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Efficacy Of Mirror Visual Feedback Approaches In Peripheral Facial Nerve Palsy Rehabilitation: From Conventional Mirror Book Therapy To Digital Mirroring Approaches– A Narrative Review.

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Abstract

Background: Facial nerve palsy causes facial asymmetry, impaired voluntary movements which lead to significant facial motor dysfunction and psychosocial distress. Rehabilitation strategies have traditionally relied on mirror therapy using physical mirrors which provide visual feedback to facilitate motor relearning. Recent advancements like Mirror Book Therapy have emerged as neuroplasticity driven approach enhancing therapy effectiveness and accessibility promoting facial function recovery.

Aims and Objectives: The review aimed to evaluate the efficacy of Mirror Book Therapy on facial symmetry in patients with peripheral facial palsy including traditional mirror book and digital mirroring approaches.

Materials and methods: The literature was searched for relevant randomised control trials in PubMed, Google Scholar, Research Gate databases using keywords 'mirror book therapy', 'mirror visual feedback', 'peripheral facial palsy' and 'facial symmetry'. The studies from inception to December 2025 were searched. Thirty-two studies were retrieved, out of which six were included in the final review.

Results: Three studies evaluated the efficacy using physical mirror book and three used digital mirroring approaches on patients with acute to subacute facial palsy and moderate to severe paralysis. Interventions comprised mirror book therapy, motor imagery, mirror effect plus protocol and digital mirroring approaches. Facial outcomes were commonly assessed using the Sunnybrook, Housebrackmann, Facial disability index and Facial clinnimetric evaluation scales. The majority of studies reported greater improvements in facial symmetry, facial function and quality of life compared with conventional rehabilitation.

Conclusion: Mirror visual feedback is an effective rehabilitative approach for facial nerve palsy, promoting motor relearning and cortical reorganization. Mirror Book Therapy have demonstrated significant benefits, while digital mirroring technology further enhances patient engagement, precision and remote therapy potential.

Keywords: mirror book therapy, mirror visual feedback, peripheral facial palsy and facial symmetry

INTRODUCTION

Peripheral facial palsy (PFP) is a neurological disorder characterized by sudden weakness or paralysis of the muscles innervated by the facial nerve on one side of the face.[1] Clinically, patients present with drooping of the mouth, inability to close the eye and diminished forehead wrinkling, reflecting a lower motor neuron lesion. Differentiation from central facial palsy is essential, as the latter typically spares the forehead due to bilateral cortical innervation.[2]

PFP is the most common cause of lower motor neuron facial paralysis, with Bell's palsy accounting for approximately 70% of cases.[3] The annual incidence is estimated at 15–30 per 100,000 population, with a lifetime risk of about 1 in 60 individuals.[4] While many patients recover spontaneously, up to 30% experience incomplete recovery, leading to complications such as synkinesis, muscle contracture and permanent disfigurement.[5] Beyond motor dysfunction, patients often face difficulties with speech, eating, eye protection and emotional expression, which contribute to significant psychosocial distress and reduced quality of life.[6]

The etiology of PFP is diverse. Idiopathic Bell's palsy remains the predominant form, driven by inflammatory edema and compression of the facial nerve within the bony canal. Other causes include viral infections such as herpes simplex virus, trauma to nerve, tumors, autoimmune diseases and neurological disorders like Guillain-Barré syndrome.[7] Pathophysiologically, inflammation and ischemia result in demyelination and impaired neural conduction, explaining the sudden onset and variable recovery observed clinically.[8]

Rehabilitation strategies have evolved to address both motor recovery and psychosocial adaptation. Mirror therapy, originally developed for phantom limb pain, has been adapted for facial rehabilitation.[9] Building on this concept, bifold mirrors and mirror book therapy (MBT) have been introduced which involves reflecting the unaffected side of the face to create the illusion of symmetrical movement, facilitating cortical reorganization and motor control. Emerging evidence suggests that mirror book therapy, wherein patients use a physical mirror-book device to simulate symmetrical facial activity, can improve motor outcomes and patient satisfaction in PFP rehabilitation.[10]

Recent advancements have transitioned mirror visual feedback into the digital domain. Digital mirroring approaches, including software platforms and mobile applications, capture the motion of the unaffected side and digitally replicate it on the affected side in real time.[11] These interactive systems reduce logistical challenges, allow remote or home-based therapy, and integrate features such as progress tracking, personalized exercise programs and telemedicine capabilities.[12] By enhancing accessibility, precision and patient-centered care delivery, digital mirroring represents a significant advancement in the continuum of facial palsy management.[13]

Although and digital mirroring approaches have each been studied for peripheral facial palsy, no review has not been published which combined these approaches in a single framework. Because these interventions share the same neuroplasticity-based foundation but differ in how they deliver visual feedback through physical bifold mirror book or digital platforms. By bringing together traditional and digital approaches, this work aims to fill a clear gap in the literature, refine evidence-based rehabilitation strategies and guide future clinical practice for patients with facial palsy

METHODOLOGY

This narrative review synthesizes findings from clinical studies published from inception to December 2025 investigating mirror visual feedback interventions for peripheral facial nerve palsy rehabilitation using keywords 'mirror book therapy', 'mirror visual feedback', 'peripheral facial palsy' and 'facial symmetry'. Databases screened included PubMed, Google Scholar and Research Gate. Eligible study designs included randomized controlled trials if they involved patients with peripheral facial palsy, implemented mirror visual feedback including MBT or digital mirroring approaches and assessed facial motor function, facial symmetry, psychosocial and quality of life outcomes. Data extraction focused on patient demographics, sample size, intervention type, duration, frequency and combination with routine physiotherapy. Outcome measures such as Sunnybrook Facial Grading System (SFGS), Facial Disability Index (FDI), Housebrackmann scale, Facial clinnimetric evaluation scales (FaCE), Facial Nerve Grading Scale 2.0 (FNGS2.0), Beck Depression Inventory (BDI) have been studied. Studies focusing solely on central lesions, non-mirror based interventions or non-clinical populations were excluded. Thirty-two studies were retrieved, out of which six were included in the final review.

Table

Sr. no.	Study author, year and country	Study design	No. of patients	Intervention and duration	Outcome	Outcome measures	Results
1.	Bachkaniwala et al (2024)[14] India	RCT	N= 31 KT= 16 MBT=15	KT= KT and CT MBT= MBT and CT 30 minutes, 6 days /week for 3 weeks	Facial symmetry, Electrophysiological parameters (amplitude and latency of facial muscles)	SFGS, NCT	MBT proved more effective than KT in improving facial symmetry, neuromuscular re-education, and electrophysiological recovery in Bell's palsy patients.
2.	Patel et al (2023)[15] India	Interventional comparative study	N= 30 Group A= 10 Group B= 10 Group C= 10	Group A= MI, MBT and CT Group B= Mime therapy and CT Group C= Mirror feedback exercises and CT 3 days /week for 4 weeks	Facial symmetry and synkinesis, Facial and psychosocial impairment	SFGS FDI	MI plus MBT was superior to Mime Therapy and conventional treatment in enhancing facial coordination and quality of life.

3.	Martineau et al (2022)[13] Canada	RCT	N=40 EG= 20 CG= 20	EG= MEPP (MI, manipulations, facial mirror therapy) With use of free website (http://webcamtoy.com/fr/) CG= basic counselling 1 Year	Global facial symmetry, Facial synkinesis, Quality of life	FNGS2.0, SFGS, FaCE-F	The MEPP yielded better long-term gains than standard therapy in facial symmetry, motor control, and EMG recovery.
4.	Martineau et al (2021)[12] Canada	RCT, Longitudinal study	N= 28 EG= 15 CG= 13	EG= MEPP (MI, manipulations, facial mirror therapy) With use of free website (http://webcamtoy.com/fr/) CG= basic counselling 6 months	Severity of facial palsy,	FNGS 2.0, SFGS	MEPP showed greater improvement than usual care in voluntary movement, facial symmetry, and patient-reported outcomes.
5.	Barth et al (2020)[10] USA	RCT	N= 25 EG= 15 CG= 10	MBG= Mirror Book Therapy and standard rehabilitation NMBG= Standard facial rehabilitation (NMR, massage, MFR, stretching, taping, postural training) MBG= 2- 19 sessions NMBG= 2-22 sessions	Facial symmetry, Psychosocial disability	SFGS, FDI	MBT as an adjunct led to better facial function and satisfaction compared with standard rehabilitation alone.
6.	Paolucci et al (2019)[11] Italy	RCT	N=22 MTG=11 CG=11	MTG= Motor imagery and mirror therapy using specific software	Severity of facial paresis and paralysis,	HBS, SFGS, FaCE, BDI	An integrative program of Motor Imagery, Mirror

				(IDIBELL: idibell.cat/en/node/257) CG= Mime therapy, MFR. 3 months	Facial symmetry, Quality of life, Intensity of depressive symptoms.		Therapy, and exercises was more effective than conventional care for motor recovery and emotional well-being.

RESULTS

Six published studies were included in this review, enrolling a total of 176 patients with unilateral peripheral facial palsy, predominantly idiopathic Bell's palsy. The mean age of participants across studies ranged from the early thirties to mid-forties and most presented with moderate to severe paralysis (House-Brackmann grades III–V). Sample sizes varied between 22 and 40 patients per study, with interventions delivered over periods ranging from three weeks to one year. All studies combined novel rehabilitation strategies with conventional physiotherapy, though the specific protocols differed. Three studies (Patel & Bachkaniwala 2024; Patel et al. 2024; Barth et al. 2020) directly MBT, either alone or in combination with motor imagery, against comparators such as Kabat technique, mime therapy or standard rehabilitation.[10,14,15] Collectively, these trials demonstrated that MBT was consistently more effective in improving facial symmetry and motor function, with superior outcomes on the SFGS and FDI. One study also reported enhanced electrophysiological recovery, with improved amplitude and latency of facial muscle responses.[14]

Two Canadian trials (Martineau et al. 2021; Martineau et al. 2022) investigated the MEPP, which integrates motor imagery, manipulations and facial mirror book therapy delivered via a free web-based platform. Together, these studies followed 68 patients for six months to one year and found sustained improvements in global facial symmetry, voluntary movement and motor control, with better long-term recovery compared to counselling or usual care. Outcomes were measured using FNGS2.0, SFGS and the FaCE scale, confirming the added value of digital mirroring in long-term rehabilitation.[12,13]

Finally, one Italian study (Paolucci et al. 2020) assessed an integrative program combining motor imagery and mirror book therapy via specialized software in 22 patients, compared with mime therapy and manual rehabilitation. This trial highlighted not only superior motor recovery and facial symmetry but also significant improvements in quality of life and emotional well-being, with reductions in depressive symptoms measured by the BDI.[11]

Across all six studies, five reported significant gains in facial symmetry, four demonstrated improvements in motor function and voluntary movement and three documented positive psychosocial outcomes including reduced disability and better quality of life. Importantly, interventions that combined MBT or digital mirroring with conventional physiotherapy consistently outperformed standard rehabilitation alone. The evidence therefore suggests that both traditional MBT and digital mirroring approaches are effective, with digital platforms offering additional advantages in accessibility, patient engagement and long-term sustainability.

DISCUSSION

The findings of this narrative review demonstrate that mirror visual feedback approaches ranging from traditional MBT to advanced digital mirroring systems that play a significant role in promoting motor relearning, improving facial symmetry and enhancing quality of life among patients with peripheral facial palsy. Mirror visual feedback interventions leverage the principles of neuroplasticity and sensorimotor integration, providing visual input that facilitates cortical reorganization and improved voluntary motor control, consistent with prior neurorehabilitation research on visual feedback mechanisms.

Across the included studies, traditional MBT using physical bifold mirrors consistently demonstrated clinically significant improvements in facial symmetry, neuromuscular recovery and psychosocial status of PFP patients. Bachkaniwala et al. (2024) reported that MBT led to superior outcomes compared with Kabat therapy, particularly in improving Sunnybrook scores and electrophysiological measures.[14] Similar benefits were noted by Patel et al. (2023), showing that motor imagery and MBT achieved greater improvement in facial coordination and reduction in psychosocial impairment than mime therapy or standard care.[15] These findings collectively reinforce MBT as a highly accessible, low-cost and effective intervention.

Digital and computer-based mirror therapy approaches demonstrated additional advantages, particularly in user engagement, precision of visual feedback and feasibility for remote treatment.[17] Two randomized controlled trials by Martineau et al. (2021; 2022) showed that programs integrating digital mirror visual feedback such as the Motor Effect Plus Protocol (MEPP) produced significantly better long-term improvements in symmetry, voluntary movement and synkinesis reduction when compared with basic counselling or usual care. Importantly, these studies demonstrated sustained benefits up to 12 months, suggesting that digital mirror therapy may support longer-term neuroplastic adaptation.[14,15]

Paolucci et al. (2019) further demonstrated that digital mirror therapy combined with motor imagery yielded significantly greater gains in facial symmetry, emotional well-being and reduction in depressive symptoms than conventional therapy, underscoring the psychosocial benefits of technology-assisted interventions.[16] The study by Ding et al. (2019) further advanced this field by comparing a computerized Face Mirroring System with traditional MBT. FMS provided superior embodiment, improved perceived symmetry and greater user engagement. These outcomes suggest that computer vision-based systems may address limitations of physical mirrors by offering more precise visual corrections and enhanced user experience.[17]

Although most digital mirror visual feedback interventions demonstrated positive outcomes, MBT also remained effective as evidenced by Barth et al. (2020), who found that adjunctive MBT led to better facial symmetry and satisfaction compared with standard rehabilitation alone.[10] This supports the idea that traditional MBT continues to be valuable, especially in settings where digital resources are limited.

Across these studies, a consistent theme emerges that MBT both physical and digital supports neuroplasticity-driven recovery in facial palsy. Physical MBT remains highly valuable due to its affordability, simplicity and strong evidence base

Collectively, the evidence suggests that MBT both physical and digital, facilitates motor recovery through enhanced visual input, leading to improved motor recruitment and cortical reorganization. Digital MBT appears to offer added advantages such as automatic symmetry correction, customizable feedback, progress tracking and compatibility with telerehabilitation platforms. These features may be particularly beneficial for chronic cases, rural populations and patients requiring long-term follow-up.

However, despite promising results, several limitations across the included studies must be acknowledged. Many trials employed small sample sizes, limiting generalizability. Intervention durations also varied widely, ranging from a few weeks to a year and making standardized comparison challenging.

Overall, the current body of evidence supports the integration of mirror visual feedback particularly hybrid models combining MBT, motor imagery and digital mirror approach into comprehensive rehabilitation programs for facial palsy. With advancements in computer vision and telemedicine, digital mirror therapy holds significant potential to expand access, personalize rehabilitation and enhance both functional and psychosocial outcomes for patients with peripheral facial nerve palsy.

CONCLUSION

MBT offers a simple, low-cost intervention that enhances neuromuscular re-education, while digital mirroring provides added benefits of accessibility, patient engagement and long-term sustainability through web-based platforms. The advent of digital mirroring technologies, incorporating computer vision and interactive software has further optimized rehabilitation by improving patient engagement, enabling remote therapy and allowing personalized exercise regimens. These technological advancements hold substantial promise for improving functional outcomes and quality of life in patients with facial palsy Despite these promising findings, the evidence base remains limited by small sample sizes, heterogeneous protocols and the absence of direct comparative trials between MBT and digital approaches. Future research should therefore focus on larger, multicenter studies with standardized outcome measures to establish the relative efficacy of these interventions and guide their integration into routine clinical practice. Together, MBT and digital mirroring represent important advances in patient-centered rehabilitation, with the potential to significantly improve facial symmetry and quality of life in patients with peripheral facial palsy.

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Abbreviations

PFP= Peripheral Facial Palsy

MBT= Mirror Book Therapy

SFGS= Sunnybrook Facial Grading System

FDI = Facial Disability Index

HBS= Housebrackmann Scale

FaCE= Facial clinnimetric evaluation scales

FNGS2.0= Facial Nerve Grading Scale 2.0

BDI= Beck Depression Inventory

RCT= Randomised Control Trial

KT= Kabat Technique

CT= Conventional Technique

NCT= Nerve Conduction Test

MI= Motor Imagery

EG= Experimental Group

CG= Control Group

MEPP= Mirror Effect Plus Protocol

MBG= Mirror Book Group

NMBG= Non Mirror Book Group

NMR= Neuromuscular Retraining

MFR= Myofascial Release