



COMPARISON OF PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION AND NEUROMUSCULAR RE-EDUCATION WITH CONVENTIONAL TREATMENT AND HOME BASED EXERCISE PLAN ALONG WITH FACIAL NERVE STIMULATION FOR REDUCING FACIAL DISABILITY IN PATIENTS WITH BELL'S PALSY

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Abstract:

The purpose of the present study was to compare the proprioceptive neuromuscular facilitation and neuromuscular re-education with conventional treatment and home based exercise plan along with facial nerve stimulation for reducing facial disability in patients with Bell's Palsy. In the present study, purposively selected 20 patients (both male and female) with Bell's palsy with age group 20-70 years were considered. Further, the patients were allocated equally into two treatment groups. In Group-A, patients were treated with Proprioceptive Neuromuscular Facilitation (PNF) and Neuromuscular Re-Education (NRE) along with interrupted galvanic stimulation, facial massage and home based exercises. In Group-B, patients received the treatment of interrupted galvanic stimulation and manual facial massage along with home based facial exercises program in front of mirror. The outcome measures included Facial Disability Index-Physical Function (FDI-PF), Facial Disability Index-Social Function (FDI-SF), Synkinesis Assessment Questionnaire (SAQ) and Sunnybrook Facial Grading Scale (SFGS). In results. it was found that in pre-intervention condition, no significant differences were noted in FDI-PF, FDI-SF, SAQ and SFGS between these two groups. However, significant differences ($p < 0.001$) were observed in FDI-PF, FDI-SF and SFGS in post intervention condition between the patients treated in Group-A and Group-B. Statistically significant increase ($p < 0.001$) was found in FDI-PF and SFGS and significant decrease ($p < 0.013-0.001$) was found in FDI-SF and SAQ between pre- and post-intervention in Group-A. Statistically significant decrease ($p < 0.003-0.001$) was found in FDI-PF, FDI-SF, SAQ and SFGS between pre- and post-intervention in patients treated in Group-B. From the findings of the study it could be concluded the treatment protocol comprised of PNF and NRE along with interrupted galvanic stimulation, facial massage and home based exercises was more effective than only interrupted galvanic stimulation, facial massage and home based exercises in improving facial symmetry and reducing facial disability in patients with Bell's palsy.

Keywords: Proprioceptive neuromuscular technique, Neuromuscular re-education technique, Interrupted galvanic stimulation, Facial massage, Home based exercises, Bell's palsy, Facial disability, Synkinesis.

Introduction:

Bell's palsy, is the facial paralysis which is caused by dysfunction of Cranial Nerve VII, the Facial Nerve (May and Hughes, 1987). It is named after Sir Charles Bell, a Scottish

surgeon, neurologist and anatomist. It is also known as Idiopathic Facial Palsy. It results

in inability or reduced ability, to move the muscles on the affected side of the face i.e. Facial palsy (Peitersen, 2002). Population studies showed an average incidence of 20 to 30 cases per 100,000 populations (Katusic et al., 1986). It is the most common cause of acute unilateral facial paralysis, thought to cause between 60 and 75% of all unilateral facial palsy cases. The facial nerve is damaged by inflammation within the nerve causing it to become enlarged at the point where the nerve exits the skull through the stylomastoid foramen. Ischemia occurs as the nerve swells in its bony canal, blocking neural blood supply. Loss of control of the muscles on one side of the face is the main physical presentation (Peitersen, 2002).

Its clinical presentation includes inability to close the eye, inability to move the lips e.g. into a smile, pucker, at rest, the affected side of the face may "droop", the lower eyelid may drop and turn outward - "ectropion". It results into difficulty eating and drinking as lack of lip seal makes it difficult to keep fluids and food in the oral cavity, reduced clarity of speech as the "labial consonants" all require lip seal, dryness of the affected eye. Lack of tear production in the affected eye, causing a dry eye, with risk of corneal ulceration, sensitivity to sudden loud noises, altered taste sensation. (Baugh *et al.*, 2013).

Some patients also report general malaise in the first few days on onset, as well as some pain in the region of the ipsilateral mastoid (known as otalgia), but many of patients have no otalgia or malaise (Peiterson, 2002). At onset the paralysis may be complete, or partial (paresis) and although it frequently affects all branches of the facial nerve on the affected side, resulting in loss of control of that side of the mouth and the ipsilateral eye, in a few cases only one or two branches of the facial nerve are affected. There are many causes of facial palsy such as infection, ramsay hunt syndrome in herpes zoster infection, lyme disease, iatrogenic facial nerve damage, congenital, Neurosarcoidosis, Otitis media, multiple

sclerosis, guellin barre syndrome (Zhao et al. 2015).

Bell's palsy is commonly treated by various physical therapy strategies and advice. Physiotherapy treatment for Bell's palsy includes kinesio-therapy, massage therapy, cryotherapy and electrotherapy (Tiemstra and Khatkhate, 2007; Jarvis, 1974; Beurskens and Heymans, 2004). Electrical stimulation (ES) of paralyzed muscles has long been a popular intervention for patients with Bell palsy (Alakram and Puckree, 2010; Targan et al., 2000; Hyvärinen et al., 2008). 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 (Teixeira et al., 2011; He et al., 2007). However various neuro-facilitatory approaches which include proprioceptive neuromuscular facilitation, facial neuromuscular re-education, acupuncture, mime therapy were proposed in literature (Teixeira, 2011).

Different physiotherapeutic combinations have been studied. The present study was planned with the objectives to evaluate the comparative effectiveness of facial neuromuscular re-education technique and proprioceptive neuromuscular facilitation technique with conventional exercises for reducing facial disability in patients with Bell's palsy.

Materials and Methods

Samples: Initially a total of 27 patients (both male and female) with Bell's palsy verified and referred by the specialists with age group 20-70 years were randomly selected from College of Physiotherapy, Christian Medical College and Hospital, Ludhiana and Department of Physiotherapy, Dayanand Medical College and Hospital, Ludhiana, Punjab, India. Of those, 20 patients finally participated in the study. Further the patients were allocated equally into two different treatment groups, Group-A and Group-B. Group-A included 10 subjects who were treated with Proprioceptive Neuromuscular facilitation (PNF) and Neuromuscular Re-Education (NRE) along with Interrupted galvanic

stimulation with rectangular waveform with 100 ms, 3 sets, and 30 contractions in each set, facial massage and home based exercises. Group-B included 10 patients who received the treatment of interrupted galvanic stimulation with rectangular waveform with 100 ms, 3 sets, and 30 contractions in each set and manual facial massage along with home based facial exercises program in front of mirror. Prior to the study, a written consent of the subjects were also taken. The study was approved by Institutional Ethical Committee.

Outcome Measure: The outcome measures included Facial Disability Index – Physical and Social Functions (pre- and post-intervention), Synkinesis Assessment Questionnaire (pre and post-intervention) and Sunnybrook Facial Grading Scale (pre and post-intervention).

Proprioceptive Neuromuscular facilitation (PNF)

It is 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. The PNF techniques was used in managing facial paralysis conditions included rhythmic initiation, repeated stretch (repeated contractions), combination of isotonic and percussion of tendons or margin and 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.

Neuromuscular Re-education Technique (NMR)

Neuromuscular Facial Re-education is the process to facilitate the return of the desired facial movement patterns and the elimination of unwanted facial movements and expression patterns (VanSwearingen, 2008). It is based on patient education and the use of extrinsic feedback to achieve reeducation or physical learning aiming to achieve neuroplasticity by reducing as much as possible the probability of

creating abnormal patterns of movement (synkinesis) (Pourmomeny and Asadi, 2014).

Interrupted galvanic stimulation

Interrupted galvanic stimulation with rectangular waveform with 100 ms, 3 sets and 30 contractions in each set.

Manual facial massage

Manual facial massage includes effleurage, finger to thumb kneading, wringing, hacking, tapping and stroking.

Home based facial exercises

Home based facial exercises in front of mirror will be taught for 4 weeks. Patient will be reassessed after 4 weeks.

Home based Facial exercises include:

- Widen the eyes, and then frown.
- Close tightly eyes, and then wide open.
- Flare your nose and relax.
- Smile, grin, say ‘O’ and try to whistle.
- Fill air in mouth and release. Repeat.
- Pronounce the vowels or their combinations aaeou.
- Hold straw in mouth – suck and blow out air. Show as if blowing a balloon

Patient will practice this in front of mirror twice a day with about five repetitions at home.

Statistical Analysis

Standard descriptive statistics (mean, standard deviation and percentage increment/decrement) were analyzed for directly measured variables of the patients using SPSS (Statistical Package for Social Science) version 20.0. Paired t-test was applied for within group differences and independent t-test was applied for between group differences of the variables. To indicate statistical significance, 5% level of probability was used.

Results

Table 1 showed the descriptive statistics of **FDI-PF, FDI-SF, SAQ and SFGS** (both in pre- and post-intervention conditions) in patients with Bell’s palsy treated in Group-A and Group-B. The patients treated both in Group-A and

Group-B, statistically no significant differences ($p>0.05$) were found in FDI-PF, FDI-SF, SAQ and SFGS in pre-intervention conditions. However, in post intervention condition, significant differences ($p<0.001$) were observed in FDI-PF ($t = 7.050$), FDI-SF ($t=3.350$) and SFGS ($t=6.006$) between the patients treated in Group-A and Group-B.

Comparisons of pre- and post-intervention values of FDI-PF, FDI-SF, SAQ and SFGS in patients with Bell's palsy in Group-A were shown in table 2. Statistically significant increase ($p<0.001$) was found in FDI-PF ($t=4.787$) and SFGS ($t=10.345$),

whereas, significant decrease ($p<0.013-0.001$) was found in FDI-SF ($t=3.091$) and SAQ ($t=4.813$) in patients with Bell's palsy between pre- and post-intervention in this group.

Table 3 showed the comparisons of pre- and post-intervention values of FDI-PF, FDI-SF, SAQ and SFGS in patients with Bell's palsy in Group-B. Statistically significant decrease ($p<0.003-0.001$) was found in FDI-PF ($t=12.131$), FDI-SF ($t=7.998$), SAQ ($t=4.784$) and SFGS ($t=4.051$) in patients with Bell's palsy between pre- and post-intervention in Group-B.

Table 1: Descriptive statistics of FDI-PF, FDI-SF, SAQ and SFGS (both in pre- and post-intervention conditions) in patients with Bell's palsy treated in Group-A and Group-B

Variables	Group-A		Group-B		t-value	p-value
	Mean	S. D.	Mean	S.D.		
Age (years)	41.30	16.65	52.60	14.83	1.600	0.126
FDI-PF (pre)	61.65	23.71	69.30	4.64	1.001	0.330
FDI-SF (pre)	64.00	22.31	69.50	14.03	0.660	0.518
FDI-PF (post)	101.20	26.84	39.05	7.54	7.050	<0.001
FDI-SF (post)	45.20	11.93	31.60	4.79	3.350	<0.004
SAQ (pre)	87.55	3.95	84.15	6.93	1.350	0.194
SAQ (post)	69.08	12.34	65.55	8.78	0.736	0.471
SFGS (pre)	18.40	15.56	19.00	3.09	2.113	0.149
SFGS (post)	44.70	16.94	11.20	4.89	6.006	<0.001

FDI-PF = Facial Disability Index-Physical Function; FDI-SF = Facial Disability Index-Social Function; SAQ = Synkinesis Assessment Questionnaire; SFGS = Sunbrook Facial Grading System.

Table 2: Comparison of pre- and post-intervention values of FDI-PF, FDI-SF, SAQ and SFGS in patients with Bell's palsy in Group-A

Variables	Pre-intervention		Post- intervention		t-value	p-value
	Mean	S.D.	Mean	S.D.		
FDI-PF	61.65	23.71	101.20	26.84	4.787	<0.001
FDI-SF	64.00	22.31	45.20	11.93	3.091	<0.013
SAQ	87.55	3.95	69.08	12.34	4.813	<0.001
SFGS	18.40	15.56	44.70	16.94	10.345	<0.001

Table 3: Comparison of pre- and post-intervention values of FDI-PF, FDI-SF, SAQ and SFGS in patients with Bell's palsy in Group-B

Variables	Pre-intervention		Post- intervention		t-value	p-value
	Mean	S.D.	Mean	S.D.		
FDI-PF	69.30	4.64	39.05	7.54	12.131	<0.001
FDI-SF	69.50	14.03	31.60	4.79	7.998	<0.001
SAQ	84.15	6.92	65.55	8.78	4.784	<0.001
SFGS	19.00	3.09	11.20	4.89	4.051	<0.003

Discussion

In the present study, no significant differences were found in age of the patients treated in these two groups. It was also found that in pre-intervention condition, no significant differences were noted in FDI-PF, FDI-SF, SAQ and SFGS between these two groups. However, significant differences ($p < 0.001$) were observed in FDI-PF, FDI-SF and SFGS in post intervention condition between the patients treated in Group-A and Group-B (Table 1). Statistically significant increase ($p < 0.001$) was found in FDI-PF and SFGS and significant decrease ($p < 0.013-0.001$) was found in FDI-SF and SAQ between pre- and post-intervention in Group-A (Table 2). Statistically significant decrease ($p < 0.003-0.001$) was found in FDI-PF, FDI-SF, SAQ and SFGS between pre- and post-intervention in patients treated in Group-B (Table 3).

Various physiotherapy treatments including PNF (Barbara *et al.*, 2010), NMR (Brach and VanSwearingen, 1999; Manikandan, 2007), electrical stimulation for paralyzed facial muscles (Alakram and Puckree, 2010; Targan *et al.*, 2000; Hyvarnen *et al.*, 2008), conventional exercises through facial massage were reported for Bell's palsy patients. In the present study, patients of Group-A were treated with PNF, NMR, interrupted galvanic stimulation, facial massage and home based exercises and in Group-B, patients were treated only with interrupted galvanic stimulation, facial massage and home based exercises. The findings of the present study showed that significant improvement of FDI-PF (64.15%) was found in Group-A, whereas, significant decrement of FDI-SF, SAQ and SFGS in both Group-A (29.37%, 21.09% and 142.93% respectively) and in Group-B (48.78%, 22.10%

and 41.06% respectively) was noticed, showing superior effectiveness of the techniques included in Group-A for the treatment of patients with Bell's palsy.

Barbara *et al.* (2010) reported that PNF rehabilitation was shown to prove a faster recovery rate to reduce facial disability in patients with Bell's palsy if applied at an early stage. Manikandan (2007) reported that individualized NRE was more effective in improving facial symmetry in patients than conventional therapeutic measures only. The better prognosis in PNF in FDI-PF, FDI-SF, SAQ and SFGS was may be due to facilitation of proprioceptive neuromuscular system by PNF training (Kumar and Bagga, 2015). It generates appropriately forceful muscle contractions by using diagonal pattern of stretching. These repetitive movements based on irradiation principles and additional bilateral co-contraction initiate early recovery which make PNF more effective in improving facial symmetry and reducing facial disability in patients with Bell's palsy (Armijo-Olivo and Magee, 2007; Sardarul, 2013). Small sample size was one of the limitations of the study. Future study can be done considering large number of patients.

Conclusion

From the findings of the study it could be concluded the treatment protocol comprised of proprioceptive neuromuscular facilitation and neuromuscular re-education along with interrupted galvanic stimulation with rectangular waveform with 100 ms, 3 sets, and 30 contractions in each set, facial massage and home based exercises was more effective than only interrupted galvanic stimulation with rectangular

waveform with 100 ms, 3 sets, and 30 contractions in each set, facial massage and home based exercises in improving facial symmetry and reducing facial disability in patients with Bell's palsy.

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