**BELL’S PALSY: PHYSIOTHERAPY MANAGEMENT AND NEWER ADVANCES**

## Reviewer’s advice

1. Write this whole paper in past participle form. It should be in passive voice.
2. Bills palsy can occur for several different reason. It can be diabetes, age related nerve degradation and whole molecular jungle of protein, amino acid misfolding. Please read and incorporate more data in it. Sudden accident or shock or a deadly viral or bacterial attack can make muscle stiff. Therefore, we need for more experimental data. Mineral deficiency can make muscle weak too.
3. Edema is a hallmark of inflammation. Sometimes mouth and ear infection can hit the brain and cause palsy. You can read about it and cite those papers.
4. Add more citations. Write this whole paper in Times New Roman letters.

## ABSTRACT

Sir Charles Bell was the first to present anatomical basis of Bell’s Palsy. Bell’s Palsy is named after him. Bell’s palsy can be defined as an acute idiopathic lower motor neuron lesion of the facial nerve leading to the unilateral paralysis of facial muscles. It affects all age groups equally; however, incidences are more seen in age ranging from 15 years to 45 years. Bell’s palsy starts unexpectedly, and symptoms might be different for different people. The symptoms range from mild weakness to total paralysis. Some of the symptoms are dropping of the corner of mouth and eyebrow, inability to close the eye, obliterated nasolabial fold and loss of forehead wrinkles. Physiotherapy interventions play an important role to accelerate recovery, improve facial function and reduce the occurrence of complications. Common physiotherapy interventions are Electrical Stimulation, Facial Massage, Facial Exercises, Proprioceptive Neuromuscular Facilitation. Apart from these, there are newer and upcoming techniques which can be added in the treatment protocol. This article aims to discuss the current techniques and elaborate on the newer technique.

*Keywords: Bell’s Palsy, Physiotherapy, Facial Palsy, Neural Mobilization, Facial Nerve*

**INTRODUCTION**

Bell’s palsy is a lower motor neuron type of lesion. It is named after Sir Charles Bell who was a Scottish anatomist. (1774-1842). [1,2] It can be defined as a common cranial neuropathy which causes an acute idiopathic lower motor neuron lesion of the facial nerve leading to unilateral paralysis of facial muscles. This is usually temporary. [3,4] The incidence of Bell’s palsy is 20–30 cases for 100,000 and it accounts for 60–70% of all cases of one sided peripheral facial palsy. Either sex is affected equally and may occur at any age, however the incidences have been more in the age ranging from 15-45 years. Left and right sides are affected equally. [5]

The facial nerve is a 7th cranial nerve. It emerges from the facial nucleus of the brain stem. It begins as two roots (motor root and sensory root). The two roots are accompanied by the 8th cranial nerve (vestibule-cochlear nerve) to enter the internal auditory meatus. The roots leave the internal auditory meatus to enter the facial canal, where the two roots fuse to form facial nerve and the geniculate ganglion (collection of nerve cell bodies). The facial nerve exits the facial canal via the stylomastoid foramen. Finally, the facial nerve divides into five motor branches (temporal, zygomatic, buccal, marginal mandibular, and cervical) to innervate muscles of facial expression. [6,7,8

**RISK FACTORS: [9]?**

* Extreme cold
* Infections of ear
* Traumatic injury
* Sleep deprivation
* Impaired immunity
* Autoimmune syndromes

**ETIOLOGY**

Etiology of Bell’s palsy is unidentified. Literature studies suggests links to various viral infections including herpes simplex type 1, varicella-zoster virus, and others. “Herpes simplex virus (HSV) is commonly implicated in causing bell’s palsy. It causes acute inflammation and edema of the facial nerve leading to entrapment of the nerve in the bony canal (especially in the labyrinthine segment) and thereby compression and ischemia. All these eventually lead to neuropraxia or degeneration of the facial nerve” [10,11].

**SIGNS AND SYMPTOMS: [12]?**

**Create a paragraph and elaborate a little more.**

* Pain
* Numbness and Stiffness
* Inability to wrinkle half of the forehead
* Inability to close eye completely
* Drooping of eyelid
* Dryness of eye
* Obliteration of nasolabial fold
* Noise intolerance
* Drooping of corner of mouth
* Saliva dripping from the angle of mouth
* Loss of taste sensations over anterior part of tongue
* Inability to blow air
* Inability to clench teeth or grin
* Slurred speech

These are the physical symptoms that can be noticed on clinical observation and examination. However, the impact of Bell’s Palsy extends beyond that. It affects the patient psychologically and socially due to loss of facial muscle control and figure disfigurement. This eventually leads to reduced quality of life in the patients of Bell’s palsy. [11]

**INVESTIGATIONS**

In the case of Bell’s Palsy, routinely no laboratory tests or imaging tests are done to confirm that diagnosis. Sometimes they are required to rule out other sources causing Bell’s palsy. Imaging studies are useful when taste and hearing sensitivity seems to be more prominent. Nerve conduction studies and Electromyography are done to determine the severity of the condition and probably time of recovery.

**PHYSIOTHERAPY ASSESSMENT AND CLINICAL ASSESSMENT SCALES**

Physiotherapy assessment starts with the clinical observation of the patient. Detailed history taking occurs with the objective to understand etiology. After taking consent, examination of the patient started. Examination involves evaluating the function of the facial muscles. The tone of the muscles will be hypotonic, and the muscle strength reduced. The corneal reflex is checked with a cotton wisp and is usually absent. Sensations of anterior 2/3rd of tongue is also checked.

The next step is plotting the Strength-duration Curve. It is a graph to understand the status of the nerve. Electrical stimuli of different intensities are administered, and the time needed by each stimulus to start the response is noted, which is later plotted on the graph. S-D curve should be plotted after 20th day of injury/lesion, as after 21st/22nd day regeneration of nerve will start. The purpose of S-D curve plotting is to help us know whether the stimulated muscle is innervated, denervated or partially denervated. This will also give us an idea about the prognosis of the condition.

C

B

A

*Fig 1 shows a graph plotted for A. Innervated muscle B. Partially innervated muscle C. Denervated muscle. Consider re-creating this graph plotting.*

A variety of facial nerve grading scales are available which have been developed over the years with the aim to document facial nerve function, tracking recovery of the patient, and facilitating communication between the clinical practitioners.

Sunnybrook Facial Grading Scale is a gold standard measurement scale in reporting outcomes of facial nerve disorders. [14] It is a well-established grading system due to its clinical relevance, sensitivity, and robust measuring method. [15] The components tested are facial symmetry at rest, voluntary movements, and synkinesis. The composite score ranges from 0 to 100, where 100 corresponds to normal facial function and 0 corresponds to complete paralysis. [16]

House Brackman Grade is another known scale for facial palsy. The system is a wide classification involving a six-point scale with grade I indicates normal status and grade VI means flaccid paralysis. The reduction in the score indicates the improvement of facial palsy; [16] nowadays House Brackman Grade is used.

Sydney Classification is a scale based on the anatomical segment of the facial nerve which is responsible for supplying each action. The total maximum score of 15 indicates normal facial function, while 0 is the minimum score. Any increments in the score indicate improvement in facial palsy. [16]

The Facial Disability Index (FDI) is a brief, self-report questionnaire of physical disability and psychosocial factors which are related to facial neuromuscular function. It is designed to provide the clinician and healthcare workers with information about the disability and the related social and emotional well-being of patients with facial nerve disorders. [17]

The Facial Clinometric Evaluation (FaCE) scale is used to precisely assess facial function and quality of life after facial paralysis. It was developed by Dr. Jeffrey B. Kahn and colleagues to measure both impairment and disability associated with facial dysfunction. [18]

**PHYSIOTHERAPY MANAGEMENT**

Physical therapy plays an important role in the treatment of Bell’s palsy. Over the years, approaches have kept in focus the specificity and peculiarity of facial nerve physiology and the permanent sequelae which is related to the recovery processes during nerve regeneration. Many procedures and strategies have been implemented for long-standing facial palsy and developed and revised to help the patient control the symmetry of the face. These was achieved by performing slow movements and voluntary control of synkinesis. Different modes of movement are put to experiment and practice and eventually automatize them in routine activities. [19]

Some of the techniques included in routine physiotherapy are described as follows:

**Electrical Stimulation**

The application of electrical stimulation in Bell’s palsy patients primarily focuses on improving facial weakness and preventing further damage on the affected side. Electrical Stimulation starts with prepping the patient. The patient lies in supine and in loose comfortable clothes. The patient is to be explained about the tingling sensation when the impulses come. Any discomfort is to be reported immediately. Electrical Stimulator of different capacities can be used. Refer figure Fig. 1



*Fig 1: Electrical Stimulator*

**Facial Massage**

The treatment involves the application of talcum powder to smoothen the skin and allow easy skin movements. Massage can be given using fingertips or thumb. It comprises of gentle tapping, kneading, wringing, and skin-rolling of the affected side of the face was performed. [20] In finger-kneading, skin, and subcutaneous tissues of the right side of the face were moved in a circular manner from the underlying skin. In wringing, facial muscles of the right side; frontalis, zygomaticus, buccinators, and masseter were compressed, squeezed, and pulled away from side to side using fingers. In skin-rolling, skin of the right side of the face was lifted and rolled between thumb and index finger. Each manipulation was performed 10–15 times in distal to proximal (towards the mastoid process) direction. Facial massage helps in fluid drainage, regaining the ability to perform facial expressions, reduce muscle weakness and to increase muscle movements.

**Facial Exercises**

Expression exercises involves patient sitting in front of the mirror for biofeedback. Patient will be then asked to observe their normal side and try to perform the same movements on the affected side with assistance initially and later taught to self-assist. Many studies have suggested the benefits of facial exercises. Pereira L et el. did a systematic review with meta-analysis to evaluate the effects of facial exercise therapy for facial palsy and concluded that facial exercise therapy is effective for facial palsy for the outcome functionality. [21]

Ten facial expression exercises include: make it a paragraph please.

* Raising of eyebrows,
* Flaring of nostrils,
* Closing the eyes tightly,
* Smiling with lips closed,
* Sucking or sipping,
* Joining lips or puffing,
* Crying expression,
* Laughing expression,
* Pouting

Each exercise was performed 10 times, recommended by previous studies to avoid fatigue. [22]

Proprioceptive Neuromuscular Facilitation: Proprioceptive Neuromuscular Facilitation (PNF) is a manual resistance technique. It promotes relaxation, irradiation, inhibition, and facilitation through basic movement patterns. Studies suggests that it improves functioning and power of facial muscles. [23]

Many studies prove its effectiveness in the treatment of Bell’s palsy. It involves resisting stronger motions on non-affected side to stimulate and reinforce weaker motions on affected side of face and to be given for 20 repetitions for each muscle, 5 days/week. The process of giving PNF to various muscles of the face were following: [24]

***Frontalis:*** Ask the patient to lift eyebrows up, look surprised wrinkle your forehead. Apply resistance to the forehead, pushing down and medially.

***Corrugators Supercilii****:* Ask the patient to pull eyebrows down (frown). Apply resistance just above the eyebrows diagonally in a cranial and lateral direction.

***Orbicularis oculi:*** Ask the patient to close the eyes. Apply resistance to the upper eye lip pulling it up and laterally.

***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.

**Recent Advances**

**Neural Mobilization**

Neural mobilization of facial nerve in Bell’s palsy is a new and gentle technique which aims to relieve tension and its associated symptoms. [25]

Various articles have studied the benefits of neural mobilization. Dr. Salem F Alatalali concluded that neural mobilization technique was effective to reduce oedema and eventually alleviates hypoxia and its associated symptoms. [26]Studies done by Nshimiyama et el. suggests that neural mobilization aims to improve nerve gliding and reduce nerve entrapment which facilitates recovery of nerve function. [27]

Neural mobilization is applied by gently holding the lower part of the ear between the index finger and thumb. The thumb should be placed at the opening of the external auditory meatus and the index finger placed behind the auricle of the ear. The gentle horizontal traction and circular movement 25 times each with 5s rest were given for 3-4 sets/session for 15 minutes, 5 days/week, 3 weeks”. [24]

**Facial Taping**

 Kinesio taping (KT) for Bell’s palsy is nowadays increasingly used technique.

It basically helps to lift the skin, create little space between the dermis and the muscles, reduce the pressure on the pain receptors located under the skin to reduce pain. It also helps to improve blood and lymph circulation. [28]

Kinesio Taping is applied in I-shaped strips to create about 25% tension in the therapeutic zone. It is precisely given in the belly of the muscles. The muscle of focus usually in KT is zygomatic major and minor. [29] The tape is applied from the corner of mouth and goes till the pinna of ear.

**Low level laser treatment**

Low-level laser therapy (LLLT) is a non-invasive, non-thermal phototherapy technique. Various studies on low-level laser therapy have shown its efficacy in wound healing and nerve regeneration.

It is applied using a LP-1000 gallium–arsenide diode (GaAIAs) laser with 795 nm (±5 nm) wavelengths, 1 W power output, 1 cm2 irradiation spot size.

The average energy density of 1 J/cm2 in 1 second for 4 seconds (total of 4 J) is to be applied to decided points over the superficial nerve courses of the facial nerve.

Patient and physiotherapist must wear protective glasses to avoid exposure to the eyes. [30]

**HOME TAKEAWAYS [31]? Make it a paragraph, remove excess bullets**

Patient is educated about the importance of Physiotherapy and advised to:

* Exercise the facial muscle regularly at home.
* Apply moist heat to the paralyzed areas to help reduce pain.
* Massage affected area as taught.
* Use a scarf to keep the face warm because exposure to cold will worsen the condition.
* Advised to eat healthy and balanced diet rich in leafy, green vegetable and chew from the comfortable side
* Stress should be managed by regular meditation and relaxation strategies.
* Wear glasses to protect the eyes and keep it moist.
* Tape the eye closed for sleeping by putting a moist gauze or cotton.
* Wear a pair of goggles when you shower to prevent soap and shampoo from affecting your weak eye.
* Medications and supplements must not be missed.

**PREVENTION**

Bell’s palsy is not yet fully understood hence there are no guidelines available till now. However, it is advisable to keep one’s ears covered and warm in extreme cold environment. Proper rich nutrition diet with regular supplements and adequate sleep help remain immune to dreading virus in general.

**CONCLUSION**

Bell’s palsy is a condition affecting many individuals, yet many things are yet not understood. Physiotherapy techniques are needed for early recovery and better prognosis. Literature suggests many techniques like PNF to be very effective than the others. Facial exercises help to regain the function. Facial massage and neural mobilization help to reduce the inflammation and pain.

**FUTURE RESEARCH**

Few studies are available on the newer techniques of physiotherapy. Hence, research focusing different techniques should be encouraged.

**References add some more citations**

1. Baugh RF, Basura GJ, Ishii LE, Schwartz SR, Drumheller CM, Burkholder R, et al. Clinical Practice Guideline: Bell’s Palsy. Otolaryngol Neck Surg. 2013;149(c): S1–27.
2. Nivetha, Kumar S. Bell palsy’s and its clinical significance – A review. J Pharm Sci Res. 2016;8(8):752–3.
3. Bhatikar K. European Journal of Effect of Matrix Rhythm Therapy and Facial Neuromuscular Retraining Program in Bell’ S Palsy: Case Report. Eur J Pharm Med Res. 2018;5(11):280–3.
4. Eviston TJ, Croxson GR, Kennedy PGE, Hadlock T, Krishnan A V. Bell’s palsy: Aetiology, clinical feat features, multidisciplinary care. J
5. Murthy JM, Saxena AB. Bell’s palsy: Treatment guidelines. Ann Indian Acad Neurol 2011 Jul;14(Suppl 1): S70–2
6. Moran LB, Graeber MB. The facial nerve axotomy model. Brain Res Rev 2004;44(2–3):154–78.
7. Rhoton Jr. AL. Afferent connections of the facial nerve. J Comp Neurol 1968;133(1):89–100.
8. Myckatyn TM, Mackinnon SE. A review of facial nerve anatomy. Semin Plast Surg 2004;18(1):5–11.
9. Gmoorthy T, Gopinath Y, Kaviraja K. Comparision of PNF Versus Conventional Exercises for Facial Symmetry And Facial Function In Bell’s Palsy. Int J Curr Adv Res. 2018;7(1):9347–50
10. Coker NJ. Bell palsy: a herpes simplex mononeuritis? Arch Otolaryngol Head Heck Surg 1998; 124(7):823–4.
11. Ahmed (Heera), S. A., Shahid, A., & Bashir, M. (2023). Comparative Effects of Neural Mobilization and Proprioceptive Neuromuscular Facilitation in Patients with Bell’s Palsy. *Journal of Health and Rehabilitation Research*, *3*(2), 1263–1268.
12. Abbas KED, Prabhu SR: Bell’s palsy among Sudanese children report of 7 cases and review of literature. J Oral Med 1981; 36:111- 13
13. Melchiorre, Philip. Clayton's ELECTROTHERAPY. American Journal of Physical Medicine & Rehabilitation 76(3): p 212, May 1997.
14. Fattah, Adel Y. Ph.D., F.R.C.S.(Plast.); Gurusinghe, Anthony D. R. M.R.C.S.(Eng.); Gavilan, Javier M.D.; Hadlock, Tessa A. M.D.; Marcus, Jeff R. M.D.; Marres, Henri M.D., Ph.D.; Nduka, Charles C. M.A., M.D.; Slattery, William H. M.D.; Snyder-Warwick, Alison K. M.D. On behalf of the Sir Charles Bell Society. Facial Nerve Grading Instruments: Systematic Review of the Literature and Suggestion for Uniformity. Plastic and Reconstructive Surgery 135(2):p 569-579, February 2015. | DOI: 10.1097/PRS.0000000000000905
15. Ten Harkel TC, de Jong G, Marres HAM, Ingels KJAO, Speksnijder CM, Maal TJJ. Automatic grading of patients with a unilateral facial paralysis based on the Sunnybrook Facial Grading System - A deep learning study based on a convolutional neural network. Am J Otolaryngol. 2023 May-Jun;44(3):103810. doi: 10.1016/j.amjoto.2023.103810. Epub 2023 Feb 25. PMID: 36871420.
16. Mat Lazim N, Ismail H, Abdul Halim S, Nik Othman NA, Haron A. Comparison of 3 Grading Systems (House-Brackmann, Sunnybrook, Sydney) for the Assessment of Facial Nerve Paralysis and Prediction of Neural Recovery. Medeni Med J. 2023 Jun 20;38(2):111-119. doi: 10.4274/MMJ.galenos.2023.42383. PMID: 37338861; PMCID: PMC10284086.
17. VanSwearingen JM, Brach JS. The Facial Disability Index: reliability and validity of a disability assessment instrument for disorders of the facial neuromuscular system. Phys Ther. 1996 Dec;76(12):1288-98; discussion 1298-300. doi: 10.1093/ptj/76.12.1288. PMID: 8959998.
18. Kahn JB, Gliklich RE, Boyev KP, Stewart MG, Metson RB, McKenna MJ. Validation of a patient‐graded instrument for facial nerve paralysis: the FaCE scale. The Laryngoscope. 2001 Mar;111(3):387-98.
19. Devriese PP. Treatment of sequelae after facial paralysis: a global approach. *J Laryngol Otol*. 1998; 112:429-431.
20. Beurskens C.H.G., Heymans P.G. Mime therapy improves facial symmetry in people with long-term facial nerve paresis: a randomised controlled trial. *Aust. J. Physiother.*2006;52(3):177–183.
21. Pereira L, Obara K, Dias J, Menacho M, Lavado E, Cardoso J. Facial exercise therapy for facial palsy: systematic review and meta-analysis. Clinical Rehabilitation. 2011;25(7):649-658. doi:10.1177/0269215510395634
22. Infante-Cossio P, Prats-Golczer V-E, LopezMartos R, Montes-Latorre E, Exposito-Tirado JA, Gonzalez-Cardero E. E®ectiveness of facial exercise therapy for facial nerve dysfunction after super¯cial parotidectomy: A randomized controlled trial. Clin Rehabil 2016;30(11):1097–107
23. Susan S Adler, Dominiek Beckers, Math Buck. PNF in practice 4th ed. 16. Heidelberg: Springer; p.34
24. Alharbi R, Kashoo FZ, Ahmed M, Alqahtani M, Aloyuni S, Alzhrani M, Alanazi AD, Sidiq M, Alharbi BH, Nambi G. Effect of neural mobilisation in Bell's palsy: A randomised controlled trial. Hong Kong Physiother J. 2023 Dec;43(2):93-103. doi: 10.1142/S1013702523500063.
25. Kashoo FZ, Alqahtani M, Ahmad M. Neural mobilization in Bell’s palsy: A case report. Cranio - J Craniomandib Pract. 2019;0(00):1–4.
26. Alatawi SF. Effectiveness of Neural Mobilization in the Management of Chronic Low Back Pain with Radiculopathy: a Randomized Controlled Trial. Int J Physiother. 2019;6(5):217–23.
27. Nshimiyama L Meyers R. et el. Neurofunctional Intervention Approches. Neurorehabilitation and Physical Therapy: Intech Open; 2023
28. Melese H, Alamer A, Hailu Temesgen M, et al. Effectiveness of Kinesio taping on the management of knee osteoarthritis: a systematic review of randomized controlled trials. *J Pain Res* 2020; 13:1267–76.
29. Simone Rosa Barreto, Aline Mansueto et el. The use of kinesio taping in the treatment of the acute phase of post-stroke facial paralysis. Audiology communication research. 2021;26: e2462
30. Praveen Kumar Kandakurti, Sukumar Shanmugam et el. The effectiveness of low-level laser therapy combined with facial expression exercises in patients with moderate-to-severe Bell's palsy: A study protocol for a randomized controlled trial, International Journal of Surgery Protocols. Volume 24,2020, Pages 39-44.
31. C. Sugendhiran, A. Ramkumar, S. Kamalanayagi. Role of physiotherapy in Bell's Palsy in the outpatient department. Physiotherapists, Kauvery Hospital, Hosur.