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# COMPARATIVE EFFECTS OF NEUROMUSCULAR RETRAINING AND MIME THERAPY TO TREAT SYNKINESIS IN BELLS PALSY

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## ABSTRACT

***Background:*** *Bell's palsy is an unexpectedly lower motor neuron damage of the facial nerve that causes asymmetry around the mouth, loss of the ability to close the eye, elimination of the nasolabial fold, and destruction of skin creases on the opposite side of the forehead. Bell palsy has a prevalence rate of 15 to 30 per 100,000 people.*

***Objective****: To determine the Comparative effects of neuromuscular retraining and mime therapy to treat synkinesis in Bell's palsy.*

***Material and method****: It was a Randomized clinical trial study conducted in 3 clinical hospitals of Faisalabad. 64 participants enrolled in the study by considering the inclusion and exclusion criteria were randomly allocated in two groups by lottery method. Group A received the electrical stimulation and Mime therapy while group B received the electrical stimulation and neuromuscular retaining. Outcome measures of this study were Synkinesis assessment questionnaire and House Brackmann facial grading scale measured the synkinesis and paresis severity in Bell's palsy patients. Total treatment was of 4 weeks. Data was collected at baseline, after 2nd week and end of treatment at 4th week. Data was be analyzed by using SPSS.*

***Results:*** *The mean age of participants was 37.03±6.85. There was 28 male and 36 female in study. There was significant difference in effect of neuromuscular retraining along with electrical stimulation and mime therapy along with electrical stimulation at end of 4 week of treatment in reducing synkinesis (21.14±2.0 mean rank 14.52 versus 37±10.22 mean rank 41 P =0.000) and improve facial symmetry (1.07±.267 mean rank 17.93 versus 1.89±.567 P= .000). Therefore neuromuscular retraining was more effective in reducing synkinesis and improving facial function in bell's palsy patients.*

***Conclusion****: This study stated that neuromuscular re-training and electrical muscle stimulation had more beneficial effects as compared to mime therapy in decreasing synkinesis and return to normal, symmetrical facial function in Bell's palsy patients after 4 weeks of treatment.*

***Keywords:*** *Neuromuscular Retraining, Neuromuscular Re-education, Mime Therapy, Bell's palsy.*

**INTRODUCTION**

Bell palsy is a lower motor neuron damage of the facial nerve that causes asymmetry in the area of the mouth, loss of the ability to shut the eye, elimination of the nasolabial fold, and destruction of skin creases on the similar side of the forehead (1). Autoimmune responses, infections, ischemia, tumors, and other structures that stress on the facial nerve can all cause injury. The symptoms of a motor neuron lesion are less severe. Normally, only one facial nerve is damaged, but occasionally, both facial nerves may be (2).

The involvement of the periocular muscles in peripheral facial palsy allows it to be separated from central facial palsy. The absence of forehead wrinkles, loss of brow motions, and improper closure of the affected eye, often known as Bell's Phenomenon, are all symptoms of peripheral palsy. This happens as a result of the seventh cranial nerve's frontal branches being damaged. Yet, the forehead region is spared in central facial palsy because of dual innervation (3). The Bell's Phenomenon is absent, there is no loss of forehead creases, and brow movements are normal. All ipsilateral muscles are impacted by Bell Palsy or lower motor neuron lesion (LMNL). UMNL, also known as facial palsy, on the other hand, affects the lower quadrant of the face on the opposite side. The frontalis muscle is unaffected by central facial palsy, saving the motions of the forehead (4).

Bell's palsy accounts for roughly 75% of all acute facial paralysis cases, with the most common age range being 15 to 45 years and median age of onset being 40 years. The annually rate in the United Kingdom is around 20 per 100000, with one in every 60 people affected during their entire life. Both sexes are equally afflicted, despite the fact that the frequency is greater in pregnant females, with 45 cases per 100 000 (6). Bell's palsy affects both male and female equally. However, the prevalence rises in pregnancy with 43 cases per 100,000 people. One side's facial paralysis occurs more frequently on either the left or right side of face. A facial paralysis on both of the face's sides is extremely uncommon, with a prevalence rate of 0.3-2 percent (7).

The 4 phases of Bell's palsy are as follows: **1) Progress Phase:** This phase lasts from the first to the seventh day after commencement until complete progression, at which point muscles become flaccid and facial asymmetry appears. **2) Plateau Phase:** This stage lasts for two to three weeks from the time the disease is at its worst. On the basis of this phase, the disease's prognosis is anticipated. This phase transitions between two distinct times. First, during the progress phase when muscle strength is weaker (House Brackmann scale grade 5 or 6). Muscles begin to strengthen in the second period and are rated at less than a 5 on the House Brackmann scale . **3) Recovery Phase:** During this stage, muscles have grown stronger and attempt to emote naturally. Grade 4 is lower than HBGS. **4) Sequelae Phase:** This phase will start if the prior three stages did not include any treatment. Muscle strength, length, and elasticity will all continue to decline in the event of an incomplete recovery. In severe situations, paralysis will be complete. The other probable outcomes include muscle and nerve adhesion, facial nerve entrapment, and a lack of nerve excitability. Therefore, in the sequelae phase, the patient complains of synkinesis, spasm, contractures, crocodile tears syndrome, deafness, and tinnitus (18).

The cause of Bell's palsy may have several different etiologies. The incidence of Bell's palsy rises in the later months of pregnancy, according to a study about the condition's development in the late stages of pregnancy and the early postpartum and its link to the poorest long-term results. Another finding from the study was that PABP, or pregnancy-associated Bell Palsy, has poor prognosis (19).

Bell's palsy results from facial nerve compression in the geniculate ganglion. The first part of the labyrinthine facial canal has the smallest diameter. The majority of Bell's palsy sufferers experience compression at this region most frequently. Compression and ischemia are caused by inflammation of the thin section of the nerve (22). There is a connection between Bell palsy and migraine. Age, gender, migraine subtype, and co-morbid all were the risk factors for Bell palsy. Bell's palsy was not previously known to be predisposed by migraine headache (23).

Synkinesis is an unusual involuntary linked to facial activity that happens in nearly all case scenarios of facial nerve degradation that would normally renew from the proximal location of injury (25). Synkinesis

starts 12-16 weeks after facial nerve palsy regeneration and can last up to 24 month. It has been revealed that 9-55% of patient populations have insufficient FNP healing. Oral-ocular synkinesis, abnormal eye shutdown during voluntary mouth activity are all frequent type of facial synkinesis (26). The reason of synkinesis is unknown; however, abnormal recovery of the facial nerve is the most commonly cited reason (27).

29% of Bell's palsy patients have life-long residual weakness, involuntary contractions, spasms, and unintentional movements that occur concurrently with intentional movement, a condition known as synkinesis (28).

There was intriguing viewpoints of myths and misconceptions about the treatment of facial palsy in a developing nation. The study investigated the false beliefs that patients and medical professionals have about treating Bell's palsy in Pakistan. These incorrect notions frequently prevail over the truth and waste the time and money of the patients. Additionally, it may cause long-term impairment. The following list of myths is followed by the relevant facts (29):

1. **Myth:** Patients are frequently instructed to chew gum.
   **Fact:** The muscles of mastication, which are innervated by the fifth cranial nerve (CN-V), carry out the action of chewing. The degree of facial synkinesis can grow with frequent eating.
2. **Myth:** The idea held by some patients that Bell's palsy is caused by exposure to cold. Patients who have this type of thinking cover their faces with a warm cloth. They use warm compresses with turmeric powder paste, hoping to improve local vascular supply. Patients refuse to bathe, wash their faces, brush their teeth, or shave. Patients refrain from sitting in fan- or air-conditioned rooms (29).
   **Fact:** Cold environment is not a pre-disposing factor for Bell’s palsy. Cold exposure can be a risk factor for vascular disorders but not for neurogenic disorders and Bell’s palsy has a neurogenic origin.
3. **Myth:** Patients conceal their house mirrors so they won't look in them.
   **Fact:** It has no theoretical foundation, true. It may have a negative impact on mirror treatment and visual feedback used in facial rehabilitation.
4. Myth: Wild pigeon flesh is consumed by patients as a form of sickness therapy.
   **Fact:** There is no place for a high-protein diet in the management of facial nerve palsy.
   It is necessary to dispel societal myths by educating patients and raising public awareness. These beliefs prevent the disease from being managed effectively. (29)

Clinical presentation is used to make the Bell's Palsy diagnosis. Bell's palsy is a facial palsy that affects all facial muscles on the ipsilateral side of the affected facial nerve and has an unknown origin. However, MRIs and tests for nerve excitability can also be done for additional proof (31)

Treatment options for Bell's palsy range from the straightforward to the complex, from just keeping the eye protected and allowing for natural recovery to surgically decompressing the facial nerve for quick nerve function return. Corticosteroids and antiviral medications are utilized in drug therapy to address facial deformity and enhance function. Following Bell's Palsy, hemifacial spasm can be lessened with Botox injections into the afflicted muscles (36)

The neuromuscular facial re-education is a process of memorizing facial movement employing precise and specific input to (1) assist facial musculature movement in functional patterns and appearance and (2) inhibit irregular muscle activity meddling with facial movement (50).

Neuromuscular reeducation can also be aided by surface electromyographic biofeedback. The non-invasive method of neuromuscular re-education is used in the treatment of facial injuries. It seeks to restore facial symmetry and lessen swallowing and speaking difficulties. It starts with a preliminary assessment of talents and impairments, followed by supervised training sessions when the proper facial movement patterns are taught. Common facial workouts include eye closure, frowning, furrowing the forehead, grinning, puckering the lips, snarling, and pouting. To improve face symmetry, patients are trained to self-perform activities on their paretic side without allowing conscious movement on their non-paretic side (51). There was limited evidence available on synkinesis in Bell’s palsy. Individual research are present on facial symmetry or facial function or synkinesis with mine therapy and electrical stimulus or neuromuscular retraining but

comparison of mime therapy and neuromuscular retraining along with electrical stimulation was not present yet.

**METHODOLOGY**

Randomized clinical Trial at Allied Hospital, Madinah, Teaching Hospital and DHQ Hospital Faisalabad on 64 Bell's palsy patients. Participants were enrolled in the study by considering the inclusion criteria, 1. Diagnosed patients with acute or sub-acute traumatic bell's palsy, 2. Age 20-50 years with no neurological deficits both genders were included in this study. Patients were excluded who have diseases of the central nervous system, sensory loss over the face, recurrence of facial paralysis (53). Data was collected after gaining information from ethical committee of University of Faisalabad. Informed consent was signed by the participants. Participants were randomly allocated in two groups by lottery method. Group A received the electrical stimulation and Mime therapy while Group B received the electrical stimulation and neuromuscular retraining. Total treatment was of 4 weeks. Treatment was given for 5 days per week. Data was collected at baseline, after 2nd week and end of treatment at 4th week.

Electrical stimulation was delivered transcutaneous. High-voltage twin peak monophasic pulsed current with a pulse duration of 100 seconds, a pulse rate of 35 hertz, a 10 second on-time, a 30 second off-time, and a 2 second ramp up and down was applied. These parameters were developed using earlier research finding on electrical; stimulation for Bell's palsy. 4 face muscles were stimulated: first one was frontalis muscles, second one was orbicularis oculi, third one was zygomaticus major and fourth one was orbicularis oris. Electrode of EMS who have negative charged were positioned on the impacted musculature of face due to Bell's palsy. While electrode of EMS with positive charge was positioned behind the ear on the mastoid prominence on the same affected side. Current rose until the recommended noticeable contraction occurs. Electrical stimulation was raised until the muscle impacted due to paresis contracted. Nerve supply of the affected muscle was also stimulated. Ten contraction of impacted musculature of face was executed. Seven minutes of nerve stimulation by each impacted muscle this time period was equal to ten contraction of impacted muscle (28).

**Mime therapy:** a) Participants were instructed to massage their face and neck for ten to fifteen minutes every day. Effleurage and kneading bilateral of the face was used in the massage. b) Stretching exercises on the impacted side were performed to help alleviate the mimetic musculatures that engaged in synkinesis. The respondents were then allowed to learn stress and to perceive the distinction among stress and relaxation in overall, as well as in the face muscles in particular, even though synkinesis can boost muscle tone, which could be aggravated by tension. c) Particular exercises were taught to co-ordinate both sides of the face and to reduce synkinesis. Basic exercises with variability in amplitude and speed (forehead wrinkle, eye closure, smile, snarl, lip pucker), exercises for one of the face's sides to influence separate movement patterns, stress relief of the bottom jaw, exercises of the mouth (smiling, pouting), and the eye with concurrent suppression of synkinesis (slow, small movements and counter force) were included. For responses, a mirror was utilized. d), Exercises for closing the eyes and lips was performed. The upper eyelids was stretched in situations of inability to completely shut the eyelids. While retaining the lips still, eye exercises were carried out with varying speeds and forces. Lip closing exercises included cheek exercises (filling the cheeks with differing quantities of air) as well as drinking and eating exercises while retaining the impacted eye open (small movements). e) Exercises were carried out to improve the individual's knowledge of lip movements and mouth placement for different sounds. Lip positions were represented by vowels such as a, e, I and o, as well as consonants such as p and b. Finally, expression exercises were introduced. Mime therapy sought to create an aware link between the uses of muscle fibers and face expression of emotion. Exercises were accomplished in two ways: from the application of specific muscles to an expression, or from an expression as a preliminary step for a motion. (47). Total forty five minutes session was given to patient for consecutive 4 weeks.

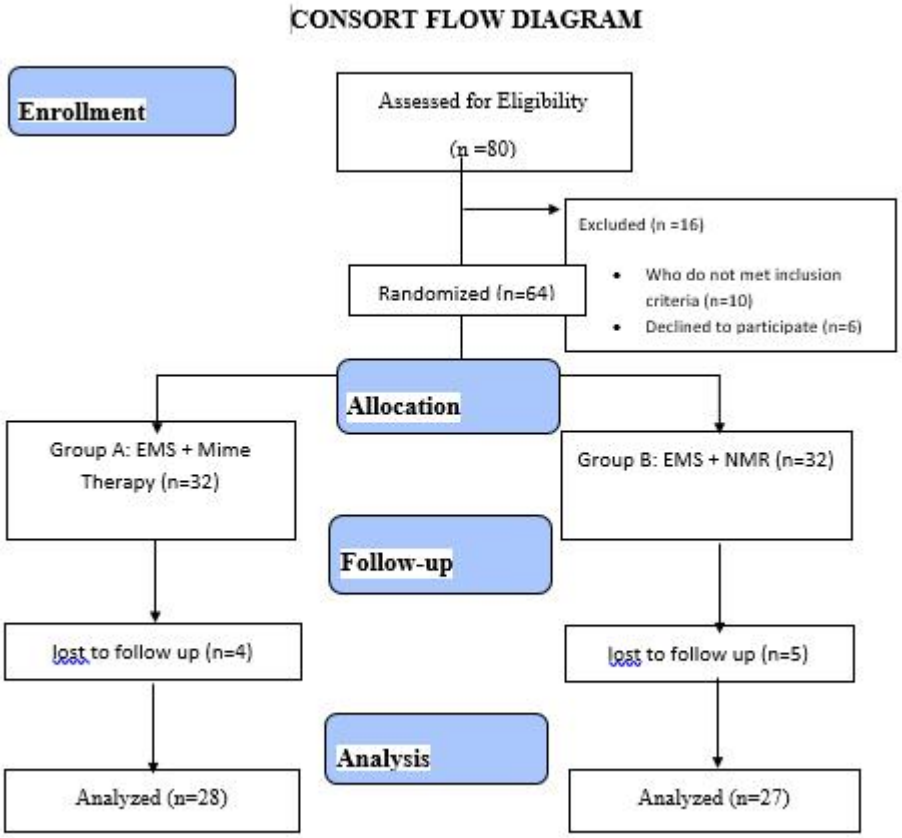
**Table 1: Neuromuscular Retraining Treatment Protocol**

| **Neuromuscular retaining** | |
|---|---|
| ○ For initiation | • Active Assisted exercises<br>• Massage<br>• Stretching<br>For impacted side of face |
| ○ For Facilitation | • Active assisted exercise |
| ○ For Movement Control | • Massage for facial retraction<br>• stretching for facial retraction<br>• Active assisted exercise on involve side |
| ○ For Relaxation | • Thermotherapy<br>• Alternating rhythmic movements<br>• Relaxation exercises<br>5-10 repetition for each exercise |

**House Brackmann facial grading scale**

To classify the extent of facial paralysis, the HBFNGS (House-Brackmann Facial Nerve Grading System is widely utilized. **Synkinesis Assessment Scale** was used to assess Synkinesis Total scores vary from zero (no synkinesis) to 100 (complete synkinesis) The SAQ's test-retest reliability was significant (Spearman's rank correlation r =0.876, P.0001). Cronbach's alpha was 0.859 (107,108).

***Fig .1: CONSORT FLOW DIAGRAM***



**RESULTS**

The purpose of the study was to determine effects of neuromuscular retraining and mime therapy to treat synkinesis in Bell's palsy. For this purpose 64 patients was taken from Allied Hospital, Madinah, Teaching Hospital and DHQ Hospital Faisalabad. Two groups was formed, each group consisted of 32 patients. Group A received the electrical stimulation and Mime therapy while Group B received the electrical stimulation and neuromuscular retraining.

To test the null hypothesis that there was no significant difference in effects of neuromuscular retraining and mime therapy to treat synkinesis in Bell's palsy, inferential statistics was applied. Data was collected at baseline, after 2nd week and end of treatment at 4th week. Before conducting inferential statistics, normality of data was checked. Because data didn't follow the normal distribution. Therefore non-parametric tests were applied. Mann-Whitney U-Test was applied to rule out the difference among two groups at the start of intervention, 2nd week and end of intervention at 4th week. Synkinesis Assessment Questionnaire and House Brackmann Scale of each patient were assessed after the start and end of treatment. Friedman Test was used to determine the effects of interventions within both group subjects at the start of treatment and after the 2 and 4 week of intervention the results.

The mean and standard deviation of age were 37.03±6.85. The minimum age was 24 years, and the maximum age was 50 years. Occupation of patients were out of 64. 29 ( 45.3%) were house wife , 11(17.2%) were students, 7( 10.9%) were businessman, 5 (7.8%) were teachers, 2(3.1%) were lawyer, 2(3.1%) were shopkeeper, 1(1.6%) were government teacher, 1(1.6%) were electrician, 1(1.6%) were labour, 1(1.6%) were waiter, 1(1.6%) were plumber,3(4.7%) were banker.

Group that was treated with neuromuscular re-education and electrical muscle stimulation shows more beneficial effects in reducing synkinesis as compared to group that was treated with mime therapy and electrical stimulation. Table: 1.

**Table: 1. Between group comparisons for mean change in Synkinesis Assessment Questionnaire score at Baseline, week 2 and week 4.**

| | Group 1 EMS + Mime Therapy | | | Group 2 EMS + NMR | | | |
|---|---|---|---|---|---|---|---|
| **Session** | **N** | **Mean± S.D** | **Mean Rank** | **N** | **Mean± S.D** | **Mean Rank** | **p-value** |
| **SAQ at Baseline** | 32 | 82.79±2.933 | 36.69 | 32 | 81.40±2.334 | 28.31 | 0.067 |
| **SAQ at 2nd week** | 28 | 53.71±12.037 | 36.02 | 27 | 42.37±8.181 | 19.69 | .000 |
| **SAQ at 4th week** | 28 | 37.00±10.220 | 41.00 | 27 | 21.14±2.057 | 14.52 | .000 |

*SAQ= Synkinesis Assessment Questionnaire, *EMS= Electrical Muscle Stimulation, *NMR= Neuromuscular Re-education.

EMS and NMR group has significant improvement in facial function with each post treatment reading as compared to the EMS + Mime therapy group. Overall both groups showed improvement in physical function of face. Synkinesis was significantly reduced in both groups after treatment. Table 2.

***Table 2. Within group comparison for mean change in Synkinesis Assessment Questionnaire score at Baseline, week 2 and week 4***

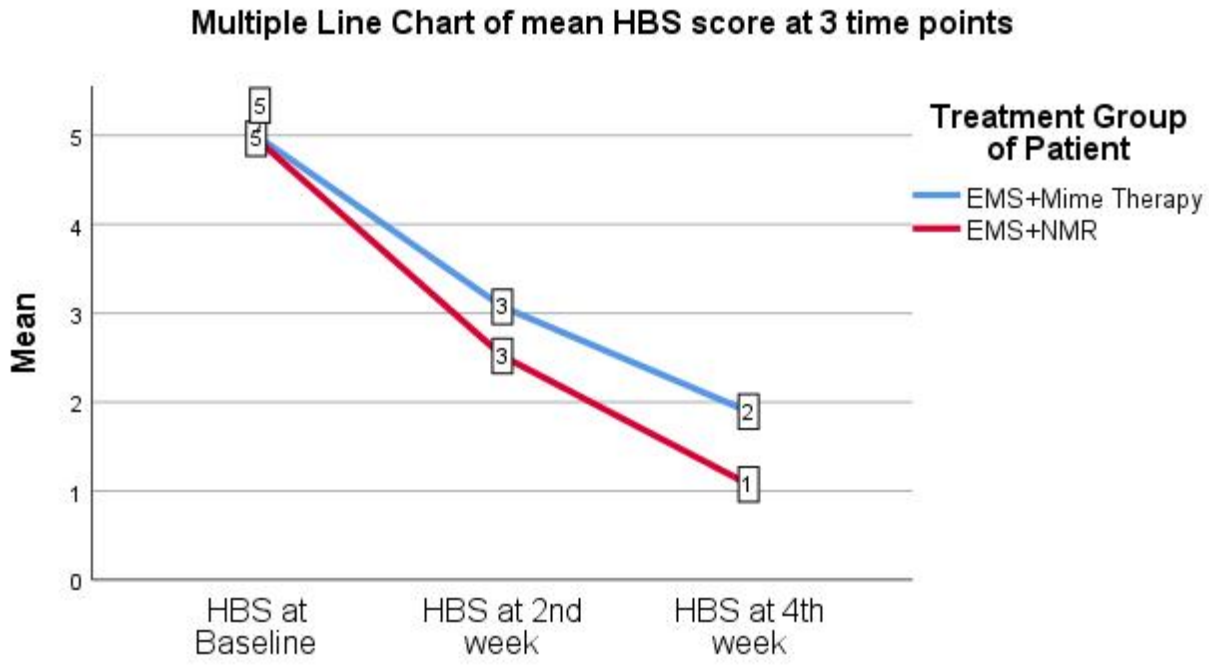
| **Treatment Group** | **Baseline** | | **2nd week** | | **4th week** | | **p-value** |
|---|---|---|---|---|---|---|---|
| | **Mean ± S.D** | **Median** | **Mean ± S.D** | **Median** | **Mean ± S.D** | **Median** | |
| **Group 1** | 82.79±2.933 | 82.20 | 53.71±12.037 | 51 | 37.00±10.220 | 37.70 | 0.000 |
| **Group 2** | 81.40±2.334 | 81 | 42.37±8.181 | 40 | 21.14±2.057 | 20 | 0.000 |

*Group 1= Electrical Muscle Stimulation + Mime Therapy, *Group 2= Electrical Muscle Stimulation + Neuromuscular Re-education

The HBS scores of the two treatment groups for baseline (pre-treatment) and post-treatment readings of 2nd and 4th week. The mean values of the HBS in EMS and neuromuscular re-education group at base line was 5, at 2nd week 3 and at 4th week was 2 that was significantly more reduced as compared to mean value in EMS and mime therapy group that was 5 at baseline, 3 at 2 week , 1 at 4week. Therefore EMS and NMR group has significant improvement in facial function and normal symmetrical function with post treatment reading as compared to the EMS + Mime therapy group. Overall both groups showed reduction in facial dysfunction

**Figure 2.**

***Fig 2: Mean improvement in HBS scores at baseline, week 2 and week 4 in both groups***




*HBS=House Brackmann Scale, *EMS= Electrical Muscle Stimulation, *NMR= Neuromuscular Re-education

**DISCUSSION**

This study stated that neuromuscular re-training techniques in addition to electrical muscle stimulation and mime therapy along with electrical muscle stimulation both reduced synkinesis and reduced facial dysfunction to normal symmetrical facial function in Bell's palsy patients. But neuromuscular re-training and electrical muscle stimulation were more effective in decreasing synkinesis and improving facial function in Bell's palsy patients after 4 weeks of treatment.

This study concluded that facial neuromuscular re-education along with conventional treatment that included electrical muscular stimulation, massage technique, and some facial exercise was more beneficial in reducing synkinesis or improving the facial symmetry of patients (P = 0.45) and facial movement (P = 0.01) suffering from Bell's palsy as compared to conventional treatment alone (50). This study's finding was consistent with the present study's findings, in which neuromuscular re-training and mime therapy were used. Electrical muscle stimulation was used as a baseline treatment. Neuromuscular re-training along with electrical muscle stimulation was more effective in reducing synkinesis or improving normal symmetry of the face (P=0.01) and improving facial function (P=0.00) in patients with Bell's palsy as compared to mime therapy. This study had one distinct feature that was the present study used the synkinesis assessment questionnaire to

evaluate the synkinesis, while the above study used the facial grading scale to evaluate the synkinesis. The total treatment protocol of the above-mentioned study was two weeks, but assessment was taken after two months by a facial grading scale, while the present study applied treatment for one week, and assessment was taken at two and four weeks of treatment.

Beurskens and Heymans conducted a study that determined the effect of mime therapy. They had used this treatment on 50 patients who complained of facial paresis. This study concluded that mime therapy was effective in reducing synkinesis (P<0.001) or improving symmetrical movement of the face (P<0.001) in fascial paresis patients (47). This study provides consistent findings with the present study. The present study reveals that mime therapy also shows a positive effect in reducing synkinesis (P 0.000) or improving normal facial symmetrical function (P 0.000) in Bell's palsy patients. They had different treatment protocols: the present study applied the four-week treatment protocol, while the above-mentioned study applied the treatment for three months. Both studies for the evaluation of synkinesis used different questionnaires: the present study used the synkinesis assessment questionnaire, and the study of Beurskens and Heymans used the Sunnybrock facial grading system.

This present study used electrical muscular stimulation as a baseline treatment. The different between present study from previous mentioned of Arnold Fredrick D souz was that neuromuscular re-training technique was more superior to mime therapy in reducing synkiness (P=0.000) and reduce facial dysfunction to normal facial symmetrical function (P=0.000). This present study used the treatment protocol of 4 week. The previous study mention was a pilot randomized clinical trial.

Mistry et al. (2014) conducted the study that determined the influence of mime therapy. They had compared this therapy with conventional therapy. They applied these therapies to thirty patients with bell palsy. This study stated that mime therapy had a positive impact on the symmetry of the face (P =0.001) and improved facial function (P =0.001) in Bell's palsy patients. Mime therapy was more effective as compared to exercise performed at home and conventional therapy in reducing synkinesis (P =0.001) in Bell's palsy patients (48). This study's findings provide support for the current study. In the present study, mime therapy along with electrical muscle stimulation reduced the synkinesis in the face (P= 0.000) and reduced the severe facial dysfunction (P= 0.000) to normal symmetrical functional function in Bell's palsy patients.

Mishra et al. carried out a study that evaluated the influence of mime therapy on subjects with Bell's palsy. They had compared this therapy with sensory exercises on 30 patients with Bell's palsy. This study shows that third groups treated with sensory exercise along with mime therapy as well as electrical muscle stimulation had reduced facial synkinesis more after 3 weeks of treatment and improved facial function as compared to group A that was treated with electrical muscle stimulation that involved galvanic current with thirty contractions with three sets per week in addition to conventional exercises that included facial exercises, and group B that was treated with electrical stimulation along with mime therapy, whereas third groups treated with sensory exercise along with mime therapy as well as electrical muscle stimulation (5). This present study had consistent results. The present study shows that mime therapy, when applied long with electrical muscle stimulation, had more effects in reducing synkinesis and improving facial symmetry in patients with bell palsy after the 3rd week of treatment.

Mughal et al. (2021) to see how effective facial neuromuscular retraining. They had used this retraining in conjunction with or without mirror visual feedback. They had applied this technique on Bell's palsy patients. A randomized controlled trial was carried out. The sample consisted of sixty four people. Individuals were randomly assigned two groups. Each with thirty two patients. Neuromuscular Retraining exercises were given to both groups. Mirror Visual Feedback was also given to first group. Two outcome measures such as Facial Disability Index as well as House Brackmann Scale were used. This tool evaluates the facial alignment and function of muscles of face. The entire treatment period lasted seven weeks. This study revealed that Mirror Visual Feedback combined with neuromuscular retraining was more beneficial as compared to neuromuscular retraining alone. This combination technique enhanced facial alignment and motion and reducing functional impairment in Bell's palsy individuals (65). The above study was consistent with the current study. The present study also found that neuromuscular retraining was effective in improving facial function as well as reducing synkinesis in Bell's palsy patients. But neuromuscular

retraining was used in conjunction with electrical stimulation for a period of four weeks, whereas the current study used the seven-week treatment protocol. This was the distinct feature of both studies.

## CONCLUSION

Neuromuscular re-training techniques in addition to electrical muscle stimulation and mime therapy along with electrical muscle stimulation both decrease the facial synkinesis and reduced facial dysfunction to normal symmetrical facial function in Bell's palsy patients. But neuromuscular re-training and electrical muscle stimulation had more beneficial effects as compared to mime therapy in decreasing synkinesis and return to normal, symmetrical facial function in Bell's palsy patients after 4 weeks of treatment.

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