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Review article

Evidence-Based Approaches to Swallowing Therapy in Post-Stroke Dysphagia: A Review of Current Research

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Abstract

Dysphagia is a common complication following stroke and can have serious consequences for patients' nutritional status, respiratory health, and overall quality of life. Swallowing exercises have emerged as a rehabilitative approach aimed at restoring swallowing function through neuromuscular stimulation and the facilitation of neuroplasticity. This literature review aims to evaluate the effectiveness of various swallowing exercise interventions in improving swallowing function among adult stroke patients with dysphagia, based on randomised controlled trials (RCTs) conducted between 2020 and 2025. The review was structured using the PICO framework and adhered to the PRISMA guidelines. Relevant studies were retrieved from PubMed, ScienceDirect, and Google Scholar using the following search terms: ("swallowing exercise" OR "swallowing therapy") AND "stroke" AND "dysphagia" AND "randomised controlled trial." A total of 282 articles were identified, of which 10 met the inclusion criteria and were analysed in depth. Various swallowing interventions, including Neuromuscular Electrical Stimulation (NMES), Transcranial Direct Current Stimulation (tDCS), traditional swallowing exercises, and oral neuromuscular training, demonstrated significant improvements in swallowing function. These were evidenced by outcome measures such as the Functional Oral Intake Scale (FOIS), Penetration Aspiration Scale (PAS), Swallowing Quality of Life Questionnaire (SWAL-QOL), and others. Swallowing exercises are effective in supporting the recovery of post-stroke dysphagia. These interventions are recommended as integral components of structured dysphagia rehabilitation programs.

INTRODUCTION

Stroke is one of the leading causes of disability and mortality worldwide. According to data from the World Stroke Organization (WSO), more than 13 million people globally experience a stroke each year, with over 5 million of these cases resulting in death.[1] A serious post-stroke complication that is often overlooked but significantly affects patients' quality of life is dysphagia, or difficulty in swallowing. The prevalence of dysphagia among stroke patients is notably high, reported to range between 50% and 80%, particularly during the acute and subacute phases. Post-stroke dysphagia affected 21.1% of patients, of which 15.1% experienced both dysphagia

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and hemiparesis and 6.0% presented with dysphagia only.[2] Dysphagia occurs frequently after a stroke, affecting up to 78% of patients.[3] This condition can lead to malnutrition, dehydration, aspiration pneumonia, and is associated with prolonged hospital stays and an increased risk of mortality.[2,4]

Post-stroke dysphagia results from neurological impairments affecting the sensorimotor system of the swallowing muscles, particularly in the oropharyngeal and laryngeal regions. Brain damage involving the cerebral cortex, brainstem, or neural pathways responsible for the swallowing process can reduce the swallowing process can reduce the suprahyoid and infrahyoid muscles contractile ability and impair the swallowing reflex's coordination.[5] This condition compromises the protective function of the airway and increases the risk of aspiration.. The recovery of dysphagia is believed to be partly due to neuroplasticity—the brain's ability to reorganize its functions, structures, and neural connections in response to internal and external stimuli.[3] Therefore, effective and structured rehabilitative interventions are essential to address post-stroke dysphagia.

Compensatory strategies focus on reducing the risk of aspiration by altering diet consistency, adjusting feeding posture, or modifying the route of nutritional intake. In contrast, rehabilitative interventions involve exercises designed to restore oromotor and swallowing function. Advancements in the understanding of neurophysiological mechanisms underlying neurogenic dysphagia have contributed to the emergence of innovative therapeutic approaches, such as central and peripheral neurostimulation techniques, which aim to facilitate the reorganization of the neural networks responsible for swallowing.[3] Several forms of therapeutic approaches include, among others: swallowing exercise, oral neuromuscular training, Transcranial direct current of stimulation (TDCS), *Shaker Exercise*, *Chin Tuck Against Resistance (CTAR)*, *Effortful Swallow*, *Mendelsohn Maneuver*, *Expiratory Muscle Strength Training (EMST)*, and *Neuromuscular Electrical Stimulation (NMES)*.[6-7]

Clinical evidence indicates that swallowing exercises can lead to significant improvements in swallowing function among stroke patients. For instance, the use of Neuromuscular Electrical Stimulation (NMES) has been shown to significantly enhance swallowing function scores, such as the Gugging Swallowing Screen (GUSS), and reduce the incidence of aspiration.[8] Nevertheless, significant challenges remain in the implementation of swallowing exercise interventions. Variations in study design, sample size, evaluation methods, and therapy duration contribute to data heterogeneity and limit the generalizability of findings. Additionally, the shortage of trained healthcare professionals in dysphagia rehabilitation and limited access to advanced therapeutic equipment, such as neurostimulation devices, pose major barriers particularly in developing countries. Therefore, the selection of effective swallowing exercise interventions should take into account the availability of resources, the patient's capabilities, and the severity of the dysphagia.

This literature review aims to evaluate the effectiveness of various types of swallowing therapy in restoring swallowing function in stroke patients with dysphagia. The review outlines the most effective therapeutic exercises, the outcomes achieved, and their potential for clinical implementation. The findings are expected to provide a strong scientific foundation for healthcare professionals in selecting appropriate and evidence-based rehabilitation approaches for dysphagia management.

METHODS

This literature review was conducted as a systematic review to evaluate the

effectiveness of swallowing exercise interventions in stroke patients with dysphagia. The approach was guided by the PICO framework (Population, Intervention, Comparison, Outcome) and the reporting followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The **Population (P)** included adult patients who experienced either ischemic or haemorrhagic stroke and were diagnosed with dysphagia; the **Intervention (I)** involved swallowing exercises; the **Comparison (C)** was a control group receiving conventional care or no swallowing exercise intervention; and the **Outcome (O)** included improvements in swallowing function, better dysphagia assessment scores, reduced aspiration risk, and enhanced quality of life.

Relevant literature was retrieved from three major scientific databases: PubMed, ScienceDirect, and Google Scholar. The search used a combination of keywords: ("swallowing exercise" OR "swallowing therapy") AND ("stroke") AND ("dysphagia") AND ("randomized controlled trial"), limited to publications between 2020 and 2025, written in English, and available in full text.

Inclusion criteria consisted of original research articles employing a Randomized Controlled Trial (RCT) or Clinical Trial design, involving adult stroke patients with dysphagia (either ischemic or haemorrhagic), and assessing swallowing exercises either as a standalone intervention or in combination with other methods. Only full-text articles published in international scientific journals between 2020 and 2025 were considered.

RESULTS

Analysis of ten randomized controlled trials (RCTs) revealed that various types of swallowing exercises had a positive impact on the recovery of swallowing function in stroke patients with dysphagia. The most implemented interventions included regular swallowing rehabilitation, oral neuromuscular training, Transcranial Direct Current Stimulation (tDCS), and Neuromuscular Electrical Stimulation (NMES). These interventions were delivered in both hospital settings and rehabilitation facilities, with session durations ranging from 20 to 45 minutes daily over a period of 2 to 5 weeks.

Most studies reported significant improvements in several outcome measures, including the Water Swallow Test (WST), the Functional Oral Intake Scale (FOIS), the Penetration Aspiration Scale (PAS), the Mann Assessment of Swallowing Ability (MASA), the Swallowing Quality of Life Questionnaire (SWAL-QOL), and the National Institutes of Health Stroke Scale (NIHSS).

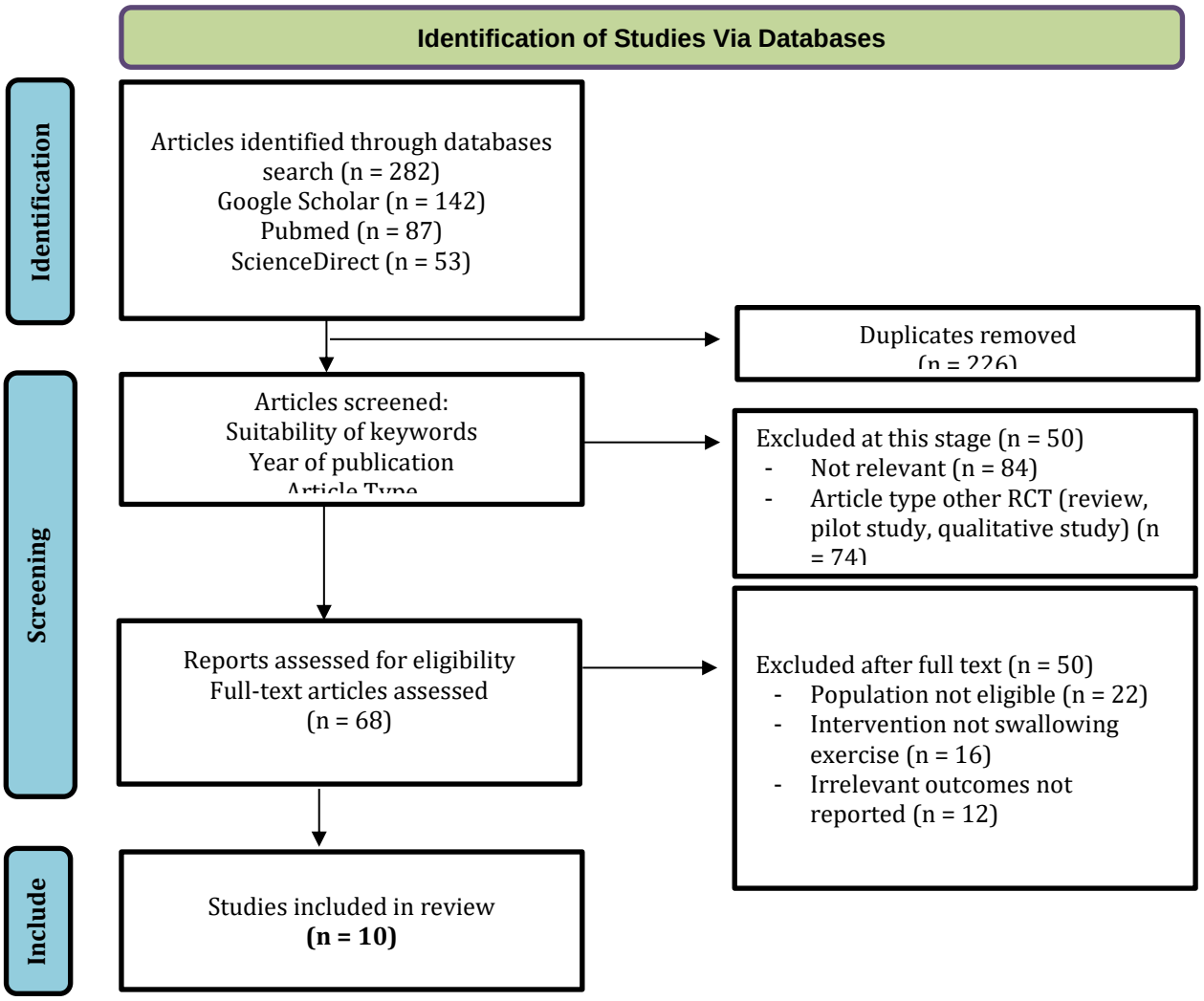

Figure 1.
PRISMA Flowchart

Table 1
Participant characteristics

Author/year/country	Designs	Participant		Intervention		Setting	Duration	Instrument / Outcomes
		IG	CG	IG	CG			
Jiongmei WanG, et al (2022), China[6]	Randomized controlled trial	30	30	Regular swallowing rehabilitation training plus vitamin c stimulation	Routine swallowing reha bilitation training,	Hospital	Once a day, each time lasts 30 minutes (2 weeks)	- Water swallow test - Video fluoroscopic swallowing study - Nourishment State Index - Immune Function Index
Sandeep Kumar, et al (2022), USA[4]	Randomized controlled trial	42 (3 groups)		Sham group, Low-dose tDCS, High-dose tDCS	-	Hospital	20 min twice daily	- The Functional Oral Intake Scale (FOIS) - Penetration aspiration scale (PAS)
Edyta Krajczy, et al (2020), Poland[9]	Randomized controlled trial	30	30	Dysphagia treatment and education about safe food and liquid consumption to patients and their caregivers	Education about safe food and liquid consumption to patients and their caregivers	Hospital stroke subunit	15 days	Swallowing reflex, coughing and voice quality, swallowing time, number of swallows, and SpO2 level
Ying Lu, et al (2021), China[10]	Randomized controlled trial	60 (3 groups)		TCM group, The Transcranial Direct Current (tDCS), TCM combined with tDCS	-	Hospital	30 minutes per treatment, for 30 consecutive days	- Water swallowing tests (WSTs) - Video fluoroscopic swallowing studies (VFSS) - functional magnetic resonance imaging (fMRI)
Hsiao-Jung Chen, et al (2020), Taiwan[11]	Randomized controlled trial	33	33	Oral health care 30 minutes before the swallowing training three times a week	Usual oral care	Hospital	3 weeks	- Functional Oral Intake Scale (FOIS) scores - Mini-Nutritional Assessment-Short Form (MNA-SF) scores - Nasogastric tube removal rates
Mei-Yun Liaw, et al (2021), Taiwan[12]	Randomized controlled trial	15	16	Respiratory muscle training and usual rehabilitation program	Usual rehabilitation program	Hospital	6 week	- Forced vital capacity (FVC) - Forced expiratory volume per second (FEV1) - The Barthel scale - FOIS scores

Author/year/country	Designs	Participant		Intervention		Setting	Duration	Instrument / Outcomes
		IG	CG	IG	CG			
Giselle D. Carnaby, et al (2021), Florida[13]	Randomized controlled trial	53		McNeill Dysphagia Therapy Program (MDTP) with adjunctive NMES	Usual care (UC) swallowing treatment	A rehabilitation facility	3 weeks (15 sessions)	- Clinical swallowing ability (MASA score) - Oral intake level (FOIS) - Modified barium swallow outcomes (dysphagia and aspiration) - Patient self-perception of swallowing ability - Body weight - Time to recover pre stroke diet - The occurrence of dysphagia–related health complications.
Patricia Hägglund, et al (2020), Sweden[14]	Prospective randomized open-label study	20	20	Oral neuromuscular training	Orofacial sensory-vibration stimulation	Hospital	Three times daily before eating (5 weeks)	- The swallowing rate (TWST) - Lip force - Swallowing function (VFS)
Sima Farpour, et al (2021), Iran[7]	A randomized, double-blind one	22	22	Transcranial direct current of stimulation (TDCS)	-	Stroke units of Hospital	20 min for five days (one session in a day)	- The Functional Oral Intake Scale (FOIS) - The Mann Assessment of Swallowing Ability (MASA) - The National Institute of Health Stroke Scale (NIHSS)
Melissa M. Howard . et al (2022), USA[5]	Randomized trial	16	15	Sensory NMES	Motor NMES	Acute rehabilitation facility	45 min	- Swallow functional assessment measure (FAM) - Dysphagia outcome severity scale (DOSS) - National outcome measurement system (NOMS) - Penetration aspiration scale (PAS) - Diet change - The swallowing quality of life questionnaire (SWAL-QOL)

DISCUSSION

Swallowing dysfunction (dysphagia) following stroke is a complex clinical issue requiring multifaceted rehabilitative strategies. From the literature reviewed, several distinct therapeutic themes emerged, each supported by empirical evidence and theoretical rationale. These themes include oral neuromuscular training, transcranial direct current stimulation (tDCS), neuromuscular electrical stimulation (NMES), and combined approaches such as Expiratory Muscle Strength Training (EMST) with Mendelsohn Maneuver.

Oral Neuromuscular Training

This intervention targets the oropharyngeal muscles responsible for bolus formation and propulsion. Wang et al. (2022) found that combining oral neuromuscular training with vitamin C stimulation significantly improved VFSS scores, indicating enhanced oromotor coordination and swallowing safety.[6] Similarly, a study reported improvements in lip strength and swallow timing using the TWST and VFSS, supporting the theory that sensorimotor stimulation can facilitate neuroplastic changes in the swallowing network.[14]

Transcranial Direct Current Stimulation (tDCS)

tDCS is a non-invasive neuromodulatory technique designed to enhance cortical excitability and promote neuroplasticity. Studies demonstrated significant improvements in FOIS and PAS scores among stroke patients receiving high-dose tDCS, highlighting its potential in restoring swallowing reflexes. These findings align with emerging neurorehabilitation theories that support cortical stimulation as a driver for functional recovery. However, the lack of standardized application protocols and limited provider training remain critical barriers to widespread implementation.[4,10]

Neuromuscular Electrical Stimulation (NMES)

Neuromuscular Electrical Stimulation (NMES) is another promising therapeutic approach. MES uses electrical impulses to activate muscles involved in the swallowing process. A study by Giselle D. Carnaby et al. (2021) demonstrated that the McNeill Dysphagia Therapy Program (MDTP), when combined with NMES, accelerated the recovery of pre-stroke dietary patterns and reduced dysphagia-related complications.[13,15] This suggests a synergistic effect, where NMES enhances the neuromuscular adaptation prompted by MDTP's functional exercises.

Combined Therapies: EMST and Mendelsohn Maneuver

Combination approaches address both respiratory and laryngeal deficits often observed in post-stroke patients. EMST strengthens expiratory musculature, while the Mendelsohn Maneuver increases laryngeal elevation duration. This combination improves airway protection and may reduce aspiration risk.

Despite consistent reports of therapeutic efficacy, several critical gaps and inconsistencies were identified. First, variability in protocols, studies employed differing durations (2–6 weeks) and frequencies (3x/week to 3x/day), complicating cross-study comparisons. This lack of standardization may lead to divergent outcomes even when using the same modality. Second, Assessment tool heterogeneity, tools such as VFSS, FOIS, PAS, and TWST were not uniformly applied, creating challenges in establishing universally accepted benchmarks of success. Third, theory-practice gap, while the theory of cortical reorganization

supports interventions like tDCS, practical implementation lags due to resource constraints and limited clinician training, especially in low-resource settings like Indonesia. Fourth, limited research on long-term outcomes, most studies focused on short-term gains, with few assessing the sustainability of functional improvements or cost-effectiveness.

Overall, evidence from 10 randomized controlled trials conducted between 2020 and 2025 supports the effectiveness of swallowing exercises in improving swallowing function among stroke patients. However, limitations such as small sample sizes and methodological variability highlight the need for further research using multicenter designs and standardized approaches. Combined methods, such as NMES integrated with conventional therapy, appear to be particularly promising, but require further investigation regarding their cost-effectiveness and feasibility in routine clinical practice.

CONCLUSION

Post-stroke dysphagia is a significant complication with wide-ranging implications for the morbidity and mortality of stroke patients. This literature review examined the effectiveness of various swallowing exercise methods, based on randomized controlled trials (RCTs), in improving swallowing function in stroke patients with dysphagia. The findings indicate that interventions such as Neuromuscular Electrical Stimulation (NMES), Transcranial Direct Current Stimulation (tDCS), and oral neuromuscular training can produce meaningful improvements across multiple swallowing function parameters, including FOIS and PAS scores, as well as overall quality of life. These interventions work by stimulating oromotor muscles and promoting neuroplasticity to restore the function of neural pathways involved in swallowing that have been impaired by stroke. It can be concluded that swallowing exercise therapy is an effective approach and should be systematically integrated into post-stroke dysphagia rehabilitation programs.

BIBLIOGRAPHY

1. Feigin VL, Brainin M, Norrving B, Martins S, Sacco RL, Hacke W, et al. World Stroke Organization (WSO): Global Stroke Fact Sheet 2022. International Journal of Stroke. 2022;17:18–29.
2. Bond VE, Doeltgen S, Kleinig T, Murray J. Dysphagia-related acute stroke complications: A retrospective observational cohort study. Journal of Stroke and Cerebrovascular Diseases. 2023;32.
3. Cheng I, Takahashi K, Miller A, Hamdy S. Cerebral control of swallowing: An update on neurobehavioral evidence. Journal of the Neurological Sciences. 2022;442.
4. Kumar S, Marchina S, Langmore S, Massaro J, Palmisano J, Wang N, et al. Fostering eating after stroke (FEASt) trial for improving post-stroke dysphagia with non-invasive brain stimulation. Scientific Reports. 2022;12:1–12.
5. Howard MM, Block ES, Mishreki D, Kim T, Rosario ER. The Effect of Sensory Level Versus Motor Level Electrical Stimulation of Pharyngeal Muscles in Acute Stroke Patients with Dysphagia: A Randomized Trial. Dysphagia. 2023;38:943–53.
6. Wang J, Chang E, Jiang Y. Effects of vitamin C stimulation on rehabilitation of dysphagia after stroke: a randomized trial. European Journal of Physical and Rehabilitation Medicine. 2022;58:558–64.
7. Farpour S, Asadi-Shekaari M, Borhani Haghighi A, Farpour HR. Improving Swallowing Function and Ability in Post Stroke Dysphagia: A

Randomized Clinical Trial. Dysphagia. 2023;38:330–9.

8. Lin Y, Wan G, Wu H, Shi J, Zhang Y, Chen H, et al. The sensitivity and specificity of the modified volume-viscosity swallow test for dysphagia screening among neurological patients. Frontiers in Neurology. 2022;13.

9. Krajczy E, Krajczy M, Luniewski J, Bogacz K, Szczegielniak J. Assessment of the effects of dysphagia therapy in patients in the early post-stroke period: A randomised controlled trial. Neurologia i Neurochirurgia Polska. 2019;53:428–34.

10. Lu Y, Zhou W, Lin Y, Du Y, Zhang X. The effects of traditional chinese medicine sensory stimulation combined with transcranial direct current stimulation on deglutition and related complications in stroke patients with dysphagia: A randomized trial. Annals of Palliative Medicine. 2021;10:6597–605.

11. Chen HJ, Chen JL, Chen CY, Lee M, Chang WH, Huang TT. Effect of an oral health programme on oral health, oral intake, and nutrition in patients with stroke and dysphagia in taiwan: A randomised controlled trial. International Journal of Environmental Research and Public Health. 2019;16:1–12.

12. Liaw MY, Hsu CH, Leong CP, Liao CY, Wang LY, Lu CH, et al. Respiratory muscle training in stroke patients with respiratory muscle weakness, dysphagia, and dysarthria - a prospective randomized trial. Medicine (United States). 2020;99:E19337.

13. Carnaby GD, LaGorio L, Silliman S, Crary M. Exercise-based swallowing intervention (McNeill Dysphagia Therapy) with adjunctive NMES to treat dysphagia post-stroke: A double-blind placebo-controlled trial. Journal of Oral Rehabilitation. 2020;47:501–10.

14. Hägglund P, Hägg M, Levring Jäghagen E, Larsson B, Wester P. Oral neuromuscular training in patients with dysphagia after stroke: a prospective, randomized, open-label study with blinded evaluators. BMC Neurology. 2020;20:1–10.

15. Huh JW, Park E, Min YS, Kim AR, Yang WJ, Oh HM, et al. Optimal placement of electrodes for treatment of post-stroke dysphagia by neuromuscular electrical stimulation combined with effortful swallowing. Singapore Medical Journal. 2020;61:487–91.