

Case Series

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Usefulness of electroneurography for physiotherapeutic management of Bell's palsy - 7 case series

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Abstract

Bell's palsy or Idiopathic Facial Palsy (IFP) is the most common form of acute spontaneous peripheral facial paralysis and can present as unilateral weakness or paralysis of the face. The initial degree of facial paralysis has been regarded as one of the most important prognostic factors for recovery. In clinical practice, the degree of initial facial paralysis is determined by the House-Brackmann (H-B) grade or Sunny brook scale of Facial grading. Facial nerve electrodiagnostics is a well-established and important tool for decision making as it can assist in diagnosis, assess the lesion severity, and aid in treatment decision making. Even though there are evidence regarding efficacy of various physiotherapeutic modalities in management of IFP, Electrical stimulation (ES) is the primary treatment physiotherapeutic choice in management of Bell's Palsy. Limited studies suggest potential negative effects of electrical stimulation in increasing aberrant reinnervation and synkinesis. The objective of the present study is to categorise the extent of nerve damage based on electrophysiological studies and thereafter provide customised physiotherapeutic treatment based on the degree of damage and avoid occurrence of facial synkinesis.

Keywords: Bell's palsy; Electroneurography; House brackmann scale; Sunny Brooke's Facial grading scale; Darsh Gunjan's Bell's palsy treatment protocol; Synkinesis.

Introduction

Bell's palsy is the most common form of acute spontaneous unilateral peripheral facial paralysis. Symptoms of Bell's Palsy usually develop rapidly, often reaching their peak within 48 hours [1]. The progression of symptoms can vary, with some patients experiencing gradual improvement over weeks to months, while others may have persistent or residual facial weakness.

Understanding the clinical features is crucial for timely diagnosis and appropriate management of Bell's Palsy [2], which often involves a multidisciplinary approach including neurology,

ophthalmology, and rehabilitation services like physiotherapy. Early rehabilitation is crucial in Bell's Palsy, for several important reasons like Prevention of Complications such as eye dryness and corneal ulceration due to inadequate eye closure (lagophthalmos). Early rehabilitation efforts that restore facial symmetry and expression can improve self-confidence and reduce psychological distress associated with facial disfigurement. Prevention of Long-Term Sequelae: Without early intervention, some patients may develop long-term facial asymmetry or dysfunction due to muscle contractures or inadequate neural recovery [3].

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While most are expected to recover, up to 29% of patients with Bell's palsy experience life-long residual weakness, involuntary contractions, spasms, and unintentional movements that occur simultaneously with intentional movement known as synkinesis [4].

Electrical Stimulation (ES) is commonly recommended treatment modality [5]. ES can potentially reduce these sequelae by preventing muscle atrophy and improving the selectivity of motor nerve regeneration. Electrical stimulation on facial muscles in the context of facial palsy, such as Bell's Palsy, can have unintended harmful effects, particularly in exacerbating synkinesis. Synkinesis refers to the involuntary movement of facial muscles that can occur when nerve regeneration after palsy is incomplete or misdirected [6].

The use of electrical stimulation, if not carefully controlled or guided by techniques like Electroneurography (ENoG), can potentially worsen synkinesis by stimulating incorrect nerve pathways or causing inappropriate muscle contractions [7]. This highlights the critical need for precise and individualized physiotherapy approaches that take into account the unique nerve regeneration patterns and muscle responses in each patient.

ENoG is valuable in diagnosing and monitoring facial nerve disorders, such as determining the severity of nerve injury in Bell's Palsy [8]. Normal ENoG findings typically show symmetric responses between the affected and unaffected sides of the face in healthy individuals. In conditions like Bell's Palsy, where there is facial nerve dysfunction, ENoG can reveal asymmetric responses with prolonged latency and reduced amplitude on the affected side. We tried to address this problem by considering Degeneration Index (DI) as therapeutic guide, which is calculated from the Electroneurographic (ENoG) study of the facial nerve. The study was conducted after obtaining Institutional ethical clearance- JVR/IEC/2023-24/2101. This study is unique in its emphasis on electroneurography as a crucial guide for selecting effective physiotherapy methods while specifically avoiding facial electrical stimulation. By doing so, it underscores the importance of tailored treatment approaches in managing Bell's Palsy and minimizing synkinesis risks.

Calculating degenerative index

The degenerative index is typically expressed as a percentage of degeneration compared to a normal response [9].

It is calculated by comparing the CMAP amplitude (in millivolts or microvolts) from the affected side (ipsilateral to the palsy) with the CMAP amplitude from the unaffected side (contralateral).

Degenerative Index= (Amplitude of affected side /Amplitude of unaffected side)×100

Ideally, the unaffected side serves as an internal control to compare against the affected side.

Interpretation

A degenerative index close to 100% indicates severe degeneration or complete nerve loss.

A lower degenerative index indicates less severe degeneration or partial nerve preservation.

Case series description

Inclusion criteria:

Acute onset of Bell's palsy (<30 days)

Between the ages of 10 till 59 years

Confirmed case of Idiopathic Facial Palsy (IFP) by Neurophysician/Neurosurgeon.

Subject or subject's legal representative/Impartial witness has signed the informed consent form.

Exclusion criteria:

History of recurrent IFP

History of recent head or neck injury

No history of ongoing otitis media or ear discharge

History of ongoing otitis media or ear discharge

Non co-operative patient

Demographic details

Age: The age range of the seven patients is between 25 and 55years.

Sex: The case series includes both male and female patients.

Duration of symptoms: The duration of symptoms at the time of initial presentation ranges from 0 days to 1 week.

Detailed patient profiles: The table below prides the detailed demographic data of all 7 patients

Correlation of ENoG findings with clinical severity and prognosis

Table 1: Demographics and clinical characteristics of patients

	Age	Gender	Side affected	Time before commencement of treatment
Case 1	36	F	Left	Day 3
Case 2	55	M	Right	Day 6
Case 3	54	F	Left	Day 3
Case 4	40	F	Left	Day 3
Case 5	37	F	Right	Day 5
Case 6	32	F	Left	Day 4
Case 7	28	M	Right	Day 3

Severity assessment: ENoG findings such as delayed latency and reduced amplitude correlate with the extent of facial nerve dysfunction observed clinically. Patients with more pronounced ENoG abnormalities presented with more severe facial weakness.

Prognostic indicators: ENoG results provide valuable prognostic information. Patients with severe ENoG findings (e.g., markedly reduced amplitude, prolonged latency) required more intensive rehabilitation and had a slower recovery trajectory compared to those with milder ENoG abnormalities.

Treatment planning: Tailored physiotherapeutic interventions were planned based on ENoG, HBS, SBFGS findings to optimize facial muscle rehabilitation and improve outcomes.

Table 2: Qualitative and quantitative findings of facial weakness in 7 cases.

	ENoG		House Brackmann Grade at baseline	Sunny Brook Scale (Max score 100)	Overall Clinical Severity
	Degeneration Index				
Case 1	Frontalis	40	Grade III	46	Moderate facial weakness
	Nasalis	68.34			
	Mentalis	76.76			
Case 2	Frontalis	50	Grade III	47	Moderate facial weakness
	Nasalis	42			
	Mentalis	75			
Case 3	Frontalis	38.46	Grade III	39	Moderate facial weakness
	Nasalis	17.64			
	Mentalis	56.52			
Case 4	Frontalis	46.15	Grade II	51	Moderate facial weakness
	Nasalis	40			
	Mentalis	10			
Case 5	Frontalis	18.75	Grade III	41	Moderate facial weakness
	Nasalis	8			
	Mentalis	51			
Case 6	Frontalis	28.60	Grade II	64	Mild facial weakness
	Nasalis	25			
	Mentalis	42			
Case 7	Frontalis	51.7	Grade IV	12	Severe facial weakness
	Nasalis	91.17			
	Mentalis	55			

Long-term monitoring: Serial ENoG assessments was undertaken to track nerve recovery progress over time, guiding adjustments in treatment strategies and providing reassessment of prognosis.

Physiotherapeutic interventions

All the patients received tailored physiotherapy sessions based on copyrighted treatment protocol under Govt. of India’s copyright office, bearing registration no I-147405/2024 Darsh Gunjan’s Bell’s palsy treatment protocol©. This protocol comprises of following steps:

Step 1: Baseline evaluation through videography, House brackmann scale [10], Sunny brooke’s facial grading scale [11], facial nerve conduction study.

Step 2: Protocol based on baseline evaluation will include:

Facial neuromuscular exercises [12] (for 10 min).

Facial massage [13] (for 5 minutes with hypoallergic face oil as per patient’s skin type).

Facial therapeutic-ultrasound [14] (at evidence based dosage:-frequency: 1000 kHz, intensity: 0.5 w/cm², on-off ratio: 1:2, duration 5 min, over mastoid process, painful area identified behind the ear and paralysed muscles delivered through ELECTROSON 900 by Technomed Electronics).

Low level laser therapy [15] (at evidence based dosage:-wavelength of 980 nm and frequency of 100 Hz, energy density of 5 Jper every point of direct contact with the skin of the face over the superficial nerve courses of the facial nerve, delivered through Tech Laser 302).

Advanced Pneumatic Radial Extracorporeal shockwave therapy [16] (at evidence based dosage:- frequency 2 Hz, Intensity 2

bars, shots: 500, TD-15 delivered through Shockwave pro 1000 by Technomed Electronics) based on degenerative index as calculated from facial nerve conduction study.

Facial taping (to be removed while sleeping)/Facial splint.

Eye care as appropriate.

Step 3: Patient will be asked to perform facial neuromuscular exercises 3 times a day followed by facial massage at home

Step 4: Except LASER & Advanced Pneumatic Radial shockwave therapy Extracorporeal shockwave therapy, which will be given every third day, rest of the therapeutic protocol will be followed every day.

Step 5: Every 21 days patient will be evaluated through videography, House Brackmann scale, Sunny Brooke’s facial grading scale, Facial nerve conduction study till complete recovery.

Clinical visit routine

Week 1 - day 1: After Step, one evaluation patient will be given Facial Neuromuscular exercises, Facial Massage, Facial Ultrasound, LLLaser therapy, Facial splint and eye care advice and home protocol advice.

Week 1 - day 2: Facial Neuromuscular exercises (for 10 minutes), Facial Massage, Facial Ultrasound.

Week 1 - day 3: Facial Neuromuscular exercises (for 10 minutes), Facial Massage (for 5 minutes), Advanced Pneumatic Radial shockwave therapy Extracorporeal shockwave therapy on facial nerve trunk in front of ear.

Week 1 - day 4: Facial Neuromuscular exercises (for 10 minutes), Facial Massage (for 5 minutes), Facial Ultrasound.

Week 1 - day 5: Facial Neuromuscular exercises (for 10 minutes), Facial Massage (for 5 minutes), Facial Ultrasound.

Week 1 - day 6: Facial Neuromuscular exercises (for 10 minutes), Facial Massage (for 5 minutes), Facial Ultrasound, LLLaser therapy.

Week 1 - day 7: Break Day, only home protocol to be followed.

Week 2: Same routine to be followed as week 1.

Week 3: Same routine to be followed as week 1.

Week 4: Step 5 undertaken and if needed same routine will be followed as in week 1.

During the course of treatment, if clinically patient shows complete recovery, then Step 5 is repeated and the patient is discharged.

Facial neuromuscular exercises included

Eye exercises: Blinking exercises to improve eyelid closure.

Forehead exercises: Raise your eyebrows as high as possible and hold for 5-10 seconds. Repeat 5-10 times.

Lip exercises: Purse your lips together tightly and hold for 5-10 seconds. Repeat 10-15 times. Smile with your lips closed and hold for 5-10 seconds. Repeat 10-15 times.

Try to pucker your lips as if kissing and hold for 5-10 seconds. Repeat 10-15 times.

Tongue exercises: Stick your tongue out as far as possible and try to touch your nose with the tip of your tongue. Hold for a few seconds and repeat 5-10 times.

Move your tongue from side to side inside your mouth, touching the corners of your lips.

Cheek puffing: Inflate the cheeks to strengthen buccinator muscles.

Smiling and frowning: Facial expression exercises to regain natural facial movements.

Patients were asked to refer to our online video on facial palsy for any clarifications regarding the treatment procedures at <https://www.youtube.com/watch?v=Jhif6SILzEI>.

Discussion

This detailed case series description provides a comprehensive overview of the patient cohort, ensuring clarity and relevance in evaluating the usefulness of Electroneurography for physiotherapeutic management of Bell's Palsy.

The above case series highlight the importance of Electroneurography in management of idiopathic facial palsy. Degenerative index in conjunction with other validated qualitative facial palsy assessment scales serve as an important tool in designing rehabilitation programme. The degenerative index is interpreted in conjunction with clinical findings to assess the severity of facial nerve involvement, thus helping in predicting the prognosis and guiding management decisions.

This case series underscores the importance of integrating ENoG findings with clinical assessments to optimize physiotherapeutic interventions and achieve favorable outcomes in patients recovering from Bell's Palsy.

Table 3: Patient's recovery pattern based on their facial functions.

Case 1	92% recovery in 45 days
Case 2	88% recovery in 37 days
Case 3	100% recovery in 30 days
Case 4	100% recovery in 30 days
Case 5	80% recovery in 50 days
Case 6	100% recovery in 26 days
Case 7	56% recovery in 55 days and 80% by 6 months

*Percentages calculated on the basis of change in Degenerative index.

Limitations

The case series acknowledges potential limitations such as sample size and variability in clinical response to treatment despite standardized diagnostic criteria.

ENoG serves as a valuable tool in objectively assessing facial nerve function, guiding treatment decisions, and predicting recovery outcomes in patients with Bell's Palsy.

Variability in ENoG interpretation and the influence of factors such as patient cooperation and timing of assessment highlight the importance of standardized protocols and clinical correlation.

Future directions

Further research is needed to refine ENoG techniques and validate its role in optimizing management strategies for facial nerve disorders.

Conclusion

ENoG is a valuable tool in the management of Bell's Palsy, offering objective assessments that aid in diagnosis, prognostication, and treatment guidance. Its integration into physiotherapeutic protocols enhances the precision of rehabilitation efforts, potentially improving outcomes for patients recovering from facial nerve disorders. However, clinicians should consider its strengths and limitations when interpreting findings and implementing tailored treatment strategies, ensuring a balanced approach that optimizes patient care based on both objective data and clinical judgment.

By leveraging objective neurophysiological data, physiotherapists' can tailor interventions, monitor progress effectively, and provide personalized care that promotes neural recovery and functional restoration in facial nerve disorders. And most importantly with objective evaluation, Physiotherapists' can easily prevent occurrence of synkinesis in patients recovering from IFP. Continued research and innovation in ENoG technology and application are essential to further advance understanding and refine therapeutic approaches in facial nerve rehabilitation.

Conflicting interest: Nil.

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