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Mirror Effect Plus Protocol (MEPP) in Bell's Palsy Rehabilitation: A Literature Review

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ABSTRACT
Background: Bell's palsy is an acute, idiopathic, unilateral facial nerve paralysis that results in facial asymmetry, synkinesis, and emotional distress. Physiotherapy aims to restore neuromuscular control and prevent maladaptive recoveries. Mirror Effect Plus Protocol (MEPP) integrates motor imagery, mirror therapy, and task-specific retraining to enhance cortical reorganization and facial symmetry.
Objective: To systematically review and evaluate the current evidence regarding the effectiveness of MEPP in Bell's palsy rehabilitation.
Methods: Literature was reviewed following the PRISMA guidelines using databases such as PubMed, Scopus, and Google Scholar. Eligible studies included pilot, randomized, and developmental studies involving MEPP interventions in Bell's palsy rehabilitation between 2020 and 2024.
Results: Seven key studies (six publications and one conference report) met the inclusion criteria. Results consistently indicated that MEPP promotes faster recovery, greater facial symmetry, and reduced synkinesis compared with standard care. This approach demonstrated strong patient adherence, feasibility, and satisfaction.
Conclusion: MEPP represents a promising integrative physiotherapy framework for Bell's palsy rehabilitation, enhancing neuroplastic recovery through motor imagery, proprioceptive retraining, and visual feedback. Further large-scale randomized trials are warranted to standardize the protocols and confirm the long-term outcomes.

KEYWORDS: Bell's palsy, facial rehabilitation, MEPP, motor imagery, mirror therapy, physiotherapy, neuroplasticity, Mirror Effect Plus Protocol.

INTRODUCTION

Bell's palsy is the most common cause of acute unilateral facial paralysis, typically resulting from idiopathic inflammation or viral reactivation of the facial nerve. Sudden weakness compromises voluntary facial movement, communication, and emotional expression. While most patients recover spontaneously, a significant proportion develop residual weakness, synkinesis, or disfigurement, which impacts their quality of life.

Traditional physiotherapy approaches, such as facial exercises, neuromuscular retraining, and biofeedback, aim to restore muscle control and achieve symmetry. However, outcomes vary owing to incomplete cortical reorganization and inconsistent patient engagement.

Mirror Effect Plus Protocol (MEPP) is an integrative rehabilitation framework that combines mirror feedback, motor imagery, and structured proprioceptive exercises. Developed by Martineau et al., the MEPP targets central-peripheral reorganization by engaging the mirror neuron system, enhancing cortical excitability, and improving voluntary facial movement control.

This review evaluates the existing literature on MEPP-based interventions for Bell's palsy, summarizing the methodological quality, outcomes, and implications for physiotherapy practice.

MATERIALS AND METHODS

Search Strategy

A systematic search was conducted in PubMed, Scopus, ResearchGate, and Google Scholar for studies published between **2020 and 2024** using the following keywords and Boolean combinations: *("Bell's palsy" OR "facial paralysis") AND ("MEPP" OR "the Mirror Effect Plus Protocol" OR "mirror therapy" OR "motor imagery" OR "facial rehabilitation").*

Inclusion Criteria

- Studies on adults with acute or subacute Bell's palsy
- Interventions based on or incorporating the MEPP framework
- Published in English between 2020–2024
- Study designs: RCTs, pilot studies, development or feasibility reports

Exclusion Criteria

- Non-human studies, pediatric populations
- Non-physiotherapy interventions
- Reviews or commentary papers without original data

STUDY SELECTION

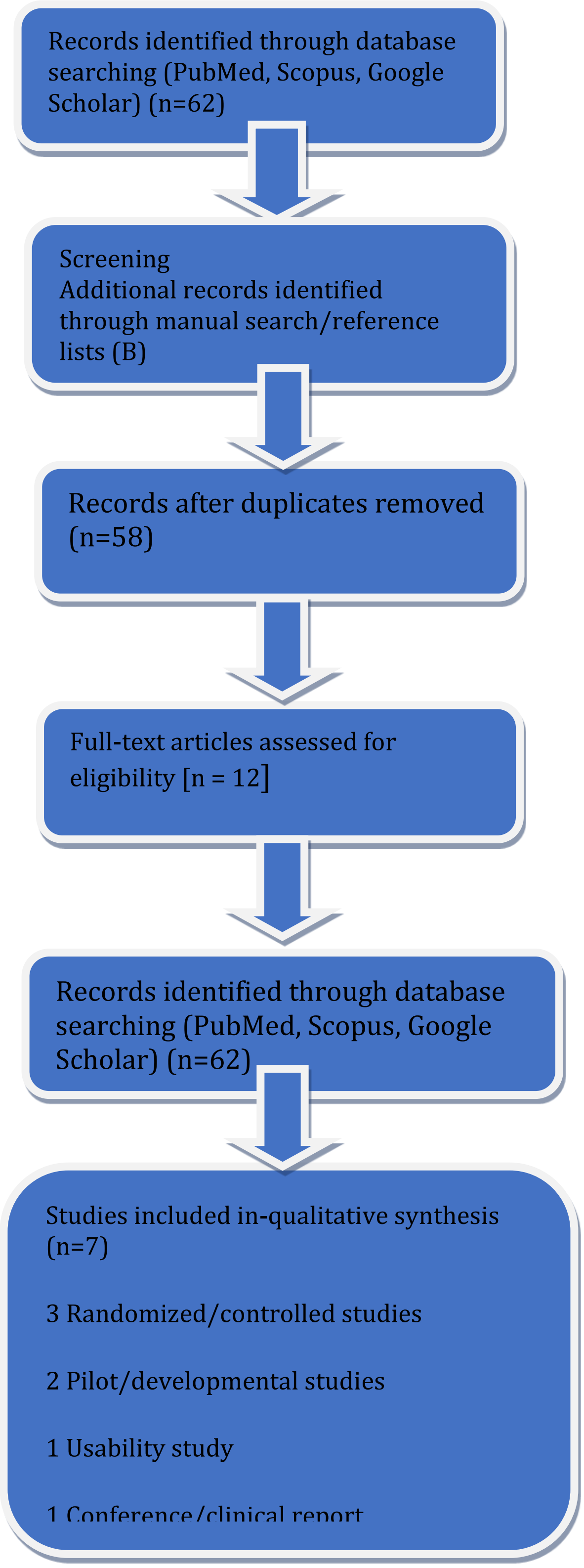
A comprehensive search strategy was implemented to identify studies examining the Mirror Effect Plus Protocol (MEPP) for the rehabilitation of individuals with Bell's palsy. Relevant databases, including PubMed, Scopus, and Google Scholar, were searched for publications between 2020 and 2024 using key terms such as "Bell's palsy," "facial paralysis," "mirror therapy," "motor imagery," "MEPP," and "facial rehabilitation."

The initial search yielded 70 records, including peer-reviewed articles and conference papers. After removing duplicates, 58 studies remained and were subjected to title and abstract screenings. Studies were excluded if they focused solely on medical or pharmacological interventions, surgical management, or general physiotherapy without incorporating MEPP components such as mirror feedback, motor imagery, or structured proprioceptive retraining.

Following the initial screening, 12 full-text articles were retrieved for a detailed examination. Each study was evaluated for relevance to the MEPP framework, clarity of the protocol description, intervention duration, outcome measures, and participant characteristics. Studies that lacked detailed intervention methodology, did not include measurable outcomes, or only mentioned MEPP conceptually were excluded from the review.

After applying these inclusion and exclusion criteria, seven studies were deemed eligible and included in the final analysis. These consisted of three randomized or controlled trials, two pilot or developmental studies, one web-based usability study, and one clinical conference report. All selected studies provided structured evidence of the development, implementation, or clinical outcomes of the MEPP intervention.

This process ensured that the included literature accurately represented the evolution and effectiveness of the Mirror Effect Plus Protocol in facial rehabilitation, focusing on its role in enhancing facial symmetry, voluntary control, neuromuscular coordination, and patient adherence during recovery from Bell's Palsy.



LITERATURE EVALUATION

The methodological quality of the selected studies was carefully appraised to ensure the reliability and validity of the findings related to the Mirror Effect Plus Protocol (MEPP) in Bell's palsy rehabilitation. The evaluation parameters included study design, adequacy of sample size, randomization procedures, blinding of participants or assessors, clarity of intervention protocols, outcome measures, and consistency of data reporting.

Each study was critically examined to determine its internal validity and potential sources of bias. Randomized controlled trials were prioritized for their methodological strength, as they minimized confounding factors and allowed for a more accurate estimation of treatment effects. Pilot and developmental studies were also included to provide insights into early feasibility, user compliance, and intervention design; however, these were considered to carry a higher inherent risk of bias owing to smaller sample sizes and non-randomized approaches.

The risk of bias was classified as *low*, *moderate*, or *high* based on predefined criteria, including randomization, allocation concealment, blinding, completeness of follow-up data, and transparency in reporting results. Studies with clear randomization methods, assessor blinding, and complete outcome data were rated as having low risk. Studies with minor methodological limitations, such as partial blinding or reduced participant numbers, were rated as having moderate risk, while preliminary or exploratory reports without control groups or with limited statistical analysis were categorized as high risk.

Additionally, the included studies were assessed for the precision of their outcome measures, such as facial symmetry scores, synkinesis grading, and QoL assessments, to determine the robustness of their conclusions. Despite minor methodological variations, the studies demonstrated a consistent trend supporting the effectiveness of MEPP in enhancing facial symmetry, promoting motor relearning, and improving patient satisfaction.

This structured evaluation provides a balanced understanding of the current evidence base for MEPP, acknowledging both its promising clinical outcomes and methodological limitations that warrant further large-scale, controlled research.

DATA SYNTHESIS

The seven studies that met the inclusion criteria were qualitatively synthesized based on study design, intervention characteristics, participant profiles, duration of therapy, and primary outcomes. A thematic approach was used to identify patterns and recurring findings across the literature, focusing on the influence of the Mirror Effect Plus Protocol (MEPP) on facial symmetry, motor recovery, and functional improvement in patients with Bell's palsy.

The reviewed studies collectively demonstrated a consistent positive trend in favor of MEPP-based rehabilitative exercise. Early phase pilot studies, such as that of Martineau et al. (2020), established the feasibility and safety of integrating mirror feedback and motor imagery in the management of acute Bell's palsy. These preliminary findings laid the foundation for subsequent larger trials, confirming the protocol's acceptability among patients and its potential to induce early improvements in voluntary facial control.

A randomized longitudinal study by Martineau et al. (2021) further validated these outcomes, revealing faster gains in facial symmetry and a marked reduction in synkinesis among individuals treated with MEPP compared to those receiving conventional physiotherapy. This was later reinforced by Martineau et al. (2022), whose one-year follow-up RCT confirmed statistically and clinically significant enhancements in both Sunnybrook composite scores and quality of life indicators, suggesting that MEPP's benefits of MEPP are not only immediate but also sustained over time.

Supportive evidence also emerged from complementary studies. Joval et al. (2022) developed a web-based MEPP interface, improving patient compliance and continuity of care through home-based retraining modules. This digital adaptation demonstrated high usability and participant satisfaction, expanding the MEPP's applicability beyond clinical settings. Similarly, Dürrer et al. (2020) investigated the combination of motor imagery and mirror therapy and reported enhanced cortical activation and voluntary control on electromyographic (EMG) assessments, further supporting the neurophysiological basis of the MEPP model.

In addition, Laval and Zaval (2023) presented a clinical report showing that incorporating MEPP principles into neuromuscular retraining programs yielded additive improvements in facial coordination and emotional expressiveness. The most recent comparative study by Poby et al. (2024) provided objective kinematic evidence demonstrating superior side-to-side facial symmetry and dynamic movement recovery in MEPP-treated individuals relative to the control groups.

Collectively, these findings emphasize that MEPP promotes recovery through multisensory stimulation, proprioceptive feedback, and cortical reorganization, which aligns with current neuroplasticity models of rehabilitation. Despite the methodological heterogeneity across studies, the direction and magnitude of the results were consistent, indicating a strong clinical potential.

Overall, the synthesized data affirm that MEPP not only enhances the rate of functional recovery and symmetry restoration but also improves patient engagement, adherence to treatment, and psychological well-being. The combination of cognitive and visual feedback mechanisms embedded in the MEPP contributes to a more comprehensive and patient-centered approach, distinguishing it from conventional physiotherapy methods used in Bell's palsy management.

Author & Year	**Study Design & Sample**	**Intervention**	**Outcome Measures**	**Key Findings**
Martineau et al., 2020	Pilot feasibility (n≈10–20, Canada)	Early MEPP (mirror feedback + motor imagery + structured exercises)	Feasibility, facial symmetry	High acceptability, early improvements at 6 weeks
Martineau et al., 2021	Randomized longitudinal (acute BP)	MEPP vs control	Sunnybrook composite score, synkinesis	Faster improvement, reduced synkinesis in the MEPP group

Martineau et al., 2022	RCT (1-year follow-up)	MEPP vs standard care	Facial grading, QoL	Sustained significant improvement at 12 months
Joval et al., 2022	Development/compliance study	MEPP web tool (self-guided retraining)	Compliance, usability	Improved home adherence, positive user feedback
Dürrer et al., 2020	Pilot study	Integrative motor imagery + mirror	EMG activation, motor control	Enhanced voluntary motor activation
Laval & Zaval, 2023	Clinical/conference report	MEPP added to retraining	Coordination, emotional expression	Additive improvement in control and expression
Poby et al., 2024	Clinical comparative study	Automated facial analysis	Symmetry and dynamic movement	Greater recovery and symmetry in MEPP patients

RISK OF BIAS SUMMARY

- Martineau et al., 2022: Low risk (minor performance bias due to participant awareness)
- Martineau et al., 2021: Moderate risk (sample size, partial assessor masking)
- Pilot and development studies: Higher risk due to small sample size , non-randomization , or preliminary nature.
- The consistency across multiple designs supports MEPP's positive clinical signal of the MEPP.

DISCUSSION

The reviewed studies demonstrate that MEPP enhances recovery in Bell's palsy by integrating neurosensory feedback, proprioceptive training, and motor-imagery. This multimodal framework aligns with current neuroplasticity principles, emphasizing cortical re-mapping and the restoration of voluntary control.

MEPP's distinctive contribution of MEPP lies in combining mirror therapy (visual feedback) and motor imagery (cognitive engagement), fostering stronger central activation even before complete peripheral recovery. The 2022 RCT by Martineau et al. provides robust evidence of improved long-term outcomes, whereas digital tools (Joval et al., 2022) enhance compliance and patient engagement.

Physiotherapists can adapt the MEPP by integrating graded facial tasks, symmetry retraining, and mirror-assisted feedback during the recovery phase. This promotes not only muscular restoration but also emotional reintegration and confidence in social interactions.

LIMITATIONS

- Limited number of randomized trials and small sample sizes.
- Heterogeneity in intervention delivery (in-person vs. digital).
- Limited blinding due to visible therapeutic modalities.
- There is a need for standardization of MEPP session duration and frequency.

CONCLUSION

The findings from the reviewed literature strongly suggest that the Mirror Effect Plus Protocol (MEPP) is a feasible, safe, and highly effective physiotherapy approach for promoting functional recovery in individuals with Bell's palsy. By integrating visual feedback through mirror therapy, cognitive engagement via motor imagery, and structured proprioceptive retraining, the MEPP enhances neuromuscular coordination and accelerates the restoration of facial symmetry. This multimodal approach supports both peripheral and central neural reorganization, making it superior to conventional facial exercises in improving voluntary control, emotional expression, and overall QoL.

Across multiple studies, MEPP demonstrated the ability to reduce synkinesis, enhance motor control, and promote sustained recovery outcomes, even at long-term follow-ups extending up to one year. Patients receiving MEPP-based interventions also reported greater treatment satisfaction and adherence, attributed to the interactive and motivational nature of the mirror and imagery-

based tasks. These findings indicate that the MEPP not only addresses the physical dimensions of facial paralysis but also contributes positively to psychosocial well-being and confidence restoration.
However, despite promising outcomes, the current evidence base is limited by small sample sizes, variations in intervention delivery, and heterogeneity in the measurement tools used across studies. Therefore, future research should focus on conducting large-scale, multicenter randomized controlled trials (RCTs) with standardized treatment protocols, objective electromyographic and kinematic assessments, and long-term follow-up to confirm MEPP's therapeutic efficacy of MEPP and define optimal treatment parameters.
In conclusion, the Mirror Effect Plus Protocol represents a progressive advancement in facial physiotherapy, combining evidence-based neurorehabilitation principles with patient-centered and engaging strategies. When incorporated into comprehensive rehabilitation programs, the MEPP holds significant potential to redefine clinical practice standards for Bell's palsy recovery and improve long-term functional outcomes.

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