Question 26 evidence tables

Question 26: What are the most effective treatments for dysphagia after stroke?

NB Any discrepancies between reviewers in evidence quality and comment were discussed at the corresponding evidence review meeting

WHO = World Health Organisation, EA = electroacupuncture, SRT = swallowing rehabilitation training, WST = water swallowing test, VFSS = video fluoroscopic swallowing study, SSA = standardized swallowing assessment, IFRS = Ichiro Fujishima rating scale, IAP = incidence of aspiration pneumonia, rTMS = repetitive transcranial magnetic stimulation, FEDSS = Fiberoptic Endoscopic Dysphagia Severity scale, PES = pharyngeal electrical stimulation, KDWT = Kubota drinking water test, MDTP = Mc Neil Dysphagia Therapy Program, SSA = Standard swallowing assessment, PAS = penetration–aspiration scale, FEES = fibreoptic endoscopic evaluation of swallowing, SES = Sensory Level Electrical Stimulation, NMES = neuromuscular electrical stimulation, tDCS = transcranial direct current stimulation TMS = transcranial magnetic stimulation, NG = nasogastric, VDS = videofluoroscopy dysphagia scale, MCID = minimum clinically important difference, TBI = traumatic brain injury, DOSS = Dysphagia outcome and severity scale, CT = computed tomography MRI = magnetic resonance imaging, EAT-10 = Eating Assessment Tool (EAT-10), FOIS = Functional Oral Intake Scale, TRP = transient receptor potential, TST= Traditional Swallowing Therapy, LOS = length of stay, BWST = bedside water-swallow test, MBSS = modified barium swallow study, NMES = Neuromuscular electrical stimulation, SSA = Standard Swallowing Assessment, sEMG = Surface electromyography, aEMG = average electromyography, VFSS = video fluoroscopic swallowing study, SR = systematic review, MA = meta-analysis, RCT = randomised controlled trial, IPDMA = individual patient data meta-analysis, MDT = multidisciplinary team, PICO = patient/population, intervention, comparison and outcomes, OR = odds ratio, CI = confidence interval, QoL = quality of life, ADL = activities of daily living, OR = odds ratio, RR = relative risk, aOR = adjusted odds ratio, cOR = crude odds ratio, CI = confidence interval, RoB = risk of bias, I2 = heterogeneity statistic.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
374	J. Huang et al. (2020). Clinical Effects and Safety of Electroacupuncture for the Treatment of Poststroke Dysphagia: A Comprehensive Systematic Review and Meta-Analysis. *Evidence-based Complementary and Alternative Medicine,* 2020: 1560978	Setting China Design Systematic Review and Meta-analysis of RCTs Subjects n= 1,216 participants with post stroke dysphagia (diagnosed using WHO criteria and appropriate radiological methods). No gender or age limitations.	Comparison between Intervention arm (Electroacupuncture plus swallow rehabilitation training) vs Control arm (swallow rehabilitation training alone). Treatment ranged from 2-4 weeks.	Primary Outcome: Effective rate of swallow function (assessed by: i) water swallow test ii) videofluoroscopy iii) standardised swallowing assessment iv) Ichiro Fujishima rating scale Secondary Outcome: i) aspiration pneumonia ii) adverse events (not specified)	Systematic Review: 16/505 identified studies were included, published between 2008 - 2019. Low risk of bias (n=1) Primary outcomes: All outcomes report significantly greater improvements in the intervention arm. Effective rate 12/12 studies included. (p<0.00001)	- Low quality Limitations: Limited search methodology Poor trial methodology - failed to use consistent measurement tool to assess change in swallow function Small sample size within the included trials

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		Participant sample size ranged between 40-128. Participant age range 36-79. No gender or further demographics reported.			Water swallow test 3/6 studies included (p<0.00001) Videofluoroscopy 2/3 studies included (p=0.00001) Ichiro Fujishima Rating Scale 2/2 studies included (p=0.00001) Secondary outcomes: Incidence of Aspiration Pneumonia 2/2 studies included (p=0.005) Adverse events: 2 studies (16 patients).	High heterogeneity in electroacupuncture protocols across the trials Limited diagnostic accuracy of the outcomes (clinical rating scales). No evidence to support sustained treatment effect. Limited to Chinese trials
374	J. Huang et al. (2020). Clinical Effects and Safety of Electroacupuncture for the Treatment of Poststroke Dysphagia: A Comprehensive Systematic Review and Meta-Analysis. *Evidence-based Complementary and Alternative Medicine,* 2020: 1560978	Setting: China. Not further specified Design: SR/MA of 16 RCTs to investigate the efficacy and safety of electroacupuncture (EA) combined with swallowing rehabilitation training (SRT) for treating dysphagia in patients with stroke versus SRT alone. Participants: 1,216people with post-stroke dysphagia (PSD) diagnosed according to WHO criteria using appropriate radiological methods, not limited by gender, and age	EA combined with SRT. 2 weeks to 30 days duration. Not further specified. Control arm: SRT	The primary outcomes were an effective rate (1o outcome) and swallowing function, as assessed by the water swallowing test (WST), video fluoroscopic swallowing study (VFSS), standardized swallowing assessment (SSA), and the Ichiro Fujishima rating scale (IFRS). Secondary outcomes were the incidence of aspiration pneumonia (IAP) and adverse events.	Quality of included studies: Of 16 RCTs, only one was of low risk of bias (5/7 areas of bias adequately addressed. For the rest (15/16 RCTs) 1-3/7 areas of bias were adequately addressed. All effects below are immediately post therapy. No maintenance/ follow up. Effective rate: significantly greater benefits for intervention arm (OR 5.40, 95% CI [3.78, 7.72], I^2 = 0%. N = 12 RCTs WST: significantly greater benefits for intervention arm (MD −0.78, 95% CI [−1.07, −0.50]). There was	- Low quality Search: the search was not supplemented by consulting current contents, reviews, textbooks, specialized registers, or/and experts in the particular field of study, and by reviewing the references in the studies found. Characteristics of included studies: limited information provided on participant characteristics (only age and time post onset). No information on other demographics e.g. gender; no information on stroke or dysphagia; limited

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					substantial heterogeneity (p=0.05, I^2 = 66%). N = 3 RCTs VFSS: significantly greater benefits for intervention arm (MD 1.47, 95% CI [1.11, 1.84], I^2 = 0%). N = 2 RCTs SSA: Not reported. IFRS: significantly greater benefits for intervention arm (MD 1.94, 95% CI [1.67, 2.22], I^2 = 96%). N = 2 RCTs. IAP: significantly greater benefits for intervention arm (OR 0.20, 95% CI [0.06, 0.61], I^2 = 0%). N = 2 RCTs. Adverse events: N=2 RCTs. 16 people reported AEs. 10 had adverse events related to acupuncture, such as pain and hematoma, but they were not severe. The remaining 6 patients developed irritating cough during eating, and they were all in the control group.	information on intervention (only duration). The authors acknowledge in the discussion that "the protocols of EA are also diverse, including differences in acupoints, stimulation methods, needle retention time, and number of treatments, leading to sources of heterogeneity in this MA" Combining individual study findings: for 2/5 MA, heterogeneity (I^2) very high. We don't know how clinically heterogeneous studies were, as not enough information is provided for the studies. All studies included in synthesis despite low quality ratings.
402	L. Zhong et al. (2021). Repetitive Transcranial Magnetic Stimulation at Different Sites for Dysphagia After Stroke: A Randomized, Observer-Blind Clinical Trial. *Frontiers in Neurology,* 12: 625683	Hospital rehabilitation centre (China); RCT – observer blinded (those measuring effects blinded , not those delivering treatment). 147 patients across 4 groups: based on where	20 mins of 5Hz rTMS 3 sites: unaffected hemisphere,, 2 affected hemisphere, 3, cerebellum, 4 control – no rTMS 10 consecutive sessions for 2 weeks. all 4 groups received 30 mins dysphagia treatment as	Measures before, t/ment, 2 weeks after t/ment and 4 weeks after t/ment. Primary outcome Fiberoptic Endoscopic Dysphagia Severity scale (FEDSS). Several secondary scales.	Young sample (mean age 64),more men than women, groups equivalent on other stroke measures (ADL eg.) all groups having rTMS improved cpd to control group. 3 people with headache, no seizures,	Low quality (-) No SHAM, no differentiation in 3 controls, small number sin each, no stroke location no objective measures. No hypotheses

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		rTMS used – 3 sites) or control group	well (5 days a week for 10 days).	FEES used semiliquid diet, (from liquid to soft solid)		
610	M. Messagi Sartor et al. (2017). Respiratory muscle strength training and neuromuscular electrical stimulation in subacute dysphagic stroke patients: a randomized controlled trial. Clinical rehabilitation 31:761-771 NB first author is Anna Guillen-Sola	Barcelona, Spain Dec2013 - June2015 Single blind design RCT Pts with dysphagia after ischaemic stroke, 1-3 weeks post stroke n=62 (50 after lost to follow up) 3 parallel groups with similar characteristics but different stroke types (mix of TACI, PACi, LACI and POCI) Mean age 69 (8.7) Sex: 38.7% female	I n = 21 Standard swallow therapy (SST) II n = 20 Inspiratory and expiratory muscle training (IEMT) + standard swallow therapy III n = 21 Neuromuscular electrical stimulation (NMES) + sham IEMT + standard swallow therapy All received 3 week SST programme, 3 hrs/day, 5 days/week + IEMT or NMES.	Respiratory muscle strength taken at: baseline 3 weeks 3 months post intervention Dysphagia severity via Videofluoroscopy (PAS, FOIS, DOSS, V-VST) taken at: baseline 3 weeks 3 months post intervention Respiratory complications taken at: 3 months post intervention follow up only.	At 3 weeks: - significant positive effect of IEMT on respiratory muscle strength - but not maintained at 3 months. - significant effect of NMES on V-VST security signs, but not maintained at 3 months. -significant effect of IEMT on V-VST security signs. -sig effect of IEMT on V-VST efficacy signs at 3 months, but no significant difference on VF.	1.1 Y 1.2 Y 1.3 Y 1.4 Y 1.5 Y 1.6 Y 1.7 Y 1.8 I - 19% II - 20% III - 19% 1.9 Y 1.10 n/a 2.1 ++ based on above 2.2 for discussion 2.3 Y but acute only 2.4 Authors conclude that IEMT + NMES beneficial for respiratory and swallow function within subacute phase. Small study Lack of evidence to support enduring treatment effect.
610	M. Messagi Sartor et al. (2017). Respiratory muscle strength training and neuromuscular electrical stimulation in subacute dysphagic stroke patients: a randomized controlled trial. Clinical rehabilitation 31:761-771	109 identified, 47 excluded n=62 ischaemic stroke, 1-3 week onset Randomised control trial, single blind with 3 parallel groups. Aiming to assess therapeutic effectiveness of NMES and of EMT vs standard	3 Groups: Group i =SST standard swallow therapy n=21 Group ii =SST +IEMT (5 sets/10 repetitions x 2 per day for 5 days per week) N=21 Group iii = SST+sham+NMES (40 min sessions 5 days per week at 80Hz n=20	Dysphagia severity assessed with penetration-aspiration scale Respiratory muscle strength training with a device (max inspiratory and expiratory pressures) at end of intervention and at 3 months	Max resp pressures most improved in group 2 Swallowing security signs improved in groups ii and iii No difference in penetration-aspiration scale between the 3 groups at 3 month follow up Adding IEMT to SST improved respiratory	-

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		swallow therapy and to evaluate any influence on occurrence of respiratory complications	3 week standard MDT programme of SST and speech therapy		muscle strength. Both IEMT and NMES improved pharyngeal swallowing security signs. Effect achieved but not a lasting effect as not maintained at 3 month follow up.	
395	M. Song et al. (2020). A comparative study on the clinical efficacy of swallowing function training with and without acupuncture in the treatment of dysphagia after cerebral infarction. *International Journal of Clinical and Experimental Medicine,* 13:5 3564-3571	Setting China Design Randomised Control Trial Participants 120 patients with post stroke dysphagia (diagnosed by expert consensus). Recruited 2-12 weeks post onset and able to cooperate with treatment	Intervention arm (Acupuncture - mainly twirling supplementation & draining method). Treatment duration: Day 1-6: 1/day Day 7: rest Iterative process for 4 weeks plus Routine treatment and management - sEMG Treatment duration: 5x/day (3mins) several minutes between sessions vs Control arm (routine treatment and management - sEMG)	Outcomes i) Water Swallow Test ii) Standardised Swallowing Assessment scale iii) sEMG iv) QoL assessment scale	Participant age range 35-75. Pre-post intervention i) Water Swallow Test improved post study in both arms. Significantly improved in the intervention arm compared to control arm ($p<0.05$). ii) Standardised Swallowing Assessment improved post study in both arms. Significantly improved ($p<0.05$) in the intervention arm. iii) sEMG improved post study in both arms ($p>0.05$), Significantly improved in the intervention arm compared to control arm ($p<0.05$). iv) QoL improved post study in both arms. Significantly improved ($p<0.05$) in the intervention arm.	- Low quality. Small sample size No evidence to support sustained treatment effect.

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395	M. Song et al. (2020). A comparative study on the clinical efficacy of swallowing function training with and without acupuncture in the treatment of dysphagia after cerebral infarction. *International Journal of Clinical and Experimental Medicine,* 13:5 3564-3571	Setting: China; hospital Design: RCT Participants: 120 people with stroke and dysphagia, with water swallow test (WST) >/=3, aged 35-75, disease course of 2-12 weeks	Swallowing training, involving dilatation of cricopharyngeal muscle 5x a day (3min each) + acupuncture x 4 weeks. Control group: swallowing training alone.	WST Standard Swallowing Assessment (SSA) Surface and average electromyography (sEMG and AEMG). Which muscles: not specified Quality of life scale (QoL), not specified which scale. Effective rate based on WST	Post-therapy compared to pre-therapy for each group; and post-therapy scores were compared between groups (t-tests and chi-squared). WST: significantly better post therapy in both groups (p=0.028 control, p=0.008 intervention). Post-therapy, intervention group significantly better than control group (p=0.015). SSA: significantly better post therapy in both groups (p=0.047 control, p=0.01 intervention). Post-therapy, intervention group significantly better than control group (p=0.026). AEMG: significantly better post therapy intervention group only (p=0.011; control group p=0.065). Post-therapy, intervention group significantly better than control group (p=0.03). sEMG: significantly better post therapy in both groups (p=0.024 control, p=0.003 intervention). Post-therapy, intervention group significantly better than control group (p=0.036).	- Low quality Poor randomization method: coin flip No concealment method is mentioned Blinding is not mentioned. Given that the treatment was acupuncture, patients unlikely to be blinded to treatment allocation, but no mention of blinding of assessors or investigators. Outcomes seem to be measured in a standard way but certain things in reporting raise uncertainty. There is surface and average electromyography (sEMG and AEMG) but unclear what muscle activity was measured. A quality of life scale is mentioned but not which quality of life scale. No mention is made of intention to treat or per protocol analysis. 60 started each group and 60 completed; no mention of any switches between groups. The authors concluded that 'swallowing function training combined with acupuncture can effectively improve the swallowing function of patients with

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
					QOL: significantly better post therapy in both groups (p=0.043 control, p=0.016 intervention). Post-therapy, intervention group significantly better than control group (p=0.036). Effective rate: significantly better for intervention group chi-square= 8.521, p=0.031	cerebral infarction'. Confidence in the results is limited as no allocation concealment and no blinding were mentioned.
401	W. Zhao et al. (2019). Clinical observation of effects of ultrashort wave therapy combined with acupuncture and rehabilitation training in the treatment of patients with dysphagia after stroke. *Journal of Neurorestoratology,* 7:3 136-142	Setting China Design RCT Subjects n= 126 participants with post stroke dysphagia (stroke diagnosed using CT/MRI within 10-15 days post onset) Dysphagia diagnosed using Fourth National Conference in Cerebrovascular Diseases criteria	Intervention (4 weeks) Comprehensive rehabilitation training (i) ultrashort wave therapy 1/day for 20 mins for 4 weeks (ii) Rehabilitation training (oromotor exercises) (iii) Acupuncture (63 patients, mean age 56 +- 9years, 36 haemorrhage, 27 infarct) vs Control (4 weeks) (i) Rehabilitation training (ii) Acupuncture (30mins for 2 weeks. Continuous treatment involved 2 courses. (63 patients, mean age 57 +- 8years, 39 haemorrhage, 24 infarct	i) Water Swallow Test ii) SWOL-QOL iii) Incidence of Aspiration Pneumonia	Pre-post intervention study i) Water Swallow Test Significant improvement in both arms (p<0.01). Significantly improved in the intervention arm over the control group (p<0.01). ii) SWOL-QOL Significant improvement in both arms (p<0.05). Significantly improved in the intervention arm over the control group (p<0.01). iii) Incidence of Aspiration Pneumonia Significantly lower rates in the intervention arm than the control arm (p<0.05)	- Low quality Poor methodology reporting re: participant allocation, blinding No evidence to support sustained treatment effect. Limited and subjective clinical outcomes

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401	W. Zhao et al. (2019). Clinical observation of effects of ultrashort wave therapy combined with acupuncture and rehabilitation training in the treatment of patients with dysphagia after stroke. *Journal of Neurorestoratology,* 7:3 136-142	Setting: China; acute hospital Design: RCT Participants: 126 people with stroke and dysphagia, aged 40-65, disease course of 10-15 days, and "no severe cerebral haemorrhage or cerebral infarction"	Comprehensive rehabilitation training, comprising swallowing rehabilitation training + acupuncture + ultrashort wave therapy. Control: swallowing rehabilitation training + acupuncture	30ml water swallow test (WST) Swallowing related quality of life (SWAL-QOL) Presence of aspiration pneumonia	Post-therapy compared to pre-therapy for each group; and post-therapy scores were compared between groups (t-tests and chi-squared). WST: significantly better post therapy in both groups ($p<0.01$). Post-therapy, intervention group significantly better than control group ($p<0.01$). SWAL-QOL: significantly better post therapy in both groups ($p<0.05$). Post-therapy, intervention group significantly better than control group ($p<0.05$). Aspiration pneumonia during intervention period: 13 (20.63%) in control group; 5 (7.94%) in intervention group ($p<0.05$).	- Low quality Randomisation is mentioned but method not specified No concealment method is mentioned Blinding is not mentioned. Very limited information provided on participants: only age, gender and type of stroke (haemorrhage vs infarct). No further info on demographics, stroke, severity or dysphagia. People with "severe cerebral hemorrhage and cerebral infarction" are excluded but not specified how measured. No mention is made of intention to treat or per protocol analysis. 63 started each group and 63 completed; no mention of any switches between groups. The authors concluded that comprehensive rehabilitation training (comprising swallowing rehabilitation training + acupuncture + ultrashort wave therapy) can greatly improve dysphagia after stroke and can effectively reduce the incidence of aspiration pneumonia.

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						Confidence in the results is limited as no allocation concealment and no blinding were mentioned.
385	Y. Lu et al. (2021). Efficacy of acupuncture for dysphagia after stroke: a systematic review and meta-analysis. *Annals of palliative medicine,* 10:3 3410-3422	Setting China Design Systematic Review and metaanalysis Subjects n= 3078 participants with post stroke dysphagia	Intervention (i) Acupuncture (ii) Rehabilitation Training (1433 participants) vs Control (i) Rehabilitation Training (1413 participants)	i) Water Swallow Test ii) Standardised Swallowing Assessment iii) Fujishima rating scale iv) SWAL-WOL v) Videofluoroscopy	Searches from inception to 2020 39/3207 included studies i) Water Swallow Test 8 studies. 475 participants in the intervention arm, 454 control arm. Significantly improved in the intervention arm over the control arm ($p<0.0001$). ii) Standardised Swallowing Assessment 8 studies, 346 participants in the intervention arm 334 in the control arm. Significantly improved in the intervention arm over the control arm ($p<0.00001$). iii) Fujishima rating scale 3 studies. 141 participants in the intervention arm, 334 in the control arm. Significantly improved in the intervention arm over the control arm ($p<0.01$). iv) SWAL-QOL 5 studies. 245 participants in the intervention arm, 232 in the control arm.	Limited search to Chinese and English studies Excluded studies not reported Small study participant numbers and few studies in each of the outcome measure domains. Therefore authors report evidence is relatively weak No evidence to support sustained treatment effect.

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					Significantly improved in the intervention arm over the control arm (p<0.0001). v) Videofluoroscopy 5 studies. 177 participants in the intervention arm, 177 in the control arm. Significantly improved in the intervention arm over the control arm (p<0.00001).	
385	Y. Lu et al. (2021). Efficacy of acupuncture for dysphagia after stroke: a systematic review and meta-analysis. *Annals of palliative medicine,* 10:3 3410-3422	Setting: China. Not further specified Design: SR/MA of 39 RCTs to investigate the efficacy and safety of acupuncture for treating dysphagia in patients with stroke Participants: 3,078 people with post-stroke dysphagia (PSD)	Acupuncture combined with swallowing rehabilitation training (SRT) in experimental group. SRT alone in control group. No further information on intervention.	Effective treatment rate, Kubota drinking water test, standardized swallowing assessment (SSA) score, Fujishima feeding-swallowing function grade score, swallowing disorder-specific quality of life scale (SWAL-QOL) score, and video fluoroscopic swallowing study (VFSS)	Quality ratings: high risk of bias in included studies. Only 2/39 had 5-6/7 areas of bias adequately addressed. 37/39 had 3/7 areas adequately addressed. Effective treatment rate: sig. higher in intervention group (IG), [relative risk (RR) =1.23, 95% confidence interval (CI): 1.19 to 1.27, P<0.00001. I^2 = 0%, n= 36 studies. Kubota drinking water test: score of drinking water test for IG was lower than the control group, and the difference was statistically significant [mean difference (MD) =−0.75, 95% CI: −1.11 to −0.41, P<0.0001. I^2 = 98%, n= 8 studies reported in text, 11 in figure. SSA score: Lower in IG and the difference was	- Low quality Search: the search was not supplemented by consulting current contents, reviews, textbooks, specialized registers, or/and experts in the particular field of study, and by reviewing the references in the studies found. Status of publication: papers were only retrieved from electronic datasets and no other sources, which means they were published. Authors do not state that they searched for reports regardless of their publication status. Study characteristics: 39 studies are reported to be

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					statistically significant (MD =−4.63, 95% CI: −5.68 to −3.59, P<0.00001. I^2 = 76%, n= 8 studies Fujishima feeding-swallowing function grade score: higher score in IG and the difference was statistically significant [standardized mean difference (SMD) =1.92, 95% CI: 1.30 to 2.54, P<0.00001 I^2 = 77%, n= 3 studies SWAL-QOL: score higher in IG and the difference was statistically significant (SMD =2.02, 95% CI: 0.82 to 3.22, P=0.0001 I^2 = 97%, n= 5 studies VFSS: higher in IG he difference was statistically significant (MD =2.53, 95% CI: 1.89 to 3.17, P<0.00001 I^2 = 65%, n= 5 studies	included in the review, and yet table 1 with study characteristics comprises 48 papers (unclear how papers relate to studies). Very limited information provided on participant characteristics (only age). No information on other demographics, e.g., gender; no information on stroke or dysphagia; no information on setting Combining individual study findings: All studies included in synthesis despite low quality ratings and high risk of bias. For 4/5 MA, heterogeneity (I2) very high. We don't know how clinically heterogeneous studies were, as not enough information is provided for the studies. The results interpretation does not take into consideration the risk of bias in included studies Publication bias: Though publication bias is reported adequately in the paper, it is stated that the funnel plot (figure 10) is based on 10 studies, but it appears to include more studies.

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358	P. M. Bath et al. (2018). Swallowing therapy for dysphagia in acute and subacute stroke. *Cochrane Database of Systematic Reviews,* 2018:10 CD000323	Design: Cochrane Systematic Review: RCTs. Subjects: Ischaemic or haemorrhagic stroke patients within 6 months of stroke, with post-stroke dysphagia, N=2660, 41 trials.	8 types: Acupuncture versus no/ routine/ sham acupuncture Behavioural versus limited, usual, or no treatment Drug intervention versus none or placebo. NMES versus none or sham stimulation. PES versus none or sham stimulation Physical stimulation versus limited, usual, or no treatment. tDCS versus none or sham stimulation TMS versus none or sham stimulation	Primary outcome: Functional outcome assessed as death or dependency (modified Rankin Scale: mRS > 2), or death or disability (Barthel Index: BI < 60), at the end of the trial. Secondary outcomes reported in SoF table: Case fatality at the end of the trial Length of inpatient stay Proportion of patients with dysphagia at the end of the trial Swallowing ability based on assessments of dysphagia impairment Penetration Aspiration score determined by VFSS and FES Chest infection or pneumonia, determined clinically or radiologically.	Swallowing therapy had no effect on functional outcome, case fatality, penetration aspiration score. Swallowing therapy probably reduced length of stay, proportion of patients with dysphagia, swallowing ability and chest infections. However, these results are based on variable quality evidence.	**++** Checklist 1 for systematic reviews and meta-analyses.
358	P. M. Bath et al. (2018). Swallowing therapy for dysphagia in acute and subacute stroke. *Cochrane Database of Systematic Reviews,* 2018:10 CD000323	Cochrane systematic review 41 trials (2660 participants).	Acupuncture (11 studies), behavioural interventions (nine studies), drug therapy (three studies), neuromuscular electrical stimulation (NMES; six studies), pharyngeal electrical stimulation (PES; four studies), physical stimulation (three	Primary outcome (death or dependency/disability at the end of the trial) Other outcomes case fatality at the end of the trial length of inpatient stay	Swallowing therapy may have reduced the proportion of participants with dysphagia at the end of the trial (OR 0.42, 95% CI 0.32 to 0.55; 1487 participants; 23 studies; I2 = 0%; P = 0.00001; low-quality evidence).	**++** High quality swallowing therapy may have reduced dysphagia, and may have improved swallowing ability. However, these results are based on evidence of

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			studies), transcranial direct current stimulation (tDCS; two studies), and transcranial magnetic stimulation (TMS; nine studies).	proportion of participants with dysphagia at the end of the trial improve swallowing ability penetration aspiration score radiological aspiration incidence of chest infection or pneumonia	Trial results show no evidence of a subgroup effect based on testing for subgroup differences (P = 0.91) Swallowing therapy may improve swallowing ability (SMD -0.66, 95% CI -1.01 to -0.32; 1173 participants; 26 studies; I2 = 86%; P = 0.0002; very low-quality evidence). No evidence of a subgroup effect based on testing for subgroup differences (P = 0.09). Swallowing therapy did not reduce the penetration aspiration score (i.e. it did not reduce radiological aspiration)(SMD-0.37, 95% CI-0.74 to -0.00; 303 participants; 11 studies; I2 = 46%; P = 0.05; low-quality evidence). Swallowing therapy may reduce the incidence of chest infection or pneumonia (OR 0.36, 95% CI 0.16 to 0.78; 618 participants; 9 studies; I2 = 59%; P = 0.009; very low-quality evidence).	variable quality, involving a variety of interventions.
396	E. K. Umay et al. (2017). The effect of sensory level electrical stimulation of the masseter muscle in early stroke patients	Setting: Physical Medicine and Rehabilitation Clinic, Ankara, Turkey Design: RCT. 4 weeks of treatment.	Stimulation group (Group 1): Sensory Level Electrical Stimulation (SES) + traditional swallow therapy.	Evaluate the effects of Sensory Level Electrical Stimulation (SES) to bilateral masseter muscles in early stroke patients	There was a significant improvement in all parameters except for the motor FIM score in the stimulation group (Group 1; P < 0.025). In Group 2,	+ No method of concealment is reported. *Caveat unable to access any of the Tables referred

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	with dysphagia: A randomized controlled study. *Neurology India,* 65:4 734-742	Participants: 98 patients with dysphagia in first month post stroke.	Control group (Group 2): Sham group (traditional swallow therapy) 4 weeks.	with dysphagia. Evaluation parameters were compared between groups before and after therapy and included: bedside screening tests (Bedside Dysphagia Score, Neurological Examination Dysphagia Score, Total Dysphagia Score, and Mann Assessment of Swallowing Ability) and by FEES by the penetration-aspiration scale.	there were no significant changes in the evaluation parameters (P > 0.025).	to in the results. Therefore, review based on what was reported in the text.
396	E. K. Umay et al. (2017). The effect of sensory level electrical stimulation of the masseter muscle in early stroke patients with dysphagia: A randomized controlled study. *Neurology India,* 65:4 734-742	Ninety-eight patients with dysphagia within the first month after ischemic stroke Turkey	Sensory-level electrical stimulation (SES) to bilateral masseter Muscles	Bedside screening tests (Bedside Dysphagia Score, Neurological Examination Dysphagia Score, Total Dysphagia Score, and Mann Assessment of Swallowing Ability test) and by flexible fibreoptic endoscopic evaluation of swallowing (FEES) reassessed after 4 weeks	There was a significant improvement in dysphagia severity scores evaluated by bedside screening tests and FEES in cognitive and total functionality levels except in motor functional independence level in the stimulation group	**+** Acceptable Assessors blinded to treatment allocation. Sham treatment - unclear patients blinded randomly allocated by block randomization, and a table of random numbers No sample size calculation 33 excluded after randomization because of protocol violations no intention to treat
357	V. Arreola et al. (2021). Effect of Transcutaneous Electrical Stimulation in Chronic Poststroke Patients with	Setting: Spain, Hospital de Mataro Design: Prospective RCT 3-arm, open label blinded analysis to evaluate and compare	Group 1 (Control) Standard compensatory treatment (CT) inc. adaptation of fluids with thickening agents, texture modified diet, oral hygiene recommendations, postural	Primary end point – Effect of the active treatment (TES groups) compared to control group on safety of swallow	PAS score Post Treatment VFS: Significant reduction from 4.69 +/- 1.71 to 3.38 +/- 1.90 (P<0.1) in the SES group, from 4.59 +/-2.02 to 3.76 +/- 2.31 (P <0.05)	**+** Acceptable quality. Small numbers. Single site. Some discrepancies in reporting in text vs. Tables. For

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	Oropharyngeal Dysphagia: 1-Year Results of a Randomized Controlled Trial. *Neurorehabilitation and Neural Repair,* 35:9 778-789	the effect of 2 stimulation levels (sensory and motor) using VitalStim™ on videofluoroscopic signs of impaired safety and efficacy of swallow and the oropharyngeal swallow response in patients with CPOD. Subjects: 90 chronic post stroke (≥ 3mos) dysphagia patients with oropharyngeal dysphagia (CPSOD).	changes if necessary (chin down and head rotation to the affected side) and nutritional advice. Group 2 (SES) Transcutaneous electrical stimulation at sensory level + CT. Group 3 (NMES) Transcutaneous electrical stimulation at a motor level + CT. Patients were treated with up to 2 cycles (6 months apart) of 15 x 1hr TES sessions over 2 weeks and followed up with 4-5 clinical and VFS assessments during 1 year.	(change in PAS scores at post treatment and 1 year follow up). Secondary end points (compared to the control group: incidence of all adverse events; change in pharyngeal residue prevalence at post-treatment and study end visits, change in NIHSS at follow up and study end visits; change in mRS and Barthel Index at follow up and clinical outcomes.	NMES group, and not significant in the control group (from 4.55 +/- 1.55 to 4.51 +/- 1.68). PAS Score 1 year Baseline vs. 1 year Follow up VFS: Reduction of 1, 1.7 and 2.0 (P=0.11; P<0.01; and P<0.01) in the control, SES and NMES groups respectively. Incidence of all adverse events: 36% of patients had at least 1 AE. In total there were 50 AEs of which 48% were in the control group, 22% in the SES group and 30% in the NMES group. Of the 50 AEs only 4% were directly related to TES. Change in pharyngeal residue at 1 year follow up: Control reduction from 89.66% (N=26) to 57.69% (N=15), SES reduction from 90% (N=27) to 76% (N=19) and NMES reduction from 63.33% (N=19) to 61.54% (N=16). Baseline NMES pharyngeal residue (P<0.05) vs. Control and (P<0.05) vs. SES. Change in NIHSS, mRS and Barthel index – No improvement in any of these measures over the study period among the 3 groups.	example, Table 2 baseline VFE Control group Aspiration % 13.79% vs. 19.1% in text (Section Long-Term Effect of the TES Treatments T1 + T2 (Baseline vs 1-year Follow-up VFS).

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
357	V. Arreola et al. (2021). Effect of Transcutaneous Electrical Stimulation in Chronic Poststroke Patients with Oropharyngeal Dysphagia: 1-Year Results of a Randomized Controlled Trial. *Neurorehabilitation and Neural Repair,* 35:9 778-789	Prospective, randomized, controlled, three-arm, open-label, blinded-analysis RCT 90 patients (74.1 ± 11.5 y, with chronic poststroke oropharyngeal dysphagia (CPSOD)	Transcutaneous electrical stimulation (TES) sensory group, compensatory treatment plus TES at sensory level intensity (SES); and motor group (NMES), compensatory treatment plus TES at motor level intensity. treated with up to two cycles (6 months apart) of 15 1-hour stimulation sessions during two weeks. The second treatment cycle of TES was only performed on those patients who still had signs of impaired safety of swallow at follow-up	Primary endpoint safety of swallow (change in penetration–aspiration scale (PAS) scores at post-treatment and study end visits. Secondary endpoints were: incidence of adverse events; change in pharyngeal residue prevalence, NIHSS, mRS and BI and clinical outcomes	Swallowing parameters significantly improved between baseline and 1-year follow-up in SES and NMES groups for prevalence of patients with a safe swallow ($P < .001$), mean PAS ($P < .001$), time to laryngeal vestibule closure ($P < .01$), and need for thickening agents ($P < .001$).	**++** High quality Randomised using specific software open-labeled for the clinician VFS and data analysis were blinded to the study arm. Power calculation: 30 subjects are necessary in each group to recognize as statistically significant
383	Y. Liang et al. (2021). Evaluating the Efficacy of VitalStim Electrical Stimulation Combined with Swallowing Function Training for Treating Dysphagia following an Acute Stroke. *Clinics (Sao Paulo, Brazil),* 76: e3069	Setting: Cadre Sanatorium of Hainan & Geriatric Hospital of Hainan, China Design: Prospective RCT divided into 2 groups: Group 1 Control group, Group 2 Experimental group. Participants: 72 patients with dysphagia following an acute stroke	Control Group: Swallow function training and conventional medical treatment. Swallow function training included: 1) Cheek muscle training 2) Tongue muscles training 3) Suction training 4) Swallowing reflex training 5) Throat training 6) Pharyngeal contraction training. Experimental group: VitalStim electrical stimulation + swallowing function training.	Clinical efficacy* of VitalStim electrical stimulation combined with swallowing function training for patients with dysphagia following acute stroke. * Clinical efficacy. Marked response: the clinical symptoms were notably relieved or disappeared, and the Kubota drinking water test (KDWT) grade increased by 2 or more. Response: the clinical symptoms were relieved, and the KDWT grade increased by 1. Non response: did not meet the above criteria. The	Overall response rate of the experimental group was higher than that of the control group 94.44% vs. 77.78% ($P < 0.041$). Incidence rate of complications in the experimental group was lower than that in the control group 2.78% vs. 25%, and the difference was statistically significant.	- Small sample. Single site. Unclear method of randomisation 'divided into 2 groups using prospective research methods'. No method of concealment is reported. One exclusion criteria was patients with dysarthria – unclear if this was stroke patients with dysarthria or patients with dysarthria because of other neurological conditions.

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				overall response is the sum of the marked response and response rates. Other outcome measures included: Swallowing function: upward and forward movement of the hyoid bone, standard swallowing assessment (SSA) score, grading score of the KDWT, and Caiteng grading score were used for evaluation; Serum indices; Neurological and limb motor functions; Quality of Life and Complications		
383	Y. Liang et al. (2021). Evaluating the Efficacy of VitalStim Electrical Stimulation Combined with Swallowing Function Training for Treating Dysphagia following an Acute Stroke. *Clinics (Sao Paulo, Brazil),* 76: e3069	72 patients with dysphagia following an acute stroke were admitted to our hospital (China)	VitalStim electrical stimulation combined with swallowing function training	Upward and forward movement speeds of the hyoid bone, anterior movement speed, the grading score of the Kubota drinking water test, Caiteng's grading score, serum superoxide dismutase, 5-hydroxytryptamine and norepinephrine levels, Fugl-Meyer Assessment score, and quality of life	The overall response rate of the experimental group was higher than that of the control group, and the difference was statistically ($p < 0.05$) upward and forward movement speeds of the hyoid bone increased in both groups - marked rise in the experimental group ($P<0.05$). e SSA scores both groups decreased after treatment, Caiteng grading scores and grading scores of the KDWT increased- more remarkable in the	**+** Acceptable Single site Randomisation - random number table method No sample size calculation – small sample Assessors of swallow function blinded for the group of subjects Unclear time between assessments

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
					experimental group, ($p<0.05$)	
361	G. D. Carnaby et al. (2020). Exercise-based swallowing intervention (McNeill Dysphagia Therapy) with adjunctive NMES to treat dysphagia post-stroke: A double-blind placebo-controlled trial. *Journal of oral rehabilitation,* 47:4 501-510	Setting: Inpatient stroke rehab, USA. Design: RCT Subjects: 53 new stroke (<0-2 weeks), new moderate dysphagia (FOIS 3-4) No reported differences but location of stroke was not equal i.e. more POCS in NMES group.	Three arms: 15 hours of: 1.Mc Neil Dysphagia Therapy Program (MDTP)+ NMES 2.MDTP + sham 3.Usual care 1st 2 groups did not get UC.	Baseline, post and 3 months: MASA (score & responsiveness >10 points full response (MCID) FOIS MBS -Dysphagia presence (not defined) MBS -Aspiration presence Dependency (mRS) Chest infection Weight change Explored time to return to pre-stroke diet	"significant differences in MASA severity rating across groups" ($\chi2 = 24.8$, $P \leq .0001$. BUT severity nor scores were reported). "Greatest change in MDTPsham group (effect size = 1.37; 95% CI: 0.68-2.07)". MBS – significant l difference in aspiration events ($\chi2 = 7.73$, $P \leq .021$), the MDTPsham arm greater overall positive change than either MDTP + NMES or UC arms [effect size = 1.26; 95% CI: 0.60-2.57] FOIS MDTPsham greatest change ($F [2, 45] = 11.38$, $P \leq .0001$), [effect size d = 1.7; 95% CI 0.88-0.017] ??. The MDTP + NMES showed significant change in comparison with the usual care group ($t = -3.19$, $P \leq .003$). Treatment response greater in MDTPsham group compared to UC but not MDTP+NMES. Reduced time to return to pre-stroke diet NB MASA score (not severity or change in score) was primary outcome.	+ Acceptable. Good study design means reduced bias, N is small, results are difficult to interpret as they have not made clear the statistical test they use for each comparison and perhaps missing data for some results. Primary outcome probably not reported. No differences between groups on looking at the data. Differences between location of stroke may impact on trajectory of dysphagia recovery. Results are consistent across measures, indication that MDTP alone is superior to MDTP+NMES & UC and MDTP +NMES is superior to UC. I would suggest a larger trial is needed to be certain of effect sizes

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					NB sample size calculation was based on a 22% difference between groups – this was not the case.	
377	H.-H. Kim & J.-S. Park (2019). Efficacy of modified chin tuck against resistance exercise using hand-free device for dysphagia in stroke survivors: A randomised controlled trial. *Journal of oral rehabilitation,* 46:11 1042-1046	Setting: Korea Design: RCT Subjects: New cortical stroke (<6months), new dysphagia (severe)	Chin tuck against resistance – modified – using a resistant device. Isometric exercise-holding the chin down for 10 seconds against the resistance (10 seconds, thrice). Isotonic exercise was repeated 30 times in the chin-down position against resistance. Vs usual care - both groups got usual care	PAS (aspiration) FOIS (functional oral intake)	Visual and statistically significant differences between groups post intervention in favour of intervention on PAS scores (3.07 ± 0.59 vs 4.47 ± 0. p <0.001) And FOIS (5.07 ± 0.88 vs 3.67 ± 1.23 p<0.001) FOIS change and difference > 1 (MCID Strong effects sizes. PAS assessment (1.3). FOIS assessment (1.1) Used stats for non-normally distributed data.	+ Adequate. Unclear blinding, but otherwise robust methods. Promising results indicating CTAR is superior to usual care. More haemorrhagic strokes in control group (could mean slower recovery) and limited data on severity or time post stroke could mean groups. These potential group differences that affect results in such small N.
360	J. K. Benfield et al. (2019). Does Therapy With Biofeedback Improve Swallowing in Adults With Dysphagia? A Systematic Review and Meta-Analysis. *Archives of Physical Medicine and Rehabilitation,* 100:3 551-561	Range of countries and settings and populations Systematic review and Meta-analysis Approx 50% stroke patients	"Biofeedback" paired with exercise Different biofeedback tools paired with different exercises.	Clinical (Tube feeding) Functional (FOIS) Physiological (hyoid displacement)	Significant improvement in physiological measure (hyoid excursion) with biofeedback vs usual care. (t=3, n=90, MD=0.22; 95% CI [0.04, 0.40] Range of aetiologies & exercises and using accelerometry and sEMG as biofeedback tool.	+ Acceptable Not all subjects were applicable, only around 50%. It's possible a meta-analysis should not have been completed due to heterogeneity. Only 5 studies included in MA, overall quality poor. Results should be interpreted with caution.
391	J.-S. Park et al. (2019). Effects of game-based chin tuck against resistance exercise vs head-lift exercise in	South Korean rehab centre. N=46 stroke patients <6months with dysphagia (severe – NG	Intervention group: isotonic and isometric chin tuck against resistance exercises within a visual computer game set up	VDS PAS FOIS Participant rating Drop out ratio	Both groups showed statistically significant improvement from pre to post treatment (P<0.001) on all scores.	+ Acceptable Methodology is good, it is unclear what measure the

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	patients with dysphagia after stroke: An assessor-blind, randomized controlled trial. *Journal of rehabilitation medicine,* 51:10 749-754	fed). Only cortical strokes Assessor blinded RCT.	Control – isotonic and isometric head lift exercise 5 x per week for 4 weeks Both groups had 30m/day traditional therapy		PAS and FOIS MCIDs. No group difference between post intervention scores (p>0.05) More drop outs due to comfort/pain in the control group 0 vs 4 : experimental group had higher scores in the motivation and interest /enjoyment items than control group ($p < 0.001$), and physical effort needed and muscle fatigue items were significantly lower than control ($p < 0.001$) Analysed FOIS with t-test - 7 point ordinal scale	sample size calculation is based on, and also one assumes data was normally distributed as they use parametric statistics. Some concerns with treating FOIS as a continuous outcome. It is unclear from this study that HLE or gbCTAR improves swallowing outcomes due to the lack of a control group. But some evidence that gbCTAR is more acceptable to patients compared to HLE
370	L. F. Everton et al. (2021). Effects of Pharyngeal Electrical Stimulation on Swallow Timings, Clearance and Safety in Post-Stroke Dysphagia: Analysis from the Swallowing Treatment Using Electrical Pharyngeal Stimulation (STEPS) Trial. *Stroke Research and Treatment,* 2021: 5520657	Setting: International trial, 15 acute hospitals in 5 countries. Design: Retrospective data analysis of RCT. Participants: Acute stroke patients (onset within 42 days) with dysphagia of PAS >2 on any of 7 boli (6x5ml and 1 x 50ml).	PES treatment to active group, sham to control group, 10 mins per day for 3 consecutive days via adapted NG Tube.	The modal PAS score determined by VFS (of worst PAS from 6x 5ml at baseline and 2 weeks and mean PAS (all 5ml boli) at baseline and 2 weeks; mean of 50ml bolus and worst 50ml bolus. Timings: Eight continuous measures (msec) of speed and duration of swallow functions such as pharyngeal transit time. Efficiency: Number of swallows to clear and oral and pharyngeal residue.	No significant differences were detected between groups for safety, timing or clearance measures.	+ Checklist 2: Controlled Trials

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370	L. F. Everton et al. (2021). Effects of Pharyngeal Electrical Stimulation on Swallow Timings, Clearance and Safety in Post-Stroke Dysphagia: Analysis from the Swallowing Treatment Using Electrical Pharyngeal Stimulation (STEPS) Trial. *Stroke Research and Treatment,* 2021: 5520657	Setting; fifteen hospitals involved in STEPS trial, across 5 countries . Most sites contributed <10% of the overall data, one site contributed 37% of data Design; retrospective analysis on Swallowing Treatment using Electrical Pharyngeal Stimulation Trial STEPS) RCT Subjects; 81 randomised participants: PES n=43 vs sham n=38 analysed at baseline and 2 weeks. Onset of stroke within 42 days. Participants swallowed up to 6 x5ml and 1 x50ml pf liquid barium at 40% w/v, images at ≥25fps. 5ml mode bolus and worst 50ml bolus chosen for analysis. Participants with any bolus with PAS >2 were randomised to PES or sham treatment. Those with a baseline and a two week VFSS were included in this analysis, including those with VFSS data recorded at	Investigated PES using VFSS from the STEPS trial incorporating measures of safety, speed and duration and efficiency	Primary outcome: safety, timing and clearance measures of 5ml mode bolus Secondary outcome: same measures for worst 50 ml bolus Timing measures (from primary swallow): Global oral transit time, stage transition duration, initiation of laryngeal closure, laryngeal vestibule closure reaction time, laryngeal closure duration, pharyngeal response time, pharyngeal transit time and upper oesophageal sphincter duration. Initiation of pharyngeal swallow: Modified Barium Swallowing Impairment Profile Clearance measures: oral and pharyngeal residue and number of swallows to clear. Operational definitions found in	No further changes to swallowing function using measures of timing, safety and clearance	+ Adequate Supplementary materials Conflict of interest acknowledged as authors employed by Phagenesis, sponsor of original STEPS trial Baseline characteristics of excluded participants included in table form Inclusion of outlier data which represents severe patients with slow swallowing function

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		frame rate of ≥25 fps (frames per second)		supplementary materials		
368	M.-J. Eom et al. (2017). Effects of resistance expiratory muscle strength training in elderly patients with dysphagic stroke. *NeuroRehabilitation,* 41:4 747-752	"Elderly" stroke patients – mean approx. 70 years. <3 months post stroke RCT	Expiratory Muscle Strength Training. (EMST 150) 5 days per week 4 weeks 5 breaths 5 sets = 25 Vs sham (device with no loading	VDS (videofluoroscopy dysphagia scale) PAS	Treatment group showed significantly greater change in VDS (15.69±7.97 vs 5.27±6.16 p 0.002) And in PAS (1.31±1.25 0.31±0.63 p=0.027) Effect sizes (cohen's d) all >0.8 = large)	**++** High quality There is evidence of physiological changes to swallowing (VDS) and change to safety (PAS). But don't know how this impacts on swallow severity/functional intake or clinical implications. Also sample size is very small. I suspect a larger study or pooled meta-analysis of smaller studies should be done in order to understand effectiveness.
372	P. Hagglund et al. (2020). Oral neuromuscular training in patients with dysphagia after stroke: a prospective, randomized, open-label study with blinded evaluators. *BMC neurology,* 20:1 405	2 centre study – treated at one of 2 hospitals (? In or outpatient) 40 New stroke and new dysphagia (at 4 weeks post stroke) RCT	Muppy – oral neuromuscular training device _ with forward force (lip strength) 5-10 seconds, 3 x 3 x daily for 5 weeks	Primary: Timed water swallow test (TWST) Secondary: lip force VFS – PAS (dichotomised normal vs abnormal), pharyngeal residue or premature spillage (any).	Post treatment no difference in TWST, but significant difference in treatment group at 12 months (13.7 vs 8.5 mls/sec, p= 0.032) Significant change in lip force post intervention in intervention group(7N (3–13) < 0.001) no group differences. Significant difference in lip force (10 vs 31 N p= 0.001) at 12 months in favour of intervention group . No difference in PAS (huge difference at baseline)	Methodology is on the whole good, but no means of achieving matched groups (swallowing & stroke), low numbers and bizarre exclusion in follow up mean that can't be certain that there is even an indication that this intervention is effective.
381	W. Li et al. (2017). Effects of extended in-patient treatment	Carried out in China, unknown setting.	Treatment group: "extended training"	Primary outcome appeared to be S100B serum	No. of participants with normal Kubota water swallow (dysphagia end of	- Low quality

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	training on outcome of post-stroke dysphagia. *European Review for Medical and Pharmacological Sciences,* 21:24 5711-5716	"Randomised controlled trials" N= 40 Stroke patients with dysphagia – unclear time post onset	Mainly ice stimulation but also oromotor training & oral trials. 30mins 3 x day Control group: radio frequency electrotherapy, acupuncture, dietary guidance, body position, swallowing training, and compensatory training. ? time Unclear how long the intervention period was	Also reported Water swallow test (Kubota) Adverse events	trial) was significantly greater for intervention group 14 vs 5 (X^2 8.12, p <0.05) Greater number of adverse events in control group 25% vs 5% Lower S100B serum In treatment group (positive effect) P<0.05	The numbers are small, unclear swallow or stroke severity of participants or whether groups were matched, many uncertainties about certain aspects of the methodology. High risk of bias. Therefore reduced confidence in the results.
366	R. Dziewas et al. (2021). European Stroke Organisation and European Society for Swallowing Disorders guideline for the diagnosis and treatment of post-stroke dysphagia. *European Stroke Journal,* 6:3 LXXXIX-CXV	Design: Systematic review and meta-analysis: RCTs, observational and epidemiological studies. Participants: Patients with post-stroke dysphagia, does not specify timepoint.	Dietary interventions: Texture modification/ thickened liquids Behavioural interventions Acupuncture Pharmacological interventions Neurostimulation methods: TES (NMES), TMS, tDCS, PES.	Outcomes Mortality Complications Aspiration risk Swallowing Function Length of stay QOL Laboratory parameters linked to malnutrition Feeding tube failures and adverse events	Key tables reported. Texture modified diet/ thickened liquids: Overall no significant differences for reduced pneumonia or for less penetration/ aspiration, or reduced fluid intake but significantly reduced LOS. Energy intake not given overall score, two studies NRCT reported, one not significant but was for reduced energy intake. Behavioural interventions: Significant reduction in pneumonia, LOS, dysphagia scores but not mortality, dependency or tube removal. Acupuncture: Significantly improved dysphagia at end of trial, dysphagia score, SwQOL and NG Tube removal but no change with independence (BI) or pneumonia.	**++** Checklist 1 for systematic reviews and meta-analyses Score

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					Pharmacological treatments: Significant differences seen for TRPV1 for: pneumonia (but not on RCTs on subgroup analysis), UES opening, LV closure time, Hyoid bone excursion and swallows/ min; significant differences seen for ACE inhibitors for: pneumonia (but not in RCTs on subgroup), LOS, aspiration; significant differences seen for dopaminergic agents for: mortality, pneumonia, LOS and latency of sw reflex; significant differences seen for metoclopramide in pneumonia. Neurostimulation: Significant differences between groups with TES/ NMES, TMS and tDCS in improving dysphagia scores but not PES. No significant improvement on mortality, pneumonia, LOS (hospital or ICU) or feeding tube removal. TMS did show some significant differences between groups for dependency (mRS) and independence (BI) and TES/ NMES on QOL. PES showed significant differences between groups for	

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					decannulation for tracheotomised patients.	
366	R. Dziewas et al. (2021). European Stroke Organisation and European Society for Swallowing Disorders guideline for the diagnosis and treatment of post-stroke dysphagia. *European Stroke Journal,* 6:3 LXXXIX-CXV	Stroke patients with dysphagia (not defined) Systematic review and meta-analysis (several questions)	Texture modification Thickening Behavioural interventions Nutritional interventions Oral health interventions Pharmacological interventions Neurostimulation Acupuncture	Functional outcome and/or survival aspiration risk length of hospital stay adverse events and complications swallow status/ability nutritional status quality of life	Texture modification Thickening : associated with a trend for a decreased risk of pneumonia(RR 0.19 [0.03, 1.40], p = 0.1 Reported reduced intake Behavioural interventions & Acupuncture improvement of dysphagia severity, which, in a smaller proportion of trials, was also reflected by an upgrade of the feeding strategy. Six RCTs including more than 600 patients showed a significant reduction of pneumonia (RR 0.57 [0.43, 0.75]), whereas no effect on functional outcome and mortality was observed. For acupuncture no effect on the incidence of pneumonia was observed (RR 0.40 [0.08, 1.98]), while quality of life indicators (RR 32 [24.99, 39.01]) were improved and removal of a feeding tube was more likely with acupuncture than with sham treatment (RR 1.79 [1.27, 2.53]). Nutritional interventions no effect of nutritional therapy on the key	**+** Acceptable Difficult to assess some of the quality due to lack of documented methods. Not as transparent or ? as robust as a Cochrane review. But many questions are covered, appeared to have extensive literature review. Difficult to compare results to other SR&MA as data presented differently. Large meta-analysis – highest quality of evidence. Lots of heterogeneity in behavioural studies. Relatively large numbers in neurostimulation MA.

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					outcomes namely mortality (RR 0.88 [0.57, 1.37]), functional status (independence) (RR 0.98 [0.91, 1.06]) or pneumonia (RR 1.12 [0.88, 1.42]) And a trend for a reduction of mortality with early enteral nutrition (RR 0.88 [0.76, 1.02], p = 0.09) Oral health interventions a trend towards a reduction of pneumonia (RR 0.14 [0.02, 1.11], p = 0.06), a significant reduction in tube feeding (RR 0.43 [0.28, 0.65]) and a significant improvement of oral health conditions (SMD -1.27 [-2.26, 0.28]) Pharmacological interventions in nonrandomized trials a significant reduction of this complication has been observed for ACE inhibitors (RR 0.60 [0.51, 0.70]) and TRPV1 agonists (RR 0.31 [0.15, 0.66]), this was not confirmed by the meta-analysis of RCTs Neurostimulation significant improvement of swallowing function compared to sham stimulation (SMD1.51 [0.60, 2.42] for rTMS, SMD 0.90 [0.60, 1.19] for TES,	

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					and SMD 0.75 [0.38, 1.12] for tDCS), for PES the treatment effect just failed to be significant (SMD 0.77 [0.06, 1.60], p = 0.07). Clinically more relevant endpoints, however, have been studied and achieved much rarer. Neurostimulation was associated with a modest impact on functional outcome. Two PES trials including 177 patients showed a significant impact of the intervention on the mRS (MD -0.33 [-0.63, 0.02]) and results from 4 rTMS trials including 86 patients showed an effect of the stimulation on the BI (MD 31.57 [27.75, 35.39]).	
371	A. Gulec et al. (2021). Effect of swallowing rehabilitation using traditional therapy, kinesiology taping and neuromuscular electrical stimulation on dysphagia in post-stroke patients: A randomized clinical trial. *Clinical Neurology and Neurosurgery,* 211: 107020	Setting: Physical Therapy and Rehabilitation Unit of Selcuk University Faculty of Medicine, Turkey Design: Single center RCT. Group 1 Neuromuscular Electrical Stimulation (NMES) and then Traditional Swallowing Therapy (TST), Group 2 TST and KT (Kinesiology taping) and Group 3 After KT was applied,	TST consisted of oral exercises, thermal-tactile stimulation, compensatory techniques and swallowing therapeutic maneuvers. Applied 3 days a week, with one session per day, and each session for 60 minutes for a total of 15 sessions. Vital Stim device was used. Applied 3 times a week for 30 min a day, for a total of 15 sessions. KT treatment was applied in 7 sessions. Y tape was applied to bring the larynx deviated to the	Bedside water swallow test, Eating Assessment Tool (Eat 10), Functional Oral Intake Scale (FOIS), Penetration-Aspiration Scale (PAS), and National Institute of Health Swallow Safety Scale (NIH-SS) before treatment, after treatment, and 3 months after the start of treatment	Statistically significant decrease in bedside water-swallow test (BWST), EAT-10, PAS, and NIHSS scores in all treatment groups 5 weeks and 3 months after treatment onset compared to pre-treatment scores ($p < 0.05$). Statistically significant increase in FOIS scores 5 weeks and 3 months after treatment compared to pre-treatment scores in all treatment groups ($p < 0.05$).	- Small numbers in each treatment arm. Multiple interventions. No control group i.e., TST only to determine effectiveness of treatment methods. No method of concealment reported.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
		NMES was first applied followed by TST. Subjects: 68 dysphagic stroke patients > 3 weeks post stroke were evaluated	intact side to the midline. I tape was applied to elevate the larynx.		When the pre-treatment, 3- week and 5-month swallow scale scores of all groups were compared, there was no significant difference in terms of BWST, EAT-10, FOIS, PAS, or NIH-SSS scores (p> 0.05) I.e., no superiority in treatment efficacy was detected in combining TST + KT + NMES compared to TST + NMES or TST + KT.	
371	A. Gulec et al. (2021). Effect of swallowing rehabilitation using traditional therapy, kinesiology taping and neuromuscular electrical stimulation on dysphagia in post-stroke patients: A randomized clinical trial. *Clinical Neurology and Neurosurgery,* 211: 107020	RCT 44 allocated treatment groups 37 patients included in the analysis Randomized to three groups: those who received TST and NMES as Group 1 (n:12), those who received both TST and KT as Group 2 (n:13), and those who received TST, NMES, and KT together as Group 3 (n:12).	Traditional swallowing therapy (TST), neuromuscular electrical stimulation (NMES), and kinesiology taping (KT) All treatments were administered by physiotherapists with at least 3 years of experience in swallowing rehabilitation.	Patients were evaluated with bedside water-swallow test, Eating Assessment Tool (EAT-10), Functional Oral Intake Scale (FOIS), Penetration-Aspiration Scale (PAS) before treatment, after treatment, and 3 months after the start of treatment Objective fiberoptic endoscopic evaluation of swallowing (FEES) blinded to the treatment groups of the patients.	A statistically significant decrease was observed in bedside water-swallow test, EAT-10, PAS in all treatment groups 5 weeks and 3 months ($p < 0.05$). There was a statistically significant increase in FOIS scores 5 weeks and 3 months after treatment compared to pretreatment scores in all treatment groups ($p < 0.05$). When the pre-treatment, 3-week, and 5-month swallow scale scores of all groups were compared, there was no significant different difference in terms of bedside water-swallow test, EAT-10, FOIS, PAS, or NIH-SSS scores ($p > 0.05$)	**+** Acceptable Single site small sample - No sample size calculation When the treatment groups were compared between each other, there was no difference between the groups at the three time points. There was no control group that received only TST in order to more clearly determine the effectiveness of treatment
369	S. J. Eskildsen et al. (2021). Scoping review to identify and map	Scoping review 26 studies had a total of 1601 patients included	Cortical or non-cortical stimulation of the swallowing network.	Dysphagia severity	Positive tendencies towards beneficial effects were found for rTMS,	**+** Acceptable

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
	non-pharmacological, non-surgical treatments for dysphagia following moderate-to-severe acquired brain injury. *BMJ Open,* 11:12 e053244		Cortical stimulation interventions were repetitive transcranial magnetic stimulation (rTMS) and transcranial direct current stimulation. Non-cortical were complex swallowing interventions, neuromuscular electrical stimulation, pharyngeal electrical stimulation (PES), sensory stimulation, strengthening exercises and respiratory muscle training.	Functional Dysphagia Scale Dysphagia Outcome Severity Scale Dysphagia Severity Rating Scale Berlin Dysphagia Index Videofluoroscopic Dysphagia Scale. Clinical Dysphagia Scale Swallowing ability/Efficiency Swallowing frequency Standardised Swallowing Assessment Mann Assessment of Swallowing Ability Timed Water Swallow Test Oral intake Improvement in Feeding Domains Return to pre-stroke diet ASHA NOMS Functional Oral Intake Scale Custom-made scales for oral nutrition Removal of nasogastric tube and eating Swallowing safety, penetration/aspiration Airway Complications	complex swallowing interventions, PES and cervical strengthening. Four studies on rTMS with sham control groups found some improvement in favour of the intervention the remaining study on rTMS found a better effect of rTMS combined with traditional dysphagia therapy than rTMS or traditional therapy alone 2 RCT studies on NMES found no difference between intervention and control 3 RCT studies on PES, 2 found effect on decannulation, the third found no difference between intervention and control on PAS The 2 studies on sensory stimulation and conventional dysphagia therapy reported mixed results	Scientific quality of the included studies was not assessed and reported Excluded studies are not listed Publication bias was not assessed

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
				Penetration Aspiration Scale Aspiration Pulmonary infection Decannulation Readiness for decannulation		
362	I. Cheng et al. (2021). Effects of pharmacological agents for neurogenic oropharyngeal dysphagia: A systematic review and meta-analysis. *Neurogastroenterology and Motility,* :	Setting: Manchester, UK Design: Systematic Review of RCTs that compared pharmacological intervention with placebo intervention for neurogenic dysphagia Subjects: 2186 Adult patients with neurogenic dysphagia (stroke, ageing, Parkinson's disease or Progressive Supranuclear Palsy), as determined clinically or through validated self-report questionnaires.	Studies which compared pharmaceutical interventions with placebo intervention. Sub analysis on the effects of pharmacological agents on post-stroke dysphagia.	Swallowing physiology measurement, clinical swallowing function ratings, functional dysphagia symptom scales or health outcomes related to swallowing functions.	Pooled effect size of transient receptor potential (TRP) channel antagonists was large compared to placebo interventions (SMD [95% CI] =1.27 [0.74,1.80], p<0.001; I^2=79%). Positive effects included reduced latency of swallowing response and dysphagia severity. Data were limited for other pharmacological agents and the overall pooled effect size of these agents was non-significant (p=0.31). When analysed separately large effect sizes observed with Nifedipine, a calcium blocking agent, (SMD [95% CI] =1.13 [0.09, 2.18]; p=0.030 and Metoclopramide, dopamine D2 receptor antagonist, (SMD [95% CI] =1.68 [1.08,2.27]; p<0.001). Sub analysis (Stroke patients with dysphagia): TRP channel agonists showed a moderate pooled effect size with	**-/+** Mixed population study w/ sub analysis of stroke patients. Search strategy not provided. Partial supplementation of literature searches. Do not state that they searched for reports regardless of publications status. Results to be interpreted with caution due to heterogeneity and small number of studies. Mixed population study although sub analysis of stroke patients.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
					substantial heterogeneity (SMD [95% CI] = 0.74 [0.10,1.39]; p=0.02; I^2=82%). The effects of the other agents were non-significant (SMD [95% CI] =0.29 [-0.25, 0.82]; p=0.29; I^2=88%). Adverse events: Major adverse events included increased mortality, worsening heart failure, flushing, giddiness, headache and hypotension in clinical trials with Lisinopril, Nifedipine and GTN.	
362	I. Cheng et al. (2021). Effects of pharmacological agents for neurogenic oropharyngeal dysphagia: A systematic review and meta-analysis. *Neurogastroenterology and Motility,* :	Setting: University of Manchester Design: systematic review and meta-analysis of existing RCT's that compared pharmacological intervention with placebo intervention for neurogenic oropharyngeal dysphagia Sub-group analysis to analyse effects of agents on stroke patients Studies published between 1998 and 2020	Studies that compared pharmaceutical interventions with placebo intervention Trials with multiple interventions eligible if study groups only differed by the use of the target pharmaceutical intervention of interest Studies excluded 'for reasons including not a randomised controlled trial, non-relevant study population, no placebo intervention and no target outcomes of relevance Data extracted included age, patient characteristics, drug strength and dosage regimen, standard deviation and	Study outcomes related to swallowing, which included swallowing physiology measurement, clinical swallowing function ratings, functional dysphagia symptom scales or health outcomes related swallowing functions were included for comparison. Most used included Standardised Swallowing Assessment, Royal Brisbane Hospital Outcome Measure for Swallowing , Penetration Aspiration	TRP channel agonists studied most with 8 RCTs. Pooled effect size was computed for these agents. TRPV1, TRPA1 and TRPM8 agonists yielded large effect size with substantial heterogeneity (SMD [95%CI]=1.27 [0.74,1.80], p<0.001; I^2 = 79%) when compared to placebo intervention. Stroke patient meta analysis; TRP channel agonists showed moderate pooled effect size with substantial heterogeneity (SMD [95%CI] = 0.74 [0.10,1.39]; P= 0.02; I^2= 82%). Effects of other agents were	Systematic review completed on various conditions with neurogenic dysphagia, limiting ability to generalise to stroke population. Meta analysis focused on stroke patients Risk of Bias: Cochrane Collaboration's tool for assessing risk of bias used. 50% of studies had high risk of performance bias due to lack of blinding, Attrition bias was high in 25% studies. Risk of publication bias cannot be evaluated. Literature search: adequate electronic literature search carried out, however apparent lack of

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
		Subjects: 14 studies included, adult patients (n=2186) with neurogenic oropharyngeal dysphagia (stroke, ageing, Parkinson's disease, progressive supranuclear palsy) determined clinically or through validated self-report questionnaire, regardless of time of onset. Mean age of all patients was 70.8 (12.2) years	confidence interval and sample sizes	Scale and endoscopic swallowing scoring Studies using non validated subjective rating of swallowing ability as an outcome measure were excluded	analysed as a group as only one RCT was available for most drug classes- non significant pooled effect (SMT [95% CI] = 0.29 [-0.25, 0.82]; p=0.29; I^2 =88%) Adverse effects in stroke patients included increased mortality, worsening of heart failure, flushing, giddiness, headache and clinical hypotension reported in studies with Lisinopril, Nifedipine and GTN	supplementation of electronic sources with other sources. '7 additional records identified through other sources'- sources not identified. Attempts made to gain raw data from authors of studies, digitizer programme used to extract graphic data if not available from authors Citations from identified papers were tracked and systematic reviews searched manually for 'relevant references'- unclear what criterion was used for this. No indication of searching for grey literature or reference to searching regardless of status of publication. Non-English studies excluded Excluded studies not listed Quality of included studies: limited information on characteristics of studies is provided- only age, diagnosis and pharmacological information (strength, dosage, comparison). Limits

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
						ability to apply results to stroke population., unclear duration post stroke 67% of studies focused on stroke , TRP channel agonists show a moderate pooled effect size with substantial heterogeneity, small number of RCT''s, mixed severity and chronicity of stroke patients. Limited external validity Further larger scale studies required
406	L. X. Li & K. Deng (2019). Acupuncture combined with swallowing training for poststroke dysphagia: a meta-analysis of randomised controlled trials. *Acupuncture in medicine : journal of the British Medical Acupuncture Society,* 37:2 81-90	Setting China Design Systematic Review and Meta Analysis Subjects n=1479 participants with post stroke dysphagia. Stroke confirmed by CT/MRI. Dysphagia confirmed by clinical diagnosis.	Intervention i) Acupuncture 12-90 sessions. Session = 5-45 mins for 2-8 weeks ii) Swallow training programme vs Control i) Swallow Training Programme	Primary Outcomes i) Effective rate ii) Swallow Function Assessment (Water Swallow Test, Videofluoroscopy, Standardised Swallow Assessment, Dysphagia Outcomes Severity Scale, Fujishima Ichiro's dysphagia scale) iii) Individual Activity (modified barthel Index) iv) SWAL-QOL Secondary Outcomes i) Adverse Events	17/1142 studies included. i) Effective rate (14 studies, 1295 participants) Significant improvement in the intervention arm compared to control arm ($p<0.001$) ii) Swallow Function Assessment (9 studies, 776 participants) Significant improvement in the intervention arm compared to control arm ($p<0.001$) iii) Individual Activity (modified barthel Index) (1 study, 124 participants) Significant improvement in the intervention arm	- Low High heterogeneity Publication bias No evidence to support sustained treatment effect. Diversity and variation in acupuncture and swallow training protocols Only Chinese trials available - ability to generalise to UK should be questioned.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
					compared to control arm (p<0.001). iv) SWAL-QOL (2 studies, 237 participants)) No difference (p=0.06) Secondary Outcomes i) Adverse Events Aspiration Pneumonia (6 studies, 32 in the intervention arm, 29 in the control arm. Dehydration (4 in the intervention arm, 5 in the control arm). Acupuncture related adverse events rarely reported.	
406	L. X. Li & K. Deng (2019). Acupuncture combined with swallowing training for poststroke dysphagia: a meta-analysis of randomised controlled trials. *Acupuncture in medicine : journal of the British Medical Acupuncture Society,* 37:2 81-90	Setting: China. Not further specified Design: SR/MA of 17 RCTs to investigate the efficacy of acupuncture for treating dysphagia in patients with stroke Participants: 1,479 people with post-stroke dysphagia (PSD)	Acupuncture combined with swallowing training (ST) in experimental group. ST alone in control group. Acupuncture: the nine most commonly used acupuncture points were GB20 (Fengchi), GB12 (Wangu) and TE17 (Yifeng) in the nape, CV23 (Lianquan) and Pang Lianquan (0.8–1 cun from CV23) in the neck, and Jinjin, Yuye and Yanhoubi (on the posterior pharyngeal wall) in the mouth. Swallowing training primarily consisted of "functional training and feeding swallowing training". The training	Primary outcomes were the clinical effective rate (ER), swallowing function assessment (SFA) based on five scales: the water swallowing test (WST, three studies); videofluoroscopic swallowing study (VFSS, one study); standardised swallowing assessment (SSA, two studies); dysphagia outcome and severity scale (DOSS, one	Quality ratings: Only 1/17 studies rated as low risk of bias All effects below are immediately post therapy. No maintenance/ follow up. ER: higher ER in intervention group and the difference was significant (RR 1.26, 95% CI 1.19 to 1.34, P<0.001. I^2=0%, n=14 studies. SFA: higher SFA in intervention group and the difference was significant (SMD 1.40, 95% CI 1.18 to	- Low quality Search: the search was not supplemented by consulting current contents, reviews, textbooks, specialized registers, or/and experts in the particular field of study, and by reviewing the references in the studies found. Publication bias: papers were only retrieved from electronic datasets and no other sources, which means they were published.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
			consisted of 12–90 sessions (5–45 min per session) and lasted from 2 weeks to 2 months.	study); and Fujishima Ichiro's dysphagia scale (FDS, two studies), individual activity based on modified Barthel index (MBI) and QOL based on swallowing-related QOL (S-QOL). Adverse events (AEs) were considered secondary outcomes	1.61, P<0.001; I^2=53.8%, n=5 studies MBI: significantly better MBI in intervention group (SMD 1.47, 1.07 to 1.87, P<0.001, n = 1 study S-QOL: No significant difference between groups (SMD 1.06, 95% CI −0.04 to 2.17, P=0.06, I^2= 93.8%, n = 2 studies AE: the number of cases of aspiration pneumonia (32 in the experimental group and 39 in the control group), malnutrition (two cases in the control group) and dehydration (four cases in the experimental group and five cases in the control group) were higher in the control group. AEs related to acupuncture, such as pain, mild vomiting, ecchymosis and haematoma, occurred rarely and were not severe. No AEs related to swallowing training were reported. N = 6 studies	Authors do not state that they searched for reports regardless of their publication status. Study characteristics: Limited information provided on participant characteristics (only age). No information on other demographics, e.g., gender. For stroke, only type provided (cerebral infarct /cerebral haemorrhage/ subarachnoid haemorrhage); no information on severity or time post stroke; no information on dysphagia; no information on setting Synthesis of findings: All studies included in synthesis despite low quality ratings and only 1/17 studies rated as low risk of bias. Heterogeneity (I^2) was high in all 3 MA, and remained high in 2/3 even after removing studies contributing to the heterogeneity. In SFA MA, five disparate scales are combined (WST, VFSS, SSA, DOSS, FDS). We don't know how clinically heterogenours studies were, as not enough information is provided for the studies. The results interpretation does not

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
						take into consideration the risk of bias in included studies
397	T. Wang et al. (2021). Comparative efficacy of non-invasive neurostimulation therapies for poststroke dysphagia: A systematic review and meta-analysis. *Neurophysiologie Clinique,* 51:6 493-506	Design: Systematic review and meta-analysis. RCTs. Subjects: N=914 from 20 included studies (27 RCTs) involving adults with ischaemic or haemorrhagic stroke and post-stroke dysphagia. Time post-onset included acute (14 days or less), recovery (14 days to 3 months) and sequelae phase (more than 3 months)	RCTs with allocated groups comparing 4 types if non-invasive neurostimulation (NINS) rTMS, tDCS, sNMES, PES with placebo (either sham or no stimulation). Traditional swallow therapy accepted as cointernvention. All protocols for giving NINS accepted.	Swallowing function before and after NINS using validated quantitative scores of clinical or radiological swallowing function. Primary outcome used if more than one scale available. DOSS, DSRS, FDS, VFS, FEES, FOIS, FEDSS	Compared to control, significant differences in swallowing outcomes, for TMS, tDCS and sNMES. When combined all 4, significant differences at all phases post-stroke, for both unilateral stroke and brainstem stroke and infarction and infarction / haemorrhage. Although labels appear wrong way round. No significant adverse events reported.	**+** Checklist 1: Systematic reviews and meta-analyses Score as scientific quality of the included studies was not used fully and too much focus on theory of why treatments work and not enough discussion on trends among studies, heterogeneity, differing protocols and making recommendations for next review with reference to quality.
404	Y. Zhu & L. Gu (2021). Noninvasive Brain Stimulation for Poststroke Dysphagia: A Meta-Analysis for Randomized Controlled Trials. *European Neurology,* :	Design: Systematic review and meta-analysis. RCTs. Participants: patients with post-stroke dysphagia, no time point given. N=14 studies, 397 participants.	RCTs involving TMS or tDCS (combined or not with conventional swallow therapy) versus sham (combined or not with conventional swallow therapy). There is no evidence of assessment of risk of bias or overall quality for the studies.	The outcomes lacked detail. The authors refer to some studies that used more than one swallowing scale and list these but there is no further mention of outcomes and they are not listed in the included studies either.	Significant difference reported between groups for swallowing function for rTMS and tDCS however, the results are not clearly reported as the forest plots do not show control and experimental groups with corresponding mean/ SD or N number. The authors state that "the study uses increase or reduction rate of swallowing-associated scores, whereas previous meta-analysis uses post-treatment scores" My understanding is that reporting pre and post scores is the preferred	Systematic Reviews and Meta-analyses Score unacceptable reject Incomplete reporting of results. Lack of assessment of scientific quality of studies (no risk of bias or assessment of quality) Lack of explicit reporting of outcomes.

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					method of presenting a meta-analysis and I stand to be corrected if the results are reported adequately, but in my opinion they are not complete.	
404	Y. Zhu & L. Gu (2021). Noninvasive Brain Stimulation for Poststroke Dysphagia: A Meta-Analysis for Randomized Controlled Trials. *European Neurology,* :	Setting: Nanjing, China Design: Systematic Review/Meta-Analysis Subjects: 7 articles (including 115 post stroke dysphagia patients treated with repetitive transcranial electrical stimulation (rTMS) and 69 treated with sham rTMS) for rTMS and 7 articles (including 102 post stroke dysphagia treated with transcranial direct current stimulation (tDCS) [combined or not combined with conventional swallowing therapy] and 101 treated with sham tDCS [combined or not combined with conventional swallowing therapy]) for tDCS.	Effect of rTMS over the pharyngeal motor cortex on post stroke dysphagia. Effect of tDCS over the pharyngeal motor cortex on post stroke dysphagia	Mean values and standard deviation (SD) of increase or reduced rate of swallowing-associated scores.	TMS compared to sham rTMS: rTMS (SMD=1.08, 95% CI =0.37-1.80, I^2=81.2%, p<0.001). Sub group analysis: Asians given r TMS compared to sham rTMS (SMD=0.83, 95% CI=0.36-1.29, I^2=50.1%, p=0.051), High frequency (HF) rTMS compared to patients treated with sham rTMS (SMD=1.14, 95% CI=0.24-2.03, I^2=84.4%, p<0.001). tDCS (combined or not combined with conventional swallowing therapy) compared to sham tDCS (combined or not combined with conventional swallowing therapy) (SMD=1.43, 95% CI=0.73-2.13, I^2 =77.6%, p<0.001). Sub group analysis: Asian: SMD=1.99, 95% CI=0.53-3.44, I^2=86.5%, p=<0.001, Caucasian: SMD=0.85, 95% CI=0.46-1.24, I^2=0.0%, p=0.533).	- Partial supplementation of literature searches. Unclear if 2 people extracted data and did not report consensus was agreed. Do not state that they searched for reports regardless of publications status. Absence of quality assessment tool/checklist. Unable to access supplementary material to view information about information of the included studies.
405	A. Alamer et al. (2020). Effectiveness of	Ethiopia - Dept of Physiotherapy, Mekelle	NeuroMuscular Electrical Stimulation (NMES) vs	Functional dysphagia scale (FDS)	Results of search:	1.1 Y 1.2 Y

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
	neuromuscular electrical stimulation on post-stroke dysphagia: A systematic review of randomized controlled trials. *Clinical Interventions in Aging,* 15: 1521-1531	University and Dept of Nursing, DebreBerhan University Systematic Review RCTs only included Studies published 2014-2019 Post stroke subjects only 11 RCTs included overall n = 784 Mean age range: Experimental gps - 54(11.9) -66.2(15.6) Control gps - 55.8(12.2) -66.1(13.1) Mean time since stroke: Exp gps 15.7(6.2) hours - 35.4(5.4) weeks Control gps 16.0(5.9) hours - 36(6) weeks	conventional swallow therapy and/or sham stimulation. Duration 10-60 mins per session, 2-5 times per week, over 2-6 weeks.	Complications VF dysphagia scale (VFDS) Standardised swallow assessments (SSA) Authors report: 6 studies used PAS 4 studies used VFDS 3 studies used FDS	852 articles retrieved from search, 560 screened, 40 full text articles read, 11 studies included in final review. All studies judged to be moderate - high quality (GRADE approach) Results of studies: 10 studies (n=748) found 'increased swallowing function' with NMES on all outcome measures compared to control groups 1 study (n=36) found no difference between experimental and control group outcomes. No studies reported complications.	1.3 Y 1.4 Y 1.5 N 1.6 N 1.7 Y 1.8 Y 1.9 Y 1.10 n/a (authors acknowledge that heterogeneity of interventions precludes meta analysis) 1.11 ? 1.12Y for systematic review, unknown for included studies. 2.1 + 2.2 Y (but note very wide range in time since stroke onset) 2.3 Authors conclude that NMES+standard swallow therapy is effective BUT studies included in review are variable in terms of time since onset and timing/duration of intervention. No reported longer term follow up data.
405	A. Alamer et al. (2020). Effectiveness of neuromuscular electrical stimulation on post-stroke dysphagia: A	Setting Design Systematic Review of Randomised Controlled	Intervention Neuromuscular Electrical Stimulation (10-60mins/session 2-5 sessions/week, 2-6 week period)	Primary Outcomes i) Swallowing function (Functional Dysphagia Scale , Videofluoroscopy Dysphagia Scale,	11 /852 included RCTs (publication date: 2014-2019). Swallowing function (Functional Dysphagia	Limited search criteria to English Language High heterogeneity in subjects time since stroke

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
	systematic review of randomized controlled trials. *Clinical Interventions in Aging,* 15: 1521-1531	Trials (Nov 210- May 2020) Subjects 784 participants with post stroke dysphagia. Mean age 54-66 in intervention arm, 55-66 in the control arm Stroke duration 15.7 hrs- 35.4 weeks intervention arm compared to 5.9 hours-36 weeks in the control arm.	and /or combined Traditional Swallow Therapy vs Control Traditional Swallow Therapy (lingual strengthening exercises, effortful swallowing, laryngeal adduction-elevation exercises, pharmacological therapy, acupuncture therapy).	Standard Swallowing Assessment, ii) Complications	Scale , Videofluoroscopy Dysphagia Scale, Standard Swallowing Assessment, ii) Complications Author conclusion: Neuromuscular stimulation plus conventional therapy had significant effect compared to the control arm	Unable to perform meta analysis due to high heterogeneity in protocols across studies e.g. duration of intervention time 10-60 mins/session, 2-5/week for 2-6 weeks. No evidence to support sustained treatment effect. Methodological quality moderate-high. only 2 studies blinded participants and staff, 4 studies blinded the assessor
378	D. S. Kushner et al. (2020). Swallowing Outcomes and Discharge Destinations in Acute Stroke Tube-Feeding Dependent Dysphagia Patients Treated With Neuromuscular Electrical Stimulation During Inpatient Rehabilitation. *American journal of physical medicine & rehabilitation,* 99:6 487-494	USA urban setting 2 Inpatient rehab facilities Retrospective Case control study 2 groups: 1. intervention: NMES + traditional dysphagia therapy (TDT) 2. control (TDT only) 2005 - 2017 n=359 NMES n = 190 control n = 169	TDT = 1 hour/day x 5 times/week NMES = VitalStim, tailored to individuals with oral trials. 1 hour sessions, frequency not provided. Duration of input not provided.	FOIS on admission and discharge (n=359, 2005-17) Discharge destination n=267 (2012-17 only)	FOIS - significant difference between NMES and control on FOIS at discharge in age-matched participants (181 vs 110) Discharge destination n=267, NMES n = 125, control n = 142. NMES group - more patients returned to community but not significant NMES group - fewer patients returned to acute care, but non significant	1.1 Y 1.2 Y 1.3 Y but additional NMES exclusion criterion was inability to tolerate the treatment. 1.4 NMES 53%: TDT 47% 1.5 N?* 1.6 unsure* 1.7 unsure* 1.8 N? 1.9 Y 1.10 Y (age matched analysis) 2.1 unsure* 2.2 for discussion 2.3 Y (acute stroke) 2.4 NMES + TDT led to improved outcomes for tube-fed pts with severe

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		Patients admitted c.20 days post stroke Mean age NMES 66.8 (14.4) control 71.9 (13.3) Groups similar in other ways except NMES 24% haemorrhagic stroke vs control 17% haemorrhagic			NMES group had longer care stays in inpatient rehab (21 days vs 12)	dysphagia compared with TDT only. Reason for very long data collection time (2005-2017) not fully explained. Reasons for various discharge destinations are unclear. Different sample sizes for original study, age-matched groups and discharge destination groups makes comparisons across groups more difficult. *due to lack of reviewer expertise in this area of research design (see SIGN guidance)
378	D. S. Kushner et al. (2020). Swallowing Outcomes and Discharge Destinations in Acute Stroke Tube-Feeding Dependent Dysphagia Patients Treated With Neuromuscular Electrical Stimulation During Inpatient Rehabilitation. *American journal of physical medicine & rehabilitation,* 99:6 487-494	Retrospective case control study N=359 acute stroke in-pts with severe to profound dysphagia FOIS score of 3 or less (ie profound to severe tube-feeding dependent dysphagia).	190 people received TDT ('traditional' dysphagia therapy) with NEMS (neuromuscular electrical stimulation) 169 controls received 'traditional' dysphagia therapy only Hourly treatment sessions, 5 days pw	FOIS (functional oral intake scale) Discharge destinations	Neuromuscular electrical stimulation with traditional dysphagia therapy was associated with better discharge swallowing outcomes and Functional Oral Intake Scale scores than traditional dysphagia therapy alone during inpatient rehabilitation in treating acute stroke feeding tube dependent dysphagia. More discharged to community and less acute care transfers in NEMS group.	-

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
389	D.-H. Oh et al. (2020). The effect of neuromuscular electrical stimulation with different electrode positions on swallowing in stroke patients with oropharyngeal dysphagia: A randomized trial. *Journal of Back and Musculoskeletal Rehabilitation,* 33:4 637-644	Inpatient rehabilitation centre x 2 "local hospitals" in the Republic of Korea. No time period provided. Single blind Blocked randomized trial design. Allocation blinded, physician and OT blinded n= 38 (randomised) n= 26 (analysed - due to transfer before end of treatment) 2 groups 1 Suprahyoid (SMG) 2Infrahyoid (IMG) Pts were <6 months post stroke, able to swallow, gave written consent. Age range: 43-78 Male: female 12:14 Time since onset: SMG 20.3 weeks (7.3) IMG 22.1 weeks (5.4)	4 week programme of VitalStim EST 30min/day, 5 days/wk = 20 sessions in total. 2 pair electrodes placed on anterior neck area +conventional dysphagia therapy (CDT) SMG - 2 pairs electrodes placed between jaw and hyoid IMG - 2 pairs electrodes placed below hyoid.	Videofluoroscopy Dysphagia Scale (VDS) Penetration-Aspiration Scale (PAS) Functional Oral Intake Scale (FOIS) All measures taken pre- and post intervention.	VDS, PAS and FOIS: No significant differences between scores in both groups pre intervention. No significant difference in post intervention scores between the two groups. Significant differences between pre and post scores on all measures in both groups.	1.1 Y 1.2 Y 1.3 Y 1.4 Y (participants not described) 1.5 Y 1.6 Y 1.7 Y (perceptual scales requiring expertise) 1.8 SMG 18-4=14 22.2% IMG 20-8=12 40% 1.9 Y 1.10 can't say 2.1 + (but reduced due to very high dropout rate?) 2.2 for discussion 2.3 yes - stroke 2.4 Authors conclude that NMES is effective in addition to conventional dysphagia therapy. Different placement can be used individually with patients e.g. If cannot comply with voluntary elevation of hyoid, then suprahyoid placement may be helpful. It is difficult to see how practitioners were blind if required to place electrodes precisely. Note very high drop out rate, particularly in IMG group (40%)

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
389	D.-H. Oh et al. (2020). The effect of neuromuscular electrical stimulation with different electrode positions on swallowing in stroke patients with oropharyngeal dysphagia: A randomized trial. *Journal of Back and Musculoskeletal Rehabilitation,* 33:4 637-644	Korea, rehab centre (single-blind blocked RCT) stroke patients, sub acute, less than 6 months . (issue with text : who 'can' swallow inclusion criteria. (possibly a typo) 38 patients, 2 groups for stimulation placement	Neuromuscular stimulation either above the hyoid or below to stimulate swallow in conjunction with effortful swallow. , 4 weeks, 30 mins , 5 days a week plus conventional therapies	Videofluoroscopy, dysphagia scale; drop out rate 12/38	Swallow improved in oral and pharyngeal stages for both group;	No hypothesis as to which placement better; small numbers; sub-acute stage and may all have recovered anyway, no control,
408	I. Cheng et al. (2021). Effects of Neurostimulation on Poststroke Dysphagia: A Synthesis of Current Evidence From Randomized Controlled Trials. *Neuromodulation,* 24:8 1388-1401	Design: systematic review and meta-analysis Included all RCT studies that compared neurostimulation (rTMS, TDCS AND PES) with sham stimulation or other interventions for post stroke dysphagia . 431 records screened with 391 excluded based on title/abstract, then a further 14 full text articles excluded. Participants: Inclusion criteria: studies with adult participants, diagnosed with post-stroke dysphagia regardless of	Studies that compared neurostimulation (rTMS, tDCS and PES) with placebo stimulation or head-to-head comparisons of different types of neurostimulation for post stroke dysphagia. Conventional dysphagia therapy accepted as a comparator Trials with multiple interventions were eligible if the study groups only differed by the use of the target neurostimulation of interest Subgroup analysis performed to analyse treatment effects based on the time of follow ups, chronicity of stroke and stimulation paradigms	Primary outcome measure (from abstract) change in (any) relevant clinical swallowing-related characteristic). Study outcomes related to swallowing, which included swallowing physiology measurement, clinical swallowing function, functional dysphagia symptom scales or health outcomes related to swallowing or pharyngeal functions for comparison Range of outcome measures used across included studies:	All three treatments (rTSM, tDCS and PES) 'yielded a moderate effect size compared with control treatments (SMD [95% CI] =0.69 [0.50, 0.89]; p <0.001)' Effect size for rTMS was the largest (SMD [95% CI] = 0.73 [0.49, 098]; p<0.001; I^2 = 10%), followed by PES and tDCS Early follow-up (immediate to 2 weeks post treatment); all treatments showed comparable moderate effect sizes Intermediate follow up (between 3 weeks and 6 months); tDCS showed	+ Acceptable Author has declared conflict of interest in systematic review as shareholder, chief scientific officer and board member of Phagenesis (company that focuses on pharyngeal electrical stimulation) Risk of bias: used Cochrane Collaborations tool. Two reviewers rated risk of bias of studies included independently, consensus process to resolve differences. Risk of bias summary table and graph provided, data on each study

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
		time of onset or type of stroke Excluded: studies with patients whose dysphagia was caused by other aetiologies 26 studies included for qualitative synthesis and for meta analysis. Studies published between 2009 and 2020. Total number of patients included in meta-analysis n=852		Penetration Aspiration scale (PAS) and Dysphagia OUtcome and Severity Scale (DOSS) used most commonly in studies (57 and 58 respectively)	larger pooled effect size than rTMS. No intermediate data for PES studies Late follow-up (from 3 months); no significant effect sizes (limited data, only 20% studies reporting on outcomes 3 months +) Effects of treatment based on chronicity of stroke; heterogeneity for acute (0-14 days) stroke studies was much higher compared to more chronic studies (subacute 15-90 days, chronic beyond 90 days). Large heterogeneity across studies Effects of noninvasive brain stim based on stimulation hemisphere; subgroup analysis conducted to compare effects of stimulation hemisphere (ipsilesional vs contralesional vs hemispheric) for NIBS studies. All three sites showed significant effect size compared with controls, strongest in bihemispheric stimulation, then contralesional, then ipsilesional	Publication status: no mention of the search of grey literature or searches regardless of publication status Attempts made to gain raw data from authors of studies, digitizer programme used to extract graphic data if not available from authors Characteristics of included studies is provided in a table. Excluded studies not listed. High heterogeneity of patient characteristics (e.g. time post stroke ranged from 30 hours to 6 years), outcome measures and treatment protocols (e.g. duration of rTMS stimulation ranging from 2 to 20 mins)- no mention of random effects analysis used to explore possible explanations

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
					Effects of rTMS on stimulation hemisphere and frequency; largest effect size of high frequency rTMS over ipsilesional hemisphere, showed high heterogeneity, implying effects less consistently reported across studies. Removal of a study (Khedr et al) reduced heterogeneity and overall effect became insignificant. Effects of tDCS based on stimulated hemisphere; all protocols used excitatory anodal tDCS, significant effect seen only in stimulation of contralesional hemisphere	
408	I. Cheng et al. (2021). Effects of Neurostimulation on Poststroke Dysphagia: A Synthesis of Current Evidence From Randomized Controlled Trials. *Neuromodulation,* 24:8 1388-1401	Setting Design Systematic Review and Meta Analysis Subjects 852 participants with post stroke dysphagia regardless of time of onset or time of stroke. Mean age 66 years.	Intervention Neurostimulation (rTMS, tDCS, PES) vs Control Sham stimulation or other interventions for swallow rehabilitation.	i) Swallowing physiology measurement (Videofluoroscopy) ii) clinical swallowing function ratings (Dysphagia Outcome and Severity Scale), iii) functional dysphagia symptom scales: Mann Assessment of Swallowing Ability (MASA, Standardised	26/638 studies included (published between 2009-2020) Follow up - early (immediate- 2 weeks), intermediate (3- 8 weeks), late (3+ months). Only 20% (7/35) reported outcomes 3months plus. Evidence not sufficient to draw conclusions on long-	- Low Limited search criteria - to English language studies. Excluded studies not reported High degree of heterogeneity in participants (see subjects data)

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
		Time since stroke 30 hours - 6 years		Swallow Assessment (SSA), Dysphagia Severity Rating Scale (DSRS), Functional Dysphagia Scale (FDS)Functional Oral Intake Scale (FOIS), videofluoroscopic dysphagia scale (VDS) iv) health outcomes related to swallowing (time for decanulation) i) ii) iii)	term effects (beyond 3 months). Moderate size effects on all 3 interventions ($p<0.001$) compared to control.	High degree of heterogeneity in study protocols and outcomes. Variation in protocols (stimulation duration eg. rTMS 2-20mins, tDCS 20-30mins, PES 10 mins) (Treatment duration eg. rTMS 1-10 days, tDCS 4-20 days, PES 1-3 days). Variation in frequency and intensity not reported. Low risk of selection bias for most studies (except allocation concealment, performance, detection, and attribution). Conflict of interest declared.
394	M. Simonelli et al. (2019). A stimulus for eating. the use of neuromuscular transcutaneous electrical stimulation in patients affected by severe dysphagia after subacute stroke: A pilot randomized controlled trial. *NeuroRehabilitation,* 44:1 103-110	IRCCS (?) Santa Lucia Foundation, Rome, Italy. Single site January 2013 - December 2015 Single blind RCT n=33 randomised Stroke patients with severe dysphagia needing tube feeding >	Both groups received intervention for 30 mins/day, 5 days/week for 8 weeks. NMES = VitalStim Pts in this group received TDT whilst having NMES. All patients also had oral trials at mealtimes, in addition to therapy. Intervention provided by trained SLPs, but no detail	Primary measures: FOIS PAS and Pooling score (from video of FEES) Secondary measures: oral diet type postural compensations duration of training (=therapy) Baselines taken 24/48 hours before starting intervention	FOIS scores improved but NMES group improved more (able to take oral diet requiring no special preparation) vs TDT group who improved to having limited consistencies. No significant difference in Pooling Scores but presence of oropharyngeal secretions was reduced in the NMES group (but very small numbers (ie no	**+** 1.1 Y 1.2 Y 1.3 Y 1.4 Y (subjects not mentioned) 1.5 Y 1.6 Y 1.7 Y Perceptual outcomes relying on professional expertise. 1.8 NMES - 17-1=16

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
		3 weeks and < 3 months since onset. No previous swallow therapy. Randomly allocated to 2 groups: 1 NMES = traditional dysphagia training (TDT) n=17 2 TDT only n=16 Participants gave written consent. Mean age: NMES + TDT - 67.2 (+/- 16.2) TDT - 72.4 (+/-12.3) Time since onset in days: NMES+TDT - 45.2 (+/- 22.3) TDT - 32.6 (+/- 18.1) Sex M:F NMES+TDT 10:6 TDT 6:10	provided about numbers of SLPs involved.	Post intervention measures taken after 12 weeks. Measures taken by 2 experienced clinicians from video, blinded to age, stage after stroke and treatment.	pooling NMES - 6 vs TDT - 4) Oral type: NMES - 100% patients returned to oral diet vs 73.3% pts in TDT group. Findings re strategies and liquids not clearly explained. Duration of therapy: NMES - 2 weeks faster than TDT (this is not very clear since the reason for scored duration is not explained.	TDT - 16-1=15 1.9 Y 1.10 n/a 2.1 + (small numbers) 2.2 for discussion 2.3 yes 2.4 Authors conclude that NMES+TDT improves swallow function and assists tube fed patients with severe dysphagia to recover oral feeding.
394	M. Simonelli et al. (2019). A stimulus for eating. the use of neuromuscular transcutaneous electrical stimulation in patients affected by severe dysphagia after	Hospital, Italy, Single blind RCT Subacute stroke 17 in intervention group, 16 in matched group	Neuromuscular electrical stimulation plus therapy in one group, just therapy in other, 5 days a week for 8 weeks,	Primary outcome FES and scale	No difference in group; both improved, stimulation group more than the other possibly (6 cpmd to 4 on score) 9/47 declined to participate, 5 withdrew	Low: Bias in numbers, no matching across groups, mechanism of action for stimulation unclear,, linked to no hypothesis, treatment specification not adequate yet.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
	subacute stroke: A pilot randomized controlled trial. *NeuroRehabilitation,* 44:1 103-110				Poss inadequate amount of stimulation..	
407	Q. Zhang & S. Wu (2021). Effects of synchronized neuromuscular electrical stimulation (NMES) on the submental muscles during ingestion of a specified volume of soft food in patients with mild-to-moderate dysphagia following stroke. *Medical Science Monitor,* 27: e928988	Affiliated Hospital of Guishou Medical University 1/6/18 - 31/5/20 RCT Single blind study (research medics blind, treating SLTs not blind) Subjects: patients with mild-moderate post stroke pharyngeal dysphagia, able to swallow min 50ml soft food in 30 mins 1-3 months post stroke n=83 3 groups 1 Conventional treatment (CT) n=28 2 Eating training (ET) n=28 3 Intensive swallow training (IST) n=27 age range 40-80 years	All pts received CT - 30 mins/day x 5 days/week for 6 weeks = 30 sessions ET group received CT + ET with max 100ml soft food. 30 swallows per session over 30 mins. IST group received CT + tongue hold swallow with oral trials and NMES	1 DOSS scores, based on modified barium swallow (MBS) pre and post intervention. 2 Stroke acquired pneumonia (SAP) cases, collected 6 week post intervention only. 3 Wet voice cases	DOSS scores significantly better post intervention for all groups, but in order 1 IST, 2 ET, 3 CT, significantly better in the IST group than ET or CT. SAP cases at enrollment - 0 during intervention - cases across all groups, highest in ET group, lowest in IST grp. Wet voice cases No sig difference in cases after first training (1 session?) After 30 sessions, significantly lower number of cases in both CT and IST gps. ET group remained high. Authors conclude that IST with NMES effective.	1.1 ? 1.2 Y (random number table method) 1.3 N (not described) 1.4 Y (researchers blind, treating SLTs not blind, pts not mentioned) 1.5 Y 1.6 Y 1.7 Y (perceptual but reliant on expertise - study does not report whether medics or SLTs completed these measures) 1.8 not reported 1.9 can't say 1.10 n/a 2.1 +/- (unsure about randomisation and concealment as latter not mentioned) 2.2 for discussion 2.3 results applicable to sub-acute patients but of limited value as no follow up data to see if benefits of NMES maintained 2.4 synchronised feeding of small amounts of food with NMES improves swallow function and reduces aspiration risk.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
						Results not applicable to pts with more severe dysphagia and need to be able to tolerate very intensive input. Aim of study unclear: specified as "...to evaluate the effects of synchronized NMES on the submental muscles during ingestion of a specified volume of soft food in pts with mild to moderate dysphagia following stroke" p.3 patients with more severe dysphagia excluded.
407	Q. Zhang & S. Wu (2021). Effects of synchronized neuromuscular electrical stimulation (NMES) on the submental muscles during ingestion of a specified volume of soft food in patients with mild-to-moderate dysphagia following stroke. *Medical Science Monitor,* 27: e928988	N=83 Pts with mild to moderate dysphagia following stroke Randomly assigned using random number table method into 3 groups: CT conventional training n = 28 ET conventional plus eating training with soft food (n=28) Conventional training plus Intensive swallowing training with synchronised NMES n=27	Treatment sessions of 30 mins once per day, 5 days per week for 6 weeks NMES pre treatment	Pre/post Modified barium swallow DOSS dysphagia outcome severity score (defines mild to moderate) Number of pts with SAP stroke associated pneumonia and wet voice No sig difference across the 3 groups pre input re age, onset, symptoms	DOSS scores improved in all groups CT and ET groups – significant difference in number of cases with SAP pre post Fewer SAP cases in IST group than CT and ET groups Significantly fewer people with wet voices in CT and IST groups Authors conclude feeding specific volume of soft food plus synchronised NMES of the sub-mental muscles can improve swallow function in this	-

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
					group and reduces their risk of aspiration	
379	S. Y. Lee et al. (2021). Compensatory Effects of Sequential 4-Channel Neuromuscular Electrical Stimulation for the Treatment of Acute, Subacute, and Chronic Dysphagia in a Prospective, Double-Blinded Randomized Clinical Trial. *Neurorehabilitation and Neural Repair,* 35:9 801-811	South Korea multi centre study - rehab units of 3 teaching hospitals. 12/09/2018 - 21/02/2020 RCT Prospective Double blind two groups: intervention and sham control group participants were over 19 years, had dysphagia (confirmed by VFSS) from range of TBI,stroke, brain tumour, encephalitis - at any stage post onset n=52 NMES n=26 control n=26 Mean age: NMES gp - 68.9 (+/- 11.) control gp - 73.4 (+/- 6.7) written consent gained from all participants	4-channel NMES standard placement of electrodes for all participants. All pts familiarised with NMES and maximised tolerance threshold to maximum intensity. Pts control NMES (rather than clinician?) NMES group had maximum tolerance NMES - simultaneously swallowing 5ml level 0 fluid and level 4 fluid twice (not clear exactly what this means) control group swallowed same fluids but did not receive NMES although electrodes attached. Authors do not describe frequency, intensity intervention/sham. Duration seems to be 1 week.	VFSS completed: 1 pre intervention 2 1 week after initial VFSS Primary measure: Videofluoroscopy dysphagia scale (VDS) Kinematic analysis performed using automated software (AKAS) Secondary measures: PAS Likert scale (presumably completed by patients, but not clearly described) for: a) Satisfaction b) Easiness c) Discomfort	VDS (oral and pharyngeal) and PAS scores showed significant improvement in both NMES and control groups, but to a greater extent in NMES group - NMES scores pre Tx 37.27 (+/- 16/95) postTX 19.19 (+/- 14.69) Control scores preTx 41.49 (+/- 17.24) postTx 35.20 (+/-18.33) Kinematic analysis: NMES group had significantly greater gains in hyoid movement (range and speed) than control in both level 0 and level 4 fluids. Likert scales: patients in the control group scored higher (more positively) on all: satisfaction, easiness and discomfort. But differences are not significant between groups, and authors report NMES results as 'favourable'	1.1 Y 1.2 Y 1.3 Y 1.4 Y 1.5 Y in characteristics apart from diagnosis: NMES n=26 stroke pts control n=20 stroke pts, 2 with brain tumour, 1 encephalitis. 1.6 Y (apart from aetiology issue above) 1.7 Y 1.8 NMES 0% control 11.5% (medical reasons, ?change in diagnosis so no longer eligible) 1.9 Y 1.10 not reported 2.1 + 2.2 for discussion 2.3 Yes (ie stroke) 2.4 authors conclude that 4 channel NMES significantly improves swallow outcomes on VDS, PAS and kinematic measures. Study skewed to male patients NMES group all stroke pts whereas control group included other aetiologies.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
		Sex: NMES group 69.2% males control group 73.9% males				This study would be difficult to replicate due to lack of clarity in reporting the frequency and timing of the intervention. This is surprising given the robust study design and otherwise clear reporting.
379	S. Y. Lee et al. (2021). Compensatory Effects of Sequential 4-Channel Neuromuscular Electrical Stimulation for the Treatment of Acute, Subacute, and Chronic Dysphagia in a Prospective, Double-Blinded Randomized Clinical Trial. *Neurorehabilitation and Neural Repair,* 35:9 801-811	Setting: multicentre ; 3 hospitals in Korea Design : prospective double blind RCT, block randomisation; Subjects: acute, sub-acute and chronic; range of brain disorders (stroke tumour encephalitis) 54 people total: 2 groups (26 stimulation - all stroke or 23 sham – 20 stroke, 2 tumour 1 encephalitis) drop out rate 3/52. Mainly acute patients.	4 channel neuromuscular electrical stimulation (unknown what mechanism is). Placement above or below hyoid while taking thin fluids. Not clear how many times stimulation occurred in session or how often the sessions were	Primary outcome Videofluroscopy scale; Also satisfaction, penetration scales Test – retest 5 days later.	Treatment group improved cpd to non-treatment (did not remove the non strokes to see if result held). Safe and well tolerated by those taking part	Low Group members small, Sham group mixed aetiology, mostly acute patients (32) , 17 subacute/chronic Replication issue(how many times per session, how many sessions? Once? No info on three site checks
375	Y. H. Jeon et al. (2020). Effects of neuromuscular electrical stimulation (NMES) plus upper cervical spine mobilization on forward head posture and swallowing function in stroke patients with dysphagia. *Brain Sciences,* 10:8 01-Oct	South Korea rehabilitation hospital Gyeonggi-do RCT n=34 2 groups: 1 experimental - NMES+upper cervical spine mobilisation n=17	Both groups received NMES + upper cervical spine mob/sham 1/day,3 times/week for 4 weeks. NMES was 30 mins, given by OT, spine mob 10 mins, given by PT. NMES was VItalStim, 2 pairs of electrodes placed. Maximum intensity reached gradually. Joint mobilisation not standardised but involved craniocervical flexion, held for 2 mins with 1 min rest.	Forward head posture -Craniocervical flexion test (CCFT) measured using Stabilizer Pressure Biofeedback (Chattanooga Group) -craniovertebral angle (CVA) photograph compared with NIH Image J . Swallowing measure: -Videofluoroscopy dysphagia scale (VDS) -PAS	CCFT and CVA Authors report significant increase in CCFT and CVA in the experimental group. Data appears to show significant improvement in CCFT and CVA in both groups, but greater improvement in the experimental group. VDS and PAS Both groups show improvement (significant	1.1 Y 1.2 Y 1.3 Y 1.4 Y (participants asked not to discuss their treatment with others) 1.5 Y 1.6 Y (more M than F across both groups) 1.7 Y 1.8 0%, 0% 1.9 Y (?) 1.10 n/a 2.1 ++?

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
		2 control - NMES + sham upper cervical spine mobilisation. n=17 Age 1 mean 63.12 (+/- 13.50) 2 mean 64.47 (+/- 8.43) Gender 1 and 2 M:F 11:6 Groups also similar in type of stroke, paretic side, weight, height, disease duration, cognition, NIHSS Study did not include pts with severe head forward posture		Measure taken 1 pre-test 2 after 4 weeks.	within subject change) but these are greater for the experimental group. On PAS and VDS pharyngeal phase and total score, but not Oral stage VDS, experimental group scored significantly better than control group.	2.2 2.3 Yes - stroke patients 2.4 Authors conclude that NMES alone improves swallow function but NMES+cervical spine mobilisation improved swallow function, CVA and CCFT. They do not conclude that NMES+cervical spine mobilisation results in better swallowing than NMES alone, although the results do suggest this. As authors note, this is a small study. Male bias No longer term follow up to determine maintenance.
375	Y. H. Jeon et al. (2020). Effects of neuromuscular electrical stimulation (NMES) plus upper cervical spine mobilization on forward head posture and swallowing function in stroke patients with dysphagia. *Brain Sciences,* 10:8 01-Oct	Setting South Korea Rehab Hospital Design RCT Subjects 34 participants with post stroke dysphagia with i) Korean mini mental score ≥19points, ii) stroke ≥6months - <2 years, dysphagia diagnosed by physician,	Intervention Neuromuscular Electrical Stimulation + upper cervical mobilisation (n=17 participants) vs Control Sham mobilisation + Neuromuscular Electrical Stimulation (n=17 participants) Both group interventions 1/day, 3/week, 4 weeks	Primary outcome i) Craniocervical flexion test ii) Craniovertibral Angle iii) Videofluoroscopy Dysphagia score and PAS	Pre - post intervention study assessed at baseline and at 4 weeks. i) Craniocervical flexion test. Significant improvement in intervention arm (p=<0.05) than the control group ii) Cranioverebral Angle Significant improvement in intervention arm (p=<0.05) than the control group. iii) Videofluoroscopy Dysphagia score (not oral	Insufficient evidence to support inclusion in the guidelines Small sample size No evidence to support sustained treatment effect. Effect could be due to spontaneous recovery - no true control group (ie no intervention).

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
		altered neck posture, voluntary participation.	NMES for 30mins Sham and Cervical Mobilisation for 10mins		stage p= 0.795) and PAS. Significant improvement in intervention arm (p=<0.05) than the control group.	Recruitment limited to mild - moderate stroke severity Excluded severe forward head posture patients Intervention time limited
398	Z. Wang et al. (2019). Effects of capsaicin on swallowing function in stroke patients with dysphagia: A randomized controlled trial. *Journal of Stroke and Cerebrovascular Diseases,* 28:6 1744-1751	A randomized, double-blind study. 69 hospitalized stroke patients Yancheng City	Capsaicin, a readily available component of peppers 3 times per day before each meal for 3 weeks.	Swallowing function was evaluated before and after the 3-week treatment, Volume-Viscosity Swallow Test (V-VST) Eating Assessment Tool (EAT-10) Standardized Swallowing Assessment (SSA)	The score decreases in the Eating Assessment Tool and Standardized Swallowing Assessment of the capsaicin intervention group were significantly greater than that of the placebo control group (P < .01). Among the 60 patients, the capsaicin intervention group exhibited effectiveness in a higher number of patients (n = 27, 90%) than the placebo group (n = 9, 30%, P < .001).	+ Acceptable Single site Unsure how participants were assigned treatment allocation – performed by pharmacist Nine total patients met the exclusion criteria during the experiment phase No sample size calculation Lack of objective instrumental evaluation of swallowing
398	Z. Wang et al. (2019). Effects of capsaicin on swallowing function in stroke patients with dysphagia: A randomized controlled trial. *Journal of Stroke and Cerebrovascular Diseases,* 28:6 1744-1751	Setting: Yancheng City No.1 Peoples Hospital, China Jan - Sept 2018 Design: double blind, single site RCT Subjects: n=69 Intervention group n=34 Control n=35	Intervention group: 1g of Sichuan red pepper powder to 50mL of mineral water, a capsaicin concentration of bg150 μM/L was obtained, based on Chinese Pharmacopoeia. Cotton swab soaked in capsaicin solution at cold 4ºC was used to dab the oropharyngeal mucosa region in the thermal tactile stimulation, soft, fast touch no	Volume-Viscosity Swallow Test (V-VST)- administered daily to patients during the treatment Eating Assessment Tool (EAT-10), administered to patients before and after the 3 week treatment - self	Authors state 'both groups were found to be effective in improving swallow function based on the results from Eating Assessment Tool, and Standardised Swallowing Assessment. However, the number of patients improved in the capsaicin intervention group was significantly	Low quality - downgraded based on concealment and randomisation methods Concealment method: method of concealment is poor ('randomisation and supply of capsaicin were performed by a blinded pharmacist who was not involved in the study').

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
		n=9 met the exclusion criteria during the experiment phase, therefore n= 30 intervention, n= 30 control group Inclusion criteria: Haemorrhagic or ischaemic stroke patients within one week of admission Clinically assessed with Volume- Viscosity Swallowing test (V-VST), presenting with clinical signs of dysphagia, older than 55 yrs of age , scoring above 7 on Abbreviated mental test scale and able to give informed consent Exclusion: unstable heart condition, history of previous other diseases which may be associated with presence of dysphagia, refusal to participate, bronchial asthma or chronic cough	longer than 5 minutes to minimise mechanical effects of the stimulus. In addition, a 1mL nectar bolus of 150µM/L capsaicin was administered to patients before each meal. Nectar viscosity obtained by adding 3.5g of Resource ThickenUp thickener to 100mL of mineral water. Treatment administered 3x per day before each meal for 3 weeks Control group: The solution and the nectar bolus were made to be identical to that in the intervention group, except for the capsaicin Randomisation and supply of capsaicin were performed by a blinded pharmacist not involved in the study Both groups received conventional dysphagia treatments such as orofacial muscle exercises, thickeners, postures, and therapeutic or compensatory manoeuvres	perceived dysphagia score Standardised Swallowing Assessment (SSA)- administered to patients before and after 3 week treatment Water Swallow Test- administered before and after 3 week treatment	greater than that of the placebo control group' ($p< 0.01$ on the EAT-10) SSA scores before/ after intervention demonstrates significant decrease in SSA after capsaicin $p<0.001$ ANCOVA used as additional analysis of changes in the EAT-10 and SSA. Improvement in self perception of dysphagia seen in both groups, with a significant change seen in the intervention group $p< 0.01$(EAT-10)	Randomisation is mentioned but method not specified Study limited to patients over 55 Lacks clarity around blinding of researchers Capsaicin concentration was 'designed to be low, making it almost indistinguishable in taste from the placebo' Acceptable drop out rate: 13.04% (discharged before end of trial, 2 patients had bronchial asthma (chronic condition, ? should not have been included at beginning of trial) and 2 patients had pyrexia Further analysis required regarding invalid data on Water swallow test (10% and 70% for intervention and control groups respectively) Recovery of dysphagia seen in both groups over 3 week period, with significant change in self perception of dysphagia and SSA in the intervention group

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						Further analysis of the conventional dysphagia each participant received during this time would be beneficial- control group demonstrated '30% of effective strategies…using such strategies. Addition of capsaicin raised the effectiveness to 90%, as shown in our intervention group' Intention to treat analysis: analysis based only on n=60 patients who received their allocated intervention. Insufficient information on n=9 patients who were excluded during the experimental phase
373	W.-j. Hao et al. (2021). Effect and Safety of Tongyan Spray () on Hyoid Motion in Patients with Dysphagia after Ischemic Stroke. *Chinese Journal of Integrative Medicine,* 27:5 369-374	Setting: inpatients and outpatients from one hospital and one rehabilitation centre in China. Design: RCT Participants: 72 (60 included in analysis) people with dysphagia post ischaemic stroke. Sex M/F 24/6 in intervention group, 25/5 in control group Age 62.23±8.89 in intervention group, 59.60±7.70 in control group. Ischaemic stroke was confirmed on CT or	Tongyan Spray composed of Zingiber officinaie , Cinnamomum cassia Presl and Radix clematidis, was used on both sides and the middle area of the pharyngeal isthmus in the oropharyngeal area once. Control group: purified water (had different taste)	Measured before and 30 minutes after intervention via videofluroscopy. Measurements of hyoid bone a) superior excursion distance in mm, b) anterior excursion distance in mm, and c) time of hyoid bone motion in sec, on four barium swallows: 2ml and 10ml of liquid barium, 10ml of semi-solid barium (yoghurt) and 10 cm^3 solid barium food (1/4 coated with	Analysis was not ITT. 60 of 72 were included in analysis. Improvement ranges of superior hyoid excursion distance and hyoid movement time in the treatment group after swallowing 2 and 10 ml liquid were significantly better in intervention arm ($P<0.05$). No other significant differences between the groups in remaining 8/12 measurements.	+ Acceptable The authors concluded that "Tongyan Spray was an effective and safe medicine for improving swallowing function in patients with ischemic post-stroke dysphagia" (abstract, p.369). However, only 4/12 measurements taken in videofluroscopy were significantly better in intervention group. No evidence provided that significant differences of 1.46 mm and 2.39 mm in

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		MRI. Dysphagia: chief complaints of "bucking" on water; could self feed; confirmed on videofluroscopy; dysphagia syndrome of "phlegm and blood stasis manifested as dysphagia, alalia, sticky and stringy mucus in the pharynx, or coughing with phlegm, dim tongue with petechia or ecchymosis, greasy fur, and slippery or unsmooth pulse" (p. 370); and within 2 weeks		barium). 12 measurements in total. Measurements were analyzed with the screenshots at a constant frame rate (12.5 frames per second) by 2 specially trained physicians after digitally processing the video data.		superior hyoid excursion and of 0.13 sec in time of hyoid motion make any difference in swallowing function clinically or as perceived by patients. The trial is small, has design limitation (see comments below), and has no follow up (post assessment was 30min after intervention) to see if the reported gains were maintained. Randomization method: random table. Unclear who performed randomization and whether they had any further involvement with study participants or data Concealment method: "the sequences into studies were written on the surface of envelops and were sealed inside the envelops" (p.370). Unclear why written on the surface of envelops and whether envelops were opaque. Blinding: The intervention group had Tongyan spray and the control group had purified water. The authors acknowledge that the purified water had a different taste to the Tongyan spray. No mention of any unblinding of participants. No mention

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						of blinding of assessors or investigators. Participants: There were no differences between participants in age, gender, comorbid conditions, standardized swallowing assessment and baseline measurements on videofluroscopy. However, no information is provided on other demographics and stroke severity. Outcome measurement: outcomes seem to be measured in a standard way but certain things in interpretation raise concerns. 12 measurements are taken (3 areas, 4 measurements in each). No mention of primary and secondary measures. In results, there were significant differences in 4/12 measurements (in 2 areas, 2 measurements) and in the discussion it is said that no change was expected in 3rd area. However, this area was not identified as a control measure in methods. 12/72, 6/36 participants in each group, are not included in the analysis because “they did not complete all examinations” (p.372, figure 2). In the

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
						study flowchart it is clear that all participants in both groups of the study received the intervention (Tongyan spray in intervention group, purified water in control group). Post measures were taken 30 min after the intervention (i.e. study duration very short). No explanation as to why participants did not complete examinations. 12 patients (17%, 6 per study arm) were excluded from analysis, i.e. analysis was not intention to treat. No mention of any switches between groups. Not reported if there were any differences between participants from different sites (2 sites, inpatients and outpatients from one site, inpatients from other site).
373	W.-j. Hao et al. (2021). Effect and Safety of Tongyan Spray () on Hyoid Motion in Patients with Dysphagia after Ischemic Stroke. *Chinese Journal of Integrative Medicine,* 27:5 369-374	Setting: Outpatients and inpatients recruited from Dept of Encephalopathy of Beijing Hospital of Integrated Chinese and Western Medicine and inpatients from 3rd dept of Neurorehabilitation Research Center Design: RCT	2 scans completed using VF technology, fluroscopic image in front standing position 1st scan completed whilst participants swallowed 4 different traits of food: 2 and 10ml of liquid barium food, 10ml of semi-solid barium food 10cm3 solid barium food (1/4/ area coated with bread barium).	The hyoid motion was represented as the motion of the most anterior superior intersection point of the hyoid bone. Each superior and anterior excursion distance of the hyoid bone and its duration time were recorded.	Significant improvement ($p<0.05$) in ranges of superior hyoid excursion distance and hyoid movement time in intervention group after swallowing 2 and 10ml liquid No significant difference in improvement ranges of superior hyoid excursion distance and hyoid	**+/-** Randomisation: assigned using a random number table. Blinding: no method of blinding noted for researchers. Researchers note that Tongyan spray ' has a different taste' to the control spray- no further

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
		Subjects: inclusion criteria identified as (1) Pts with dysphagia after ischaemic stroke had 'chief complaints as bucking while drinking water and could self feed under guidance of certain compensatory method' (2) Dysphagia confirmed with video fluoroscopy (3) 'Dysphagia syndrome of phlegm and blood stasis manifested as dysphagia, alalia, sticky and stringy mucus in the pharynx, or coughing with phlegm, dim tongue with petechia or ecchymosis, greasy fur and	2nd scan completed 30 minutes later following spray of Tongyan in intervention group, and purified room temperature water in the control group Spray used once on both sides and middle area of pharyngeal isthmus in the oropharyngeal reach. Researchers note that the Tongyan spray 'has a different taste comparing to purified treatment' Tongyan spray composed of *Zingiber officinaie, Cinnamomum cassia Presl* and *Radix clematidis*	Under fluoroscopy, videos of swallowing processes were acquired. Parameters were analysed with screenshots at a constant frame rate (12.5 frames per second) by 2 specially trained physicians after digitally processing data DICOM Explorer and Image J software was applied, changes in time and range of hyoid motion before and after medication were observed. For inter-rater reliability 2 trained raters analysed the images and measured data separately	movement time between the 2 groups when swallowing the 10ml semisolid and 10cm3 solid food ($p>0.05$) No sig difference in anterior hyoid excursion distance between 2 groups Not all allocated participants were analysed (n=12 excluded as did not complete all examinations) Authors state Tongyan spray could increase range of superior hyoid excursion distance and accelerate time of hyoid motion in patients with stroke. Further study requiring larger sample size and confirmation of pharmacological mechanisms with animal studies	exploration of what this means for participants Treatment allocation: Unclear allocation concealment method: 'sequences into studies were written on the surface of envelops and were sealed inside the envelops' No intention to treat analysis- analysis based only on participants who completed the trial (n=60). All participants received the 2nd spray, however no discussion of exclusion prior to analysis stage. Potential source of sample bias Exclusion rate of 16.67% across trial following allocation and delivery of intervention Treatment and control groups: No significant differences between groups on gender, age, medical history, SSA scores or spatial/ temporal parameters of swallowing functions detected by VF. No mention of time post stroke (onset of symptoms

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		slippery or unsmooth pulse, etc' (4) Pts of 'conscious mind' to cooperate with treatment (5) Dysphagia symptoms appeared from 2 weeks to 3 months post stroke Exclusion (1) TIA (2) Cardiac pacemaker, metal artificial valve, aneurysm clip, vascular stent, artificial joints and metal internal fixation (3) Unwilling to cooperate n=72 post stroke dysphagia participants selected Intervention group n=36 (30 included in				between 2 weeks and 3 months), or stroke severity No description of any other intervention the treatment groups were receiving, although its noted they are from both in and outpatient settings Multi-centre study, no site specific data given No analysis of difference between in and outpatients or exploring time post stroke

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
		analysis with 6 excluded) Control group n=36 (30 included in analysis with 6 excluded) Gender M/F 24/6 Intervention, 25/5 control Age 62.23 ±8.89 intervention, 59.60±7.70 control				
363	I. Dieguez-Perez & R. Leiros-Rodriguez (2020). Effectiveness of different application parameters of neuromuscular electrical stimulation for the treatment of dysphagia after a stroke: A systematic review. *Journal of Clinical Medicine,* 9:8 Jan-19	Spain - University of Vigo Systematic Review Subjects all had dysphagia post stroke. No overall n provided but from study data supplied, n = 583 Other participant characteristics not consistently reported (probably reflecting original study reporting but original papers would need to be examined to determine this.	NeuroMuscular Electrical Stimulation (NMES) Variation among studies e.g. some had experimental and control group, some had no control group Intervention varied e.g. NMES + standard dysphagia therapy/ NMES alone	Aim of study was to review 'various parameters of application of the NMES' (p.2) Standard outcome measures not used. Details collected on: Frequency impulse time intensity electrode location duration of intervention stimulation device	Frequency: 80Hz most commonly used, but not always reported. Impulse time: variable reporting. Intensity: most studies aimed for threshold of comfort. Report studies using higher intensity resulted in increased swallow function. Electrode location: generally anterior neck. No clear pattern of location and outcome. Duration: 20-60 minutes Report no advantage for pharyngeal swallow in longer sessions.	1.1 Y 1.2 Y 1.3 Y 1.4 Y 1.5 N 1.6 N 1.7 N - participants per study and interventions provided, but not study outcomes. 1.8 Y (Jadad scale) 1.9 Authors acknowledge limitation of including low quality studies but argue that breadth of studies included is positive. 1.10 N 1.11 ? 1.12 Y 2.1 +/ - 2.2 post stroke dysphagia

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
					Frequency variable: 2/day; 3-5/week, not always specified. Variability in duration of interventions overall between 1 - 8 weeks Stimulation device: VitalStim or Ampcare, but not always specified.	2.3 difficult to draw clear conclusions due to heterogeneity of studies included. Interesting exploratory study.
363	I. Dieguez-Perez & R. Leiros-Rodriguez (2020). Effectiveness of different application parameters of neuromuscular electrical stimulation for the treatment of dysphagia after a stroke: A systematic review. *Journal of Clinical Medicine,* 9:8 Jan-19	Setting Spain Design Systematic Review (search 2015- 2020) Subjects 993 participants with post stroke dysphagia.	Neuromuscular Electrical Stimulation +/- conventional therapy (thermal stimulation, tongue strengthening exercises, oro-facial and pharyngeal musculature and mouth closing exercises, laryngeal movement therapy, vocal cord adduction exercises, Shaker exercises, Masako, Mendelsohn manoeuvre, McNeill therapy, craniocervical postural correction, respiratory pattern correction, dietary habit alteration). No control group reported in all studies	Primary outcome Identify effectiveness of Neuromuscular Electrical Stimulation parameters	21/278 studies included 7 studies used Neuromuscular ELectrical Stimulation in isolation 14 studies included it in combination with other therapies Variation in equipment used. Variation in protocols i.e. placement of electrodes and impulse intensity Variation in intervention arm (10 days - 2 month). Variation in protocol (placement of electrodes) Variation in number (2 sessions/day - 5 sessions / week), length of treatment sessions (20-60mins) 30mins most frequently	- Low quality Heterogeneity in the included studies Limited search strategy, criteria, terms Excluded studies not identified non-controlled and no-nrandomised studies included Excluded some studies applying NMES invasively or intracranially Small sample size in some studies

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					used. Some studies failed to report information regarding sessions. Authors report: greatest efficiency is 60-80Hz, 700 us of pulse duration in 20-30min sessions. 80Hz most frequently used (15 studies), lower frequencies were used in 2 studies, but not reported in 4 studies. Duration times varied (700us most frequently used (6 studies), 3 studies used shorter frequencies. Thresholds reached of comfort (9 studies), patient pain threshold (1 study), or 'as tolerated' (7 studies). Swallow function, presence and severity of penetration and aspiration, and hyoid movement significantly improved in the intervention arm at higher intensity.	
380	L. Li et al. (2021). Systematic review and network meta-analysis of noninvasive brain	Design: Systematic review and meta-analysis. RCTs Setting	RCTs involving 2 types of non-invasive brain stimulation (NIBS): tDCS vs sham and rTMS vs sham	Primary outcomes: dysphagia outcome and severity scale (DOSS), standardized	Significant differences between groups: higher (better) DOSS scores in patients receiving tDCS	**++** Checklist 1: Systematic Reviews and Meta-analyses

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
	stimulation on dysphagia after stroke. *Neural Plasticity,* 2021: 3831472	Participants: Patient with post-stroke dysphagia, N=738 , 18 studies included.		swallowing assessment (SSA), and penetration-aspiration scale (PAS). Secondary outcomes: functional dysphagia scale (FDS) and water swallow test (WST)	and rTMS, significantly lower (better) SSA scores in patients receiving tDCS and rTMS. Significantly lower (better) PAS scores overall for NIBS. Significant differences in FDS scores (better) for tDCS and rTMS and for WST (better) for tDCS and rTMS. Overall, network meta-anlysis showed that rTMS was superior to tDCS although both forms yielded significant differences between groups. No obvious adverse reactions.	
380	L. Li et al. (2021). Systematic review and network meta-analysis of noninvasive brain stimulation on dysphagia after stroke. *Neural Plasticity,* 2021: 3831472	Setting: Shandong University of Traditional Chinese Medicine, Shandong, China. Design: Systematic Review of RCTS about the effect of dysphagia after stroke. Subjects: 738 stroke patients	Studies comparing the effects of two different Noninvasive Brain Stimulation methods: repeated transcranial magnetic stimulation (rTMS) and transcranial direct current stimulation (tDCS).	Primary Outcomes: Dysphagia outcome and severity scale (DOSS), standardised swallowing assessment (SSA), and penetration-aspiration scale (PAS). Secondary outcomes: functional dysphagia scale (FD) and water swallow test (WST).	Meta analysis: NIBS could improve the DOSS score (SMD = 1.44, 95% CI 0.80 to 2.08, P <0.05) and the WST score (SMD=6.23, 95% CI 5.44 to 7.03, P <0.05). NIBS could reduce the SSA score (SMD =-1.04, 95% CI –1.50 to - 0.58, P <0.05), the PAS score (SMD=-0.85, 95% CI –1.33 to –0.36, P <0.05), and the FD scale score (SMD = -1.05, 95% CI –1.48 to –0.62, P< 0.05). Network meta analysis: Best probabilistic ranking of the effects of the two different NIBS on the DOSS score is rTMS (p=0.52) > TDCS (p=0.48), the best probabilistic ranking of the	**+** Partial supplementation of literature searches. Do not state that they searched for reports regardless of publications status.

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					SSA score is rTMS (P=0.72) > TDCS (P=0.28), and the best probabilistic ranking of the PAS score is rTMS (P=0.68) > tDCS (P=0.32).	
359	P. M. Bath et al. (2020). Pharyngeal electrical stimulation for neurogenic dysphagia following stroke, traumatic brain injury or other causes: Main results from the PHADER cohort study. *EClinicalMedicine,* 28: 100608	Design: Prospective single arm observational clinical cohort study – the stroke patients in group A were compared to a randomised historical control. Setting: 14 secondary/ tertiary hospitals in Austria, Germany and UK Participants: Group A: N = 85 ischaemic or haemorrhagic stroke patients (average onset within 16 days) and group B: N = 99 stroke with ventilation & tracheotomy (average onset within 32 days) with post-stroke dysphagia and DSRS score of 6 or higher.	PES on 3 consecutive days, 10 minus per day, following establishment of threshold and maximum thresholds to then calculate optimal threshold of delivery.	Primary: Dysphagia severity rating scale (DSRS) at 3months. Secondary: FOIS, PAS scores, SAEs.	Primary: Significant difference in DSRS scores at 3 months for both groups A and B (not between groups) (score from 10.9 reduced to 4.2 and 11.7 reduced to 6.5). Secondary: FOIS significant difference in both groups at 3 months (improved from 1.7 to 4.5 and 1.2 to 4.3), and PAS scores improved significantly in both groups (6.2 down 2/8 and 7.2 down to 3.0). 1 of 74. SAEs was considered possibly related to catheter insertion. The results of group A are compared to a randomised historical control from the STEPS trial (patients who received sham treatment in that trial). Treatment was safe.	**++** Sign checklist 3: Cohort studies
367	R. Dziewas et al. (2018). Pharyngeal electrical stimulation for early decannulation in tracheotomised patients with neurogenic dysphagia after stroke (PHAST-	Setting: Included 9 sites (7 acute care hospital and 2 rehabilitation centres, Germany, Austria and Italy. Design: International, prospective, single blind, RCT with sequential design.	Intervention: Patients randomised (computer) into PES versus sham. Detection and maximum thresholds obtained followed by calculation of optimal intensity to deliver treatment. Three consecutive days of PES or sham given for 10 minutes	Primary endpoint: Assessed 24-72hrs after last PES treatment: readiness for decannulation using 3 point algorithm based on FEES assessment (pooling of saliva,	Trial was stopped early after 70 patients recruited due to sequential analysis indicating superiority in PES group. In PES group, 49% (17/35) were ready for decannulation compared to 9% (3/34) in sham group.	**++** Checklist 2: Controlled trial .

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
	TRAC): a prospective, single-blinded, randomised trial. *The Lancet Neurology,* 17:10 849-859	Subjects: 69 stroke patients with supratentorial: haemorrhagic or ischaemic stroke, >18 years, range 19-50 days post-stroke (average 28 days), mechanically ventilated for 48hrs after stroke (off ventilator) but not weaned due to severe dysphagia.	on 3 consecutive days via adapted NG feeding tube. Only investigators knew what treatment patient received. Outcomes assessors were blinded. Cannot guarantee patients were blinded.	swallows within 1 minute and sensation/ response to touch by scope)	In PES group, 14/17 decannulated, 3/17 cuff down permanently. No recannulation whilst in hospital. More likely to respond earlier post-randomisation and shorter time on ventilation. For info: open label second part of study: Non-responders in PES group given another cycle and further 4 (27%) decannulated and in sham group, receiving first cycle of PES, 16 /30 (53%) could be decannulated. Post-hoc analysis: PES responders d/c significantly earlier.	
367	R. Dziewas et al. (2018). Pharyngeal electrical stimulation for early decannulation in tracheotomised patients with neurogenic dysphagia after stroke (PHAST-TRAC): a prospective, single-blinded, randomised trial. *The Lancet Neurology,* 17:10 849-859	Design: prospective, multi centre, single blind RCT (9 sites over 3 countries, 7 acute care hospitals, 2 rehab facilities) , sequential design Post -hoc meta analysis Study protocol and statistical analysis plan published previously Study completed between May 2015 and July 2017	Randomly assigned to receive PES or sham treatment via computerised system. All investigators not involved in treatment were masked. Treating investigators not involved in recruitment or assessment. Masking of patients not guaranteed as 'in principle patients could feel whether PES was applied' Stimulation catheter inserted prior to randomisation. PES or sham stimulation was given on 3 consecutive days for 10 mins per day. Intensity of PES was individually adjusted and optimised by healthcare worker	Primary endpoint; readiness for decannulation 24-72 hrs after treatment, assessed using fiberoptic endoscopic evaluation of swallowing, based on a standardised protocol including: a.) absence of massive pooling of saliva b.) presence of one of more spontaneous swallows c.) presence of at least minimum laryngeal sensation	Sequential analysis after 50 patients reached the primary endpoint showed no futility; analysis after 70 patients showed superiority of PES treatment. Trial was stopped following recommendation from IDSMB Primary endpoint: 49% of patients in PES group and 9% in sham group were judged to be ready for decannulation. Following decision to decannulate, 82% of patients in PES group were decannulated;	**++** High quality Randomisation: using 'computerised interactive wireless randomisation system (IWRS) that applied randomisation stratified by study site in blocks of four patients per site'. Investigators responsible for treatment application were blinded to outcome measurement, recruitment or dysphagia assessment pre/post randomisation

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		69 patients randomly assigned; 35 to receive PES and 34 to receive sham stimulation Inclusion criteria; older than 18 years, supratentorial stroke (haemorrhagic or ischaemic), mechanically ventilated for at least 48hrs, successfully weaned from mechanical ventilation but remained with tracheostomy , free of sedation for at least 3 days at time of first decannulation screening, score -1 points or more on Richmond Agitation and Sedation scale and could not be decannulated because of severe dysphagia	Sham group; optimisation procedure was imitated as closely as possible, treating investigator interacted with base station as if stimulation catheter connected, catheter hidden in pouch to reduce risk of bias	Secondary endpoints included treatment effect in delayed and retreated patients, necessity of recannulations , PES treatment parameters, dysphagia scores, severity of stroke, length of stay, SLT management plan and adverse events	cuff was deflated without decannulation in the other 18% of patients. Nil patients required recannulation over next 48hrs or prior to discharge. Secondary endpoint (unmasked); 49% of patients from PES group remained, having not reached the primary endpoint (one withdrew, one experienced adverse event). 43% of patients received a2nd retreatment cycle of PES and 27% were judged to be ready for decannulation. 30 patients from the sham group received PES, with 53% judged as ready for decannulation. Overall results (randomised and unmasked results): 57% of patients ready for decannulation 24-72hrs post PES. Post hoc analysis to re-analyse findings following FEES review, PES also associated with increased proportion of patients ready for decannulation (29%) in PES group vs 6% in sham group	Patients potentially unblinded following randomisation as 'in principle, patients could feel whether PES was applied' Bias: Sham controlled trial. Efforts made to reduce bias by connecting the base station to a patient simulator box instead of the stimulation catheter placed inside the patient. Connecting ends of the stimulation catheter, base station and patient simulator were hidden inside a pouch to reduce bias. Both intervention and sham stimulation delivered for 10 mins. All FEES videos of primary endpoint assessment were anonymised and adjudicated by independent FEES review board. Open label treatment offered to all participants, irrespective of original allocated group, following primary endpoint Multi centre trial, however no site specific data given

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
387	H. Mao et al. (2022). Clinical study on swallowing function of brainstem stroke by tDCS. *Neurological Sciences,* 43:1 477-484	Subjects = brainstem stroke ward patients. 2 groups randomly divided via computer to 'conventional' vs 'conventional' plus tDCS n=40 Age 50-80, 2-12 month onset. Broadly comparable groups with regard to age, gender and site of stroke. Brainstem stroke confirmed on CT, MRI Assessor blind to treatment allocation.	Investigates effect of (tDCS) combined with 'conventional' comprehensive rehabilitation on dysphagia after brainstem stroke. 8 weeks continuous treatment. Both groups received reported 'conventional swallow function therapy, one group also received additional tDCS	Pre/post: Dysphagia outcome and severity scale (DOSS) Functional Dysphagia Scale (FDS) pre/post Both of above measures based on Videofluoroscopic swallowing study VFSS Pre/post: White blood cell (WBC) c-reactive protein, prealbumin (PAB),albumin (Alb), Haemoglobin (Hb)	independent and paired t tests and CHI square. After 8 weeks DOSS and FDS scores improved (P<0.05). WBC and CRP were decreased (P<0.05). Alb and Hb were improved (P<0.05) PAB no different (P=0.474) tDCS group reported as superior to 'conventional' comprehensive group in improving swallowing function and nutritional indices (P<0.05) Authors conclude tDCS therapy combined with 'routine training' can improve swallowing function and nutritional status of patients and reduce infection	-
387	H. Mao et al. (2022). Clinical study on swallowing function of brainstem stroke by tDCS. *Neurological Sciences,* 43:1 477-484	40 brainstem stroke patients with dysphagia, rehab ward Randomly allocated into tDCS group and control group by a computer-generated randomization list. "All assessments in both groups were performed by a certain therapist … blinded to the treatment allocation".	Both groups were given routine swallowing function training, and tDCS group added transcranial direct current stimulation (tDCS) – anodal on lesional hemisphere 20 min each time, once a day, 6days each week, for a total of 8 weeks.	DOSS and functional dysphagia scale on VFSS Nutritional measures	If DOSS "score changed to 5 and 6 after treatment, and we define it as effective" After 8 weeks therapy: tDCS group 45% and Control group 10" 'effective' (p=0.01)	Low quality (but close to acceptable) Stroke severity was described using the NHSS Randomization seems adequate. There was blinding although 1. It does not seem there was an adequate concealment method used; 2. the description of blinding of the assessor is odd and may have been easily subverted

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						and 3. it doesn't seem that analysis was necessarily blinded. Subjects were not blinded. Baseline DOSS scores are not provided. The description of a successful outcome using the DOSS score is unsatisfactory and actual scores are not shown. There is no information on the experience or training of the assessor.
384	Q. Lin et al. (2021). A systematic review and meta-analysis on the effectiveness of transcranial direct current stimulation (tDCS) on swallowing function of post-stroke patients. *American journal of physical medicine & rehabilitation,* :	Searched for randomised control trials (RCT). Age 18+, ischaemic or haemorrhagic stroke based on CT or MRI. Articles focus on tDCS. Outcome measures standardised validated, scales. Search strategies included. 1239 abstracts identified, reduced to 55 full text reviews and then reduced to 10 studies from 2011-2020 included in meta-analysis. Followed PRISMA (preferred reporting items for systematic reviews and meta-analyses. Registered	Two reviewers reviewed abstracts and extracted data Cochrane collaboration risk of bias tool used to review quality of studies extracted. Utilised statistical software Review manager 5.4 – to consider heterogeneity	Variety of different outcome measures (DOISS, FDS, FEDSS, MMA-SA, KWS) The pooled results showed that of the four trials found to have a small effect size,11, 18-20 three were positive11, 18, 19 and one was negative (SMD=-0.13; 95%CI: -1.12-0.86).20 One trial had a moderate positive effect size (SMD=0.62; 95%CI: -0.01-1.26)17 and 5 trials had large positive effect sizes ranging from 0.81 to 1.35.12-14, 16, 28 Of these, only four trials were statistically significant	Overall analyses reported to demonstrate a significant effect size for swallowing function. Subgroup analyses reported to suggest that both acute and chronic stroke patients showed significant effects on swallowing function after tDCS Discusses varying effect size findings and attempts to account for this whilst acknowledging that further work with larger study size is indicated	-

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		protocol with PROSPERO.		Reported moderate positive effect size (SMD=0.56; 95%CI: 0.28-0.85) in chronic stroke patients and a large positive effect size (SMD=1.03, 95%CI: 0.54-1.52) in acute stroke patients. Both were reported as statistically significant.		
384	Q. Lin et al. (2021). A systematic review and meta-analysis on the effectiveness of transcranial direct current stimulation (tDCS) on swallowing function of post-stroke patients. *American journal of physical medicine & rehabilitation,* :	Systematic review and meta analysis of RCTs investigating the therapeutic effects of transcranial direct current stimulation (tDCS) on swallowing function in post-stroke patients. 10 studies: six single blind; Three were published in English, and seven were published in Chinese. Total 343 patients: 187 in the experimental group and 156 in the control group.	Transcranial direct current stimulation (tDCS)	Validated dysphagia severity scores, effect sizes	"The overall analyses demonstrated a significant effect size for swallowing function. Subgroup analyses suggested that both acute and chronic stroke patients showed significant effects on swallowing function after tDCS. Furthermore, compared with sham stimulation, tDCS anodal to the affected, unaffected, and bilateral hemispheres can produce a significant effect size for swallowing function in stroke patients".	- Low quality The main issues from the SIGN checklist are with: "The scientific quality of the included studies was assessed and reported. Was the scientific quality of the included studies used appropriately?" In this paper, the quality of the methodology of the extracted studies was examined using the Cochrane Collaboration Risk of Bias Tool. This is indeed a very excellent appropriate tool to use. However, by reference to the Pingue paper reviewed earlier (614), the authors have not used it appropriately. In their review, the paper is the highest quality of all they examined, while I found it be of low quality.

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						It is noted in this review that the Pingue paper is at low risk for random sequence generation, for allocation concealment, for blinding of participants and personnel, for blinding of outcome assessment, and for incomplete outcome data. Only the last, I believe, is justified by reference to the Cochrane Bias Tool. • Was the allocation sequence random? The tool requires "Answer 'Yes' if a random component was used in the sequence generation process". This is not clear from the paper. • Was the allocation sequence concealed until participants were enrolled and assigned to interventions? Answer 'Yes' if the trial used any form of remote or centrally administered method to allocate interventions to participants… None of this is discussed in the paper so 'No' should be recorded. • For blinding of participants and personnel and for blinding of outcome assessment: this was a single blind study and only

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						the participants were blinded. • The very large differences in key variables (proportion of ischaemic stroke and in use of NG tubes) also suggests problems with randomisation.
393	S. A. E. Sawan et al. (2020). Transcranial direct current stimulation (tDCS): its effect on improving dysphagia in stroke patients. *Egyptian Journal of Neurology, Psychiatry and Neurosurgery,* 56:1 111	RCT single blinded n=40 Acute and subacute stage Carotid territory confirmed within first month via CT/MRI Age 45-60 Ischaemic stroke Mild to severe dysphagia Divided randomly into two equal groups of 20 (groups A and B). Two equal subgroups: group A 10 x unilateral hemispheric stroke Group A2 10xbilateral hemispheric stroke. Group B1 10 x unilateral hemispheric stroke Group Group B2 10x bilateral hemispheric stroke.	Group A1 received anodal tDCS on pharyngeal motor cortex, and a selected program to improve swallowing. A constant current of 2 mA intensity was applied for 30 min. Stimulation was applied for five consecutive sessions for 2 weeks. Group A2 received selected program and active tDCS. Five consecutive sessions were applied on the dominant hemisphere and then on the non-dominant hemisphere. A constant current of 2 mA intensity was applied for 30 min. Group B (Control) received the selected program dysphagia and sham tDCS. Stimulation was applied for five consecutive sessions for 2 weeks. to improve	Dysphagia outcome and severity scale (DOSS) Video fluoroscopy National Institutes of Health Stroke Scale (NIHSS) as a measure of stroke severity	Reports that the combination of intensive swallowing therapy and anodal tDCS improved swallowing more than swallowing therapy alone Proposes that anodal tDCS applied to the contralateral or bilateral hemispheres of acute stroke patients effectively improves swallowing function when combined with intensive swallowing therapy. NIHSS and time of stimulation were significantly correlated with improvement of swallowing and could be used as predictors of improvement of dysphagia after tDCS sessions	-
393	S. A. E. Sawan et al. (2020). Transcranial direct current stimulation (tDCS): its effect on improving	"This randomized controlled single blinded study was conducted in 40 patients with	Group A1 received anodal tDCS on pharyngeal motor cortex. Group A2 (bilat stroke) received five consecutive sessions were applied on the	DOSS score changes	Tx group median DOSS score 1 (1 – 3) to 6 (1 – 7) (p=0.001) Control: DOSS median 2 (1 – 3) to 2 (1 – 5) (p=0.773)	**0** Unacceptable – reject No randomisation method reported.

REF ID	Source	Setting, design & subjects	Intervention	Outcomes	Results	Evidence quality (SIGN checklist score) and comment
	dysphagia in stroke patients. *Egyptian Journal of Neurology, Psychiatry and Neurosurgery,* 56:1 111	cerebrovascular ischemic stroke. Patients were selected from (blinded for peer review)".	dominant hemisphere and then on the non-dominant hemisphere. Control: sham tDCS			Inadequate clinical data on subjects Single blind "Comparison of treatment effect between different groups was tested using Wilcoxon signed-rank test for quantitative data" – This test tests paired differences in the same group. I can see no comparison of tx effects between the groups
392	V. Pingue et al. (2018). Dual transcranial direct current stimulation for poststroke dysphagia: A randomized controlled trial. *Neurorehabilitation and Neural Repair,* 32:44748 635-644	n=40 – people referred to neuro-rehab dept over a 1 yr period 2014-15 Median age 66 31 L hemisphere 9 R hemisphere 20 male 20 female 20 with NG tube (naso-gastric) All Right handed Randomly assigned to two groups Single-blind study The swallowing evaluation and training as well as the (real or sham) stimulation were performed by an investigator who did not participate in outcome measurements or data analysis	Anodal tDCS to lesioned hemisphere, cathodal tDCS to contralateral hemisphere in early stage of rehab. 10 daily sessions Swallow assessed by Rehab doctors and specialist SLT (Speech and Language Therapist) One group received 2 mA of anodal tDCS over the lesioned hemisphere and cathodal stimulation to the contralateral one The other group received sham stimulation by means of a battery-driven constant current stimulator ...over 10 days of treatment during conventional swallowing rehabilitation therapy sessions of 30 minutes duration. In the sham treatment group, the same protocol was applied,	Pre post swallowing evaluation one week pre and one week post treatment using DOSS (Dysphagia outcome and severity scale) Video fluoroscopy conducted and assessed using PAS (penetration-Aspiration scale) Swallowing training Patients who were at risk of aspiration were tube fed received indirect therapy	Reports that the percentage of patients reaching thresholds of improvement was higher in tDCS group than sham but not significant Only a subgroup of pts without NG tube showed a significantly higher improvement with tDCS vs sham Authors suggest that in pts with post stroke dysphagia, treatment with dual tDCS in -the early phase of rehab does not significantly increase the probability of recovery compared with sham stimulation The rehabilitation outcome appeared to be maintained at 2-month follow-up in both groups.	-

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		Unilateral stroke in 4 weeks prior to joining >18 No other sig disease 'mild to severe dysphagia' determined by DOSS score of <5 National Institutes of Health Stroke Scale (NIHSS) score at enrolment <22 Randomised control trial Randomised to receive tDCS vs sham stimulation during swallowing manoeuvres. Investigated whether anodal tDCS over the lesioned hemisphere and cathodal stimulation of the contralateral one could improve swallowing function compared with sham stimulation and whether there were any clinical features predictive of the effect of tDCS in individual patients	except that the 2-mA current was delivered for only 30 s Long term telephone follow up at 2 months			

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392	V. Pingue et al. (2018). Dual transcranial direct current stimulation for poststroke dysphagia: A randomized controlled trial. *Neurorehabilitation and Neural Repair,* 32:44748 635-644	Neurorehabilitation department, Italy. 40 adult patients with poststroke dysphagia: 20 had NG tube Inclusion: (1) occurrence of unilateral stroke in the 4 weeks prior to enrollment; (2) no other muscular and neurological disease or severe disorder of consciousness; (4) mild to severe dysphagia, with a Dysphagia Outcome Severity Scale (DOSS) score <5; and (5) a National Institutes of Health Stroke Scale (NIHSS) score at enrollment <22. Excluded patients with a prior history of dysphagia, other severe clinical conditions (eg, severe infections), or potential ontraindications to tDCS	10 days of anodal tDCS over the lesioned hemisphere and cathodal stimulation of the contralateral one – targeting pharyngeal motor cortex. Could improve swallowing function compared with sham stimulation and were there were any clinical features predictive of the effect of tDCS in individual patients. Single blind	Change DOSS score 2 or more defined as clinically significant	The percentage of patients who reached various thresholds of improvement was higher in the tDCS group than in the sham group, but the differences were not significant. e.g for DOSS improve 2 or more 6 (30%) in the tDCS group and 2 (10%) in the sham treatment (p=0.24)	Low Quality Randomisation method unclear: "Patients were allocated to 2 groups based on random extractions from a Bernoulli distribution with parameter 0.5". Single blind only. Two groups have important differences in factors that may influence the outcomes, eg the proportion of patients with a NG tube was significantly lower among individuals treated with tDCS compared to those given the sham treatment (30% vs 70%, P = .026) Multiple outcomes, unclear which primary, and no control multiple comparisons
382	Y. Li et al. (2020). The effect of transcranial direct current stimulation of pharyngeal motor cortex on swallowing function in patients with chronic dysphagia after stroke: A	n= 26 age 25-65, 6-24 month onset, post-stroke with chronic dysphagia Retrospective cohort study July 16=Apr 18	Unilateral vs bilateral anodal tDCS. Hypothesis bilateral tDCS probably most effective Groups A -=13 B = 13 C= 13 unilateral or bilateral tDCS??	Videofluoroscopy pre and 2 weeks post to evaluate swallow function plus SWAL-QUAL 11 domains	Swallow function and QOL improved in all 3 groups Oral transit time faster and improved QOLi n tDCS groups. Substantial improvement in bilateral anodal tDCS group	-

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	retrospective cohort study. *Medicine,* 99:10 e19121		13 'conventional' therapies 20 mins daily 6 days per week for 2 weeks Swallow function and QOL pre and 2 weeks post			
382	Y. Li et al. (2020). The effect of transcranial direct current stimulation of pharyngeal motor cortex on swallowing function in patients with chronic dysphagia after stroke: A retrospective cohort study. *Medicine,* 99:10 e19121	Retrospective cohort study. Neurorehab hospital, China "Patients with chronic dysphagia induced by stroke with unilateral cortical and subcortical lesions" Restricted to ages 25-65	26 pts treated with unilateral (13) or bilateral (13) hemispheric anodal tDCS Compared with "randomly selected 13 eligible patients without tDCS who were appropriate for tDCS as reference group".	Videofluoroscopic examinations measures nd SWAL-QOL before and 2 weeks after treatment. (Not explicit that Chinese SWAL QOL used)	Improvements in all parameters were greatest in bilateral, then unilateral vs no tDCS	- Low quality Retrospective cohort study. No measure stroke severity so unclear if groups being studied are selected from source populations that are comparable in all respects other than the factor under investigation Unclear how those without tDCS were 'randomly selected' No dysphagia severity score recorded ?selection bias – unclear how it was decided subjects got bilateral/unilateral or no tDCS Unclear if same SLT did all assessments No correction for multiple comparisons
386	Y. Lu et al. (2021). The effects of traditional Chinese medicine sensory stimulation combined with transcranial direct current stimulation on deglutition and related complications in stroke	n=60 stroke haemorrhagic or ischaemic on CT or MRI Age 60-80 Approx. 3 week onset Prospective single blind randomised trial	Randomised into 3 groups, single blind TCM (traditional Chinese medicine) ,tDCS and combined	WST Water swallow tests pre and 30 days post treatment VFSS (video-fluoroscopic study of swallowing) pre post fMRI (functional Magnetic resonance imaging)	WST and VFSS scores in combined group significantly higher than both other groups Brain activation higher in combined group than other two groups	**0**

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	patients with dysphagia: a randomized trial. *Annals of palliative medicine,* 10:6 6597-6605					
386	Y. Lu et al. (2021). The effects of traditional Chinese medicine sensory stimulation combined with transcranial direct current stimulation on deglutition and related complications in stroke patients with dysphagia: a randomized trial. *Annals of palliative medicine,* 10:6 6597-6605	60 stroke patients between 60 and 80y with dysphagia Hospital type unclear but average 3 weeks since stroke Single blind Randomization was completed using a computer-generated numbers table from the statistics package SPSS18.0.	Three groups: 1. Traditional Chinese medicine (TCM) Jieyudan powder stick stimulation 2. Sensory stimulation combined with transcranial direct current stimulation (tDCS) 3. Both	Water swallowing test VFSS measures fMRI	"The WST and VFSS scores in the combined treatment group were significantly higher than that observed in the other two groups ($P<0.05$)".	**0** Unacceptable – reject No dysphagia severity scores No data stroke severity The outcome measures are once off and often ad-hoc. The statistics are poorly described – multiple two way comparisons although three groups and no correction for multiple tests.
364	A. Dionisio et al. (2018). Transcranial Magnetic Stimulation as an Intervention Tool to Recover from Language, Swallowing and Attentional Deficits after Stroke: A Systematic Review. *Cerebrovascular Diseases,* 46:44654 176-183	Portugal, systematic review ; any paper for non-motor rehab (includes aphasia, dysphagia, neglect, visual extinction.) – only repetitive TMS included		Efficacy limitations	38 papers of which 8 dysphagia (between 2009 – 2017) 6 in acute 2 in chronic stage Variation in protocols (placement, frequency)	Low on evidence SR carried out well. No meta- analysis feasible, Bias in early use of TMS with spontaneous recovery Variation in protocols prevent clear uptake yet; more larger trials needed….
400	C. Zhang et al. (2021). Repetitive transcranial magnetic stimulation in combination with neuromuscular electrical stimulation	China hospital, cohort study; 4 conditions, 64 acute stroke patients (less than 2 months) divided between 4, so 16 in each group (6 lost	Combined rTMS and Neuromuscular stimulation ; bilateral rTMS or unilateral protocol 10 rTMS and 10 NMES over 2 weeks, HF(10HZ) TMS over	Standardised swallow assessment, degree of dysphagia	Change in standardise swallow score, not in degree of dysphagia	Low: Acute patients, no spontaneous recovery account, small numbers to start and some attrition across groups;

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	for treatment of post-stroke dysphagia. *Journal of International Medical Research,* 47:2 662-672	to ift assessment, 6 more at one month follow up	affected side, LF(1HZ) TMS over non affected; 15 mins each, proper SHAM protocol			Measures scales open to bias, change cannot be attributed solely to interventions
403	L. Zhong et al. (2021). The Effectiveness of Acupuncture for Dysphagia after Stroke: A Systematic Review and Meta-Analysis. *Evidence-based Complementary and Alternative Medicine,* 2021: 8837625	Setting China Design Systematic Review and Meta Analysis (inception - 2020) Subjects 3024 participants with post stroke dysphagia. Stroke confirmed by CT/MRI. Dysphagia confirmed by clinical assessment, a videofluoroscopy or Fiberoptic Endoscopic Evaluation of Swallowing	Intervention Acupuncture (3/week for more than 2 week duration) +/- swallow interventions (behavioural intervention, drug therapy, electrical stimulation) vs Control Swallow interventions (behavioural intervention, drug therapy, electrical stimulation)	Primary Outcomes i) Standardised Swallow Assessment, ii) Fujishima Ichiro's dysphagia scale iii) Videofluoroscopy or Fiberoptic Endoscopic Evaluation of Swallowing iv) Watain /Water Swallow Test iSecondary Outcomes i) Adverse Events	35/2221 studies included (published between 2006-2020), 4 high risk of bias i) Standardised Swallow Assessment (13 studies). Significant improvement in intervention arm ($p<0.00001$) compared to control arm ii) Fujishima Ichiro's dysphagia scale (12 studies). Significant improvement in intervention arm ($p<0.00001$) compared to control arm iii) Videofluoroscopy (8 studies). Significant improvement in intervention arm ($p<0.00001$) compared to control arm iv) Water Swallow Test (11 studies). Significant improvement in intervention arm ($p<0.0002$) compared to control arm	- Low quality Limited search criteria Limited search to Chinese and English databases / language All studies , except one failed to report: Allocation concealment, blinding of performance (participants and staff), blinded assessment and outcome. High heterogeneity. Publication bias Diverse electroacupuncture protocols across the trials (site, stimulation method, needle time, treatment duration). Sample effect not reported (age, comorbidity, gender, disease severity, acupuncture stimulation, expectation, staff/patient relationship).

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					Secondary Outcomes i) Adverse Events (3 studies - none serious, dropouts reported in 4 studies).	Variation in treatment duration Subjectivity of clinical swallow assessments (SSA, FIDS, WST). No evidence to support sustained treatment effect. Trials and publications limited to China.
403	L. Zhong et al. (2021). The Effectiveness of Acupuncture for Dysphagia after Stroke: A Systematic Review and Meta-Analysis. *Evidence-based Complementary and Alternative Medicine,* 2021: 8837625	Setting: China. Not further specified Design: SR/MA of 35 RCTs to investigate the efficacy of acupuncture for treating dysphagia in patients with stroke. Stroke determined by CT or MRI. Dysphagia determined with VFSS or FEES Participants: 3,024 people with post-stroke dysphagia (PSD)	Acupuncture alone or acupuncture combined with other interventions (behavioural interventions, drug therapy, and electrical stimulation). The interventions were the same between experimental and control groups, except for acupuncture in the experimental groups. Frequency: 3-7 times a week Duration: 2-12 weeks Most frequent acupoints: Fengchi (GB20), Jinjin (EX-HN12), Yuye (EX-HN13), Lianquan (RN23), Yifeng (SJ17).	Water swallowing test (WST), standardized swallowing assessment (SSA), penetration-aspiration scale (PAS) [18], and functional oral intake scale (FOIS); or objective index, such as videofluroscopic swallowing study (VFSS) or endoscopic evaluation of swallowing	Quality ratings. Only 1/35 studies had >4/7 areas of bias adequately addressed. 4/35 were judged by authors as high risk of bias. 34/35 had 2-3/7 areas adequately addressed. All effects below are immediately post therapy for 33/35 studies. Only 2/35 studies reported a 3month follow up. In all MAs below, heterogeneity was I^2 >75%. Acupuncture combined with other interventions was better than that of the control group for: WST: MD = −1.21, 95% CI: −1.85 to −0.57, P = 0.0002, n = 11 studies SSA: MD = −3.78, 95% CI: −4.64 to −2.91, P < 0.00001, n = 13 studies	- Low quality Search: the search was not supplemented by consulting current contents, reviews, textbooks, specialized registers, or/and experts in the particular field of study. Publication bias: Unclear. Papers were retrieved from electronic datasets and manual searches 'of relevant references. Authors do not state that they searched for reports regardless of their publication status. Study characteristics: Limited information provided on participant characteristics (only age). No information on other

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					Ichiro Fujishima rating scale (IFRS): MD = 1.68, 95% CI: 1.16 to 2.20, P < 0.00001, n=12 studies VFSS: MD = 2.26, 95% CI: 1.77 to 2.74, P < 0.00001, n=8 studies AE: reported in 3 studies and included bleeding, pain, discomfort, no life-threatening AEs. Not reported in which group these occurred.	demographics, e.g., gender. No information on stroke, severity or dysphagia; no information on setting. Synthesis of findings: All studies included in synthesis despite low quality ratings (34/35 studies had 2-3/7 areas rated as low risk of bias) and 4/35 judged by authors as high risk of bias. Heterogeneity (I^2) was high in all MAs, and remained high in subgroup analyses. We don't know how clinically heterogeneous studies were, as not enough information is provided for the studies. The discussion considers the included studies as low or moderate risk of bias.
399	W. Yang et al. (2021). The Effect of Repetitive Transcranial Magnetic Stimulation on Dysphagia After Stroke: A Systematic Review and Meta-Analysis. *Frontiers in Neuroscience,* 15: 769848	China, systematic review, RCTs and non RCTs , includes a meta-analysis	rTMS on dysphagia post stroke low frequency and high frequency stim included	Mean scores before and after intervention; measures: PAS, dysphagia grade lack of heterogeneity in outcome measures	Meta analysis from 7 papers and 6 mores for SR, 10 papers, 2 graded A, others B for bias, Meta-analysis; small positive effect; no Hi/Low stim difference with conventional	Used a quality checklist and risk of bias Appropriate method for dealing with heterogeneity issue Mixed lesion sites across studies (main A grade paper: brainstem) v cortical lesions, Underpinning bilateral balance theory still in experimental stage

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365	Y. Du et al. (2021). The effects of different frequencies of repetitive transcranial magnetic stimulation (rTMS) on patients with swallowing disorders after cerebral infarction. *NeuroRehabilitation,* :	China, hospital, pre/post cohort study, 90 stroke patients, 90 controls,	3 treatment conditions for stroke: freq of rTMS (10Hz, 5HZ, 1 HZ) same protocol delivery for all groups; 30 in eact TX	Measures: water test, VFSS, EEG, pre and post EEG 16 leads,	10HZ stim shows positive effects on pharynx and aspiration, others	Low: Unclear on randomisation method, Control group (no sham used) ; unclear who control group are? Stroke patients? – receive routine Txt; Small numbers, Indicative … but not strong
376	Y. Jiao et al. (2022). Clinical effect of repetitive transcranial magnetic stimulation on dysphagia due to stroke. *Neurological Sciences,* :	China, pre/post cohort study, convenience sample Acute dysphagia	3Hz RTMS in Txt group, 61 patients (random table method),,	Water swallow test pre and post	Both improve, TMS slightly more on water test	Low : Bias in selection and assignment, acute patients small numbers no sham used in control no sense of 3HZ choice enough? Correct? drug therapy and usual TxTs given; cannot isolate rmt.