

ORIGINAL ARTICLE

A COMPARITIVE STUDY TO FIND OUT THE EFFECT OF MIRROR THERAPY WITH ELECTRICAL STIMULATION AND MIRROR THERAPY ONLY ON FUNCTIONAL RECOVERY OF HAND IN STROKE SUBJECTS

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ABSTRACT

Background of the study: Impairment of motor functions of hand is common in stroke subjects and this leads to restriction of activities of daily life. So the purpose is to investigate the simultaneous effect of mirror therapy and electrical stimulation on functional recovery of hand in stroke subjects.

Methodology: 30 subjects which cerebrovascular accidents or stroke where selected for study and randomized into two groups. Experimental group received mirror therapy to the normal hand and paretic hand which is placed behind the mirror received electrical stimulation to the wrist whereas control group received mirror therapy only for duration of 30 minutes a day for month.

Outcome Measures: pre and post test values of all the subjects were evaluated using Chedock arm and hand activity inventory.

Result: The results has revealed that there is significance noted in experimental ($p=0.0222$) when compared to control group. A significant difference was also observed in the outcome scale of within the group.

Conclusion: Improvement on functional recovery of hand was more in mirror therapy and electrical stimulation group when compared with mirror therapy alone. This might be due to simultaneous application of the mirror and electrical stimulation therapies that resulted in stronger activation of brain resulted in improved motor functions. So, in clinical practice it is advised to give treatment with both the therapies than mirror therapy alone.

Keywords: Mirror Therapy, Electrical Stimulation, Stroke, Functional Recovery of the Hand.

INTRODUCTION

Stroke or a cerebral vascular disease, is the sudden death of brain cells due to inadequate blood flow. The WHO clinically defines stroke as clinical syndrome characterized by rapidly developing clinical signs and symptoms of focal, and at times global loss of cerebral function, with symptoms lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin¹. Stroke is the second commonest cause of death and fourth leading cause of disability worldwide². It is estimated that ischemic stroke accounts for 50%–85% of all strokes worldwide³. Indian studies have estimated that the incidence rates increase from 27-34/100,000 in the 35-44 age groups to 822-1116/100,000 in the 75+ age group. In India, the prevalence of stroke in younger individuals is high (18-32% of all stroke cases) compared with high-income countries^{4, 5}. The male to female sex ratio for India is 7:16.

Most of the stroke subjects presents with signs and symptoms of contra lateral hemiplegia, sensory impairments, and impaired balance and gait disturbances, homonymous hemi anopia. Following middle cerebral artery stroke, subjects presents with disability of weakness of distal muscles of hand which leads to difficulty in performing activities of daily living and is usually severe and lacks sufficient recovery.

Various treatment techniques or therapies have been employed to improve impaired motor functions of the hand. These include functional electrical stimulation⁷, constrained induced movement therapy⁸, EMG biofeedback⁹, virtual reality¹⁰, robotic therapy¹¹, mirror therapy¹².

The recovery rate of motor functions of wrist and hand are poor. Therefore effective methods are warranted for hand rehabilitation. Electrical stimulation and mirror therapy is one of the treatment techniques that are given to improve muscle strength and motor functions of hand.

Studies have revealed that there is a synergic effect of mirror therapy and neuromuscular electrical stimulation for hand function in stroke Patient. The mirror and NMES group showed significant improvements in the Fugl-Meyer scores of hand, wrist, coordination and power of hand extension¹³. Most of the studies did study in improving the hand functions with mirror therapy alone or electrical stimulation alone. None of the studies could determine whether the simultaneously application of the mirror and electrical stimulation therapy effected the activation of the brain or its stronger activation of the brain resulted in improved motor functions. So the purpose of the study is to compare and evaluate the effectiveness of mirror therapy and electrical stimulation with mirror therapy alone on the functional recovery of hand in stroke subjects.

METHODOLOGY

All subjects of first time hemiplegia with distal hand deficits were screened for inclusion and exclusion criteria. The subjects with the age group of 35-60 years who are clinically diagnosed middle cerebral artery infarcts with the brunstorm grading of hand 2 to 3 were included in the study. The subjects whose vitals are unstable, not co-operative and having other neurological and orthopedic problems, sensory impairment were excluded from the study. The nature and purpose of study was explained to subjects

before recruiting them in the study. Informed consent form was taken from every subject and subject attender.

PROCEDURE

30 subjects were selected for study and were randomized into two groups 15 experimental and 15 control groups. Experimental group received mirror therapy to normal hand along with electrical stimulation to affected wrist whereas control group re-ceived only electrical stimulation to affected wrist.

In both the groups, subject was made to sit in a chair and a mirror is placed in sagittal plane in front of the subject and the paretic limb is placed behind the mirror and the normal limb is placed in front of the mirror. In experimental group normal limb was made to perform exercises such as wrist flexion and exten-sion, fingers flexion, extension, opposition movements, grasping different shape objects, peg board activities in front of the mirror while subjects looked into the mirror watching the movements of their normal limb. Simultaneously electrical stimulation was given to the paretic limb with the wrist in dropped position. Ini-tially wipe the extensor aspect of forearm with alcohol swab to reduce skin resistance and then electrical stimulation was given with the rubber electrodes of the size 7cm x5cm with one elec-trode placed over the lateral epicondyle i.e. on common extensor origin and other electrode over the muscle bulk of extensor mus-cles i.e. on distal part of forearm and then secured with adhesive tape.

The scientific physio stimulation has been used for the study. These electrical devices delivered trains of asymmetric biphasic pulses at an amplitude of 30milliamperes with a pulse width of 250microseconds at 35HZ. It lasted for five seconds and then stopped for five seconds with faradic type of current and the intensity of stimulation was determined so that the subjects could feel muscle contraction .Control group received mirror ther-apy only where normal hand performs movements in front of mirror whereas paretic hand which is in wrist dropped position placed behind the mirror, the therapist suggest to try to keep the wrist in neutral position. The treatment was given for 30mins for 1month.After the treatment the subjects were reassessed with Chedoke arm and hand activity inventory14.



Figure:1 – Electrical stimulation of paretic wrist behind the mirror.

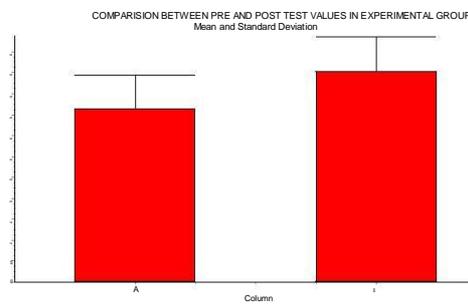


Figure - 2: Training the opposition movements of normal hand in front of mirror

DATA PRESENTATION AND STATISTICAL ANALYSIS

MEAN		STANDARD DEVIATION	P VALUE	T VALUE
PRE	41.333	8.095	<0.0001	17.793
POST	50.267	8.276		

Table 1: Comparison between pre and post values of experimental group.

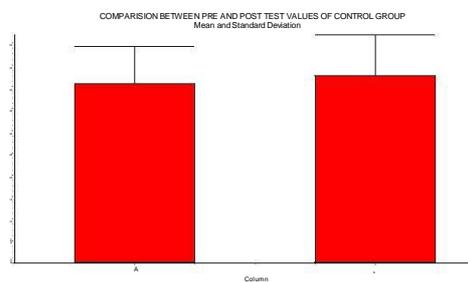


Graph 1: Comparison between pre and post values of experimental group.

The two-tailed P value is < 0.0001, considered extremely signif-icant.

MEAN		STANDARD DEVIATION	P VALUE	T VALUE
PRE	40.600	8.500	<0.0001	5.398
POST	42.533	9.195		

Table 2: Comparison between pre test and post test values of control group.

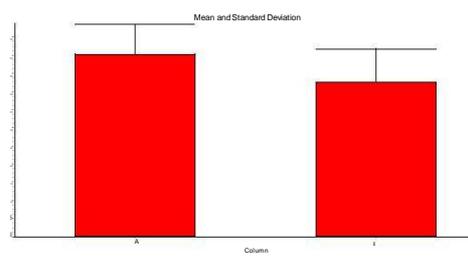


Graph 2: Comparison between pre test and post test values of control group.

The two-tailed P value is < 0.0001, considered extremely signif-icant.

MEAN	STANDARD DEVIATION		P VALUE	T VALUE
PRE	50.267	8.276	0.02222	2.421
POST	42.533	9.195		

Table 3: Comparison between post values of both the groups.



Graph 3: Comparison between post values of both groups. The two-tailed P value is 0.0222, considered significant.

RESULTS

Comparison between pre and post test values of Experimental group considered extremely significant with P value <0.0001. Comparison between the pre and post test values of Control group considered extremely significant with P value <0.0001. Comparison between the post test values of both the groups considered significant with P value 0.0222.

DISCUSSION

Impairment of motor function of hand is common in stroke subjects and this leads to restriction of activities of daily life. So, the purpose of this study is to compare the effectiveness of mirror therapy and electrical stimulation with mirror therapy alone on functional recovery of hand in stroke subjects.

The results of this study have revealed that there is significant ($p=0.0222$) change noticed in Chedoke arm and hand activity inventory in between the groups with regards to hand functions. This shows that improvement was more in mirror and electrical stimulation group than in mirror therapy group alone. The mirror group ($p<0.0001$) also showed improvements in motor functions of hand when measured before and after the treatment within the group.

There are several theories, which can be classified into two common mechanisms for the improvement in mirror therapy: a primary motor cortex mechanism and a mirror neuron system mechanism¹⁵. In this study as the subjects perform movements with normal hand in front of mirror at the same time the subjects look into the mirror watching the movements of their non-paretic hand and imagined their paretic-side wrist and hand were doing exactly the same thing, which substitutes the often decreased or void proprioceptive input, thus helping recruit the premotor cortex and improve motor rehabilitation through close interaction with the premotor cortex. Some authors have performed transcranial magnetic stimulation during mirror illusion in healthy subjects and showed increased excitability of the primary motor cortex of the hand behind the mirror¹⁶. Some others have suggested that when the non-paretic limb engaged during motor training, crossed facilitatory drive from the intact hemisphere give rise to increased excitability in the homologous motor pathways of the paretic limb, facilitating recovery of function¹⁷.

In this study as the wrist is in flexed position with fingers extended due to passive insufficiency, electrical stimulation was given to wrist of paretic hand that influences cortical reorganization.

Electrical stimulation not only stimulates motor nerve fibers but also afferent sensory nerve fibers. Alteration of afferent input has been shown to lead to organizational changes in cortex^{18, 19}. And prolonged stimulation of peripheral nerves can induce changes of motor networks in human cortex²⁰. Previous studies have revealed that the afferent feedback provided by electrical stimulation temporally coupled with task-related motor execution could facilitate brain plasticity.

CONCLUSION

Improvement on functional recovery of hand was more in mirror therapy and electrical stimulation group when compared with mirror therapy alone. This might be due to simultaneous application of the mirror and electrical stimulation therapies that resulted in stronger activation of brain resulted in improved motor functions. So, in clinical practice it is advised to give treatment with both the therapies than mirror therapy alone.

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