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The Effect of Neural Mobilization Versus Facial Proprioceptive Neuromuscular Facilitation in Patients with Bell's Palsy: A Randomized Clinical Trial

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Abstract: ***Background**: Bell's palsy is an acute idiopathic LMN lesion of facial nerve that causes the unilateral paralysis of facial muscles. Individually the PNF is effective and neural mobilization is new advance therapeutic concept and no study has been done on comparison between the neural mobilization and facial PNF. So, there is need to study the comparative effectiveness of treatment between neural mobilization and facial PNF. **Aim**: To evaluate the comparative effectiveness of neural mobilization and facial PNF technique in patients with Bell's palsy. **Methods**: 26 patients were included in study according to selection criteria and divided into two groups by random sampling method, 13 patients in each groups. Reaction of degeneration Test and Modified house brackmann scale were taken before and after the intervention. In Group-A neural mobilization for 3-4 sets/session and in Group-B PNF for 2 sets/session for 15 minutes for 5 days/week for 3 weeks with continuations of conventional Physiotherapy were given. **Result**: The Wilcoxon Signed Rank Test and Mann-Whitney U Test were used to analyze for statistics among groups. In Intra group analysis there was significant improvement seen in RD Test and MHBS in both groups. In Inter group analysis there was statistical significant difference seen in MHBS in both groups. In RD Test there was statistically no significant difference seen between groups. **Conclusion**: Facial PNF is more effective than neural mobilization along with conventional Physiotherapy in Bell's palsy patients.*

Keywords: Facial Nerve, Facial paralysis, Kabat rehabilitation, Neural rehabilitation

1. Introduction

The face in our human body is considered as the persona of the soul. It has a feature of expression that helps in communication. This is because of the synchronized functions of the neuro-musculoskeletal system.[1]

If this synchronization is disturbed, facial paralysis can result and cause facial asymmetry and this seriously affects the individual's ability to work in his or her social environment and cause the social Loneliness.[1,2]

Bell's palsy is named after the Scottish anatomist, Sir Charles Bell (1774-1842).[3,4] It is a common cranial neuropathy causing an acute idiopathic lower motor neuron lesion of the facial nerve that causes the unilateral paralysis of facial muscles.[5,6]

Incidence of Bell's palsy is ~ 25 per 1, 00,000 annually or 1 in 60 person in a lifetime with both males and females are equally affected. [4, 7, 8] It can happen at any age but people who are more susceptible to this condition are between the ages of 15 and 45.[9]

The causes of Bell's palsy are unknown although possible triggers of inflammation may be include, Severe cold, Infection of ear, traumatic injury.[1,10]

Facial nerve lesions cause a reduction in the conduction of impulses in the muscles of face.[1] Patients usually feel that they suddenly cannot control their facial muscles, usually to one side and in the morning patients wakes up and sees that a face is not moving.[11] Bell's palsy starts unexpectedly and symptoms might vary from person to person and may range in mild weakness to total paralysis and result in, Dropping of corner of mouth and eyebrow, Inability to close eye, Nasolabial fold disappears, Loss of forehead wrinkles.[1,12]

Various treatments are available for Bell's palsy, such as medical, surgical, and physiotherapy. Medical treatment involves steroids and antiviral drugs. Surgical treatment involves transmetoid or suboptimal decompression.[13] Physiotherapy treatments involve massage therapy, electrical stimulation, etc.[14]

Neural mobilization of nervous system was derived by Maitland in 1985, Elvey in 1986, and rediscover by Butler in 1991. [17] It is a new technique in physiotherapy for the treatment of Bell's palsy and it is a gentle nerve stretching technique to relieve tension and its associated symptoms.[18] Various studies done on other peripheral nerves but a few studies available for facial nerve.

This comes in agreement with study done by Faizan Zaffar Kashoo et al [2019] on "Neural mobilization in bell's palsy" on one patient and mentioned that neural mobilization has never been tried on the facial nerve.[18]

PNF was derived by Kabat, Margaret, and Dorothy Voss. It is a manual resistance technique that promotes a basic

pattern of movement through facilitation, inhibition, resistance of group of muscles. It has been noted that it increases the functioning and power of facial muscles. [15, 16] It is one of the treatments which having literatures supporting that it is more effective than conventional therapy but its comparative effect with neural mobilization was not done until now.

So, the objective of this study to compare the effects of neural mobilization and PNF in Bell's palsy patients.

2. Methodology

The proposal was approved by Ethics Committee, School Of Physiotherapy, RK University (ECR/259/Indt/GJ/2016), and CTRI (Clinical trial registry – India) CTRI/2020/12/029951. Total 26 subjects were taken from Various Physiotherapy Clinics of Rajkot city with all COVID 19 precautions. All the subjects were explained about the procedure before enrolment in study. Informed written consents were obtained from the subjects who fulfilled the inclusion and exclusion criteria and were willing to participate in the study.

Inclusion criteria:
- Patients with unilateral Bell's palsy
- Both gender are included
- Age : 15-45 years
- Modified house brackmann scale : grade- 3-4

Exclusion criteria:
- UMN facial palsy
- Non cooperative patients
- Any open wound or ulcer over face
- After any the surgery of dental, ear, nose and throat
- Any traumatic injury

Materials and Apparatus:
- Pen
- Paper
- Consent form
- Assessment form
- Plinth
- Water
- Glass
- Tongue blade
- Plastic bag
- Mask
- Hand gloves
- Sanitizer
- Modified House Brackmann Scale
- Electrical stimulation(Tapsi)
- Pen and pad electrode

On the first visit, complete assessment was done and randomly divided into 2 groups by random sampling method with 13 subjects in each group.
- GROUP-A (n=13):- Neural mobilization with conventional Physiotherapy. Neural mobilization was applied by gently holding the lower part of the ear between the index finger and thumb. The thumb was placed at the opening of the external auditory meatus and the index finger was placed behind the auricle of the ear. The gentle horizontal traction and circular movement 25 times each with 5 s rest were given for 3-4 sets/session for 15 minutes, 5 days/week, 3 weeks.
- GROUP-B (n=13):- Proprioceptive Neuromuscular Facilitation with conventional Physiotherapy. Stronger motions on non affected side were resisted in order to stimulate and reinforce weaker motions on affected side of face and were given for 2 sets/session for 15 minutes, 5 days/week, 3 weeks.

The process of giving PNF to various muscles of the face were following,
- Frontalis: ask the patient to lift eye brows up, look surprised wrinkle your forehead. – Apply resistance to the forehead, pushing caudally and medially.
- Corrugators supercilii: ask the patient to pull eye brows down (frown) –Apply resistance just above the eye brows diagonally in a cranial and lateral direction.
- Orbicularis oculi: ask the patient to close the eyes. Separate exercise for upper and lower eye lids.
- Procerus: ask the patient to wrinkle your nose. Apply resistance next to the nose diagonally down and out.
- Risorius: ask the patient to smile. Apply resistance to the corner of mouth medially and slightly downward.
- Buccinator: ask the patient to suck your cheeks in, pull in against the tongue blade. Apply resistance diagonally upward and diagonally downward and straight out.
- Orbicularis oris: ask the patient to purse the lips whistle and say prunes. Apply resistance laterally and upward to the upper lip, laterally and downward to the lower lip.
- Mentalis: ask the patient to wrinkle the chin. Apply resistance down and out of the chin.

In Conventional Physiotherapy, electrical stimulation and visual biofeedback exercise were given.

Outcome measures used in this study were modified house brackmann scale and reaction of degeneration test and were taken on 1st day and after 3 weeks.

The facial nerve disorders committee of American academy of otolaryngology-head and neck surgery developed a MHBS. It is valid and reliable to measure recovery level in Bell's palsy. [19, 20]

In the modified house brackmann scale, patients were asked to make various facial movements in all four regions; brow, eye, nasolabial fold, and oral commissure and gave a score from 1to6 according to a degree of movement in all four regions. Score 1= normal movement, score 2= slight weakness with >75%of normal, score 3= obvious movement with >50% of normal, score 4= asymmetry at rest with <50% normal, score 5= trace movement, score 6= no movement. Assessment of synkinesis was taken from the entire face on a scale of 0to3. The sum of all region and secondary movement was done and divided into grade I to VI. Grade I= 4, grade II= 5-9, grade III= 10-14, grade IV= 15-19, grade V= 20-23, grade VI= >24.

The RD test was described by Erb's in 1868. This test is described whether the muscle is able to contract when stimulated by a tetanizing current through its motor point. If Reaction of degeneration is present muscle is denervated and if an absent muscle is innervated. [21]

In the reaction of degeneration test, faradic type current and interrupted direct current was given to Frontalis, Buccinator, and Mentalis muscles of patients and checked that reaction of degeneration was present or absent.

3. Result

Statistical analysis was done by the SPSS version 21 for windows. Microsoft Word and Excel were used to generate graphs and tables.

The normality of data was checked by using Shaprio-Wilk test, which showed that data is the non-parametric type for both reaction of degeneration test and modified house brackmann scale.

The level of significant (p-value) was set at 0.05 level.

The Wilcoxon Signed Rank Test for intra-group analysis and Mann-Whitney U Test for inter-group analysis were used.

The study involved 26 Bell's palsy patients. The result is presented for 26 patients (13 patients in group A and 13 patients in group B)

Table 1: Age Distribution of Both Groups

Age(Year)	Mean	SD
Group A	35.46	10.87
Group B	32.92	8.8

Table 2: Group A Gender Distribution

Gender Group A	No. of Patients
Male	9
Female	4
Total	13

Table 3: Group B Gender Distributions

Gender Group B	No. of Patients
Male	5
Female	8
Total	13

The finding suggests that there was significant improvement seen in RD Test and MHBS in both group A and group B with P-value is lesser than 0.05. (Table 4-5)

Table 4: Group A Intra Group Analysis

Outcome measure		Mean	Standard Deviation	Z value	P value
RD Test	PRE	1.77	0.439	-2.828	0.005
	POST	1.15	0.376		
MHBS	PRE	3.38	0.506	-3.419	0.001
	POST	1.54	0.519		

Table 5: Group B Intra Group Analysis

Outcome measure		Mean	Standard Deviation	Z value	P value
RD Test	PRE	1.92	0.277	-3.317	0.001
	POST	1.08	0.277		
MHBS	PRE	3.54	0.519	-3.286	0.001
	POST	1.15	0.376		

There was statistically significant difference seen in MHBS (p value<0.05) between group A and group B. but there was statistically no significant difference seen in RD Test (p value>0.05) between group A and group B.(Table 6)

Table 6: Inter Group Analysis

Outcome measure	Mean		Standard Deviation		Z value	P value
	Group A	Group B	Group A	Group B		
RD Test	1.15	1.08	0.376	0.277	-0.602	0.547
MHBS	1.54	1.15	0.519	0.376	-2.021	0.043

Finally, the finding of the study suggests that although the improvement was seen in both groups but a greater amount of improvement was seen in group B (PNF + conventional Physiotherapy) than group A (neural mobilization + conventional Physiotherapy) after 3 weeks of intervention.

So, based on the analysis of the result, the null hypothesis was rejected and the experimental hypothesis was accepted which suggests that there was a significant difference seen in the effect of neural mobilization and facial PNF technique in Bell's palsy patients.

4. Discussion

The better improvement seen in the PNF group may be due to the neuromuscular facilitation is a process by which the response of neuromuscular mechanism is made easier. The term facilitation refers to enhance the capacity to initiate movement response thereby increase neuronal activity and alter synaptic potential.

When impulses are initiated from the area of CNS and sensory receptor organ, it may increase the excitability of cell. It refers to increase in central excitation and is a means of facilitating response of neuromuscular mechanism and it may also lower the synaptic threshold of alpha motor neuron by repeated use of pathway and facilitates the passage of impulse and produce a movements response.[22, 23]

Faster recovery may be seen because of PNF acts on cutaneous muscle distributed over the wide place of the human face which might also contribute to early development. [2]

PNF generates appropriately forceful muscle contraction by using the diagonal pattern of stretching. The contractions of muscle on the stronger side will facilitates and reinforce the action on the more affected side and also by preventing full motion on the stronger side will promote activity and increase the strength on the weaker side by irradiation and these make early recovery which makes PNF more effective so, may be according to this mechanism improvement was seen in modified house brackmann scale. [15]

This comes in agreement with Chandan Kumar et al, who mention that proprioceptive neuromuscular facilitation was more effective because it generates sufficient muscle contraction by using diagonal pattern of stretching and these repetitive movements based on irradiation principle initiate early recovery in Bell's palsy patients. [2]

Another study was done by Tushar J Palekar et al mention that proprioceptive neuromuscular facilitation technique produces significant muscle contraction by diagonal pattern of stretching and thus improves facial symmetry and reduces facial disability. [12]

There was also improvement seen in neural mobilization group may be due to it involves movements and/or tension of nervous system which result in decreased intrinsic pressure of the neural tissue and may increase the tissue mobility and axonal transport which is required for the axonal and structural integrity of neuron and may reduce the intraneural swelling, improve circulation to the nerve and remove waste product from the nerve and ultimately there was an indirect effect on muscle and may be by these way improvement seen in modified house brackmann scale. [24]

Dr. Salem F Alatalali presented that neural mobilization technique was effective to disappear oedema and there by alleviating hypoxia and reduce associated symptoms. [25]

Another study was done by Manu Goyal et al also mention that neural mobilization technique was sufficient to reduce the oedema, improve blood circulation, decreased associated symptoms, and remove the waste product. [24]

In both the groups improvement seen in reaction of degeneration test because it will cause the gradual reduction in swelling and because of that there will be decompression over the nerve and causes the regeneration of nerve impulse.

However, subjects in the Proprioceptive neuromuscular facilitation group showed more improvement than Neural mobilization may be due to the PNF technique directly targets the muscles and there is active contraction of the muscle in this technique whereas neural mobilization has an indirect effect on muscle via the nerve. Neural mobilization acts through mechanical interference and there is no active contraction of the muscles occurring in this technique. This direct effect of the PNF technique on facial muscles could be the probable reason for the better result of the PNF technique than neural mobilization in Bell's palsy patients. [26] Limitations of the study are small sample size**,** no follow up taken after cessation of treatment and double blinding was also not done. Study can be done with 3 different groups (acute, sub-acute, and chronic) in Bell's palsy patients, as well as using other outcome measures like NCV and EMG for facial nerve and muscle respectively.

5. Conclusion

This study concluded that facial proprioceptive neuromuscular facilitation technique is more effective than neural mobilization along with conventional Physiotherapy in Bell's palsy patients.

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