

FACIAL NEUROMUSCULAR RETRAINING VS CONVENTIONAL PHYSIOTHERAPY TO REDUCE SYNKINESIS AND IMPROVE FACIAL SYMMETRY IN FACIAL PALSY PATIENTS: A RANDOMIZED CONTROLLED TRIAL

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Abstract

Background: Facial palsy is a condition in the nervous system that affects the facial muscles resulting in muscle weakness, synkinesis and asymmetry of the face muscles. The treatment of facial palsy includes Facial Neuromuscular Retraining where there is the need of selective activation of muscles and control of movements.

Objective: To compare the effects of Facial Neuromuscular Retraining and Conventional Physiotherapy on synkinesis and facial asymmetry in patients with facial palsy.

Methodology: It was a study design which comprised of 60 patients with facial palsy ranging from 21 to 70 years. Equal distribution of subjects into two groups was done. Group A (n=30) subjects were subjected to FNMR treatment with selective movement control, motor control exercise, inhibition of synkinesis and mirror retraining. Group B (n=30) subjects were subjected to conventional physiotherapy involving facial exercise and massage. Subjects were treated for 4 weeks for 5 days in a week.

Results: Improvement in both SAQ and FDI scores ($p < 0.001$) was found for both groups. Group A demonstrated a decrease in the mean SAQ score from 60.07 ± 10.13 to 44.22 ± 11.03 and an increase in the mean FDI score from 53.87 ± 13.83 to 73.46 ± 12.40 . Group B demonstrated a decrease in the mean SAQ score from 63.19 ± 12.85 to 52.22 ± 13.42 and an increase in the mean FDI score from 55.47 ± 11.19 to 65.73 ± 11.68 . Significance between the two groups was found regarding SAQ scores ($p = 0.014$) and FDI scores ($p = 0.016$) after treatment. Difference in mean FDI improvement was in favor of Group A and was statistically significant ($p = 0.001$), while the difference in SAQ improvement did not reach significance ($p = 0.091$).

Conclusion: The two treatment approaches under study – Facial Neuromuscular Retraining Therapy and conventional Physiotherapy – have proven themselves effective in bringing about favorable results in the change

of the parameters studied in the patients diagnosed with facial palsy. However, a greater degree of improvement and better outcomes were achieved with Facial Neuromuscular Retraining.

INTRODUCTION

The human face is a key aspect of communication, emotion and social interactions and facial movements contribute to important processes such as blinking, speech articulation, mastication and oral competence. One of the most disabling cranial neuropathies that clinical practice faces, facial palsy is a weakness of some or all of the muscles of the face caused by dysfunction of the seventh cranial (facial) nerve (Atabek, 2020). Facial expressions play key roles in nonverbal communication and even slight asymmetry can cause changes in felt emotions by others, leading to embarrassment, anxiety, depression and diminished social participation that often remain after neurological recovery (Cohn et al., 2020).

One of the long-term complications of injury to the peripheral facial nerve is synkinesis which like voluntary movement, involves involuntary contractions of voluntary muscles, including unwanted muscle contraction of the eye during smiling. It occurs mostly due to aberrant regeneration of the axons and in certain cases, ephaptic cross-transmission between neighboring facial nerve fibers and its frequency differs significantly depending on the severity of damage in the injury and the length of follow-up as it is more frequent following severe or incompletely recovered facial palsy (Guntinas-Lichius et al., 2022).

Use of the Sunnybrook Facial Grading System has gained popularity as an outcome measure used in most rehabilitation research in that it is more sensitive to clinical change by assessing resting symmetry, voluntary movement and synkinesis independently. Patient-rated scales are also vital, as perceived disability may not necessarily be reflected by clinician-rated scales. Facial Disability Index (FDI) assesses physical functioning and social well-being but Synkinesis Assessment Questionnaire (SAQ) directly assesses

the frequency and severity of involuntary movement; both assessment instruments have become popular in rehabilitation studies due to the inclusion of the patients themselves to judge functional limitation within the assessment questionnaire. It has been more recently supplanted by surface electromyography and computerized facial tracking in the hopes of minimizing the effect of observer bias and offer objective, quantitative data of rehabilitative progress (Mengi et al., 2024).

One of the most important new developments in the facial rehabilitation is the Facial Neuromuscular Retraining (FNMR). In contrast to usual physiotherapy with more muscle strengthening, FNMR prioritizes movement quality, to restore selective muscle activation, enhance facial symmetry, suppress synkinesis and normalization of motor functioning by structured individualized motor relearning. FNMR has a theoretical foundation based on the principles of motor and sensorimotor integration and neuroplasticity that is experience-dependent (Liang & Zhu, 2026).

The objective of this study was;

1. To compare the effects of Facial Neuromuscular Retraining and Conventional physiotherapy on synkinesis and facial asymmetry among patients with Facial palsy.

2. Methodology

2.1 Study Design and Setting

A randomized controlled trial (RCT) design was adopted to determine the effects of facial neuromuscular retraining on synkinesis and facial asymmetry in facial palsy patients. The study was conducted at the **BARKI Complex, Shareef Mall, Katchery Chowk and Physio by Dr Ammar Hans Plaza, Bosan Road, Multan, Pakistan**. The study protocol was approved by the ethical committee of TIMES University Multan and written informed consent

was obtained from all participants before participation. Pasted text

2.2 Participants and Sample Size

The study population consisted of diagnosed facial palsy patients from Multan. A total sample size of **60 participants** was recruited based on G*Power calculation. Participants were equally divided into two intervention groups, with **30 participants allocated to the facial neuromuscular retraining group (Group A)** and **30 participants allocated to the Conventional physiotherapy group (Group B)**. Pasted text

Participants included individuals aged **21–70 years**, diagnosed with unilateral facial palsy, with chronic stage of facial palsy (3–12 months after onset) and with facial asymmetry and synkinesis. Patients with other neurological ailments which involve the facial muscles, Psychologically or metabolically ill patients that can affect the results of the studies, cognitively impaired patients, uncooperative and incapable of taking on treatment instructions were excluded. Pasted text

2.3 Sampling and Randomization

A non-probability purposive sampling technique was used. After eligibility assessment and baseline evaluation, participants were randomly allocated into two groups using a lottery method. Equal allocation was maintained to ensure comparable group sizes. Pasted text

2.4 Intervention Protocol

Participants that fit into the inclusion criteria were randomly allocated into two groups using the lottery method; Group A and Group B. Group A was allocated into treatment of Facial Neuromuscular Retraining (FNMR) while Group B was allocated into Conventional Physiotherapy. Pasted text

Group A: Facial Neuromuscular Retraining

Participants performed slow, graded, controlled, and task-specific facial retraining exercises were performed. Continuous mirror feedback was used to correct facial imbalances and enhance motor

learning. Treatment was provided five sessions per week for four weeks. Each session lasted approximately 45 minutes. Each activity was performed with repeated practice to improve functional movement control. Pasted text

Group B: Conventional Physiotherapy

Participants focused on simple voluntary contractions of the facial muscles. The mirror was used only as a guide during home exercises and was not used for retraining. Facial Massage was performed to improve circulation and reduce stiffness. Basic facial strengthening exercise routines were performed. Treatment was provided five sessions per week for four weeks. Each session lasted approximately 45 minutes.

2.5 Outcome Measures

Facial Disability Assessment

Facial Disability Index (FDI) is a reliable and validated disease-specific and self-reported questionnaire proposed to measure the extent to which the facial palsy influences the physical functioning and social/well-being status as well as the appearance of the face (the facial asymmetry). FDI has two subscales:

1. Physical Function (FDI-P)
2. Social / Well-Being (FDI-S)

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Synkinesis Assessment

Synkinesis Assessment Questionnaire (SAQ) is a reliable and tested measurement that is administered to determine the severity of synkinesis in patients with facial palsy. It is particular in measuring involuntary facial movements during voluntary facial movements, and is usually applied in measuring treatment results in facial neuromuscular rehabilitation. Pasted text

2.6 Statistical Analysis

IBM SPSS Statistics (Version 26.0) was used for analysis of data. The descriptive analysis was carried out to describe the data. For categorical variables, the results were described as frequencies and percentages. For continuous

variables, the results were expressed as mean and standard deviation (SD). The normality of the continuous variables was checked using the Shapiro–Wilk test. Since the data showed normal distribution, the parametric tests of statistics were used for analysis. For comparing pre-test and post-test data in the same group, the paired-samples t-test was applied. An independent-samples t-test was used to compare the means of two independent groups. The significant value was considered $p < 0.10$. Pasted text

3. Results

3.1 Participant Characteristics

A total of 60 diagnosed facial palsy patients completed the study, with 30 participants in each intervention group. In Group A, the largest percentage of participants was found to belong to the age group of 40-49 years (40.0%, $n=12$), while in Group B, the largest percentage belonged to the age group of 30-39 years (36.7%, $n=11$). Pasted text

Table 1. Demographic Characteristics of Participants

Age group (years)	Group A, n (%)	Group B, n (%)	Total, n (%)
20-29	8 (26.7)	7 (23.3)	15 (25.0)
30-39	9 (30.0)	9 (30.0)	18 (30.0)
40-49	9 (30.0)	11 (36.7)	20 (33.3)
50-59	1 (3.3)	1 (3.3)	2 (3.3)
60-69	1 (3.3)	1 (3.3)	2 (3.3)
70-79	2 (6.7)	1 (3.3)	3 (5.0)
Total	30 (100)	30 (100)	60 (100)

The distribution demonstrated balanced representation of affected sides, with slightly higher Right-sided involvement. Pasted text

3.2 Normality Test

Table 2. Shapiro–Wilk Test of Normality for Both Groups

Group	Variable	Statistic (W)	df	Sig. (p)
A	SAQ_Pre	0.975	30	0.674
A	SAQ_Post	0.969	30	0.501
A	FDI_Pre	0.966	30	0.428
A	FDI_Post	0.970	30	0.544
B	SAQ_Pre	0.991	30	0.994
B	SAQ_Post	0.982	30	0.878
B	FDI_Pre	0.963	30	0.379

B	FDI_Post	0.947	30	0.137
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The normality of the dependent variables was examined by the Shapiro-Wilk test for both intervention groups. Specifically, the Shapiro-Wilk test was performed for the pre-intervention and post-intervention scores on Synkinesis Assessment Questionnaire (SAQ) and Facial Disability Index (FDI) with a significance level of 0.05 being considered. In Group A, there were non-significant results from the Shapiro-Wilk test for SAQ pre-intervention ($W = 0.975$, $p = 0.674$), SAQ post-intervention ($W = 0.969$, $p = 0.501$), FDI pre-intervention ($W = 0.966$, $p = 0.428$), and FDI post-intervention ($W = 0.970$, $p = 0.544$). Likewise, there were also non-significant results from the Shapiro-Wilk test for Group B for SAQ pre-intervention ($W = 0.991$, $p = 0.994$), SAQ post-intervention ($W = 0.982$, $p = 0.878$), FDI pre-intervention ($W = 0.963$, $p = 0.379$) and FDI post-intervention ($W = 0.947$, $p = 0.137$). The significance values in all Shapiro-Wilk tests were <0.10 , signifying that there was no significant departure from normality found in any of the analyzed score distributions by the test. This suggests that parametric statistical tests can be considered, after the assumption conditions have been met especially with regard to normality of difference scores in paired samples t-test. Pasted text

3.3 Within-Group Comparison of Group A and B: Facial Neuromuscular Retraining

The results of the paired-samples t-test indicated the significance of the difference in SAQ and FDI measurements after the implementation of Facial Neuromuscular Retraining

3.4 Within-Group Comparison of SAQ Scores in Group A

Assessment	Mean $\pm$ SD	Mean difference (pre – post)	t-value	df	p-value
Pre-intervention	60.07 $\pm$ 10.13	15.85	9.30	29	<0.001
Post-intervention	44.22 $\pm$ 11.03				

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Interpretation

Pre-intervention mean SAQ score was 60.07 $\pm$ 10.13 whereas the post-intervention score was 44.22 $\pm$ 11.03. The paired samples t test showed that the differences between the two scores were statistically significant $t(29) = 9.30$, $p < 0.001$.

The mean decrease of 15.85 points signifies that there has been considerable improvement in the severity of synkinesis after Facial Neuromuscular Retraining. As the lower SAQ scores indicate the less severe synkinesis, this implies that the results are favorable for the intervention.

3.5 Within-Group Comparison of SAQ Scores in Group B

Assessment	Mean $\pm$ SD	Mean difference (pre – post)	t-value	df	p-value
Pre-intervention	63.19 $\pm$ 12.85	10.97	4.83	29	<0.001
Post-intervention	52.22 $\pm$ 13.42				

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Interpretation

The mean SAQ score dropped from 63.19 $\pm$ 12.85 before treatment to 52.22 $\pm$ 13.42 after receiving Conventional Physiotherapy. According to the results of the paired-samples t-test, there is a statistically significant difference, $t(29) = 4.83$, p

< 0.001. Despite the statistically significant drop of the mean by 10.97 points, which represents a considerable decrease in the occurrence of synkinesis, the size of this difference is smaller compared to that of Group A.

3.6 Within-Group Comparison of FDI Scores in Group A

Assessment	Mean $\pm$ SD	Mean difference (pre – post)	t-value	df	p-value
Pre-intervention	53.87 $\pm$ 13.83	-19.59	-8.81	29	<0.001
Post-intervention	73.46 $\pm$ 12.40				

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Interpretation

The mean of FDI score rose from 53.87 $\pm$ 13.83 pre-therapy to 73.46 $\pm$ 12.40 post-treatment. There was a statistically significant difference between both scores according to the paired-samples t-test, $t(29) = -8.81$, $p < 0.001$. An

increase of mean by approximately 19.59 denotes improvement in facial functions and decreased disability (facial asymmetry) due to FNMR. A negative t-statistic is simply an indicator of order in calculation of differences (pre-intervention minus post-intervention).

3.6 Within-Group Comparison of FDI Scores in Group B

Assessment	Mean $\pm$ SD	Mean difference (pre – post)	t-value	df	p-value
Pre-intervention	55.47 $\pm$ 11.19	-10.26	-6.26	29	<0.001
Post-intervention	65.73 $\pm$ 11.68				

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Interpretation

The mean score of FDI was raised from 55.47 $\pm$ 11.19 pre-treatment to 65.73 $\pm$ 11.68 post-treatment. Paired-samples t-test revealed a statistically significant difference, $t(29) = -6.26$, $p < 0.001$. The mean improvement of about 10.26

points shows better facial functioning and lowers disability (facial asymmetry) after receiving Conventional Physiotherapy. The findings show that the conventional therapy produced favorable outcomes in terms of these indicators.

3.7 Between-Group Comparison of Outcome Measures (Post-Intervention Comparison Between Groups)

Outcome	Group A, Mean $\pm$ SD	Group B, Mean $\pm$ SD	t-value	df	p-value
SAQ_Post	44.22 $\pm$ 11.03	52.22 $\pm$ 13.42	-2.52	58	0.014
FDI_Post	73.46 $\pm$ 12.40	65.73 $\pm$ 11.68	2.49	58	0.016

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Interpretation

In post-intervention analysis, the mean SAQ score in Group A was 44.22 ± 11.03 while in Group B, it was 52.22 ± 13.42 . Analysis of variance of two independent samples showed a significant difference between the groups, $t(58) = -2.52$, $p = 0.014$. The mean post-intervention SAQ score in Group A was about 8.00 points less than that in Group B. Since the lower the SAQ score, the less pronounced is synkinesis, the

4. Discussion

This current research was aimed at comparing the effects of Facial Neuromuscular Retraining (FNMR) and Conventional Physiotherapy on the synkinesis and facial asymmetry of the patients who suffer from facial palsy. The condition is known to be responsible for motor dysfunction, aberrant facial movements, asymmetry and problems with expressing emotions and communicating. Hence, the aim of the current research was to see whether FNMR would yield better results in comparison to conventional physiotherapy during a four-week period. According to the results, both methods were effective, yet the overall tendency indicated the superiority of FNMR especially in regard to improvement of FDI score. These results prove the effectiveness of the facial rehabilitation but emphasize the importance of choosing treatment methods that involve not only muscle activity but its quality and coordination.

It is also possible to interpret the results in the light of the systematic review by Silva et al. (2022), who examined the use of PNF for treating facial paresis. According to the review, there were six studies including 184 participants. PNF was applied in combination with other rehabilitation techniques, while outcomes included such aspects as facial recovery, recovery period and synkinesis. It is possible to obtain comparative data regarding the specific FNMR and conventional physiotherapy programs applied in this research, but one should not generalize the results to all forms of PNF, facial exercise therapy or neuromuscular rehabilitation interventions (Silva et al., 2022).

above result is more supportive of FNR than CP. The mean FDI score after intervention was 73.46 ± 12.40 in Group A and 65.73 ± 11.68 in Group B. This difference is statistically significant at $t(58) = 2.49$, $p = 0.016$. On average, FDI score in Group A was 7.73 points greater than that in Group B. As high FDI scores indicate more optimal facial function, the result supports FNMR.

The development of improved control over facial movements could be discussed in connection with the research by Jeong et al. (2023) in which the effectiveness of neuromuscular retraining along with botulinum toxin type A was studied among 99 participants with chronic unilateral facial paralysis. In this case, the duration of the treatment program was at least one year and improvement in voluntary movements and decrease in involuntary secondary movements were reported. It is possible to assume that decreased levels of excessive muscle activities may provide more suitable conditions for retraining. Nevertheless, the difference between the two studies should be pointed out as Jeong et al. explored the effect of a combined therapy, namely of botulinum toxin and long-term retraining, while the current research estimated the effect of FNMR during four weeks (Jeong et al., 2023).

Rahim et al. (2025) evaluated the efficacy of the Kabat technique in comparison with neuromuscular re-education in about 70 patients with Bell's palsy without trauma. According to the results obtained by the authors, higher levels of facial function and disability were noted in the Kabat technique group. Thus, the different results in relation to facial rehabilitation can be caused by different rehabilitation techniques and specific characteristics of the patients. The Kabat technique and FNMR differ in implementation and focus of their effects. Therefore, the efficiency of each technique may depend on the period of the illness, initial severity, patients' adherence and selected outcomes of rehabilitation. Thus, the differences between the

findings of Rahim et al. and those obtained in the current study should be considered taking into account different comparative groups (Rahim et al., 2025).

5. Conclusion

It is observed from the present study that Facial Neuromuscular Retraining in Group A and Conventional Physiotherapy in Group B were effective for improving outcomes among patients with facial palsy. However, the degree of improvement in the outcomes of Group A was different from that of Group B and overall, better outcomes were achieved in Group A. The mean decrease in the score of SAQ was 15.85 points in Group A from 60.07 ± 10.13 prior to treatment to 44.22 ± 11.03 following treatment. There was a rise of about 19.59 points in the mean score of FDI from 53.87 ± 13.83 to 73.46 ± 12.40 . All changes were statistically significant ($p < 0.001$). In Group B, there was a decrease of 10.97 points in the score of SAQ from 63.19 ± 12.85 to 52.22 ± 13.42 and a 10.26 points increase in the score of FDI from 55.47 ± 11.19 to 65.73 ± 11.68 . Changes were statistically significant ($p < 0.001$). The between-groups analysis showed statistically significant differences in the post-treatment scores of SAQ ($p = 0.014$) and FDI ($p = 0.016$) in favor of Group A based on the observed changes in scores and the presumed direction of scoring. The comparison of the improvement scores indicated a significantly higher level of FDI improvement in Group A compared to Group B ($p = 0.001$). At the same time, the difference in SAQ improvement between Groups A and B did not prove to be statistically significant ($p = 0.091$). Thus, the results showed a greater advantage of Facial Neuromuscular Retraining for the outcome in terms of FDI rather than for the change in SAQ scores. In conclusion, Facial Neuromuscular Retraining seems to be a promising method of rehabilitation in patients with facial palsy and can provide greater improvements in some facial function outcomes compared to Conventional Physiotherapy during four weeks of treatment. Nonetheless, both interventions have shown

positive changes, and the results should be discussed in connection with the limitations of the study in terms of sample size, length of the intervention, and the measures used.

6. Limitations

- The study involved 60 participants, with 30 participants in each group. A small sample size may reduce the applicability of results to the general population of patients suffering from facial palsy.
- Treatment was only conducted for four weeks. Consequently, this study was unable to demonstrate the durability of the benefits obtained using Facial Neuromuscular Retraining and Conventional Physiotherapy.
- Results were only collected pre-treatment and post-treatment. It is unclear how well improvements were sustained or whether synkinesis and facial asymmetry recurred without further follow-up periods.
- The study relied mainly on the SAQ and FDI to measure outcomes. Further outcome measures using clinical tests or facial movement assessment would offer a more comprehensive assessment of facial function.
- The results are limited to the specific treatments, participants, and treatment period evaluated in this study. Variations in the severity, time period of, and causes of facial palsy may affect treatment outcomes.

7. Recommendations

- The future studies should use more subjects to ensure greater reliability and validity of their findings.
- The researchers should assess the effects of Facial Neuromuscular Retraining and Conventional Physiotherapy during the longer periods of treatment in order to see whether it brings additional results.
- It would be helpful to conduct follow-up assessment to understand whether the improvements in synkinesis, facial function and facial asymmetry are sustainable.
- The future studies should apply the validated facial scales along with facial movement and quality of life measures together with SAQ and

FDI to make the evaluation of the treatments more complete.

- The physiotherapists can consider using Facial Neuromuscular Retraining in order to treat patients with facial palsy, especially when selective facial movements and control over synkinesis are important for treatment, although there is need for more research in this area before coming to conclusions on long-term superiority of the treatment.

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