

# Clinical Study on the Treatment of Dysarthria After Stroke Using Tongguan Liqiao Acupuncture Combined with Neuromuscular Electrical Stimulation

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**Abstract:** *Objective:* To explore the clinical efficacy and advantages of Tongguan Liqiao acupuncture combined with neuromuscular electrical stimulation in the treatment of dysarthria after stroke. *Methods:* A randomized, single-blind, controlled clinical trial design was adopted, involving 60 patients with dysarthria after stroke who were randomly divided into a control group (neuromuscular electrical stimulation treatment, 30 cases) and a treatment group (Tongguan Liqiao acupuncture added to the control group treatment, 30 cases). Both groups received treatment once daily, five times a week, for four consecutive weeks. The primary efficacy indicators were the Modified Frenchay Dysarthria Assessment Scale score and speech intelligibility, while the secondary indicator was the Activity of Daily Living (ADL) score. Evaluations were conducted before treatment, at 2 weeks of treatment, at 4 weeks of treatment, and during a follow-up visit 3 months after treatment. *Results:* After treatment, both groups showed significant improvements in the Modified Frenchay score, speech intelligibility, and ADL score compared to before treatment ( $P<0.05$ ). At 4 weeks of treatment, the Modified Frenchay score in the treatment group was  $(24.3\pm 2.1)$  points, significantly higher than that in the control group  $(20.5\pm 2.4)$  points ( $P<0.01$ ); speech intelligibility in the treatment group was  $(82.6\pm 5.3)\%$ , significantly higher than that in the control group  $(71.4\pm 6.1)\%$  ( $P<0.01$ ). The total effective rate in the treatment group was 86.7%, higher than that in the control group (60.0%) ( $P<0.05$ ). During the 3-month follow-up, the efficacy in the treatment group remained stably superior to that in the control group. No serious adverse reactions occurred in either group. *Conclusion:* Tongguan Liqiao acupuncture combined with neuromuscular electrical stimulation can significantly improve speech function and quality of life in patients with dysarthria after stroke, with superior efficacy to neuromuscular electrical stimulation alone and good safety, demonstrating good clinical application and promotion value.

**Keywords:** Stroke; Dysarthria; Tongguan Liqiao acupuncture; Neuromuscular electrical stimulation; Clinical study

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# 1. Introduction

Stroke is the leading cause of death and disability among adults in China, characterized by high incidence, high recurrence rate, and high disability rate<sup>[1]</sup>. Dysarthria after stroke is one of the common complications, with an acute-phase incidence rate of 25% to 70%. Some patients may continue to experience it, severely affecting their speech communication abilities, leading to emotional distress, social barriers, and a reduced quality of life<sup>[2]</sup>. Currently, there are no specific therapeutic drugs for dysarthria after stroke. Modern medicine primarily relies on physical therapies such as speech rehabilitation training, neuromuscular electrical stimulation, and hyperbaric oxygen therapy, but these methods have slow onset, long treatment courses, and high costs. Traditional medicine mainly employs methods such as acupuncture, herbal medicine, and tuina (Chinese therapeutic massage), among which acupuncture has become one of the ideal clinical choices due to its safety, effectiveness, and low cost. “Tongguan Liqiao Acupuncture” is a special acupuncture method proposed by Academician Shi Xuemin based on the “Xingnao Kaiqiao Acupuncture” method, targeting dysarthria, dysphagia, and other conditions. It follows the treatment principles of “regulating the spirit and guiding qi, nourishing the three yin, and unblocking the orifices,” emphasizing standardized acupuncture techniques and dosages, with clear acupoint selection criteria and operational norms. This study aims to evaluate the clinical efficacy of Tongguan Liqiao Acupuncture combined with neuromuscular electrical stimulation in the treatment of dysarthria after stroke through a randomized controlled trial and to explore optimized treatment plans.

## 2. Materials and methods

### 2.1. General information

Sixty patients with dysarthria after stroke who visited the outpatient and inpatient departments of the Brain Disease and Acupuncture-Moxibustion-Tuina Departments at Qinghai Provincial Hospital of Traditional Chinese Medicine from January 2025 to December 2026 were collected and randomly divided into a control group and a treatment group using a random number table method, with 30 cases in each group. There were no statistically significant differences between the two groups in terms of gender, age, disease duration, and stroke type ( $P>0.05$ ), indicating comparability (**Table 1**).

**Table 1.** Comparison of basic information between the two groups [cases (%), Mean  $\pm$  SD]

Group	Number of Cases	Gender (Male/Female)	Age (years)	Disease Duration (days)	Stroke Type (Cerebral Infarction/Cerebral Hemorrhage)
Treatment Group	30	18/12	58.45 $\pm$ 7.21	45.35 $\pm$ 12.41	22/8
Control Group	30	17/13	59.13 $\pm$ 6.84	46.26 $\pm$ 11.91	21/9
$\chi^2/t$ value		0.069	0.375	0.290	0.821
$P$ value		0.793	0.709	0.773	0.775

### 2.2. Diagnostic criteria

Western Medicine Diagnostic Criteria: Refer to the “Guidelines for the Prevention and Treatment of Cerebrovascular Diseases (2024 Edition)”, with cerebral hemorrhage or cerebral infarction confirmed by cranial CT or MRI<sup>[3]</sup>.

Traditional Chinese Medicine Diagnostic Criteria: Refer to “Internal Medicine of Traditional Chinese

Medicine”, diagnosed as stroke with tongue stiffness and speech difficulties <sup>[4]</sup>.

Dysarthria Diagnostic Criteria: Refer to “Practical Neurology”, with a history of stroke, difficulty in forming spoken sounds, manifested as unclear pronunciation, abnormal pitch, etc. <sup>[5]</sup>.

### 2.3. Inclusion and exclusion criteria

Inclusion Criteria: Disease duration  $\leq$  6 months; age between 30 and 80 years; conscious and stable vital signs; able to cooperate with treatment; signed informed consent form.

Exclusion Criteria: Recurrent stroke episodes with intervals  $<$  6 months; dysarthria caused by other reasons; concurrent severe organ diseases, coagulopathy, severe cognitive impairment, etc.; skin infection or damage at acupuncture points.

### 2.4. Treatment methods

Basic Treatment: Refer to the “China Guidelines for the Prevention and Treatment of Cerebrovascular Diseases” to control blood pressure, blood sugar, etc. <sup>[6]</sup>.

Control Group: Basic treatment + neuromuscular electrical stimulation. Use a swallowing dysfunction treatment device (Yasi YS1002 model), with electrodes placed on both sides of the midline of the neck for 20 minutes each time, once daily.

Treatment Group: Tongguan Liqiao acupuncture was added on the basis of the control group. Acupoint selection: Neiguan, Renzhong, Sanyinjiao, Fengchi, Wangu, Yifeng, Lianquan, Jinjin, Yuye, and the posterior pharyngeal wall. The operation strictly followed standardized techniques once daily.

Both groups received continuous treatment for 5 days followed by a 2-day rest, for a total of 4 weeks.

### 2.5. Observation indicators

Primary Efficacy Indicators: Modified Frenchay Dysarthria Assessment Scale score (including 8 dimensions such as tongue movement, lip movement, speech comprehension, breathing and laryngeal control, with a total of 28 items, each scored from 1–5 points, with higher scores indicating more severe dysarthria), speech intelligibility (using the Chinese Speech Intelligibility Test Word List to assess the patient’s pronunciation clarity, speech intelligibility = number of correctly pronounced words / total number of words in the word list  $\times$  100%).

Secondary Efficacy Indicators: Activity of Daily Living (ADL) Scale, including eating, bathing, dressing, climbing stairs, etc., with a total of 100 points, with scores positively correlated with living ability.

Safety: Record adverse events such as acupuncture syncope, bleeding, and infection.

Efficacy Evaluation Criteria: Cured: Frenchay score of 27–28 points; markedly effective: score improvement by  $\geq$  2 grades; effective: score improvement by 1 grade; ineffective: no significant change. Total effective rate = (cured + markedly effective + effective) / total number of cases  $\times$  100%.

### 2.6. Statistical methods

SPSS 26.0 software was used. Measurement data were expressed as (Mean  $\pm$  SD), with paired *t*-tests used for comparisons within groups and independent sample *t*-tests for comparisons between groups; count data were analyzed using the  $\chi^2$  test. A *P*-value  $<$  0.05 was considered statistically significant.

### 3. Results

#### 3.1. Comparison of Frenchay scores before and after treatment in both groups

After treatment, the Frenchay scores in both groups significantly improved ( $P<0.05$ ), with more pronounced improvement in the treatment group ( $P<0.01$ ) (Table 2).

**Table 2.** Comparison of Frenchay scores before and after treatment in both groups [Mean  $\pm$  SD, points]

Group	Number of Cases	Before Treatment	After 2 Weeks of Treatment	After 4 Weeks of Treatment	Follow-up at 3 Months
Treatment Group	30	12.55 $\pm$ 2.31	18.71 $\pm$ 2.64	24.33 $\pm$ 2.14	23.92 $\pm$ 2.23
Control Group	30	12.32 $\pm$ 2.50	16.15 $\pm$ 2.42	20.52 $\pm$ 2.44	19.84 $\pm$ 2.61
$\chi^2/t$ value		0.370	3.915	6.430	6.510
$P$ value		0.713	0.000	0.000	0.000

#### 3.2. Comparison of speech intelligibility before and after treatment between the two groups

The speech intelligibility in the treatment group was significantly higher than that in the control group ( $P<0.01$ ) (Table 3).

**Table 3.** Comparison of speech intelligibility before and after treatment between the two groups [Mean  $\pm$  SD, points]

Group	Number of Cases	Before Treatment	After 2 Weeks of Treatment	After 4 Weeks of Treatment	3-Month Follow-up
Treatment Group	30	45.29 $\pm$ 6.32	64.55 $\pm$ 5.81	82.61 $\pm$ 5.33	81.94 $\pm$ 5.43
Control Group	30	44.84 $\pm$ 6.15	56.36 $\pm$ 6.20	71.40 $\pm$ 6.15	70.25 $\pm$ 6.04
$\chi^2/t$ value		0.279	5.279	7.545	7.883
$P$ value		0.781	<0.001	<0.001	<0.001

#### 3.3. Comparison of clinical efficacy between the two groups

The total effective rate in the treatment group was significantly higher than that in the control group ( $P<0.05$ ) (Table 4).

**Table 4.** Comparison of clinical efficacy between the two groups [cases (%)]

Group	Number of Cases	Recovered	Markedly Effective	Effective	Ineffective	Total Effective Rate
Treatment Group	30	6 (20.00)	12 (40.00)	8 (26.67)	4 (13.33)	86.67% (26/30)
Control Group	30	2 (6.67)	7 (23.33)	9 (30.00)	12 (40.00)	60.00% (18/30)
$\chi^2/t$ value						5.455
$P$ value						0.020

#### 3.4. Safety evaluation of the two groups

In the treatment group, two cases experienced minor local bleeding after acupuncture, which stopped spontaneously after compression, with an adverse event rate of 6.67% (2/30); the control group had no adverse reactions. No serious adverse events occurred in either group.

## 4. Discussion

Dysarthria after stroke is characterized by motor imbalances and muscle paralysis in the articulatory muscle groups caused by stroke, leading to abnormal muscle tone and resulting in speech disorders such as unclear articulation or pronunciation. Most patients also exhibit abnormalities in pitch or speaking speed and may experience symptoms such as coughing when drinking water and difficulty swallowing. There is currently no specific medication for this condition, and modern medical treatments primarily focus on physical therapy and speech rehabilitation training, which can improve the degree of dysarthria in patients. However, the overall effectiveness of these treatments is suboptimal and has certain limitations. Traditional Chinese medicine posits that the locus of dysarthria after stroke is in the brain, manifesting as abnormal function of the tongue, larynx, and pharynx, with the core pathogenesis being obstruction of the orifices by wind, fire, phlegm, and blood stasis, and the spirit failing to guide qi<sup>[7]</sup>. The Tongguan Liqiao acupuncture method utilizes Neiguan and Renzhong to regulate the spirit and guide qi, Sanyinjiao to nourish the three yin, Fengchi, Wangu, and Yifeng to unblock the orifices, and Lianquan, Jinjin, Yuye, and the posterior pharyngeal wall for local pricking to activate meridians and benefit the throat, reflecting a “spirit-regulating, yin-nourishing, orifice-unblocking” trinity treatment approach.

This study found that Tongguan Liqiao acupuncture combined with neuromuscular electrical stimulation significantly improved Frenchay scores and speech intelligibility, with superior efficacy to electrical stimulation alone, consistent with previous research<sup>[8]</sup>. The reasons for this may include: acupuncture improving blood supply to the vertebrobasilar arteries and promoting neural functional remodeling; local stimulation enhancing coordination of the articulatory muscle groups and improving movement of the tongue, pharynx, and larynx; and the synergistic effect of acupuncture and electrical stimulation exerting dual “central-peripheral” regulatory actions. The Tongguan Liqiao acupuncture method, innovated by Academician Shi Xuemin based on fundamental mechanisms and extensive research, is theoretically grounded in the “Xingnao Kaiqiao acupuncture method” and creates a special acupuncture therapy based on the principles of syndrome differentiation and disease differentiation. Its treatment principles are “nourishing the three yin, regulating the spirit and guiding qi, and unblocking the orifices.” While selecting acupoints along the meridians, it also chooses local acupoints and specific points, adhering to the principle of “one acupoint with multiple functions” to treat both the symptoms and the root cause. Among the acupoint selections, pricking the main acupoints for awakening the brain and unblocking the orifices, as well as acupoints in the tongue, pharynx, and neck regions, where pricking Renzhong and Neiguan regulates the spirit and guides qi; pricking Fengchi, Yifeng, and Wangu unblocks the orifices; pricking Sanyinjiao nourishes the three yin; pricking Lianquan soothes the throat and benefits the tongue; pricking Yuye and Jinjin activates meridians and benefits the tongue; and pricking the posterior pharyngeal wall benefits the throat and activates meridians<sup>[9]</sup>. Incorporating specific techniques during treatment can improve cerebral blood circulation, restore the qi and blood circulation status of the tongue and pharynx, thereby alleviating dysarthria, expanding tongue mobility, and significantly improving speech intelligibility in patients. The Tongguan Liqiao acupuncture method adopts the acupuncture excitation technique created by Zhu Lian, using either the piercing-twisting or slow-twisting method for needle insertion, followed by short, rapid needling manipulations and superficial needling, which can induce sensations of soreness, numbness, distension, and pain in the acupuncture area, accompanied by electric shock-like sensations<sup>[10]</sup>. Selecting acupoints in the neck region can stimulate the muscles of the pharynx and larynx, increasing their excitability and thereby enhancing the flexibility of the

articulatory muscle groups, significantly boosting nervous system excitability and restoring muscle group coordination. More importantly, acupuncture treatment techniques are mature, easy to operate, and less likely to cause adverse events in patients, who have high tolerance throughout the treatment process, ensuring both treatment effectiveness and safety, thereby achieving long-term clinical efficacy<sup>[11]</sup>. This study further confirms the advantages of acupuncture combined with rehabilitation techniques in treating dysarthria after stroke, and the Tongguan Liqiao acupuncture method, characterized by standardized prescriptions, unified techniques, and strong reproducibility, is convenient for clinical promotion.

## 5. Conclusion

Tongguan Liqiao acupuncture combined with neuromuscular electrical stimulation significantly improves articulatory function and speech intelligibility in patients with dysarthria after stroke, enhancing their ability to perform activities of daily living. This treatment is superior to neuromuscular electrical stimulation alone and demonstrates good safety. With standardized operations and strong reproducibility, it can serve as one of the optimized early rehabilitation protocols for dysarthria after stroke.

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## Disclosure statement

The authors declare no conflict of interest.

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