

A systematic review of the effect of the integration of speech therapy with music therapy on swallowing for patients with Parkinson's disease

Natwipa Wanicharoen¹, Vich Boonrod², Erin Songdechagruiwud³, Palita Yaemsuan^{1*}

¹Communication Sciences and Disorders Division, Department of Occupational Therapy, Faculty of Associated Medical Sciences, Chiang Mai University, Chiang Mai Province, Thailand.

²Department of Music, Faculty of Humanities, Naresuan University, Phitsanulok Province, Thailand.

³Chonburi Hospital, Chonburi Province, Thailand.

ARTICLE INFO

Article history:

Received 12 July 2025

Accepted as revised 29 September 2025

Available online 14 October 2025

Keywords:

Parkinson's disease, swallowing, speech therapy, music therapy, systematic review.

ABSTRACT

Background: Dysphagia, or swallowing impairment, is a common complication in individuals with Parkinson's disease. Speech therapy is a non-pharmacological intervention that employs behavioral techniques to address this condition. A growing body of research also suggests that music therapy may have beneficial effects on swallowing function in this population. However, the effectiveness of integrating speech and music therapy for improving swallowing in individuals with Parkinson's disease has not yet been systematically evaluated.

Objectives: The objective of this systematic review was to examine the effectiveness of integrating speech therapy with music therapy for swallowing in patients with Parkinson's disease.

Materials and methods: This study was registered in PROSPERO (CRD420251118370) and performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). A total of two studies met the inclusion criteria. The authors systematically reviewed four electronic databases: PubMed, CINAHL Complete, the Cochrane Library, and Google Scholar. A hand search of the reference list of related articles was performed to identify any additional eligible studies. The assessment of bias risk was conducted using the Joanna Briggs Institute's (JBI) critical appraisal tools.

Results: A total of two studies investigated the effects of speech therapy in combination with music therapy. One study implemented an interdisciplinary choral singing therapy program that included vocal exercise and choral singing. The other study applied a conventional speech therapy protocol-specifically, Lee Silverman Voice Treatment (LSVT LOUD®) and vocal exercises-combined with music therapy incorporating motor, breathing, vocal, and singing exercises. The integration of speech and music therapy demonstrated promising results in improving swallowing function in individuals with Parkinson's disease.

Conclusion: The findings highlight the potential benefits of integrating speech and music therapy to improve swallowing function in individuals with Parkinson's disease. However, due to the limited number of studies and methodological heterogeneity, definitive conclusions regarding the most effective intervention components cannot yet be drawn. While encouraging, the current evidence underscores the need for further high-quality research particularly randomized controlled trials to establish standardized protocols. Advancing this interdisciplinary approach may enhance rehabilitation outcomes and improve quality of life for this population.

* Corresponding contributor.

Author's Address: Communication Sciences and Disorders Division, Department of Occupational Therapy, Faculty of Associated Medical Sciences, Chiang Mai University, Chiang Mai Province, Thailand.

E-mail address: palita.y@cmu.ac.th

doi: 10.12982/JAMS.2026.014

E-ISSN: 2539-6056

Introduction

The prevalence of Parkinson's disease is projected to exceed one million individuals in the United States by 2030, based on U.S. Census Bureau population estimates, and more than 10 million people worldwide.¹ Parkinson's disease is a neurological condition characterized by involuntary or uncontrolled movements such as tremors in the hands, arms, legs, jaw, or head, along with muscle stiffness, impaired balance, and coordination difficulties. Symptoms typically emerge gradually and worsen progressively over time. As the condition progresses, individuals may encounter difficulties with mobility and communication.² This includes dysphagia, or swallowing impairment, which is a common non-motor symptom observed in individuals with Parkinson's disease across all stages, including the prodromal phase when diagnostic criteria are not yet met³ as well as the early stages of the disease.⁴

Individuals with Parkinson's disease may exhibit dysphagia in the oral, pharyngeal, and esophageal phases.⁵⁻⁷ Contributing factors include muscular incoordination or weakness and sensory dysfunction, with repetitive tongue pumping being the most frequent manifestation. Additional difficulties may involve delayed initiation of the pharyngeal swallow, poor lip seal and oral containment, pharyngeal residue, and airway invasion.⁶

Studies reported differences in the prevalence of dysphagia in Parkinson's disease. For instance, a meta-analysis by Kalf *et al.*⁸ examined the prevalence of oropharyngeal dysphagia. The findings showed that while using subjective outcomes yielded an estimated prevalence of oropharyngeal dysphagia of 35% (95% confidence interval; CI=28-41), using objective data yielded an estimate of 82% (95% CI=77-87). However, due to variations in the methods used to assess swallowing functions, the prevalence of dysphagia in individuals with Parkinson's disease varies. Recently, a meta-analysis of Gong *et al.*⁹ studies the prevalence of dysphagia in Parkinson's disease across continents. The findings showed that Oceania has the highest frequency of dysphagia in Parkinson's disease (56.3%), followed by Africa (39.5%), Asia (38.6%), Europe (36.1%), and America (28.9%).

Additionally, studies have investigated quality of life (QoL) related to swallowing in patients with Parkinson's disease in various countries. For example, in Brazil, a study by Carneiro *et al.*¹⁰ used the Swallowing Quality of Life Questionnaire (SWAL-QOL). The findings showed that patients with Parkinson's disease have considerably lower ratings on all SWAL-QOL domains than normal controls. The disease's progression worsens swallowing QOL, particularly in terms of eating duration, symptom frequency, and sleep. This occurs primarily in the later stages of the disease. In Hong Kong, a study by Chan *et al.*¹¹ used Chinese version of the Swallowing Quality-of-Life Questionnaire

(C-SWAL-QOL). The findings showed that the most severely affected scales included sleep, fatigue, eating duration, and communication. Dysphagia, in particular, hampers medicine intake and causes malnutrition and aspiration pneumonia, which is a leading cause of death in individuals with Parkinson's disease.¹² In clinical practice, patients should receive early screening, diagnosis, and treatment to avoid complications from dysphagia.⁹

Numerous studies have demonstrated that speech therapy is a non-pharmacological intervention employing behavioral techniques to address dysphagia in patients with Parkinson's disease. Early evidence from Robertson and Thomson¹³ showed that intensive speech therapy improved speech intelligibility and voice quality, with patients also reporting secondary improvements in swallowing, despite the therapy not being specifically designed for dysphagia. Subsequent studies have provided physiological confirmation of these cross-system effects. Evidence suggests that intensive speech therapy exerts beneficial influences on swallowing across multiple phases. In the oral phase, increased tongue and submental activity enhance bolus propulsion, consistent with reports of reduced oral transit time following intensive voice therapy.¹⁴ In the pharyngeal phase, greater hyolaryngeal excursion and improved tongue base retraction facilitate bolus transit through the pharyngoesophageal segment, thereby reducing aspiration risk.^{14,15} For airway protection, enhanced glottal closure and stronger expiratory drive contribute to safer swallowing, with recent findings also demonstrating improved reflexive cough capacity.^{15,16} These overlapping mechanisms support the rationale for investigating speech therapy in relation to dysphagia, even though its primary target is communication.¹⁷

Currently, a growing body of research suggests that music therapy particularly therapeutic singing may support swallowing function in individuals with Parkinson's disease. In the early stages, Stegemöller *et al.*¹⁸ reported that a structured singing program enhanced motor and neuromuscular outcomes, which were interpreted as reflecting prolonged laryngeal elevation and improved airway protection, although swallowing-related quality of life remained unchanged. In later stages, Yeo *et al.*¹⁹ demonstrated that a therapist led singing intervention helped preserve swallowing function and improved self-reported swallowing outcomes compared to usual care. Consistent with these findings, a systematic review highlighted that music therapy programs especially those incorporating singing can yield benefits across motor, communication, and swallowing domains in Parkinson's disease, suggesting their potential as a complementary rehabilitation strategy.²⁰

Mechanistically, music therapy engages vocal-respiratory tasks that overlap with the physiology of swallowing. Singing involves sustained phonation and

pitch modulation, which strengthen oral motor control, stimulate the suprahyoid and laryngeal muscles to facilitate hyolaryngeal excursion, and enhance breath-swallow coordination and glottal closure. These mechanisms mirror some effects of conventional speech or voice therapy; however, music therapy distinguishes itself by embedding exercises within rhythm, melody, and familiar songs, thereby fostering emotional engagement and long-term adherence.¹⁸⁻²⁰ Emerging studies have begun to explore the integration of speech and music therapy for dysphagia in patients with Parkinson's disease, reflecting a growing interest in multidisciplinary approaches.^{21,22} For example, a study by Funderburke investigated an 8-week interdisciplinary choral singing therapy (ICST) program that combined music and voice therapy.²¹ Participants' swallowing evaluations improved, showing increases in angle of elevation and magnitude of displacement. Similarly, a study by Mohseni *et al.*²² investigated a 4-week telerehabilitation program that integrated speech and music therapy for dysphagia in patients with Parkinson's disease. The combined therapy group demonstrated greater improvements on the Swallowing Disturbance Questionnaire (SDQ) and Dysphagia Handicap Index (DHI) compared to groups receiving speech or music therapy alone.

While early reports suggest potential benefits of such combined interventions, the effectiveness of integrating speech therapy with music therapy for swallowing in patients with Parkinson's disease has not yet been systematically evaluated. To address this gap, the objective of this systematic review was to investigate the effectiveness of integrating speech and music therapy on swallowing outcomes in this population.

The review question was: "What is the effectiveness of speech therapy integrated with music therapy on swallowing outcomes in patients with Parkinson's disease?" The findings aim to provide an up-to-date synthesis of the existing evidence, supporting clinical decision-making and encouraging interdisciplinary collaboration to optimize patient care.

Method

This study was registered in PROSPERO (CRD420251118370) and performed according to PRISMA.²³

Data sources and searches

The literature search was performed by two independent authors (N.W and V.B). The four electronic databases included PubMed, CINAHL Complete, the Cochrane Library, and Google Scholar. A hand search of the reference list of related articles was performed to identify any additional eligible studies. A systematic search was conducted across all databases from September to October 2024 to identify articles published between 2010 and 2024. All studies were published in English language.

A range of search terms was employed and applied consistently across all databases. These terms included: ("Parkinson's disease") AND ("dysphagia" OR "swallowing impairment") AND ("speech therapy") AND ("music therapy") AND ("swallowing").

Inclusion and exclusion criteria

Table 1 shows the Participant, Intervention, Comparison, Outcome, and Study design (PICOs) frameworks that were used for selection criteria.

Table 1. Inclusion and exclusion criteria.

PICOS	Inclusion criteria	Exclusion criteria
Population	Patients who were diagnosed with Parkinson's disease at any stage of disease progression and severity and patients who had dysphagia of any severity.	Patients who were with non-parkinsonian conditions and without dysphagia.
Intervention	Speech therapy integrated with music therapy	Speech therapy or music therapy alone as a primary intervention.
Comparison	Studies with and without a comparative group were considered, such as music therapy or speech therapy alone or without intervention.	N/A
Outcome	Swallowing-related outcomes, as evaluated by instrumental assessment and/or functional scores.	Swallowing-related outcomes were not considered as primary outcomes.
Study design	Randomised and non-randomised studies.	Editorials, opinions and commentaries, and qualitative studies

Data extraction

Two independent authors (NW and VB) screened titles and abstracts of the records identified through the searches described above. The results from the searches were exported into the industry standard bibliographic tool Endnote™ to merge search results from different databases, and duplicates were removed. Once the initial results list was finalized, two authors (NW and VB) obtained full-text copies of all the remaining studies that fulfilled the listed inclusion criteria. They independently assessed the studies based on the inclusion criteria and decided whether to include or exclude studies. We resolved any disagreements through discussion, but when consensus could not be reached, a third reviewer (ES) was consulted, and her decision was final.

The main characteristics of the included studies were extracted by the two independent authors (NW and VB) using a designed template. We resolved any disagreements through discussion, but when consensus could not be reached, a third reviewer (ES) was consulted, and her decision is final. Data were extracted on study characteristics (author, year, country, type of study, and sample size), patient characteristics (diagnostic, age, and gender), intervention (type of intervention and comparator groups), and outcome measures (measurements and all swallow related outcomes).

Quality assessment

The quality of the studies included in this review were evaluated using the JBI critical appraisal tools according to research type. The two independent authors (NW and VB) reviewed the methodological quality of the included studies. Any disagreement was resolved by consensus, and whenever this was not possible, a third reviewer (ES) was consulted, whose decision was final.

The JBI quasi-experimental studies checklist is made up of nine items: certainty of cause and effect, pre-homogeneity verification, exposure to the same environment outside of the intervention, presence or absence of a control group, pre- and post-intervention effect measures, description of dropouts, equivalence of outcome measures, appropriateness of outcome variable measures, and statistical analysis methods. For each item, the checklist assigned a score of 1 to “yes” and 0 to “unclear,” “no,” and “not applicable”.²⁴

Table 2 shows the quasi-experimental study that were appraised using the JBI tool.²⁴ The quality assessment score for quasi-experimental study was 4 out of 9 (high risk). The quasi-experimental design of this study is vulnerable to selection bias, owing to the lack of a control group.

Table 2. The JBI critical appraisal checklist for quasi-experimental study.

JBI critical appraisal checklist for quasi-experimental study	Funderburke ²³
Is it clear in the study what is the “cause” and what is the “effect” (i.e., there is no confusion about which variable comes first)?	Y
Was there a control group?	N
Were the participants included in any comparisons similar?	NA
Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	NA
Were there multiple measurements of the outcome both pre- and post-intervention/ exposure?	Y
Were the outcomes of participants included in any comparisons measured in the same way?	NA
Were outcomes measured in a reliable way?	Y
Was follow-up complete and if not, were differences between groups in terms of their follow-up adequately described and analyzed?	N
Was appropriate statistical analysis used?	Y
Overall appraisal	4/9 (High risk)

Note: Y: yes, N: no, NA: not applicable.

The JBI RCT studies checklist is made up of 13 items: randomization, allocation concealment, pre-homogeneity verification, blinding (participants, intervenors, and assessors), identical conditions other than experimental treatment, description of dropouts, analysis based on randomization, equivalence of outcome measures, appropriateness of outcome variable measures and statistical analysis methods,

and appropriateness of the study design. For each item, the checklist assigned a score of 1 to “yes” and 0 to “unclear,” “no,” and “not applicable”.²⁵

Table 3 shows the critical appraisal for the randomized clinical trials that were assessed using the JBI tool.²⁵ The quality assessment score for RCT study was 11 out of 13 (low risk).

Table 3. The JBI critical appraisal checklist for randomized controlled trials.

JBI critical appraisal checklist for randomized controlled trials	Mohseni et al. ²⁵
Was true randomization used for assignment of participants to treatment groups?	Y
Was allocation to treatment groups concealed?	Y
Were treatment groups similar at the baseline?	Y
Were participants blind to treatment assignment?	Y
Were those delivering treatment blind to treatment assignment?	N
Were outcomes assessors blind to treatment assignment?	N
Were treatment groups treated identically other than the intervention of interest?	Y
Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?	Y
Were participants analyzed in the groups to which they were randomized?	Y
Were outcomes measured in the same way for treatment groups?	Y
Were outcomes measured in a reliable way?	Y
Was appropriate statistical analysis used?	Y
Was the trial design appropriate, and any deviations from the standard RCT design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial?	Y
Overall appraisal	11 (Low risk)

Data analysis

A descriptive analysis of the data was conducted. The researchers did not perform analysis of subgroups or subsets. Meta-analysis of the studies was not undertaken due to the heterogeneity of the interventions and outcome measures employed in the studies. This makes it challenging to integrate the data in a meaningful way and perform a meta-analysis.

Results

Search results

Figure 1 shows the PRISMA flowchart of the study. A comprehensive literature search in electronic databases (N=34,128) and a hand search (N=13) yielded 34,141 studies. After duplicates were removed, 14,907 studies remained and were kept for title and abstract review. Then, 14,894 studies were excluded

after screening due to factors such as unrelated studies (N=11,778), non-English language (N=655), and other considerations (N=2,461). Thereafter, 13 studies were assessed for full-text articles for eligibility, and 11 studies were excluded for reasons such as not integrating speech and music (N=9) or not focusing on swallowing in Parkinson's disease patients (N=2). Consequently, the review included the remaining two studies.

Table 4 shows study characteristics included in the study. Two of the studies included in this review are clinical trials, one was a quasi-experimental study,²¹ and one was a randomized study.²² Studies were published, one in 2012²¹ and another one in 2023.²² Of the total studies, one was conducted in the USA,²¹ and one in Iran, West Asia.²²

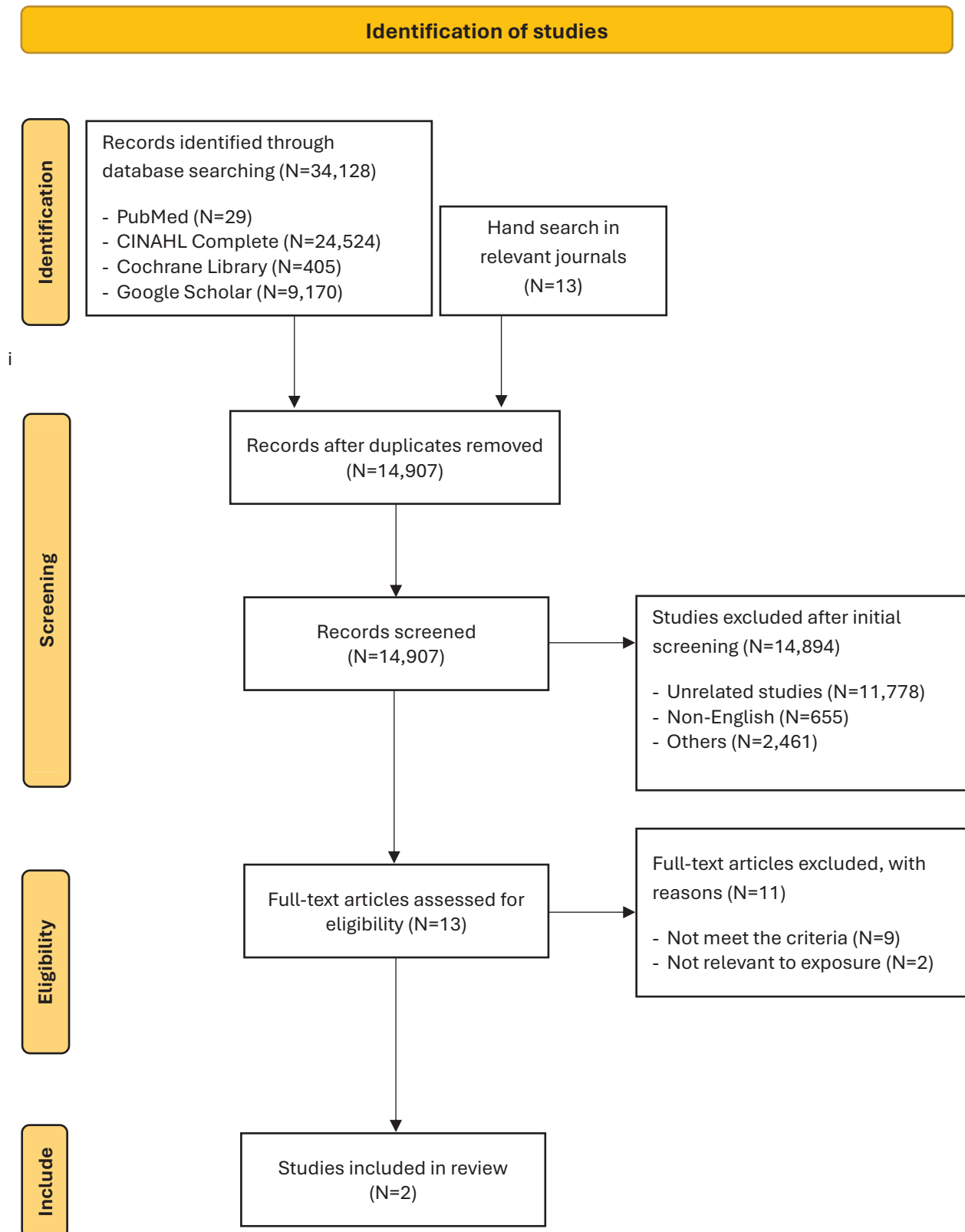


Figure 1. Methodology flowchart.

Table 4. Included studies.

Study/ Year/ Country	Study design	Participant	Interventions	Control	Duration	Interventionist	Measurements on swallowing function	Outcomes
Funder burke ²¹ / 2012 / USA	Quasi- experimental design	- Three male patients with idiopathic Parkinson's disease - Ages: 67 and 85 years - Patients with Parkinson's disease being at stages 2.5 or better based on the H&Y scale. - Patients had been on a stable regimen of antiparkinsonian and psychotropic medications for 30 days prior to participation.	ICST	No	8 sessions for 8 weeks (2.5-3 hours per session)	Speech therapist	- Video fluoroscopy, utilizing the modified barium swallow study (MBS) - Swallowing quality of life questionnaire (SWAL-QOL)	- A choral singing program, integrating speech therapy and music therapy, may lead to positive changes in swallowing measures for individuals with Parkinson's disease. - Improvements were noted in swallowing evaluations, with increases in angle of elevation and magnitude displacement for participants. - Therapeutic benefits can occur even with non-swallowing specific activities, highlighting the importance of context in motor movement rehabilitation.

Table 4. Included studies. (Continue)

Study/ Year/ Country	Study design	Participant	Interventions	Control	Duration	Interventionist	Measurements on swallowing function	Outcomes
Mohseni et al. ²² / 2023 / Iran	RCT	- Thirty-three patients with idiopathic Parkinson's disease - 25 men and 8 women with complaints of swallowing impairment - Mean age, 58.88 years - Patients with Parkinson's disease being at stages 1 to 2 (mild) based on the H&Y scale. - Patients were in the "on-state" of the medication cycle, which typically occurs one hour after medication.	Combination therapy (speech therapy + music therapy)	- Speech therapy - Music therapy	12 tele-rehabilitation sessions for 4 weeks (1 hour per session)	Speech therapist (to perform speech exercises) and a music and singing specialist (to perform singing exercises)	- Dysphagia handicap index (DHI) - Swallowing disturbance questionnaire (SDQ)	- Significant improvements in swallowing function were observed across all treatment groups, with the combination therapy group demonstrating the greatest benefits. - The combination therapy group achieved superior outcomes compared with both conventional speech therapy and music therapy groups on the SDQ and DHI scores. - These improvements were sustained at a 3-month follow-up, indicating lasting therapeutic effects. - Overall, the findings suggest that both speech therapy and combination therapy are effective in reducing dysphagia symptoms in patients with Parkinson's disease, with combination therapy offering the most pronounced benefits.

Thirty-six participants included in the study were patients with idiopathic Parkinson's disease who were clinically evaluated and ultimately diagnosed by a neurologist.^{21,22} The number of participants with Parkinson's disease included in each study was 3 in one study²¹ and 33 in another one.²² The total number of patients included in the study was 36, comprising 28 males and 8 females.^{21,22}

Disease severity was characterized using the Hoehn and Yahr (H&Y) scale, which included subjects with a score of 1-2²² and 2.5,²¹ reflecting the mild functional disability. Both studies recorded information about the participants' medication cycle during assessment or treatment. In one study, the patients were in the "on-state" of the medication cycle, which typically occurs one hour after medication.²² In another study, patients had been on a stable regimen of antiparkinsonian and psychotropic medications for 30 days prior to participation.²¹

A total of 2 studies reported the effect of speech therapy in combination with music therapy.^{21,22} Interventions were heterogeneous across the included studies. One study was interdisciplinary choral singing therapy (ICST), including vocal exercise and choral singing.²¹ Another study was conventional speech therapy (LSVT therapy and vocal exercises) combined with music therapy (motor, breathing, vocal, and singing exercises).²² In one study, speech therapy in combination with music therapy was compared to speech therapy or music therapy alone,²² while the remaining study was without a comparative group.²¹

The intervention duration in one study was 8 weeks and was conducted by a speech therapist.²¹ Another study was 4 weeks, and a speech therapist contributed to the speech intervention, while a music therapist contributed to the music intervention.²²

The included studies assessed different assessments but focused on domains directly related to swallowing outcomes. One study used videofluoroscopy, utilizing the MBS, and self-reported outcomes were measured using the SWAL-QOL.²¹ Another study used DHI (functional, physical, and emotional sub-tests, and as total score) and SDQ scores.²²

A study by Funderburke²¹ demonstrated that a choral singing program, integrating speech therapy and music therapy, may lead to positive changes in swallowing measures for individuals with Parkinson's disease. The findings showed that swallowing function increased the angle of elevation and amplitude of hyoid bone displacement during three consecutive swallows of 10 ml of thin liquid and pudding-thick barium. Although no statistically significant improvements were observed in SWAL-QOL scores, slight numerical increases were noted in selected subscales such as communication and fear of eating. These subjective trends, while limited by the small sample size and short training duration, were directionally consistent with

the physiological gains observed. Therapeutic benefits can therefore occur even with non-swallowing-specific activities, highlighting the importance of context in motor movement rehabilitation.

A study by Mohseni *et al.*²² demonstrated that a telerehabilitation program combining speech therapy and music therapy significantly improved swallowing functions in patients with Parkinson's disease. The findings showed that the combination therapy group did better on the SDQ and all its sub-tests (functional, physical, and emotional), as well as the total score of the DHI. They also did better on the SDQ score than the two other groups that only received speech therapy or music therapy. This suggests that the combined approach is more effective in addressing the multifaceted nature of dysphagia in Parkinson's disease. The study highlighted that the combination therapy group outperformed the other groups in all sub-tests and the total score of DHI, indicating a comprehensive improvement in swallowing function, including functional, physical, and emotional aspects. The interventions maintained their improvements during a 3-month follow-up, demonstrating their lasting effects.

Discussion

To the best of our knowledge, this was the first systematic review to investigate the effectiveness of integrating speech therapy with music therapy on swallowing outcomes in patients with Parkinson's disease.

Based on our findings, it is not possible to determine with certainty which types of speech therapy and music therapy are most effective for improving swallowing function in patients with Parkinson's disease, largely due to the heterogeneity of the included studies. There have been only two studies that have focused on the integration of speech therapy and music therapy to improve swallowing function in patients with Parkinson's disease.^{21,22} Nevertheless, our review indicates that the combined use of speech therapy and music therapy, as a non-pharmacological approach, provides meaningful benefits for swallowing outcomes. These findings are generally consistent with previous evidence supporting the effectiveness of speech therapy alone¹⁴⁻¹⁷ and music therapy alone¹⁸ in improving swallowing function in patients with Parkinson's disease.

Both included studies provide evidence that speech therapy even when primarily targeting communication can positively influence swallowing mechanisms in individuals with Parkinson's disease. In Funderburke's study,²¹ structured vocal exercises such as lip buzzing, glissandos, messa di voce, and articulation practice were incorporated to improve respiratory-phonatory coordination, vocal intensity, and articulatory precision. These tasks engaged the tongue, lips, jaw, and submental muscles, contributing

to oral bolus formation and propulsion, and ultimately supporting swallowing physiology. Similarly, Mohseni *et al.*²² reported that conventional speech therapy adapted from LSVT principles including sustained vowels, pitch variation, and loudness training-significantly improved swallowing outcomes when delivered alone or in combination with music therapy. The program emphasized high effort phonatory tasks, which reinforced respiratory drive, glottal closure, and submental muscle activation, thereby supporting oral bolus propulsion and airway protection.

These findings align with the broader literature on intensive speech therapy, particularly Lee Silverman Voice Treatment (LSVT LOUD®), which has been shown to improve both speech and swallowing outcomes in individuals with Parkinson's disease. Unlike traditional multifocus therapies, LSVT emphasizes high-effort phonation and motor learning principles, resulting in increased respiratory drive, glottal closure, and hyolaryngeal excursion.¹³⁻¹⁶ Importantly, LSVT's efficacy has been attributed to principles of motor learning and activity-dependent neuroplasticity, which suggest that intensive vocal training can induce long-term adaptive changes in shared neural pathways involved in both speech and swallowing.²⁶⁻²⁸

Although neither of the included studies directly applied the LSVT protocol, both incorporated interventions grounded in the same principle of intensive, high-effort vocalization. In Funderburke's study,²¹ this was delivered through ICST, while in Mohseni *et al.*²² it was implemented as an LSVT-adapted program. These approaches share a common mechanism that provides a biological rationale for the observed cross-system effects, supporting the view that intensive speech therapy whether delivered through structured vocal drills, ICST, or other high-effort phonatory formats can indirectly enhance swallowing safety.

Beyond speech therapy, singing represents a novel approach that leverages the principles of neuroplasticity, suggesting that musical stimuli can activate neural processes to influence non-musical behaviors such as swallowing. The notion that singing may enhance swallowing function given that respiration, phonation, and articulation engage overlapping neuroanatomical substrates-supports the theoretical basis for music therapy in this context. The shared neural networks involved in singing and speaking further reinforce the auditory-motor feedback loop that singing specifically activates in the brain.²⁹ Swallowing and vocalization both require coordinated activation of muscles in the upper airway, including the oral, pharyngeal, laryngeal, and respiratory areas.³⁰ This physiological rationale is supported by Funderburke's study,²¹ in which the choral singing component of ICST produced measurable improvements in hyolaryngeal excursion on videofluoroscopy, indicating a direct physiological benefit of singing-based training on swallowing safety.

Remarkably, music may also enhance enjoyment.

The participatory and pleasurable aspects of music therapy have been shown to improve patient motivation and adherence to rehabilitation programs.²² This is particularly critical in managing chronic illnesses such as Parkinson's disease, where long-term benefits depend on sustained therapy participation.³¹ Specifically, choral singing has been incorporated into therapeutic programs to help individuals with Parkinson's disease manage consequences of the condition, including social isolation, low mood, and communication difficulties.³² Music therapy in Parkinson's disease has been shown to improve not only voice and swallowing, but also emotional and social functioning. However, extended session durations may result in fatigue, reduced concentration, and decreased motivation.²¹ Therefore, collaboration between speech therapists and music therapists is essential to determine appropriate session lengths tailored to the needs of individuals with Parkinson's disease.

In summary, our findings support the notion that, although speech therapy and music therapy are not primarily designed to rehabilitate swallowing, their training paradigms can indirectly enhance swallowing physiology. These results underscore the potential value of implementing integrated speech and music therapy programs more broadly in future rehabilitation efforts for individuals with Parkinson's disease.

Practical implications

Collaboration between speech therapists and music therapists is vital, as their complementary expertise optimizes patient care. In one study, the integrated intervention was delivered solely by a speech therapist,²¹ while in another, the speech therapist provided the speech therapy component, and the music therapist delivered the music therapy component.²² Their joint involvement is crucial for promoting safe swallowing practices and improving quality of life in patients with Parkinson's disease. We further suggest that the development of standardized speech therapy-music therapy protocols is needed to enhance replication and offer clinicians more precise practice guidance. Since both approaches are safe, effective, and non-pharmacological, they should receive more therapeutic recognition and promotion.

Limitations

This systematic review has several limitations that should be acknowledged. Firstly, the final review included only two studies with a combined sample of 36 participants, which limited the strength of the findings. In addition, the quasi-experimental study carried a high risk of selection bias due to the absence of a control group. Although the results are encouraging, further research employing RCT designs is needed to identify effective intervention types that can support the clinical integration of speech therapy and music therapy for patients with Parkinson's disease. Furthermore,

although integrating speech therapy with music therapy shows promising effects on swallowing in individuals with Parkinson's disease, the current evidence is too limited to draw firm conclusions, highlighting the need for further investigation.

Conclusion

In conclusion, based on our findings, it is not yet possible to determine the specific types of speech therapy interventions that are integrated with music therapy for patients with Parkinson's disease, largely due to the heterogeneity of the included studies. Nevertheless, the evidence indicates that combining speech therapy with music therapy shows promise for improving swallowing function in this population. Such an interdisciplinary approach has the potential to enhance rehabilitation outcomes and improve quality of life. Further research is required to establish standardized speech therapy–music therapy protocols that can strengthen the evidence base and support broader clinical implementation.

Ethical approval

This study had received ethical approval from The Ethics Committee, Faculty of Associated Medical Sciences, Chiang Mai University (CMU), Thailand (AMSEC-67EM-038).

Funding

This study received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflicts of Interest

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

CRedit authorship contribution statement

Natwipa Wanicharoen: conceptualization, data curation, formal analysis, investigation, methodology, project administration, supervision, visualization, writing: original draft, writing: review and editing; **Vich Boonrod:** conceptualization, data curation, formal analysis, investigation, methodology, writing: original draft; **Erin Songdechagraiwud:** data curation, formal analysis; **Palita Yaemsuan:** visualization, writing: review and editing, correspondence.

References

- [1] Marras C, Beck JC, Bower JH, et al. Prevalence of Parkinson's disease across North America. *NPJ Parkinsons Dis.* 2018; 4: 21. doi:10.1038/s41531-018-0058-0.
- [2] Parkinson's disease: Causes, symptoms, and treatments. National Institute of Aging. 2022. <https://www.nia.nih.gov/health/parkinsons-disease/parkinsons-disease-causes-symp-toms-and-treatments>. (accessed Dec 23, 2024).
- [3] Durcan R, Wiblin L, Lawson RA, et al. Prevalence and duration of non-motor symptoms in prodromal Parkinson's disease. *Eur J Neurol.* 2019; 26(7): 979-85. doi:10.1111/ene.13919.
- [4] Sung HY, Kim JS, Lee KS, et al. The prevalence and patterns of pharyngoesophageal dysmotility in patients with early-stage Parkinson's disease. *Mov Disord.* 2010; 25(14): 2361-8. doi:10.1002/mds.23290.
- [5] Ertekin C, Tarlaci S, Aydogdu I, et al. Electrophysiological evaluation of pharyngeal phase of swallowing in patients with Parkinson's disease. *Mov Disord.* 2002; 17(5): 942-9. doi:10.1002/mds.10240.
- [6] Tjaden K. Speech and swallowing in Parkinson's disease. *Top Geriatr Rehabil.* 2008; 24(2): 115-26. doi:10.1097/01.TGR.0000318899.87690.44.
- [7] Patel B, Legacy J, Hegland KW, Okun MS, Herndon NE. A comprehensive review of the diagnosis and treatment of Parkinson's disease dysphagia and aspiration. *Expert Rev Gastroenterol Hepatol.* 2020; 14(6): 411-24. doi:10.1080/17474124.2020.1769475.
- [8] Kalf JG, de Swart BJ, Bloem BR, Munneke M. Prevalence of oropharyngeal dysphagia in Parkinson's disease: a meta-analysis. *Parkinsonism Relat Disord.* 2012; 18(4): 311-5. doi:10.1016/j.parkreldis.2011.11.006.
- [9] Gong S, Gao Y, Liu J, et al. The prevalence and associated factors of dysphagia in Parkinson's disease: A systematic review and meta-analysis. *Front Neurol.* 2022; 13: 1000527. doi:10.3389/fneur.2022.1000527.
- [10] Carneiro D, das Graças Wanderley de Sales Coriolano M, Belo LR, de Marcos Rabelo AR, Asano AG, Lins OG. Quality of life related to swallowing in Parkinson's disease. *Dysphagia.* 2014; 29(5): 578-82. doi:10.1007/s00455-014-9548-3.
- [11] Chan HF, Ng ML, Kim H, Kim DY. Swallowing-related quality of life among oral-feeding Chinese patients with Parkinson's disease - a preliminary study using Chinese SWAL-QOL. *Disabil Rehabil.* 2022; 44(7): 1077-83. doi:10.1080/09638288.2020.1791979.
- [12] Suttrup I, Warnecke T. Dysphagia in Parkinson's disease. *Dysphagia.* 2016; 31(1): 24-32. doi:10.1007/s00455-015-9671-9.
- [13] Robertson C, Thomson F. Speech therapy in Parkinson's disease: a study of the efficacy and long-term effects of intensive treatment. *Br J Disord Commun.* 1984; 19(3): 213-24. doi:10.3109/13682828409029837.
- [14] El Sharkawi A, Ramig L, Logemann JA, Pauloski BR, Rademaker AW, Smith CH, et al. Swallowing and voice effects of Lee Silverman Voice Treatment (LSVT®): a pilot study. *J Neurol Neurosurg Psychiatry.* 2002; 72(1): 31-6.

- [15] Russell JA, Ciucci MR, Connor NP, Schallert T. Targeted exercise therapy for voice and swallow in persons with Parkinson's disease. *Brain Res.* 2010; 1341: 3-11. doi:10.1016/j.brainres.2010.03.029.
- [16] Miles A, Jardine M, Johnston F, de Lisle M, Friary P, Allen J. Effect of Lee Silverman Voice Treatment (LSVT LOUD®) on swallowing and cough in Parkinson's disease: A pilot study. *J Neurol Sci.* 2017; 383: 180-7. doi:10.1016/j.jns.2017.11.015.
- [17] Baijens LW, Speyer R. Effects of therapy for dysphagia in Parkinson's disease: systematic review. *Dysphagia.* 2009; 24(1): 91-102. doi:10.1007/s00455-008-9180-1.
- [18] Stegemöller EL, Hibbing P, Radig H, Wingate J. Therapeutic singing as an early intervention for swallowing in persons with Parkinson's disease. *Complement Ther Med.* 2017; 31: 127-33. doi:10.1016/j.ctim.2017.03.002.
- [19] Yeo MS, Hwang J, Lee HK, Kim SJ, Cho SR. Therapeutic singing-induced swallowing exercise for dysphagia in advanced-stage Parkinson's disease. *Front Neurol.* 2024; 15: 1323703. doi:10.3389/fneur.2024.1323703.
- [20] MachadoSotomayorMJ, Arufe-GiráldezV, Ruíz-Rico G, Navarro-Patón R. Music therapy and Parkinson's disease: A systematic review from 2015-2020. *Int J Environ Res Public Health.* 2021; 18(21): 11618. doi: 10.3390/ijerph182111618.
- [21] Funderburke SK. Effects of interdisciplinary choral singing on the voice and swallowing function of individuals with Parkinson's disease [master's thesis]. Gainesville: University of Florida; 2012.
- [22] Mohseni Z, Saffarian A, Mohamadi R, Abolghasemi J, Habibi SA. Effect of conventional speech therapy combined with music therapy on swallowing in patients with Parkinson's disease (Telerehabilitation): a randomized-controlled trial. *k. Middle East J Rehabil Health Stud* 2023;10(1): e131572. doi:10.5812/mejrh-131572.
- [23] Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ.* 2021; 372: n71. doi:10.1136/bmj.n71.
- [24] Barker TH, Habibi N, Aromataris E, et al. The revised JBI critical appraisal tool for the assessment of risk of bias for quasi-experimental studies. *JBI Evid Synth.* 2024; 22(3): 378-88. doi:10.11124/JBIES-23-00268.
- [25] Barker TH, Stone JC, Sears K, et al. The revised JBI critical appraisal tool for the assessment of risk of bias for randomized controlled trials. *JBI Evid Synth.* 2023; 21(3): 494-506. doi:10.11124/JBIES-22-00430.
- [26] Kleim JA, Jones TA. Principles of experience-dependent neural plasticity: implications for rehabilitation after brain damage. *J Speech Lang Hear Res.* 2008; 51(1): S225-S239. doi:10.1044/1092-4388(2008/018).
- [27] Ramig L, Halpern A, Spielman J, Fox C, Freeman K. Speech treatment in Parkinson's disease: Randomized controlled trial (RCT). *Mov Disord.* 2018; 33(11): 1777-91. doi:10.1002/mds.27460.
- [28] Ramig LO, Sapis S, Countryman S, et al. Intensive voice treatment (LSVT) for patients with Parkinson's disease: a 2 year follow up. *J Neurol Neurosurg Psychiatry.* 2001; 71(4): 493-8. doi:10.1136/jnnp.71.4.493.
- [29] Ozdemir E, Norton A, Schlaug G. Shared and distinct neural correlates of singing and speaking. *Neuroimage.* 2006; 33(2): 628-35. doi:10.1016/j.neuroimage.2006.07.013.
- [30] Jacob P, Kahrilas PJ, Logemann JA, Shah V, Ha T. Upper esophageal sphincter opening and modulation during swallowing. *Gastroenterology.* 1989; 97(6): 1469-78. doi:10.1016/0016-5085(89)90391-0.
- [31] Winiker K, Kertscher B. Behavioural interventions for swallowing in subjects with Parkinson's disease: A mixed methods systematic review. *Int J Lang Commun Disord.* 2023; 58(4): 1375-1404. doi:10.1111/1460-6984.12865.
- [32] Fogg-Rogers L, Buetow S, Talmage A, et al. Choral singing therapy following stroke or Parkinson's disease: an exploration of participants' experiences. *Disabil Rehabil.* 2016; 38(10): 952-62. doi:10.3109/09638288.2015.1068875.