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A Comparative study on Soft Tissue Manipulation Versus Proprioceptive Neuromuscular Facilitation Along with Electrical Stimulation to Improve Facial Muscle Strength in Bell's Palsy

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ABSTRACT

Background: Bell's Palsy a condition characterized by sudden weakness in the muscles on one half of the face, which significantly impacting patients' quality of life. Physiotherapeutic (or) rehabilitation strategies enhances recovery which includes soft tissue manipulation and proprioceptive neuromuscular facilitation combined with electrical stimulation.

Aim: This study aims to compare the effectiveness of soft tissue manipulation versus proprioceptive neuromuscular facilitation along with electrical stimulation in improving facial muscles, strength and functional outcomes in patients with bell's palsy.

Methods: Through a simple random sampling, 30 patients were included in the study, which are divides into 2 groups. One group received soft tissue manipulation along with electrical stimulation while the other received proprioceptive neuromuscular facilitation along with electrical stimulation for a duration of four weeks assessments of facial muscle strength, range of motion and after treatment with sunny brook facial grading system and House-Brackmann grading scale.

Results: Both treatment modalities resulted in significant improvements in facial muscle strength and range of motion. However, the proprioceptive neuromuscular facilitation with electrical stimulation group demonstrates statistically significant outcome with p-value <0.0001 in improving muscle strength and overall functional recovery compared to soft tissue manipulation group.

Conclusion: Proprioceptive neuromuscular facilitation along with electrical stimulation is more effective in facilitation recovery in patients with bell's palsy. These results support the use of therapeutic approaches in clinical practice and highlight the need for further research to refine the treatment protocols.

Key words: Bell's palsy, electrical stimulation, proprioceptive neuromuscular facilitation, soft tissue manipulation, sunny brook facial grading system, House-Brackmann grading scale.

INTRODUCTION

Bell's palsy also known as acute facial palsy of unknown cause is a common neuropathy leading to facial muscle paresis or complete paralysis characteristically on one side, occurring suddenly and may progress over 48

hrs. [1] It occurs due to the connection between the nerves is impaired with lower motor neuron lesion leading to problems with neural pathway. It also causes changes in taste, sensitivity to sound and alteration in lacrimation and salivation [2]. Bell's palsy affects approximately 15 to 20 individuals per 100,000 each year contributing to around 40,000 new cases annually. The overall life time probability of developing the condition is about 1 in 60. Recurrence occurs roughly 8% to 12% of cases. Notably, about 70% of individuals recover fully without medical intervention. This condition shows no bias towards gender or race and can arise at any age, although it is more frequently observed in middle aged and older adults with the average onset age being around 40 years [3]. The exact cause of bell's palsy remains. Unknown however it is widely linked to viral infections that lead to inflammation of the facial nerve, contributing to localized swelling, demyelination and restricted blood flow. Studies have highlighted various contributing factors that may heighten the risk of developing bell's palsy, such as high blood sugar [4] or un managed high blood pressure, pre-eclampsia[5], frequent migraines [6] and radiation exposure [7]. While bell's palsy is often classified as idiopathic, evidence suggests that immune responses, vascular insufficiency and genetic predisposition may play a significant role in its development [8]. Facial nerve palsy can also result from various causes such as idiopathic factors, trauma, neoplasms, congenital anomalies or acute immune conditions. Around 70% of these cases are identified specifically as bell's palsy. The onset of bell's palsy symptoms is typically abrupt with maximum severity developing within 48 to 72 hrs. the condition can range from mild facial weakness to complete paralysis of the muscles on the affected side. Common signs include an in ability to close the eye, lift the corner of mouth or purse the lips. Visible features often involve drooping of one side of the face sagging of eyebrow, flattening difficulties and dryness of the eye or mouth [1]. Some individuals may also experience facial tingling of numbness which is generally a misinterpretation of motor impairment rather than true sensory loss [9]. A systemic diagnostic approach is essential with careful observation of the patient's facial expressions and active testing of facial muscle movements to assess the extent of nerve involvement. To track the nerve degeneration, nerve excitability tests are routinely performed. These tests determine the minimal electrical stimulus required to elicit a visible muscle response, providing insights into the nerve excitation threshold [10]. The severity and prognosis of facial nerves palsy are commonly assessed using standardized grading systems such as the house Brackmann scale, which categorize facial function into six levels- grade-8 representing complete paralysis [11]. Another widely used tool is the sunny brook facial grading system, which evaluates resting facial symmetry. Voluntary muscles movements and synkinesis, most patients have good prognosis. The majority of patients recovers completely around 13% suffer slight paresis and 4 to 5% are left with significant facial dysfunction. There are many traditional approaches used for rehabilitation of bell's palsy which mainly includes electrical stimulation. Individually the soft tissue manipulation technique and Proprioceptive neuromuscular facilitation has been proven effective, yet no studies have been done on comparison between these two neuro facilitatory approaches. 30 patients are diagnosed with unilateral bell's palsy from both genders. Patients are assured by using sunny brook facial grading scale and House Brackmann grading system. They were divided randomly into 2 groups, group-A and group-B. group A received facial PNF and Group B received STM along with electrical stimulation for 4 weeks. The House Brackmann scale is used to assess facial nerve function [12] grading from I (normal) to VI (complete paralysis), based on eyebrow lift, eye closure and mouth movement on both sides for comparison [13]. The Sunnybrook system evaluates resting symmetry, voluntary movement and

synkinesis, with a score from 0 (total paralysis) to 100 (normal function). It is increasingly preferred due to its reliability, low variability and sensitivity to treatment-related changes [14]. Transcutaneous electrical stimulation uses low amplitude pulsed currents to activate motor nerves. Electrical stimulation activates nerve healing and enhances facial control by stimulating specific muscle. Unaffected side, gradually increased to produce visible twitches on the affected side [15]. Each muscle group is stimulated separately for about 10 minutes to avoid synkinesis. initially, galvanic currents are applied to individual facial muscles for 30 contractions, while faradic currents stimulate facial nerve trunk, triggering contractions via peripheral and central pathways. PNF is a manual resistance technique that enhances or inhibits movements by activating natural motor patterns. It involves applying resistance to strong muscles to prevent compensatory movements and assistance to weak muscles to support proper function. In facial rehabilitation, PNF targets actions like eyebrow elevation/depression, eyelid movements, mouth retraction and protrusion and co-ordination lip control. Movements are often reinforced with head and neck positioning to improve muscle activation and symmetry [16]. STM benefits various conditions by stimulating pressure receptors enhancing vagal activity and lowering cortisol levels [17]. Techniques like effleurage, kneading, plucking, wringing and stroking improve circulation reduce muscle tension and promote relaxation. Movements are typically performed with fingers avoiding unnecessary facial contact. Effleurage aids lymphatic drainage while stroking has sedative or stimulating effects depending on speed. Kneading moves tissues in circular motion, plucking involves lifting with the thumb and index finger and wringing compresses and lifts tissue [18]. This study efforts were put to compare both the treatments i.e., soft tissue manipulation and proprioceptive neuro muscular facilitation along with electrical stimulation in improving facial muscle strength in bell's palsy. The present study aims to evaluate the effectiveness of proprioceptive neuromuscular facilitation (PNF) and soft tissue manipulation (STM) in patients with Bell's palsy. Specifically, the objectives are to assess the impact of STM with electrical stimulation, evaluate the effect of PNF with electrical stimulation, and compare the outcomes of both approaches in order to determine the more effective intervention for improving recovery in Bell's palsy.

MATERIALS AND METHODOLOGY

Study design:

This study describes the methods used to assess the comparative effectiveness of soft tissue manipulation and proprioceptive neuromuscular facilitation (PNF) combined with electrical stimulation in improving facial muscle strength in individuals with Bell's palsy.

Study population and sample size:

In this study 30 subjects were selected through simple random technique and assigned into 2 groups. Each group consists of 15 subjects with group-A receiving soft tissue manipulation and group-B receiving Proprioceptive neuromuscular facilitation along with the Electrical stimulation for 4 weeks. This study was conducted at the physiotherapy department of NRI medical hospital, Mangalagiri, Guntur(dt), India.

Selection of participants:

Inclusion criteria: Verified presence of bell's palsy including patients above 10 years of age. Includes Both Female and male. CVA stroke patients with SFGS=0 and HBS=6. Rapid onset of unilateral facial Paralysis (within 72 hours).

Exclusion criteria: Include Recent surgery or trauma to the treatment area and Systematic diseases like Diabetic or sarcoidosis subjects with unstable medical condition and other comorbidities other than Bell's palsy. Any neurological and psychological disorders like multiple sclerosis and Parkinson's, tumors. Systemic

Diseases like diabetic or sarcoidosis, lymes diseases and Ramsay hunt syndrome. Pregnancy.

METHODS

1. Soft tissue manipulation:

It helps to improve blood circulation, reduce muscle tension, and promote relaxation in the affected facial muscles, potentially aiding in nerve recovery and reducing stiffness.

1(a). Effleurage This effleurage is a light; gliding massage technique used in bell's palsy to enhance circulation and relaxation.

Patient position- supine or seated with proper head and neck support

Therapist position- seated or standing beside the patient

Procedure: Ensure cleanliness and explain the technique to ease anxiety and begin with soft strokes on the unaffected side to relax the facial muscles. Using fingertips or palms, apply gentle, rhythmic strokes from the fore head down to the cheeks, chin and neck with light to moderate pressure for 5-10 minutes.

1(b). Stroking Is a gentle technique used in bell's palsy treatment to reduce tension and encourage relaxation.

Patient position– supine or seated comfortably with proper support

Therapist position- standing or seated beside the patient

Procedure: Maintain hygiene and explain the process to the patient and begin with soft strokes on the unaffected side to promote comfort. Use fingertips or palms to apply light, rhythmic strokes from the forehead down to the cheeks, chin and neck, continue for 5-10 minutes, ensuring gentle, calming pressure throughout.

1(c). Kneading Is a deeper massage technique used in bell's palsy to reduce muscle tension and boost circulation.

Patient position- supine or seated with proper head and neck support.

Therapist position- standing or sitting beside the patient.

Procedure: Maintain hygiene and explain the technique to the patient. Begin with light effleurage on the unaffected side to relax facial muscles. Using fingertips, thumbs or palms apply rhythmic kneading on the affected side and gently pressing and lifting the tissues. Focus on forehead, cheeks, jawline and mouth. Perform for 5-10 minutes, adjusting pressure to ensure comfort.

1(d). Plucking is a targeted massage technique in bell's palsy used to stimulate facial muscles and enhance blood flow.

Patient position- supine or seated comfortably with proper support

Therapist position- standing or sitting beside the patient

Procedure: keep the area clean and explain the technique to the patient. Begin with light effleurage on the unaffected side to relax muscles. Gently pinch the skin using the thumb and index finger in a rhythmic, string-plucking motion. Focus on forehead, cheeks, jawline and around the mouth. Continue for 5-10 minutes with light to moderate pressure on tense areas.

1(e). Wringing is a facial massage technique used in bell's palsy to ease tension and enhance muscle tone.

Patient position- supine or seated with proper head and neck support

Therapist position- seated or standing beside the patient

Procedure: maintain hygiene and explain the procedure to reduce anxiety. Begin with light effleurage on the unaffected side for relaxation. Using both hands, gently twist and mobilize the skin and tissue with a wringing motion, similar to twisting a cloth. Focus on forehead, cheeks, and jawline using rhythmic alternating pressure. Perform for 5-10 minutes with light to moderate pressure ensuring patient comfort.

2. Proprioceptive Neuromuscular Facilitation (PNF)

This method is for facial muscles helps restore symmetry and control through guided, resisted movements.

PNF for facial muscles are:

1. Elevation and depression of eyebrows, diagonal direction.
2. Opening and closing of the eyelids, diagonal direction.

3. Retraction of angle of mouth downwards, protrusion of the lips upwards.
4. Retraction of angle of mouth upwards; protrusion of lips.
5. Lips open with inversion, lips close with
6. Protrusion as check compress.
7. Mouth opening to the right, reinforced by head and neck flexion.
8. Mouth opening to left, reinforced by head and neck extension.

Patient position- high sitting on a chair or stool with proper support.

Therapist position- standing behind the patient.

Procedure: The therapist uses assistance on the affected side to support weak muscles and resistance on the unaffected side to inhibit excessive movement. The patient performs facial motions such as eyebrow elevation/depression, eyelid movements, mouth retraction/protrusion, and lip control in specific diagonal patterns. Movements are reinforced with head and neck flexion or extension as needed. This combined approach enhances coordination and promotes balanced facial muscle activity.

3. Electrical stimulation

Procedure: Use galvanic current for individual muscles and faradic for nerve trunks, start at low intensity. Gradually increase intensity to elicit mild, comfortable contractions, monitor and adjust based on patient feedback. Electrical stimulation is proven to be successful Rx procedure for bell's palsy with a great outcome.

STATISTICAL ANALYSIS

Statistical analysis was conducted through paired t test to compare the pre and post values of SFGS and HBS and unpaired t test to compare post values of SFGS and HBS of group A and group B.

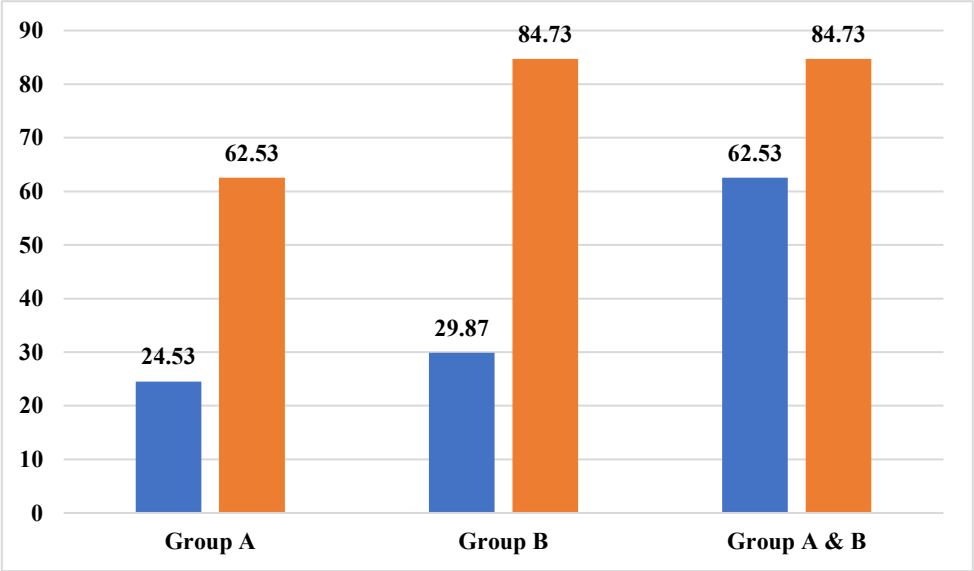
RESULT

The data has been collected by conducting SFGS and HBS with different treatment techniques of PNF and STM along with electrical stimulation of different causes of bell's palsy patients separately. The SFGS were documented at rest and at the symmetry of voluntary movement and in synkinesis and the HBS were compared with their pre and post values. Among the 2 treatment techniques with 2 parameters PNF shows a significant decrease in post value to the pre value.

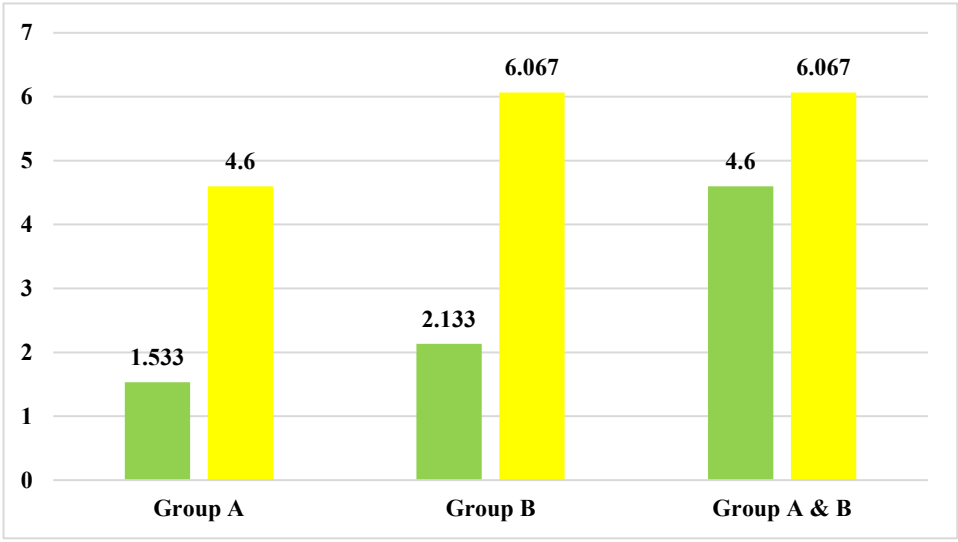
Paired T- test of pre PNF and post SFGS: The pre mean value of SFGS of PNF along with the electrical stimulation is 29.87 with SD=9.015 and the post mean value of pnf along with the electrical stimulation is 84.73 with SD=6.397 respectively. The p value <0.0001 is considered statistically significant. Paired T-test of pre STM and post STM in SFGS: The pre mean value of SFGS of STM along with the electrical stimulation is=24.53 with SD=11.27 and the post mean value of STM along with the electrical stimulation is=62.53 with SD=17.19. The p value<0.0001 is considered statistically significant. Unpaired T test of Post PNF and Post STM in SFGS: The post mean values of SFGS both PNF along with electrical stimulation is=84.73 with SD=6.397 and STM along with electrical stimulation is=62.53 with SD=17.19. The p value<0.0001 is considered statistically significant. Paired T test of Pre PNF and Post PNF in HBS: The pre mean value of HBS of PNF along with the electrical stimulation is=2.133 with SD=0.5936 and the post mean value of PNF along with the electrical stimulation is=6.067 with SD=0.5936. The p value<0.0001 is considered statistically significant. Paired T test of Pre STM and Post STM in HBS: The pre mean value of HBS of STM along with the electrical stimulation is=1.533 with SD=0.8338 and the post mean value of STM along with the electrical stimulation is=4.600 with SD=1.404. The p value<0.0001 is considered statistically significant. Unpaired T test of Post PNF and Post STM in HBS: The post mean values of HBS both PNF along with electrical stimulation is=6.067 with SD=0.5936 and STM along with electrical stimulation is=4.600 with SD=1.404. The p value 0.0009 is considered statistically significant.

Table-1: Sunnybrook facial grading and House Brackman Pre and post values of group-A and group-B

Group-A					Group-B			
SFGS	**Mean**	**SD**	**T-value**	**P-value**	**Mean**	**SD**	**T-value**	**P-value**
Pre	24.53	11.27	14.26	<0.0001	29.87	9.015	29.84	<0.0001
post	62.53	17.19	14.26	<0.0001	84.73	6.397	29.84	<0.0001
post &post	62.53	17.19	4.688	<0.0001	84.73	6.397	4.688	<0.0001
HBS								
pre	1.533	0.8338	16.88	<0.0001	2.133	0.8338	59.00	<0.0001
post	4.600	1.404	16.88	<0.0001	6.067	0.5936	59.00	<0.0001
Post & post	4.600	1.404	3.726	<0.0009	6.067	0.5936	3.726	<0.0009



Graph-1: pre and post values of SFGS of group-A and group-B



Graph-2: pre and post values of House Brackman of group-A and group-B

DISCUSSION

Face is the most characteristic part of the body. The bell's palsy adversely affects it. It mainly causes deviation of face towards one side due to paralysis of half of the face. Further it causes difficulty in closing eyes, smiling, closing mouth properly and drooling of saliva. It has detrimental effects on

physical, corneal, mental health, social welfare and quality of life. Impairment in the face or lack of facial expressions also affect one's communication [19]. The purpose of the study was to find out the effectiveness of proprioceptive neuromuscular facilitation (PNF) and soft tissue manipulation along with electrical stimulation in improving facial symmetry and facial muscle physical function in lower motor neuron Bell's palsy. Existing literature on the effectiveness of soft tissue manipulation and proprioceptive neuromuscular facilitation reported that patients performing soft tissue manipulation and PNF along with electrical stimulation has better recovery. Bell's palsy affects muscles as well as proprioception. The PNF exactly works on these two, whereas STM has a quite generalized effect. PNF includes proprioceptive, which is an important factor while treating any type of facial paralysis. PNF improves facial function by initiating voluntary effort via proprioceptive stimulation. It is a method of stretching muscles to maximize their flexibility that is performed by the therapist and involves a series of contractions and relaxations with enforced stretching during relaxation phase [20]. STM has a different set of physiological and therapeutic effects than other interventions used to treat Bell's palsy. Some of the therapeutic effects of STM are reduction of stress, relaxation, reducing pain, improving circulation, etc. Edema or swelling near the parotid gland is commonly seen in Bell's palsy, as it is the exact site on the facial nerve where infection is present. It is a proper indication for STM, and STM is the only treatment for that. Individual, patients performed PNF has high recovery rate than the patients who performed soft tissue manipulation with evidence of specific benefits in increased clinical severity is less clear [21]. It was quite predictable that PNF is more effective than STM, but the difference was quite significant. whereas STM has a quite generalized effect. Just like Mari Namura et al found PNF was effective in sharpening the mouth and submandibular region and might be useful for perioral muscles to adapt to the alterations [22]. This article provide evidence on the effectiveness of proprioceptive neuromuscular facilitation and soft tissue manipulation along with the electrical stimulation. This review considerably strengthens the evidence base in support of facial PNF and provides the information on the benefits of therapy at different time points post-onset of bell's palsy or for patients living with different levels of severity. This study strengthens previous review on the value physical therapy early in recovery and also add to the previously limited evidence in support of its use for chronic cases. The findings also demonstrate on increase in the use of validated outcome measures, compared to the previous studies. A clinical facial grading system (House-Brackmann or Sunny Brook) was used. The uses of the both clinician and patient outcome measure was observed in highly rated studies [23]. PNF is compared more frequently with other interventions. Individualized facial neuromuscular re-education is more effective in improving facial symmetry in patients with bell's palsy than conventional therapeutic measures [24]. In this study Mean and standard deviation of both group A and Group B has significant differences in the effectiveness of the STM and PNF. This study showed PNF along with electrical stimulation in Bell's palsy had significant decrease in disability of face and increasing the quality of life as just in Mirzakhani N et al [25]. After studying the protocol of Bell's palsy, it is clear that there should be an additional treatment & intervention with electrical stimulation to improve the quality of muscle contraction. It can be PNF or STM. Inspite of the fact that the PNF has a significant recovery in Bell's palsy. Hence it can be recommended that PNF can be used as an adjective to Electrical Stimulation in improving facial symmetry and facial muscle function in persons with Bell's palsy.

CONCLUSION

The study concludes that both Soft Tissue Manipulation (STM) and Proprioceptive

Neuromuscular Facilitation (PNF), when combined with electrical stimulation, are effective in improving facial muscle strength and function in individuals with Bell's palsy. However, PNF demonstrated significantly greater improvements in both the Sunnybrook Facial Grading Scale (SFGS) and House Brackmann Scale (HBS) compared to STM. These findings highlight the superior efficacy of PNF as a neuro facilitatory approach in the rehabilitation of facial nerve dysfunction. Integrating PNF with electrical stimulation may be considered a more effective therapeutic strategy for enhancing facial recovery in Bell's palsy patients.

Declaration by authors

Ethical approval: Approved

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