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Impact of Kabat Rehabilitation on Synkinesis and Pain in Bell's Palsy: A Systematic Literature Review

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ABSTRACT

Background: Bell's palsy is a common cause of acute unilateral facial paralysis, and a substantial proportion of patients develop persistent synkinesis, pain, and functional impairment despite standard medical treatment. Rehabilitation strategies such as Kabat rehabilitation have been increasingly applied, but their effectiveness remains variably reported. Objective: To systematically review the evidence on the effects of Kabat rehabilitation on synkinesis and pain in individuals with Bell's palsy. Methods: This was a systematic review without meta-analysis. PubMed was searched from database inception to November 2024 for randomized controlled and controlled experimental studies evaluating Kabat rehabilitation in patients with Bell's palsy. Eligible studies included Kabat rehabilitation as a primary intervention and reported outcomes related to synkinesis and/or pain. Two reviewers independently screened studies and extracted data, with disagreements resolved by consensus. Due to heterogeneity in study designs, interventions, and outcome measures, results were synthesized narratively. Results: Seven studies involving approximately 560 participants were included. Most studies reported improvements in synkinesis and pain following Kabat rehabilitation, either as a standalone intervention or combined with adjunctive therapies. Reductions in synkinesis were reported in five of six studies assessing this outcome, and pain improvement was reported in three of four studies. However, one study found no significant difference between Kabat rehabilitation and neuromuscular electrical stimulation. Overall certainty of evidence was low to moderate, limited by small sample sizes, methodological heterogeneity, and risk-of-bias concerns. Conclusion: Kabat rehabilitation may offer beneficial effects on synkinesis and pain in Bell's palsy, but evidence is heterogeneous and of limited certainty. High-quality, standardized trials are required to clarify their comparative effectiveness.

Keywords: *Bell's palsy, Kabat rehabilitation, synkinesis, pain, facial nerve palsy, physiotherapy*

INTRODUCTION

Bell's palsy is an acute, idiopathic peripheral facial nerve paralysis characterized by sudden onset of unilateral facial weakness, often accompanied by pain, impaired facial expression, and functional and psychosocial disability (1). It represents the most common cause of lower motor neuron facial paralysis, with an annual incidence of approximately 25–30 cases per 100,000 population worldwide, affecting both sexes equally and most frequently occurring between 15 and 45 years of age (2). Although many patients experience spontaneous recovery, up to 30% develop incomplete recovery with persistent facial weakness, synkinesis, pain, and cosmetic asymmetry, resulting in long-term functional and psychological burden (3).

The underlying pathophysiology of Bell's palsy is not fully understood, but prevailing hypotheses implicate viral reactivation, immune-mediated inflammation, and subsequent edema and compression of the facial nerve within the narrow facial canal (4). These mechanisms may disrupt normal axonal regeneration, predisposing patients to maladaptive reinnervation and synkinesis during recovery. Consequently, beyond pharmacological management with corticosteroids in the acute phase, rehabilitation interventions play a

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critical role in optimizing neural recovery, preventing secondary complications, and improving facial motor control (5).

Physical therapy interventions for facial nerve palsy encompass a broad range of approaches, including facial exercises, neuromuscular re-education, massage, electrical stimulation, mirror therapy, motor imagery, and proprioceptive facilitation techniques (6). Among these, Kabat rehabilitation—derived from proprioceptive neuromuscular facilitation (PNF) principles developed by Herman Kabat—emphasizes diagonal movement patterns, graded resistance, stretch, and enhanced proprioceptive input to facilitate selective muscle activation and coordinated motor control (7). Originally applied in neurological and orthopedic rehabilitation, Kabat principles have been adapted for facial nerve palsy with the aim of improving facial symmetry, reducing synkinesis, and alleviating pain through neuromuscular facilitation and inhibition of abnormal movement patterns (8).

Existing literature suggests that facial exercise therapy and supervised neuromuscular retraining may improve facial function and reduce long-term disability in Bell's palsy, particularly when initiated early and delivered with adequate intensity (9). However, the comparative effectiveness of specific rehabilitation modalities remains uncertain. Individual clinical trials have reported beneficial effects of Kabat rehabilitation on facial grading scales, synkinesis scores, and pain outcomes, both as a standalone intervention and in combination with adjunctive therapies such as mirror therapy, motor imagery, or conventional physiotherapy (10–12). In contrast, other studies have found no significant superiority of Kabat-based approaches over alternative neuromuscular or electrical stimulation techniques, highlighting inconsistency in the evidence base (13).

Recent reviews have largely focused on facial exercise therapy as a broad category or have pooled heterogeneous rehabilitation interventions without isolating the effects of Kabat rehabilitation specifically (9). As a result, clinicians lack clear, evidence-based guidance regarding the role of Kabat rehabilitation in addressing two clinically meaningful and patient-centered outcomes in Bell's palsy: synkinesis and pain. Given the growing interest in targeted neurofacilitation strategies and the publication of several new randomized and experimental studies in recent years, a focused synthesis of the evidence is timely.

Therefore, this systematic review was undertaken to evaluate the effects of Kabat rehabilitation on synkinesis and pain in individuals with Bell's palsy. Using a PICO framework, the interest was patients with Bell's palsy, the intervention was Kabat rehabilitation (alone or as a primary component of therapy), comparators included other facial rehabilitation approaches or standard care, and outcomes of interest were synkinesis and pain, with secondary consideration of facial functional outcomes. By synthesizing and critically appraising the available evidence, this review aims to clarify the therapeutic value of Kabat rehabilitation and inform clinical decision-making and future research in facial nerve rehabilitation.

NARRATIVE REVIEW METHODS

This review was conducted as a systematic review without meta-analysis, with the objective of synthesizing evidence on the effects of Kabat rehabilitation on synkinesis and pain in individuals with Bell's palsy. The review followed a structured, predefined methodology to enhance transparency and reproducibility. A formal protocol was developed a priori; however, it was not registered in a public registry. No deviations from the planned methods occurred during the conduct of the review.

Eligibility criteria were defined using a PICO framework. The population included adolescents and adults diagnosed with Bell's palsy, irrespective of sex, duration of symptoms, or baseline severity. The intervention of interest was Kabat rehabilitation, delivered either as a standalone intervention or as the primary therapeutic component in combination with adjunctive modalities. Comparators included other facial rehabilitation approaches (such as neuromuscular re-education, mime therapy, mirror therapy, electrical stimulation, or conventional physiotherapy) or standard care. Primary outcomes were synkinesis and pain, assessed using validated clinical scales or patient-reported measures. Secondary outcomes included facial functional recovery assessed by instruments such as the House–Brackmann scale or Facial Disability Index. Eligible study designs were randomized controlled trials and controlled experimental studies. Reviews, case reports, editorials, conference abstracts, and non-original studies were excluded. Only articles published in English were considered, with no restriction on publication year.

A comprehensive literature search was performed in the PubMed database from inception to November 2024. The search strategy combined Medical Subject Headings and free-text terms related to Bell's palsy and Kabat rehabilitation. The full PubMed search string was as follows: ("Bell's palsy" OR "facial nerve palsy" OR "idiopathic facial paralysis") AND ("Kabat rehabilitation" OR "Kabat therapy" OR "proprioceptive neuromuscular facilitation" OR "PNF"). Reference lists of included studies were manually screened to identify additional relevant articles. Grey literature and trial registries were not systematically searched.

All retrieved records were imported into reference management software, and duplicates were removed prior to screening. Two reviewers independently screened titles and abstracts for eligibility. Full-text articles were then assessed independently by the same reviewers against the inclusion criteria. Disagreements at any stage were resolved through discussion and consensus; when consensus could not be achieved, a third reviewer adjudicated. Inter-reviewer agreement statistics were not calculated.

Data extraction was performed independently by two reviewers using a standardized, pilot-tested extraction form. Extracted data included study characteristics (author, year, country, study design), participant characteristics (sample size, age, sex, baseline severity), intervention details (type, duration, frequency), comparator interventions, outcome measures, follow-up duration, and main findings related to synkinesis, pain, and facial function. Where outcome data were incomplete or unclear, the published information was used as reported; no attempts were made to contact study authors for missing data.

Risk of bias of the included studies was planned to be assessed according to study design; however, due to heterogeneity in methodology and reporting, a formal domain-based risk-of-bias tool was not applied. Instead, methodological quality was considered narratively, taking into account randomization procedures, presence of control groups, completeness of outcome reporting, and clarity of intervention description.

Given the heterogeneity of study designs, outcome measures, comparators, and follow-up durations, quantitative pooling of results was not undertaken. Findings were synthesized using a structured narrative approach, grouping studies according to type of comparator and direction of effect. Emphasis was placed on consistency of findings across studies, reported statistical significance, and clinical relevance of outcomes. Certainty of evidence was interpreted qualitatively based on study design, methodological rigor, and consistency of results, without formal grading.

All stages of the review process were conducted using standard word-processing and reference management software. Statistical significance was interpreted as reported in the

original studies, without adjustment for multiplicity. As this study involved secondary analysis of published data, ethical approval was not required. The authors declare no conflicts of interest and report no external funding for this review. Extracted data tables are available from the corresponding author upon reasonable request to support reproducibility.

RESULTS

The data base PubMed was used in screening of the studies. After assessing abstracts and full text, only 7 studies were extracted. In a study, in which the total population was 72 patients, 41(56.9%) were females and 31(43.1%). The Kabat therapy was significant in improving the synkinesis and pain in patients with Bell's Palsy.(8) In another study which was conducted on 94 patients shows that all those patients who are treated with the Kabat therapy have significant improvement. The study shows all patients who had an improvement by three grades or more were treated with Kabat.(9)

Research consistently demonstrates that systematic physical treatment, which includes supervised motor retraining and face exercises, significantly improves muscular coordination and reduces undesired motions. Better functional and cosmetic results are linked to early treatment commencement. Recent clinical cohort data indicate a synergistic impact that speeds up recovery when passive modalities like electrical stimulation are combined with active interventions like neuromuscular re-education. The studies' tables show statistical significance in recovery indicators, with intervention groups outperforming controls.(10)

Following supervised physiotherapy and neuromuscular retraining, recent clinical trials consistently show notable improvements in facial muscle function and a decrease in synkinesis. Regular professional supervision combined with home-based exercise programs results in better functional recovery and increased adherence. When used sparingly, massage and electrical stimulation promote neuron regeneration and the restoration of muscle tone. The article's linked tables show quantifiable variations in the recovery paths of patients, with improvement rates consistently greater in intervention groups than in controls.(11)

The trials' statistical tables repeatedly demonstrate that intervention groups outperformed controls in terms of functional gains, with notable decreases in synkinesis scores and the degree of facial disabilities.

Patient satisfaction ratings are much greater among individuals participating in complete, multi-modal programs, and rehabilitation techniques that combine both active and passive modalities show synergistic advantages. However, a few still have persistent deficiencies, demonstrating the need for long-term, tailored treatment.(12) The outcomes demonstrated no statistically significant differences between Group A and Group B in all evaluated characteristics.

The chi-square analysis produced a p-value of 1.000 when evaluating age, sex distribution, reflexes, levels of functional impairment, House-Brackmann scores, communication ability, and other functional characteristics, indicating that both groups were equivalent with no significant disparities.(13)

The analysis indicated that both groups demonstrated substantial improvements in House-Brackmann (HB) scores, Facial Disability Index (FDI), and Lip Mobility Index. Participants in Group A, who received Kabat therapy and facial motor imagery, demonstrated slightly superior improvement, particularly in the social dimension of the FDI scale. This shows that the people in the mime therapy group had better psychosocial health and better facial symmetry.(14)

Table 1. Corrected summary of studies included or closely related trials.

Reference	Country	Key findings	Therapy	Outcome
Amjad A, 2024 (7)	Pakistan	Pain and synkinesis were significant with the given treatment.	Kabat rehabilitation.	Reduction in pain and synkinesis by Kabat rehabilitation.
Monini S, 2016 (8)		Significant difference was found in patients treated with Kabat therapy. Positive association.	Kabat rehabilitation	Kabat rehabilitation has a positive correlation with synkinesis and pain in patients with Bell's Palsy.
Hamed SA, 2023 (9)	Egypt	Kabat rehabilitation physical therapy have better results.	Kabat rehabilitation + physical therapy	Reduction in recovery time. Better effect.
(Heera) SA, 2023, (10)	Pakistan	Kabat Rehabilitation+ mirror therapy have better results than Kabat alone.	Kabat rehabilitation+ mirror therapy	Reduce recovery time and better effect on reducing disability and improving function.
Rahim R, 2023, (11)	Pakistan	Kabat rehabilitation was statistically significant.	Kabat rehabilitation	Improves facial grading scale and functional disability.
Chauhan Deepak Lohar R. 2023, (12)	India	No statistically significance was present between the two groups.	Kabat rehabilitation and neuromuscular techniques	Kabat rehabilitation was less effective than neuromuscular electrical stimulation.
Rajpurohit P, 2025, (13)	India	Kabat rehabilitation along with facial motor imagery is statistically significant.	Kabat rehabilitation+ facial motor imagery	This therapy has better outcome.

This systematic review without meta-analysis synthesizes current evidence on the effects of Kabat rehabilitation on synkinesis and pain in individuals with Bell's palsy. Across seven included studies, Kabat-based interventions were generally associated with improvements in synkinesis, pain, and facial functional outcomes, particularly when compared with no rehabilitation, mime therapy, or standard physiotherapy. However, the direction and magnitude of effects were not uniform across all comparators, and at least one controlled study reported no significant superiority of Kabat rehabilitation over neuromuscular electrical stimulation, underscoring heterogeneity and uncertainty within the evidence base (8,12).

Interpretation of these findings must account for methodological variability and risk-of-bias considerations. Although most included studies employed randomized controlled designs, limitations such as small sample sizes, short follow-up durations, inconsistent reporting of allocation concealment, and lack of assessor blinding were common. Outcome measures varied across studies, particularly for synkinesis and pain, limiting direct comparability and precluding quantitative synthesis. As a result, the overall certainty of evidence was judged to be low to moderate, with greater confidence in the direction of effect than in the precision of effect estimates.

Despite these limitations, the findings are broadly consistent with prior evidence suggesting that targeted facial rehabilitation improves recovery trajectories in Bell's palsy. Previous systematic reviews focusing on facial exercise therapy and neuromuscular retraining have demonstrated benefits in facial symmetry and functional outcomes, especially when therapy is initiated early and delivered under professional supervision (5). The present review extends this literature by isolating Kabat rehabilitation as a distinct neurofacilitation-based approach and highlighting its potential advantages for reducing maladaptive reinnervation and synkinesis. Landmark primary studies, particularly those examining severe cases of Bell's palsy, suggest that Kabat rehabilitation may facilitate greater improvements in House–Brackmann grades compared with non-rehabilitated controls, especially among patients with higher baseline severity (1).

From a clinical perspective, the observed reductions in synkinesis and pain are meaningful, as these outcomes are strongly associated with long-term disability, impaired social interaction, and reduced quality of life. Although effect sizes were inconsistently reported, several studies indicated that patients receiving Kabat rehabilitation were more likely to achieve clinically relevant improvements, such as multi-grade recovery on facial grading scales or earlier pain resolution. In practice, Kabat rehabilitation may be particularly valuable as part of a multimodal rehabilitation strategy, integrated with mirror therapy, motor imagery, or conventional physiotherapy, rather than as a standalone intervention (10,11,14).

Potential mechanisms underlying the observed benefits include enhanced proprioceptive feedback, facilitation of selective muscle activation, and inhibition of abnormal synergistic movements through diagonal and resisted movement patterns. These mechanisms align with principles of neuroplasticity and motor relearning and may explain why adjunctive approaches such as motor imagery further augmented outcomes in some studies (14). Differences in baseline severity, timing of intervention initiation, and treatment dosage likely contributed to variability in outcomes across studies and may represent important effect modifiers.

Several limitations of the evidence base and the review process warrant consideration. The restriction to a single electronic database and English-language publications raises the possibility of publication and language bias. Grey literature and unpublished trials were not systematically searched, and selective outcome reporting at the study level cannot be excluded. Additionally, the absence of a formal domain-based risk-of-bias assessment limits the precision of certainty judgments. These factors collectively constrain the strength of inferences that can be drawn.

Future research should prioritize adequately powered, multicenter randomized controlled trials with standardized Kabat rehabilitation protocols, clearly defined comparators, and uniform outcome measures for synkinesis, pain, and facial function. Longer follow-up periods are needed to assess durability of effects and late-onset synkinesis. Incorporation of patient-reported outcome measures and psychosocial endpoints would further enhance clinical relevance.

CONCLUSION

Evidence from this systematic review suggests that Kabat rehabilitation may improve synkinesis, pain, and facial functional recovery in individuals with Bell’s palsy, particularly when compared with no rehabilitation or certain alternative facial therapy approaches; however, findings are heterogeneous and supported by low-to-moderate certainty evidence. While Kabat-based interventions appear to offer clinically meaningful benefits as part of a structured rehabilitation program, definitive conclusions regarding superiority over other neuromuscular techniques cannot be drawn. Clinicians may consider Kabat rehabilitation as a component of multimodal facial therapy, with treatment decisions guided by patient severity and resource availability. Further high-quality, standardized trials are required to clarify optimal protocols and comparative effectiveness.

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DECLARATIONS

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Informed Consent: NA.

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Concept: QU, TM; Design: QU, TM; Literature Search: MM, AM, MH; Screening/Extraction: AA, AWK; Analysis/Synthesis: QU, TM, AWK; Drafting: QU, TM, MM, AM, MH, AA, AWK

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