Pre and post treatment scores of each individual taken regarding the three test mentioned above. When the post treatment scores of experimental and control groups brunnstrom stages were compared, probability is <0.0001 and'P' value is 5.134 and the difference were considered extremely significant.

Similarly, probability and P values of post treatment scores of both the groups of Modified Ashworth Scale were 0.0060 and 2.977 respectively and the difference considered very significant.In the same way, the probability and P values of post treatment scores of the two groups of Functional Independence Measure were 0.0171 and 2.535 respectively and the difference considered significantly. When the pretreatment and post treatment of the same group compared, the difference was considered extremely significant for experimental group.

CONCLUSION

Mirror is a simple, inexpensive and most importantly, a patient specific treatment, that incorporating mirror therapy into the conventional rehabilitation program at an early stage of treatment, and applying it for a long periodand continuing the therapy at home after discharge. It is beneficial in improving the effects and outcome on upper extremity motor recovery and function.Mirror therapy shared and a predictable rehabilitation program enhanced upper-extremity motor recovery and functioning in our sub acute stroke inpatients. In our group of sub acute stroke patients, hand function improved more after mirror therapy in addition to an unadventurous rehabilitation program.

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