Hindawi
Evidence-Based Complementary and Alternative Medicine
Volume 2022, Article ID 8803507, 26 pages
https://doi.org/10.1155/2022/8803507

Review Article

Manual Acupuncture or Combination of Rehabilitation Therapy to Treat Poststroke Dysphagia: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

Hailun Jiang,[1,2,3] Qiang Zhang,[4] Qi Zhao,[1,3] Hao Chen,[1,2,3] Xi Nan,[1,2,3] Miao Liu,[4] Chunsheng Yin,[1,2,3] Wei Liu,[1,2,3] Xiaonong Fan,[1,3] Zhihong Meng,[1,3] and Yuzheng Du[1,3]

[1]*First Teaching Hospital of Tianjin University of Traditional Chinese Medicine, Tianjin 300193, China*
[2]*Tianjin University of Traditional Chinese Medicine, Tianjin 301617, China*
[3]*National Clinical Research Center for Chinese Medicine Acupuncture and Moxibustion, Tianjin 300381, China*
[4]*BeiJing Daxing District Hospital of Integrated Chinese and Western Medicine, Beijing 102600, China*

Correspondence should be addressed to Zhihong Meng; profmengzhihong@163.com and Yuzheng Du; drduyuzheng@163.com

Received 24 November 2021; Revised 13 September 2022; Accepted 29 September 2022; Published 15 October 2022

Academic Editor: Adolfo Andrade-Cetto

Backgroundand Objective. Poststroke dysphagia is one of the most common stroke complications with high morbidity and long course, while acupuncture treatment is easily accepted by patients due to its reliability, feasibility, simple operation, low price, and quick effect. Our objective was to evaluate the efficacy of manual acupuncture in poststroke dysphagia patients. *Methods*. Databases including Medline, Web of Science, PubMed, Cochrane Library databases, EMBASE, CNKI (China National Knowledge Infrastructure), WanFang (WanFang Database), and VIP (Chongqing VIP) were searched from inception until Aug 19, 2022. Data were analyzed using Revman 5.3, Stata 14.0, and TSA 0.9.5.10 Beta software. Evidence quality evaluation was performed by using GRADE profiler 3.6. *Results*. A total of 33 randomized control trials (RCTs) enrolled 2680 patients. Meta-analysis results revealed that compared to rehabilitation, acupuncture decreased water swallow test (WST) and standard swallowing assessment (SSA) scores. Meanwhile, in contrast to rehabilitation alone, integration of acupuncture with rehabilitation effectively decreased WST and SSA scores; improved swallowing scores of videofluoroscopic swallowing study (VFSS), swallowing scores of Fujishima Ichiro, Barthel index (BI), and swallowing quality of life questionnaire (SWAL-QOL); reduced the aspiration rates as well as aspiration pneumonia; and shortened the duration of empty swallowing and the duration of 5 mL water swallowing. Pooled analysis did not reveal any significant differences in dysphagia outcome severity scores (DOSS) ($p = 0.15 > 0.05p$) between the acupuncture group combined with rehabilitation group and the rehabilitation group alone. After the risk-of-bias assessment, these studies were not of low quality, except in terms of allocation concealment and blindness. Evidence quality evaluation showed that allocation concealment and blindness led to a downgrade and primary outcomes' evaluation of acupuncture combined with rehabilitation were ranked as moderate-quality evidence while acupuncture alone was ranked as low-quality. *Conclusion*. This meta-analysis provided positive pieces of evidences that acupuncture and acupuncture combined with rehabilitation were better than using rehabilitation alone in the treatment of poststroke dysphagia.

1. Introduction

Dysphagia, whose typical clinical manifestations include sialorrhea, bradymasesis, coughing, and choking when drinking water or eating, is prevalent among stroke patients [1]. A cohort study in South London revealed a 15%–37% prevalence rate of dysphagia among first-ever stroke patients who were recorded in the South London Stroke Register between 2001 and 2018 [2]. An Asian study reported a 36.3% incidence of dysphagia among stroke patients [3]. Potentially, dysphagia affects the quality of life, increases the occurrence of malnutrition, and prolongs hospital stay.

Moreover, dysphagia patients are likely to suffer from pneumonia, resulting in death [4].

The current professional rehabilitation therapies include exercises that improve the coordination of muscle movements in the mouth and throat. Besides, applications of nasogastric tubes remain a priority for severe dysphagia patients with high aspiration risks [5]. Long periods of rehabilitation are difficult to sustain while exercises require close monitoring, leading to additional financial and manpower burdens. The placement of a nasogastric tube through the nose of a patient is associated with pain and bad postoperative memories. Additionally, a limited number of drugs, including capsaicin, nifedipine, and methylprednisolone have been reported to treat dysphagia. However, their therapeutic actions and long-term effects remain unclear [6–8]. Thus, alternative therapies, including acupuncture, neuromuscular electrical stimulation (NMES), transcranial magnetic stimulation (TMS), and balloon dilation among others, are easily accepted by patients [9]. However, these new rehabilitation technologies will cause more or less pain and discomfort to patients. Instruments such as NMES and TMS require the hospital to purchase corresponding instruments, and the treatment costs are high, making it difficult for primary hospitals' application. In addition, due to the lack of clinical research on NMES and TMS, parameters such as stimulation target selection, electrical stimulation frequency, duration, and course of treatment are still unclear [10, 11]. Pain and other discomforts will occur during the application of balloon dilatation and the course of treatment is generally more than 15 days, which will cause psychological pressure on patients. Acupuncture was first promoted by the World Health Organization (WHO) in 1979 [12] and has been extensively been used to treat various neurological diseases in China. By overcoming the serious side effects associated with chemical drugs, acupuncture is considered a "natural, green, and time-honored" therapy that is accepted by a majority of patients because of its reliability, feasibility, simple operation, low price, and instant effects [13].

However, the existing systematic reviews in some aspects should be improved. For instance, the included studies are of low quality, the level of clinical evidence cannot be established, and acupuncture methods, as well as acupoints in different studies, significantly vary. A recent review on swallowing therapy [14] from the Cochrane database put forward that acupuncture could not improve the swallowing capacity of patients. However, there was significant heterogeneity in the included articles and no corresponding explanation was given, moreover, the review [14] mentioned that the quality of evidence ranged from "very low" and "low". The topic is of importance to clinicians and policymakers because the significance of unconventional treatments, such as acupuncture is controversial. Therefore, we aimed at providing higher-quality evidence and at exploring the clinical efficacy of acupuncture on poststroke dysphagia. We only included high-quality RCTs (the modified Jadad scores were equal to or above 4 points). Further, "manual" acupuncture and locations of acupoints were specified to minimize clinical heterogeneities.

2. Materials and Methods

2.1. Study Registration. We conducted a protocol of systematic review and meta-analysis following preferred reporting items for systematic reviews and meta-analyses protocol (PRISMA-P). Meanwhile, the study was registered on the PROSPERO (International prospective register of systematic reviews) on July 8, 2021, and the registration number is CRD42021258346.

2.2. Search Strategy. Two independent reviewers (Jiang. HL and Zhang. Q) searched databases including Medline, Web of Science, PubMed, Cochrane Library databases, EMBASE, CNKI (China National Knowledge Infrastructure), WanFang (WanFang Database), and VIP (Chongqing VIP) from inception until Aug 19, 2022, and found no language restriction. Based on the characteristics of each database to develop the corresponding retrieval strategy, the following English keywords were used|: (stroke ∗ OR Poststroke OR Cerebrovascular OR CVA ∗ OR Apoplexy OR Vascular Accident ∗ OR brain OR Cerebral ∗) and (Point ∗ OR Acupuncture OR Acupoint ∗) and (Swallowing Disorder ∗ OR Dysphagia OR Deglutition Disorder ∗) and (Randomized OR RCT OR Randomly) and (Trial ∗). The search strategy is listed in Table S1.

2.3. Inclusion Criteria. The inclusion criteria for the selected literature were as follows: (i) patients with dysphagia after stroke; (ii) clinical randomized controlled trials comparing manual acupuncture with rehabilitation therapy for the treatment of poststroke dysphagia; the manual acupuncture study group included acupuncture alone or acupuncture coupled with rehabilitation therapy to treat dysphagia; the control group was treated with rehabilitation therapy; (iii) in duplicated published articles, the one with more complete data was included; and (iv) literature that included acupoints located around the nape, neck, or throat.

Note: the diagnostic criteria for poststroke dysphagia refers to "Diagnostic Criteria of Cerebrovascular Diseases in China (version 2019) [15]" and "European Stroke Organization and European Society for Swallowing Disorders Guideline for the Diagnosis and Treatment of Poststroke Dysphagia [16]." Clinical manifestations include stroke patients choking on drinking water or voice changes, dysarthria, abnormal gag reflex, and cough after eating.

Rehabilitation therapy for swallowing disorders includes indirect training and direct training [17]. Direct training is related to the eating process. Indirect training includes the following: (1) breathing training, (2) oral exercise training, (3) oral sensorimotor training, (4) vocal cord closure training (5) supraglottic swallowing and ultrasound supraglottic swallowing, (6) Mendelsohn maneuver, (7) Shaker training, (8) Masako technique, (9) K-point stimulation, (10) low-frequency electrical stimulation, (11) swallowing apraxia training, (12) esophageal dilation, and (13) intermittent oroesophageal tube feeding.

2.4. Exclusion Criteria. The exclusion criteria were as follows: (i) articles whose full literature was unavailable and (ii) if the quality of the article, as evaluated by the modified Jadad scale, was rated as low quality (Jadad < 4), then it was excluded.

2.5. Outcome

2.5.1. Primary Outcomes. The primary outcomes were as follows:

Water swallow test (WST)
Video fluoroscopic swallowing study (VFSS)

2.5.2. Secondary Outcomes. The secondary outcomes were as follows:

Standard swallowing assessment (SSA) scores
Swallowing scores of Fujishima Ichiro
The rates of aspiration
The rates of aspiration pneumonia
The dysphagia outcome severity score (DOSS)
Barthel index (BI)
Swallowing quality of life questionnaire (SWAL-QOL)
Duration of empty swallowing
Duration of 5 mL water swallowing

2.6. Data Extraction. Two independent reviewers (Jiang. HL and Zhang. Q) searched and screened the works of the literature and then extracted the general information of the included trials, involving the name of the first author, year of publication, source of diagnosis, sample size, age of participants, RCTs districts, types of stroke, duration of dysphagia after stroke, intervention measures, the course of the intervention, outcome indicators, and the information about acupuncture treatment (including reinforcing and reducing, acupoints, and needle retaining time). If any inconsistency is being raised up, then the decision would be made through discussion, and if the discrepancies still persisted, then the third reviewer (Zhao Q) would make the final decision.

2.7. Risk-of-Bias Assessments. Each study was classified as "low," "high," or "unclear risk of bias" at the following items: ①random sequence generation (selection bias), ②allocation concealment (selection bias), ③ blinding of participants and personnel (performance bias), ④blinding of outcome assessment (detection bias), ⑤ incomplete outcome data (attrition bias), ⑥ selective reporting (reporting bias), and ⑦ Other bias. Two independent reviewers (Jiang. HL and Zhang. Q) evaluated the methodological quality and the risk of bias of the included RCTs separately and discussed on resolving the disagreements, based on the Cochrane risk-of-bias criteria [18]. If two reviewers were divided over risk-of-bias assessments, then the third reviewer (Zhao Q) would be consulted to confirm the judgment and to finally reach a consensus on all items.

2.8. Data Synthesis and Statistical Analysis. Data synthesis was performed using the Review Manager software 5.4 (developed by the UK's International Cochrane Collaboration) and Stata 14.0 (developed by the USA's StataCorp LLC). Relative risks (RR) were used as the effect analysis statistics for dichotomous variables, while the weighted mean difference (WMD) and a 95% confidence interval (CI) were calculated for continuous variables. The chi-square test was used to establish statistical heterogeneity between data of included trials; besides, I^2 or Chi-square test pp was used to quantitatively determine heterogeneity. When $I^2 < 50\%$ or chi-square test $p \geq 0.1p$, heterogeneity was considered unapparent, and the fixed-effects model was applied. However, significant heterogeneity was present when $I^2 \geq 50\%$ or chi-square test $p < 0.1p$, and the random-effect model was applied. Then, sensitivity or subgroup analyses were performed to determine heterogeneity sources. Egger's test was performed to test for publication bias, and $p > 0.05p$ implied the absence of publication bias. The prespecified pp value threshold for one primary outcome was set at $p = 0.05p$, and for the other, it was set at $p = 0.033p$ [19]. Secondary outcomes with $p < 0.05p$ were considered significant.

Trial sequence analysis (TSA) was performed using TSA 0.9.5.10 Beta (developed by the Copenhagen Trial Unit's Centre for Clinical Intervention Research). TSA parameter setting: I error probability of 5% and II error probability of 20% [20].

The X-axis represents the sample size; the Y-axis represents the statistics on the Z-value; the symmetrical green horizontal dashed lines represent the conventional boundary value ($Z = 1.96$, $p = 0.05p$ (two-sides)); the symmetrical solid red lines represent the TSA boundary value; the vertical red line represents the required information size (RIS), and the blue curve represents the cumulative Z-value.

In case the blue curve did not intersect with any red line, then the sample size was considered insufficient; consequently, a series of similar trials should be performed. The current sample size was considered enough if the blue curve intersected with any of the red lines.

2.9. Evidence Quality Evaluation. The GRADE profiler 3.6 (developed by the European Commission Marie Curie Reintegration grant EU IGR42192 to Holger Schünemann, the Cochrane Collaboration, and the Norwegian Knowledge Centre for the Health Services) was used to evaluate the quality of evidence for the primary outcome, based on the grading of recommendations, assessment, development, and evaluation (GRADE) approach [21]. As the outcome was from RCTs, the starting level of quality of evidence was high. Then, the two independent reviewers (Jiang HL and Zhang Q) separately downgraded the level from the following five aspects: imprecision (random error), unexplained heterogeneity or inconsistency of results, indirectness of evidence, study limitations (risk of bias), and publication bias, and if disagreements persisted, the third investigator (Zhao Q) was consulted to confirm the judgment so as to finally reach a consensus on all items. Ultimately, the quality of evidence was determined into the following four levels to verify the reliability and accuracy of outcomes: the highest quality, moderate quality, low, and very low [22]. Two independent reviewers (Jiang. HL and Zhang. Q) evaluated the methodological quality and the risk of bias of the included RCTs separately and discussed on resolving the disagreements, based on the GRADE handbook.

3. Results

3.1. Study Participants and Grouping. This study included 33 trials [23–55] involving 2,680 participants. A total of 220 participants were included in the acupuncture group, 1,289 patients were in the rehabilitation group, while 1,171 patients were in the acupuncture combined with the rehabilitation group. Besides, four RCTs [43–46] designed two groups, comprising both the acupuncture and rehabilitation groups; 26 [23–25, 28–37, 39–42, 47–55] RCTs designed two groups, comprising acupuncture + rehabilitation group and rehabilitation group; and three RCTs [26, 27, 38] designed three groups, comprising acupuncture group, rehabilitation group, and acupuncture + rehabilitation group. The process is shown in Figure 1.

3.2. Risk-of-Bias Assessments. The modified Jadad score for all these studies was ≥4.

① Random sequence generation (selection bias): All the trials reported specific randomization methods, except Xie's study [43], thus one was an "unclear risk" of selection bias, and the others were regarded as having a "low risk" of selection bias.

② Allocation concealment (selection bias): A total of nine [26, 27, 30, 31, 33, 42, 49, 52, 54] trials provided the methods of allocation concealment, therefore, these trials were considered to have a "low risk" of selection bias. The remaining 24 trials did not indicate the allocation concealment and were regarded as having an "unclear risk".

③ Blinding of participants and personnel (performance bias) and blinding of outcome assessment (detection bias): Five [36, 48, 49, 52, 54] trials reported blindness; the outcome assessor in these trials were blinded and were considered to have a low risk of performance bias. Meanwhile, Xie's study [43] indicated blindness without specific measures, therefore, the trial was considered to have an "unclear risk" of performance bias. Given that blindness may have a certain impact on the outcome assessment, 28 trials did not indicate blindness and were considered to have an "unclear risk" performance of bias since most of the indicators were easily unaffected by psychological suggestions.

④ Incomplete outcome data (attrition bias): All of the studies provided the causes and numbers of lost patients at follow-up. A total of 100 patients in 16 trials were excluded after they were lost to follow-up and ITT analysis was not used; they were considered to have an "unclear risk" attrition of bias since the lost follow-up rate was less than 15%.

⑤ Selective reporting (reporting bias): Only one trial [36] conducted clinical registration and it was difficult to evaluate the reporting bias. Thus, we assumed that the reporting bias was at a low risk only after an ethical review board had reviewed the report. Therefore, in selective reporting, 14 trials had a low risk of reporting bias.

⑥Other bias: Any other bias source was not detected, therefore, all the trials were considered to have a "low risk" of bias.

Overall, the quality of these trials was not low, especially in terms of allocation concealment, and blindness is low. The blindness of manual acupuncture is a prevalent problem in clinical acupuncture trials, therefore, additional mechanisms are necessary to overcome it. The bias risk assessment is presented in Figure 2.

3.3. The Basic Characteristics of the Inclusion Study

3.3.1. Characteristics of PICO Summarized in Table 1. Characteristics of manual acupuncture are summarized in Table 2 and Figure 3. A total of 72 acupoints were involved, and Figure 3 shows acupoints that were used greater than or equal to 3 times. Lianquan (CV23), Fengchi (GB20), Jinjing (EX-HN12), Yuye (EX-HN13), and Yifeng (TE 17), which are mainly distributed in the superior border of hyoid bone, tongue and neck, are frequently selected for stimulation. In 33 RCTs, their acupoint frequencies were 21, 19, 11, 11, and 10.

3.3.2. Characteristics of the Rehabilitation Training Summarized in Table 3

3.4. Meta-Analysis Results

3.4.1. Acupuncture vs. Rehabilitation (Figures 4 and 5). Compared with rehabilitation, this study found two indicators of acupuncture. Pooled results revealed significant differences in swallowing scores of WST ($p < 0.05p$) and SSA ($p < 0.05$() as shown in Figures 4 and 5.

3.4.2. The Swallowing Scores of WST (Figure 4). The results of the meta-analysis showed that the swallowing scores of WST of the acupuncture + rehabilitation group were lower than that of the rehabilitation group (WMD = −0.46, 95% CI (−0.70, −0.22)). In this analysis, there was no significant between-study heterogeneity (5 RCTs, $I^2 = 0\%$).

3.4.3. SSA (Figure 5). The results of the meta-analysis showed that the SSA score of the acupuncture group was lower than that of the rehabilitation group (WMD = −3.73, 95% CI (−6.05,-1.41)), and the

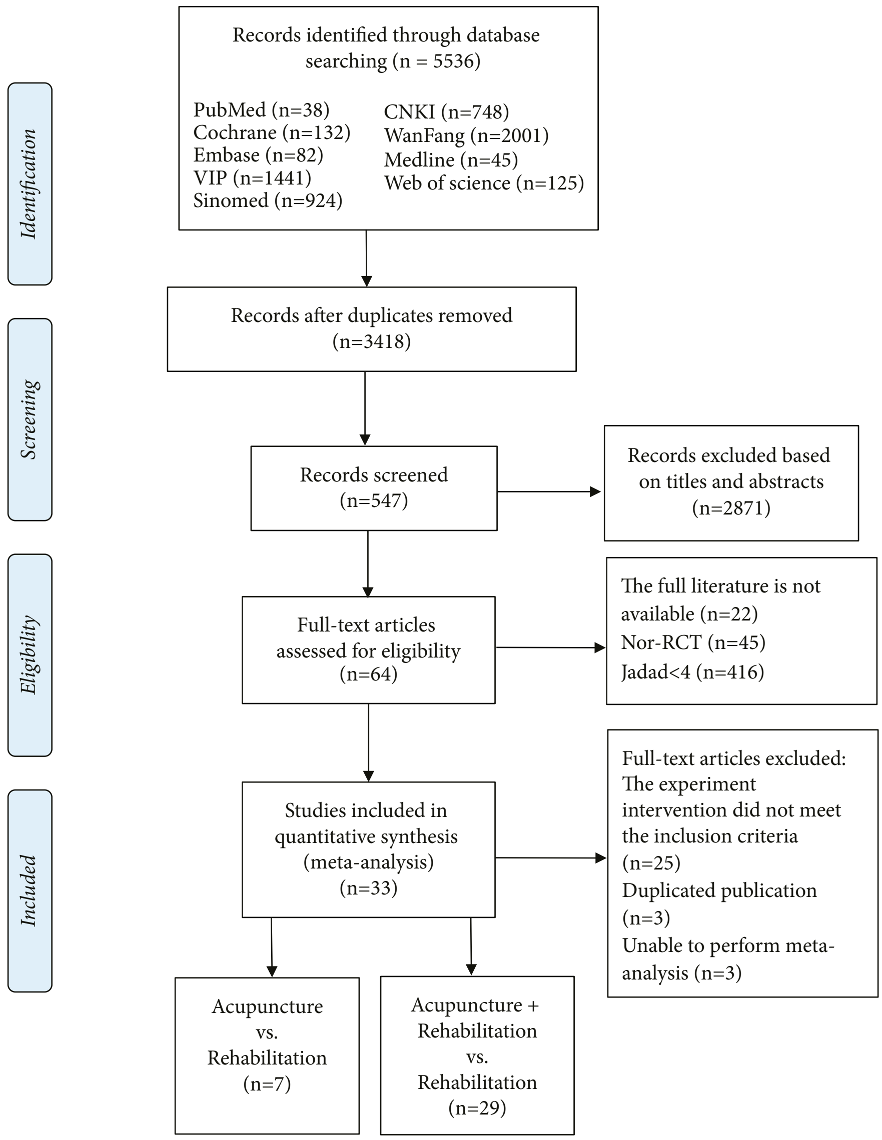


Figure 1: Flow chart of study identification and selection.

heterogeneity of the SSA score was high (3 RCTs, $I^2 = 80\%$). The index of one study [26] crossed the invalid line ($p > 0.05p$), while after excluding it, heterogeneity remained apparent ($I^2 = 80\% \longrightarrow I^2 = 66\%$); meanwhile, no significant methodological heterogeneity was noted in Jing's study [26]. Subgroup analysis wasperformed based on the frequency of treatment (once/d, twice/d), where the identified frequency of treatment was a significant outcome moderator, and heterogeneity was significant between the two subgroups ($I^2 = 89.3\%$). The subgroup with treatment of twice/week (WMD = −5.55, 95% CI (6.74, −4.36)) had better outcomes than that of once/d (WMD = −2.58, 95% CI (−4.07, −1.09)). The result of the subgroup analysis revealed a tendency for WMD of SSA to increase with increasing frequencies of acupuncture treatment. However, further research is still needed due to the small number of included studies.

3.5. Acupuncture + Rehabilitation vs. Rehabilitation (Figures 6–16). Compared to rehabilitation, we found eleven indicators of the meta-analysis on acupuncture combined with rehabilitation. Pooled analysis revealed significant differences in ten indicators, including swallowing scores of WST, swallowing scores of VFSS ($p < 0.033$p), SSA, swallowing scores of Fujishima Ichiro, aspiration rates, aspiration pneumonia rates, BI, SWAL-QOL, duration of empty swallowing, and duration of 5 mL water swallowing ($p < 0.05$p) as shown in Figures 6–16.

3.5.1. The Swallowing Scores of WST (Figure 6). The results of the meta-analysis showed that the WST score of the acupuncture + rehabilitation group was lower than that of the rehabilitation group (WMD = −0.74, 95% CI (−0.96, −0.52)), and swallowing scores of heterogeneity WST were

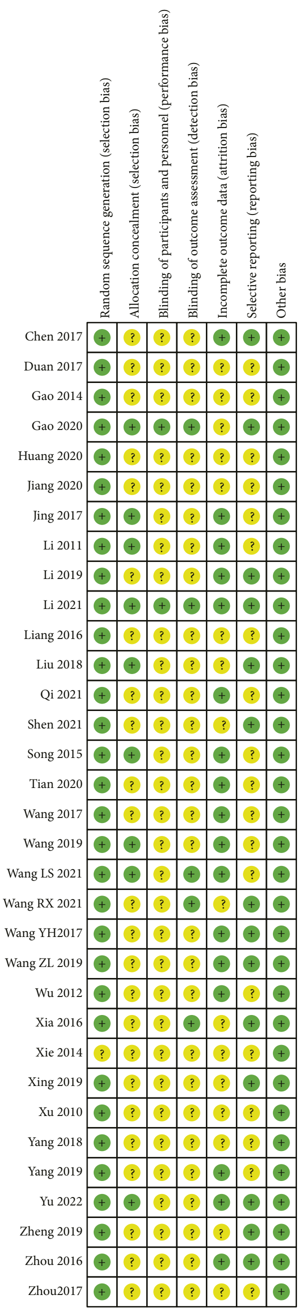


Figure 2: Risk of bias assessment for included studies.

high (16 RCTs and $I^2 = 87\%$). Subgroup analysis was based on categories of stimulation therapies in rehabilitation (with electrical stimulation therapy in rehabilitation; with ice stimulation therapy in rehabilitation, and without stimulation therapy in rehabilitation), which illustrated that the mode of stimulation was a significant effect factor. The rehabilitation without stimulation therapy (WMD = −0.96, 95% CI (−1.33, −0.58)) had better outcomes than the rehabilitation with ice stimulation therapy (WMD = −0.70, 95% CI (−0.96, −0.43)) and electrical stimulation therapy (WMD = −0.54, 95% CI (−0.77, −0.31)). Subgroup analysis 2.1 indicated a tendency for WMD of WST to decrease when removing stimulation therapy in rehabilitation treatment.

Subgroup analysis 2.2 was based on the total number of treatments (≤20 times, > 20 times). It illustrated that the total number of treatments which was greater than 20 times in subgroup (WMD = −0.93, 95% CI (−1.20, −0.66)) had better outcomes than less than 20 times' subgroup (WMD = −0.51, 95% CI (−0.68, −0.34)). Subgroup 2.2 analysis indicated a tendency for WMD of WST to decrease when the total number of acupuncture treatments was increased.

3.5.2. The Swallowing Scores of VFSS (Figure 7). The results of the meta-analysis showed that the VFSS score of the acupuncture + rehabilitation group was higher than that of the rehabilitation group (WMD = 1.35, 95% CI (1, 1.71)), and swallowing scores of VFSS's heterogeneity were high (9 RCTs and $I^2 = 77\%$). All indices were on the right of the invalid line, without significant methodological heterogeneity. Using a one-by-one exclusion method, Wang's study [32] exhibited a certain effect on I^2's variation. According to subgroup analysis 2.3 based on disease duration (>3 years, < 6 months), it illustrated that disease duration may be a significant effect factor. The subgroup with disease duration of more than 3 years (WMD = 3.18, 95% CI (2.29, 4.07)) had better outcomes than the less than 6 months' subgroup (WMD = 1.13, 95% CI (0.88, 1.39)). Subgroup analysis 2.3 suggested a tendency for WMD of VFSS to increase with a prolonged disease course.

Additionally, subgroup analysis 2.4 was performed based on the treatment frequency (5 times/week, 67 times/week, and 10 times/week), indicating that heterogeneity was derived from the treatment frequency, showing that treatment frequency may be a significant effect factor, and heterogeneity was significant among the three subgroups ($I^2 = 92.8\%$ and tag 2.4). The subgroup with treatment of 10 times/week (WMD = 3.18, 95% CI (2.29, 4.07)) had better outcomes than that of 67 times/week (WMD = 1.23, 95% CI (1.03, 1.42)) and 5 times/week (WMD = 0.80, 95% CI (0.55, 1.05)). The result of the subgroup analysis revealed a tendency for WMD of VFSS to increase with increasing frequency of treatment.

The disease duration and treatment frequency all could be the sources of heterogeneity. Thus, further research studies are still needed due to the small number of included studies.

3.5.3. SSA (Figure 8). The results of the meta-analysis showed that the SSA score of the acupuncture + rehabilitation group was lower than that of the rehabilitation group (WMD = −3.66, 95% CI (−4.66, −2.66)), and the heterogeneity of SSA score was high (12 RCTs and $I^2 = 91\%$). All indices were on the left of the invalid line without significant methodological heterogeneity. Subgroup analysis was conducted based on categories of stimulation therapies in rehabilitation (with electrical stimulation therapy in rehabilitation, with sensory stimulation therapy in rehabilitation, and without stimulation therapy in rehabilitation), and it illustrated that the mode of stimulation may influence the SSA score, as the rehabilitation without stimulation therapy (WMD = −4.30, 95% CI (−5.95, −2.65)) had better outcomes than the rehabilitation with sensory

Table 1: The characteristics of the PICO.

References	Sample size (AC + Re/Re) [AC/Re]	Age (year)	Disease duration (d)	Intervention		Intervention time (days)	Outcome
				Treatment	Control		
Chen and Guan [23]	40/40	AC + Re: 62.34 ± 12.53 Re: 64.67 ± 13.42	AC + Re: 450.3 ± 247.8 Re: 489.6 ± 282.3	AC (1/d) + ST + NES	ST + NES (1/d)	14 (5/W)	①⑦
Gao et al. [24]	52/49	AC + Re: 60.25 ± 8.36 Re: 61.37 ± 7.36	1 ~ 7	AC (1/d) + NES	NES (2/d)	27~29 (5-6/W)	①
Jiang et al. [25]	62/58	AC + Re: 60 ± 10 Re: 60 ± 9	AC + Re: 16.46 ± 9.06 Re: 18.97 ± 8.09	AC (1/d) + ST + NES	ST (2/d) + NES	28 (5/W)	⑤⑥⑩⑪
Jing and Jiang [26]	28/29 [28/29]	AC + Re: 62.04 ± 4.77 Re: 60.93 ± 4.56 AC: 61.46 ± 4.53	AC + Re: 70.3 ± 38.08 Re: 73.4 ± 48.53 AC: 52.6 ± 42.39	AC (1/d) + ST + NES	ST (1/d) + NES	28 (5/W)	③
Li et al. [27]	30/30 [30/30]	—	—	AC (1/d) + ST	ST (1/d)	28 (6/W)	①④
Li et al. [28]	40/40	AC + Re: 61.9 ± 7.9 Re: 63.6 ± 6.9	AC + Re: 16.9 ± 7.1 Re: 18.5 ± 8.1	AC (1/d) + ST	ST (2/d)	28 (6/W)	③
Liang et al. [29]	52/50	AC + Re: 56.06 ± 8.15 Re: 54.34 ± 7.72	AC + Re: 40.94 ± 36.01 Re: 43.46 ± 39.43	AC (1/d) + ST	ST (1/d)	21 (6/W)	①
Xiaoping et al. [30]	48/49	AC + Re: 67.0 ± 10.8 Re: 67.1 ± 10.5	AC + Re: 41.1 ± 38.6 Re: 40.5 ± 30.8	AC (1/d) + ST	ST (1/d)	56 (5/W)	①③⑨
Song [31]	30/30	AC + Re: 60.72 ± 8.30 Re: 61.62 ± 8.06	AC + Re: 64.8 ± 31.5 Re: 62.7 ± 40.8	AC (3/w) + ST	ST (1/d)	28 (AC: 3/W; R:5/W)	①④
Wang et al. [32]	45/45	AC + Re: 65 ± 4 Re: 66 ± 4	AC + Re: 1324.95 ± 708.1 Re: 1168 ± 631.45	AC (2/d) + ST	ST (2/d)	21 (5/W)	②⑥
Wang and Shen [33]	30/30	AC + Re: 55.86 ± 8.93 Re: 56.12 ± 9.04	AC + Re: 64.09 ± 10.51/Re: 63.28 ± 10.35	AC (3/w) + ST	ST (1/d)	42 (AC: 3/W; R: 5/W)	①④⑨
Wang [34]	50/50	AC + Re: 57.84 ± 5.25 Re: 60.27 ± 6.32	AC + Re: 56.4 ± 10.8 Re: 52.8 ± 6.9	AC (1/d) + ST	ST (1/d)	10 (1/d)	④
Wu [35]	30/30	AC + Re: 63.76 ± 9.46 Re: 63.72 ± 9.24	AC + Re: 35.12 ± 12.50 Re: 34.76 ± 12.74	AC (1/d) + ST	ST (1/d)	42 (5/W)	①②⑤
Xia et al. [36]	60/60	AC + Re: 65.3 ± 14.2 Re: 66.1 ± 14.3	AC + Re: 9.3 ± 2.3 Re: 8.7 ± 2.5	AC (1/d) + ST	ST (1/d)	28 (6/W)	③⑦⑧⑨
Xing et al. [37]	49/48	AC + Re: 66.9 ± 7.3 Re: 67 ± 7.2	AC + Re: 28.1 ± 3.5 Re: 28.1 ± 3.4	AC (1/d) + ST	ST (1/d)	28 (AC: 5/WR: 7/w)	②③
Xu [38]	20/20 [20/20]	AC + Re: 64.05 ± 10.27 Re: 67.4 ± 8.78 AC: 61.5 ± 7.16	—	AC (1/d) + ST	ST	28 (6/W)	①
Yang et al. [39]	20/20	AC + Re: 61.90 ± 10.30/Re: 62.70 ± 10.10	AC + Re: 75.90 ± 25.50 Re: 79.10 ± 15.10	AC (1/d) + ST	ST (1/d)	14 (6/W)	②
Zheng and Sun [40]	43/42	AC + Re: 62.57 ± 9.77/Re: 61.26 ± 9.59	AC + Re: 23.06 ± 6.91 Re: 22.72 ± 6.56	AC (1/d) + ST	ST (1/d)	28 (6/w)	②③⑥⑧
Zhou et al. [41]	60/50	AC + Re: 59.4 ± 2.6/Re: 58.3 ± 3.1	14~182	AC (1/d) + ST	ST (1/d)	28 (1/d)	①
Zhou et al. [42]	31/30	AC + Re: 59.90 ± 3.87 Re: 60.43 ± 4.07	AC + Re: 34.81 ± 12.02 Re: 29.30 ± 9.87	AC (1/d) + ST + NES	ST + NES (1/d)	28 (6/w)	③⑨
Xie [43]	[38/38]	AC: 55.53 ± 13.91 Re: 58.95 ± 13.44	AC: 59.66 ± 79.52 Re: 65.05 ± 105.64	AC (1/d)	NES (1/d)	20 (1/d)	①
Duan and Wang [44]	[25/25]	AC: 64.4 ± 7.28 Re: 64.96 ± 7.52	AC: 50.48 ± 16.28 Re: 57.60 ± 17.76	AC (1/d)	ST (1/d)	28 (6/w)	①③
Wang et al. [45]	[45/45]	AC: 65.32 ± 7.24 Re: 65.73 ± 6.25	AC: 26.85 ± 2.27 Re: 26.12 ± 3.31	AC (2/d)	ST (2/d)	28 (6/w)	③
Yang et al. [46]	[34/32]	AC: 62.11 Re: 61.56	15~90	AC (1/d)	ST + NES (1/d)	30 (1/d)	①
Yu et al. [47]	21/21	AC + Re: 71 ± 7 Re: 71 ± 6	AC + Re: 62.02 ± 33.6 Re: 65.03 ± 42.7	AC (1/d) + ST + NES	ST + NES (1/d)	21 (5/W)	①⑨

Table 1: Continued.

References	Sample size (AC + Re/Re) [AC/Re]	Age (year)	Disease duration (d)	Intervention		Intervention time (days)	Outcome
				Treatment	Control		
Tian et al. [50]	33/32	AC + Re: 57.13 ± 1.62 Re: 57.15 ± 1.59	AC + Re: 23.41 ± 4.73 Re: 23.45 ± 4.71	AC (1/d) + ST + NES	ST (1/d) + NES	28 (5/W)	③⑨⑩⑪
Li et al. [52]	62/62	AC + Re: 65.7 ± 5.2 Re: 64.2 ± 5.7	AC + Re: 2.25 ± 0.92 Re: 2.41 ± 0.83	AC (1/d) + ST	ST (1/d)	28 (5/W)	①⑨
Shen et al. [55]	30/30	AC + Re: 65.23 ± 11.13 Re: 64.76 ± 11.51	AC + Re: 41.4 ± 39.6 Re: 40.5 ± 33.3	AC (1/d) + ST	ST (1/d)	28 (6/W)	①②③⑨
Huang et al. [53]	32/32	AC + Re: 66.00 (62.50, 72.50) Re: 65.00 (57.50, 76.50)	AC + Re: 180 (14.7, 315) Re: 60 (4.2, 330)	AC (1/d) + ST	ST (1/d)	28 (3/W)	①
Gao and Zhou [56]	42/42	AC + Re: 62.95 ± 8.99 Re: 62.43 ± 10.12	AC + Re: 55.2 ± 62.1 Re: 30.9 ± 22.8	AC (1/d) + ST + NES	NES + ST (1/d)	28 (5/W)	①③⑥⑩⑪
Wang et al. [49]	38/38	AC + Re: 67.0 ± 10.8 Re: 67.1 ± 10.5	AC + Re: 5.94 ± 6.81 Re: 6.32 ± 2.56	AC (1/d) + NES + ST	NES + ST (1/d)	21 (6/W)	①②⑨
Wang [48]	33/32	AC + Re: 63.58 ± 10.288 Re: 63.90 ± 10.189	AC + Re: 41.32 ± 37.01 Re: 36.06 ± 37.73	AC (6/w) + NES + ST	ST (1/d)	28 (6/W)	②③
Qi et al. [51]	60/60	AC + Re: 63 ± 10 Re: 63 ± 11	AC + Re: 14.2 ± 4.1 Re: 15.2 ± 3.8	AC (1/d) + ST	ST (1/d)	14 (7/W)	②③

AC: acupuncture; Re: rehabilitation; ST: swallowing training; NES: neuromuscular electrical stimulation. *Note*. [ ] means acupuncture alone group compared with rehabilitation alone group; ① WST. ② VFSS. ③ SSA scores. ④ Swallowing scores of Fujishima Ichiro. ⑤ The rates of aspiration. ⑥ The rates of aspiration pneumonia. ⑦ DOSS. ⑧ BI. ⑨ SWAL-QOL. ⑩ Duration of empty swallowing⑪ Duration of 5 mL water swallowing.

Table 2: The characteristics of manual acupuncture.

References	Acupoints	Reinforcing and reducing	Needle retaining time
Chen and Guan [23]	Three tongue needle	Mild supplementing and reducing	30 min
Gao et al. [24]	Three tongue needle	Mild supplementing and reducing	30 min
Jiang et al. [25]	Tongue acupuncture: heart point, spleen point, and kidney point	—	0 min
Jing and Jiang [26]	Lianquan (CV23), Panglianquan, Shanglianquan, Yifeng (TE17), Fengchi (GB20), and Jingbailao (EX-HN15)	Mild supplementing and reducing	30 min
Li et al. [27]	Fengchi (GB20), Lianquan (CV23), Shanglianquan, Jinjing (EX-HN12), Yuye (EX-HN13), Lieque (LU7), Dicang (ST41), Jiache (ST6), Xiaguan (ST7), and Jiachengjiang	GB20 (reinforcing)	30 min
Li et al. [28]	Fengchi (GB20), Yiming (EX-HN14), Gongxuepoint, Zhiqiangpoint, Tunyanpoint, Lianquan (CV23), Waijinjin, and Waiyuye	GB20, EX-HN14 and Gongxuepoint retaining needle, others not	30 min
Liang et al. [29]	Scalp motor area low 2/5, Fengchi (GB20), Yiming (EX-HN14), Gongxuepoint, Zhiqiangpoint, Tunyanpoint, Lianquan (CV23), Waijinjin, Waiyuye Yifeng (TE17), Qianzheng, Yingxiang (LI20), Jiachengjiang, scalp emotional area, foot motor sensory area, Shenshu (BL23), Huiyang (BL35), Xiaguan (ST7), Jiache (ST6), Sizhukong (TE23), Fayinpoint, and Fanliupoint	—	30 min
Xiaoping et al. [30]	Fengchi (GB20), Yiming (EX-HN14), Gongxue point, Lianquan (CV23), Jinjing (EX-HN12), Yuye (EX-HN13), Tunyan point, Zhiqiang point, and Fayin point	GB20, EX-HN14 and Gongxuepoint retaining needle, others not	30 min
Song [31]	Tiantu (CV22)	—	20–30 min
Wang et al. [32]	Aqiang point, Zhiqiang point, Tunyan point, Tiiyan point, and Fayin point	—	30 min
Wang and Shen [33]	Baihui (GV20),Sishencong (EX-HN1), language area, Lianquan (CV23), Jinjing (EX-HN12), and Yuye (EX-HN13)	—	30 min
Wang [34]	Fengchi (GB20), Yifeng (TE17), Tiantu (CV22), and piercing the pharynx posterior wall	—	—
Wu [35]	Taixi (KI3), Fengchi (GB20), Lianquan (CV23), Jialianquan, Jinjing (EX-HN12), Yuye (EX-HN13), and pharynx posterior wall	—	30 min
Xia et al. [36]	Fengchi (GB 20, unilateral), Jiaji (C2–C4) (EX-B2, bilateral), Lianquan (CV 23, unilateral), Jiajianquan (left CV 23 and right CV 23, bilateral), Baihui (GV 20, unilateral), Lieque (LV 07, bilateral), Fenglong (ST 40, bilateral), Sanyinjiao (SP 06, bilateral), Jinjin (EX-HN 12, unilateral), Yuye (EX-HN13, unilateral), Taixi (K 103, bilateral), and Zhaohai (K 106, bilateral)	PC6, HT1, LU5, BL40, LR3, ST40, LI1, ST44, LI4 reducing, SP6, KI3, CV6, ST36 reinforcing GV20, GB20, CV23 mild supplementing and reducing piercing EX-HN12, and EX-HN13	30 min
Xing et al. [37]	Dazhui (GV14), Fengfu (GV16), Shenting (GV24), Shendao (GV11), Baihui (GV20), Shuigou (GV26), Qimen (LR14), Danzhong (CV17), Shenshu (BL23), Ganshu (BL18), Sanyinjiao (SP6), Xinshu (BL15), Pishu (BL20), Tiantu (CV22), Yinlingquan (SP9), Lianquan (CV23), Fenglong (ST40), Waiguan (TE5), Xiaxi (GB43), and Xingjian (LR2)	—	30 min
Xu [38]	Tongue acupuncture: heart point and Lianquan (CV23)	—	30 min
Yang et al. [39]	Lianquan (CV23) and Fengchi (GB20)	GB20 reinforcing	30 min

Table 2: Continued.

References	Acupoints	Reinforcing and reducing	Needle retaining time
Zheng and Sun [40]	Liangquan (CV23), Jinjing (EX-HN12), Yuye (EX-HN13), Fengchi (GB20), Yifeng (TE17), Waiguan (TE5), Quchi (LI11), Binao (LI14), Yongquan (KI1), Zusanli (ST36), and Siqiang	GB20 reinforcing TE17, CV23 mild supplementing and reducing piercing EX-HN12, and EX-HN13	—
Zhou et al. [41]	Aqiang point: Aqiang point, Zhiqiang point, Tunyan point, Tiyan point, Fayin point	—	30 min
Zhou et al. [42]	MS6 low 2/5 and MS10	—	20 min
Xie [43]	Three tongue needles	Lifting and thrusting until “deqi” then mild supplementing and reducing	30 min
Duan and Wang [44]	Tianrong (SI17, bilateral), Lianquan (CV23), Waijinjin, and Waiyuye	SI17 (twisting reducing)	30 min
Wang et al. [45]	Aqiang point, Tunyan point, and Tiyan point	Twirling, lifting, and thrusting slowly	20 min
Yang et al. [46]	Lianquan (CV23), Fengchi (GB20), Yifeng (TE17), and Lieque (LU7)	—	30 min
Yu et al. [47]	The bottom 2/5 in the anterior parietal temporal oblique and posterior parietal oblique, Fengchi (GB20), Yiming (EX-HN14), Gongxuepoint, Zhiqiangpoint, Tunyanpoint, Fayinpoint, Lianquan (CV23), Waijinjin, and Waiyuye	GB20, EX-HN14 and Gongxuepoint twirling and retaining, others not	30 min
Tian et al. [50]	Lianquan (CV23), Panglianquan, Fengchi (GB20), Wangu (GB12), Yifeng (TE 17), Jinjin (EX-HN 12), Yuye (EX-HN13)	Twirling	30 min
Li et al. [52]	Neiguan (PC6), Shuigou (GV26), Sanyinjiao (SP6), Fengchi (GB20), Wangu (GB12), Yifeng (TE 17), pharynx posterior wall, and Lianquan (CV23)	PC6 (reducing by lifting and thrusting with twirling), GV26 (reducing by bird-peck needling), SP6 (reinforcing by twirling), GB20, GB12, TE 17 (reinforcing by twirling), and CV23 (reducing by twirling)	30 min
Shen et al. [55]	Lianquan (CV23), Pang Lianquan, Jinjin (EX-HN 12), and Yuye (EX-HN13)	CV23 (lifting and thrusting) and CV23 (lifting and thrusting with twirling)	30 min
Huang et al. [53]	Baihui (GV20), Fengchi (GB20), Fengfu (GV16), Yamen (GV15), Yifeng (TE17), Lianquan (CV23), Jinjin (EX-HN12), Yuye (EX-HN13), and Zusanli (ST36)	—	30 min
Gao and Zhou [56]	Fengchi (GB20), Tianzhu (BL10), Wangu (GB12), Lianquan (CV23), Panglianquan, Jinjin (EX-HN 12), and Yuye (EX-HN13)	—	30 min
Wang et al. [49]	Shexia, Fengchi (GB20), Wangu (GB12), Tianzhu (BL10), and Yifeng (TE17)	GB20, GB12, BL10, BL10, and TE17 : High frequency and small amplitude	30 min
Wang [48]	Fengfu (GV16), Fengchi (GB20), Yifeng (TE 17), Lianquan (CV23), Liyanpoint1, Liyanpoint2, Shenmen (HT7), Lieque (LU7), and Zhaohai (LI6)	—	30 min
Qi et al. [51]	Fengchi (GB20), Tianzhu (BL10), Wangu (GB12), Lianquan (CV23), Panglianquan, Jinjin (EX-HN 12), and Yuye (EX-HN13),	GB20, BL10, GB12, CV23, and PangLianquan (twirling)	30 min

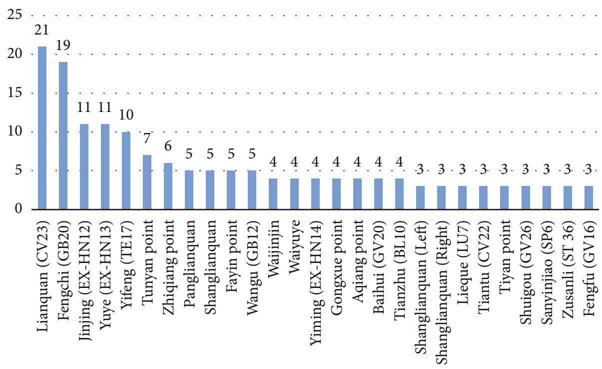


Figure 3: Acupoint frequency map.

stimulation therapy (WMD = −3.57, 95% CI (−4.93, −2.21)) and electrical stimulation therapy (WMD = −3.11, 95% CI (−4.46, −1.75)). However, no indication was found with regard to whether heterogeneity was derived from stimulation (tag 2.5), and there was no significant heterogeneity among the three subgroups ($I^2 = 0\%$). Subgroup analysis indicated a tendency for WMD of SSA to decrease when removing stimulation therapy during rehabilitation treatment.

3.5.4. The Swallowing Scores of Fujishima Ichirowas (Figure 9). The results of the meta-analysis showed that the swallowing scores of Fujishima Ichirowas of the acupuncture + rehabilitation group were higher than that of the rehabilitation group (WMD = 1.31, 95% CI (0.82,1.80)), and the heterogeneity was high (4 RCTs and $I^2 = 57\%$). The index of Song's study [31] crossed the invalid line ($p > 0.05p$), and after excluding it, the variation in heterogeneity was remarkable ($I^2 = 57\% \longrightarrow I^2 = 0\%$). Subgroup analysis was performed based on the number of acupoints (single point and acupoint combination) and it illustrated that the acupuncture prescription contained acupoint combination (WMD = 1.5, 95% CI (1.17, 1.82)) and had better outcomes than single acupoint (WMD = 0.60, 95% CI (−0.05, 1.25)).

3.5.5. The Rates of Aspiration (Figure 10). The results of the meta-analysis showed that the rates of aspiration of the acupuncture + rehabilitation group were lower than that of the rehabilitation group (RR = 0.55, 95% CI (0.34, 0.90)). In this analysis, no significant between-study heterogeneity (2 RCTs and $I^2 = 12\%$) was observed.

3.5.6. The Rates of Aspiration Pneumonia (Figure 11). The results of the meta-analysis showed that the rates of aspiration pneumonia of the acupuncture + rehabilitation group were lower than that of the rehabilitation group (RR = 0.42, 95% CI (0.25, 0.70)). In this analysis, there was no significant between-study heterogeneity (4 RCTs and $I^2 = 0\%$), and subgroup analysis was not performed.

3.5.7. DOSS (Figure 12). Pooled analysis did not reveal significant differences in DOSS (WMD = 1.31, 95% CI (0.82, 1.80), $p = 0.15 > 0.05p$) between the groups. In this analysis, there was a significant between-study heterogeneity (2 RCTs and $I^2 = 96\%$).

3.5.8. BI (Figure 13). The results of the meta-analysis showed that the BI score of the acupuncture + rehabilitation group was lower than that of the rehabilitation group (WMD = 15.99, 95% CI (12.27, 19.72)). In this analysis, there was no significant between-study heterogeneity (2 RCTs and $I^2 = 34\%$).

3.5.9. SWAL-QOL (Figure 14). The pooled results of the meta-analysis presented that the SWAL-QOL score of the acupuncture + rehabilitation group was higher than that of the rehabilitation group (WMD = 19.04, 95% CI (14.08, 24.01)). In this analysis, there was a significant between-study heterogeneity (9 RCTs, and $I^2 = 91\%$).

3.5.10. Duration of Empty Swallowing (Figure 15). The pooled results of meta-analysis presented that the duration of empty swallowing of the acupuncture + rehabilitation group took less time than that of the rehabilitation group ($WMD_1 = -0.23$, 95% CI (−0.34, −0.12), $WMD_2 = -0.28$, 95% CI (−0.45–0.12)). In this analysis, a significant between-study heterogeneity (3 RCTs, ${I_1}^2 = 71\%$, ${I_2}^2 = 83\%$) was observed.

3.5.11. Duration of 5 mL Water Swallowing (Figure 16). The pooled results of meta-analysis presented that the duration of 5 mL water swallowing of the acupuncture + rehabilitation group took less time than that of the rehabilitation group ($WMD_1 = -0.27$, 95% CI (−0.44, −0.10), $WMD_2 = -0.24$, 95% CI (−0.36–0.12)). In this analysis, there was significant between study heterogeneity (3 RCTs, ${I_1}^2 = 86\%$, and ${I_2}^2 = 78\%$).

3.6. Trial Sequence Analysis (Figures 17–19)

3.6.1. The TSA of Acupuncture Alone (WST). The TSA of acupuncture alone (WST) revealed that the cumulative Z-curve crossed the TSA boundary value when the second trial [27] was complete, met the conventional boundary value ($Z = 1.96$, $p = 0.05p$ (two-sided)) and RIS (162 cases) when the third study [43] was complete. This means that the cumulative sample size met expectations, suggesting that similar clinical trials can be terminated as shown in Figure 17.

3.6.2. The TSA of Acupuncture Combined with Rehabilitation (WST). The TSA of acupuncture combined with rehabilitation (WST) revealed that the cumulative Z-curve crossed the conventional boundary value ($Z = 1.96$, $p = 0.05p$ (two-sided)) when the first study [38] was complete, reached the TSA boundary value when the second study [27] was complete, and met RIS (222 cases) when the fourth study [24] was complete. This means that the cumulative sample size met the expectations, suggesting that

Table 3: The characteristics of the rehabilitation training.

References	Content
Chen and Guan [23]	Viralstim type low-frequency pulse electrical stimulation and direct and indirect strategies
Gao et al. [24]	Swallowing disorder therapeutic apparatus
Jiang et al. [25]	Rehabilitation training + low-frequency pulse electrical
Jing and Jiang [26]	Low-frequency neuromuscular electrical stimulation, ice stimulation + speech training + lip reduction training + practice blowing or whistling + chewing training + lip exercise training + empty swallowing action
Li et al. [27]	Swallowing function training, ice stimulation compensation strategy:(1) the Mendelson's technique, (2) supraglottic swallowing, (3) nodding swallowing, and (4) turn the head and swallowing, and direct strategy: food
Li et al. [28]	Oral sensorimotor training, Shaker training, Masako training, and Mendelsohn training
Liang et al. [29]	Strength training, exercise relearning, biofeedback, temperature tactile stimulation, and swallowing manipulation therapy
Xiaoping et al. [30]	Indirect training + direct training indirect training methods: (a) swallowing muscle training, (b) pressing exercises, (c) closed glottis training, (d) Mendelsohn maneuver, (e) ice stimulation, and (f) the tongue muscle training direct training method: (a) food placement, (b) food form, (c) feeding posture, (d) gradually adjusting food intake, and (e) interactive swallowing
Song [31]	Indirect training: cheek, lip and other swallowing muscle training, tongue muscle training, vocal cord closure training, cold stimulation, breath-holding and vocal exercise, the Mendelsohn method, and supraglottic swallowing direct training: posture when eating, food shape, and bitesize
Wang et al. [32]	Swallowing muscle training, tongue muscle training, vocal cord closure training, swallowing reflex training, buccinator and tongue muscle training, mandibular and tongue exercise training, ice stimulation, posture adjustment, and removal of retained food in the pharynx, etc.
Wang and Shen [33]	Swallowing rehabilitation training such as tongue training, lip training, and eating training
Wang [34]	Basic and feeding training. Basic rehabilitation training: cold stimulation of the pharynx, lip movement rehabilitation training, tongue movement rehabilitation training, jaw movement rehabilitation training ingestion rehabilitation training.
Wu [35]	Rehabilitation training for swallowing disorders: breathing training, neck mobility training, exercise training around the oral cavity and tongue muscles, pharynx ice stimulation, and Shaq (training, swallowing mode training, and Mendelsohn training)
Xia et al. [36]	Functional training active or passive exercise of the oral, facial, and lingual muscles, and sensory stimuli (containing the Mendelsohn maneuver, supraglottic and supraglottic maneuvers, swallowing efforts, and the Shaker exercise)
Xing et al. [37]	Tongue muscle exercise, buccal muscle exercise, the breathing exercise method, and the throat muscle exercise method
Xu [38]	Ingestion training + swallowing function training + ice stimulation + cough training + neck rotation training
Yang et al. [39]	Basic training and direct feeding training basic training: ice stimulation, tongue exercise training, the Mendelsson technique training, chin exercise training, breathing and cough training, lip and cheek exercise training, pronunciation, and vocal cord adduction training, etc. Direct feeding training: diet training, pharyngeal food removal training, swallowing skills practice, and breath-holding training
Zheng and Sun [40]	Ice stimulation, tongue movement training, soft palate lift training, throat movement training, and eating training
Zhou et al. [41]	Swallowing training: tongue, jaw, upper, and lower lips
Zhou et al. [42]	Rehabilitation training + vocastim-maste swallowing disorder therapeutic apparatus
Xie [43]	Swallowing disorder therapeutic apparatus
Duan and Wang [44]	Swallowing organ training, ice stimulation, and eating training
Wang et al. [45]	Swallowing muscle training, tongue muscle training, vocal cord closure training, swallowing reflex training, mandibular and tongue exercise training, and ice stimulation
Yang et al. [46]	Swallowing disorder therapeutic apparatus, ice stimulation

Table 3: Continued.

References	Content
Yu et al. [47]	Direct strategy: food Indirect swallowing training: pronunciation training, tongue muscle and masticatory muscle training, sucking training, laryngeal lift training, and glottis atresia training neuromuscular electrical stimulation
Tian et al. [50]	Indirect training includes sensory stimulation and oral motor training, such as ice stimulation, lip movement, jaw movement, and tongue movement training. Direct training includes feeding training, including eating utensils, food selection, eating position, eating environment, swallowing methods, acupuncture swallowing, onsonic swallowing, interactive swallowing and Myo trac dual-channel biostimulation feedback device
Li et al. [52]	Breathing training treatment includes abdominal breathing training, pursed lip breathing training, and active circuit breathing training practice
Shen et al. [55]	Feeding training, swallowing reflex training, and tongue training
Huang et al. [53]	Supraglottic swallowing, the Mendelsohn method, the Shaker method, tongue exercise, and orofacial myofunctional exercises, cold stimulation to oral cavity and throat, and vocal cord closure exercise
Gao and Zhou [56]	Lip atresia training, tongue muscle training, jaw exercise training, ice stimulation training, breath-holding training, Mendelson’s technique, and low-frequency neuromuscular electrical stimulation
Wang et al. [49]	Oral neuromuscular training, facial sensory vibration, and compensatory techniques, etc.
Wang [48]	Ice stimulation, Shaker training, Mendelson’s technique, breathing training, and neuromuscular electrical stimulation
Qi et al. [51]	Swallowing organ exercise training, vocalization exercise, gag reflex training, tongue muscle function training, and feeding training respiratory function training: deep breathing training, narrow mouth breathing training, abdominal relaxation training, diaphragm activity training, and abdominal breathing

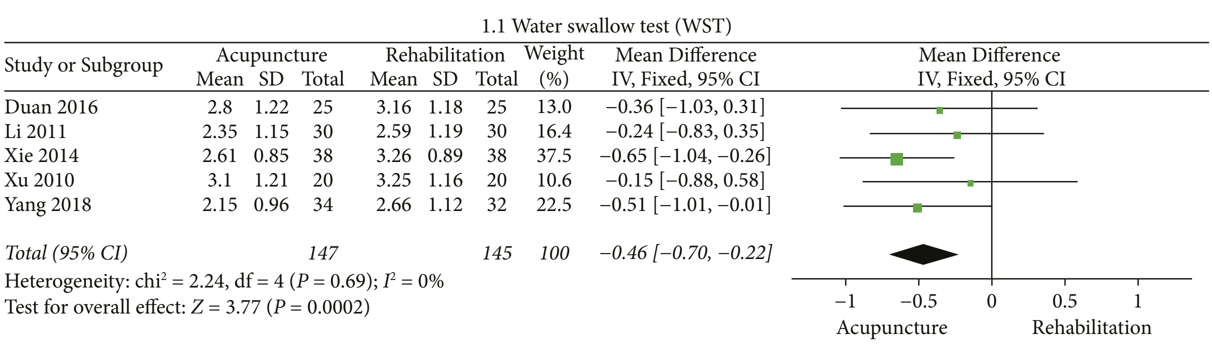


Figure 4: Forest plot of WST (acupuncture vs. rehabilitation).

additional similar clinical trials are unnecessary as shown in Figure 18.

3.6.3. The TSA of Acupuncture Combined with Rehabilitation (VFSS). The TSA of acupuncture combined with rehabilitation (VFSS) revealed that the cumulative Z-curve reached the TSA boundary value when the first study [35] was complete, met RIS (98 cases) when the second study [32] was complete, and crossed the conventional boundary value ($Z = 1.96$, $p = 0.05p$ (two-sided)) when the third study [39] was complete. This implies that the cumulative sample size met expectations, suggesting that additional similar clinical trials are unnecessary. The combination of TSA and meta-analysis reduced false-positive results further confirming the reliability of the findings. All three TSA results confirmed the benefits of acupuncture therapy in poststroke dysphagia as shown in Figure 19.

3.7. Safety Analysis. Thirty-three randomized controlled trials were included in this study, twelve of which reported the loss at follow-up; however, this loss at follow-up was insignificantly related to experimental research. The reasons for loss at follow-up were mostly factors, including poor patient compliance and family reasons. Furthermore, one trial [20] reported one case of cerebral infarction recurrence and one case of severe pneumonia in the treatment group. In the control group, we reported one case of cerebral infarction recurrence and two cases of severe pneumonia. Ten

1.2 Standard swallowing assessment (SSA) scores

Study or Subgroup	Acupuncture Mean	Acupuncture SD	Acupuncture Total	Rehabilitation Mean	Rehabilitation SD	Rehabilitation Total	Weight (%)	Mean Difference IV, Random, 95% CI
1.2.1 1 time /d								
Duan 2016	21.88	3.75	25	25.24	4.2	25	30.4	−3.36 [−5.57, −1.15]
Jing 2017	25.21	3.74	28	27.14	4.01	29	31.9	−1.93 [−3.94, 0.08]
Subtotal (95% CI)			*53*			*54*	*62.3*	*−2.58 [−4.07, −1.09]*
Heterogeneity: Tau^2 = 0.00; Chi ^{2} = 0.88, df = 1 (P = 0.35); I^2 = 0%								
Test for overall effect: Z = 3.40 (P = 0.0007)								
1.2.2 2 times/d								
Wang YH 2017	18.17	2.84	45	23.72	2.93	45	37.7	−5.55 [−6.74, −4.36]
Subtotal (95% CI)			*45*			*45*	*37.7*	*−5.55 [−6.74, −4.36]*
Heterogeneity: Not applicable								
Test for overall effect: Z = 9.12 (P < 0.00001)								
Total (95% CI)			*98*			*99*	*100.0*	*−3.73 [−6.05, −1.41]*
Heterogeneity: Tau^2 = 3.35; Chi ^{2} = 10.21, df = 2 (P = 0.006); I^2 = 80%								
Test for overall effect: Z = 3.15 (P = 0.002)								
Test for subgroup differences: chi ^{2} = 9.33, df = 1 (P = 0.002), I^2 = 89.3%								

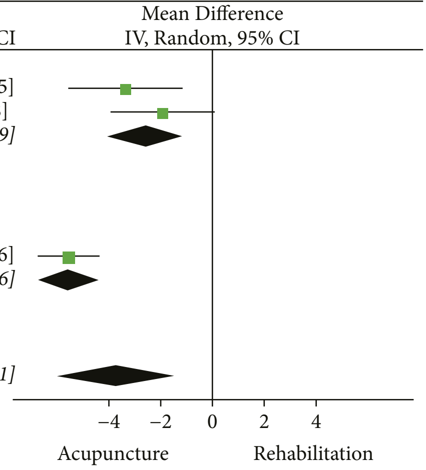


Figure 5: Forest plot of SSA (acupuncture vs. rehabilitation).

trials [21, 24–26, 31, 32, 48, 51–53] reported mild adverse reactions, including three cases of fainting needles, eighteen cases of subcutaneous hemorrhage, four cases of pain, 2 cases of nausea, 2 cases of inappetence, and one of them withdrew from the trial because of fainting during needles. One trial [19] reported four patients who were allergic to electrode sticks of the dysphagia treatment instrument and these patients withdrew at midway. One trial [55] reported four patients withdrew because of fainting, cannot insist on swallowing rehabilitation training and other reasons. None of the 33 trials reported any severe adverse reactions due to acupuncture and rehabilitation treatments, indicating the safety of acupuncture and rehabilitation therapies.

3.8. Publication Bias (Figures 20–25). Egger's test was performed to investigate the publication bias of the primary outcome. Five studies were evaluated for the WST of acupuncture alone (Egger's test: $p = 0.018p$, Figure 20, and Egger graph, Figure 21), and the findings showed publication bias of manual acupuncture alone in treating poststroke dysphagia. Fourteen studies were evaluated for the WST of acupuncture combined with rehabilitation (Egger's test: $p = 0.082p$, Figure 22, and Egger graph, Figure 23), and the findings showed no publication bias of manual acupuncture combined with rehabilitation therapy in treating poststroke dysphagia. Moreover, nine studies were evaluated for the VFSS of acupuncture combined with rehabilitation (Egger's test: $p = 0.316p$, Figure 24, and Egger graph, Figure 25), and the findings showed no publication bias of manual acupuncture in treating poststroke dysphagia.

3.9. Sensitivity Analysis (Figures S3–S17). A sensitivity analysis was performed to test the stability of the results. Only 1 study [36] was unstable (Figure S12). This could have been attributed to the small number of included studies containing BI or large interindividual variations in curative effects. Of course, more reasons still needs to be explored.

3.10. Evidence Quality Evaluation (Table 4). The quality of evidence for primary outcomes was evaluated based on the evidence quality grading system (GRADE). Study limitations (risk of bias: most of the studies have methodological problems in allocation concealment and blindness) led to a downgrade, one outcome was ranked as low-quality evidence and two were ranked as moderate-quality evidence and the results are shown in Table 4.

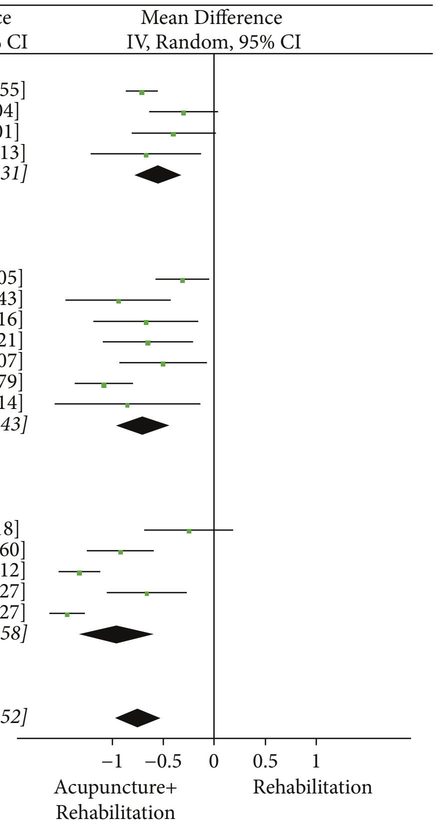
4. Discussion

Compared to the rehabilitation group, the acupuncture group and acupuncture combined with the rehabilitation group demonstrated better effects in the treatment of poststroke dysphagia.

All included studies contained acupoints in the nape, neck, or throat areas, thereby reducing clinical heterogeneity. Besides, they were closely associated with the stimulation of neck muscles and nerves in dysphagia treatment. Acupuncture at Fengchi (GB20) point increases the amplitude of submental muscles and subhyoid muscles, indicating that acupuncture increases average muscle amplitude and muscle strength [56]; acupuncture on Lianquan (CV23) and Panglianquan stimulates the pharyngeal muscles, including the tongue muscle, hyoid muscle, pharyngeal constrictor, and superior pharyngeal constrictor; and the three acupoints are related to the hypoglossal, vagus, and glossopharyngeal nerves. Acupuncture on these three acupoints stimulates nerve motor fibers and generates nerve impulses to the cerebral cortex or the medulla oblongata swallowing center, repairs the damaged medullary arc function after stroke, and improves the swallowing function [25]. Yifeng (TE17), Wangu (GB12), and Lianquan (CV23) are associated with the vagus nerve, glossopharyngeal nerve, facial nerve, and other nerve endings. Acupuncture initiates nerve impulses and enhances nerve reflexes, repairs or rebuilds the swallowing reflex arc, and promotes swallowing functions [57, 58]. Since acupuncture is extensively used in stroke rehabilitation, multiple studies have focused on

2.1Water swallow test (WST)

Study or Subgroup	Acupuncture+Rehabilitation Mean	SD	Total	Rehabilitation Mean	SD	Total	Weight (%)	Mean Difference IV, Random, 95% CI
1.4.1 With electrical stimulation therapy in Rehabilitation								
Chen 2017	2.1	0.28	40	2.81	0.42	40	7.5	−0.71 [−0.87, −0.55]
Gao 2014	2.71	0.84	52	3.01	0.89	49	6.6	−0.30 [−0.64, 0.04]
Gao 2020	2.81	0.99	42	3.21	0.92	42	6.1	−0.40 [−0.81, 0.01]
Yu 2022	2.19	0.75	21	2.86	1.01	21	5.3	−0.67 [−1.21, −0.13]
Subtotal (95% CI)			*155*			*152*	*25.5*	*−0.54 [−0.77, −0.31]*
Heterogeneity: Tau² = 0.03; Chi² = 5.86, df = 3 (P = 0.12); I² = 49%								
Test for overall effect: Z = 4.65 (P < 0.00001)								
1.4.2 With ice stimulation therapy in Rehabilitation								
Huang 2020	2.75	0.57	32	3.06	0.5	32	7.0	−0.31 [−0.57, −0.05]
Li 2011	1.65	0.8	30	2.59	1.19	30	5.4	−0.94 [−1.45, −0.43]
Liang 2016	2.27	1.32	52	2.94	1.32	50	5.5	−0.67 [−1.18, −0.16]
Liu 2018	2.21	0.99	49	2.86	1.21	48	5.9	−0.65 [−1.09, −0.21]
Song 2015	1.56	0.82	30	2.06	0.87	30	6.0	−0.50 [−0.93, −0.07]
Wu 2012	2.76	0.5	30	3.84	0.62	30	6.9	−1.08 [−1.37, −0.79]
Xu 2010	2.4	1.14	20	3.25	1.16	20	4.3	−0.85 [−1.56, −0.14]
Subtotal (95% CI)			*243*			*240*	*41.0*	*−0.70 [−0.96, −0.43]*
Heterogeneity: Tau² = 0.08; Chi² = 17.08, df = 6 (P = 0.009); I² = 65%								
Test for overall effect: Z = 5.18 (P < 0.00001)								
1.4.3 Without stimulation therapy in Rehabilitation								
Li 2021	1.51	1.31	62	1.76	1.15	62	6.0	−0.25 [−0.68, 0.18]
Shen 2021	3.35	0.75	30	4.27	0.51	30	6.6	−0.92 [−1.24, −0.60]
Wang 2019	1.52	0.27	30	2.84	0.49	30	7.3	−1.32 [−1.52, −1.12]
Wang LS 2021	2.13	0.78	38	2.79	0.96	38	6.2	−0.66 [−1.05, −0.27]
Zhou 2016	1.54	0.31	60	2.98	0.55	50	7.4	−1.44 [−1.61, −1.27]
Subtotal (95% CI)			*220*			*210*	*33.6*	*−0.96 [−1.33, −0.58]*
Heterogeneity: Tau² = 0.16; Chi² = 37.42, df = 4 (P < 0.00001); I² = 89%								
Test for overall effect: Z = 5.03 (P < 0.00001)								
Total (95% CI)			*618*			*602*	*100.0*	*−0.74 [−0.96, −0.52]*
Heterogeneity: Tau² = 0.16; Chi² = 115.39, df = 15 (P < 0.00001); I² = 87%								
Test for overall effect: Z = 6.66 (P < 0.00001)								
Test for subgroup differences: chi² = 3.49, df = 2 (P = 0.17), I² = 42.7%								



2.2Water swallow test (WST)

Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight (%)	Mean Difference IV, Random, 95% CI
1.2.1 Total,≤20 times								
Chen 2017	2.1	0.28	40	2.81	0.42	40	7.5	−0.71 [−0.87, −0.55]
Gao 2020	2.81	0.99	42	3.21	0.92	42	6.1	−0.40 [−0.81, 0.01]
Huang 2020	2.75	0.57	32	3.06	0.5	32	7.0	−0.31 [−0.57, −0.05]
Li 2021	1.51	1.31	62	1.76	1.15	62	6.0	−0.25 [−0.68, 0.18]
Liang 2016	2.27	1.32	52	2.94	1.32	50	5.5	−0.67 [−1.18, −0.16]
Song 2015	1.56	0.82	30	2.06	0.87	30	6.0	−0.50 [−0.93, −0.07]
Yu 2022	2.19	0.75	21	2.86	1.01	21	5.3	−0.67 [−1.21, −0.13]
Subtotal (95% CI)			*279*			*277*	*43.3*	*−0.51 [−0.68, −0.34]*
Heterogeneity: Tau² = 0.02; Chi² = 9.97, df = 6 (*P* = 0.13); I² = 40%								
Test for overall effect: *Z* = 5.93 (*P* < 0.00001)								
1.2.2 Total,>20 times								
Gao 2014	2.71	0.84	52	3.01	0.89	49	6.6	−0.30 [−0.64, 0.04]
Li 2011	1.65	0.8	30	2.59	1.19	30	5.4	−0.94 [−1.45, −0.43]
Liu 2018	2.21	0.99	49	2.86	1.21	48	5.9	−0.65 [−1.09, −0.21]
Shen 2021	3.35	0.75	30	4.27	0.51	30	6.6	−0.92 [−1.24, −0.60]
Wang 2019	1.52	0.27	30	2.84	0.49	30	7.3	−1.32 [−1.52, −1.12]
Wang LS 2021	2.13	0.78	38	2.79	0.96	38	6.2	−0.66 [−1.05, −0.27]
Wu 2012	2.76	0.5	30	3.84	0.62	30	6.9	−1.08 [−1.37, −0.79]
Xu 2010	2.4	1.14	20	3.25	1.16	20	4.3	−0.85 [−1.56, −0.14]
Zhou 2016	1.54	0.31	60	2.98	0.55	50	7.4	−1.44 [−1.61, −1.27]
Subtotal (95% CI)			*339*			*325*	*56.7*	*−0.93 [−1.20, −0.66]*
Heterogeneity: Tau² = 0.13; Chi² = 52.01, df = 8 (*P* < 0.00001); I² = 85%								
Test for overall effect: *Z* = 6.78 (*P* < 0.00001)								
Total (95% CI)			*618*			*602*	*100.0*	*−0.74 [−0.96, −0.52]*
Heterogeneity: Tau² = 0.16; Chi² = 115.39, df = 15 (*P* < 0.00001); I² = 87%								
Test for overall effect: *Z* = 6.66 (*P* < 0.00001)								
Test for subgroup differences: Chi² = 6.68, df = 1 (*P* = 0.010); I² = 85.0%								

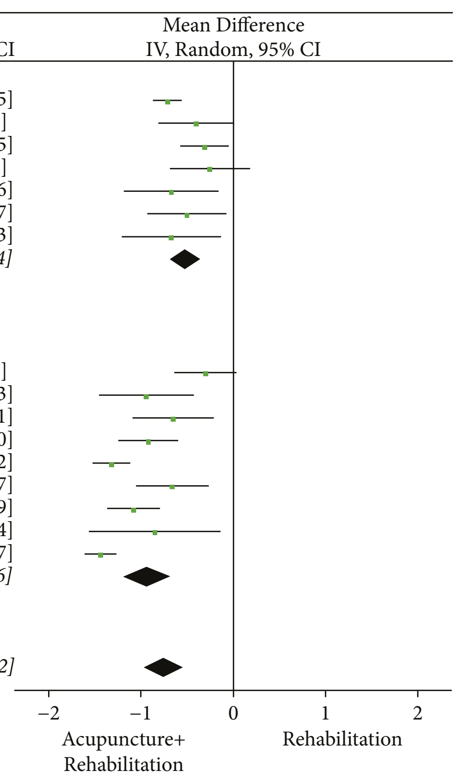


Figure 6: Forest plot of WST (acupuncture + rehabilitation vs. rehabilitation).

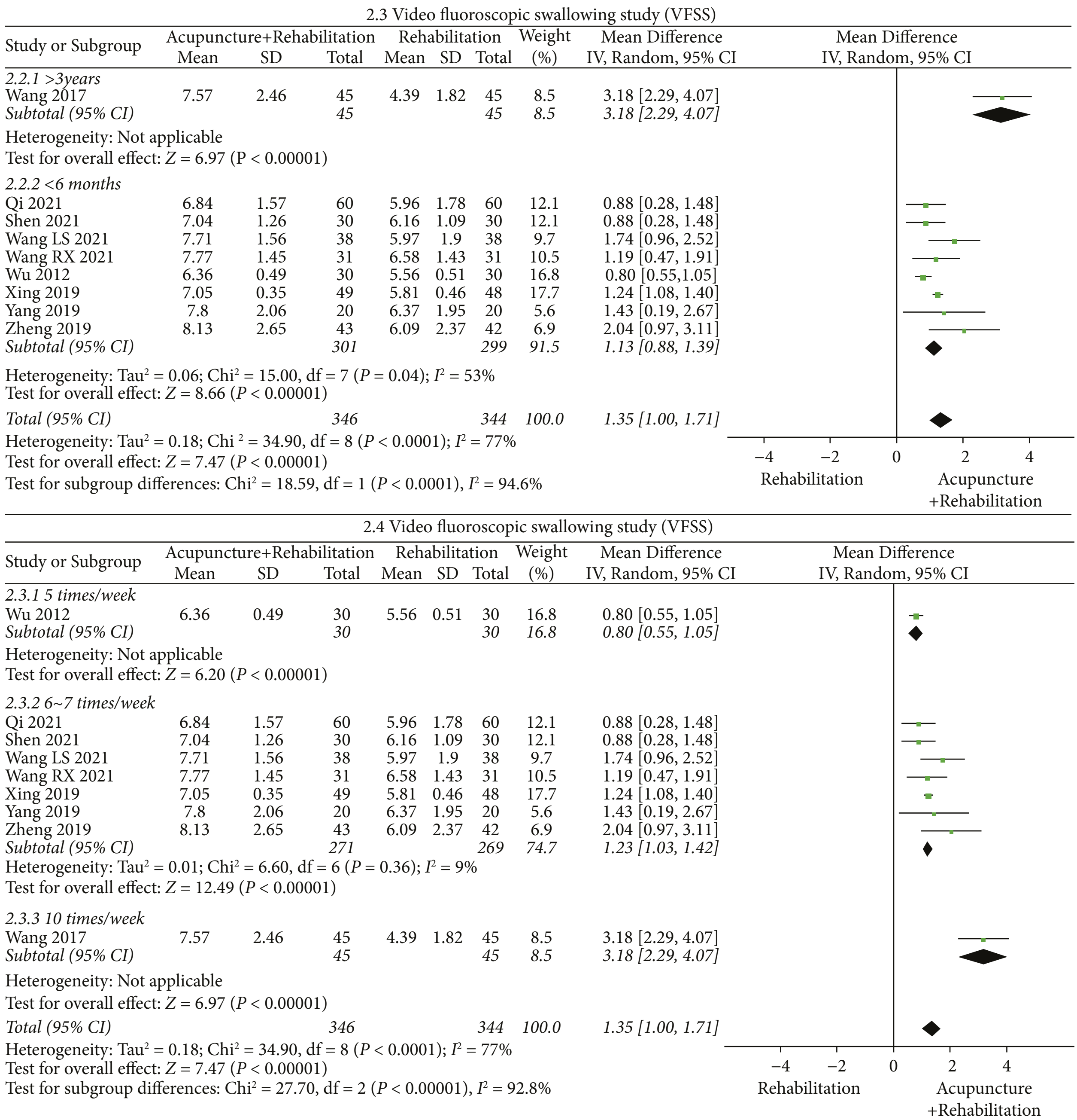


FIGURE 7: Forest plot of VFSS (acupuncture + rehabilitation vs. rehabilitation).

interconnections between acupuncture therapy and brain functions as well as on poststroke structural plasticity [59]. For instance, one study applied functional magnetic resonance imaging (fMRI) based on graph theory analysis. It reported that the regulatory effect of acupuncture potentially promotes the reorganization of disrupted poststroke whole-brain networks and the neural plasticity process [60]. Therefore, acupuncture regulates the peripheral nerves and the central nervous system.

In the acupuncture combined with the rehabilitation group, subgroup analyses of WST and SSA (Figure 6, tag 2.1 and Figure 8, tag 2.5) revealed that when other stimuli (including ice stimulation and electrical stimulation) were involved in rehabilitation training, and there was a tendency for the efficacy of acupuncture combined with the rehabilitation to decrease. One clinical study confirmed that there was no difference in the therapeutic effects of gustative-thermic-tactile stimulation and the addition of neuromuscular electrical stimulation [61]. Perhaps, one single stimulus is sufficient for dysphagia. Thus, we raise the question of whether more types of stimulation imply better outcomes for patients? Another RCT did not reveal any differences in therapeutic effects between neuromuscular electrostimulation therapy (NMES) and traditional dysphagia therapy (TDT such as thermal stimulation, posture adaptation, and lingual/larynx-motional exercises) and both

2.5 Standard swallowing assessment (SSA) scores

Study or Subgroup	Acupuncture+Rehabilitation Mean	SD	Total	Rehabilitation Mean	SD	Total	Weight (%)	Mean Difference IV, Random, 95% CI
3.4.1 With electrical - stimulation therapy in Rehabilitation								
Gao 2020	25.52	1.76	42	26.64	2.24	42	9.3	−1.12 [−1.98, −0.26]
Jing 2017	21.61	4.4	28	27.14	4.01	29	6.7	−5.53 [−7.72, −3.34]
Tian 2020	22.21	1.56	57	25.11	1.86	57	9.6	−2.90 [−3.53, −2.27]
Wang RX 2021	21.9	2.27	21	23.94	2.08	21	8.5	−2.04 [−3.36, −0.72]
Zhou2017	22.57	3.1	31	27.64	3.7	30	7.7	−5.07 [−6.79, −3.35]
Subtotal (95% CI)			*179*			*179*	*41.7*	*−3.11 [−4.46, −1.75]*
Heterogeneity: Tau² = 1.90; Chi² = 27.74, df = 4 (*P* < 0.0001); I² = 86%								
Test for overall effect: *Z* = 4.50 (*P* < 0.00001)								
3.4.2 With sensory stimulation therapy in Rehabilitation								
Liu 2018	20.6	3.5	49	23.5	4.4	48	8.0	−2.90 [−4.48, −1.32]
Xia 2016	20.12	1.84	60	23.07	2.5	60	9.4	−2.95 [−3.74, −2.16]
Zheng 2019	19.82	3.66	43	25.24	5.1	42	7.3	−5.42 [−7.31, −3.53]
Subtotal (95% CI)			*152*			*150*	*24.7*	*−3.57 [−4.93, −2.21]*
Heterogeneity: Tau² = 0.94; Chi² = 5.81, df = 2 (*P* = 0.05); I² = 66%								
Test for overall effect: *Z* = 5.14 (*P* < 0.00001)								
3.4.3 Without stimulation therapy in Rehabilitation								
Li 2019	22.7	2.99	40	24.63	2.96	40	8.5	−1.93 [−3.23, −0.63]
Qi 2021	18.76	1.84	60	25.11	2.49	60	9.4	−6.35 [−7.13, −5.57]
Shen 2021	25.84	5.35	30	29.52	4.81	30	6.0	−3.68 [−6.25, −1.11]
Xing 2019	18.92	1.08	49	23.66	1.29	48	9.7	−4.74 [−5.21, −4.27]
Subtotal (95% CI)			*179*			*178*	*33.6*	*−4.30 [−5.95, −2.65]*
Heterogeneity: Tau² = 2.35; Chi² = 34.35, df = 3 (*P* < 0.00001); I² = 91%								
Test for overall effect: *Z* = 5.12 (*P* < 0.00001)								
Total (95% CI)			*510*			*507*	*100.0*	*−3.66 [−4.66, −2.66]*
Heterogeneity: Tau² = 2.62; Chi² = 128.65, df = 11 (*P* < 0.00001); I² = 91%								
Test for overall effect: *Z* = 7.17 (*P* < 0.00001)								
Test for subgroup differences: Chi² = 1.20, df = 2 (*P* = 0.55), I² = 0%								

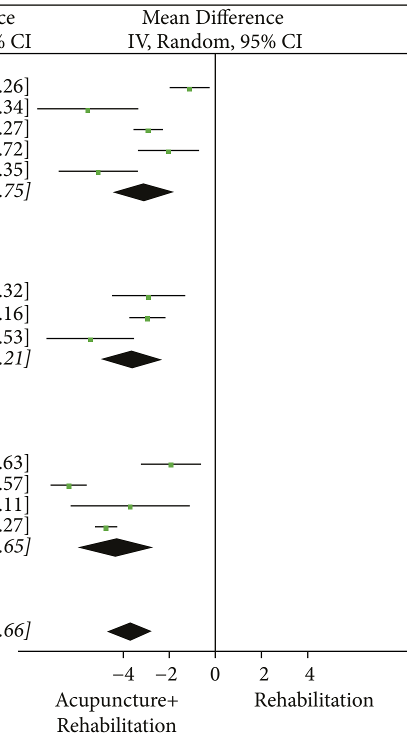


Figure 8: Forest plot of SSA (acupuncture + rehabilitation vs. rehabilitation).

2.6 Swallowing scores of Fujishima Ichiro

Study or Subgroup	Acupuncture+Rehabilitation Mean	SD	Total	Rehabilitation Mean	SD	Total	Weight (%)	Mean Difference IV, Random, 95% CI
4.2.1 Single Acupoint								
Song 2015	8.53	0.8	30	7.93	1.62	30	25.3	0.60 [−0.05, 1.25]
Subtotal (95% CI)			*30*			*30*	*25.3*	*0.60 [−0.05, 1.25]*
Heterogeneity: Not applicable								
Test for overall effect: *Z* = 1.82 (*P* = 0.07)								
4.2.2 Acupoint Combination								
Li 2011	8.03	1.87	30	6	2.41	30	13.8	2.03 [0.94, 3.12]
Wang 2019	7.45	1.34	30	6.03	1.12	30	26.1	1.42 [0.80, 2.04]
Wang ZL 2019	7.23	1.05	50	5.77	1.02	50	34.8	1.46 [1.05, 1.87]
Subtotal (95% CI)			*110*			*110*	*74.7*	*1.50 [1.17, 1.82]*
Heterogeneity: Tau² = 0.00; Chi² = 1.01, df = 2 (*P* = 0.60); I² = 0%								
Test for overall effect: *Z* = 9.05 (*P* < 0.00001)								
Total (95% CI)			*140*			*140*	*100.0*	*1.31 [0.82, 1.80]*
Heterogeneity: Tau² = 0.13; Chi² = 6.94, df = 3 (*P* = 0.07); I² = 57%								
Test for overall effect: *Z* = 5.29 (*P* < 0.00001)								
Test for subgroup differences: Chi² = 5.94, df = 1 (*P* = 0.01), I² = 83.2%								

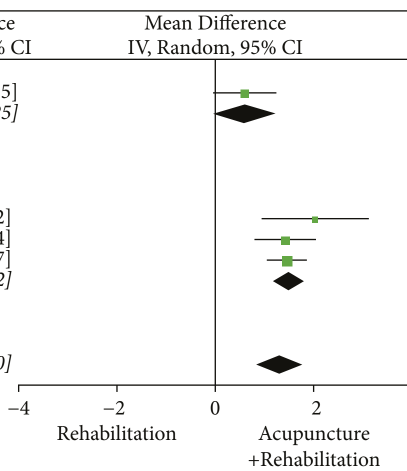


Figure 9: Forest plot of the swallowing scores of Fujishima Ichirowas (acupuncture + rehabilitation vs. rehabilitation).

2.7 The rates of aspiration

Study or Subgroup	Acupuncture+Rehabilitation Events	Total	Rehabilitation Events	Total	Weight (%)	Risk Ratio M-H, Fixed, 95% CI
Jiang 2020	10	62	21	58	64.4	0.45 [0.23, 0.86]
Wu 2012	9	30	12	30	35.6	0.75 [0.37, 1.51]
Total (95% CI)		*92*		*88*	*100.0*	*0.55 [0.34, 0.90]*
Total events	19		33			
Heterogeneity: chi² = 1.13, df = 1 (*P* = 0.29); I² = 12%						
Test for overall effect: *Z* = 2.41 (*P* = 0.02)						

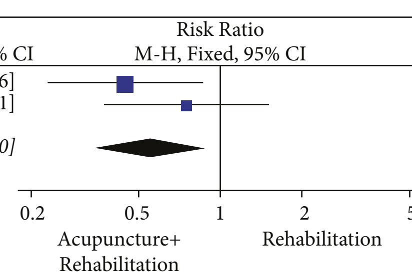


Figure 10: Forest plot of the rates of aspiration (acupuncture + rehabilitation vs. rehabilitation).

2.8 The rates of aspiration pneumonia

Study or Subgroup	Acupuncture+Rehabilitation Events	Acupuncture+Rehabilitation Total	Rehabilitation Events	Rehabilitation Total	Weight (%)	Risk Ratio M-H, Fixed, 95% CI
Gao 2020	2	42	9	42	21.6	0.22 [0.05, 0.97]
Jiang 2020	11	62	19	58	47.0	0.54 [0.28, 1.04]
Wang 2017	1	45	2	45	4.8	0.50 [0.05, 5.32]
Zheng 2019	4	43	11	42	26.6	0.36 [0.12, 1.03]
Total (95% CI)		*192*		*187*	*100.0*	*0.42 [0.25, 0.70]*
Total events	18		41			

Heterogeneity: $Chi^2 = 1.42$, df = 3 ($P = 0.70$); $I^2 = 0\%$
Test for overall effect: $Z = 3.35$ ($P = 0.0008$)

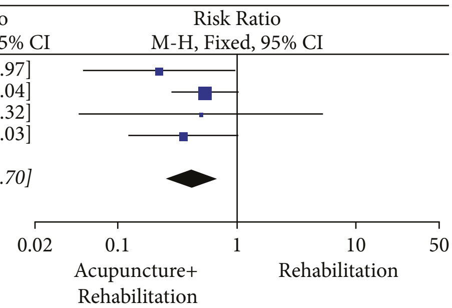


Figure 11: Forest plot of the rates of aspiration pneumonia. (acupuncture + rehabilitation vs. rehabilitation).

2.9 The dysphagia Outcome Severity Score (DOSS)

Study or Subgroup	Acupuncture+Rehabilitation Mean	SD	Total	Rehabilitation Mean	SD	Total	Weight (%)	Mean Difference IV, Random, 95% CI
Chen 2017	5.26	1.17	40	4.89	1.29	40	49.5	0.37 [−0.17, 0.91]
Xia 2016	5.8	1.3	60	3.7	1.1	60	50.5	2.10 [1.67, 2.53]
Total (95% CI)			*100*			*100*	*100.0*	*1.24 [−0.45, 2.94]*

Heterogeneity: $Tau^2 = 1.43$; $Chi^2 = 24.11$, df = 1 ($P < 0.00001$); $I^2 = 96\%$
Test for overall effect: $Z = 1.44$ ($P = 0.15$)

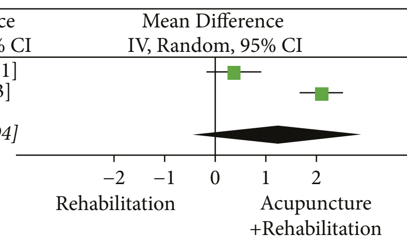


Figure 12: Forest plot of DOSS (acupuncture + rehabilitation vs. rehabilitation).

2.10 Barthel index (BI)

Study or Subgroup	Acupuncture+Rehabilitation Mean	SD	Total	Rehabilitation Mean	SD	Total	Weight (%)	Mean Difference IV, Fixed, 95% CI
Xia 2016	88.2	11.1	60	71	12.3	60	78.9	17.20 [13.01, 21.39]
Zheng 2019	74.08	19.35	43	62.62	18.83	42	21.1	11.46 [3.34, 19.58]
Total (95% CI)			*103*			*102*	*100.0*	*15.99 [12.27, 19.72]*

Heterogeneity: $chi^2 = 1.52$, df = 1 ($P = 0.22$); $I^2 = 34\%$
Test for overall effect: $Z = 8.41$ ($P < 0.00001$)

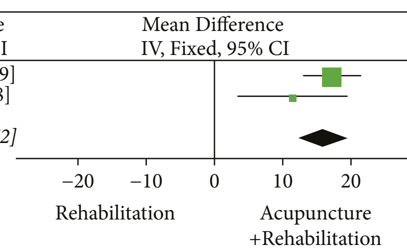


Figure 13: Forest plot of BI (acupuncture + rehabilitation vs. rehabilitation).

2.11 Swallowing quality of life questionnaire (SWAL-QOL)

Study or Subgroup	Acupuncture+Rehabilitation Mean	SD	Total	Rehabilitation Mean	SD	Total	Weight (%)	Mean Difference IV, Random, 95% CI
Li 2021	37.1	8.53	62	30	5.1	62	14.2	7.10 [4.63, 9.57]
Liu 2018	155.7	17.6	49	134.8	16.5	48	11.5	20.90 [14.11, 27.69]
Shen 2021	201.35	28.62	30	179.6	29.61	30	6.4	21.75 [7.01, 36.49]
Tian 2020	142.56	14.56	57	131.54	11.34	57	12.9	11.02 [6.23, 15.81]
Wang 2019	156.24	27.32	50	133.19	24.58	50	9.1	23.05 [12.86, 33.24]
Wang LS 2021	80.84	1.95	38	63.61	1.98	38	14.6	17.23 [16.35, 18.11]
Xia 2016	197.1	19.3	60	165.1	19.9	60	11.4	32.00 [24.99, 39.01]
Yu 2022	148.76	13.52	21	121.71	11.05	21	11.0	27.05 [19.58, 34.52]
Zhou2017	175.29	20.63	31	157.52	21.09	30	8.9	17.77 [7.30, 28.24]
Total (95% CI)			*398*			*396*	*100.0*	*19.04 [14.08, 24.01]*

Heterogeneity: $Tau^2 = 43.69$; $Chi^2 = 93.23$, df = 8 ($P < 0.00001$); $I^2 = 91\%$
Test for overall effect: $Z = 7.52$ ($P < 0.00001$)

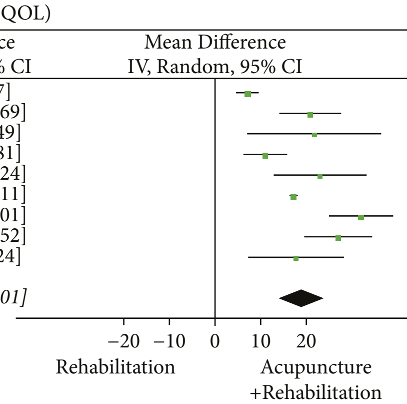


Figure 14: Forest plot of SWAL-QOL (acupuncture + rehabilitation vs. rehabilitation).

treatments improved the symptoms of dysphagia [62]. Perhaps, electrical stimulation and TDT were able to substitute for each other. A high-quality randomized double-blind clinical trial concluded that the therapeutic effects of exercise-based swallowing therapy alone were superior to NMES [63]. Furthermore, the same article indicated the primary hypothesis that exercise-based swallowing therapy + NMES would result in superior outcomes was not

2.12 Duration of empty swallowing

Study or Subgroup	Acupuncture+Rehabilitation Mean	SD	Total	Rehabilitation Mean	SD	Total	Weight (%)	Mean Difference IV, Random, 95% CI
10.1.1 Submental muscle group								
Gao 2020	3.28	0.06	42	3.44	0.08	42	29.8	−0.16 [−0.19, −0.13]
Jiang 2020	1.47	0.44	62	1.87	0.59	58	7.5	−0.40 [−0.59, −0.21]
Tian 2020	3.12	0.29	57	3.34	0.31	57	15.0	−0.22 [−0.33, −0.11]
Subtotal (95% CI)			*161*			*157*	*52.3*	*−0.23 [−0.34, −0.12]*
Heterogeneity: Tau² = 0.01; Chi² = 7.01, df = 2 (P = 0.03); I² = 71%								
Test for overall effect: Z = 4.09 (P < 0.0001)								
10.1.2 Infrahyoid muscles								
Gao 2020	3.11	0.08	42	3.27	0.07	42	29.5	−0.16 [−0.19, −0.13]
Jiang 2020	1.36	0.57	62	1.89	0.78	58	4.8	−0.53 [−0.78, −0.28]
Tian 2020	3.01	0.31	57	3.29	0.35	57	13.5	−0.28 [−0.40, −0.16]
Subtotal (95% CI)			*161*			*157*	*47.7*	*−0.28 [−0.45, −0.12]*
Heterogeneity: Tau² = 0.02; Chi² = 11.71, df = 2 (P = 0.003); I² = 83%								
Test for overall effect: Z = 3.39 (P = 0.0007)								

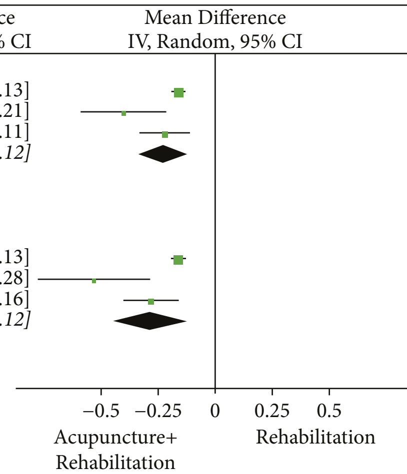


Figure 15: Forest plot of duration of empty swallowing (acupuncture + rehabilitation vs. rehabilitation).

2.13 Duration of 5 mL water swallowing

Study or Subgroup	Acupuncture+Rehabilitation Mean	SD	Total	Rehabilitation Mean	SD	Total	Weight (%)	Mean Difference IV, Random, 95% CI
11.1.1 Submental muscle group								
Gao 2020	3.16	0.09	42	3.3	0.05	42	25.3	−0.14 [−0.17, −0.11]
Jiang 2020	1.53	0.57	62	1.97	0.58	58	8.4	−0.44 [−0.65, −0.23]
Tian 2020	2.99	0.31	57	3.29	0.31	57	16.0	−0.30 [−0.41, −0.19]
Subtotal (95% CI)			*161*			*157*	*49.7*	*−0.27 [−0.44, −0.10]*
Heterogeneity: Tau² = 0.02; Chi² = 14.46, df = 2 (P = 0.0007); I² = 86%								
Test for overall effect: Z = 3.20 (P = 0.001)								
11.1.2 Infrahyoid muscles								
Gao 2020	3.12	0.06	42	3.34	0.09	42	25.2	−0.22 [−0.25, −0.19]
Jiang 2020	1.36	0.57	62	1.89	0.78	58	6.5	−0.53 [−0.78, −0.28]
Tian 2020	2.98	0.22	42	3.12	0.24	57	18.6	−0.14 [−0.23, −0.05]
Subtotal (95% CI)			*146*			*157*	*50.3*	*−0.24 [−0.36, −0.12]*
Heterogeneity: Tau² = 0.01; Chi² = 9.00, df = 2 (P = 0.01); I² = 78%								
Test for overall effect: Z = 3.95 (P < 0.00001)								

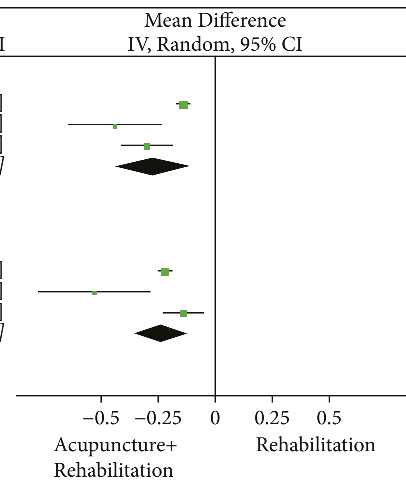


Figure 16: Forest plot of duration of 5 mL water swallowing (acupuncture + rehabilitation vs. rehabilitation).

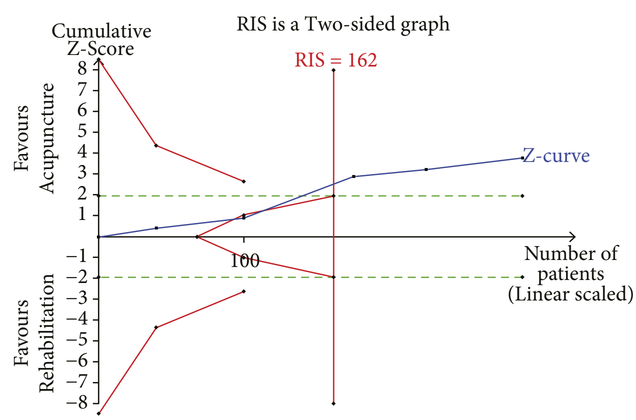


Figure 17: Trial sequence analysis of acupuncture alone (WST).

upheld [63]. The abovementioned studies [61–63] opposed that more treatments mean better outcomes. In the meta-analysis, we propose that when acupuncture exists in treatment, then, stimulative treatments in rehabilitation therapies can be substituted. Multiple stimuli increase negative feelings for patients (such as pain, bradycardia, and laryngeal muscle spasms) and are an economic burden. Currently, only one study has confirmed that there are no differences in response rates of acupuncture plus neuromuscular electrical stimulation versus acupuncture alone [64]. Additional studies found that acupuncture plus electrical stimulation is better than acupuncture alone [65–69]; in contrast with the findings of this study. Due to the poor quality of the abovementioned reports [64–70], additional high-quality RCTs are necessary to explore whether stimulative treatments in rehabilitation training can be substituted by acupuncture.

In the review, there was one high-quality study [24] of acupuncture plus neuromuscular electrical stimulation versus neuromuscular electrical stimulation (Figure 6), which showed no significant differences between the two groups. Indirectly, this addresses the question above

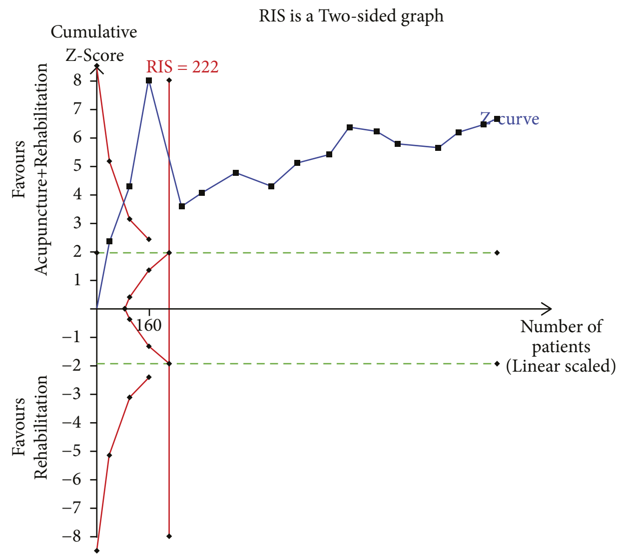


Figure 18: Trial sequence analysis of acupuncture + rehabilitation (WST).

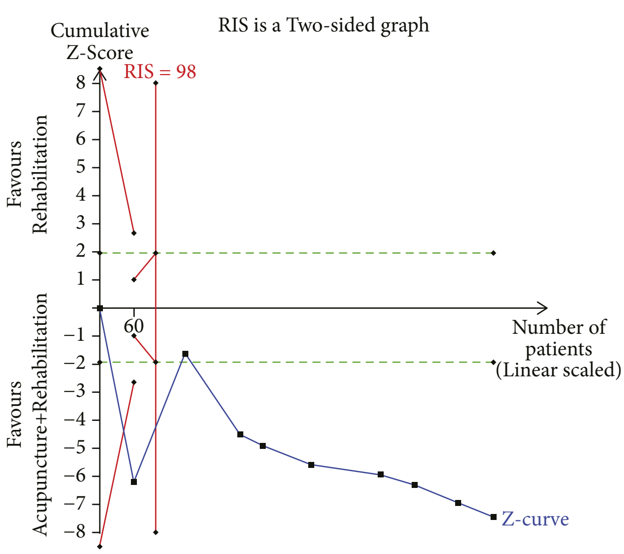


Figure 19: Trial sequence analysis of acupuncture + rehabilitation (VFSS).

Number of studies = 5 Root MSE = .2957

Std_Eff	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
slope	-1.199921	.159455	-7.53	0.005	-1.707378	-.6924642
bias	2.777281	.5833595	4.76	0.018	.9207708	4.633791

Test of H0: no small-study effects P = 0.018

Figure 20: Egger's test for the WST (acupuncture vs. rehabilitation).

(whether more types of stimulation imply better outcomes for patients), and the answer to this is either acupuncture or electrical stimulation is sufficient. Certainly, different

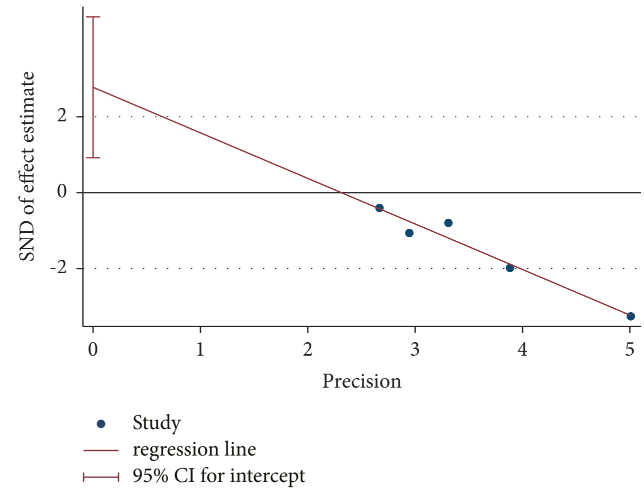


Figure 21: Egger graph for the WST (acupuncture vs. rehabilitation).

Number of studies = 16 Root MSE = 2.566

Std_Eff	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
slope	-1.274914	.2304045	-5.53	0.000	-1.769082	-.7807451
bias	2.891945	1.540924	1.88	0.082	-.4130086	6.196898

Test of H0: no small-study effects P = 0.082

Figure 22: Egger's test for the WST (acupuncture + rehabilitation vs. rehabilitation).

application parameters of NMES combined with acupuncture were out of the scope of the current study.

Subgroup analysis of VFFS revealed that acupuncture combined with rehabilitation exhibits a good curative effect on the long course of the disease and a high frequency of treatment (Figure 7, tag 2.3 and tag 2.4). With a follow-up period of 1 year, a recent clinical trial confirmed an optimum period of rehabilitation of two to three months after stroke [70]. Apart from Wang et al. [32], the other eight patients in RCTs had a disease course of two to three months. Nevertheless, due to the lack of longer follow-up and few studies with disease duration of more than 3 years, neither follow-up effect on long disease duration patients nor optimal timing of acupuncture is clear, and further research studies are needed. Subgroup analysis of VFFS indicated that without follow-up, short-term efficacy was more apparent in patients with a longer disease course. Additionally, due to the small number of included studies, it was difficult to establish whether heterogeneity was affected by the intervention or patient characteristics, or both. Besides, in the acupuncture alone group and acupuncture combined with the rehabilitation group, subgroup analyses of SSA and WST suggested the efficacy of acupuncture may be related to the acupuncture treatment dose. The dose-response relationship is a hallmark of pharmacological studies and this relationship also exists in acupuncture research. Stimulation's dose including the total number and the frequency of treatments is considered to be one of the most important components of

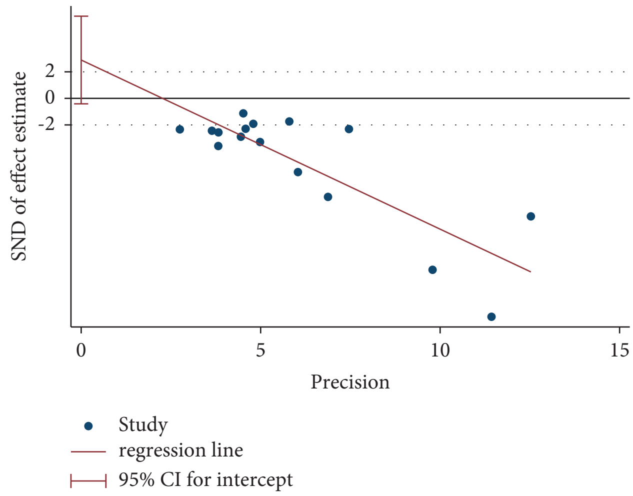


Figure 23: Egger graph for the WST (acupuncture + rehabilitation vs. rehabilitation).

Number of studies = 9 Root MSE = 2.067

Std_Eff	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
slope	.9874237	.2098008	4.71	0.002	.4913235	1.483524
bias	1.195563	1.107091	1.08	0.316	-1.422291	3.813416

Test of H0: no small-study effects P = 0.316

Figure 24: Egger's test for the VFSS (acupuncture + rehabilitation vs. rehabilitation).

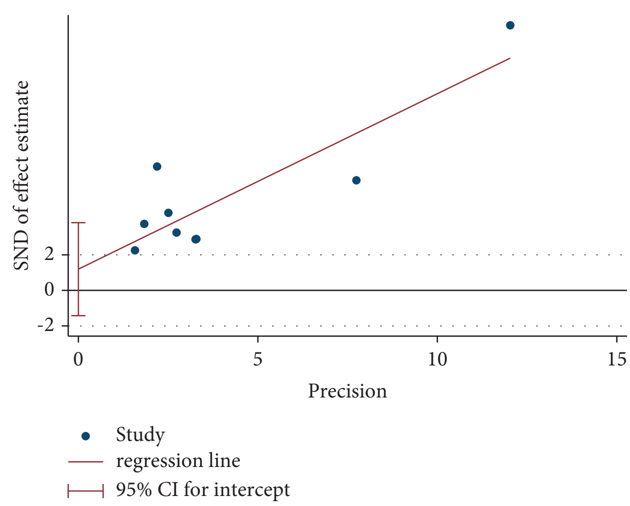


Figure 25: Egger graph for the VFSS (acupuncture + rehabilitation vs. rehabilitation).

acupuncture and it may have a great impact on the efficacy of acupuncture [71].

Swallowing scores of Fujishima Ichirowas' subgroup analysis revealed a significant heterogeneity between the two subgroups ($I^2 = 83.2\%$, Figure 5, and tag 5). Moreover, in the treatment of poststroke dysphasia, rehabilitation training combined with multiple acupoints was more effective than rehabilitation training combined with a single acupoint in the treatment of poststroke dysphasia. This is because dysphagia treatment with a single acupoint may easily induce acupuncture tolerance. Acupuncture tolerance was first proposed by professor Han et al. [72]. With advances in acupuncture research, studies have demonstrated that long-term and repeated acupuncture stimulation leads to adaptation. Besides, local receptors on acupoints are no longer sensitive [73, 74]. Therefore, avoiding long-term single acupuncture stimulation at the same acupoint is necessary and thus, acupoint combination should be considered [75].

Given that VFSS is a "gold standard" for dysphagia diagnosis and exhibits high sensitivity and specificity, and considering the economical, quick, and clear classification of the water swallow test, the water swallow test and

Table 4: Evidence quality evaluation.

Certainty assessment							No. of patients		Effect (95% CL)	Certainty
No of studies	Reference no	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Acupuncture Group	Rehabilitation Group		
Manual acupuncture compared to rehabilitation (WST)										
5	Randomized trials	Serious	No serious inconsistency	No serious indirectness	No serious imprecision	Strongly suspected	147	145	MD 0.47 lower (0.72 to 0.23 lower)	⊕⊕⊖⊖ Low
Manual acupuncture combined with rehabilitation compared to rehabilitation (WST)										
16	Randomized trials	Serious	No serious inconsistency	No serious indirectness	No serious imprecision	None	618	602	MD 0.74 lower (0.96 to 0.52 lower)	⊕⊕⊕⊖ Moderate
Manual acupuncture compared to rehabilitation(VFSS)										
9	Randomized trials	Serious	No serious inconsistency	No serious indirectness	No serious imprecision	None	346	344	MD 1.35 higher (1.00 to 1.71 higher)	⊕⊕⊕⊖ Moderate

videofluoroscopic swallowing study (VFSS) were selected as the primary outcomes of this study. Chen's study [23] used WST and DOSS as outcome indicators and reported conflicting results (Figures 6 and 12). This indicates that the selection of primary outcomes influenced our judgment with regard to curative effects. We selected DOSS as an exploratory outcome since it is not extensively used in dysphagia diagnosis.

5. Limitations

This review has various limitations: (i) although most of the included articles used clinical success rate as an outcome indicator, there is no uniform international standard for the definition of success rate. Therefore, we did not consider clinical response rate as one of the outcome indicators, which may have caused a loss of evidence; (ii) poststroke dysphagia is one of the most prevalent stroke complications with high morbidity and a long disease course. The shortest course of treatment in the included studies is 10 days, while the longest is 8 weeks; and only one study [36] had a 3-monthfollow-up and reported a long-term efficacy; and (iii) although we used Egger's test to evaluate publication bias in this review, the fact that all the included RCTs were conducted in China potentially contributes to a publication bias.

6. Conclusions

This meta-analysis provided positive evidence that acupuncture or acupuncture combined with rehabilitation were better than using rehabilitation alone in the treatment of poststroke dysphagia. Meanwhile, multicenter RCTs with a large sample and a rigorous design are needed to explore whether acupuncture could replace other stimulative therapies in rehabilitation training. Moreover, acupoint combination, frequency, and the total number of treatments may be important factors that could influence therapeutic effect, which can provide guidance for subsequent similar RCTs.

Data Availability

The datasets generated during and analyzed during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

Jiang. HL, Zhang. Q, and Zhao. Q contributed equally; they are co-first authors and share first authorship. Du. YZ and Meng. ZH are co-corresponding authors and are responsible for this research study. Jiang. HL, Zhang. Q, and Zhao. Q designed the study and drafted the manuscript. Chen. H, Nan. X, Liu. M, Yin. CS, Li BX, and Zhu WM made the figures and tables. Liu. W and Fan. XN revised the manuscript. All authors contributed to this article and approved the submitted version.

Acknowledgments

This research was supported by the National Key R&D Program of China (No. 2018YFC1705000 (Subject No. 42018YFC1705004) and No. 2019YFC0840709) and also supported by Tianjin Science and Technology Project (No. 18PTLCSY00060 and No. 21JCQNJC01560).

Supplementary Materials

Table S1: search strategy. Table S2: PRISMA-P 2020 Checklist. Figure S3: the sensitivity analysis of WST of acupuncture alone. Figure S4: the sensitivity analysis of SSA of acupuncture alone. Figure S5: the sensitivity analysis of WST of acupuncture combined with rehabilitation. Figure S6: the sensitivity analysis of VFSS of acupuncture combined with rehabilitation. Figure S7: the sensitivity analysis of SSA of acupuncture combined with rehabilitation. Figure S8: the sensitivity analysis of swallowing scores of Fujishima Ichiro of acupuncture combined with rehabilitation. Figure S9: the sensitivity analysis of the rates of aspiration of acupuncture combined with rehabilitation. Figure S10: the sensitivity analysis of the rates of aspiration pneumonia of acupuncture combined with rehabilitation. Figure S11: the sensitivity analysis of DOSS of acupuncture combined with rehabilitation. Figure S12: the sensitivity analysis of BI of acupuncture combined with rehabilitation. Figure S13: the sensitivity analysis of SWAL-QOL of acupuncture combined with rehabilitation. Figure S14: the sensitivity analysis of duration of empty swallowing (submental muscle group) of acupuncture combined with rehabilitation. Figure S15: the sensitivity analysis of duration of empty swallowing (infrahyoid muscles) of acupuncture combined with rehabilitation. Figure S16: the sensitivity analysis of duration of 5 mL water swallowing (submental muscle group) of acupuncture combined with rehabilitation. Figure S17: the sensitivity analysis of duration of 5 mL water swallowing (infrahyoid muscles) of acupuncture combined with rehabilitation. (*Supplementary Materials*)

References

[1] Y. J. Wang, S. S. Wang, X. Q. Zhao et al., "Chinese dysphagia and nutrition management manual for acute stroke patients," *Chinese Journal of Stroke*, vol. 14, pp. 1153–1169, 2019.

[2] C. Amanda, B. Ajay, G. R. Anthony, C. D. A. Wolfe, and Y. Wang, "Trends in prevalence of acute stroke impairments: a population-based cohort study using the South London stroke register," *PLoS Medicine*, vol. 17, no. 10, Article ID e1003366, 2020.

[3] P. P. Meng, S. C. Zhang, C. Han, Q. Wang, G. T. Bai, and S. W. Yue, "The occurrence rate of swallowing disorders after stroke patients in Asia: a PRISMA-compliant systematic review and meta-analysis," *Journal of Stroke and Cerebrovascular Diseases*, vol. 29, no. 10, Article ID 105113, 2020.

[4] M. Arnold, K. Liesirova, A. Broeg-Morvay et al., "Dysphagia in acute stroke: incidence, burden and impact on clinical outcome," *PLoS One*, vol. 11, no. 2, Article ID e0148424, 2016.

[5] M. Trapl, P. Enderle, M. Nowotny et al., "Dysphagia bedside screening for acute-stroke patients: the gugging swallowing screen," *Stroke*, vol. 38, no. 11, pp. 2948–2952, 2007.

[6] Z. Wang, L. Wu, Q. Fang, M. Shen, L. Zhang, and X. Liu, "Effects of capsaicin on swallowing function in stroke patients with dysphagia: a randomized controlled trial," *Journal of Stroke and Cerebrovascular Diseases*, vol. 28, no. 6, pp. 1744–1751, 2019.
[7] I. Perez, D. G. Smithard, H. Davies, and L. Kalra, "Pharmacological treatment of dysphagia in stroke," *Dysphagia*, vol. 13, no. 1, pp. 12–16, 1998.
[8] Z. P. Zhang, H. Y. Liu, and L. Wang, "Clinical observation on 110 cases of swallowing dysfunction in stroke patients treated by low-dose methylprednisolone," *Jilin Medical Journal*, vol. 34, pp. 3369-3370, 2013.
[9] W. Qin, Z. Wang, Y. Zhong et al., "Comparative efficacy of non-pharmaceutical therapy in the treatment of dysphagia after stroke: a protocol for systematic review," *Medicine*, vol. 99, no. 9, Article ID e19115, 2020.
[10] J. L. Zhao and J. Q. Li, "Advance on neuromuscular electrical stimulation for dysphagia therapy," *Journal of Logistics University of PAP (Medical Sciences)*, vol. 19, no. 7, pp. 594–596, 2010.
[11] X. D. Song, M. Wang, and Q. Su, "Research progress of repetitive transcranial magnetic stimulationin the treatment of neurological diseases," *Journal of Shandong First Medical University & Shandong Academy of Medical Sciences*, vol. 43, no. 8, pp. 635–641, 2022.
[12] Y. H. Du and Y. L. Xiao, "Preliminary study on clinical disease spectrum of modern acupuncture and moxibustion," *Chinese Acupuncture and Moxibustion*, vol. 5, pp. 59–62, 2002.
[13] G. F. Dong, X. D. Wu, Y. J. Han, H. Meng, and X. Wang, "Research on basic questions of intellectual property rights of acupuncture and moxibustion," *Acupuncture Research*, vol. 36, no. 6, pp. 457–460, 2011.
[14] P. M. Bath, F. J. Bath, and D. G. Smithard, "Interventions for dysphagia in acute stroke," *Cochrane Database of Systematic Reviews*, vol. 10, no. 2, Article ID CD000323, 2000.
[15] Cerebrovascular Disease Group, Chinese Association of Neurology, J. S. Zeng, M. Liu, and L. Y. Cui, "Diagnostic criteria of cerebrovascular diseases in China (version 2019)," *Chinese Journal of Neurology*, vol. 52, no. 9, pp. 710–715, 2019.
[16] R. Dziewas, E. Michou, M. Trapl-Grundschober et al., "European stroke organisation and European society for swallowing disorders guideline for the diagnosis and treatment of post-stroke dysphagia," *European Stroke Journal*, vol. 6, no. 3, 2021.
[17] L. Tian, *Speech Therapy Techniques*, People's Medical Publishing House (PMPH), Beijing, China, 2019.
[18] J. P. T. Higgins, J. Thomas, and J. Chandler, "Cochrane handbook for systematic reviews of interventions," 2021, https://www.training.cochrane.org/handbook.
[19] J. C. Jakobsen, J. Wetterslev, P. Winkel, T. Lange, and C. Gluud, "Thresholds for statistical and clinical significance in systematic reviews with meta-analytic methods," *BMC Medical Research Methodology*, vol. 14, pp. 120–213, 2014.
[20] K. Thorlund, J. Engstrøm, J. Wetterslev, J. Brok, G. Imberger, and C. Gluud, *User Manual for Trial Sequential Analysis (TSA)*, Copenhagen Trial Unit Centre for Clinical Intervention Research, Copenhagen, Denmark, 2017.
[21] H. Schünemann, J. Brożek, A. Oxman, and G. O. Guyatt, "GRADE handbook for grading quality of evidence and strength of recommendation," 2009, https://training.cochrane.org/resource/grade-handbook.
[22] J. J. Meerpohl, G. Langer, M. Perleth, G. Gartlehner, A. Kaminski-Hartenthaler, and H. Schunemann, "GRADE guidelines: 3 rating the quality of evidence (confidence in the estimates of effect)," *Zeitschrift für Evidenz, Fortbildung und Qualität im Gesundheitswesen*, vol. 106, no. 6, pp. 449–456, 2012.
[23] F. X. Chen and Y. X. Guan, "Effect of three needles of tongue combined with low frequency pulse electrical stimulation on the mobility of the hyoid complex in patients with dysphagia after stroke," *World Chinese Medicine*, vol. 12, pp. 3085–3088, 2017.
[24] N. Gao, H. B. Ma, and X. Z. Zhang, "Clinical observation of latch needle plus deglutition disorder therapeutic apparatus after stroke of swallowing disorder," *Journal of Emergency in Traditional Chinese Medicine*, vol. 23, pp. 265–267, 2014.
[25] Y. J. Jiang, L. Lin, Y. M. You et al., "Clinical study of dysphasia after cerebral stroke mainly treated with three tongue needle therapy," *Shanghai Journal of Acupuncture and Moxibustion*, vol. 39, pp. 530–535, 2020.
[26] R. H. Jing and Y. P. Jiang, "The clinical efficacy study of acupuncture combined with rehabilitation training treating for the recovery phase post-stroke patients with dysphagia," *Xinjiang Journal of Traditional Chinese Medicine*, vol. 37, pp. 31–34, 2019.
[27] P. F. Li, Y. X. Pan, and Y. Wang, "Acupuncture with rehabilitation training of swallowing in the treatment of dysphagia after stroke," *Journal of Clinical Acupuncture and Moxibustion*, vol. 27, pp. 1–5, 2011.
[28] X. Z. Li, B. L. Gu, H. Zhou, X. Jian-Hong, and Z. Xiang-Ming, "Influence of nape acupuncture therapy on swallowing function of patients with cerebral infarction," *Medical Journal of Chinese People's Liberation Army*, vol. 44, pp. 322–326, 2019.
[29] K. Liang, X. D. Li, and G. Y. Xie, "A randomized controlled research of acupuncture in the treatment of pseudobulbar paralysis," *Zhejiang Journal of Integrated Traditional Chinese and Western Medicine*, vol. 26, pp. 338–341, 2016.
[30] L. Xiaoping, C. Feiyu, C. Jiamei, and B. Yehua, "Effects of nape acupuncture combined with swallowing rehabilitation on dysphagia in pseudobulbar palsy," *Journal of Traditional Chinese Medicine*, vol. 38, no. 1, pp. 117–124, 2018.
[31] B. J. Song, "RN22 deep needling combined with rehabilitation training in the treatment of clinical observation of dysphagia after stroke," Dissertation/Master's Thesis, China Academy of Chinese Medical Sciences, Beijing, China, 2015.
[32] Y. H. Wang, G. F. Yang, H. X. Zhou, L. Junying, and W. Xinzhi, "Clinical observation of acupuncture plus rehabilitation training for post-stroke deglutition disorder," *Shanghai Journal of Acupuncture and Moxibustion*, vol. 36, pp. 663–667, 2017.
[33] J. Wang and W. D. Shen, "Efficacy of scalp acupuncture and tongue acupuncture combined with rehabilitation training on dysphagia after cerebral stroke," *Shanxi Journal of Traditional Chinese Medicine*, vol. 40, pp. 1774–1777, 2019.
[34] Z. L. Wang, "Clinical observation of acupuncture combined with rehabilitation training in the treatment of dysphagia after stroke," *International Medicine and Health Guidance News*, vol. 9, pp. 1353–1357, 2019.
[35] Y. L. Wu, "The study of acupuncture kinesitherapy treatment for dysphagia caused by pseudobular paralysis after stroke," Dissertation/Master's Thesis, Qingdao University, Qingdao, China, 2012.
[36] W. G. Xia, C. J. Zheng, J. H. Xia, and Y. Zhang, "Post-stroke dysphagia treated with acupuncture of meridian differentiation: a randomized controlled trial," *Chinese Acupuncture & Moxibustion*, vol. 36, no. 7, pp. 673–678, 2016.

[37] B. F. Xing, X. Zhou, and X. Q. Deng, "Effect of "Tongdu Tiaoshen" needling combined with swallowing training on dysphagia, cerebral blood flow and serum BDNF and NGF levels in ischemic stroke patients," *Acupuncture Research*, vol. 44, no. 7, pp. 506–511, 2019.

[38] L. Y. Xu, "Clinical study of acupuncture combined with rehabilitative training in dysphagia caused by pseudobulbar palsy after stroke," Dissertation/Master's Thesis, Fujian University of Traditional Chinese Medicine, Fuzhou, China, 2010.

[39] D. L. Yang, P. X. Wang, D. X. Hou, W. Q. Zhou, and Y. S. Zhang, "Clinical function and surface electromyography of Zhang Yongshu's "nourishing Yang and nourishing Yin" acupuncture therapy in the treatment of swallowing dysfunction after stroke," *Fujian Journal of Traditional Chinese Medicine*, vol. 50, pp. 22–24, 2019.

[40] X. Zheng and X. G. Sun, "Therapeutic effect of "Tiaoshen Yiyan" acupuncture combined with rehabilitation training on dysphagia after ischemic stroke," *Medical Information*, vol. 32, pp. 156–159, 2019.

[41] H. X. Zhou, Y. H. Wang, and X. K. Cheng, "Randomized parallel control study about acupuncture aqiang acupoints combined with swallowing function training treatment of dysphagia after stroke," *Journal of Practical Traditional Chinese Internal Medicine*, vol. 30, pp. 91–93, 2016.

[42] T. X. Zhou, L. J. Li, E. H. Feng, and W. X. Huang, "Clinical observation of scalp acupuncture combined with swallowing and speech therapeutic instrument for treatment of post-stroke dysphagia," *Journal of Guangzhou University of Traditional Chinese Medicine*, vol. 34, pp. 859–863, 2017.

[43] Y. Xie, "An assessment of the effect on the acupuncture treatment for dysphagia of stroke," Dissertation/Master's Thesis, Shanxi College of Traditional Chinese Medicine, Taiyuan, China, 2014.

[44] X. F. Duan and H. R. Wang, "Clinical effect of acupuncture at Tianrong (SII7) on dysphagia in patients with post-stroke," *Journal of Clinical Acupuncture and Moxibustion*, vol. 32, pp. 29–31, 2016.

[45] Y. H. Wang, G. F. Yang, H. X. Zhou, J. Y. Liu, and X. Z. Wang, "Therapeutic study of dysphagia caused by pseudobulbar paralysis post-stroke treated with acupuncture at aqianqzu points," *Liaoning Journal of Traditional Chinese Medicine*, vol. 44, pp. 2398–2400, 2017.

[46] R. J. Yang, D. Cao, and T. Yu, "Clinical study on acupuncture treatment of dysphagia in apoplexy," *Biped and Health*, vol. 27, pp. 184-185, 2018.

[47] J. Yu, Y. Zhu, J. H. Mao, J. H. Yuan, Y. L. Xu, and J. X. Huang, "Scalp-nape acupuncture as adjuvant therapy for pharyngeal dysphagia of stroke at recovery stage: a randomized controlled trial," *Chinese Acupuncture & Moxibustion*, vol. 42, no. 5, pp. 481–485, 2022.

[48] R. X. Wang, "Clinical research of targeted acupuncture combining rehabilitation training treating post-stroke dysphagia of pharyngeal stage due to bulbar palsy," Dissertation/Master's Thesis, Gansu University of Traditional Chinese Medicine, Lanzhou, China, 2021.

[49] L. S. Wang, H. Y. Zhao, Y. Zhang, and G. N. Li, "Combination of acupuncture with rehabilitation training for pseudobulbar paralysis after stroke: a randomized controlled trial swallowing five points combined with rehabilitation training in the treatment of post-stroke pseudobulbar palsy: a randomized controlled trial," *World Journal of Acupuncture-Moxibustion*, vol. 31, no. 3, pp. 202–206, 2021.

[50] Y. Tian, Y. X. He, R. R. Shi, and X. Ma, "Effect of acupuncture combined with EMG biofeedback on dysphagia after apoplexy," *World Chinese Medicine*, vol. 15, no. 12, pp. 1792–1795, 2020.

[51] Y. J. Qi, Q. Y. Pan, W. Y. Wang, W. L. Sun, and B. Sun, "Effect of nape cluster acupuncture on swallowing function and respiratory function in patients with post-stroke dysphagia," *Acupuncture and Moxibustion*, vol. 41, no. 12, pp. 1303–1307, 2021.

[52] Z. H. Li, H. M. Li, and N. N. Ai, "Clinical trials of Xingnao Kaiqiao needling combined with respiratory training for post-stroke dysphagia," *Acupuncture Research*, vol. 46, no. 10, pp. 875–879, 2021.

[53] Y. Q. Huang, W. Ma, and W. D. Shen, "Efficacy evaluation of acupuncture plus rehabilitation training for post-stroke deglutition disorders of Qi-deficiency blood stasis pattern," *Journal of Acupuncture and Tuina Science*, vol. 18, no. 5, pp. 367–373, 2020.

[54] J. X. Gao, "Clinical study on the treatment of dysphagia with wind-phlegm after stroke by nape-aligned acupuncture," Dissertation/Doctoral Thesis], Liaoning University of Traditional Chinese Medicine, Shenyan, China, 2020.

[55] Z. Q. Shen, W. D. Zhang, and H. L. Chen, "Efficacy of glossopharyngeal acupuncture combined with swallowing function training for treatment of post-stroke dysphagia," *Guangxi Medical Journal*, vol. 43, no. 24, pp. 2933–2936, 2021.

[56] J. X. Gao and H. F. Zhou, "Therapeutic effect of nape cluster acupuncture combined with swallowing function training on post-stroke dysphagia," *Chinese acupuncture*, vol. 40, no. 6, pp. 586–590, 2020.

[57] L. Y. Huang and W. Z. Yuan, "Clinical study on Xingnao Kaiqiao acupuncture combined with Vitalstim swallowing therapy apparatus in treating swallowing dysphagia after stroke," *Medical Equipment*, pp. 1293–1295, 2017.

[58] X. X. Deng and C. Wu, ""Xingnao Kaiqiao" acupuncture therapy combined with vitalstim swallowing therapeutic apparatus in treatment of dysphagia of stroke," *Acta Chinese Medicine*, vol. 3, pp. 466–469, 2017.

[59] J. Zhang, C. Lu, X. Wu, D. Nie, and H. Yu, "Neuroplasticity of acupuncture for stroke: an evidence-based review of MRI," *Neural Plasticity*, vol. 2021, Article ID 2662585, 14 pages, 2021.

[60] X. Han, H. Jin, K. Li et al., "Acupuncture modulates disrupted whole-brain network after ischemic stroke: evidence based on graph theory analysis," *Neural Plasticity*, vol. 2020, Article ID 8838498, 10 pages, 2020.

[61] P. C. Cola, S. M. M. Onofri, C. J. Rubira, C. R. Pedroni, P. Clave, and R. G. da Silva, "Electrical, taste, and temperature stimulation in patients with chronic dysphagia after stroke: a randomized controlled pilot trial," *Acta Neurologica Belgica*, vol. 121, no. 5, pp. 1157–1164, 2021.

[62] S. Miller, D. Diers, M. Jungheim, C. Schnittger, H. J. Sturenburg, and M. Ptok, "Studying effects of neuromuscular electrostimulation therapy in patients with dysphagia: which pitfalls may occur? a translational phase I study," *GMS German Medical Science*, vol. 19, 2021.

[63] G. D. Carnaby, L. LaGorio, S. Silliman, and M. Crary, "Exercise-based swallowing intervention (McNeill dysphagia therapy) with adjunctive NMES to treat dysphagia post-stroke: a double-blindplacebo-controlled trial," *Journal of Oral Rehabilitation*, vol. 47, no. 4, pp. 501–510, 2020.

[64] T. Li, "Observation on 60 cases of dysphagia after stroke treated by acupuncture combined with dysphagia therapy

instrument," *Journal of Practical Traditional Chinese Medicine*, vol. 32, pp. 253-254, 2016.

[65] J. F. Hang, J. H. Liu, and C. F. Tan, "Effect of head acupuncture combined with swallowing function therapy instrument on patients with ischemic stroke," *China Medical Herald*, vol. 17, pp. 80–84, 2020.

[66] B. You, "92 cases of dysphagia after stroke were treated by acupuncture combined with dysphagia therapy instrument," *Chinese Manipulation and Rehabilitation Medicine*, vol. 9, pp. 16-17, 2018.

[67] L. M. Nie, "The study about the optimal effectiveness of Jin's three needle combined with the Vitalstim swallowing therapy apparatus on treating the bulbar paralysis after stroke," Dissertation/Master's Thesis, Guangxi University of Traditional Chinese Medicine, Nanning, China, 2016.

[68] J. N. Ma, J. Xiong, and L. N. Ning, "Acupuncture combined with dysphagia therapeutic equipment on dysphagic patients with cerebral infarction," *Journal of Changchun University of Chinese Medicine*, vol. 31, pp. 374–376, 2015.

[69] H. M. Chen, "36 cases of dysphagia caused by pseudobulbar paralysis after stroke were treated with acupuncture and swallowing speech therapy," *Henan Traditional Chinese Medicine*, vol. 29, pp. 598-599, 2009.

[70] A. W. Dromerick, S. Geed, J. Barth et al., "Critical period after stroke study (CPASS): a phase II clinical trial testing an optimal time for motor recovery after stroke in humans," *Proceedings of the National Academy of Sciences of the USA*, vol. 118, no. 39, Article ID e2026676118, 2021.

[71] D. E. Yoon, I. S. Lee, and Y. Chae, "Identifying dose components of manual acupuncture to determine the dose-response relationship of acupuncture treatment: a systematic review," *The American Journal of Chinese Medicine*, vol. 50, no. 3, pp. 653–671, 2022.

[72] J. S. Han, J. Tang, B. S. Huang, X. Liang, and N. Zhang, "Acupuncture tolerance in rats: anti-opiate substrates implicated," *Chinese Medical Journal*, vol. 92, no. 9, pp. 625–627, 1979.

[73] W. X. Fan, "Alternating acupoint electroacupuncture for treatment of wind-phlegm obstruction type cerebral infarction (acute phase) clinical research," Dissertation/Master's Thesis, Guangxi University of Traditional Chinese Medicine, Nanning, China, 2020.

[74] L. Y. Cui and M. X. Ding, "Progress of researches on central mechanism of electroacupuncture tolerance," *Acupuncture Research*, vol. 41, pp. 550–555, 2016.

[75] Q. Xi, Y. Guo, Y. M. Guo, and J. Wang, "Brief investigation on acupuncture tolerance," *Journal of Clinical Acupuncture and Moxibustion*, vol. 25, pp. 43-44, 2009.