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This is the third in a series of eight guideline chapters that provide evidence-based recommendations for recovery from stroke and TIA in adults.

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Disclaimer

Introduction

The Stroke Foundation is a national charity that partners with the community to prevent, treat and beat stroke. We stand alongside stroke survivors and their families, healthcare professionals and researchers. We build community awareness and foster new thinking and innovative treatments. We support survivors on their journey to live the best possible life after stroke.

We are the voice of stroke in Australia and we work to:

- Raise awareness of the risk factors, signs of stroke and promote healthy lifestyles.
- Improve treatment for stroke to save lives and reduce disability.
- Improve life after stroke for survivors.
- Encourage and facilitate stroke research.
- Advocate for initiatives to prevent, treat and beat stroke.
- Raise funds from the community, corporate sector and government to continue our mission.

The Stroke Foundation has been developing stroke guidelines since 2002 and in 2017 released the fourth edition. In order for the Australian Government to ensure up-to-date, best-practice clinical advice is provided and maintained to healthcare professionals, the NHMRC requires clinical guidelines be kept current and relevant by reviewing and updating them at least every five years. As a result, the Stroke Foundation, in partnership with Cochrane Australia, have moved to a model of living guidelines, in which recommendations are continually reviewed and updated in response to new evidence. This approach was piloted in a three year project (July 2018 -June 2021) funded by the Australian Government via the Medical Research Future Fund.

This online version of the *Australian and New Zealand Living Clinical Guidelines for Stroke Management* updates and supersedes the Clinical Guidelines for Stroke Management 2017. The Clinical Guidelines have been updated in accordance with the *2016 NHMRC Standards for Guidelines* and therefore recommendations are based on the best evidence available. The Clinical Guidelines cover the whole continuum of stroke care, across 8 chapters.

Review of the Clinical Guidelines used an internationally recognised guideline development approach, known as GRADE (**G**rading of **R**ecommendations **A**ssessment, **D**evelopment and **E**valuation), and an innovative guideline development and publishing platform, known as MAGICapp (**Ma**king **G**rade the **I**rresistible **C**hoice). GRADE ensures a systematic process is used to develop recommendations that are based on the balance of benefits and harms, patient values, and resource considerations. MAGICapp enables transparent display of this process and access to additional practical information useful for guideline recommendation implementation.

Purpose

The *Clinical Guidelines for Stroke Management* provides a series of best-practice recommendations to assist decision-making in the management of stroke and transient ischaemic attack (TIA) in adults, using the best available evidence. The Clinical Guidelines should not be seen as an inflexible recipe for stroke management; rather, they provide a guide to appropriate practice to be followed subject to clinical judgment and patient preferences.

Scope

The Clinical Guidelines cover the most critical topics for effective management of stroke, relevant to the Australian and New Zealand context, and include aspects of stroke management across the continuum of care including pre-hospital, assessment and diagnosis, acute medical and surgical management, secondary prevention, rehabilitation, discharge planning, community participation, and management of TIA. Some issues are dealt with in more detail, particularly where current management is at variance with best practice, or where the evidence needs translation into practice.

The Clinical Guidelines do not cover:

- Subarachnoid haemorrhage (refer to other available guidelines like the *2023 Guideline for the Management of Patients with Aneurysmal Subarachnoid Hemorrhage: A Guideline from the American Heart Association/American Stroke Association* (Hoh et al 2023 *[124]*);
- Stroke in infants, children and youth, i.e. <18 years old (refer to Victorian Subacute Childhood Stroke Advisory Committee, *Guideline for the subacute management of childhood stroke – 2019*, https://informme.org.au/Guidelines/Childhood-stroke-guidelines); or
- Primary prevention of stroke. (Refer to *Guidelines for assessing and managing cardiovascular disease risk 2023* (National Vascular Disease Prevention Alliance *[5]*) - https://informme.org.au/guidelines/guideline-for-assessing-and-managing-cardiovascular-disease-risk, and *Guideline for the diagnosis and management of hypertension in adults 2016* (Heart Foundation {6}) - https://www.heartfoundation.org.au/for-professionals/clinical-information/hypertension).

Target audience

The Clinical Guidelines are intended for use by healthcare professionals, administrators, funders and policy makers who plan, organise and deliver care for people with stroke or TIA during all phases of recovery.

Development

The Guidelines are published in eight separate chapters:
Pre-hospital care
Early assessment and diagnosis
Acute medical and surgical management
Secondary prevention
Rehabilitation
Managing complications
Discharge planning and transfer of care
Community participation and long-term care
The Clinical Guidelines have been developed according to processes prescribed by the National Health and Medical Research Council (NHMRC) under the direction of an interdisciplinary working group. Refer to the document on InformMe that details the Interdisciplinary Working Group Membership and Terms of Reference.

Use

The primary goal of the Clinical Guidelines is to help healthcare professionals improve the quality of the stroke care they provide.

Guidelines differ from clinical or care pathways (also referred to as critical pathways, care paths, integrated care pathways, case management plans, clinical care pathways or care maps). Guidelines are an overview of the current best evidence translated into clinically relevant statements. Care pathways are based on best practice guidelines but provide a local link between the guidelines and their use.

In considering implementation of the Guidelines at a local level, healthcare professionals are encouraged to identify the barriers, enablers and facilitators to evidence-based practice within their own environment and determine the best strategy for local needs. Where change is required, initial and ongoing education is essential and is relevant to

all recommendations in the Guidelines.

Aboriginal and Torres Strait Islander People

Refer to the document on InformMe for information regarding Aboriginal and Torres Strait Islander people.

Decision-making

Stroke survivors should be treated in accordance with the principles of shared decision-making contained within the *Acute Stroke Care Clinical Standard*, *Acute Stroke Services Framework 2023* and *Rehabilitation Stroke Services Framework 2022*, which include, among other things, that treatment should be patient-centred. Therefore, stroke survivors should be involved in decisions about their care at all times; but where they do not have capacity, or have limited capacity, family members should be involved in the decision-making.

Consent

The principles of informed consent underpin these Clinical Guidelines and therefore the wording of the recommendations are directed at the healthcare professional; that is, the intervention should/may be used, rather than offered, for the stroke patient. For patients with aphasia and/or cognitive disorders requiring formal consent, easy English or aphasia-friendly written versions of an information sheet and consent form should be offered and clearly explained to patients and their families in order to assist understanding and agreement.

Endorsement

The Clinical Guidelines have been endorsed (based on the 2017 version) by a number of organisations and associations. Refer to the document on InformMe that details the organisations formally endorsing the Clinical Guidelines.

Evidence gaps

Refer to the document on InformMe that details the gaps in evidence identified, noting areas for further research.

Reports

Refer to documents on InformMe - Technical Report, Administrative Report and Dissemination and Implementation Report.

Resources

Refer to documents on InformMe that provide supporting resources to assist with implementation of the Clinical Guidelines.

Publication Approval

Australian Government
National Health and Medical Research Council

The 2017 guideline recommendations were approved by the Chief Executive Officer of the National Health and Medical Research Council (NHMRC) on 25 July 2017 under Section 14A of the National Health and Medical Research Council Act 1992 with a subsequent amendment approved on 22 November 2017. Since moving to a continual (living) guideline model, further updates have been approved:

- 9 July 2018 (updated recommendations for neurointervention)
- 7 November 2019 (updated recommendations for thrombolysis, acute antiplatelet therapy, and patent foramen ovale management)
- 11 February 2021 (updated recommendations for oxygen therapy, cholesterol lowering targets, new acute antiplatelet agent, shoulder pain and weakness)
- 7 July 2021 (updated recommendations for standing, antiplatelet therapy, and activities of living)
- 22 December 2021 (updated recommendations for pre-hospital care, acute telehealth, head position, telehealth for rehabilitation, swelling of extremities, memory, management of atrial fibrillation, lifestyle modifications, and virtual reality for arm function)
- 5 August 2022 (updated recommendations for pre-hospital care [mobile stroke unit], assessment for rehabilitation, aphasia, dysarthria, prevention and treatment for depression, treatment of anxiety, personality and behaviour, pressure injury)
- 6 December 2022 (updated recommendations for aphasia and incontinence)
- 27 July 2023 (updated recommendations for driving, neurointervention, oxygen therapy, and central post-stroke pain)
- 8 December 2023 (updated recommendation for management of atrial fibrillation)
- 2 January 2025 (updated recommendation for self-management)
- 22 April 2025 (updated recommendations for ICH management – surgical interventions, cerebral venous thrombosis, sleep disorders, and carer support)
- 3 September 2025 (updated intravenous thrombolysis, acute blood pressure lowering therapy, and ICH management – medical interventions)
- 24 April 2026 (updated intravenous thrombolysis and head position)
- 26 August 2026 (adherence to pharmacotherapy and lifestyle modifications – physical activity).

In approving the guidelines recommendations the NHMRC considers that they meet the NHMRC standard for clinical practice guidelines. This approval is valid for a period of five years.
NHMRC is satisfied that the guideline recommendations are systematically derived, based on identification and synthesis of the best available scientific evidence and are developed for health professionals practising in an Australian health care setting.

This publication reflects the views of the authors and not necessarily the views of the Australian Government.

Disclaimer

These Clinical Guidelines are a general guide to appropriate practice, to be followed subject to the clinician's judgment and the patient's preference in each individual case. The Clinical Guidelines are designed to provide information to assist decision-making and are based on the best evidence available at the time of development.

Funding

The Stroke Foundation gratefully acknowledges the financial assistance provided to establish the Living Stroke Guidelines between 2018-2021 by the Australian Government, Medical Research Future Fund. Following on from this funding was secured by the Australian Living Evidence Collaboration (https://livingevidence.org.au) to assist the continuation of the Living Stroke Guidelines. From 2024 the Stroke Foundation has been funding the Living Stroke Guidelines from public donations. The development of the final recommendations are not influenced by the views or interests of any funding body.

Citation

Stroke Foundation. Clinical Guidelines for Stroke Management. Available at https://informme.org.au/en/Guidelines/Clinical-Guidelines-for-Stroke- Management. Accessed [insert date, month

and year and if applicable specific sections or chapters].

Methodology

Development of questions

Questions have been extensively developed and reviewed over the four iterations of the guidelines. In this 'living' phase the Content Steering Group reviews the PICO questions on an annual basis. The clinical questions are listed at the start of each chapter. Individual PICOs (population, intervention/s, comparator, outcomes) are listed in the research evidence section as related to each topic or recommendation.

Literature identification

On a monthly basis, we monitor the literature for relevant, new evidence by screening all randomised controlled trials or systematic reviews related to stroke published in the Pubmed database. One member of the project team initially screens all abstracts and excludes clearly irrelevant studies. Potentially included studies are allocated to relevant topics covered by the guidelines and a second member of the project team reviews and confirms included studies prior to sending to the relevant working group members. In addition, each month new economic studies and studies related to patient values and preferences are also captured.

Clinical expert review

Where new evidence has been identified by the project team a summary is sent to content experts who review and make a final decision to include or exclude the study and also to assess the potential impact of the new evidence on current recommendations. As a result of this assessment one of two options will be communicated for each topic:

a. New evidence is unlikely to change current recommendations: review and potentially integrate information in the next review cycle; or

b. New relevant evidence may change current recommendations: rapidly review.

Data extraction, updating evidence summary and GRADE profile

For rapid updates, the project team incorporates the new evidence into the existing body of evidence by:

- Updating the Summary of Findings table including the risk of bias assessment
- Review any additional studies related to Preferences and values of patients on the topic

Concurrently members of the economic working group review newly published economic studies.

The project team then drafts changes to the overall summary (GRADE profile). This profile is then reviewed and modified by clinical content experts and people with relevant lived experience (consumers). Finally changes to the changes to the recommendation, rationale and practical considerations are considered, discussed and agreed.

Draft changes are then circulated to the wider expert working groups (including consumer panel) for internal review. Once signed off by the Steering Group a period of public consultation is undertaken. Feedback is then reviewed and any changes made in response to feedback before finally submitting to the National Health and Medical Research Council (NHMRC) for approval.

Brief summary of GRADE

The Guidelines were developed following the GRADE methodology (Grading of Recommendations, Assessment, Development and Evaluation).

GRADE 'evidence to decision' framework includes a minimum of four factors to guide the development of a recommendation and determine the strength of that recommendation:

1. The balance between desirable and undesirable consequences.
2. Confidence in the estimates of effect (quality of evidence).
3. Confidence in values and preferences and their variability (clinical and consumer preferences).
4. Resource use (cost and implementation considerations).

For full details of how GRADE is used for developing clinical recommendations, refer to the GRADE handbook, available at: http://gdt.guidelinedevelopment.org/app/handbook/handbook.html.

Strength of recommendations

The GRADE process uses only two categories for the strength of recommendations, based on how confident the guideline panel is that the "desirable effects of an intervention outweigh undesirable effects [...] across the range of patients for whom the recommendation is intended" (GRADE Handbook):

- **Strong** recommendations: where guideline authors are certain that the evidence supports a clear balance towards either desirable or undesirable effects; or
- **Weak** (or conditional) recommendations: where the guideline panel is less certain about the balance between desirable and undesirable effects.

These strong or weak recommendations can either be for or against an intervention. If the recommendation is against an intervention this means it is recommended NOT to do that intervention. There are a number of recommendations where we have stated that the intervention may only be used in the context of research. We have done this because these are guidelines for clinical practice, and while the intervention cannot be recommended as standard practice at the current time, we recognise there is good rationale to continue further research.

The implications of a strong or weak recommendation for a particular treatment are summarised in the GRADE handbook as follows:

Table 1: Implications of GRADE recommendation categories (for a positive recommendation) for patients, clinicians and policy makers. Source: GRADE Handbook (http://gdt.guidelinedevelopment.org/app/handbook/handbook.html)

	Strong Recommendation	Weak Recommendation
For patients	Most individuals in this situation would want the recommended course of action and only a small proportion would not.	The majority of individuals in this situation would want the suggested course of action, but many would not.
For clinicians	Most individuals should receive the recommended course of action. Adherence to this recommendation according to the guideline could be used as a quality criterion or performance indicator. Formal decision aids are not likely to be	Recognise that different choices will be appropriate for different patients, and that you must help each patient arrive at a management decision consistent with her or his values and preferences. Decision aids may well

	needed to help individuals make decisions consistent with their values and preferences.	be useful helping individuals making decisions consistent with their values and preferences. Clinicians should expect to spend more time with patients when working towards a decision.
For policy makers	The recommendation can be adapted as policy in most situations including for the use as performance indicators.	Policy making will require substantial debates and involvement of many stakeholders. Policies are also more likely to vary between regions. Performance indicators would have to focus on the fact that adequate deliberation about the management options has taken place.

For topics where there is either a lack of evidence or insufficient quality of evidence on which to base a recommendation but the guideline panel believed advice should be made, statements were developed based on consensus and expert opinion (guided by any underlying or indirect evidence). These statements are labelled as ‘Practice statements’ and correspond to 'consensus-based recommendations' outlined in the NHMRC procedures and requirements.

For topics outside the search strategy (i.e. where no systematic literature search was conducted), additional considerations are provided. These are labelled ‘Info Box’ and correspond to ‘practice points’ outlined in the NHMRC procedures and requirements.

Explanation of absolute effect estimates used

The standardised evidence profile tables presented in the Clinical Guidelines include “Absolute effect estimates” for dichotomous outcomes. These represent the number of people per 1000 people expected to have the outcome in the control and intervention groups. This estimated risk in people receiving the intervention is based on a relative effect estimate which might be adjusted, e.g. to account for baseline differences between participants or when effect estimates have been pooled from different studies in a systematic review and adjusted to account for the variance of each individual estimate. Therefore, this estimated risk in the intervention group may differ from the raw estimate of the intervention group risk from the corresponding study. The estimated risk reflects the best estimate of the risk in the relevant population, relative to the risk observed among patients receiving the control or comparator intervention.

Wherever possible (i.e. when the relevant study reported enough information to allow the calculation to be done), these estimates were calculated using the following procedure:

Obtain the relative effect estimate (odds ratio or relative risk) and confidence interval from the best available study (systematic review or primary study) providing evidence about the effects of the intervention.

Use the observed number of events in the control group of the same study to calculate a baseline risk per 1000 people (or “assumed control risk”).

Calculate an estimate of the corresponding risk per 1000 in people receiving the intervention using the relative effect estimate. This can be done using methods based on the formulas for calculating

absolute risk reductions provided in the *Cochrane Handbook for Systematic Reviews of Interventions* (http://handbook.cochrane.org/). Applying the same calculations to the upper and lower bounds of the confidence interval for the relative effect estimate gives a confidence interval for the risk in the intervention group, which is then used to calculate the confidence interval for the difference per 1000 people, reported in the evidence tables.

Cost effectiveness summaries

There are several important points to consider when interpreting the cost-effectiveness information provided in the *Resources and Other Considerations*
sections of the Clinical Guidelines.

Firstly, an intervention can be cost-effective without being cost-saving. This means that although there is an additional cost for the health benefits gained from the intervention, the intervention is still considered worthwhile. The incremental cost-effectiveness ratios (ICER) presented (e.g. cost per quality adjusted life year gained) are an indication of the cost-effectiveness or "value-for-money", with lower ICERs indicating better cost-effectiveness of an intervention.

Secondly, whether or not the intervention is cost-effective is a judgment call; and should reflect a society's willingness-to-pay to have the intervention for the potential outcomes achieved. An ICER that is approximately or equivalent to US$50,000 has been commonly used by researchers in the past as a threshold for judging an intervention as being cost-effective (http://www.nejm.org/doi/full/10.1056/NEJMp1405158#t=article). However, no scientific basis for this threshold exists and actual willingness-to-pay may differ. For example, in a survey of 1000 Australian respondents conducted in 2007, the willingness-to-pay for an additional quality adjusted life year in Australia was estimated to be $64,000 (https://www.ncbi.nlm.nih.gov/pubmed/ 19382128).

Thirdly, there is no absolute threshold for determining whether an intervention should be funded based on the ICER (https://www.ncbi.nlm.nih.gov/ pmc/articles/PMC5153921/). ICERs are only one of the major factors considered in priority setting (the process to decide which interventions should be funded within a given resource constraint). Other considerations include affordability, budget impact, fairness, feasibility and other factors that are important in the local context (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5153921/).

Lastly, in areas where there are no data from economic evaluations that support the recommendations or practice statements, it remains unclear whether the additional costs of providing the intervention above usual care for the additional potential benefits obtained is justified. However, this should not detract from implementing the Clinical Guideline recommendations.

Use of language related to timing of interventions

***Immediate*:** without delay, or within minutes, not hours (life critical action required).
***Urgent*:** minutes to several hours (immediate action but not life critical).
Very early: within hours and up to 24 hours.
Early: within 48 hours.

For all Clinical Guideline recommendations we make the assumption that healthcare professionals will be appropriately qualified and skilled to carry out the intervention.

Dysphagia

Dysphagia (problems with swallowing) is a common consequence of acute stroke, with a reported incidence of 8% to 80% (Wilkinson et al 2026 *[107]*). Dysphagic stroke patients spend approximately an additional 8.8 days in hospital and were 12% more likely to be referred to community rehabilitation at hospital discharge compared to non-dysphagic stroke patients (Duncan et al. 2025 *[506]*). Dysphagia is associated with an increased risk of complications, such as aspiration pneumonia, dehydration and malnutrition (Wilkinson et al 2026 *[107]*). Dysphagia was also found to lead to poor clinical outcomes (chest infection, death, disability, discharge destination, longer length of stay), reinforcing the need for early detection and management (Wilkinson et al 2026 *[107]*).

It is believed that early identification and appropriate subsequent management of dysphagia is crucial to patient outcomes. The most recent National Stroke Audit of Acute Services in Australia showed that 67% of stroke patients received formal swallow screening and 60% were screened or swallow assessment performed before given oral intake (medications, food and fluids) (Stroke Foundation 2023 *[471]*). Around 74% of patients received formal assessment from speech pathologists within 48 hours (Stroke Foundation 2023*[471]*). All 107 hospitals surveyed indicated that they had locally agreed management protocols for swallow dysfunction (Stroke Foundation 2023 *[471]*).

Interventions for the treatment of dysphagia involve behavioural approaches that may be compensatory or rehabilitative in nature. Compensatory approaches include modification of fluid and food consistencies, postural techniques and swallowing strategies. Rehabilitative approaches include swallowing exercise that focus on muscle strength; resistance or skill training; and can be direct (with food or fluid) or indirect (without food or fluid).

A New Zealand study reported the additional cost of community rehabilitation services per dysphagic stroke patient were estimated to be NZD 370 over the first 3 months post-hospital discharge. Stroke-related dysphagia added an overall cost per year of NZD 77.2 million to New Zealand society in 2021 (NZD 24,200 per patient on average) (Duncan et al. 2025 [506]. A systematic review reporting international data found the presence of dysphagia added 40.36% to health care costs (Attrill et al 2018 [599]).

Weak recommendation

Updated

DRAFT RECOMMENDATION - AUGUST 2026

For patients with dysphagia, use individually tailored behavioural approaches, such as swallowing maneuvers, environmental modifications, safe swallowing advice, dietary modifications and for eligible patients, include early direct therapy with food and/or fluids (Wilkinson et al 2026 *[107]*).

Evidence to decision

Benefits and harms

Substantial net benefits of the recommended alternative

Behavioural interventions via compensatory techniques such as swallowing exercises, environmental modifications (e.g. upright positioning for feeding), and safe swallowing advice improved swallowing ability and reduced dysphagia at the end of the intervention based on a small number of studies (Wilkinson et al 2026 *[107]*). However, due to the diversity of therapies delivered in the intervention group, it is difficult to draw strong conclusions about the defining characteristics of the behavioural interventions that reduced dysphagia.

Certainty of the evidence	Low

The quality of the evidence is very low to low.

Values and preferences	Substantial variability is expected or uncertain

It is expected that most people with dysphagia would want compensatory interventions to reduce the impact.

Preferences for diet modification are expected to vary due to differences in societal, cultural, and individual associations, and the severity of dysphagia. People with dysphagia may express dissatisfaction to changes in texture and consistency of foods and liquids (Wu et al 2021 *[503]*), while some patients and carers may experience an emotional response to restrictive or modified eating and drinking (Maloney and Walsh 2018 *[504]*). Modified diets may place additional burden on carers who are preparing meals and fluids with modified textures and/or consistencies (Eltringham et al. 2019 *[505]*).

Resources and other considerations	Important issues, or potential issues not investigated

Providing compensatory techniques requires only a small amount of additional resourcing from speech pathologists.

A New Zealand cost-analysis study determined that patients with stroke who were dysphagic spent an additional 8.8 days in hospital (estimated increase in average cost NZD 16,100 per person), while those who were severely dysphagic spent an additional 14.6 days in hospital (estimated increase in average cost NZD 26,800 per person) compared to non-dysphagic stroke patients. The additional cost of community rehabilitation services was estimated at NZD 370 to 430 per person over the first three months post-hospital discharge. Health-related quality of life in the first year post-hospital discharge was reduced by 0.06 (95% CI 0.03 to 0.10) index points and in severe dysphagia reduced by 0.12 (95% Ci 0.03 to 0.20) index points, corresponding to cost impacts of NZD 3,470 and NZD 6,500 respectively (Duncan et al 2024 *[506]*).

Rationale

There is some evidence that behavioural approaches, including postural techniques and swallow strategies lead to a reduction in dysphagia after the intervention period. However, the certainty of evidence is low. There is very little high quality evidence regarding diet modification, but it is noted this is common practice and further studies are needed to guide practice.

Practical info

Behavioural approaches in rehabilitation focus on identifying and modifying actions. Such approaches to dysphagia can be undertaken with foods and fluids or if the patient is nil by mouth, they may be used to improve swallow function prior to the patient resuming oral intake.
Where stroke patients require modified texture foods and thickened fluids, these should be prescribed using nationally agreed descriptors (Cichero et al. 2017 *[125]*). Speech Pathology Australia endorses The International Dysphagia Diet Standardisation Initiative (IDDSI) framework as best practice for speech pathologists in Australia.

PICO (9.4)

Population: All stroke patients with dysphagia
Intervention: Postural techniques and swallow strategies (compensatory -direct)
Comparator: Control

Summary

The Wilkinson et al (2026) *[107]* Cochrane review included 39 studies of behavioural interventions to improve dysphagia. Overall, behavioural interventions were found to significantly reduce dysphagia at the end of the trials (OR 0.41, 95% CI 0.30 to 0.57; 9 studies, n=958 participants) and reduce swallowing impairment (SMD -1.17, 95% CI -1.6 to -0.74; 26 studies, n=1224 participants; considerable heterogeneity I^2=84%; very low certainty evidence). Two studies were identified which specifically focus on **postural techniques and swallowing (compensatory - direct) strategies**. Carnaby et al (2006) undertook a multicomponent intervention which included diet modification as needed. A standard low-intensity intervention (swallowing compensation strategies and diet prescription three times weekly for up to a month) was compared to high-intensity intervention (as per low-intensity but seen at least daily) versus usual care. Both intervention groups had a significant rise in the proportion of patients regaining swallowing function by 6 months compared to usual care. However, high-intensity therapy led to increased proportion of patients who returned to a normal diet (p=0.04) and recovered swallowing (p=0.02) by 6 months compared to both usual care and low-intensity therapy. The other study by Song et al (2004) reported rehabilitation training (characterised by swallowing and ingesting training) lead to improved swallow function compared to control group (p< 0.01).

Zhuang et al (2023) *[358]* conducted a network meta-analysis of 42 studies (n=2,993) comparing seven dysphagia therapies including behavioural interventions. They reported that acupuncture (OR 0.26, 95% CI 0.15 to 0.41), behavioural interventions (OR 0.38, 95% CI 0.21 to 0.64), drug therapy (OR 0.30, 95% CI 0.12 to 0.70), neuromuscular electrical stimulation (NMES; OR 0.23, 95% CI 0.11 to 0.43), and pharyngeal electrical stimulation (PES; OR 0.27, 95% CI 0.12 to 0.59) interventions were superior to control in improving dysphagia. The therapy most likely to improve dysphagia was NMES (OR 0.23, 95% CI 0.11 to 0.43) but behavioural interventions were best for reducing the secondary outcomes of chest infection or pneumonia (OR 0.37, 95% CI 0.09 to 1.58). Like the previous Cochrane review, behavioural interventions were grouped together and due to small study sizes and various outcomes comparisons between specific techniques are difficult.

Bakhtiyari et al (2015) *[108]* conducted a 3-arm randomised controlled trial investigating the optimal time to introduce behavioural intervention for dysphagia, blinding patients to group allocation but not therapists or assessors. All groups were similar at baseline. Findings suggested that early intervention significantly reduced dysphagia and frequency of pneumonia compared to the medium and late-onset groups. The early intervention group also required fewer intervention sessions.

Combined, the evidence suggests that compensatory interventions (postural techniques and swallowing strategies) during swallowing practice may reduce dysphagia, and that earlier intervention is preferable to delayed intervention.

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates** Control	 Postural techniques and swallow strategies	**Certainty of the evidence** (Quality of evidence)	**Summary**
Dysphagia at end of trial	Based on data from 481 participants in 4 studies[1]	Four comparisons from three studies (Carbaby 2006, Song 2004, Zheng 2014) noted in the Cochrane review by Bath (2018) found the proportion with dysphagia at the end of trial was 32.7% in the intervention		**Low** Due to serious risk of bias[2]	Behavioral interventions such as postural techniques and swallow strategies may decrease

		group vs 48% in the control group. One additional small study by Jeon 2020 also reported improved swallowing function.		dysphagia at end of trial

1. Systematic review [107]
2. **Risk of Bias: serious.** Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias, Incomplete data and/or large loss to follow up; **Indirectness: no serious.** The outcome time frame in studies were insufficient;

References

[107] Bath PM, Lee HS, Everton LF : Swallowing therapy for dysphagia in acute and subacute stroke. The Cochrane database of systematic reviews 2018;10:CD000323
[108] Bakhtiyari J, Sarraf P, Nakhostin-Ansari N, Tafakhori A, Logemann J, Faghihzadeh S, Harirchian MH : Effects of early intervention of swallowing therapy on recovery from dysphagia following stroke. Iranian journal of neurology 2015;14(3):119-24
[358] Zhuang Y, Wang X, Yin X, Li X, Liu W : Exploration of treatment methods for patients with post-stroke dysphagia: a network meta-analysis. Biotechnology & genetic engineering reviews 1-18

PICO (9.6)

Population: All stroke patients with dysphagia
Intervention: Modification of fluid consistencies (compensatory -direct)
Comparator: Control

Summary

Wilkinson et al (2026) *[107]* updated a Cochrane review and included 39 studies of behavioural interventions to improve dysphagia. Only two studies focused on modification of diet/fluids.

- Yuan et al (2003)(n=64): Two different interventions (enteral nutrition agent with thickener plus swallowing therapy, and traditional liquid diet plus swallowing therapy) were tested compared to control (liquid only diet with no swallowing therapy). The traditional liquid diet and swallowing therapy group had 8/11 with dysphagia at end of trial compared to 22/24 in the control group. The enteral nutrition agent with thickener and swallow therapy group had 6/18 participants with dysphagia at end of trial compared to 9/11 in the traditional liquid diet and swallow therapy group.
- Wang et al (2023)(n=180): Oral trial with Xantham gum thickened fluids and classic dysphagia therapy reduced swallowing impairment (SMD -1.15, 95% CI -1.47 to -0.82; n=167) when compared to classic dysphagia therapy alone.

Gillman et al (2017)*[151]* included 8 studies (5 randomised trials) involving 215 inpatient rehabilitation patients and 30 acute patients (mixed populations). Meta-analysis of rehabilitation studies found implementing a free water protocol did not lead to an increase in aspiration pneumonia (odds ratio 1.51, 95% CI 0.2 to 100; 6 studies, n=206; high heterogeneity I^2=74%, low quality evidence). There were very few lung complication events (8) and 6 of these came from one trial with degenerative neurological conditions or low mobility. The intervention group appeared to have higher self-reported swallowing related quality of life.

Werden Abrams et al (2023) *[423]* reviewed 33 mixed methods studies (n=4,990) summarising the evidence of adverse events and effects of thickened liquid use in adults. The most reported adverse outcomes associated with the use of thickened liquids included aspiration (11 studies), pneumonia (4 studies), dehydration (5 studies), reduced fluid intake (8 studies) and reduced quality of life (18 studies). Study populations were not limited to stroke and interventions used varied liquid viscosities.

Further studies are needed.

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates** Control	Modification of fluid	**Certainty of the evidence** (Quality of evidence)	**Summary**
Swallowing ability	[1]	The Cochrane review by Wilkinson et al (2026) had two articles for the modification of diet/fluids. Yuan et al (2003)(n=64): Traditional liquid diet and swallowing therapy group had 8/11 with dysphagia at end of trial compared to 22/24 in the control group (liquid diet only). Enteral nutrition agent with thickener and swallow therapy group had 6/18 participants with dysphagia at end of trial compared to 9/11 in the traditional liquid diet and swallow therapy group.Wang et al (2023)(n=180): Oral trial with Xantham gum thickened fluids and classic dysphagia therapy reduced swallowing impairment (SMD -1.15, 95% CI -1.47 to -0.82; n=167) when compared to classic dysphagia therapy alone.		**Very low** Due to very serious imprecision, Due to serious risk of bias[2]	We are uncertain whether modification of food/fluid improves or worsen swallowing ability

1. Systematic review [107]
2. **Risk of Bias: serious.** Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias; **Imprecision: very serious.** Low number of patients, Only data from one study;

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Weak recommendation

New

DRAFT RECOMMENDATION - AUGUST 2026

For patients with dysphagia, strength exercises or skill-based training may be used to improve swallowing ability and reduce the risk of swallowing related complications (Wilkinson et al 2026 [107]; Liu et al 2022 *[351]*; Gao et al 2023 *[421]*; Duncan et al 2020 *[152]*).

Previously this was a consensus recommendation but is a draft evidence-based recommendation. The wording has slightly changed.

Evidence to decision

Benefits and harms	Substantial net benefits of the recommended alternative

Rehabilitation exercises to strengthen muscles involved in swallowing were found to improve safety of swallowing and swallowing ability.

Certainty of the evidence	Low

The quality of the evidence is low to moderate.

Values and preferences	No substantial variability expected

It is expected that most patients will want therapy to improve swallowing ability or swallowing safety.

Resources and other considerations	No important issues with the recommended alternative

No economic literature has been identified. Strength training uses minimal equipment but further information is needed regarding optimal dose.

Rationale

There is low to moderate evidence that rehabilitation exercises (indirect/without food or fluid) can increase the safety of swallowing and swallowing ability. Rehabilitation exercises include suprahyoid muscle complex strengthening (e.g. chin tuck against resistance or Shaker therapy), tongue resistance exercises, respiratory muscle training, effortful swallowing and other specific exercises.

Practical info

Strength exercises or skill-based training includes interventions that aim to increase strength of muscles used for swallowing and improved timing and coordination of the swallow.
Chin tuck against resistance therapy: an inflatable rubber ball placed between the chin and the sternum was the most common set up. Training protocols varied between isokinetic repetitions only or only isometric repetition with several studies involving both. The isokinetic task was 1 set of 30 consecutive squeezes, while the isometric task was the holding of the squeeze from 10 to 60 s for 3 to 10 repetitions. The training frequency varied from once a day, 5 days/week to three times daily, 7 days/week. The duration

of treatment varied from 8 days to 6 weeks. The duration varied from 8 days to 6 weeks. Further studies are needed to determine the optimal training dose (Liu et al 2022 *[351]*).
Chin tuck was found to be better than the previously used Shaker exercise which requires patients to lift their heads against gravity to look at their toes in a supine position and is better tolerated especially in elderly patients. In the Shaker exercise when patients raise their heads, the sternocleidomastoid muscle is activated causing unnecessary muscle fatigue.

PICO (9.12)
Population: All stroke patients with dysphagia
Intervention: Rehabilitative exercises (rehabilitation -indirect)
Comparator: Control

Summary

Rehabilitation exercises (indirect/without food or fluid) include a range of strategies. These include suprahyoid muscle complex strengthening (e.g. chin tuck against resistance or Shaker therapy), tongue resistance exercises, respiratory muscle training, effortful swallowing and other specific exercises.

A Cochrane review by Wilkinson et al (2026) *[107]* included 39 studies of behavioural interventions. Behavioural interventions overall showed significant improvement in swallowing impairment (SMD -1.17, 95% CI -1.6 to -0.74; 26 studies, n=1224; substantial heterogeneity I^2= 84.2%; very low certainty evidence), reduced dysphagia at end of trial (OR 0.41, 95% CI 0.33 to 0.47; 9 studies, n=958; very low certainty evidence), reduced PAS (MD -0.99, 95% CI -1.42 to -0.55; 16 studies, n=586; considerable heterogeneity I^2= 89%; low certainty evidence) and reduced chest infection/pneumonia (OR 0.45, 95% CI 0.27 to 0.76; 8 studies, n=784; low certainty evidence). Analyses of mixed exercise interventions revealed significant improvements in swallowing impairment (SMD -0.93, 95% CI -1.23 to -0.63; 2 studies, n=187; low certainty evidence), reduced dysphagia at end of trial (OR 0.46, 95% CI 0.30 to 0.71; 5 studies, n=648; low certainty evidence), reduced chest infection/pneumonia (OR 0.47, 95% CI 0.27 to 0.80; 5 studies, n=610; low certainty evidence) and reduced length of stay (MD -2.70 days, 95% CI -5.68 to 0.28; 2 studies, n=370; low certainty evidence).

Gao et al (2023)*[421]* included 7 studies (n=259) combining results for oropharyngeal muscle strength training interventions (chink tuck, Shaker therapy, tongue resistance exercises) found that pooled PAS scores reduced (MD -0.95, 95% CI -1.34 to -0.62; 7 studies, n=259) and FOIS scores increased (MD 1.04, 95% CI 0.55 to 1.55; 3 studies, n=85) compared to conventional therapy.

Duncan et al (2020)*[152]* included 22 studies (n=1700) specifically in acute or critical care. Five studies involved exercises aimed to strengthen muscles related to swallowing. No meta-analysis was undertaken of these studies separately but are briefly described below:

- Moon et al 2017 (n=18) -expiratory muscle strength training in addition to traditional swallowing rehabilitation led to significant improvements in functional dysphagia scale, vallecular residue, and penetration-aspiration scale compared to swallowing rehabilitation only.
- Moon et al 2018 (n=16) -tongue pressure strength and accuracy training and usual rehabilitation significantly improved aspects of the Mann Assessment of Swallowing Ability.
- Guillen-Sola et al 2017 (n=62) -three way study with inspiratory/expiratory muscle training in addition to usual therapy or neuromuscular electrical stimulation plus usual therapy. No difference in swallowing was found between the muscle training group and the electrical stimulation group compared to usual therapy.
- Park et al 2018 (n=22) -chin tuck against resistance exercise improved swallow function compared to usual therapy alone.
- Park et al 2019 (n=24) -effortful swallowing training plus usual therapy improved tongue strength and oral phases of the video fluoroscopic dysphagia scale compared to usual therapy alone.

Hao et al (2024) *[487]* included the above studies in a review (10 mixed methods studies, n=313) specifically assessing the effectiveness of respiratory muscle training (RMT) on swallowing function in stroke patients. RMT demonstrated a significant effect on reducing the risk of aspiration (SMD 1.19, 95% CI 0.53 to 1.84; 4 studies, n=91), improved activity of the swallowing muscles (SMD 2.91, 95% CI 2.22 to 3.61; 2 studies, n=104) and improved recovery of water swallowing function (RR 1.22, 95% CI 1.05 to 1.42; 2 studies, n=104). There was no significant effect on the functional level of oral intake. Interventions compared inspiratory and/or expiratory muscle training alone or combined with traditional swallowing treatment, compared to traditional swallowing treatment alone or sham treatment. These results should be considered with caution due to the small

participant numbers and high risk of bias in the included studies.

Chin tuck:

A Cochrane review by Wilkinson et al (2026) *[107]* included 39 studies of behavioural interventions. Chin tuck against resistance (CTAR) significantly improved swallowing impairment (SMD -0.89, 95% CI -1.43 to -0.34; 2 studies, n=70; very low certainty evidence) and dysphagia at end of trial (OR 0.11, 95% CI 0.01 to 0.93; 1 study, n=45; very low certainty evidence) and PAS (MD -1.40, 95% CI -2.00 to -0.80; 1 study, n= 25; very low certainty evidence) in subgroup analyses.

Liu et al (2022) *[351]* included nine studies (n=548) investigating the effects of chin tuck against resistance (CTAR) exercise. Pooled results of 5 included studies (n=247) found that exercise leads to safer swallow as indicated by significantly lower penetration aspiration scale (PAS) scores (MD −1.43, 95% CI −1.81 to −1.06) compared with no exercise intervention. CTAR exercises also increased oral intake(SMD −1.82, 95% CI −3.28 to −0.35; 3 studies, n=107; considerable heterogeneity I^2=89%) and led to greater psychological wellbeing (self-depression scale; MD −5.72; 95% CI −7.39 to −4.05; 3 studies, n=200) compared with no exercise intervention. CTAR exercise was significantly superior to Shaker exercise in improving swallow safety (MD −0.49, 95% CI −0.83 to −0.16; 4 studies, n=237) and psychological wellbeing (MD −2.20, 95% CI −3.77 to −0.64; 3 studies, n=200). Park et al. (2021)*[313]* with nine studies investigating chin tuck against resistance. Four had the population of stroke patients with dysphagia, while the remaining five were in healthy adults.

- Park et al 2018 (n=22) -chin tuck against resistance exercise improved swallow function compared to usual therapy alone.
- Park et al (2019)[157](n=37) found chin-tuck against resistance exercise was no different to head-lift exercise on swallowing function.
- Kim and Park (2019)[159](n=30) found modified chin tuck against resistance exercise improved the penetration-aspiration scale and functional oral intake scale compared to usual therapy.
- Gao et al 2017 (n=90) found chin tuck against resistance exercise with traditional dysphagia treatment improved swallowing function compared to traditional dysphagia treatment after 4 and 6 week interventions. The study had an additional intervention of interest, Shaker exercise which also improved swallowing function compared to traditional dysphagia treatment after 4 and 6 week interventions and had no significant difference with chin tuck against resistance exercise.

Tongue resistance:

A Cochrane review by Wilkinson et al (2026) *[107]* found swallowing impairment significantly improved with tongue strength (SMD -0.66, 95% CI -1.36 to 0.05; 2 studies, n=52; very low certainty evidence) and no difference between groups for PAS (MD -0.34, 95% CI -1.07 to 0.39; 2 studies, n=43) in subgroup analyses.

Forced expiratory:

A Cochrane review by Wilkinson et al (2026) *[107]*found respiratory muscle strength training significantly improved swallowing impairment (SMD -2.53, 95% CI -4.53 to -0.53; 5 studies, n= 165; considerable heterogeneity I^2=96%; very low certainty evidence) and PAS (MD -1.03, 95%CI -1.87 to -0.19; 5 studies, n=165; considerable heterogeneity I^2=96%; very low certainty evidence) in subgroup analyses.

Balcerak et al (2022) *[343]* conducted a review of 41 studies (n=2,166) encompassing seven different therapeutic concepts for dysphagia recovery after stroke. Thirteen trials (n=661) assessed the impact of physical training and/or the intensity of physical therapy on dysphasia recovery. Three of these studies (n=93) reported that forced respiratory muscle training enhanced recovery compared to resistance training. In total, nine studies (n=526) reported positive impact of the physical therapies on recovery however only two of these (n=51) had impact on the oral phase of the act of swallowing.

Skill training:

Benfield et al (2023) *[495]* conducted a feasibility trial (n=27) to improve dysphagia utilizing swallow strength and skill training with surface electromyography (sEMG) biofeedback, combined with usual care. Skill training required participants to hit an amplitude and timing target with their swallow and the timing of targets varied across 30 seconds. Sessions aimed to complete three strength blocks and three skill blocks with a 120 s rest

between blocks, which equates to 60 swallow repetitions. Compared to usual care alone, the intervention observed a non-significant improvement in Dysphagia Severity Rating Scale (DSRS) scores at 2 weeks (MD -1.1, 95% CI -3.3 to 1.1). Mean penetration-aspiration scale (PAS) score for 5 mL thin liquids improved by one point in the intervention group and worsened slightly in the control (MD -0.3, 95% CI -1.9 to 0.3). At 90 days, there were no differences in DSRS and no serious adverse events.

Shaker exercises

A Cochrane review by Wilkinson et al (2026) *[107]* found shaker significantly improved swallowing impairment (SMD -0.87, 95% CI -1.61 to -0.13; 1 study, n=31; very low certainty evidence) and PAS (MD -1.12, 95% CI -1.61 to -0.64; 2 studies, n=58; very low certainty evidence) in subgroup analyses. However, there was little or no difference in dysphagia at end of trial.

Other:

A Cochrane review by Wilkinson et al (2026) *[107]* completed subgroup analysis for behavioural interventions:

- Dilatation: significantly improved swallowing impairment(SMD -4.00, 95% CI -4.87 to -3.14; 1 study, n=64; very low certainty evidence).
- Oromotor exercises: significantly improved swallowing impairment (SMD -0.71, 95% CI -1.18 to -0.24; 3 studies, n=76; very low certainty evidence), reduced dysphagia at end of trial (OR 0.38, 95% CI 0.18 to 0.79; 2 studies, n= 104; very low certainty evidence) and improved PAS (MD -0.91, 95% CI -2.22 to 0.40; 1 study, n=30; very low certainty evidence).
- Kinesio taping: did not improve swallowing impairment (SMD -0.10, 95% CI -0.69 to 0.50; 1 study, n=44; very low certainty evidence). However, a study by Kim et al (2024) *[515]* (n=30) found effortful swallowing against kinesiology taping attached to the front of the neck with approximately 70 to 80% tension significantly improved swallowing function (oral and pharyngeal phases of VDS and PAS, $p<0.05$).

Carnaby et al (2020)*[145]*(n=53) conducted a 3-arm study that compared McNeill Dysphagia Therapy Program (MDTP) in addition to electrical stimulation, MDTP plus sham electrical stimulation, and usual care. All groups received standardised behavioural swallowing therapy with a speech pathologist. MDTP alone (plus sham electrical stimulation) demonstrated a greater reduction in dysphagia severity compared to MDTP plus electrical stimulation or usual care (effect size 1.37, 95% CI 0.68 to 2.07). There was no difference between groups in the proportion demonstrating dysphagia post-treatment, however, MDTP alone had fewer patients with dysphagia identified during modified barium swallow study. Both MDTP and MDTP plus electrical stimulation significantly improved oral intake level compared to usual care.

Hagglund et al (2020)*[153]*(n=40) found oral resistance training plus sensory-vibration had significantly better swallowing rate at 12 month follow up than sensory-vibration alone in subacute patients. There was no difference at the end of the 5 week intervention.

Wang et al (2022) *[424]* trialed (n=109) a specialist nurse led digital coaching program for improving dysphagia outcomes in addition to standard care. Functional oral intake scale and swallowing quality of life scores improved significantly in the intervention at 3 weeks however the improvements at 6 weeks were comparable to standard care alone. The incidence of pneumonia at 6 weeks was also comparable in the intervention (n = 2, 4%) and control (n = 7, 14%).

Overall there is growing evidence that various exercises can improve swallowing ability or reduce complications. There are a number of generally small trials with various interventions. Almost all report a beneficial effect on swallowing function. Further large, quality studies are needed to confirm specific approaches.

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates**		**Certainty of the evidence** (Quality of evidence)	**Summary**
		Control	Rehabilitative exercises		
Dysphagia at end	Odds ratio: 0.41	**690** per	**480** per	**Very low** Due to serious risk	Rehabilitative exercises

of trial	(CI 95% 0.30 - 0.57) Based on data from 958 participants in 9 studies[1] Follow up 6 months	1000 1000 Difference: **21 fewer per 1000** (CI 95% 40 fewer - 56 fewer)	of bias, Due to serious imprecision, Due to serious publication bias[2]	may decrease dysphagia at end of trial.
Chest infection/ pneumonia	Odds ratio: 0.45 (CI 95% 0.27 - 0.76) Based on data from 784 participants in 8 studies[3] Follow up 6 months	**180** per 1000 **40** per 1000 Difference: **14 fewer per 1000** (CI 95% 11 fewer - 26 fewer)	**Low** Due to serious risk of bias, Due to serious imprecision[4]	Rehabilitative exercises may reduce incidence of chest infection/pneumonia.
Swallowing safety[5]	Measured by: Penetration-Aspiration Scale Scale: 1 - 8 Lower better Based on data from 586 participants in 16 studies[6] Follow up 6 months	Difference: **MD 0.99 lower** (CI 95% 1.42 lower - 0.55 lower)	**Low** Due to serious risk of bias, Due to serious inconsistency[7]	Rehabilitative exercises may improve swallowing safety.
Swallowing impairment	Measured by: Scale: 0 - 100 Lower better Based on data from 1224 participants in 26 studies[8] Follow up 6 months	Difference: **SMD 1.17 lower** (CI 95% 1.60 lower - 0.74 lower)	**Very low** Due to serious risk of bias, Due to serious inconsistency, Due to serious imprecision.[9]	Rehabilitative exercises may reduce swallowing impairment.

1. Systematic review [107] . **Baseline/comparator** Control arm of reference used for intervention .
2. **Risk of Bias: serious.** Unclear reporting of allocation, blinding and/or incomplete outcomes; **Imprecision: serious.** Wide confidence intervals; **Publication bias: serious.** Asymmetrical funnel plot;
3. Systematic review [107] . **Baseline/comparator** Control arm of reference used for intervention .
4. **Risk of Bias: serious.** Unclear reporting of allocation, blinding and/or incomplete outcomes; **Imprecision: serious.** 95% confidence intervals include appreciable benefit or harm. ;
5. undefined
6. Systematic review [107] . **Baseline/comparator** Control arm of reference used for intervention .
7. **Risk of Bias: serious.** Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias, Incomplete data and/or large loss to follow up; **Inconsistency: serious.** The magnitude of statistical heterogeneity was high, with I^2: 84.2%.; **Imprecision: no serious.** Low number of patients;
8. Systematic review [107] . **Baseline/comparator** Control arm of reference used for intervention .
9. **Risk of Bias: serious.** Unclear reporting of allocation, blinding and/or incomplete outcomes; **Inconsistency: serious.** The magnitude of statistical heterogeneity was considerable, with I^2: 91%.; **Imprecision: serious.** Wide confidence intervals;

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Weak recommendation	Updated

DRAFT RECOMMENDATION - AUGUST 2026

For patients with dysphagia, surface neuromuscular electrical stimulation may be used. This intervention should only be used by clinicians with specialised knowledge and training (Wilkinson et al 2026 *[107]*).

Strength of recommendation has changed from weak recommendation against to weak recommendation.

Evidence to decision

Benefits and harms	Small net benefit, or little difference between alternatives

Surface neuromuscular stimulation of swallowing (NMES) as an intervention for dysphagia improves aspects of swallowing.

NMES appears to be most effective when combined with swallowing therapy. No harm or adverse events were reported with surface NMES.

Certainty of the evidence	Low

The quality of the evidence was assessed as very low to moderate.

Values and preferences	Substantial variability is expected or uncertain

Patient comfort associated with receiving surface NMES was not reported in any of the studies and should

be considered before recommending this intervention.

Resources and other considerations

Important issues, or potential issues not investigated

Resources considerations

No literature to understand or describe the potential economic implications of this recommendation was identified. It should be noted that clinicians require specialised knowledge and training to use NMES.

Clinicians should only use electrical stimulation devices that have been approved by the Therapeutic Goods Administration of Australia.

Rationale

Patients may want to be offered surface NMES as a treatment option for dysphagia. The evidence for the effectiveness of surface NMES is growing and it is now added as a therapy to consider. Surface NMES is an intervention that requires additional training and experience. Further clinical research will help refine the most appropriate parameters.

Practical info

The application parameters of NMES for dysphagia have been recommended to include a frequency of 60-80Hz, 700μs of impulse time, an intensity above the motor threshold (respecting the patient's tolerance) and an application time of 20–30 min, placing the electrodes in the anterior side of the neck. (Dieguez-Perez and Leiros-Rodriguez (2020) *[150]*) The horizontal electrode placement for transcutaneous NMES should target suprahyoid muscles or both suprahyoid and thyrohyoid muscles. (Doan et al. 2022 *[346]*)
It should be noted that clinicians require specialised knowledge and training to use NMES, Speech Pathology Australia's statement (last updated 21/07/23) regarding NMES resources is:
Speech Pathologists wanting to apply NMES to clinical practice should do so within a documented and appraised system (e.g. research protocol, quality assurance) with documented support from the employing organisation and treating medical team.
Clinicians should only use electrical stimulation devices that have been approved by the Therapeutic Goods Administration of Australia. In addition, clinicians must confirm that the device is safe for use over the intended anatomical area, in agreement with the manufacturer's instruction manual. This statement represents good practice based on clinical experience and expert opinion.

PICO (9.7)

Population: All stroke patients with dysphagia
Intervention: Surface neuromuscular electrical stimulation (NMES)
Comparator: Usual care / placebo / sham

Summary

A Cochrane review by Wilkinson et al (2026)[107] included 25 studies for neuromuscular electrical stimulation (NMES) to improve dysphagia. Compared to usual care, NMES reduced swallowing impairment (SMD -0.69, 95% CI -1.01 to -0.37; 19 studies, n=866; substantial heterogeneity I2=78%; moderate certainty evidence), the proportion of participants with dysphagia at the end of the trial (OR 0.43, 95% CI 0.28 to 0.67; 7 studies, n=383; very low certainty evidence) and pharyngeal transit time (MD -0.23, 95% CI -0.39 to -0.08; 3 studies, n=126; substantial heterogeneity I2=63%). There was no significant difference between groups in penetration/aspiration (MD -0.71, 95% CI -1.75 to 0.34; 6 studies, n=155; very low certainty evidence) and the rate of chest infection/pneumonia (OR 0.30, 95% CI 0.03 to 3.03; 4 studies, n=189; substantial heterogeneity I2=77%; very low certainty evidence).

Wang et al (2023)*[422]* reviewed 46 trials (n=3,346) finding significant improvements for NMES combined with standard treatment in standardised swallowing assessment (MD -6.39, 95% CI -6.56 to -6.22; 21 studies, n=1,913; considerable heterogeneity I^2=92%) and video fluoroscopic swallow study (MD 1.42, 95% CI 1.28 to 1.57; 11 studies, n=955; considerable heterogeneity I^2= 98%). However, the results have very high

heterogeneity due to widely varying intervention protocols and the certainty of evidence is very low.

Alayaseh et al (2026) *[592]* reviewed 18 studies (n =938) that examined combining swallowing exercises with neuromuscular electrical stimulation (NMES) or neuromuscular taping (NMT) in post stroke dysphagia management. Significant improvements were found for swallowing function measured by penetration-aspiration scale (Effect size -1.49 955 CI -1.92 to -1.06, 7 studies, n=251, substantial heterogeneity I^2=67%) in interventions that combined swallowing training exercises with NMES or taping. No studies used NMT as an intervention and only one included study (Kim & Park 2024, n=30) involved kinesiology taping.

Doan et al (2022) *[346]* conducted a meta-analysis of 19 trials (n=989) comparing the effectiveness of transcutaneous neuromuscular electrical stimulation (tNMES) with conventional swallowing therapies (CSTs) on swallowing function, in post-stroke dysphagia patients. Combined tNMES + CSTs significantly improved swallowing function compared to CSTs alone (SMD 0.91, 95% CI 0.68 to 1.14; 19 RCTs, n=989). Subgroup analysis on varying electrode placements found that individualised electrode placement for each patient based on dysphagia assessment resulted in the largest pooled effect size (SMD 1.65, 95% CI 0.38 to 2.91; 2 RCTs, n=140). Significant pooled effect sizes were found for placement: a) horizontally above and below the hyoid bone; and b) horizontally above hyoid bone (SMD 0.87, 95% CI 0.59 to 1.14; 5 RCTs, n=231 and SMD 0.94, 95% CI 0.72 to 1.16; 6 RCTs, n=359 respectively). A significant effect size was observed in infrahyoid stimulation and resistance training (SMD 1.73, 95% CI 1.07 to 2.39; 1 RCT, n=50).

Zhuang et al (2023) *[358]* conducted a network meta-analysis of 42 trials (n=2,993) comparing seven dysphagia therapies, finding that acupuncture (OR 0.26, 95% CI 0.15 to 0.41), behavioural interventions (OR 0.38, 95% CI 0.21 to 0.64), drug therapy (OR 0.30, 95% CI 0.12 to 0.70), neuromuscular electrical stimulation (NMES; OR 0.23, 95% CI 0.11 to 0.43), and pharyngeal electrical stimulation (PES; OR 0.27, 95% CI 0.12 to 0.59) interventions were superior to control in improving dysphagia. The surface under the cumulative ranking curve analysis (SUCRA) score showed that the best therapy for improvement of dysphagia was NMES (OR 0.23, 95% CI 0.11 to 0.43). SUCRA score reported the best therapy for secondary outcomes of chest infection or pneumonia was behavioural interventions (OR 0.37, 95% CI 0.09 to 1.58). Small sample sizes and low power values did not allow for subgroup analysis. Evaluation methods across included studies inconsistent which may weaken effectiveness of results.

Li et al (2025) *[590]* reviewed 6 trials (n=473) in surface electromyographic biofeedback (sEMG-BF) to improve swallowing function and quality of life in post-stroke dysphagia patients. Compared to conventional treatment, sEMG-BF significantly improved mean amplitude (MD 6.45 95% CI 3.53to 9.38, 4 studies, n=203, substantial heterogeneity I^2=76%), reduced swallowing duration (MD -0.22 955 CI -0.26 to -0.18, 2 studies, n=125) and improved standardised swallowing assessment score (MD -6.43 95% CI -9.74 to -3.11, 4 studies, n=203, considerable heterogeneity I^2=91%), however improvement in swallowing quality of life did not reach significance (MD 29.36 95% CI -14.95 to 73.69, 2 studies, n=120, considerable heterogeneity I^2=98%). Network meta-analysis revealed sEMG-BF outperformed neuromuscular stimulation and conventional therapy for improving swallowing function and swallowing quality of life.

Seo et al. (2021)*[314]* (n=26) found sequential 4 channel NMES had significant improvements in oral (-4.5±3.2 vs -1.7±2.0, p=0.032) and total VDS (-12.7±8.8 vs -6.9±6.8, p=0.044) scores compared to 2 channel NMES. 4 channel NMES also had non-significant improvements in PAS (-2.1±2.0 vs -1.0±1.9, p=0.21) and FOIS (1.6±1.1 vs 0.6±1.0, p=0.051) score compared to 2 channel NMES.

A study by Darwish et al. (2024)*[514]* included 70 participants and found additional neuromuscular electrical stimulation and exercises significantly improved GUSS score (p<0.05). The control group which was oral care and nasogastric tube feeding had a significant increase in aspiration pneumonia after 2 weeks of intervention (p<0.05).

Pharyngeal transit time and swallowing function/ability may be improved with interventions combining NMES with conventional treatment.

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates**		**Certainty of the evidence** (Quality of evidence)	**Summary**
		Usual	Surfac		

		care / placebo / sham	e neuromuscular electrical stimulation		
Proportion of participants with dysphagia at end of trial 6 months	Odds ratio: 0.43 (CI 95% 0.28 - 0.67) Based on data from 383 participants in 7 studies[1] Follow up 6 months	**700** per 1000	**501** per 1000 Difference: **199 fewer per 1000** (CI 95% 305 fewer - 90 fewer)	**Very low** Due to serious risk of bias, Due to serious imprecision, Due to serious publication bias[2]	Surface neuromuscular electrical stimulation may decrease proportion of participants with dysphagia at end of trial slightly.
Chest infection/ pneumonia 6 months	Odds ratio: 0.30 (CI 95% 0.03 - 3.03) Based on data from 189 participants in 4 studies[3] Follow up 6 months	**200** per 1000	**70** per 1000 Difference: **130 fewer per 1000** (CI 95% 193 fewer - 231 more)	**Very low** Due to serious imprecision, Due to very serious imprecision, Due to serious inconsistency[4]	We are uncertain whether surface neuromuscular electrical stimulation increases or decreases the risk of chest infection/pneumonia.
Swallowing impairment 6 months	Measured by: Standardised swallowing assessment Scale: 0 - 46 Lower better Based on data from 866 participants in 19 studies[5]		Difference: **SMD 0.69 lower** (CI 95% 1.01 lower - 0.37 lower)	**Moderate** Due to serious inconsistency[6]	Surface neuromuscular electrical stimulation probably reduces swallowing impairment.
PAS 6 months	Measured by: Scale: 1 - 8 Lower better Based on data from 115 participants in 6 studies[7]		Difference: **MD 0.71 lower** (CI 95% 1.75 lower - 0.34 higher)	**Very low** Due to serious inconsistency, Due to very serious imprecision[8]	We are uncertain whether surface neuromuscular electrical stimulation increases or decreases penetration aspiration score.

3. Systematic review [107] . **Baseline/comparator** Control arm of reference used for intervention .
4. **Risk of Bias: serious.** unclear reporting of allocation, blinding and/or incomplete outcomes; **Imprecision: serious.** 95% confidence intervals include appreciable benefit or harm (an RR of < 0.75 or > 1.25; significant risk of imprecision, with a risk ratio (RR) < 0.75 for dysphagia at end of trial (RR 0.72, 95% CI 0.62 to 0.85) and chest infection/pneumonia (RR 0.36, 95% CI 0.06 to 2.28)); **Publication bias: serious.** asymmetrical funnel plot;
5. Systematic review [107] . **Baseline/comparator** Control arm of reference used for intervention .
6. **Inconsistency: serious.** unexplained heterogeneity; **Imprecision: very serious.** 95% confidence intervals include appreciable benefit or harm (an RR of < 0.75 or > 1.25; significant risk of imprecision, with a risk ratio (RR) < 0.75 for dysphagia at end of trial (RR 0.72, 95% CI 0.62 to 0.85) and chest infection/pneumonia (RR 0.36, 95% CI 0.06 to 2.28)), Low number of patients;
7. Systematic review [107] . **Baseline/comparator** Control arm of reference used for intervention .
8. **Inconsistency: serious.** The magnitude of statistical heterogeneity was substantial, with I^2:78%.;

9. Systematic review [107] . **Baseline/comparator** Control arm of reference used for intervention .
10. **Inconsistency: serious.** The magnitude of statistical heterogeneity was substantial, with unexplained heterogeneity; **Imprecision: very serious.** Low number of patients, Wide confidence intervals;

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Weak recommendation against

Updated

DRAFT RECOMMENDATION - AUGUST 2026

For patients with dysphagia, non-invasive brain stimulation should not be used in routine practice. Health professionals with specialised knowledge and training may use non-invasive brain stimulation, particularly transcranial magnetic stimulation within a research framework only (Wilkinson et al 2026 [107])

Updated recommendation, evidence, Rationale and Practical info.

Evidence to decision

Benefits and harms

Small net benefit, or little difference between alternatives

Non-invasive brain stimulation has moderate to large effect size in improving swallowing function. However, there was varying effects from no difference between groups to small effect for penetration aspiration scale. The strongest benefits were for transcranial magnetic stimulation. Weaker benefits were reported for theta burst stimulation and transcranial direct current stimulation. Few adverse events are reported, and the incidence of chest infection and pneumonia was not reported.

Certainty of the evidence

Low

The quality of the evidence for TMS was low to moderate, tDCS was very low to moderate and TBS was very low to low.

Values and preferences

Substantial variability is expected or uncertain

Patients' experiences of non-invasive brain stimulation have not been explored. There may be some variation in accepting this intervention considering its unclear benefits.

Resources and other considerations

Important negative issues

Resources considerations

No literature to understand or describe the potential economic implications of this recommendation was identified. Brain stimulation equipment is not readily available in clinical practice. Clinicians and researchers require specialised knowledge and training.

Rationale

Non-invasive brain stimulation is showing promising results in improving swallowing function in clinical trials, particularly for transcranial magnetic stimulation. However, the most effective parameters with respect to stimulation type, location, intensity and duration remain unclear. Equipment is not routinely available in clinical care and we recommend using it within a clinical research framework.

Practical info

The application of high-frequency (5-10 Hz) rTMS over the ipsilesional hemisphere showed the largest effect size (SMD 0.83, 95% CI 0.14 to 1.52; I^2=61%). The effect sizes for low-frequency (1 Hz) over the contralesional hemisphere (SMD 0.61, 95% CI 0.23 to 0.98) and high-frequency over the contralesional hemisphere (SMD 0.59, 95% CI 0.03 to 1.14) were comparable. Sensitivity analysis showed that for the high-frequency ipsilesional subgroup, excluding the study by Khedr and colleagues resulted in reduction of heterogeneity (I^2=38%) and the overall effect became insignificant (SMD 0.57, 95% CI −0.05 to 1.18; p=0.07). Khedr et al (2009) used 3 Hz rTMS, as opposed to 5 or 10 Hz rTMS used in the remaining 5 studies. (Chen et al 2020 [131])

All studies used anode tDCS while performing swallowing exercises. Studies used a dose of 1 or 2 mA for 20-30 minutes for 5-10 days. Stimulation was placed over the pharyngeal motor cortex in most studies. The electrode size ranged from 15-35 cm^2. (Marchina et al 2020 [470])

PICO (9.9)

Population: All stroke patients with dysphagia
Intervention: Transcranial direct current stimulation (tDCS)
Comparator: Sham or control

Summary

A Cochrane review by Wilkinson et al (2026) *[107]* included 15 studies for transcranial direct current stimulation (tDCS) to improve dysphagia. Compared to usual care, tDCS reduced swallowing impairment (SMD -0.63, 95% CI -0.81 to -0.44; 14 studies, n=496; moderate certainty evidence) and the proportion of people with dysphagia at the end of trial (OR 0.28, 95% CI 0.09 to 0.88; 3 studies, n=118; low certainty evidence). There was no significant difference between groups for penetration aspiration score (PAS; MD -0.82, 95% CI -1.83 to 0.18; 4 studies, n=135; substantial heterogeneity I^2=73%; very low certainty evidence).

A systematic review by Cheng et al (2020)*[131]* included 26 studies (n=852) assessing the impact of three forms of neurostimulation (transcranial direct current stimulation [tDCS], repetitive transcranial magnetic stimulation [rTMS] and pharyngeal electrical stimulation [PES]) as a treatment for dysphagia post-stroke. Overall, there was a moderate significant effect from tDCS (SMD 0.65, 95% CI 0.25 to 1.04; 7 studies, n=203) as compared to sham. Stimulation on the contralesional hemisphere appeared to be the most effective.

Zhao et al (2022)*[322]* with 16 studies (n= 668) found a large and significant pooled effect size for tDCS (SMD 0.80, 95% CI 0.45 to 1.14; 16 studies, n=668; moderate heterogeneity I^2=77%). Subgroup analysis found a large and significant effect size for chronic patients (SMD 0.80, 95% CI 0.43 to 1.16; 14 studies, n=595; moderate heterogeneity I^2=76%). A moderate and significant effect was shown for stimulation intensities of 1mA and 1.6 mA (SMD 0.47, 95% CI 0.13 to 0.81; 7 studies, n=203 vs 1.39, 95% CI 0.69 to 2.08; 1 study, n=40). tDCS to the unilateral hemisphere (SMD 0.82, 95% CI 0.11 to 1.53; 8 studies, n=284; moderate heterogeneity I^2=86%), brainstem (SMD 1.06, 95% CI 0.58 to 1.53; 3 studies, n=105) and bulbar paralysis (SMD 0.71, 95% CI 0.18 to 1.25; 1 study, n=120) all demonstrated a large and significant effects.

Another systematic review by Lin et al. (2021)*[288]* included 10 studies (n=343) specific to tDCS and reported a moderate significant effect from tDCS (SMD 0.66, 95% CI 0.40 to 0.92) as compared to sham. Subgroup

analysis found a moderate effect (SMD 0.56, 95% CI 0.28 to 0.85; 8 studies, n=270) in chronic stroke patients and a large effect (SMD 1.03, 95% CI 0.54 to 1.52; 2 studies, n=73) in acute stroke patients. Anodal tDCS on the contralateral hemisphere had a greater improvement on swallowing function (SMD 0.88, 95% CI 0.49 to 1.27; 3 studies, n=103) compared to anodal tDCS in the ipsilateral hemisphere (SMD 0.44, 95% CI 0.15 to 0.79; 5 studies, n=176) or in the bilateral hemispheres (SMD 1.67, 95% CI 0.22 to 1.11; 3 studies, n=84).

He et al (2022) *[348]* conducted a review of 15 trials (n=787) involving transcranial direct current stimulation (tDCS) on swallowing function. Meta analysis of six included studies (n = 223) measuring improvements according to the Mann Assessment of Swallowing Ability (MASA), reported a significant difference in tDCS outcomes compared with the control group (MD 7.57, 95% CI 4.53 to 10.62). A subgroup analysis showed that bilateral brain stimulation had a larger positive effect (MD 6.19, 95% CI 4.65 to 7.74; 3 studies, n=170) than stimulation of undamaged brain region only (MD 5.87, 95% CI 2.40 to 9.35; 2 studies, n=126).

Yao et al (2024) *[491]* reviewed 18 studies (n=827) on the efficacy of non-invasive brain stimulation treatments in post-stroke dysphagia. Transcranial direct current stimulation (tDCS) showed a significantly greater improvement in swallowing function immediately after treatment (SMD 2.99, 95% CI 1.86 to 4.11; 15 studies, n=374; considerable heterogeneity I^2=96.4%), improvement was also observed some days (undefined) after treatment (SMD 2.01, 95% CI 0.87 to 3.16; 4 studies, n=120; considerable heterogeneity I^2=83.0%) compared to sham control. Results should be considered with caution due to the high heterogeneity and absence of defined long-term follow up periods.

Li et al (2021)*[350]* conducted a review of 18 studies (n=738) on non-invasive brain stimulation on dysphagia after stroke. Subgroup analysis of 7 studies (n = 414) showed that Standardised Swallowing Assessment (SSA) scores in repetitive transcranial magnetic stimulation (rTMS) and transcranial direct current stimulation (tDCS) groups were lower than those in the control group (SMD -1.29, 95% CI -1.83 to -0.75 and SMD -0.46, 95% CI -0.87 to -0.05 respectively). Subgroup analysis of eight studies (n=297) showed that penetration aspiration scale (PAS) scores in the rTMS group were lower than in the control group (SMD −0.90, 95% CI -1.43 to -0.37), however PAS scores in the tDCS group were not significantly different to the control group (SMD −0.39, 95% CI -1.30 to 0.51).

Xie et al (2023) *[355]* conducted a review of 20 studies (n=838) examining dosage considerations for transcranial direct current stimulation (tDCS). Network meta-analysis showed 20 min of stimulation at 1.4 mA was the optimal parameters for anodal tDCS and exhibited superior efficacy compared to conventional swallowing exercise therapy (SMD 1.08, 95% CI 0.46 to 1.69) and sham tDCS (SMD 1.45, 95% CI 0.54 to 2.36). Methodological quality of included RCTs varied.

Overall, studies to date suggest that transcranial direct current neurostimulation may improve dysphagia. However, further robust studies are needed to improve the certainty of evidence.

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates** Sham or control	**Absolute effect estimates** tDCS	**Certainty of the evidence** (Quality of evidence)	**Summary**
Dysphagia at end of trial 6 months	Odds ratio: 0.28 (CI 95% 0.09 - 0.88) Based on data from 118 participants in 3 studies[1]	**933** per 1000	**796** per 1000 Difference: **137 fewer per 1000** (CI 95% 377 fewer - 8 fewer)	**Low** Due to very serious imprecision[2]	Transcranial direct current stimulation (tDCS) may reduce the proportion of people with dysphagia at end of trial.
Swallowing impairment 6 months	Measured by: Scale: 0 - 100 Lower better Based on data from 496		Difference: **SMD 0.63 lower**	**Moderate** Due to serious publication bias[4]	Transcranial direct current stimulation (tDCS)

	participants in 14 studies[3]	(CI 95% 0.81 lower - 0.44 lower)		probably reduces the proportion of people with dysphagia at end of trial.
Penetration aspiration score (PAS) 6 months	Measured by: Scale: 1 - 8 Lower better Based on data from 135 participants in 4 studies[5]	Mean Mean Difference: **MD 0.82 lower** (CI 95% 1.83 lower - 0.18 higher)	**Very low** Due to serious inconsistency, Due to very serious imprecision[6]	We are uncertain whether transcranial direct current stimulation (tDCS) increases or decreases penetration aspiration score (PAS).

1. Systematic review [107] . **Baseline/comparator** Control arm of reference used for intervention .
2. **Imprecision: very serious.** Low number of patients; 95% confidence intervals include appreciable benefit or harm (an RR of < 0.75 or > 1.25);
3. Systematic review [107] . **Baseline/comparator** Control arm of reference used for intervention .
4. **Publication bias: serious.** Asymmetrical funnel plot;
5. Systematic review [107] . **Baseline/comparator** Control arm of reference used for intervention .
6. **Inconsistency: serious.** unexplained heterogeneity high I2 > 50%; **Imprecision: very serious.** Low number of patients, Wide confidence intervals;

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PICO (9.10)

Population: All stroke patients with dysphagia
Intervention: Transcranial magnetic stimulation (rTMS)
Comparator: Sham or control

Summary

A Cochrane review by Wilkinson et al (2026) [107] included 21 studies for transcranial magnetic stimulation (TMS) to improve dysphagia. Compared to usual care, TMS reduced swallowing impairment (SMD -1.03, 95% CI -1.38 to -0.69; 17 studies, n=661; substantial heterogeneity I2= 69%; low certainty evidence) and penetration aspiration score (PAS; MD -1.19, 95% CI -1.53 to -0.85; 12 studies, n=519; moderate certainty evidence).

Liu et al (2025) *[589]* reviewed 14 trials (n=882) in transcranial magnetic stimulation (TMS) on post-stroke dysphagia. TMS significantly improved swallowing function across all scales: Penetration-Aspiration Scale (MD -1.32 95% CI -1.50 to -1.14, 14 studies, n=638, substantial heterogeneity I^2=77%), Standardised Swallowing Assessment (MD -1.97 95% CI -2.43 to -1.50, 5 studies, n=556), Fibreoptic endoscopic dysphagia severity scale (MD -0.65 95% CI -0.84 to -0.46, 4 studies, n=398), functional oral intake (MD 0.92 95% CI 0.72 to 1.13, 4 studies, n=192) and functional dysphagia scale (MD -5.54 95% CI -7.48 to -3.60, 4 studies, n=128). Sensitivity analyses revealed similar benefits for both repetitive transcranial magnetic stimulation (MD -0.70 95% CI -0.88 to -0.53, 11 studies, n=591) and theta burst stimulation (MD -0.81 95% CI -0.9 to -0.62, 3 studies, n=222).

Cheng et al. (2020)*[131]* included 26 studies (n=852) assessing the impact of three forms of neurostimulation (transcranial direct current stimulation [tDCS], repetitive transcranial magnetic stimulation [rTMS] and pharyngeal electrical stimulation [PES]) as a treatment for dysphagia post-stroke. Overall the meta-analysis indicated that there was a significant, moderate effect size indicating that active neurostimulation was a beneficial treatment for dysphagia as compared to sham (SMD 0.69, 95% CI 0.50 to 0.89). There was a significant benefit from rTMS (SMD 0.73, 95% CI 0.49 to 0.98; 20 comparisons) as compared to sham.

Tan et al. (2021)*[315]* included 16 studies (n=473) and found a moderate to large effect size in improving swallowing function after rTMS (g -0.86, 95% CI -1.57 to -0.16; 9 studies, n=145; moderate heterogeneity I^2=74.72%) and medium effect size in tDCS (g -0.61, 95% CI -1.04 to -0.17; 7 studies, n=227; moderate heterogeneity I^2=61.49%). At follow up, the difference was statistically insignificant for rTMS (g -0.90, 95% CI -1.88 to 0.09; 3 studies, n=66; moderate heterogeneity I^2=71%), while tDCS had a very large and significant improvement (g -1.34, 95% CI -2.06 to -0.63; 2 studies, n=34) in swallowing function.

Li et al. (2022)*[309]* included 9 studies (n=393) and compared to standard physical and medical treatment, rTMS treatment resulted in significant improvement in dysphagia immediately after treatment (SMD 0.85, 95% CI 0.45 to 1.24; 9 studies, n=370; moderate heterogeneity I^2=61%), at 1 month (SMD 0.88, 95% CI 0.41 to 1.35; 7 studies, n=342; moderate heterogeneity I^2= 69%) and at 2 months (SMD 2.28, 95% CI 0.28 to 4.27; 2 studies, n=66; substantial heterogeneity I^2=87%). No difference was observed between the different stimulation sites (affected, unaffected and bilateral hemisphere).

Lin et al (2025) *[560]* reviewed 17 studies (n = 788) evaluating pharyngeal electrical stimulation (PES), neuro-muscular electrical stimulation (NMES), repetitive transcranial magnetic stimulation (rTMS) and transcranial direct current stimulation (tDCS). For swallowing function, only rTMS observed significant improvements, compared to no treatment (SMD 5.10 95% CI 3.20 to 7.01, 1 study, n = 26) and compared to control (SMD 1.03 95% CVI 0.55 to 1.52, 4 studies, n = 200). Significant improvements in quality of life were reported in NMES (SMD 3.51 95% CI 0.54 to 6.47, 3 studies, n = 114), rTMS (SMD 3.40 95% CI 2.13 to 4.66, 1 study, n = 26) and tDCS (SMD 1.10 95% CI 0.54 to 1.83, 1 study, n = 44) compared to controls.

Treatment parameters - protocols and frequencies:

Hsiao et al. (2022) *[349]* conducted a meta-analysis of six studies (n = 158) on effective treatment protocols for repetitive transcranial magnetic stimulation (rTMS). Standardised swallowing assessment (SSA) scores reported a significant improvement following high-frequency rTMS on the ipsilesional cortex, immediately and at 4 weeks (SMD -0.61, 95% CI -1.14 to -0.08; SMD -0.74, 95% CI -1.27 to -0.21 respectively) compared to the sham group. Similarly, following low-frequency rTMS on the ipsilensional cortex, a significant improvement in SSA scores was found in the intervention group compared to the control both immediately and at 4 weeks (SMD -0.59, 95% CI -1.12 to -0.06; SMD -0.92, 95% CI -1.48 to -0.37 respectively). A significant improvement in penetration-aspiration scale (PAS) scores was also found in low-frequency rTMS intervention immediately following (SMD -0.60, 95% CI -1.19 to -0.01) but not at 4 weeks, compared to the control. No significant improvements were found in PAS scores during high-frequency rTMS intervention at either time point compared to the control.

Sun et al. (2023) *[492]* evaluated 18 studies (n=680) on the effect of repetitive transcranial magnetic stimulation (rTMS) at different frequencies on swallowing disordered after stroke. Measured by leakage-aspiration scale (PAS) indicators, 1 Hz, 3 Hz, 5 Hz and 10 Hz all showed significantly better treatment effects

compared to control, cumulative probability ranking showed the best effect of 3 Hz, while 5 Hz and 10 Hz were similar. Measured by standard swallowing function assessment (SSA) index, 3 Hz, 5 Hz and 10 Hz showed significant improvements compared to control, and ranking showed the effect was optimal at 10 Hz, followed by 5 Hz, while 1 Hz was ranked lower than the control. After combining the PAS and SSA factors, the treatment effect of 10 Hz and bilateral stimulation sites was good. The authors noted that the results need to be verified with high-quality studies.

Liu et al. (2024) *[493]* reviewed 5 trials (n=673) reporting significant effects of cerebellar rTMS combined with conventional swallowing exercises in penetration-aspiration scale (MD -1.60, 95% CI -2.07 to -1.12, 3 studies, n=215) and swallowing severity scale (MD -3.00, 95% CI -4.20 to -1.81, 2 studies, n=92) at 4 week follow up, compared to conventional exercises alone. No significant differences were observed based on stimulation site (unilateral vs bilateral cerebellum), stimulation mode (rTMS vs intermittent theta-burst stimulation) or stimulation frequency (5 Hz vs 10 Hz).

Wu et al (2024) *[558]* reviewed 18 studies (n = 760), network meta-analysis revealed significant improvements in swallowing function for high-frequency (HF) rTMS over ipsilesional hemisphere (ipsi-hemi) (SMD -0.94 95% CI -1.51 to -0.43, 6 studies), HF-rTMS over bilateral hemisphere (bi-hemi) (SMD -2.59 95% CI -3.50 to -1.72), HF ipsilesional cerebellar (ipsi-CRB) (SMD -0.79 95% CI -1.56 to -0.10, 3 studies), HF bilateral cerebella (bi-CRB) (SMD, -1.02 95% CI, -1.83 to -0.29, 3 studies), and HF/ipsi-hemi + low frequency (LF)/contralesional hemisphere (contra-hemi) (SMD -2.72 95% CI, -4.13 to -1.41, 1 study) rTMS all significantly improved swallowing function compared with control. For patients with acute stroke, HF/ipsi-hemi rTMS had a positive effect (SMD 1.36; 95% CI, 2.86 to 0.02); in subacute stage (2 weeks to 3 months after stroke), HF/ipsi-hemi + LF/contra-hemi rTMS showed the best efficacy (SMD 2.68 95% CI, 4.26 to 1.26). However, rTMS failed to improve swallowing function in chronic stage (>3 months after stroke).

Peng et al (2025) *[557]* reviewed 18 studies (n = 835) reporting both cerebral and cerebellar rTMS significantly improved swallowing function compared to control groups. Subgroup analysis of cerebral rTMS showed high-frequency rTMS effectively improved swallowing function (MD -1.73 95% CI -2.63 to -0.84, 7 studies, n = 271), but not low-frequency rTMS (MD -1.57 95% CI -3.33 to 0.19, 3 studies, n = 102). Further, bilateral cerebral rTMS demonstrated superior efficacy in improving swallowing function (MD -3.04 95% CI -3.04 to -1.88, 2 studies, n = 52) over unilateral cerebral rTMS (MD -0.97 95% CI -1.52 to -0.42, 8 studies, n = 323) compared to controls. Cerebellar rTMS (MD -1.63 95% CI -1.98 to -1.28, 5 studies, n = 318) appeared to be superior to cerebral rTMS (MD -0.90 95% CI -1.11 to -0.70, 6 studies, n = 283). Significant swallowing function improvements were observed in cerebellar rTMS at 5Hz (MD -1.27 95% CI -2.07 to -0.47, 1 study, n = 69), 10Hz (MD -1.86 95% CI -2.30 to -1.42, 3 studies, n = 185) and 50Hz (MD -1.20 95% CI -2.04 to -0.36, 1 study, n = 64) stimulation frequencies.

Jiayao et al (2025) *[559]* reviewed 27 studies (n = 1,694); network meta-analysis revealed contralateral HF-rTMS (MD -11.34 95% CI -14.57 to -8.12) and bilateral HF-rTMS (MD -6.52 95% CI -8.50 to -4.55) were superior to ipsilateral HF-rTMS (MD -1.89 95% CI -2.82 to -0.96) in improving swallowing function measure by Standard Swallowing Assessment (SSA). Treatment of patients < 1 month post stroke demonstrated superior improvements in swallowing function in ipsilateral HF-rTMS (MD -0.56 95% CI -0.96 to -0.15). Three studies reported adverse events including headache (1 study) and dizziness (2 studies).

Overall, studies to date suggest that transcranial magnetic stimulation significantly improve dysphagia although there is significant heterogeneity leading to some uncertainty. Furthermore, the best treatment parameters are yet to be determined.

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates** Sham or control	 rTMS	**Certainty of the evidence** (Quality of evidence)	**Summary**
Swallowing impairment 6 months	Measured by: Scale: 0 - 100 Lower better Based on data from 661		Difference: **SMD 1.03 lower**	**Low** Due to serious inconsistency, Due to serious publication bias[2]	Transcranial magnetic stimulation may reduce swallowing

	participants in 17 studies[1]	(CI 95% 1.38 lower - 0.69 lower)		impairment.
Penetration aspiration score (PAS) 6 months	Measured by: Scale: 1 - 8 Lower better Based on data from 519 participants in 12 studies[3]	Mean Mean Difference: **MD 1.19 lower** (CI 95% 1.53 lower - 0.85 lower)	**Moderate** Due to serious imprecision[4]	Transcranial magnetic stimulation may reduce penetration aspiration score (PAS).

1. Systematic review [107] . **Baseline/comparator** Control arm of reference used for intervention .
2. **Inconsistency: serious.** high I2 > 50% possibly due to varied assessments used to obtain outcome; **Publication bias: serious.** Asymmetrical funnel plot;
3. Systematic review [107] . **Baseline/comparator** Control arm of reference used for intervention .
4. **Imprecision: serious.** Wide confidence intervals;

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PICO (9.18)

Population: Adults with stroke
Intervention: Theta burst stimulation (TBS)
Comparator: Usual care

Summary

A Cochrane review by Wilkinson et al (2026) *[107]* included 5 studies for theta burst stimulation (TBS) to improve dysphagia. Compared to usual care, TBS reduced swallowing impairment (SMD -0.81, 95% CI -1.06 to -0.56; 5 studies, n=280; low certainty evidence) and penetration aspiration score (PAS; MD -1.26, 95% CI -2.04 to -0.48; 5 studies, n=280; substantial heterogeneity I^2=77%; very low certainty evidence).

Outcome	Study results and	Absolute effect estimates	Certainty of the evidence	Summary

Timeframe	measurements	Usual care	TBS	(Quality of evidence)	
Swallowing impairment 6 months	Measured by: Scale: 0 - 46 Lower better Based on data from 280 participants in 5 studies[1]	Difference: **SMD 0.81 lower** (CI 95% 1.06 lower - 0.56 lower)		**Low** Due to serious inconsistency, Due to serious imprecision[2]	Theta burst stimulation (TBS) may decrease swallowing impairment.
Penetration aspiration score 6 months	Measured by: Scale: 1 - 8 Lower better Based on data from 280 participants in 5 studies[3]	Difference: **MD 1.26 lower** (CI 95% 2.04 lower - 0.48 lower)		**Very low** Due to serious inconsistency, Due to very serious imprecision[4]	Theta burst stimulation (TBS) may reduce penetration aspiration score slightly.

1. Systematic review [107] . **Baseline/comparator** Control arm of reference used for intervention .
2. **Inconsistency: serious.** high I2 > 50% possibly due to varied assessments used to obtain outcome; **Imprecision: serious.** Low number of patients;
3. Systematic review [107] . **Baseline/comparator** Control arm of reference used for intervention .
4. **Inconsistency: serious.** unexplained heterogeneity high I2 > 50%; **Imprecision: very serious.** Low number of patients, Wide confidence intervals;

References

[107] Wilkinson G, Everton LF, Bath PM, Benfield JK : Swallowing therapy for dysphagia in acute and subacute stroke. The Cochrane database of systematic reviews 2026;8:CD000323

Weak recommendation against

Updated evidence, no change in recommendation

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For patients with dysphagia, pharyngeal electrical stimulation is not routinely recommended (Wilkinson et al 2026 *[107]*).

Evidence to decision

Benefits and harms

Small net benefit, or little difference between alternatives

There is no strong evidence to support the use of pharyngeal electrical stimulation (PES) as a treatment for dysphagia following stroke. No adverse events were reported in any studies investigating PES as a treatment for dysphagia.

Certainty of the evidence

Low

The quality of the evidence was assessed as low to moderate.

Values and preferences

Substantial variability is expected or uncertain

Patient comfort associated with receiving PES was not reported in any of the studies and should be considered. It should be noted that failure to insert the catheter and withdrawal of consent were two

reasons for participant attrition in the randomised controlled trial investigating PES in acute and subacute settings, which may reflect patient preferences regarding nasopharyngeal catheter insertion.

Resources and other considerations

Important issues, or potential issues not investigated

Resources considerations

No economic studies were identified.

Implementation considerations

PES is an invasive therapy which requires resources, training and staff time. Clinicians using PES would require specialised knowledge and training.

Rationale

The meta-analysis involving eight randomised controlled trials found no benefits regarding swallowing. We believe few patients will want PES due to the invasive nature of the treatment and the lack of benefit of the intervention and do not recommend its use in clinical care.

PICO (9.8)

Population: All stroke patients with dysphagia
Intervention: Pharyngeal electrical stimulation
Comparator: Sham

Summary

Pharyngeal electrical stimulation (PES) differs from neuromuscular electrical stimulation (NMES) as an intervention tool as it is more invasive requiring the insertion of a catheter with a pair of bipolar titanium ring electrodes housed in the tube (similar to a nasogastric tube) to deliver the electrical stimulation to the pharynx.

A Cochrane review by Wilkinson et al (2026)*[107]* included 8 studies for PES to improve dysphagia. No significant difference between groups were found for swallowing impairment (SMD -0.15, 95% CI -0.46 to 0.16; 5 studies, n=272; low certainty evidence), proportion of people with dysphagia at end of trial (OR 0.55, 95% CI 0.15 to 2.11; 3 studies, n = 66; moderate certainty evidence) or pharyngeal transit time (MD -0.15, 95% CI -0.67 to 0.37; 1 study; n=28). Compared to usual care, PES reduced penetration aspiration (MD -0.74, 95% CI -1.44 to -0.03; 5 studies, n=195; low certainty evidence and chest infections/pneumonia (OR 0.33, 95% CI 0.12 to 0.93; 2 studies, n=88; low certainty evidence).

Liu et al (2023) *[490]* reviewed 6 trials (n = 341) on the efficacy of pharyngeal cavity electrical stimulation-assisted swallowing (PES-assisted swallowing) on post-stroke dysphagia. Compared to sham treatment, PES-assisted swallowing showed a slight significant improvement in swallowing function (SMD = -0.20, 95% CI -0.38 to -0.03, 7 studies, n = 514) and significantly improved the extubation rate of nasogastric feeding (RR 2.88, 955 CI 1.15 to 7.26, 3 studies, n = 119). However, there were no significant improvements on oral ingestion, reduction of aspiration or length of hospital stay.

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates**		**Certainty of the evidence** (Quality of evidence)	**Summary**
		Sham	Pharyngeal electrical stimulation		

Proportion of participants with dysphagia at end of trial 6 months	Odds ratio: 0.55 (CI 95% 0.15 - 2.11) Based on data from 66 participants in 3 studies[1]	**781** per 1000 **662** per 1000 Difference: **119 fewer per 1000** (CI 95% 432 fewer - 102 more)	**Moderate** Due to serious imprecision[2]	Pharyngeal electrical stimulation has little or no difference on proportion of participants with dysphagia at end of trial
Chest infection/ pneumonia 6 months	Odds ratio: 0.33 (CI 95% 0.12 - 0.93) Based on data from 88 participants in 2 studies[3]	**667** per 1000 **398** per 1000 Difference: **269 fewer per 1000** (CI 95% 473 fewer - 16 fewer)	**Low** Due to serious imprecision, Due to very serious imprecision[4]	Pharyngeal electrical stimulation may decrease chest infection/pneumonia slightly.
Swallowing ability	Measured by: Dysphagia Severity Rating Scale, Functional Oral Intake Scale, Dysphagia Outcome and Severity Scale (DOSS) or water swallowing test Scale: - Based on data from 272 participants in 5 studies[5]	Difference: **SMD 0.15 lower** (CI 95% 0.46 lower - 0.16 higher)	**Low** Due to very serious imprecision[6]	Pharyngeal electrical stimulation has little or no difference on swallowing ability.
Penetration aspiration score	Measured by: VFSS, FEES, PAS Scale: 1 - 8 Lower better Based on data from 195 participants in 5 studies[7] Follow up 6 months	Difference: **MD 0.74 lower** (CI 95% 1.44 lower - 0.03 lower)	**Low** Due to very serious imprecision[8]	Pharyngeal electrical stimulation may decrease penetration aspiration score.

1. Systematic review [107] . **Baseline/comparator** Control arm of reference used for intervention .
2. **Imprecision: serious.** Wide confidence intervals, Low number of patients;
3. Systematic review [107] . **Baseline/comparator** Control arm of reference used for intervention .
4. **Imprecision: very serious.** Wide confidence intervals, Low number of patients;
5. Systematic review [107] . **Baseline/comparator** Control arm of reference used for intervention .
6. **Imprecision: very serious.** Low number of patients, Wide confidence intervals;
7. Systematic review [107] . **Baseline/comparator** Control arm of reference used for intervention .
8. **Imprecision: very serious.** Low number of patients, Wide confidence intervals;

References

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PICO (9.17)
Population: Adults with stroke with dysphagia and tracheotomy
Intervention: Interventions to improve swallowing
Comparator: Usual care

Summary
Gao et al (2026) *[586]* trialed (n=47) modified air-pulse stimulation via a flexible endoscope delivered via nasal passage in tracheotomised patients with dysphagia after stroke, compared to conventional air-pulse stimulation. In addition to the daily, 5 minute intervention or control for 2 weeks, both groups received conventional swallowing rehabilitation for 30 minutes per day which included: sensory comprehensive training: cold stimulation training (5 minutes), taste stimulation training (10 minutes) and vibration perception training (5 minutes); oral exercise training: muscle strength training for lips, tongue, upper and lower jaw, cheeks, and soft palate (10 minutes). Modified air-pulse stimulation showed significant improvements in penetration-aspiration scale (Z = −3.28, P = .001), spontaneous swallowing frequency (t = −7.60 95% CI 2.65 to 4.58, P < .0001) and clinical pulmonary infection score (t = 3.19 95% CI −2.18 to −0.49, P < .01) compared to conventional stimulation. The intervention also showed significantly better nutritional outcomes compared to the control. Caution should be used when interpreting these results due to baseline differences in aspiration between groups, improvements within both groups and small sample sizes.

References
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Consensus-based recommendations

- Assess and manage the nutrition and hydration of patients with dysphagia with early consideration of alternative non-oral routes, until a safe swallowing method is established for oral intake.
- Regularly monitor the tolerance, intake, nutrition and hydration of patients on texture-modified diets and/or fluids to reduce the increased risk of malnutrition and dehydration.
- Tactile, thermal, carbonated or sour stimulation may be used as a component of dysphagia rehabilitation program for patients post stroke. This should be considered in the context of their current diet and fluid recommendations and with regular oral care.
- Provide the most appropriate form (i.e. whole, crushed, cut, liquid) of oral medications that is safest and easiest to swallow for patients with dysphagia
- Urgently review patients with persistent weight loss, dehydration and/or recurrent chest infections.
- Provide appropriate training in feeding and swallowing techniques to all staff and carers involved in feeding patients.
- Provide appropriate training for the maintenance of oral hygiene, including daily brushing of teeth and/or dentures and care of gums to all staff. (Refer to Oral hygiene section in Chapter 6)
- Involve patients with dysphagia and their carers in shared-decision making for dysphagia assessment and management. Shared-decision making should be a priority in cases of eating and drinking with risk and end of life management.

Please also refer to the topic Early Nutrition in Managing Complications.

Rationale

Patients with dysphagia are at increased risk of malnourishment, dehydration and aspiration pneumonia, reinforcing the need for close monitoring. Furthermore, any modification from regular liquids and solid diets contributed to reduced hydration at discharge for patients with dysphagia in acute settings (Crary et al. 2016 *[122]*). Therefore, the hydration and nutrition status should be regularly monitored and managed. Further research is required to determine optimal protocols for tactile, thermal, carbonated or sour stimulation as a component of dysphagia rehabilitation.

PICO (9.13)

Population: All stroke patients with dysphagia
Intervention: Peripheral sensory stimulation (rehabilitation -indirect)
Comparator: Control

Summary

A Cochrane review by Wilkinson et al (2026)*[107]* included 6 studies for peripheral sensory stimulation, which includes physical stimulation with tactile, thermal or sour stimulation, to improve dysphagia. Compared to usual care, physical stimulation reduced the proportion of participants with dysphagia at the end of trial (OR 0.29, 95% CI 0.14 to 0.60; 4 studies, n=350; low certainty evidence), swallowing impairment (SMD -0.78, 95% CI -1.29 to -0.26; 3 studies, n=228; substantial heterogeneity I^2=65%; low certainty evidence) and risk of chest infection/pneumonia (OR 0.20, 95% CI 0.05 to 0.76; 1 study, n=96; low certainty evidence).

The impact of thermo-tactile stimulation (TTS) on swallowing in people with dysphagia was investigated in a review conducted by Schwarz et al (2018)*[143]* with 10 studies (n=237). The safety and efficacy were reported poorly, the studies were of low to moderate quality rating and only one was a RCT. Of the four studies that delivered TTS as an immediate precursor to the swallow, the outcomes were measured differently but all found small to moderate change in temporal swallow measures.

Zhou & Wang (2025) *[591]* conducted a 6-week trial (n=92) combining swallowing function training and ice stimulation in patients with post-stroke dysphagia. At 6 week follow up, ice stimulation combined with swallowing function training showed greater improvements in Water Swallowing Test (2.16 SD ±0.41 vs 3.79 SD ±0.60), Standardised Swallowing Assessment score (11.11 SD ±1.63 vs 22.37 SD ±1.90), Video Fluoroscopic Study Score (6.97 SD ±1.38 vs 5.94 SD ±1.16), however the improvements were significant in both groups compared to swallowing function training alone. Overall effective rate (93.48% vs 71.74%) was higher, and incidence of complications (8.70% vs 28.26%) was lower with the combined intervention than swallowing training alone.

Hwang et al (2022)*[344]* conducted a systematic review of 7 studies (n=96) reported that repetitive peripheral magnetic stimulation (rPMS) intervention on the suprahyoid muscles had positive effects on outcomes of swallowing function, swallowing safety, swallowing performance and quality of life, compared to sham control. Only two included studies recruited stroke patients (n=28). Protocols for rPMS intervention varied between studies; frequency (20 - 30 Hz), duration (2-3 s), intensity (70%-80% to 90% of maximum intensity), rest time/stimulation off (8 s to 27-28 s), number of intervention sessions (2-3 to 30), co-exercises and intervention period (1 - 6 weeks). No statistical analysis on pooled data.

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates**		**Certainty of the evidence** (Quality of evidence)	**Summary**
		Control	Sensory stimulation		
Proportion of participants with dysphagia at end of trial	Odds ratio: 0.29 (CI 95% 0.14 - 0.60) Based on data from 350 participants in	**920** per 1000	**769** per 1000	**Low** Due to serious risk of bias, Due to serious imprecision,[2]	Sensory stimulation may decrease proportion of participants with
		Difference: **151 fewer per 1000** (CI 95% 303 fewer - 47 fewer)			

6 months	4 studies[1]			dysphagia at end of trial.
Chest infection/ pneumonia 6 months	Odds ratio: 0.20 (CI 95% 0.05 - 0.76) Based on data from 96 participants in 1 studies[3]	**250** per 1000 **63** per 1000 Difference: **187 fewer per 1000** (CI 95% 234 fewer - 48 fewer)	**Low** Due to serious risk of bias, Due to serious imprecision,[4]	Sensory stimulation may decrease the risk of chest infection/pneumonia.
Swallowing impairment 6 months	Measured by: Scale: 0 - 46 Lower better Based on data from 228 participants in 3 studies[5]	Difference: **SMD 0.78 lower** (CI 95% 1.29 lower - 0.26 lower)	**Low** Due to serious inconsistency, Due to serious imprecision[6]	Sensory stimulation may decrease swallowing impairment.

1. Systematic review [107] . **Baseline/comparator** Control arm of reference used for intervention .
2. **Risk of Bias: serious.** Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias, Selective outcome reporting; **Imprecision: serious.** Low number of patients;
3. Systematic review [107] . **Baseline/comparator** Control arm of reference used for intervention .
4. **Risk of Bias: serious.** Inadequate concealment of allocation during randomization process, resulting in potential for selection bias, Inadequate/lack of blinding of participants and personnel, resulting in potential for performance bias, Inadequate/lack of blinding of outcome assessors, resulting in potential for detection bias, Selective outcome reporting; **Imprecision: serious.** Low number of patients;
5. Systematic review [107] . **Baseline/comparator** Control arm of reference used for intervention .
6. **Inconsistency: serious.** The magnitude of statistical heterogeneity was high, with I^2:65 %.; **Imprecision: serious.** Low number of patients;

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Search string

(Stroke Rehabilitation[MeSH] OR Cerebrovascular Disorders[MeSH] OR Endarterectomy, Carotid[MeSH] OR Thrombectomy[MeSH] OR Deglutition Disorders[MeSH] OR Deglutition[MeSH] OR Muscle Spasticity[MeSH] OR Aphasia[MeSH] OR Apraxias[MeSH] OR Dysarthria[MeSH] OR stroke[TI] OR strokes[TI] OR poststroke[TI] OR post-stroke[TI] OR "transient ischemic"[TI] OR "transient ischaemic"[TI] OR "carotid endarterectomy"[TI:~5] OR thrombectomy[TI] OR swallowing[TI] OR deglutition[TI] OR dysphagia[TI] OR spasticity[TI] OR aphasia*[TI] OR apraxia*[TI] OR dyspraxia*[TI] OR dysarthria*[TI])

Inclusion and exclusion criteria

Population

Include:
All adults with stroke with dysphagia
Exclude:
Children/paediatric/neonatal/pregnancy
Animal studies
Prevalence/Incidence

Intervention

Include:
Medical interventions
Exclude:

Comparator

Include:
No intervention or usual care
Exclude:

Outcome

Include:
Death
Institutionlisation rate
Improved swallowing function
QOL
Nutritional status
Carer burden
Exclude:
Predictor of outcomes
Associations/Relationships

Study characteristics

Include:
Major new randomised trial
Individual patient data (IPD) analysis
New data for specific populations
Exclude:
Observational studies
Non-randomised study (if existing studies are randomised)
SR with only studies previously included