

The Efficacy of Mirror Therapy in Facial Palsy among Subjects with Facial Paralysis

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I. INTRODUCTION

The seventh cranial nerve has the nucleus over pons. It exits the skull through Stylomastoid foramen and passes through parotid gland and gives five branches, they are Temporal, Zygomatic, Buccal, Mandibular and Cervical. The facial motor nucleus has dorsal and ventral divisions that contain lower motor neurons supplying the muscles of the upper and lower face. The dorsal division receives bilateral upper motor neuron input while the ventral division receives only contralateral input¹. Lesions over Corticobulbar tract and the nucleus reduce or inhibit or stop the input to ventral division, but dorsal division input is maintained or not affected. So the facial palsy is found with hemiparesis of the contralateral facial muscles. Facial palsy comprises of peripheral and central facial palsy. Peripheral facial palsy affects superior and inferior region of face. The main cause of peripheral facial palsy is Bell's palsy in which the cause remains unknown whereas the central facial palsy only affects the inferior area of the face¹. Facial palsy is the weakness of musculature in the facial region with loss of sensation¹. The facial muscles become weak and droop and it's drawn across the opposite side of the face². In partial facial palsy conditions, the lower part of the face is more affected. In severe facial palsy conditions the taste is affected over the anterior 2/3rd of tongue. It may cause mild dysarthria and difficulty in eating. The muscles of forehead escapes the lesion and remains unaffected as uncrossed areas from the ipsilateral and the supranuclear areas, movements in the frontalis and upper orbicularis oculi are often spared in such type of lesion. Also, many patients voluntary muscle control of the face is lost but the muscles for spontaneous emotional expressions remain unaffected. The causes for Upper Motor Neuron facial palsy is mostly due to stroke, tumors, Any lesion occurring within or affecting the corticobulbar tract. Lower motor neuron lesion involves lesion in branches. Branches of the facial nerve leaving the facial motor nucleus (FMN) for the muscles do so via both left and right posterior (dorsal) and anterior (ventral) routes. The temporal branch travels out from the left and right posterior components. The inferior four branches do so via the left and right anterior components. The left and right branches supply their respective sides of the face. Accordingly, the posterior

components receive motor input from both hemispheres of the cerebral cortex (bilaterally), whereas the anterior components receive strictly contralateral input. This means that the temporal branch of the facial nerve receives motor input from both hemispheres of the cerebral cortex whereas the zygomatic, buccal, mandibular and cervical branches receive information from only contralateral hemispheres. Now, because the anterior facial motor nucleus receives only contralateral cortical input whereas the posterior receives that which is bilateral, a corticobulbar lesion (UMN lesion) occurring in the left hemisphere would eliminate motor input to the right anterior facial motor nucleus component, thus removing signalling to the inferior four facial nerve branches, thereby paralyzing the right mid- and lower-face. The posterior component, however, although now only receiving input from the right hemisphere, is still able to allow the temporal branch to sufficiently innervate the entire forehead. This means that the forehead will not be paralyzed. The same mechanism applies for an upper motor neuron lesion in the right hemisphere. The left anterior facial motor nucleus component no longer receives cortical motor input due to its strict contralateral innervation, whereas the posterior component is still sufficiently supplied by the left hemisphere. The result is paralysis of the left mid- and lower- face with an unaffected forehead. The facial nerve is essential for communication and expression, and impairment of its function can severely disabling as speech, mastication and expression are heavily depend on these muscles that is controlled by the facial nerve. The facial palsy can affect the social wellbeing of the individual that demands treatment of facial nerve paralysis as a vital concern. Electrical stimulation is the use of electrical current to stimulate the paralysed muscle and facilitate the muscle contraction. Electrical stimulation therapy is mostly used in clinical settings to rehabilitate the muscles and facilitate the motor activity of the muscle. Electrical stimulation has a two type of currents such as galvanic and faradic type of current. The galvanic current is used to stimulate the individual muscles and the faradic current used to stimulate the nerve trunks^{6, 7, 8}. Electrical stimulation helps in the recovery of the weak or paralysed facial muscles in facial palsy. Electrical stimulation promote regeneration and demyelination of injured facial nerve. It is effective in functional recovery of facial expression muscles in facial nerve and facial symmetry. The mirror therapy was

invented by vilayanur S. Ramachandran. Mirror therapy works on the principle of mirror neuron system and visual feedback. Mirror therapy consist of a mirror box in which a mirror is attached to one side and the patient is asked to keep their affected limb inside the box and perform the movement with the unaffected limb. This process gives visual feedback to the patient that the movement is occurred in affected limb. It's reduces the phantom limb pain, in which the patient still have pain in the limb even after having amputated.^{4,5} Neural Plasticity is considered to a main mechanism of Mirror Therapy in stroke patients, and it is generally considered to be mediated by Mirror induced illusion. In 2012 cochrane review found that positive effects of Mirror therapy on motor function and activities of daily living. Facial exercises are proved to be for facial muscle activity, lip and tongue dysfunction. Facial exercises are done to restore the function of the facial muscles. These include specific action exercises. Then the patient is made to do active exercises in front of the mirror which prevents muscle atrophy and enhance muscle function. Facial disability index questionnaire is used to measure the facial impairment and disability after facial paralysis. These statements are subsequently grouped into 6 independent domains. A score is calculated from 0 (Worst) to 100 (Best) by using a specific formula. The facial disability index (FDI) has been validated formally with respect to its ability to accurately and reliably measure these aspects of facial paralysis^{9, 10}.

Aim of the Study

The aim of the study was to evaluate the effect of mirror therapy in facial palsy.

Need for the Study

Facial palsy is the condition affecting the motor functions of the facial region. Orofacial exercises are generally used to rehabilitate facial paresis in Upper Motor Nerve lesion, but few studies had proven the effectiveness, Moreover no other effective therapies have yet been established and to our knowledge no studies are available in mirror therapy in facial palsy in Upper Motor Nerve lesions to improve the motor activity and to find out the better Protocol for facial palsy. Therefore this study will add growing body of knowledge that this techniques yield outcomes which should be ideal choice for treatment in facial palsy.

II. METHODOLOGY

STUDY DESIGN : Experimental design
STUDY TYPE : Pre-test and Post-test type
SAMPLING METHOD : Convenient sampling
SAMPLE SIZE 10
STUDY DURATION : 2 Weeks
STUDY SETTING : SRM Medical College Hospital and research

Centre, SRM Institute of science and technology, Kattankulathur

INCLUSION CRITERIA

Subjects with Upper Motor Neuron lesion Age group – 21to 50 years

Gender - Both male and female

Mini Mental status examination score >25 Subjects willing to participate

EXCLUSION CRITERIA

Subjects with Lower Motor Neuron lesion Oral cancer

Temporo mandibular joint fracture Recent tooth implantation

Recent Head injury

PROCEDURE

The subjects were selected based on the inclusion and exclusion criteria. Informed consent form was clearly explained to the subjects and it was obtained from the subjects.

The subjects are divided into two groups Group A and Group B.

The facial disability index (FDI) questionnaire is given to the subjects and the questionnaire was filled by the subjects and was used to assess the severity of the condition.

GROUP A

Group A subjects received electrical stimulation with galvanic current given for muscles and faradic current given for nerve trunks with duration of 15 to 20 minutes.

The electrical stimulation is given daily for 2 weeks. The facial palsy exercises are taught to the patient and they followed the exercises daily for two weeks. After 2 weeks of duration the post-test assessment was taken.

GROUP B

Group B subjects received electrical stimulation in galvanic current given for muscles and faradic current given for nerve trunks with duration of 15 to 20 minutes.

The electrical stimulation is given daily for 2 weeks. The mirror therapy exercises was taught to the subjects in front of the mirror and asked them to do the exercises in front of the mirror.

Electrical Stimulation (Group A & Group B) Position of the therapist: Appropriate walk stands position.

Position of the Patient:

Patient was made to lie supine with pillow support to make them relaxed and comfortable. The body part to be treated is exposed and the rest body part was draped.

Treatment parameters:

Type: Faradic current: Frequency: 50-100HZ

Pulse duration: 0.1-1ms.

Type: Galvanic current: Frequency: 30 pulse per minute Pulse duration: 1 to 600 ms.

Treatment duration: 15 to 20 mins

The mirror therapy exercises (Group B)

Balloon blowing exercise	Buccinator
Resisted isometrics	Frontalis, corrugator supercilii,

The post-test was taken after 2 weeks of duration of each samples for both groups (control group and experiment group). The post test is taken using the facial disability index questionnaire (FDI).

OUTCOME MEASURE:

Facial disability index questionnaire

III. DATA ANALYSIS

The obtained data was analysed using the IBM SPSS version 20 software compatible for windows. The statistical tool used in the study was paired‘t’ test, independent‘t’ test. Paired‘t’ test was used for analysis of pre-test and post-test means within the groups; whereas independent t-test was used for analysis of the comparison between the group A and group B.

EXERCISES	MUSCLES
Horizontal wrinkling	Frontalis
Vertical wrinkling	Corrugator supercilii
Eye closure and opening	Orbicularis Oculi
Nasal flaring	Nasalis
Vowels (A,E,I,O,U)	Orbicularis Oris, Depressor, mentalis, Zygomatic major

TABLE-1

PRE-TEST AND POST-TEST VALUES OFFACIAL DISABILITY INDEX QUESTIONNAIRE AMONG GROUP A TRATED WITH ELECTRICAL STIMULATION AND FACIAL EXECISES AND GROUP B SUBJECTS TREATED WITH ELECTRICAL STIMULATION AND MIRROR THERAPY(N=10).

GROUPS	TEST	MEAN	N	S D	Std.error mean	T	Df	Sig. (2-tailed)
Group A	Pre test	74.8	5	15.36066	6.86950	-4.243	4	0.013
	Post test	91.3	5	12.04990	5.38888			
Group B	Pre test	66	5	20.20829	9.03742	-4.922	4	0.008
	Post test	105	5	4.60163	2.05791			

P value <0.05

According to the table 1, there is a there is a significant improvement in mean values in facial disability index questionnaire in Group-A with significant value 0.013, and there is significant improvement in mean values in facial disability index questionnaire in Group-B with significant value 0.008(OP<0.05).

GRAPH 1

PRE-TEST AND POST-TEST MEAN VALUES OF FACIAL DISABILITY INDEX QUESTIONNAIRE AMONG GROUP A TREATED WITH ELECTRICAL STIMULATION AND FACIAL EXERCISE AND GROUP B TREATED WITH ELECTRICAL STIMULATION AND MIRROR THERAPY (N=10)

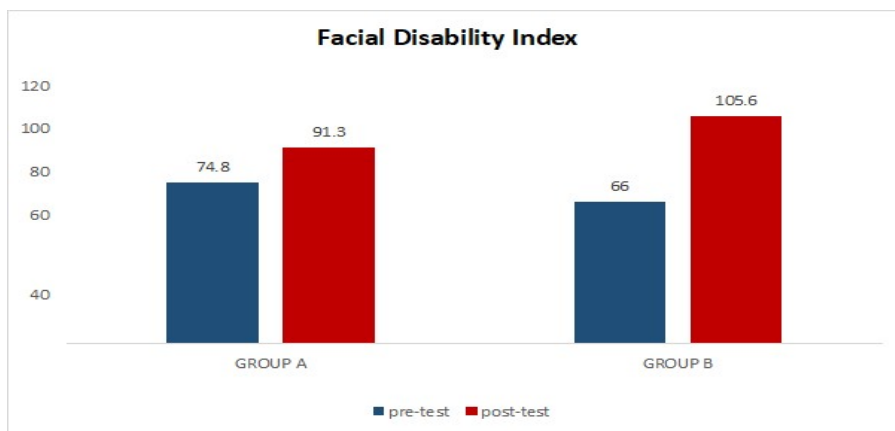


TABLE2

COMPARISON OF POST-TEST MEAN VALUES OF FACIAL DISABILITY INDEX QUESTIONNAIRE AMONG GROUP A TREATED WITH ELECTRICAL STIMULATION AND FACIAL EXERCISIES AND GROUP B TREATED WITH ELECTRICAL STIMULATION AND MIRROR THERAPY (N=10).

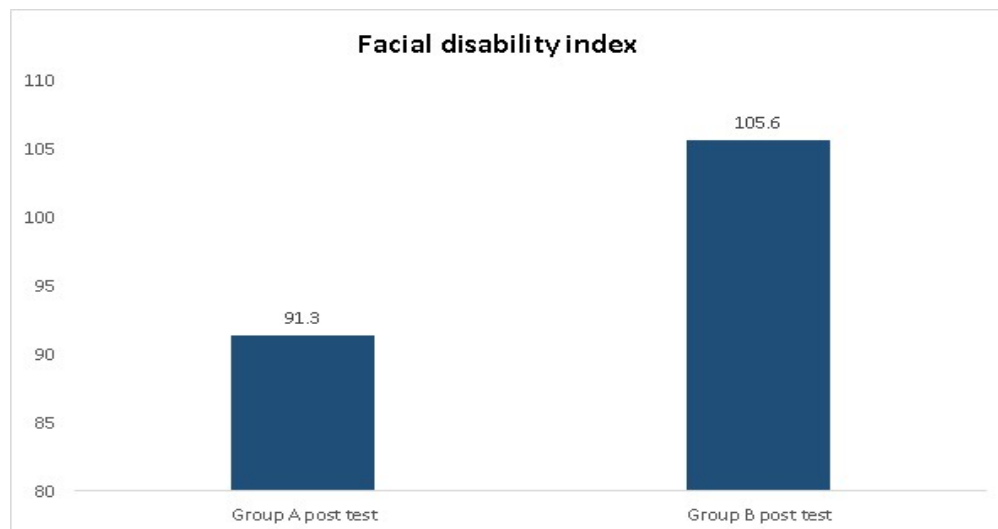
		Levene's test for equality of variances			
		F	Sig.	T	Sig.(2-tailed)
Post-test Group A	91.3	1.844	.212	-2.479	.038
Group B	105				

P value < 0.05

According to this table, the 't' test value was -2.479 with a p value < 0.05. Thus there was a significant difference in the improvement of facial palsy between the Group-A and Group-B among facial paralysis subjects.

GRAPH-2

COMPARISON OF POST-TEST MEAN VALUES OF FACIAL DISABILITY INDEX QUESTIONNAIRE AMONG GROUP A TREATED WITH ELECTRICAL STIMULATION AND FACIAL EXERCISIES AND GROUPB TREATED WITH ELECTRICAL STIMULATION AND MIRROR THERAPY (N=10)



IV. RESULTS

According to the Table 1 and Graph 1, The pre-test mean value of facial disability index questionnaire of facial palsy subjects in Group-A is 74.8 and the post-test mean value is 91.3, which has significant difference of 0.013. While the subjects in Group-B receiving the electrical stimulation and mirror therapy showed pre-test value of 66 and post-test mean value of 105, in which the improvement is significant with value of 0.008. Thus there was a significant difference (p<0.05) and improvement in mean values of facial disability index questionnaire of facial palsy subjects belonging to the Group-A receiving electrical stimulation and facial exercises whereas, there was a significant changes observed (p<0.05) and an improvement in facial disability index questionnaire was noted the subjects in Group-B.

According to the Table 2 & Graph 2, The t' test value was -2.479 with a p value <0.05 which shows that there was a significant difference in the improvement of motor functions between the Group-A and Group-B in subjects with facial palsy.

V. DISCUSSION

This study determines the effectiveness of mirror therapy for improving motor function among facial palsy subjects.

Facial palsy is said to be loss of facial movement due to nerve damage, occurring as a result of facial muscles are become weak and droop. It happen one or both sides of the face as stated by, Illinois-chicago (2016). About 10 facial palsy subjects who fell in the age group of 21 to 50 years satisfied both inclusion and exclusion criteria were include in this study. They were analysed using facial disability index (FDI) questionnaire and divided into Group- A and Group-B

randomly.

This results of this study shows that there was a statistical difference in the Group-A & Group B (p value<0.05) when pre-test and post-test was compared, depicting improvement in motor function as there was significance improvement in values facial disability index (FDI). there is increase in motor function post electrotherapy and electrotherapy combined with mirror therapy.

This results goes in hand with **Luca Mirela Cristina et al., (2015)** who stated that mirror therapy improves the motor functions, manual skills and activities of daily living. It is the low cost method to improve motor activity.

Mirror therapy was invented by Ramachandran and Rogers-Ramachandran in 1996. In mirror therapy, the affected person is feel the imaginary movement of the affected body part behaving like normal body part through mirror. The clinical, effect of mirror therapy is much more significant than other treatments as stated by **Weeks SR, Anderson-Barnes VC, (2010)**¹⁵.

But when both the group are compared there was a significant improvement in motor function among Group B subjects than Group A subjects (P <0.05) which shows that mirror therapy training for a period of 2 weeks has a better effect in improving motor function among facial palsy subjects.

The effectiveness of mirror therapy has improved motor function, activities of daily living. Mirror therapy was improved the motor function of the affected part and daily activity as stated by **Thieme H., (2012)**¹⁶.The facial palsy completely recover with treatment. Some facial palsy condition may not recover fully for physical therapy, and eye care can prevent the deformity and improve the quality of life. mirror therapy is improves sensory and attentional deficits and support motor recovery in a distal plegic limb as described by **Christian Dohle et al., (2008)**.The mirror therapy is the non-pharmacological rehabilitation technique designed to remoulade the cortical mechanisms. Mirror therapy is easy to use and low-cost advanced technique as stated by **Peter Le Feuvre., (2015)**. Furthermore Mirror image of active hand increase the extensibility of neurons in ipsilateral primary motor cortex significantly more than viewing the inactive side directly as stated by **Annabel Mc Dermott OT et al., (2004)**. Mirror therapy is a form of motor imaginary technique in which a mirror is used to convey visual stimuli to the brain through observation of unaffected body part as it carries out a set of movement. The underlying principle is movements of the affected part that can be carried by the opposite side of the body part via visual cues. This explains the better effects of mirror therapy. Thus mirror therapy can be added in management of upper motor lesion facial palsy in order to improve the social well being of the patient and also helps to improve their quality of life.

VI. CONCLUSION

The study concludes that on application of mirror therapy on the facial palsy subjects for two weeks along with electrical stimulation has better improvement of motor function. Thus mirror therapy can benefit the subjects and can be recommended in the treatment of the facial paralysis among facial palsy subjects.

VII. LIMITATIONS

Facial paralysis subjects had difficulty in understanding the mirror therapy technique.

Some of the subjects were unwilling to perform the mirror therapy for next session due to repetitions.

VIII. RECOMMENDATIONS

Larger sample size can also be taken into the study.

Further studies can be done on various age group peoples.

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