RESEARCH PAPER

Comparison Of Effectiveness Of Visual Feedback Therapy And Facial Proprioceptive Neuromuscular Facilitation Technique In Bell's Palsy

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ABSTRACT

Background: Bell's palsy is a sudden-onset peripheral facial neuropathy characterized by unilateral facial muscle weakness or paralysis, significantly affectZing facial expression, emotional communication, and quality of life. Early physiotherapeutic intervention can enhance recovery and minimize residual deficits.

Objective: To compare the effectiveness of Visual Feedback Therapy (VFT) and Proprioceptive Neuromuscular Facilitation (PNF) in improving facial muscle function and symmetry in individuals with Bell's palsy.

Methodology:A quasi-experimental study was conducted at NIMS Hospital, Jaipur, with 30 participants diagnosed with acute Bell's palsy. Participants were divided into two groups: Group A received electrical stimulation with VFT using a mirror; Group B received electrical stimulation with facial PNF techniques. Interventions were administered five days a week for four weeks. Outcomes were measured pre- and post-intervention using the Sunnybrook Facial Grading System (SBFGS) and the Facial Disability Index (FDI).

Results: Both groups showed significant improvement ($p<0.0001$) in facial symmetry and function. However, Group B demonstrated a greater mean improvement in SBFGS and FDI scores compared to Group A, indicating superior effectiveness of the PNF technique.

Conclusion: While both VFT and PNF are effective in the rehabilitation of Bell's palsy, the PNF technique yields more significant improvements in facial muscle function and symmetry. These findings support the integration of PNF in physiotherapy protocols for Bell's palsy rehabilitation.

Keywords: Bell's palsy, Visual Feedback Therapy, Proprioceptive Neuromuscular Facilitation, SBFGS, FDI

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1. INTRODUCTION

The human face plays a vital role in communication, emotional expression, and social interaction. Any weakness of facial muscles can lead to physical disability as well as psychological and social distress. One of the most common causes of lower motor neuron facial paralysis is Bell's palsy, an acute-onset peripheral facial neuropathy. It accounts for 60–75% of all cases of facial paralysis, with an incidence of 7–40 cases per 100,000 people per year, affecting both genders equally [1].

Bell's palsy is named after the Scottish anatomist Sir Charles Bell, who first described facial nerve function and cases of facial paralysis. The first case of idiopathic facial paralysis was reported in the eighteenth century by Nicolaus Friedrich [2]. In 1828, Charles Bell described a well-known case of permanent facial paralysis following trauma. The facial nerve (7th cranial nerve) consists of motor, sensory, and parasympathetic nuclei. It originates in the pons and passes through the internal acoustic meatus into the facial (fallopian) canal, forming the geniculate ganglion, and traveling through the labyrinthine, tympanic, and mastoid segments before exiting through the stylo-mastoid foramen [1,2,3,5]. After exiting the skull, it divides into five terminal branches supplying the muscles of facial expression, the stapedius muscle, lacrimal gland, submandibular gland, and taste sensation from the anterior two-thirds of the tongue.

The exact cause of Bell's palsy remains unknown. Studies show a higher incidence during winter months. Approximately 70% of patients recover completely without treatment, while 30% may have incomplete recovery [6]. The recurrence rate is approximately 7% [7]. Symptoms usually appear suddenly and reach maximum severity within 48–72 hours, including unilateral facial weakness or paralysis, drooping of one side of the face, inability to close the eye, flattened nasolabial fold, difficulty smiling, ear pain, hyperacusis, altered taste, and dry eyes or dry mouth. Around 85% of patients show partial recovery within three weeks without treatment [10].

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1.1 Visual Feedback Therapy (VFT)

Visual Feedback Therapy (VFT), also known as mirror therapy, uses a mirror to provide visual input during facial exercises. Originally developed for phantom limb pain [17] and subsequently applied in stroke rehabilitation [18,19], VFT engages patients in performing facial movements such as raising eyebrows, closing eyes, smiling, and puffing cheeks for 10–20 minutes, 2–3 times daily [16]. Mirror therapy enhances weak muscle contraction, reduces muscle hyperactivity, and decreases synkinesis by stimulating brain areas responsible for movement and coordination [20].

1.2 Proprioceptive Neuromuscular Facilitation (PNF)

Proprioceptive Neuromuscular Facilitation (PNF) is a therapeutic technique that improves muscle activation by stimulating proprioceptors along with tactile, verbal, and visual cues [21]. It follows motor learning principles and aims to improve functional movement. Key principles include tactile, verbal, and visual stimulation; application of resistance (isometric, concentric, eccentric); stretching techniques; irradiation and reinforcement; and functional diagonal movement patterns [21]. The Hold-Relax technique is commonly employed in Bell's palsy rehabilitation, involving stretching the muscle, performing an isometric contraction, relaxing, and applying a deeper stretch [22].

1.3 Need of the Study

Bell's palsy causes facial muscle weakness and asymmetry, affecting emotional expression and quality of life. While many patients recover spontaneously, some experience lasting deficits. Early physiotherapy, particularly VFT and PNF, is essential for recovery. However, there is insufficient comparative evidence on their effectiveness. This study aims to evaluate and compare VFT and PNF outcomes to guide evidence-based clinical practice in Bell's palsy rehabilitation.

2. MATERIALS AND METHODOLOGY

2.1 Study Design

A quasi-experimental study design was used. The study was conducted at NIMS Hospital, Jaipur. Participants included patients diagnosed with Bell's palsy, aged between 15 and 60 years. A final sample size of 30 participants was selected using purposive sampling.

2.2 Inclusion and Exclusion Criteria

Inclusion Criteria

- Age between 15–60 years
- Both male and female participants
- Confirmed diagnosis of Bell's palsy
- No prior physical therapy treatment
- Cooperative patients

Exclusion Criteria

- Chronic Bell's palsy
- Previous history of facial paralysis
- History of facial trauma or skull fracture
- Metal implants
- Central nervous system tumors
- Skin allergies or open facial wounds
- Other neurological disorders (e.g., stroke, Guillain-Barré syndrome)

2.3 Outcome Measures

Sunnybrook Facial Grading System (SBFGS)

Facial symmetry was assessed using the 13-item Sunnybrook Facial Grading System (SBFGS), which evaluates resting symmetry, voluntary movement, and synkinesis. The SBFGS demonstrates high reliability (r = 0.927) [42].

Facial Disability Index (FDI)

The Facial Disability Index (FDI) is a validated questionnaire used to assess physical function and social well-being in individuals with Bell's palsy. It has good reliability (physical function = 0.88; social/well-being function = 0.83) [43]. The physical function subscale correlates well with clinician-based facial movement assessments, supporting its construct validity [43].

2.4 Treatment Groups

GROUP A	GROUP B
Electrical stimulation (muscle stimulator) along with Visual Feedback Therapy using a mirror.	Electrical stimulation (muscle stimulator) along with facial Proprioceptive Neuromuscular Facilitation (PNF).
Interrupted galvanic current stimulation at the motor point of the muscle, combined with facial exercises performed in front of a mirror — 5 days per week for 4 weeks.	Interrupted galvanic current stimulation at the motor point of the muscle, combined with facial PNF techniques — 5 days per week for 4 weeks.

2.5 Intervention Protocol

Group A: Electrical Stimulation with Visual Feedback Therapy

Participants received electrical stimulation followed by facial exercises performed in front of a mirror. A carbon-impregnated silicon rubber electrode with conductive gel was placed at the C7 region. Pen

electrodes stimulated facial motor points using interrupted galvanic current with a pulse duration of 100 ms. Intensity was adjusted to produce visible muscle contraction. Three sets of 30 minimal contractions were applied to motor points including the frontalis, corrugator supercilii, orbicularis oculi, nasalis, risorius, orbicularis oris, lower lip depressors, and upper lip elevators.

Following stimulation, participants performed facial exercises in front of a mirror — including frowning, eyebrow raising, nose wrinkling, smiling, lip exercises (pouting, puckering, fish pout), jaw movements, and eye exercises — with 10 repetitions and a 5-second hold each, twice daily.

FIG : Visual Feedback Therapy

Group B: Electrical Stimulation with Facial PNF

Participants received the same electrical stimulation protocol as Group A, followed by facial PNF using the Hold-Relax technique. The muscle was placed in a stretch position, an isometric contraction was held for 5–8 seconds, then the muscle was relaxed, and a deeper stretch applied. Two sets of 8–10 repetitions were performed. Muscles targeted included the frontalis, corrugator supercilii, orbicularis oculi, procerus, levator labii alaeque nasi, orbicularis oris, zygomaticus, risorius, and mentalis.

FIG: Facial PNF

2.6 Data Analysis

Data were analyzed using IBM SPSS version 30 and Microsoft Excel 2010. Descriptive statistics were presented as mean ± standard deviation. Mean difference percentages were calculated. An unpaired t-test was used to compare pre-test and post-test values within and between groups. Statistical significance was set at $p < 0.05$.

3. RESULTS

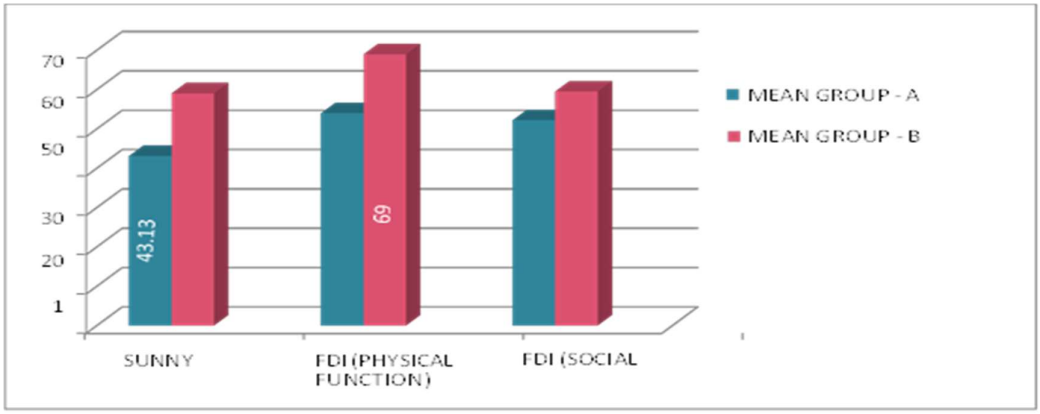
Both groups demonstrated statistically significant improvement ($p < 0.0001$) following four weeks of intervention. Group B (Facial PNF) showed superior outcomes compared to Group A (VFT) across all three measured parameters. The results are summarized in Table 1 below.

Table 1: Comparison of Group A and Group B — Post-Intervention Outcomes

Variable	Group A Mean	Group A SD	Group B Mean	Group B SD	Inference
SBFGS	43.13	±18.68	**59.06**	±16.99	Significant (p<0.0001, t=2.35)

FDI – Physical Function	54.00	±21.84	**69.00**	±15.51	Significant (p<0.0001, t=2.09)
FDI – Social Function	52.26	±21.53	**59.46**	±16.32	Significant (p<0.001, t=0.99)

Group B had a mean SBFGS score of 59.06 (±16.99) compared to 43.13 (±18.68) in Group A; a mean FDI-Physical Function score of 69.00 (±15.51) compared to 54.00 (±21.84) in Group A; and a mean FDI-Social Function score of 59.46 (±16.32) compared to 52.26 (±21.53) in Group A. P-values ranged from <0.0001 to <0.001, with t-values from 0.99 to 2.35, confirming statistical significance across all parameters. These findings indicate that Group B consistently achieved superior functional and symmetry outcomes in both physical and social domains.



GRAPH: A bar graph representation showing the proportion of both groups comparison

4. DISCUSSION

The findings of this study align with current evidence supporting both VFT and PNF as effective interventions for Bell's palsy rehabilitation. The statistically significant improvements in SBFGS and FDI scores in both groups confirm the utility of structured physiotherapy protocols incorporating electrical stimulation.

The superior outcomes in Group B suggest that the multi-sensory nature of PNF — integrating tactile, proprioceptive, and visual inputs simultaneously — may be more effective in facilitating neuromuscular re-education than visual feedback alone. The Hold-Relax technique likely promotes greater motor unit recruitment, improved proprioceptive awareness, and enhanced plasticity of facial motor pathways.

Previous studies support these observations. Kabat rehabilitation (PNF) combined with facial exercises and nerve stimulation has been shown to significantly reduce facial disability and synkinesis [45,46]. Similarly, Devi et al. reported efficacy of PNF with low-frequency electrical stimulation in reducing facial disability in Bell's palsy [22]. The current study adds to this body of evidence by directly comparing VFT and PNF under controlled conditions.

Visual Feedback Therapy, while less effective than PNF in this study, still demonstrated clinically meaningful improvements. Mughal et al. (2021) similarly reported that mirror visual feedback combined with neuromuscular retraining improved facial outcomes [38]. The mechanism may involve activation of mirror neuron systems, facilitating cortical reorganization and improving voluntary motor control.

5. LIMITATIONS AND FUTURE DIRECTIONS

5.1 Limitations

- Small Sample Size: The study involved only 30 participants, limiting generalizability to the broader population.
- Short Duration: The four-week intervention period may be insufficient to observe long-term effects and sustainability of improvements.
- Single-Center Study: Conducted solely at NIMS Hospital, Jaipur, reducing population diversity and external validity.

5.2 Future Research Directions

- Future studies should include larger sample sizes and longer follow-up periods to assess the sustainability of treatment effects.
- Extended study durations are recommended to evaluate long-term effectiveness and sustainability of the interventions.
- Objective measures such as electromyography (EMG) or facial motion tracking software should be incorporated to increase precision in assessment.
- Multi-center randomized controlled trials would strengthen the evidence base and improve generalizability.

6. CONCLUSION

This study compared the effectiveness of Visual Feedback Therapy (Group A) and Facial

Proprioceptive Neuromuscular Facilitation (Group B) in patients with Bell's palsy, using the Sunnybrook Facial Grading System and the Facial Disability Index (Physical and Social Function) as outcome measures. Both groups showed statistically significant improvements post-intervention ($p < 0.0001$), indicating that each therapy modality contributes positively to facial rehabilitation.

However, Group B (Facial PNF) consistently demonstrated greater mean improvements across all parameters. These findings suggest that Facial Proprioceptive Neuromuscular Facilitation is more effective in enhancing facial motor recovery and overall functional outcomes in Bell's palsy patients compared to Visual Feedback Therapy alone. Clinicians are encouraged to integrate facial PNF into evidence-based physiotherapy protocols for Bell's palsy rehabilitation, while VFT may serve as a valuable complementary modality.

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