"EFFECT OF NEUROMUSCULAR ELECTRICAL STIMULATION VERSUS FACIAL EXERCISES ON FACIAL MUSCLE STRENGTH AND ORAL MOTOR FUNCTION IN POST STROKE SUBJECTS WITH FACIAL PALSY"

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ABSTRACT

BACKGROUND AND OBJECTIVE: Facial palsy frequently occurs following a stroke, often hindering patients' engagement in rehabilitation programs and contributing to unfavourable recovery outcomes. Neuromuscular Electrical Stimulation (NMES) is commonly used as a supportive therapeutic approach. This study aimed to evaluate and compare the impact of NMES and facial exercises on enhancing facial muscle strength and oral motor function in individuals affected by post-stroke facial palsy.

METHOD: This quasi-experimental study involved 60 participants diagnosed with stroke, with an average age of 58 years. Using systematic random sampling, they were divided into two groups. Group A (n=30) received Neuromuscular Electrical Stimulation in combination with standard therapy, while Group B (n=30) underwent Facial Exercises. Both groups participated in intervention sessions three times per week over an eight-week period. The effectiveness of the treatments was evaluated using Manual Muscle Testing and the Oral Motor Assessment Scale.

RESULT: The independent t-test was applied to compare mean differences between continuous variables across the groups, while the paired t-test assessed the statistical significance of changes from pre- to post-intervention within each group. The results showed that both groups experienced notable improvements in the measured parameters when analyzed individually. However, when comparing outcomes between the groups, Neuromuscular Electrical Stimulation combined with conventional therapy led to greater improvements in

Oral Motor Assessment Scale (OMAS) scores than Facial Exercises alone.

CONCLUSION: Over the course of eight weeks of intervention, both groups demonstrated statistically significant improvements in post-test scores on the Oral Motor Assessment Scale (OMAS). However, Manual Muscle Testing (MMT) revealed comparable gains across both groups. Notably, Neuromuscular Electrical Stimulation combined with conventional therapy proved more effective than Facial Exercises in enhancing OMAS outcomes, while both interventions yielded similar results in MMT. These findings suggest that incorporating such treatment approaches may be beneficial in the rehabilitation of individuals recovering from stroke.

KEY WORDS: Post stroke, Neuromuscular Electrical Stimulation, Facial Exercises, Manual Muscle Testing and Oral Motor Assessment Scale.

INTRODUCTION

Facial paresis is among the most frequent complications in individuals who have experienced a stroke, and it involves changes in facial movement. Stroke is defined as a rapidly progressing localized or widespread disturbance in brain function that lasts more than 24 hours or may lead to death, with no clear cause other than a vascular origin.[1] It is estimated that around 20 million people suffer from stroke annually, and out of these, 15 million are expected to live with long-term disabilities.[2] In India, stroke ranks as one of the primary causes of both death and disability. Its prevalence ranges from 84–262 per 100,000 people in rural regions to 334–424 per 100,000 people in urban areas.[3]

Facial weakness resulting from stroke can occur in various regions of the brain and brainstem. A stroke affecting the brain may lead to central facial weakness. The facial nerve originates from the central portion of the brainstem (pons) and transmits motor signals to the muscles responsible for facial expressions. These motor fibers arise from the motor cortex of both cerebral hemispheres. [4] Damage to the motor cortex, such as that caused by stroke, leads to paralysis on the opposite side of the lower face, while the upper facial muscles remain functional on both sides due to dual innervation. As a result, affected individuals may have a weak smile but retain the ability to tightly close their eyes and wrinkle their forehead evenly. [5]

Stroke carries a high likelihood of leading to complications such a s difficulty swallowing (dysphagia), movement disorders, language impairments, sensory deficits, and cognitive dysfunction. [6] the buccinator, orbicularis oris, and risorius muscles are involved in both facial expression and the oral phase of swallowing. The swallowing process consists of four stages: oral preparatory phase, oral phase, pharyngeal phase, and esophageal phase. Stroke patients with dysphagia often experience disruptions in the oral preparatory, oral, and pharyngeal phases. [7] Dysphagia, which refers to difficulty in transferring food from the mouth to the esophagus due to weakness or paralysis of the muscles involved in swallowing, is extremely common. [8]

Neurological conditions like stroke lead to paralysis on the opposite side of the body, impacting the facial muscles. [9] In individuals with facial palsy, dysfunction of facial muscles tends to be more pronounced in the lower face compared to the upper. Consequently, weakened facial musculature contributes to difficulties during the oral phase of chewing and bolus manipulation, residual food in the mouth, drooling, and impaired facial expressions. [10] Facial asymmetry resulting from facial nerve paresis includes sagging at the mouth corner, saliva leakage from the corner, uneven smiling, and reduced speech clarity due to wasting of the lips, tongue, and throat muscles. Treatment options may include antibiotics, anti-inflammatory medications, and in severe cases, surgical decompression. In addition to these specific treatments, physical therapy provides further benefits. [11] Over the past century, various physical therapy approaches for managing facial palsy have been developed and refined, although current rehabilitation methods have shown inconsistent outcomes. [12]

This study incorporates neuromuscular electrical stimulation (NMES) and facial exercises alongside standard therapy to enhance muscle strength and oral functionality in individuals with post-stroke facial palsy. NMES delivers electrical impulses to the skin over the front of the throat or facial area. It aids in strengthening

muscles, preventing atrophy, and
retraining neuromuscular function. Nevertheless, most studies have concentrated on muscles involved in swallowing

located at the front of the neck in patients with pharyngeal dysphagia to evaluate its impact on swallowing ability. [13] Therefore, there is limited evidence regarding the efficacy of NMES in individuals with oral phase dysphagia and central facial palsy (CFP). The present research seeks to assess the influence of NMES on facial muscles and oral phase swallowing in patients experiencing oral phase dysphagia due to CFP following a stroke. [14]

Surface electrical stimulation is applied during the early phase of denervation after facial nerve paralysis begins. In this stage, the purpose of electrical stimulation is to maintain facial function and support the transition period until full reinnervation occurs. For electrostimulation to activate denervated muscles directly, muscle stimulation—not nerve stimulation—is necessary. In the initial phase of a facial injury or recurrent nerve impairment, electrical stimulation serves as a suitable clinical approach. Its objective is to facilitate the recovery of facial nerve function during the interval between the onset of denervation and muscle healing. Electrical stimulation seems to accelerate the healing process. [15] Facial exercises assist in restoring strength in the muscles responsible for facial expression, which are impacted following a stroke. Facial exercises are described as movements that involve strengthening, mobilizing, or manipulating the facial muscles. [16] These exercises include oral motor techniques aimed at specific muscles to enhance swallowing, speech, and facial functionality. Impaired motor control in the mouth can lead to dysphagia (difficulty swallowing) or dysarthria (speech motor disorder) in up to 40% of stroke patients. [17] These exercises serve several purposes: activating functional movement and facial expression, encouraging facial symmetry, managing and minimizing synkinesis, reintegrating emotional expression, and preserving active muscle tone and movement awareness. [18] Performing exercises in front of a mirror enhances facial muscle performance. Isometric exercises are identified as the most prevalent form of therapy, alongside isotonic exercises (strength training where muscle tension remains constant). These exercises can be quite beneficial; however, progress tends to be slow. Facial exercises also contribute to better facial functionality. To avoid muscle degeneration or the development of soft tissue contractures, physical therapy focusing on soft tissue and muscle retraining should be implemented. [19]

Additional rehabilitation approaches such as mime therapy, electromyography biofeedback, neuromuscular retraining techniques, and Kabat methods are utilized. Mime therapy is an alternative rehabilitation strategy for individuals with facial nerve paresis of various origins. It incorporates self-massage, relaxation techniques, coordination drills, suppression of synkinesis, and exercises for emotional expression. The theoretical foundation of mime therapy suggests that when facial expressions are impaired, it becomes necessary to engage the entire body to restore emotional and communicative abilities. [20] Neuromuscular retraining aims to enhance movement range, reduce flaccidity, prevent

synkinesis, and improve control of facial muscles. [21] Facial neuromuscular retraining employs both sensory and motor feedback. It uses sensory input along with coordinated movement exercises to support and reestablish proper facial movement patterns, while eliminating all inappropriate, involuntary, and abnormal facial expressions. [22] Electromyography biofeedback delivers essential information for correcting movement and aids the rehabilitation process. It serves as a supplementary tool to retraining exercises across various treatment categories. Acquiring facial movement skills is challenging without feedback. Electromyography biofeedback is employed to offer either visual or auditory cues reflecting function during rehabilitation sessions. [23]

The Kabat rehabilitation method for facial palsy can activate or reestablish the neuromuscular pathway, helping to restore normal nerve terminal function within the muscles. This technique involves executing

spiral and diagonal movements in defined patterns. These motions activate muscles by training them through comprehensive movement patterns during facial nerve recovery. [24]

The aim of this systematic review and meta-analysis was to assess how effective neuromuscular electrical stimulation is when combined with standard therapy and facial exercises for treating facial palsy.

NEED OF THE STUDY

The most prevalent physical impairment in individuals with post-stroke facial palsy is reduced muscle strength and dysfunction in oral motor control. Neuromuscular Electrical Stimulation (NMES) is used to help restore facial nerve activity during the phase between the onset of denervation and the regeneration of muscles in stroke patients. A facial exercise regimen is considered an effective approach, offering improvements in both muscle performance and oral motor abilities.

Numerous studies have explored the impact of orofacial myofunctional exercises in individuals with dysphagia, the effectiveness of facial exercise therapy for facial palsy, and the role of neuromuscular electrical stimulation in enhancing facial muscle strength and oral function in stroke patients with facial palsy. Some of these investigations have concentrated solely on targeted electrical stimulation, facial exercises, or a combination of both. Most research has emphasized strengthening specific muscles, such as those in the tongue and cheeks, while only a few have examined comprehensive improvements in the strength, speed, and functionality of the entire orofacial muscle group. This study aims to evaluate and compare the effects of Neuromuscular Electrical Stimulation and facial exercises on facial muscle strength and oral function in stroke patients with facial palsy.

AIM OF THE STUDY

The aim of the study is to assess the effect of Neuromuscular Electrical Stimulation versus Facial Exercises on facial muscle strength and oral function and to compare them in post-stroke subjects with facial palsy.

OBJECTIVES OF THE STUDY

1. To determine the effect of neuromuscular electrical stimulation on facial muscle strength and oral function in post-stroke subjects with facial palsy.
2. To determine the effect of facial exercises on facial muscle strength and oral function in post-stroke subjects with facial palsy.
3. To compare the effect of neuromuscular electrical stimulation and facial exercises on facial muscle strength and oral function in post-stroke subjects with facial palsy.

HYPOTHESIS

RESEARCH HYPOTHESIS (H1): Effects of Neuromuscular Electrical Stimulation may be more significant than Facial Exercises on improving facial muscle strength and oral function in post-stroke subjects with Facial palsy **NULL HYPOTHESIS (H0):** There is no significant difference between effect of Neuromuscular Electrical Stimulation and Facial Exercises on improving facial muscle strength and oral function in post-stroke subjects with Facial palsy.

MATERIALS AND METHODS

STUDY SETTING : Department of Physiotherapy, Tertiary care teaching hospital affiliated to Dr.N.T. R University

ETHICAL CLEARANCE AND INFORMED CONSENT: The study protocol was approved by the Ethical Committee of Swatantra Institute of Physiotherapy & Rehabilitation (Annexure-I), the investigator explained the purpose of the study and given the patient information sheet. The participants were requested to provide their consent to participate in the study (Annexure-II). All the participants signed the informed consent and the rights of the included participants have been secured.

STUDY TYPE : Quasi experimental study

STUDY POPULATION : Post-stroke Subjects will be recruited from General Medicine OPD of Tertiary care teaching hospital affiliated to Dr.N.T.R. University
STUDY DURATION: Study will be conducted during a period of one year **TREATMENT DURATION**: Eight weeks, 3 sessions /week for 80 minutes. **STUDY SAMPLING METHOD** : Systematic random Sampling
SAMPLE SIZE : 60 subjects based on prevalence of Stroke.

$H = Z^2PQ/L^{2,}$ Where Z = 1.96, P = Prevalence of stroke 0.424 [(2)], Q =100, P = 100-0.424=99.576, L = absolute error of 2%.
GROUP A: Neuromuscular Electrical Stimulation along with conventional physiotherapy (30 subjects)

GROUP B: Facial exercises (30 subjects)

CRITERIA FOR SAMPLE COLLECTION

INCLUSION CRITERIA:

- Individuals who have experienced a stroke within the past 6 months
- Participants aged between 45 and 90 years, covering middle adulthood (45–54) and older age (55–90)
- Those who voluntarily agree to take part in the study
- Stroke onset occurred less than 3 months ago
- A Mini-Mental State Examination (MMSE) score of 24 or higher

EXCLUSIVE CRITERIA:

- Presence of a cardiac pacemaker implant
- Significant communication impairments, including severe aphasia
- Medically unstable condition
- Dermatological issues that may interfere with electrode application

STUDY TOOLS AND OUTCOME MEASURES

ORAL MOTOR ASSESSMENT SCALE (OMAS)- The oral motor assessment scale evaluates the functional oral motor capabilities of individuals. This scale consists of 7 items, requiring patients to demonstrate specific motor abilities. The key components assessed include Mouth closure, Lip closure on utensil, Lip closure during swallowing, Control of food during swallowing (solid/soft), Chewing, Straw sucking, and Control of liquid during swallowing. Each skill is rated on a scale from 0 to 3, where 0 indicates passive, 1 indicates sub-functional, 2 indicates semi- functional, and 3 indicates functional performance. Once the subjects were examined, their scores were collected for statistical evaluation. This scale, designed to qualitatively assess oral motor abilities, is considered an essential diagnostic tool for clinicians. [25]

MANUAL MUSCLE TEST- The Manual Muscle Test is utilized to assess whether a muscle is adequately active or strong enough to handle everyday functional demands. This evaluation uses a 5-point scale to measure the strength of each specific muscle. The Manual Muscle Test (MMT) employs a five-level grading system, which replaced earlier two-, three-, or four-point scales. Scores below 3 typically indicate muscle weakness. A score of 0 reflects no activity, 1 indicates trace activity, 2 signifies poor strength, 3 denotes fair strength, 4 represents good strength, and 5 corresponds to normal strength. Muscle grading is based on its performance. [26]

TREATMENT PROTOCOL:

GROUP A: NEUROMUSCULAR ELECTRICAL STIMULATION

In Group A, 30 participants were screened, and baseline assessments were conducted during the course of treatment. These individuals underwent Neuromuscular Electrical Stimulation (NMES) combined with standard physiotherapy for a duration of 8 weeks, administered three times per week for 80 minutes per session.

NMES delivers electrical impulses to the skin over the front of the throat or facial area. It is recognized for its effectiveness in enhancing muscle strength, preventing muscle wasting, and facilitating neuromuscular re-education. The stimulation device used provided one channel of bipolar electrical stimulation with a constant pulse rate of 80 Hz and a fixed biphasic pulse duration of 700 µs. For the experimental group, the intensity was gradually increased in 0.5 mA increments. The stimulation level was raised until participants reported a gripping sensation in their facial muscles, which was verified by a therapist through visible muscle contraction. The stimulation intensity varied among individuals, ranging from 9.0 to 14.0 mA, with an average of 13.2 mA. Each subject received 30-minute sessions, five times per week, over a period of 4 weeks. Following the intervention, maximal cheek strength and maximal lip strength were measured in all participants. [27]

NMES works by applying electrical stimulation to muscles through surface electrodes, causing muscle contraction via nerve fiber depolarization. This sustained contraction positively affects muscle activation and proves beneficial for increasing strength, reducing spasms, preventing atrophy, and supporting retraining. NMES enhances the recruitment of motor units, which is directly linked to improved muscle strength.

GROUP B: FACIAL EXERCISES:

In Group B, 30 participants were screened, and baseline assessments were conducted during the treatment period. These individuals engaged in Facial Exercises over a span of 8 weeks, with sessions held three times per week, each lasting 80 minutes.

Participants were guided to perform facial movements or exercises on the affected side, avoiding voluntary movement on the unaffected side, for 5–10 repetitions. The exercises included lip closure drills, pronunciation of letters and words, emotional expression activities, and daily home practice aimed at maintaining symmetrical eye opening during three specific mouth actions (lip pursing, teeth baring, and cheek puffing).

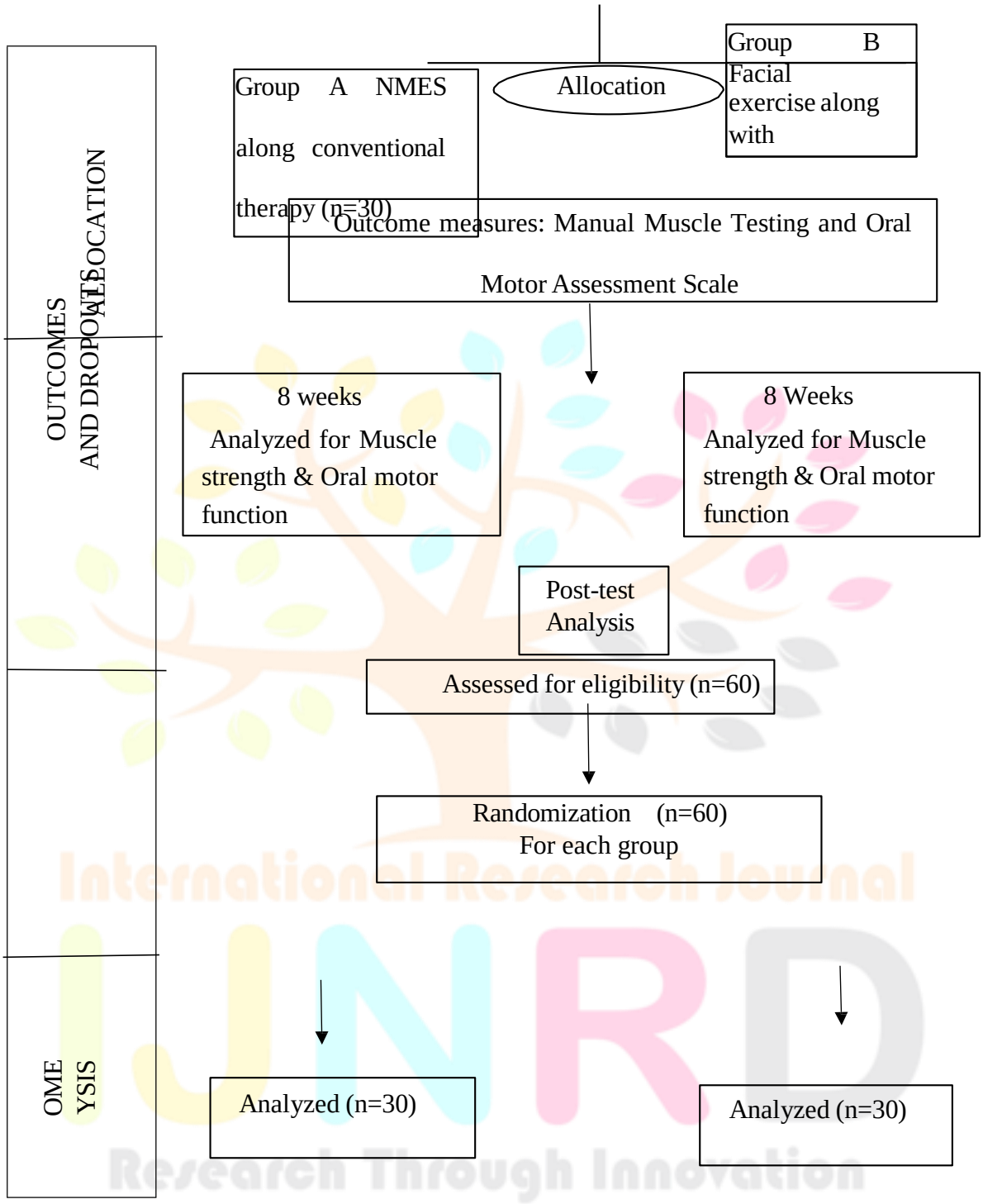
This study focused on activating facial expression muscles in the upper, middle, and lower regions of the face through six specific exercises: (1) raising the eyebrows and wrinkling the forehead, (2) drawing the eyebrows together, (3) forcefully closing the eyes, (4) pushing the lips forward, (5) stretching the lips outward, and (6) pressing the right and left cheeks against resistance. Each of these exercises was performed once daily, with each position held for 7 seconds. Isometric exercises were the most frequently used treatment type, accompanied by isotonic exercises in some cases (i.e., strength training where muscle tension remains constant). An example of an isotonic exercise to reduce forehead lines involved lifting the eyebrows as high as possible for a few seconds, then gradually lowering them. Some studies also incorporated massage and stretching exercises.

Training frequency and duration varied. In many cases, patients were expected to complete daily home routines, occasionally supported by weekly therapist-led sessions. In other studies, the intervention was limited to three sessions per week. The total therapy duration was 8 weeks. [28]

Both Facial Exercises and Neuromuscular Electrical Stimulation address two key areas—facial muscle strengthening and oral motor function.

Fig,1: Electrical Stimulation

FLOWCHART


Group B
Facial exercise along with
Group A NMES along conventional therapy (n=30)
Allocation
Outcome measures: Manual Muscle Testing and Oral Motor Assessment Scale
8 weeks
Analyzed for Muscle strength & Oral motor function
8 Weeks
Analyzed for Muscle strength & Oral motor function
Post-test Analysis
Assessed for eligibility (n=60)
Randomization (n=60)
For each group
Analyzed (n=30)
Analyzed (n=30)
OUTCOMES AND DROPOUTS
ALLOCATION
OME
YSIS

STATISTICAL ANALYSIS

All statistical analysis will be done by using SPSS software version 20.0 and MS excel – 2019.

All descriptive statistical data will be presented as mean ± standard deviation and mean differences will be calculated and presented.

Within the groups: Paired student "t" test is performed to assess the statistical difference with in the groups for Manual Muscle Test for muscle strength and Oral Motor Assessment Scale for oral motor function from pre-test and post-test values.

Between the Groups: Independent student "t" test is performed to assess the statistically significant difference in mean value between the groups for Manual Muscle Test for muscle strength and Oral Motor Assessment Scale for oral motor function

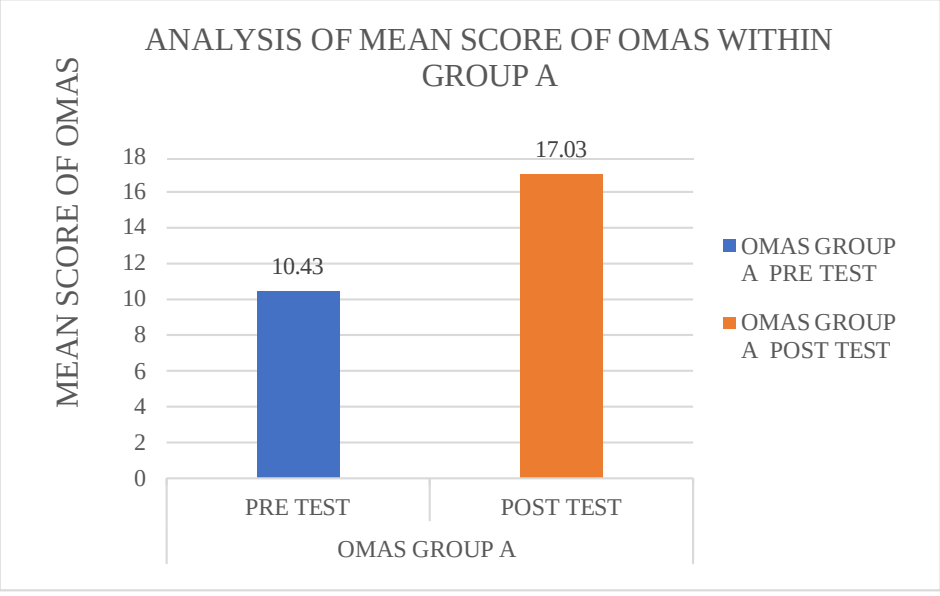
For all statistical analysis, $P<0.05$ will be considered as statistically significant.

OBSERVATIONS AND RESULTS

ANALYSIS OF MEAN SCORES OF ORAL MOTOR ASSESSMENT SCALE WITH IN GROUP A

GROUP A		MEAN	SD	P VALUE	INTERFERENCE
OMAS	PRE-TEST	10.43	0.89	0.001	Highly significant
	POST TEST	17.03	0.88		

TABLE 1



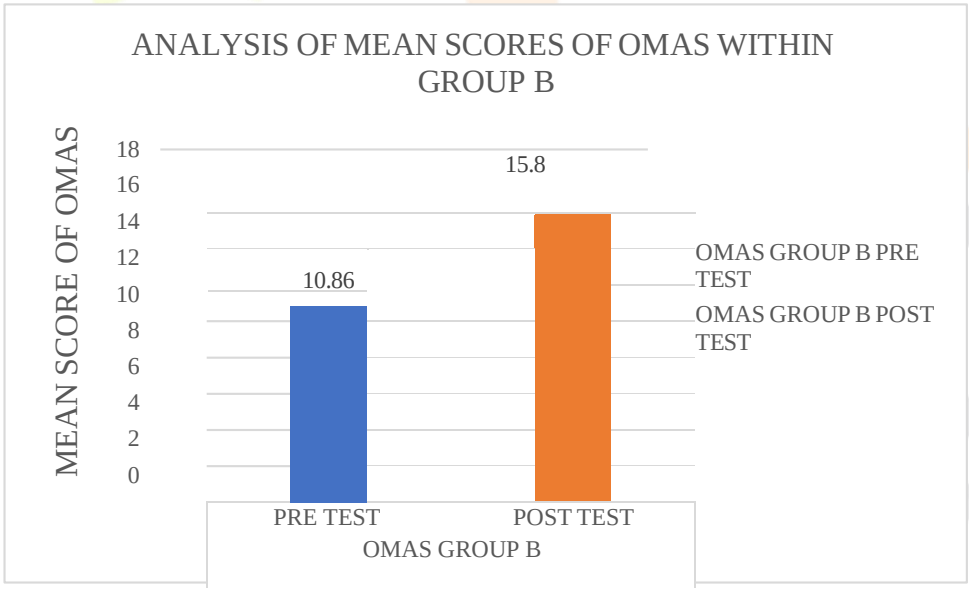
GRAPH 1

RESULTS: The above table and graph show that the mean scores of Oral motor assessment scale changes from pre- test to post-test values within group A were found to be statistically highly significant ($p<0.005$).

ANALYSIS OF MEAN SCORES OF ORAL MOTOR ASSESSMENT SCALE WITHIN GROUP B

GROUP B		MEAN	SD	P VALUE	INTERFERENCE
OMAS	PRE-TEST	10.86	0.93	0.001	Highly significant
	POST TEST	15.8	2.02		

TABLE 2



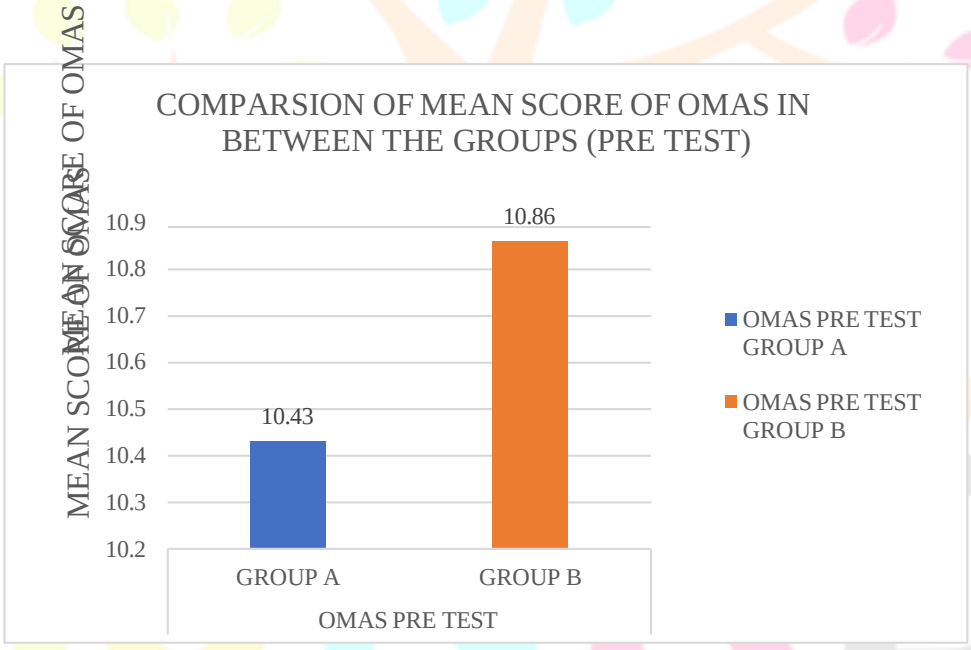
GRAPH 2

RESULT: The above table and graph show that the mean scores of Oral motor assessment scale changes from the pre- test to post-test values within group B were found to be statistically highly significant ($p<0.005$).

COMPARISON OF MEAN SCORES OF OMAS IN BETWEEN THE GROUPS (PRE-TEST)

GROUPS		MEAN	SD	P VALUE	INTERFERENCE
OMAS	GROUP A	10.43	0.89	0.0724	Insignificant
	GROUP B	10.86	0.93		

TABLE 3



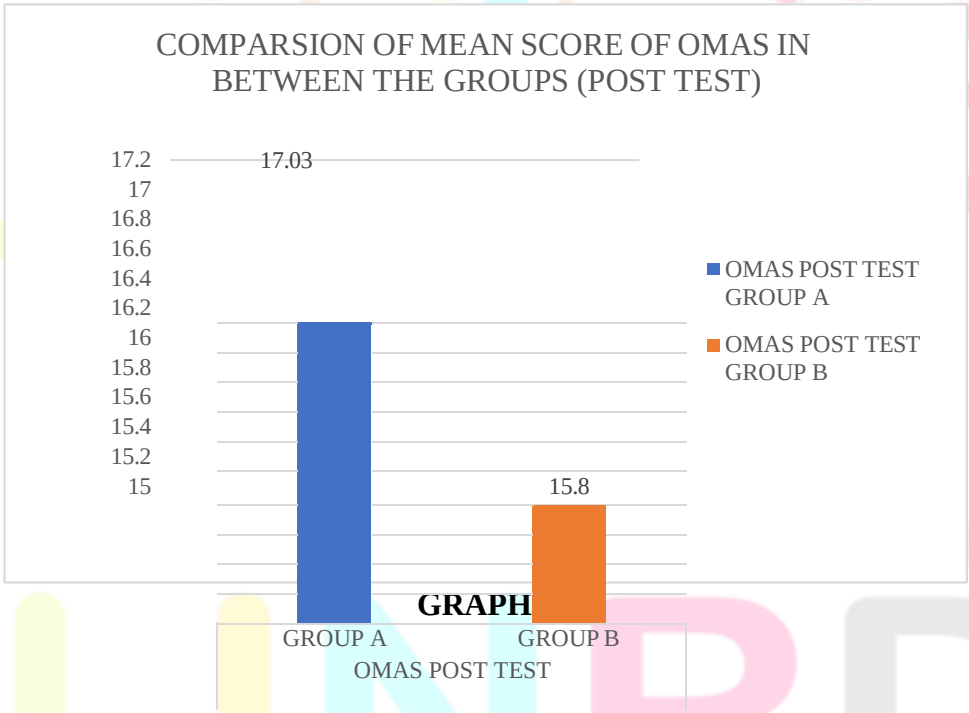
GRAPH 3

RESULT: The above table and graph show the baseline measurement of Oral motor assessment scale in between groups. Oral motor mean score in group A is 10.42 and group B is 10.86 which are found statistically insignificant.

COMPARSION OF MEAN SCORE OF OMAS IN BETWEEN THE GROUPS (POST-TEST)

GROUPS		MEAN	SD	P VALUE	INTERFERENCE
OMAS	GROUP A	17.03	0.88	0.0037	Highly significant
	GROUP B	15.8	2.02		

TABLE 4



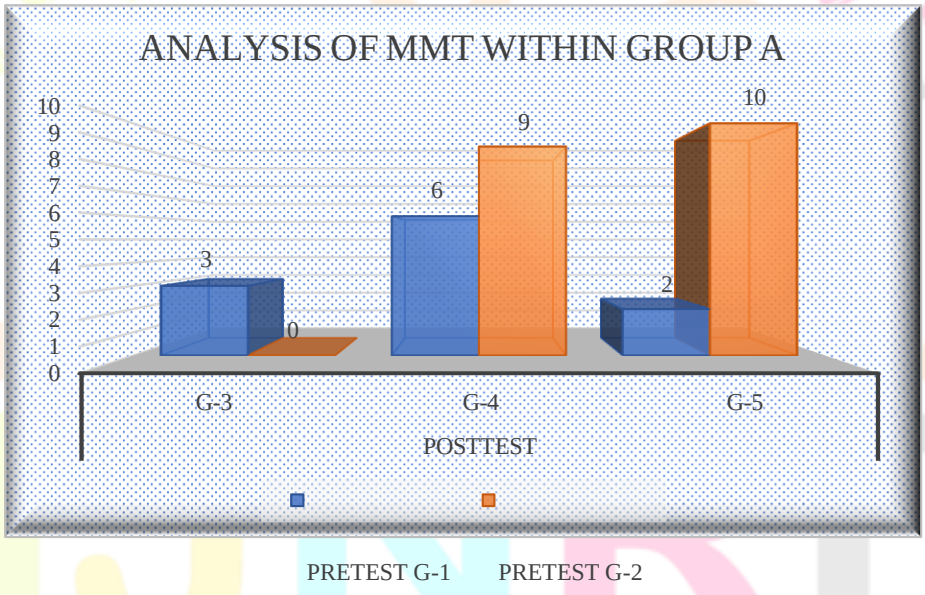
GRAPH

RESULT: The above table and graph show the baseline measurement of Oral motor assessment scale in between the groups. Oral motor mean score in group A is 17.03 and group B is 15.8 which were found statistically highly significant($p<0.005$).

ANALYSIS OF MMT WITHIN GROUP A

		POSTTEST			TOTAL	P-VALU	INTERFERENE
		G-3	G-4	G-5			
PRETEST	G-1	3	6	2	11		
		27.3%	54.5%	18.2%	100.0%		
	G-2	0	9	10	19		
		0.0%	47.4%	52.6%	100.0%		
TOTAL		3	15	12	30	0.026	significant
		10.0%	50.0%	40.0%	100.0%		

TABLE-5



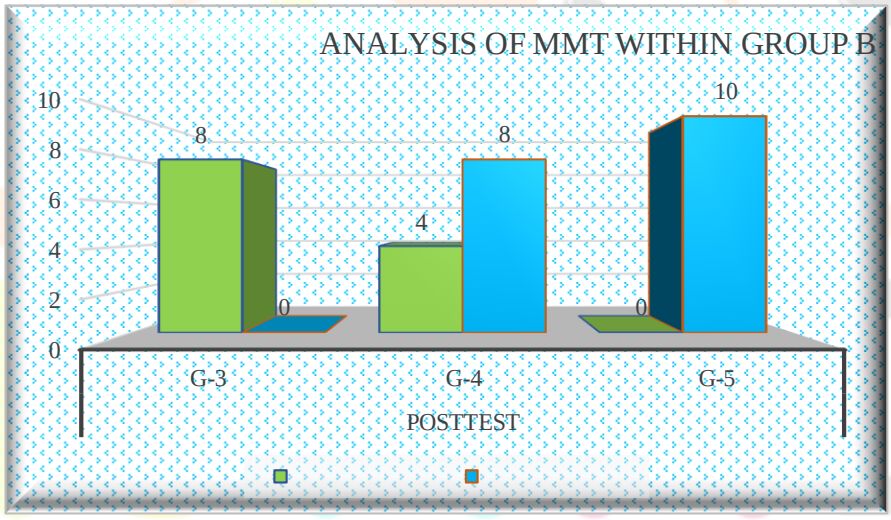
GRAPH-5

RESULT: The above table and graph show that the analysis of MMT changes from pre-test to post-test values within group A were found to be statistically significant ($p<0.005$).

ANALYSIS OF MMT WITHIN GROUP B

		POSTTEST			Total	P-VALUE	INTERFERENCE
		G-3	G-4	G-5			
PRETEST	G-1	8	4	0	12	0.001	Highly Significant
		66.7%	33.3%	0.0%	100.0%		
	G-2	0	8	10	18		
		0.0%	44.4%	55.6%	100.0%		
TOTAL		8	12	10	30		
		26.7%	40.0%	33.3%	100.0%		

TABLE-6



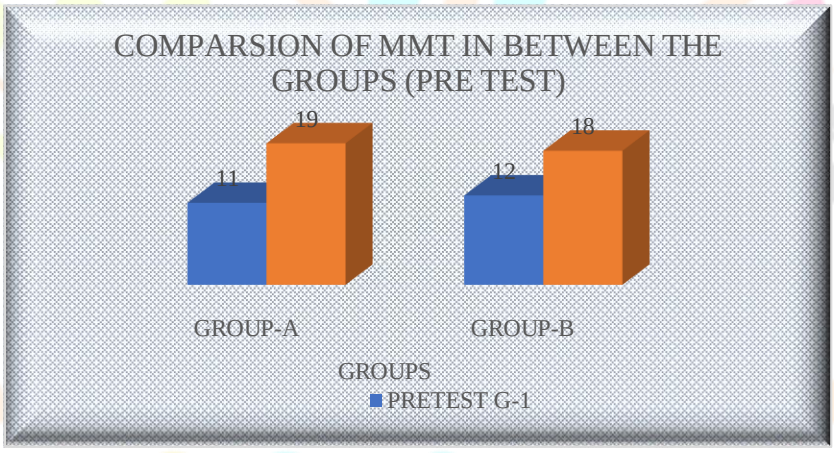
GRAPH-6

RESULT: The above table and graph show that the MMT changes from pre-test to post-test values within group B were found to be statistically significant($p<0.005$).

COMPARISON OF MMT IN BETWEEN THE GROUPS(PRE-TEST)

		GROUPS		TOTAL	P -VALUE I	TERFERENCE
		GROUP-A	GROUP-B			
PRETEST	G-1	11	12	23	0.501	Insignificant
		47.8%	52.2%	100.0%		
	G-2	19	18	37		
		51.4%	48.6%	100.0%		
TOTAL		30	30	60		
		50.0%	50.0%	100.0%		

TABLE-7



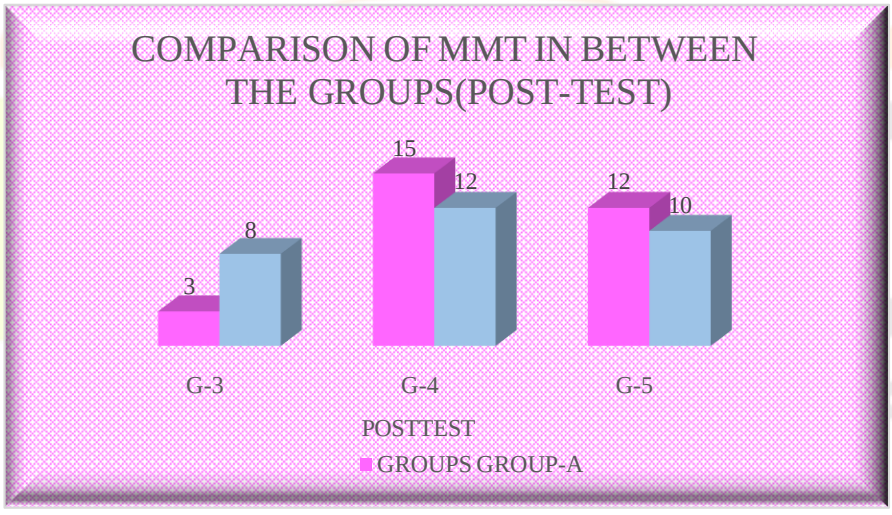
GRAPH-7

RESULT: The above table and graph show that the baseline measurement of MMT in group A and group B were found to be statistically insignificant.

COMPARISON OF MMT IN BETWEEN THE GROUPS(POST-TEST)

		GROUPS		TOTAL	P-VALUE	INTERFERNCE
		GROUP-A	GROUP-B			
POSTTEST	G-3	3	8	11	0.248	Insignificant
		27.3%	72.7%	100.0%		
	G-4	15	12	27		
		55.6%	44.4%	100.0%		
	G-5	12	10	22		
		54.5%	45.5%	100.0%		
TOTAL		30	30	60		
		50.0%	50.0%	100.0%		

TABLE-8



GRAPH-8

RESULT: The above table and graph show that the baseline measurement of MMT in group A and group B were found to be statistically insignificant.

RESULTS

The purpose of the study was to evaluate the impact of Neuromuscular Electrical Stimulation and facial exercises on facial muscle strength and oral motor function in individuals with facial palsy following a stroke. The CONSORT flow diagram illustrated the study's structure, including participant screening, random assignment, and post-intervention analysis. A total of 60 participants were screened for eligibility, and all who met the inclusion criteria underwent baseline evaluations before being randomly divided into two groups.

In this study, 30 participants completed the intervention in Group A, and another 30 completed it in Group B. The findings revealed a notable difference between the pre-test and post-intervention results after eight weeks. One-month follow-up measurements of MMT and OMAS indicated statistically significant improvements in one group, while the other group showed no significant change.

DISCUSSION

The objective of the study was to compare the effects of Neuromuscular Electrical Stimulation and Facial Exercises in individuals with facial palsy following a stroke. Manual Muscle Testing and the Oral Motor Assessment Scale were used as outcome measures to evaluate facial muscle strength and oral motor function. The findings revealed a significant improvement in the Oral Motor Assessment Scale, while Manual Muscle Testing showed comparable progress across both interventions. Both approaches proved similarly effective in enhancing muscle strength and oral motor performance.

Although numerous studies have highlighted the benefits of Neuromuscular Electrical Stimulation, there is limited research comparing facial exercises in cases of facial palsy. Participants were evaluated for improvements in muscle strength and oral motor function at baseline and after the intervention using Manual Muscle Testing and the Oral Motor Assessment Scale. Subjects were divided into Group A and Group B.

In Group A (Neuromuscular Electrical Stimulation combined with conventional therapy), there was a statistically significant improvement in the Oral Motor Assessment Scale.

Kanwal Khanzada, Muhammad Junaid Ijaz Gondal et al. found that combining nerve stimulation with the Kabat rehabilitation program was more effective in improving voluntary muscle contraction, reducing facial disability, preventing synkinesis, enhancing facial functions, maintaining muscle tone, and stimulating neural transmission. Their approach primarily focused on assessing symmetry in resting and voluntary muscles and improving both physical and social functioning. [29]

Katie A. Fargher and Susan E. Coulson reported that electrical stimulation in rehabilitation programs was beneficial in reducing the time to full recovery, increasing recovery rates, improving facial function, and lowering complication rates. Electrical stimulation induces muscle contraction, helps maintain muscle integrity, and supports the restoration of structure and function. They applied similar therapy parameters to preserve muscle properties. Their study showed a significantly greater improvement in facial function, suggesting that extensive electrical stimulation may positively influence facial recovery. [30]

In Group B (Facial Exercises), there was a statistically significant improvement in the Oral Motor Assessment Scale Sajid Ali, Waqas Ahmad et al. stated that combining facial exercises with the Kabat rehabilitation program was more effective in enhancing facial function, preventing synkinesis, improving voluntary muscle contraction, reducing facial disability, maintaining facial muscle tone, and stimulating neural transmission. Their study also emphasized the importance of soft-tissue and muscle re-education to prevent muscle wasting and the formation of soft-tissue contractures. The primary focus was on improving both physical and social functioning. [31]

Annabella Vaughan, Danielle Gardner et al. noted improvements in facial movement and function through various rehabilitation methods for facial palsy. Rehabilitation can optimize functional recovery and enhance

quality of life and psychological well-being. It also significantly boosts facial muscle strength or movement and contributes positively to swallowing function and overall quality of life. [32]

The findings of this study indicate that after 8 weeks of intervention, Neuromuscular Electrical Stimulation combined with conventional therapy resulted in a statistically greater improvement in the Oral Motor Assessment Scale compared to facial exercises in terms of facial muscle strength and oral motor function. However, both groups showed similar progress in Manual Muscle Testing. The study concludes that Neuromuscular Electrical Stimulation alongside conventional therapy serves as a beneficial addition to OMAS in post-stroke individuals with facial palsy.

IMPLICATIONS OF THE STUDY

LIMITATIONS

- The limited sample size in this study restricts the ability to generalize the findings to a broader population.
- Outcome assessors were not blinded during the evaluation process.
- The study lacked a follow-up period to assess the long-term effectiveness of the intervention.

RECOMMENDATIONS FOR FUTURE RESEARCH

- Future studies could improve by using a more robust randomization method and including a larger sample size to strengthen the reliability of the findings.
- Reducing potential bias through blinding procedures or using objective outcome measures could help improve the accuracy of the results.
- Incorporating long-term follow-up evaluations may provide better insight into the sustained impact of the intervention over time.

CONCLUSION

This study concludes that both Neuromuscular Electrical Stimulation combined with conventional therapy and Facial Exercises led to significant improvements in Oral Motor Assessment Scale (OMAS), reflecting enhanced facial muscle strength and oral motor function in post-stroke individuals with facial palsy. However, Neuromuscular Electrical Stimulation with conventional therapy demonstrated greater effectiveness in OMAS compared to Facial Exercises. In contrast, Manual Muscle Testing (MMT) showed comparable outcomes between the two interventions. Therefore, these treatment approaches may be considered for managing facial palsy in post-stroke patients.

SUMMARY

TITLE: EFFECT OF NEUROMUSCULAR ELECTRICAL STIMULATION VERSUS FACIAL EXERCISES ON FACIAL MUSCLE STRENGTH AND ORAL MOTOR FUNCTION IN POST STROKE SUBJECTS WITH FACIAL PALSY

PURPOSE: The purpose of the study was to compare the effect of Neuromuscular Electrical Stimulation versus Facial Exercises on facial muscle strength and oral motor function in post stroke subjects with facial palsy.

METHOD: This quasi-experimental study involved 60 participants diagnosed with stroke, with an average age of 58 years. Using systematic random sampling, they were divided into two groups. Group A (n=30) received Neuromuscular Electrical Stimulation in combination with standard therapy, while Group B (n=30) underwent Facial Exercises. Both groups participated in intervention sessions three times per week over an eight-week period. The effectiveness of the treatments was evaluated using Manual Muscle Testing and the Oral Motor Assessment Scale.

RESULT: The independent t-test was applied to compare mean differences between continuous variables across the groups, while the paired t-test assessed the statistical significance of changes from pre- to post-intervention within each group. The results showed that both groups experienced notable improvements in the measured parameters when analyzed individually. However, when comparing outcomes between the groups, Neuromuscular Electrical Stimulation combined with conventional therapy led to greater improvements in Oral Motor Assessment Scale (OMAS) scores than Facial Exercises alone**.**

CONCLUSION: Over the course of eight weeks of intervention, both groups demonstrated statistically significant improvements in post-test scores on the Oral Motor Assessment Scale (OMAS). However, Manual Muscle Testing (MMT) revealed comparable gains across both groups. Notably, Neuromuscular Electrical Stimulation combined with conventional therapy proved more effective than Facial Exercises in enhancing OMAS outcomes, while both interventions yielded similar results in MMT. These findings suggest that incorporating such treatment approaches may be beneficial in the rehabilitation of individuals recovering from stroke.

KEY WORDS: Post stroke, Neuromuscular Electrical Stimulation, Facial Exercises, Manual Muscle Testing and Oral Motor Assessment Scale.

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