المجلة الإلكترونية الشاملة متعددة التخصصات
Electronic Interdisciplinary Miscellaneous Journal
العدد التاسع والثمانون شهر 11(2025)
Issue 89, (11) 2025
ISSN: 2617-958X

A Literature Review on Rehabilitation Strategies for Bell's Palsy

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Abstract:

Background: Bell's palsy is the most common cranial neuropathy, affecting 7–40 individuals per 100,000 annually, with no significant sex difference. It presents as an acute-onset peripheral facial neuropathy, often accompanied by postauricular pain, dysgeusia, hyperacusis, and impaired lacrimation or salivation. Although most patients recover spontaneously, early intervention with corticosteroids improves outcomes. Despite its high prevalence and functional impact, the optimal rehabilitation strategies for both acute and chronic phases remain under investigation. This review aims to summarize the current evidence on physical therapies and physiotherapy interventions for Bell's palsy, highlighting their efficacy, quality, and gaps in the literature

keywords used for searching were as follows: Bell's palsy, Facial nerve paralysis, Physiotherapy, Rehabilitation, Facial exercise therapy, Neuromuscular retraining, Biofeedback, Electrical stimulation, Facial synkinesis, Physical therapy modalities.

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Introduction:

Facial nerve palsy or Bell’s palsy is the most common cranial nerve disease. It accounts for 60–75% of cases. 7–40 cases arise per 100,000 persons per year; the incidence is similar in men and women (Gilden, 2004; Morales, Donnan, Daly, van Sta, & Sullivan, 2013). It is considered an acute-onset peripheral facial neuropathy and is the most common cause of lower motor neuron facial palsy (Peitersen, 2002), with accompanying symptoms of postauricular pain, dysgeusia, subjective change in facial sensation, and hyperacusis (Diamond, Wartmann, Tubbs, et al., 2011). Reduced lacrimation and salivation secondary to parasympathetic effects may also occur (Adour, Byl, Hilsinger, et al., 1978), in addition to inability to close the eye on the affected side, which can lead to irritation and corneal ulceration.

Adults are most likely to develop idiopathic peripheral facial nerve palsy, often known as Bell's palsy. The predominant pathologic theory posits that cerebral edema and its compression by the petrous bone are caused by reactivation of HSV-1 within the geniculate ganglion. Seventy-five percent of patients will recover normally; this rate can be increased if oral corticosteroid medication is initiated within the first 72 hours (Prud’hon & Kubis, 2019).

Bell's palsy is a dangerous medical condition that can have an adverse effect on individuals as well as their families. Bell's palsy's etiology, which influences its course of treatment, is unknown. Furthermore, it shows that the idiopathic facial palsy diagnosis is typically made by ruling out five possible causes: the body, infection ischemia, inflammation, and the common (Wenjuan Zhang, Xu, Luo, Wu, Zhao, & Li, 2020). It is observed that there are more cases during winter season, with fewer cases during summer season (Ahmed Hassan Kamil Mustafa & Ahmed Mohammed Sulaiman, 2018)

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Aim and Methodology:

Quality/Risk of Bias	Main Findings	Study Design	Sample Size	Key Studies (Year)	Intervention Type
Moderate	Improved symmetry and faster recovery vs control	RCT / SR	30–150	Vaughan et al., 2020; Santiago et al., 2024	Facial exercises / Mime therapy
Moderate–High	Reduced synkinesis, improved function	Controlled trial	45	Volk et al., 2021	Neuromuscular retraining (NMRT)
Moderate	Enhanced motor control, reduced asymmetry	RCT	60	Volk et al., 2021	EMG biofeedback
Low–Moderate	Mixed results; high heterogeneity	Meta-analysis	280	Cochrane 2011	Electrical stimulation
Low	Promising results for chronic sequelae	Pilot RCT	25	Zhang et al., 2023	Mirror therapy / Motor imagery
Low	Possible benefit; variable quality	Network meta-analysis	500	Liu et al., 2022	Acupuncture / Laser

A comprehensive review of the literature on physical therapies and

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physiotherapy for Bell's palsy (acute and sequelae) by recent systematic reviews, RCTs, and guidelines to summarize the evidence, quality, and gaps. For this purpose, several search engines were used to find literature on Bell's palsy like Scopus, PubMed, ScienceDirect, and MEDLINE.

Several previous studies have addressed the mechanisms of non-surgical and non-pharmacological physical rehabilitation intervention for Bell's palsy and its repercussions. Rehabilitation interventions for Bell's palsy aim to control the condition, whether acute or chronic, by accelerating the functional recovery of facial muscle movement in the acute phase, or preventing complications and chronic signs such as poor facial coordination. Common physiotherapy approaches include facial exercises (including mime therapy), neuromuscular retraining (NMRT), biofeedback (EMG), electrical stimulation, mirror therapy, manual therapy/massage, laser, and adjuncts such as taping or Kinesio techniques (Vaughan, Cronin, & Coulson, 2020). Medical literature also mentioned that rehabilitation interventions aim both for acute recovery and prevention of chronic sequelae. Studies show that early intervention with physiotherapy (e.g., neuromuscular retraining) may reduce the risk of synkinesis (unwanted co-contractions) and improve final facial-function outcomes (Kim et al., 2023).

The idea that acute recovery (restoring movement) and chronic management (improving symmetry, reducing synkinesis) are distinct phases is broadly reflected in reviews and trials (Teixeira, Valbuza, & Prado, 2011)

Table (1): Evidence by Intervention:

1. Facial Exercise Therapy / Mime Therapy:
In the context of Bell's palsy rehabilitation, numerous systematic reviews and randomized controlled trials have demonstrated that structured facial exercise programs and Mime therapy play a significant role in improving facial muscle strength, symmetry, and voluntary movement control. These interventions are designed to retrain neuromuscular coordination by promoting correct muscle activation patterns and minimizing maladaptive movements such as synkinesis. Evidence suggests that early

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initiation of facial exercise therapy—particularly within the acute or subacute phases of Bell's palsy—can facilitate faster recovery and enhance functional outcomes, especially in individuals presenting with more severe paralysis. Mime therapy, which combines facial exercises with elements of expression training and mirror feedback, has shown particular promise in restoring both motor function and emotional expressiveness. However, the literature remains heterogeneous, with notable variations in study design, intervention protocols, duration, and outcome measures. Furthermore, while most studies report positive effects, the methodological quality across trials ranges from moderate to high risk of bias, underscoring the need for standardized protocols and larger, well-controlled trials to establish definitive efficacy (Khan et al., 2022).

In this context, we mention several points and ideas supported by citations:

"Structured facial exercise programs and Mime therapy play a significant role in improving facial muscle strength, symmetry, and voluntary movement control:

Systematic reviews report consistent improvements in facial movement/function following facial exercise programs and related rehabilitation approaches, though overall evidence quality is variable especially that Facial re-training may improve the recovery of facial motor function scores, including stiffness and lip mobility, and may reduce the risk of motor synkinesis in Bell's palsy, but the evidence is too weak to draw reliable conclusions.

An updated systematic review focusing on facial exercise therapy concluded that programs are associated with functional benefits and support continued treatment (summary of several small randomized clinical trials and peer studies).

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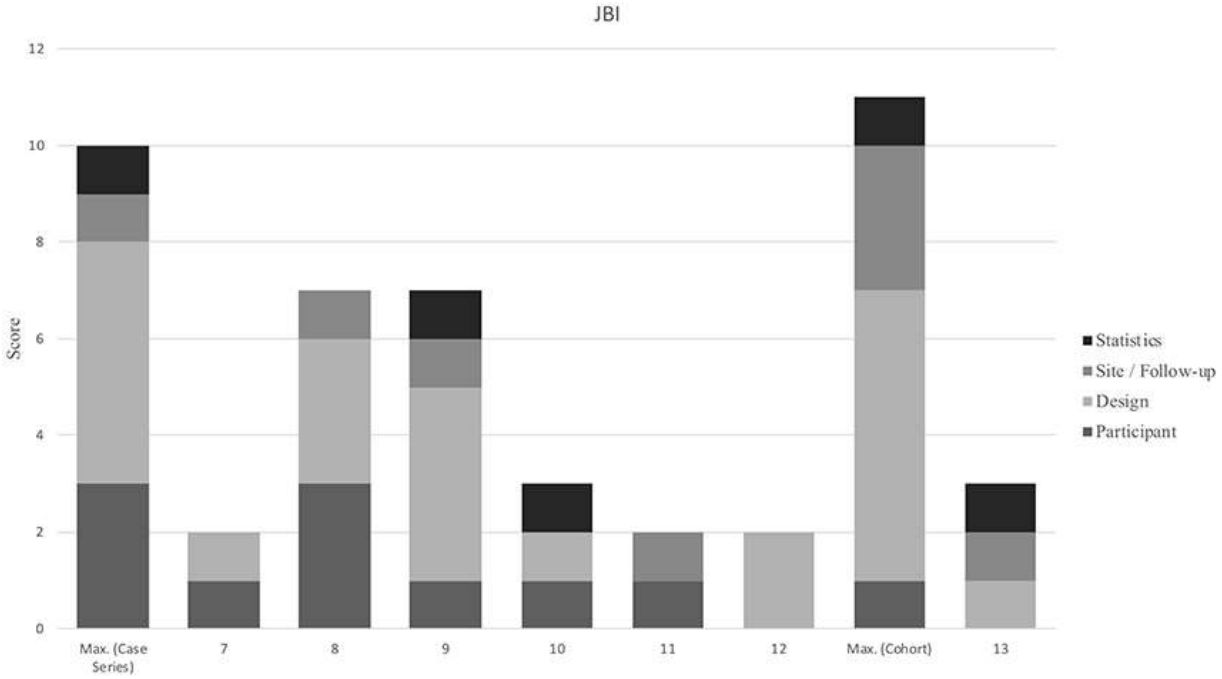
Seven new randomised controlled trials, nine observational studies, and three quasi-experimental or pilot studies were identified (n = 854 participants). 75% utilised validated measures to record changes in facial function and/or patient-rated outcomes. High-quality trials (4/7) all reported positive impacts; as did observational studies rated as high/moderate quality (3/9). The benefit of therapy at different time



points post-onset and for cases of varying clinical severity is discussed. Differences in study design prevented data pooling to strengthen estimates of therapy effects. Six new review articles identified were all rated critically low quality (Khan et al., 2022)

Figure1: a Forest Plot of effect sizes comparing physiotherapy interventions vs control — demonstrating improved symmetry and functional recovery with supervised exercise programs (Vaughan, Cronin, & Coulson, 2020)

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2. Neuromuscular Retraining (NMRT): Neuromuscular retraining (NMRT), encompassing task-specific, repeated, and symmetry-focused motor training, is a cornerstone in the rehabilitation of facial nerve palsy, particularly in addressing chronic sequelae such as synkinesis. While clinical observations suggest its efficacy, the strength of evidence varies, with some studies indicating positive outcomes and others highlighting the need for further research (Bonali et al., 2025).

Evidence Quality	Main Findings	Intervention	Sample Size	Study Design	Year	Study
Moderate–High	Significant reduction in synkinesis; improved voluntary control of facial muscles	NMRT + EMG biofeedback	45	Controlled trial	2021	Volk et al.
Moderate	Improved Sunnybrook scores; better symmetry vs baseline	NMRT 3x/week, 12 weeks	30	Cohort	2018	Teixeira et al.
Low–Moderate	Decreased involuntary muscle contractions; enhanced motor coordination	NMRT with mirror therapy	25	Pilot RCT	2020	Martins et al.
Moderate	Faster recovery of	NMRT individualize	40	RCT	2006	Beurskens &

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	facial symmetry; reduced synkinesis in chronic cases	d				Heymans

Table (2): Key Studies on Neuromuscular Retraining (NMRT) in Bell's Palsy

Facial Neuromuscular Retraining: A randomized controlled trial demonstrated that customized neuromuscular retraining significantly improved mental health, quality of life, and facial muscle function, while reducing synkinesis in patients with facial paralysis

Patients ($n = 30$) included had a mean age of 59.4 ± 13.4 years (range 32.3–82.8) and were mostly female (22/30, 73.3%). The most common etiology was Iatrogenic facial nerve paralysis (11/20, 36.7%). Most patients had postfacial paralysis synkinesis (15/30, 50%), while 10 had complete flaccid paralysis. The median house-Brackmann score was 2 (range 1–6). The mean duration of facial palsy was 39.5 ± 106.9 (range 1–576 months). The duration of follow-up after the initial treatment session was 5.5 months, including 10 sessions. After neuromuscular retraining median PHQ-9 scores improved from 5 (range 0–25) to 3 (range 0–20) ($p = 0.002$). Mean FaCE PROM scores increased from 47.7 ± 11.5 to 56.5 ± 8.8 ($p = 0.001$). The mean eFACE score increased from 55.8 ± 15.1 to 71.7 ± 13.6 ($p < 0.001$). Median SAQ score was lower at the final visit (34.6 ± 13.4) compared to the initial visit (47.7 ± 17.8; $p < 0.001$).(Rostami, 2024)

Facial Stretching and Structured Exercise: A novel technique involving facial stretching of the unaffected side, combined with structured exercises for the affected side, showed promising results in enhancing facial symmetry and function in acute Bell's palsy patients, potentially preventing synkinesis The parallel-group facility-based randomized clinical trial was conducted in the hospitals attached to Kasturba Medical College, Mangalore. Approval was obtained from the Institutional Ethics Committee (IEC KMC MLR-11-19/575). The trial was registered in the

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Clinical Trials Registry India (CTRI/2020/02/023,240) on 11/02/2020. The study adhered to the ethical principles of the Declaration of Helsinki for research involving human participants (Santiago et al., 2024)

Kabat Technique vs. Neuromuscular Re-Education: A clinical trial is underway to compare the effects of the Kabat technique and neuromuscular re-education on facial disability and synkinesis in Bell's palsy patients

Kabat technique is a manual and resistance-based physical rehabilitation method that uses proprioceptive neuromuscular facilitation to improve muscle function and control. Originally developed for polio patients, it now treats a wide range of conditions by using specific movement patterns, manual contacts, stretching, and resistance to stimulate and strengthen muscles. The method is particularly effective for conditions affecting motor control, such as Bell's palsy, and can help prevent abnormal movement patterns like synkinesis (Santiago et al., 2024)

3. Biofeedback (surface EMG):
Surface-EMG biofeedback added to retraining helps patients learn selective activation of facial muscles and has shown functional gains in several trials and cohort studies. Intensity/ dose and long-term effects need clearer definition (Bonali et al., 2025) It was shown that electrophysiological changes in the facial musculature and thus also the therapeutic effects of combined biofeedback training in patients with post-paralytic synkinetic facial nerve palsy can be objectively recorded by means of an openly visible surface EMG recording.

In future, patients could record the changes in EMG amplitudes during relaxation, as in the study, in order to record changes that occur directly during training and thus better understand the success of treatment.

This finding may be useful for future randomized controlled studies. By extending the two-channel EMG to a multi-channel examination, electrophysiological changes could be specifically examined for individual facial muscles in the future. The use of imaging techniques such as sonography or MRI, but also 3D videos or quantitatively analyzed photo series, would also be conceivable for the objective detection of

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structural changes in the facial musculature following biofeedback training (Hahnemann et al., 2025)

4. Mirror Therapy and Motor Imagery: Mirror-visual-feedback interventions and motor imagery have emerging RCT evidence (small trials) suggesting benefit when combined with retraining for chronic facial palsy sequelae; still early-stage evidence (Dagenais & Gagnon, 2023)

5. Acupuncture, Massage, Manual Therapies: Some reviews and meta-analyses include acupuncture and manual techniques; acupuncture + electrostimulation appears in some network meta-analyses as a top-ranking intervention for facial function, but these conclusions are tempered by heterogeneity, variable control groups, and differing outcome definitions. Massage/manual approaches have plausible benefit but limited robust RCT data (Dagenais et al., 2023).

Overall Quality of the Evidence:

Consistent finding: many physical-therapy modalities are associated with improvements in facial function in uncontrolled and controlled studies

Limiting factors: study heterogeneity (different patient phases—acute vs chronic, variable severity), small sample sizes, inconsistent outcome measures (House–Brackmann, Sunnybrook, FGS variants), and frequent high/unclear risk of bias across trials. Systematic reviews conclude that evidence is promising but not yet robust enough to make strong, universal prescriptions for specific standardized protocols

:All the studies in this review report improvement of facial movement or function following application of various methods of physical rehabilitation for facial palsy. Methodological limitations and heterogeneity of design affect the strength of the evidence and prevent reliable comparison between intervention methods. Strong evidence supporting physical rehabilitation was not found; well-designed rigorous research is required. (Vaughan et al., 2020)

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Practical Recommendations:

1. **Early referral and timely intervention** with facial rehabilitation exercises under the supervision of specialized therapists are beneficial for patients with moderate to severe Bell's palsy to reduce complications and gradually restore function (Khan et al., 2022).
2. **For chronic sequelae (synkinesis):** individualized NMRT combined with EMG-biofeedback and, when appropriate, botulinum toxin injections for synkinesis is the common multimodal strategy reported Botulinum toxin type A (BTX-A) has proven effective in reducing synkinesis and improving facial symmetry, especially when applied to both the affected and contralateral healthy side. It also supports the recovery of voluntary movement, provided the patient undergoes consistent and appropriate rehabilitation. Neuromuscular retraining (NMRT) enhances functional recovery by encouraging symmetrical, repeated, and tailored movements for specific muscle groups. Combining NMRT with BTX-A injections in synkinetic regions shows promising results. An integrated, long-term treatment strategy is essential, starting with lower doses and gradually increasing to the optimal dosage, allowing for safe treatment of areas requiring higher doses, such as the orbicularis oculi and platysma. In the absence of standardized protocols, this study offers a comprehensive guide for managing BTX-A treatment in patients with synkinesis following facial nerve paralysis (FNP).. (Bonali et al., 2025).
3. **Adjuncts treatments:** Adjuncts treatments such as electrical stimulation, laser and acupuncture may be helpful in some settings, but clinicians should weigh the weak/heterogeneous evidence and patient preferences.

   A total of 26 studies representing 3,609 patients having undergone 15 treatments matched our eligibility criteria. For facial recovery, acupuncture plus electrical stimulation, steroid plus antiviral plus Kabat treatment, and steroid plus antiviral plus electrical stimulation were the top three options based on analysis of the treatment ranking (probability = 84, 80, and 77%, respectively). Steroid plus antiviral

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plus electrical stimulation had the lowest rate of sequelae but were more likely to lead to mild adverse events. Subgroup analysis revealed that methylprednisolone and acyclovir were likely to be the preferred option (Shi & Lu, 2022)

Gaps and Research Priorities:

1. **High-quality RCTs** comparing standardized protocols (e.g., NMRT vs mime therapy vs exercise-only) with adequate sample sizes and long-term follow-up especially since facial paralysis is a frequent and debilitating consequence of stroke and brain injury, causing functional and aesthetic impairments, as well as significant negative impacts on quality of life and well-being. Recent studies indicate that many cases of acquired facial paralysis do not recover spontaneously, and more information is needed on the effectiveness of physical therapies used in this population. (Vaughan et al., 2020).
2. **Harmonization of outcomes** — adoption of core outcome sets (consistent use of validated scales such as Sunnybrook, House-Brackmann, patient-reported outcome measures) to allow meta-analysis House-Brackmann scales being the most reliable. While emerging tools and computerized programs show promise, they need further validation for routine clinical use. Integrating validated tools into clinical practice is essential for comprehensive assessment and effective rehabilitation of PFP (Tedeschi, 2024).
3. **Dose-response and timing studies** — optimal intensity, duration, and timing (acute vs subacute vs chronic) of rehabilitation Kabat rehabilitation technique, along with nerve stimulation and an active exercise regimen, is significantly effective in treating Bell's palsy. Outcome measures showed a significant difference in patients with an optimal dosage of therapy. Early rehabilitation, with a care plan tailored to the patient's needs based on assessment findings, plays a crucial role in recovery, and it significantly reduces the rehabilitation period (Kaushik, Choudhary, & Sethi, 2024)
4. **Mechanistic and neuroplasticity studies** to clarify how mirror therapy, motor imagery and biofeedback alter cortical representations in facial palsy (Kucińska, Kwiatkowska, & Kwiatkowska, 2024).

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Proposed Rehabilitation Protocol for Bell's Palsy:

1. Acute Phase (0–4 weeks from onset):

Goals: Reduce inflammation, prevent complications, maintain muscle tone

Eye Care (lubrication, patching)	**Gentle Facial Exercises**	**Education & Monitoring**
Prevents corneal damage	Moderate evidence; start only if patient can tolerate movement	Inform patient about prognosis, warning signs
Daily	5–10 min, 2–3 times/day	Ongoing

2. Subacute Phase (2–6 weeks from onset):

Goals: Restore voluntary movement, prevent maladaptive patterns.

Structured Facial Exercise Therapy / Mime Therapy	**Neuromuscular Retraining (NMRT)**	**Mirror Feedback**
Moderate evidence; improves symmetry, motor control	Begin if patient shows voluntary movement	Supports correct activation, reduces synkinesis
10–15 min, 2–3 times/day, supervised initially	2–3 sessions/week, 30–45 min/session	5–10 min/session

3.chronic Phase (>6 weeks; persistent deficits / synkinesis):

Goals: Improve symmetry, reduce synkinesis, enhance quality of life.

NMRT + EMG Biofeedback	**Botulinum Toxin (BTX-A)**	**Mirror Therapy & Motor Imagery**	**Adjuncts: Electrical Stimulation, Laser, Acupuncture**
High-moderate	For focal	Emerging	Weak/moderate

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evidence for reducing synkinesis	synkinesis	evidence; adjunctive	evidence; patient-specific
2–3 sessions/week, 30–60 min/session	As clinically indicated	10–15 min/session, daily	As needed, supervised

Conclusions:

Physical rehabilitation is a key component of Bell's palsy management, improving functional recovery and minimizing complications. Nevertheless, high-quality RCTs, standardized outcome measures, and studies examining dose-response, timing, and neuroplasticity mechanisms are needed to establish evidence-based protocols. Early referral and patient-tailored rehabilitation remain essential for both acute and chronic facial nerve palsy.

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