Comparison between Proprioceptive Neuromuscular Facilitation and Neuromuscular Re-Education for Reducing Facial Disability and Synkinesis in Patients with Bell’s palsy: A Randomized Clinical Trial

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Abstract

Purpose: To evaluate the comparative effectiveness of neuromuscular re-education technique and proprioceptive neuromuscular facilitation technique on improving facial disability and synkinesis in rehabilitation of bell's palsy.

Methodology: It was a randomized clinical trial consisting 40 participants (males and females) 20 in each group, with Bell's palsy of non-traumatic origin. Group A received proprioceptive neuromuscular technique (PNF) with conventional PT treatment and Group B received facial neuromuscular re-education technique (NMR) combined with conventional PT treatment for 6 days a week for 4 weeks.

Results: The result suggest that Group A had significant higher score at Sunny brook facial grading scale (SFGS) whereas in Facial Disability Index (FDI) Group A had significant difference at total score but there was no significant difference over individual component (social and physical function). Group B had significant better improvement over Synkinesis Assessment Questionnaire (SAQ).

Conclusions: Both PNF group and NMR showed significant results and displayed efficient improvement in facial symmetry after 4 weeks of treatment. PNF with conventional PT is more effective in improving facial function and reducing facial disability whereas NMR with conventional PT is better in reducing synkinesis in Bell’s palsy rehabilitation.

Key words:
Proprioceptive neuromuscular technique; Neuromuscular re-education technique; Bell’s palsy; Facial disability; Synkinesis

Introduction

Peripheral facial palsy is the most frequent cranial neuropathy and can originate from various kinds of damage to the seventh cranial nerve, including its motor nucleus [1-6]. Bell’s palsy is unilateral weakness or paralysis of the face due to acute peripheral facial nerve dysfunction with no readily identifiable cause and with some recovery of function within six month [2,3,6]. It is an acute disorder of the facial nerve, basically the lower motor neuron lesion in origin, which may begin with symptoms of pain in the mastoid region and produce total or partial paralysis of movement of one side of the face [4]. Bell’s palsy is the most common form of peripheral facial palsy in adults, with an annual incidence of 20-30 cases per 100,000 [3,5,6]. No gender, side, annual or seasonal differences have been noted in most Studies and no racial predilection has been established [6,7]. Recurrence rate is about 10% that can present on the same or the contralateral side [8]. The onset of Bell’s palsy is sudden and usually evolves rapidly during a period of 1to 7 days, but it may also progress more slowly, reaching maximum weakness up to 1 to 3 weeks after onset [9,10].

A peripheral palsy of the facial nerve can cause not only a distressing disfigurement of the face but also impair the ability to communicate by facial expression and articulation. An impairment of the motor function of the facial mimic muscles may also cause an inability to eat, drink and speak in an agreeable manner, thereby causing embarrassment and social isolation. This may seriously affect the individual's possibilities to function in his or her social environment.

Most Bell's palsy patients recover well but persistent peripheral facial palsy can be devastating handicap, apart from negatively affecting facial appearance, asymmetry in facial muscles, and weakness of the facial musculature can result in difficulty in eating, drinking, speaking and conveying intimate human emotions and communication signals [9,10]. Disabling secondary defects also include disappearance of facial creases and nasolabial fold, the forehead unfurrows and the comer of the mouth droops. The eyelids will not close and the lower lid sags, on attempted closure, the eye rolls upward (Bell's phenomenon). Eye irritation often results from lack of lubrication and constant exposure. Tear production decreases; the individual's possibilities to function in his or her social environment.

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muscle spasm, and facial pain. The most troublesome sequel for patients is the associated movements, so called synkinesis, and contractures that give the patient a feeling of stiffness in the facial muscles [11]. The social and psychological consequences of peripheral facial palsy can be significant [12]. Treatment typically incorporates Medical, surgical and physiotherapy treatment [13].

Bell’s palsy is commonly treated by various physical therapy strategies and advice. Physiotherapy treatment for Bell’s palsy includes kinesiotherapy, massage therapy, cryotherapy and electrotherapy [13-15].

Electrical stimulation (ES) of paralyzed muscles has long been a popular intervention for patients with Bell palsy [16-18]. Traditional approach through physical therapy using facial massage and repetition of common facial expression in a general exercise regime have been considered to be of little benefit according to literature [19-21]. However various neurofacilitatory approaches which include proprioceptive neuromuscular facilitation (PNF), facial neuromuscular re-education, acupuncture, mime therapy are proposed in literature [19].

Facial neuromuscular re-education (FNR)

Neuromuscular retraining (NMR) for facial paralysis is a combination of neurophysiology, psychology, therapeutic science, learning theory, and art. Facial neuromuscular re-education is a process of relearning facial movement using specific and accurate feedback to

- Enhance facial muscle activity in functional patterns of facial movement and expression and
- Suppress abnormal muscle activity interfering with facial function.

The exercise program is individualized for each patient and is based on the signs of facial impairment identified and the key symptoms the patient reported at evaluation.

Neuromuscular retraining is gaining recognition as an effective element for optimal recovery from facial nerve paresis. Facial NMR is an evidence-based therapeutic practice utilizing specific movement training techniques to optimize facial muscular control [22]. Retraining techniques have been developed for treating sequel that range from flaccidity to mass action and synkinesis, improving facial motor control and enhancing patient satisfaction and outcomes [19]. It is a process utilizing both sensory feedback and focused, coordinated movement activities, to facilitate the return of desired facial movement patterns and inhibit unwanted or abnormal facial expressions.

Based on biological plausibility and gradual but steadily emerging evidence of efficacy of facial neuromuscular re-education, patients have an opportunity to explore conservative options for recovery of facial movements and function [16].

Proprioceptive neuromuscular facilitation (PNF)

It was devised by Kabat et al. proprioceptive neuromuscular facilitation a manual resistance technique that works by simulating fundamental patterns of movement, it hastens the response of the neuromuscular mechanism through stimulation of the proprioceptors; could result in either facilitation or inhibition. It has been reported to permit improvement in function of facial muscles. It facilitates flexibility, strength and co-ordination [23-25].

The effectiveness of facial exercise therapy for facial palsy has been debated in systematic reviews and the mechanism of action is partially explained [19]. Evidence of specific treatment addressed to specific cause is under debate and little evidence is available on the timing of intervention with respect to time of onset. Well-designed randomized control trial therefore required to evaluate the effect of rehabilitation in patients with facial palsy. Physiotherapeutic management which are in practice for the treatment of Bell’s palsy lacks strong evidence for being a best treatment procedure.

Individually both the technique PNF and NMR have proven to be effective yet there is no study which has done comparison between two neuro-facilitatory approaches so that is the need of the study.

Hence this is an effort taken to compare between proprioceptive neuromuscular facilitation technique and neuromuscular re-education technique for reducing facial disability and synkinesis in patients with Bell’s palsy, and we tried to find out an ideal treatment protocol between PNF and NMR for Bell’s palsy rehabilitation and regarding which technique is superior.

Aim and Objectives

Aim

To evaluate the comparative effectiveness of facial neuromuscular re-education technique and proprioceptive neuromuscular facilitation technique on improving facial disability and synkinesis in rehabilitation of bell’s palsy.

Objectives

- To find out the effectiveness of facial neuromuscular re-education for reducing facial disability and synkinesis in subjects with bell’s palsy
- To study the effectiveness of PNF in preventing facial disability, synkinesis enhancing facilitation in subjects with bell's palsy.
- To find out better treatment protocol between facial neuromuscular re-educate technique and proprioceptive neuromuscular facilitation technique for reducing facial disability, synkinesis and to improve the quality of life in patients with Bell's palsy.

Need of the Study

Individually both the treatment techniques have been proved to be effective, but there is lack of study available which compares the two neuro facilitatory approaches: proprioceptive neuromuscular facilitation (PNF) and neuromuscular re-education (NMR) in finding out a better protocol for patients with Bell’s palsy (BP).

Therefore this study will add to the growing body of knowledge that if these two techniques yield comparable outcomes and if one technique is superior to the other, which should be the ideal choice of therapy.
Hypothesis

Experimental hypothesis
There is a significant difference in improving facial symmetry and decreasing facial disability when treated by facial neuromuscular re-education and proprioceptive neuromuscular facilitation.

Null hypothesis
There is no significant difference in improving facial symmetry and decreasing facial disability when treated by facial neuromuscular re-education and Proprioceptive neuromuscular facilitation.

Apparatus and equipment
- Standard electrical stimulator
- Mirror
- Electrodes
- Paper sticking
- Electrode gel
- Chair
- Powder
- Graph papers

Outcome measures
Item Sunny brook facial grading scale (SFGS): It is an observer-based rating scale that is responsive to change and consist of three sub components as resting symmetry, symmetry of voluntary movement and synkinesis and each sub component are scored individually, and the scores are combined for a total or composite score. The scores of the SFGS ranges from 0 (complete paralysis) to 100 (normal facial function). For both the SFGS rest and SFGS synkinesis sections, a higher score relates to greater impairments. For the SFGS movement section, a lower score relates to greater impairment. SFGS has high reliability with interclass correlation coefficient of 0.890 [26,27].

Facial disability index (FDI): It measures physical disability and psychosocial factors related to facial neuromuscular function. It consist of two sub scales as FDI physical function subscale and FDI social/ wellbeing function subscale. The total score is 200,100 of each subscale. FDI has high reliability and construct validity [28].

Synkinesis assessment questionnaire (SAQ): It is a simple patient graded instrument designed to assess facial synkinesis. The total score is out of 100. It consists of 9 questions. It has high reliability and validity [29].

Intervention -Independent Variables:
1. Group A: PNF+Conventional PT
2. Group B: NMR+Conventional PT

Methodology

Study design -A randomized clinical trial
- Sample: Study consisting 40 participants (males and females) 20 in each group, with Bell's palsy of non-traumatic origin.
- Sample size -40
- Sampling design: Simple random sampling,
- Sampling method: Lottery method.
- Source of subject: MGM's Department of neuro-physiotherapy, MGM'S General Hospital, and private Hospital in Aurangabad.

Inclusion criteria
- Subjects with age between 20-70 years.
- Diagnosed case of Bell’s palsy.
- Non-traumatic onset.
- Acute onset 1-3 wks.
- No other neurological deficit.

Exclusion criteria
- Psychiatric illness or non co-operative patients
- Upper motor neuron disease
- Neurotomesis
- Post-surgical cases

Procedure
- Study was performed in neuro-physiotherapy OPD of MGM Institute of Physiotherapy and various other hospitals situated in Aurangabad. Demographic data and initial assessment was taken along with written consent. Purpose of the study was explained to all the subjects participated in study. After initial neurological examination, SD curve was taken to evaluate the type of nerve injury and then subjects who met inclusion criteria were assigned into two groups, 20 each. Still-shot photography of both spontaneous and voluntary facial movements was taken.
- Assessment of severity of paresis was measured using Sunnybrook facial grading scale (pre and post treatment)
- Facial disability score was noted pre and post treatment.
- Synkinesis Assessment Questionnaire was taken (pre and post treatment).
- Intervention was given for 6 days a week, for total 4 weeks. Treatment duration of one session was approximately 45 minutes to one hour.
- All patients received standard medical treatment which includes corticosteroids. All patients received corticosteroids for10 days.

Group A: Proprioceptive neuromuscular technique (PNF) (APPENDIX 1) and Conventional treatment

The PNF techniques that we have used in managing facial paralysis conditions are: rhythmic initiation, repeated stretch (repeated contractions), combination of isotonic and percussion of tendons or margin & fascia of the muscle. PNF technique was given as to all the facial muscles one by one and irradiation technique was utilized to facilitate the contraction of weaker muscles.
Conventional treatment in Group-A include - interrupted galvanic stimulation with rectangular waveform with 100 ms, 3 sets, and 30 contractions in each set.

**Manual facial massage** - effleurage, finger to thumb kneading, wringing, hacking, tapping & stroking.

**Group B: Neuromuscular re-education technique (NMR)** (APPENDIX 2) and convention treatment

NMR was given as follows: based on physical signs and identified by using the SFGS impairment and FDI disability measures, patients were classified into one of four treatment based categories (initiation, facilitation, movement control and relaxation) [30]. The physical therapy approach (suggested by the name of the treatment category) specifically targeted for the set of signs and symptoms of each category are based on the biological plausibility that the underlying neuromuscular physiology differed by treatment category. The primary treatment for problems of facial twitches and spasms in these phase are relaxation exercises, the standard relaxation exercises originally described by Jacobson which is small rhythmic, alternating movements to relax the muscles [31]. Techniques to inhibit muscle activation include sustained stretching and cross-friction massage to reduce passive tissue restrictions.

**Conventional treatment - include** Interrupted galvanic stimulation with rectangular waveform with 100 ms, 3 sets, and 30 contractions in each set.

**Manual facial massage** - effleurage, finger to thumb kneading, wringing, hacking, tapping and stroking. Each Patient is treated by same physiotherapist. Outcome measure was used by another therapist who was blind about group characteristics and intervention protocols. The therapist who used outcome measures was blinded to intervention and group.

Ethical approval and informed consent: Before implementing the study, an approval from university ethical committee was taken. Also the informed consent was taken from subjects with stroke, who were willing to participate in study.

Mean score, standard deviation, degree of freedom, confidence interval, P value and significance were calculated to express the results. SPSS version 20 (Statistical Package for Social Sciences) for Windows and Microsoft Office Excel- 2007 was used to statistically analyse obtained data from the study (Figure 1).

Unpaired test was performed to compare age, duration of symptoms and post interventional assessment values in between two groups and paired t tests used for comparison within the groups. Statistical level of significance is set at alpha=0.05.

**Results**

Total 45 patients were selected and out of which 4 were excluded because they refused to participate in the study and 1 were not able to complete the intervention of 4 weeks, so total 40 subjects were randomly allocated according to criteria.

**Discussion**

The purpose of this study was twofold: first to compares the two neuro facilitatory approaches- proprioceptive neuromuscular facilitation (PNF) and Neuromuscular re-education on improving facial disability and synkinesis in rehabilitation of bell’s palsy and second, to find out a better rehabilitation protocol for patients with Bell’s palsy.

**Data analysis**

The subjects were divided in two groups group A and group B, comprising 20 in each. Analysis of the data was done first at baseline level between the groups, then within group comparison was done for both the groups from pre to post intervention level and later comparison was done at post intervention level between both the groups (Table 1).

**Table 1**: Demographic data of the population.

| Gender | Age (years) (Mean ± SD) | Onset duration (Mean ± SD) | Side affected |
|--------|-------------------------|---------------------------|---------------|
| Male   | Femal e                 | Left                      | Rig ht        |
| Group A (n=20) | 12 8 37.2 ± 9.19 | 6.9 ± 3.64 | 9 11 |
| Group B (n=20) | 12 8 40.05 ± 11.84 | 7.5 ± 5.26 | 11 9 |

Above table shows demographic data of the population in group A, Group B. The two domains age and onset of the population in group A and B matched so this shows that the data matched for baseline characteristics.

When analysis was done for demographic information of participants, no statistically significant difference was found showing that subjects are matched for baseline characteristics like age, gender, affected side and onset duration of Bell’s palsy which is shown in Table 1. When comparison was done at baseline level between both the
groups it was found that there was no statistically significant difference between both the groups at SFGS, FDI and SAQ score which is shown in Table 2 and Figure 2.

| Components | Group-A (Mean ± SD) | Group-B (Mean ± SD) | P-value | Sign |
|------------|---------------------|---------------------|---------|------|
| SFGC       |                     |                     |         |      |
| Resting symmetry | 14.50 ± 4.83 | 13.0 ± 5.23 | P= 0.353 | NS   |
| Voluntary movement | 38.60 ± 10.40 | 35.10 ± 7.25 | P=0.270 | NS   |
| Synkinesis | 5.85 ± 2.75 | 5.35 ± 2.75 | P=0.567 | NS   |
| Total      | 18.25 ± 8.81 | 16.75 ± 11.10 | P=0.639 | NS   |
| FDI        |                     |                     |         |      |
| Physical function | 42.25 ± 5.25 | 42.50 ± 5.25 | P=0.881 | NS   |
| Social function | 42.60 ± 7.81 | 42.60 ± 7.25 | P=1.000 | N.S  |
| Total      | 84.85 ± 11.44 | 85.10 ± 8.78 | P=0.939 | NS   |
| SAQ        |                     |                     |         |      |
|            | 47.44 ± 6.37 | 45.88 ± 10.25 | P=0.568 | NS   |

NS- Not significant P˂0.05 shows a statically significant result

Table 2: Baseline measurements of the subjects for Group-A & Group-B.

The above table shows that both groups are matched for their baseline characters (SFGC, FDI, and SAQ).

The above graph shows the difference between pre and post values for SFGS, FDI and SAQ of Group A.

When comparison was done at pre and post intervention level for both the groups it was found that there is statistically significant difference in both the groups for SFGS, FDI and SAQ score which is shown in Tables 3 and 4 and Figures 3and 4. This shows that proprioceptive neuromuscular facilitation (PNF) and Neuro-muscular re-education technique (NMF) both are effective in rehabilitation of Bell’s palsy.

Table 3: Pre and post intervention measurement of Group A for SFGS, FDI and SAQ

The above table shows statically significant difference in the pre and post values SFGC, FDI and SAQ for group A.

The above graph shows pre intervention values for SFGS, FDI and SAQ of Group A.

When comparison was done at pre and post intervention level for both the groups it was found that there is statistically significant difference in both the groups for SFGS, FDI and SAQ score which is shown in Tables 3 and 4 and Figures 3and 4. This shows that proprioceptive neuromuscular facilitation (PNF) and Neuro-muscular re-education technique (NMF) both are effective in rehabilitation of Bell’s palsy.

| Group B | Component       | Pre (Mean ± SD) | Post (Mean ± SD) | P-value | Sign |
|---------|-----------------|-----------------|------------------|---------|------|
| SFGC    | Resting symmetry | 13.0 ± 5.23 | 4.0 ± ±4.7 | P= 0.0001 | S    |
|         | Voluntary Movement | 35.10 ± 7.81 | 60.60 ±11.48 | P= 0.0001 | S    |
|         | Synkinesis       | 5.35±2.75       | 1.55 ± 1.98       | P= 0.0001 | S    |
|         | Total            | 16.75 ± 11.10    | 55.05 ± 12.58    | P= 0.0001 | S    |
| FDI     | Physical function | 42.50 ± 5.25 | 88.75 ± 3.58 | P= 0.0001 | S    |

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The above table shows statically significant difference in the post intervention values SFGC, FDI and SAQ for group B except physical function and social function of FDI which is statically insignificant.

The finding suggest that out of the three sub component of SFGS the two subcomponents of SFGS, Resting symmetry and Voluntary Movement showed significant improvement in group A, whereas the third sub component, synkinesis showed significant improvement in group B but the total SFGS scores showed significant improvement in group A as is shown in Table 5 and Figure 5.

Table 5: Post intervention measurements of the subjects for Group A and Group B.

The above graph shows Post intervention values for SFGS, FDI and SAQ of Group A and Group B.

In the post intervention analysis of FDI the FDI Physical function subscale and Social subscale showed no substantial significance whereas the total FDI scores showed significant improvement in group A as shown in table 5 graph 4. In the post treatment analysis of SAQ shown in table 5 Figure 5 it was identified that the subjects in group B showed significant improvement in reducing the synkinesis.

Finally the findings of the study suggest that although improvement in symmetry of face was seen in both the groups but a greater amount of improvement in facial voluntary movement was noted in group A (PNF+Conventional PT) after 4 weeks of intervention, the subjects in group A reported improved resting symmetry and voluntary movement and reduction in facial disability and Group B (NMF+conventional PT) was better in reducing facial synkinesis. Therefore on the basis of analysis of result the null hypothesis is rejected and thus the experimental hypothesis is accepted.

Several studies have been designed to investigate the effect of PNF and NMR individually [22-25]. Some studies showed no significant change in gross facial movements, few of those studies reported some benefits of PNF and NMR on improving facial profile and this was the first attempt to evaluate the effect of PNF and NMR on facial disability and synkinesis reduction.

Sardarul and Pendefunda et al. did a study on Neuro-proprioceptive facilitation in the re-education of functional problems in facial paralysis a practical approach and reported that there was significant improvement in qualitative and quantitative score of house Brackman scale after PNF training and the patients were more inclined to socialize after the treatment because of the regained conscience over their facial mimics, expressions [35].

Table 5: Post intervention measurements of the subjects for Group A and Group B.

The above graph shows the difference between pre and post values for SFGS, FDI and SAQ of Group B.

When comparison was done at post intervention level between both the groups it was found that there is statistically significant difference between Post SFGS, Post FDI and Post SAQ which is shown in Table 5 and Figure 4.

Figure 4: Comparison of pre and post values for SFGS, FDI and SAQ of Group B.

When comparison was done at post intervention level between both the groups it was found that there is statistically significant difference between both the groups.

The above graph shows the difference between pre and post values for SFGS, FDI and SAQ of Group B.

| Components | Group A (Mean ± SD) | Group B (Mean ± SD) | P-value | Sign. |
|------------|---------------------|---------------------|---------|-------|
| SFGC       |                     |                     |         |       |
| RESTING SYMMETRY | 7.0 ± 4.10          | 4.0 ± 4.47         | P= 0.033 | S     |
| VOLUNTARY MOVEMENT | 77.60 ± 13.13      | 60.60 ± 11.48      | P= 0.000 | S     |
| SYNKINESIS | 3.15 ± 2.05         | 1.55 ± 1.98        | P= 0.017 | S     |
| TOTAL      | 67.45 ± 13.82       | 55.05 ± 12.58      | P= 0.005 | S     |
| FDI        |                     |                     |         |       |
| PHYSICAL FUNCTION | 89.25 ± 3.35       | 88.75 ± 5.58       | P= 0.651 | NS    |
| SOCIAL FUNCTION | 96.20 ± 4.39       | 95.80 ± 4.39       | P= 0.775 | NS    |
| TOTAL      | 185.45± 5.36       | 173.85± 9.93       | P= 0.000 | S     |
| SAQ        | 27.66 ±5.78         | 13.67 ±3.62        | P=0.013  | S     |

*S: Statically significant; NS: statically non-significant
Previous study done by Barbara et al. to access the validity of an early rehabilitative approach to Bell's palsy patients and concluded that when applied at an early stage, PNF rehabilitation was shown to provide a and faster recovery rate in comparison with non-rehabilitated patients [25].

Brach and Swearingen conducted a study on 'Physical therapy for facial paralysis: a tailored treatment approach’ and in his case report he describes a classification system used to guide treatment and to monitor recovery of an individual with facial paralysis and revealed that recovery from Bell palsy can be a complicated and lengthy process. The use of a classification system may help simplify the rehabilitation process [36]. Manikandan conducted a study on effect of facial neuromuscular re-education on facial symmetry in patients with Bell’s palsy: a randomized controlled trial and concluded that individualized facial neuromuscular re-education is more effective in improving facial symmetry in patients with Bell’s palsy than conventional therapeutic measures [37].

The better prognosis in PNF group in two sub component of SFGS, resting symmetry and voluntary movement and in FDI’s physical function, social function subscales and in SAQ assessment was may be due to facilitation of proprioceptive neuromuscular system by PNF training. Proprioceptors such as muscle, tendon spindles and receptors in joint capsule and ligament are stimulated32. Using this method, resisted movement stimulate the proprioceptors, facilitating muscle contraction. The 24 facial muscles act mutually or individually and lack facia, as facial muscle is a thin cutaneous muscle acting from bone to skin or skin to skin. PNF might affect the cutaneous muscle distributed over the Wide area of human face, which may contribute to early improvement. Since the facial muscle are thin cutaneous muscle, the only drawback is continuous training might be needed to maintain long term strengthened muscle [19-21].

Neuromuscular retraining used in group B is a problem solving approach to treatment using selective motor training to facilitate symmetrical movement and control undesired gross motor activity (synkinesis). Tools such as specific mirror exercises provide augmented sensory information to enhance neural adaptation and learning [19]. The application of learning theory maximizes motivation through individualized instruction and active patient participation. Because each patient presents a different functional profile, there are no generic lists of exercises. Treatment is based on individual function, and as a result, each treatment program is different.

Treatment is based on functional profile rather than etiology. Techniques to facilitate movement and inhibit abnormal patterns refine motor control, coordination and complexity of movement [33]. Although each patient's program differs, there are common aspects in the treatment of all patients, which may be the reason of better prognosis in synkinesis sub component of SFGS and synkinesis assessment questionnaire.

The results showed significant beneficial effects of PNF on Facial disability Index as fast recovery was seen within 4 weeks as it acts on cutaneous muscle distributed over the wide area of human face, which may contribute to early improvement. The beneficial effect of NMR on synkinesis reduction was may be, as it is selective motor training to facilitate symmetrical movement and control undesired gross motor activity (synkinesis) as reported by SAQ. The subjects reported overall improvement in physical function as eating, drinking, speaking, brushing teeth and had become socially and psychologically independent as reported by FDI.

PNF generates appropriately forceful muscle contractions by using diagonal pattern of stretching than NMR. These repetitive movements based on irradiation principles and additional bilateral co-contraction initiate early recovery which make PNF more effective at improving facial symmetry and reducing facial disability in subjects post Bell’s palsy [32,35]. Whereas in NMR each patient's program differs, and it needs categorization of patients and is used to treat long term sequel as synkinesis so need long settings of treatment session and it does not produce bilateral co-contraction [34,36,37].

In this study Neurofacilitatory approach like PNF and NMR was used, these approaches have been used in clinical settings on Bell's palsy syndrome patients with positive effects on increasing muscle control and overall functionality. There is need to know the movement of the principal muscles and how to appropriately stimulate them in such a manner as to obtain the maximum muscular response so maximum recovery in all aspect can be achieved.

From the findings of this study, it can be recommended that both PNF and NMR approaches are appropriate pattern of facial muscle strengthening for improving symmetry of face and reducing facial disability and synkinesis than gross facial exercises.

Clinical Implication

The result of this study have important clinical implication for developing effective intervention for patients with bell’s palsy by incorporating PNF when compared with NMR for reducing facial disability and synkinesis that can improve facial symmetry. They can be easily incorporated in any rehabilitation technique.

Limitation

Limitation of the present study includes small number of sample, relatively short intervention period of 4 wks. No follow up was taken, whether improvements in facial symmetry was maintained even after cessation of treatment.

Future Research

Future clinical trial study can be carried out on a larger sample size with long term follow up. A similar study can be conducted including acute, sub-acute and chronic (in 3 different groups) Bell’s palsy patients.

Conclusion

The result obtained from the study demonstrated that both PNF group and NMR showed significant results and displayed efficient improvement in facial symmetry after 4 weeks of treatment. When compared with NMR group, PNF group showed significant improvement in reducing facial disability and synkinesis. Therefore proving that, PNF with conventional therapy is more effective than NMR with conventional therapy in Bell’s palsy rehabilitation.

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