Efficacy and Safety of Thread Embedding Acupuncture for Facial Expression Muscles Atrophy After Peripheral Facial Paralysis: Study Protocol for a Randomized Controlled Trial

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Study protocol

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Abstract

Background

Facial expression muscles atrophy is one kind of sequelae after peripheral facial paralysis. It causes critical problems in facial appearance of patient as well as social and psychological problems. This study aims to evaluate the efficacy and safety of Thread-embedding acupuncture (TEA) for the management of facial expression muscles atrophy after peripheral facial paralysis.

Methods

This is a patient-assessor blinded, randomized, sham-controlled trial. A total of 56 eligible patients will be randomly allocated to a TEA group (n = 28) or a sham TEA (STEA) group (n = 28). Both groups will receive TEA or STEA treatment at 2 predefined points once a week for 8 weeks. Additionally, both groups will receive the same acupuncture treatment twice a week for 8 weeks as a concurrent treatment. Changes in facial expression muscle thickness ratio of the affected/healthy side measured by B-mode ultrasonography will be assessed at baseline and at 10 weeks after screening as the primary outcome. Furthermore, the House-Brackmann Grade and lip mobility score will be measured and analyzed as secondary outcomes. Secondary outcomes will be assessed at baseline and at 4, 8, 10 and 12 weeks after screening.

Discussion

The study will compare TEA with sham TEA to explore the feasibility for TEA in improving symptoms caused by facial expression muscles atrophy after peripheral facial paralysis.

Trial registration:

Chinese Clinical Trial Registry, ChiCTR1900027170. Registered on 3 November 2019, http://www.chictr.org.cn/edit.aspx?pid=45173&htm=4

Background

Peripheral facial paralysis (PFP) occurs from the peripheral neuronal lesion of the facial nerve, which can be either primary (Bell's Palsy) or secondary [1]. Bell's palsy accounts for the majority of PFP, and the severity of the symptoms varies among patients. Approximately 29% of patients with Bell's palsy are known to experience sequelae [2, 3]. A study performed by Peitersen showed that 64% of the older age patients (over 60 years old) could not return to their normal state without treatment [4]. May's research showed that 87% of their study participants with an electromyography ratio (the maximum amplitude accounted for the percentage of normal amplitude) < 10% could not regain normal facial nerve functions

[5]. According to the Sunderland Classification system [6], PFP patients with level 3–5 injury have a probability for developing sequelae [7, 8]. The PFP sequelae include synkinesis, contracture, spasm, crocodile tear syndrome and facial expression muscles atrophy (FEMA) [9]. In a society with a high level of interest in appearance, these symptoms negatively impact on the quality of life by causing psychological or social problems [10–12].

As FEMA occurs in the deep layer below the skin, in all PFP sequelae, it is the one easily ignored by patients and doctors [9, 13]. However, it can be diagnosed by an experienced doctor approximately 3 months after the onset of PFP [14]. If it is not treated properly, it will persist for an extended period or permanently [9].

Studies have documented that acupuncture prevents and alleviates muscular atrophy [15, 16] and improves muscular functions [17, 18]. TEA is a novel subtype of acupuncture treatment that includes the insertion and embedding of certain absorbable medical threads, such as catgut, polydioxanone or polyglycolic acid among others, into subcutaneous tissues or muscles at specific points. Absorbable medical thread provides the function of traditional acupuncture for an extended period through the mechanical and chemical stimulations of the thread. It has been widely used for the treatment of musculoskeletal disease [19–21], obesity [22, 23] and cosmetic problems [24], especially in the reduction of facial wrinkles and improvement of skin elasticity in China and other Asian countries [25]. In addition, TEA has also been used for the treatment of PFP sequelae [26]. However, the clinical efficacy of TEA for FEMA after PFP has not been established. In our hospital, TEA has been used for FEMA after PFP for many years. Most patients obtained a satisfactory curative effect. However, evidence-based clinical research for this treatment has not been done. The safety and efficacy of TEA on facial connective tissues has been investigated in many studies [19–25]. Therefore, we designed this study for a patient-assessor blinded, randomized, sham-controlled trial to explore the efficacy and safety of TEA in the treatment of FEMA after PFP.

Objective

The aim of this study is to assess the efficacy and safety of TEA compared to sham TEA in alleviating FEMA after PFP.

Methods/design

Study design

This is a patient-assessor blinded, randomized, sham-controlled efficacy trial on TEA for alleviating FEMA after PFP. A total of 56 eligible participants will be recruited from the inpatient and outpatient departments of the First Affiliated Hospital of Zhejiang Chinese Medical University. They will be assigned randomly into either the TEA or STEA group. Both groups will be given a total of 8 weeks interventions, with once treatment per week. They will then be followed up regularly for up to 4 weeks after the

completion of the intervention. Changes in facial expression muscle thickness ratio of the affected/healthy side measured by B-mode ultrasonography will be assessed at baseline and at 10 weeks after screening as the primary outcome. Furthermore, the House-Brackmann Grade [27] and lip mobility score [28] will be measured and analyzed as secondary outcomes. Secondary outcomes will be assessed at baseline and at 4, 8, 10 and 12 weeks after screening (Fig. 1, 2). This study protocol has been approved by the Ethics Committee of the First Affiliated Hospital of Zhejiang Chinese Medical University on the Use of Human Subjects for Teaching and Research (approval No.2020-K-084–01) and registered in Chinese Clinical Trial Registry (ChiCTR1900027170). The Standards for reporting interventions in controlled trials of acupuncture (STRICTA) 2010 [29] checklist for items is given in Table 1. The study design also follows the Standard Protocol Items: Recommendations for Interventional Trials (SPIRIT) Checklist (Additional file 7).

Table 1
Checklists for items in STRICTA 2010

Item	Detail
• Acupuncture rationale	1a) Style of acupuncture: Thread-embedding acupuncture
	1b. Reasoning for treatment provided (based on historical context, literature sources, and/or consensus methods, with references where appropriate): By the consensus of a group of clinical experts, and modified from that used in a previous study [26, 30]
	1c. Extent to which treatment was varied: No variation
• Details of needling	2a. Number of needle insertions per subject per session: two predefined points
	2b & 2c. Names of points used and depth of insertion, based on a specified unit of measurement, or on a particular tissue level: 1) Point 1 is located in the frontal (FRO) muscle. Making a straight line from pupil to the front hairline, point 1 is in the middle of the line between the eyebrows and the front hairline. Point 2 is located in the depressor anguli oris (DAO) muscle. Making a vertical line to the mandibular margin through the oral angle, point 2 is 1 cm below the oral angle of the line (Fig. 4). 2) Transverse insertion along the line downward from 1 cm above point 1 or 2 in the layer of target muscle.
	2d. Response sought: None
	2e. Needle stimulation: No additional stimulation
	2f. Needle retention time: No retention time
	2g. Needle type: Thread-embedding acupuncture (Fig. 3)
• Treatment regimen	3a. Number of treatment sessions: Eight
	3b. Frequency and duration of treatment sessions: Once a week for 8 weeks
• Other components of treatment	4a. Details of other interventions administered to the acupuncture group: traditional acupuncture
	4b. Setting and context of treatment, including instructions to practitioners, and information and explanations to patients: Minimized conversation between practitioner and participant
• Practitioner background	5. Description of participating acupuncturists: Specialists of the acupuncture & moxibustion department with at least 3 years of clinical experience

This checklist, which should be read in conjunction with the explanations of the Standards for reporting interventions in controlled trials of acupuncture (STRICTA) items, is designed to replace item 5 in the Consolidated standards of reporting trials (CONSORT) 2010 when reporting an acupuncture trial.

Item	Detail
• Control or comparator interventions	6a. Rationale for the control or comparator in the context of the research question, with sources that justify this choice: Thread removed needle will be used as a comparator. In this manner, the specific effect of thread only will be derived.
	6b. Precise description of the control or comparator. If sham acupuncture or any other type of acupuncture-like control is used (provide details as for Items 1 to 3 above): All conditions other than the use of the thread-removed needle will be the same as those in the experimental group.
This checklist, which should be read in conjunction with the explanations of the Standards for reporting interventions in controlled trials of acupuncture (STRICTA) items, is designed to replace item 5 in the Consolidated standards of reporting trials (CONSORT) 2010 when reporting an acupuncture trial.	

Participants and setting

Patients with FEMA after PFP will be recruited. This study is conducted in the First Affiliated Hospital of Zhejiang Chinese Medical University.

Inclusion criteria

Patients will be eligible for the study if they:

1. Male or female patients aged 18–65 years.
2. Diagnosed with peripheral facial paralysis ≥ 3 months prior to screening.
3. House-Brackmann Grade of the patients' ≥.
4. Atrophic facial expression muscles as revealed by B-mode ultrasonography. The muscle thickness of affected side/healthy side ≤ 90%.

Exclusion criteria

Patients will be excluded from the study if they:

1. Patients with central facial paralysis;
2. Patients with bilateral facial nerve palsy or recurrent facial nerve palsy (more than two occurrences);
3. Patients with a history of hypersensitivity to TEA or severe keloid;
4. Patients with contraindications such as skin diseases or hemostatic disorders (prothrombin time international normalized ratio [PT INR] > 2.0 or taking anticoagulant) that inhibit TEA administration;
5. Pregnancy or nursing;
6. Insufficiency of the heart, lungs, liver, and/or kidneys.
7. Mental illness resulting in inability to comply with the clinical trial protocol; or any other condition that can render the individual unsuitable for inclusion in the trial, as determined by the principle investigator.

Elimination criteria

Patients will be eliminated from the study if they:

1. Inclusion despite non-fulfilment of the inclusion criteria.
2. Lack of exclusion despite fulfilment of the exclusion criteria.
3. Eligible participants who are not on any clinical interventions.

Dropout criteria

Patients will be dropped out from the study if they:

1. Poor compliance to the treatment (lack of adherence to treatment for personal reasons).
2. Serious adverse events, complications, or special physiological changes necessitating discontinuation of the intervention.
3. Voluntary dropout.

Recruitment

Subjects will be recruited through either of the following sources: (1) advertisements in newspapers and internet; patients who are interested can contact research staff by phone; or (2) the department of acupuncture and moxibustion of the First Affiliated Hospital of Zhejiang Chinese Medical University receives a high number of patients with FEMA after PFP. Recruitment advertisements will be released through posters and videos displayed on bulletin boards in the outpatient and inpatient lobbies of the First Affiliated Hospital of Zhejiang Chinese Medical University. If they are interested, they can contact research staff by phone. Informed consent will be obtained from eligible patients (Additional file 1).

Interventions

Treatments will be done by skilled acupuncturists who will strictly follow the detailed procedures for both groups. During the treatment as well as the 4 weeks follow-up period, any other acupuncture or physiotherapy that could impact the results will be prohibited. Drugs prescribed for the participants 4 weeks before the trial will be allowed at the discretion of the investigators depending on whether they can affect the outcomes. Information regarding medications administered to the participants will be recorded in the case report form (CRF).

Standard operating procedures

Needle requirements

Disposable sterile TEA devices will be used in accordance with national standards within the validity period.

The TEA devices are covered with a protective cap before use and comprised of three parts: 0.7*30TWLB disposable hypodermic needle (Kangbao Medical Equipment co. LTD, Jiangsu, China), 0.4*50mm flat head acupuncture needle (Jiachen Acupuncture Medical Equipment co. LTD, Jiangsu, China) and a 1.0-cm absorbable thread (4 – 0', Polyglycolic acid thread made by B. Braun Surgical, S.A, Rubi, Spain) (Fig. 3). The absorbable thread is a major TEA component and is internally buried in the treatment areas. The

flat head acupuncture needle is used to push the thread out of the injection needle head into the body tissue.

Hygiene of the operator

The operator will be required to sterilize his or her hands using a sanitizer and wear sterile gloves and mask before the TEA and STEA procedures. For the acupuncture procedures, the operator will be required to sterilize his or her hands with a sanitizer before operation.

Sterilization of the operation points

Within a 5 cm diameter with the acupoint as the center, the skin over the operation points will be sterilized using a cotton swab twice dipped in 0.45–0.55% povidone iodine.

Procedure

TEA group

Participants in this group will receive TEA treatment at 2 predefined points once a week for 8 weeks. Point selection and details of this procedure were determined by a consensus of clinical experts and modified from those used in previous study [26].

1. Selection of points: Point 1 is located in the frontal (FRO) muscle. Making a straight line from pupil to the front hairline, point 1 is in the middle of the line between the eyebrows and the front hairline while point 2 is located in the depressor anguli oris (DAO) muscle. Making a vertical line to the mandibular margin through the oral angle, point 2 is 1 cm below the oral angle of the line (Fig. 4).
2. Detailed procedures: After covering the patient's eyes and sterilizing the skin, practitioners will perform the intervention procedure. The injection needle with thread will be transversely inserted along the line downward from 1 cm above point 1 or 2 in the layer where the two target muscles are. The handle of the flat head acupuncture needle will be pushed to insert the thread in the target muscle after which the injection needle and the flat head acupuncture needle will be removed. Sterile cotton balls will be used to press local pinholes to prevent bleeding.

STEA group

Participants in this group will receive STEA treatment at 2 predefined points (same as TEA group) once a week for 8 weeks. For the sham control, the procedure will be the same as TEA group except that there will be no thread in the TEA device. Conversations, apart from those essential to the procedure, during interventions will be minimized in order to prevent bias.

Concurrent treatment

As traditional acupuncture is commonly accepted treatment for the sequelae after PFP, in order to improve the adherence to intervention, traditional acupuncture is a concurrent treatment for both groups in this study. Both groups will receive the same traditional needle acupuncture treatment twice a week for 8 weeks. One of the two acupuncture treatments will be given on the same day as the intervention. Hence,

acupuncture treatment will be performed immediately after TEA or STEA. For the acupuncture treatment, a 0.25*40mm disposable acupuncture needle (Jiachen Acupuncture Medical Equipment co. LTD, Jiangsu, China) will be inserted to a depth of 5 mm and retained for 30min in the following 10 acupoints: affected side of GB20, LI4, LR3, GB12, ST7, SI18, LI20, BL2, SJ23, ST4.

Treatment period

All participants will receive TEA or STEA treatment once a week and concurrent acupuncture treatment twice a week for 8 weeks. One of the two acupuncture treatments will be given on the same day as the intervention.

Outcome measures

Primary outcome measure

Facial expression muscle thickness ratio of affected/healthy side as determined by B-mode ultrasonography will be used as the primary outcome measure.

The operator will test the muscle thickness of both sides of frontal muscle as well as depressor anguli oris muscle and calculate the ratio of affected/healthy side.

1. Four test points: both sides of frontal muscle and depressor anguli oris muscle, the points will be the same as the TEA points but on both sides (Fig. 5).
2. Detailed procedure: The examination will be performed in a quiet room with low light and constant room temperature. Participants will lay still for 5 minutes before test. During measurement, they will lay on the examination bed on their back, keep their mouth close and relaxed without making any other expression. All measurements will be done by the same experienced B-mode ultrasonographer.
3. Equipment: GE Logiq9 real-time ultrasonic diagnostic instrument will be used. The probe is M12L with a frequency of 5 ~ 14MHz and the main frequency of 10MHz.
4. Timepoint of the test: Two measurements will be taken: pre-treatment and at follow-up 1 (week 10).

Secondary outcome measures

1. House-Brackmann Grade (H-B Grade), severity of facial paralysis will be assessed using the HB Grade at weeks 0, 4, 8, 10 and 12. Grade I (normal function) to VI (total paralysis) will be evaluated according to facial function at rest and with effort.
2. Lip mobility score. Lip mobility will be assessed using the lip-length index (LL-index) and snout index (S-index) at weeks 0, 4, 8, 10 and 12. The LL-index will be calculated by determining the percentage change in lip length between grinning and resting. The S-index will be calculated by calculating the percentage change in lip length between puckering and resting. Lip length will be measured by determining the inter-commissural distance.

Randomization assignment

All subjects will be randomly assigned to either the intervention or the sham-controlled group. Subjects in the intervention group will receive TEA treatment, whereas the subjects in the sham-controlled group will receive the sham treatment. Random numbers will be generated by a statistician from the Clinical Evaluation and Analysis Centre of The First Affiliated Hospital of Zhejiang Chinese Medical University using SPSS for Windows (Version 22.0; SPSS Inc., Armonk, NY, USA). Sealed opaque assignment envelopes were used for allocation concealment. Those envelopes will be stored in a locker and the key kept by the clinical research coordinator (CRC). CRC will offer the envelopes that correspond to the group allocation to the acupuncturist after completion of recruitment.

Blinding

To achieve participant and evaluator blinding, the clinical research coordinator (CRC) will be the only one allowed to manage the allocation information as well as offer limited information to each researcher in accordance with their roles. The researchers involved in the study will be blinded to the allocation. In both TEA or STEA groups, the participants exhibited the same responses during the procedure. Throughout the whole treatment, the participants' eyes will be covered with a blindfold to prevent them from observing the procedures. Data managers, statisticians, therapists, and interviewers will be independent and shall not be allowed to communicate allocations or other important information among each other.

The conditions for unblinding are: (1) if serious adverse events occur, and the participant has to be withdrawn from the trial, or (2) the end of the trial.

Participants

Sample size

The sample size was calculated on the basis of previous similar studies [26, 30], as well as the advice of an expert group. With an alpha (significance level) of 0.05, a power (1-beta) of 0.90, a dropout rate of 10% and a ratio of 1:1, we determined, using the formula below, that the adequate sample size in each group is 28 participants ($\sigma = 23.30$ and $d = 21.54$):

$$n = 2\sigma^2(Z_{\alpha/2}+Z_{\beta})^2/d^2$$

Data processing and analysis

Descriptive data including the rates of recruitment, dropout, and number of interventions missed will be analyzed and reported as count and percentage. All missing values, efficacy, and safety analyses will be based on the modified intention-to-treat (ITT) principle. Data processing and analysis will be performed at the Clinical Evaluation and Analysis Centre of The First Affiliated Hospital of Zhejiang Chinese Medical University in accordance with the intention-to-treat principle using SPSS Statistics V.22.0. Bilateral test will be used to compare the baseline equilibrium between the 2 groups. Quantitative results will be described by the mean, standard deviation, median (quartile 3–1, Q3–Q1), minimum, and maximum. Qualitative results will be presented as total number and percentages. Grade results with rank meaning will be described by both quantitative and qualitative methods. The chi-square test will be used to

compare enumeration data. The Wilcoxon rank sum test will be used to compare ranked data. A p-value of < 0.05 will be considered statistically significant.

Data management and confidentiality

Two trained research assistants blinded to the treatment group allocation will record the baseline characteristics of all participants, and the results of the facial expression muscle thickness ratio of affected/healthy side tested by B-ultrasonography at the baseline (week 0) and follow-up 1 (week 10). They will evaluate and record the HB Grade and Lip mobility score at weeks 0, 4, 8, 10 and 12. Safety assessment and adverse events will be recorded every week starting from week 1 to week 12. Data from this trial will be collected in the CRF. Changes in the CRF will be recorded by authorized researchers who will provide the date, reason, and signature. After completion of the CRFs, two independent researchers blinded to the group allocation will input the data into an Excel spreadsheet. Data will be crosschecked by the two researchers.

Hardcopy data will be stored in a secure locker and electronic data will be stored in a specified computer with encryption. The principal investigator will have access to all documents, protect the electronic documents with a password and create backups for all documents. The First Affiliated Hospital of Zhejiang Chinese Medical University will be responsible for data storage and management.

Data monitoring and trial steering committee

An independent data monitoring committee (DMC) made up of members from Clinical Evaluation and Analysis Centre of The First Affiliated Hospital of Zhejiang Chinese Medical University. The DMC, blinded to the treatment allocations, will regularly meet to monitor the study data. The DMC will also perform an interim analysis when 50% of patients have been randomized and completed the primary outcome measurement. The First Affiliated Hospital of Zhejiang Chinese Medical University will audit this study for participant enrolment, consent and costs.

Follow-up

After intervention period, there will be twice follow-ups. The researchers will contact the participants by phone or by Wechat app to make sure they will complete the follow-up.

Adverse events

Adverse events (AEs) for acupuncture refers to the occurrence of symptoms or diseases that inhibit the purpose of treatment during or after acupuncture treatment. All AEs associated with TEA or acupuncture will be reported to the researcher by the participants or observed by the researcher. The description of AEs will include, time of occurrence, location of the reaction, level of severity, corresponding management and the necessity for patient withdrawal from the trial. AEs of TEA or acupuncture will be classified as local or systemic reactions according to their location.

Local reactions

Minor bleeding at the needle point.

Subcutaneous bruise.

Subcutaneous haematomas.

Pain in the operated area after operation.

Local allergy in the punctured region after treatment.

Local infection.

Local nodules.

Systemic reactions

Dizziness or fainting during or after treatment.

Systemic allergy.

Systemic infection.

For patients with common adverse reactions, appropriate medical care will be given to ease local bleeding, bruising and so on.

Severe AEs are defined as symptoms or diseases that result in hospitalization or prolonged hospitalization, disability, a life-threatening situation or even death. In this trial, systemic infection and allergy are two major severe AEs. Severe AEs will be reported to the Ethics Committee within 24 hours. The Ethics Committee will provide medical suggestions for the research team and decide on whether the patient should continue with the ongoing treatment. Proper compensation will be given to cover their medical costs.

Modification of the protocol

Any modifications to the protocol, including changes to the study objectives, study design, patient population, sample sizes, study procedures or significant administrative aspects, will require a formal application to the Zhejiang Provincial Administration of Traditional Chinese Medicine as well as the Chinese clinical trial registry.

Dissemination

Initial data will be accessible through the Research Manager (ResMan). The results of this study will be published in open-access and peer-reviewed journals and presented at relevant conferences.

Discussion

Acupuncture has been a primary medical intervention for PFP after acute stage in China [31–33]. It is a common treatment method for patients with FEMA after PFP. However, as traditional acupuncture therapy requires about 3 times of treatment frequency per week, many patients find it difficult to adhere to it. TEA is a new type of acupuncture with a low treatment frequency (once a week). The suture thread, such as polyglycolic acid which has good biodegradability and biocompatibility [34], is widely used in TEA in China. The TEA embedded thread can increase the tensile strength and stimulate myoblast formation in connective tissues [25, 35], and these mechanisms are considered to be the basis for the clinical application of this treatment.

According to the present study protocol, after 8 weeks of treatment, we will choose two target muscles by using B-ultrasonography to check for muscle thickness and thread absorption. STEA will be used as a comparison in this trial to determine the effect of specific intervention factors. As the penetration of traditional acupuncture can also be used for muscular atrophy, STEA is applied to exclude the needle insertion effect. To minimize comparison bias, group allocation will be blinded to participants, assessors, and to the statistician. In addition to TEA in the treatment group and STEA in the control group, both groups will receive the same traditional acupuncture treatment as a concurrent treatment. Other than acupuncture treatment, any treatment that may affect the results will be prohibited.

With regard to the outcome measures, Facial expression muscle thickness ratio of affected/healthy side tested by B-ultrasonography will be used as the primary outcome measure. Frontal muscle and depressor angulioris muscle will be selected as two target muscles for B-ultrasonography. B-ultrasonography is widely used in the measurement of muscle or other soft tissues and disease diagnosis [36]. It is a sensitive detection method for facial muscle thickness, and has the advantages of safety, non-invasion, simple operation and cheap price [37–39]. Studies have shown that there is no significant difference in bilateral expression muscle thickness in normal humans [40, 41]. Therefore, the thickness of healthy facial expression muscles can be used as a contrast for atrophic facial expression muscle side. The test will be performed at week 0 and week 12. Because improvements of the muscle structure and strength need long time recovery, the final test was set at two weeks after treatment.

In the evaluation of TEA treatment for FEMA, the whole facial expression muscles function recovery is very important. The physical functions that affect the patient's daily activity will be assessed via H-B Grade and lip mobility score as the secondary outcome measures.

In summary, we have described a protocol for a pilot RCT to evaluate the efficacy and safety of thread embedding acupuncture for facial expression muscles atrophy after Peripheral facial paralysis.

These findings will lead to a greater understanding of TEA and highlight the treatment as a therapeutic option for patients with facial expression muscles atrophy after Peripheral facial paralysis.

Trial status

This study protocol version number is 1.0, dated 10 July 2019. The participants have been recruited for the present study since October 2020. Ten patients are under treatment. And the recruitment will be completed at March 2022.

Abbreviations

PFP
Peripheral facial paralysis; FEMA:facial expression muscles atrophy; TEA:thread-embedding acupuncture; STEA:sham thread-embedding acupuncture; CRF:Case report form; H-B Grade:House-Brackmann Grade; CRC:clinical research coordinator; STRICTA:Standards for reporting interventions in controlled trials of acupuncture

Declarations

Acknowledgements

Not applicable.

Authors' contributions

BY conceived and drafted the protocol; LX designed the trial. SL contributed to the sample size calculation and wrote the statistical analysis plan; YJ drew the flow charts; SC and YW prepared the figures and tables. All authors have read and approved the final manuscript.

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Availability of data and materials

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

Ethics approval and consent to participate

This study protocol has been approved by the Ethics Committee of the First Affiliated Hospital of Zhejiang Chinese Medical University on the Use of Human Subjects for Teaching and Research (approval No.2020-K-084–01). Consent is obtained from every participant.

Consent for publication

Written informed consent was obtained from the patient(s) for publication of this manuscript and accompanying images.

Competing interests

The authors declare that they have no competing interests.

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Figures

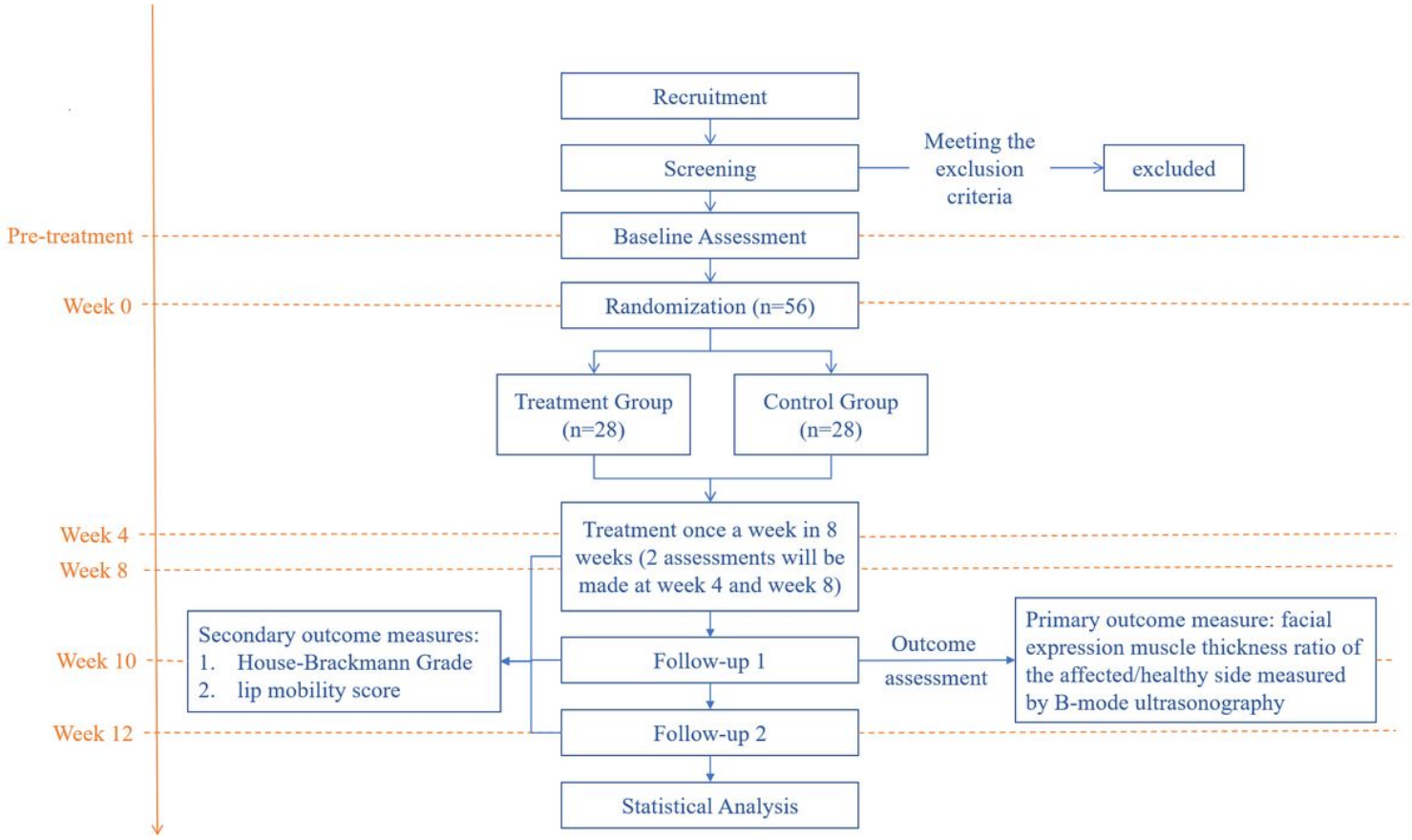

Figure 1

Flow chart for our randomized controlled trial on the efficacy and safety of TEA for FEMA after PFP.

STUDY PERIOD											
Timepoint/week	Enrollment	Intervention								Follow-up	
	-1~0	1	2	3	4	5	6	7	8	10	12
ENROLMENT:											
Informed consent	●										
Demographic characteristics	●										
Medical history	●										
Physical examination	●										
B-ultrasonography	●										
H-B Grade	●										
Lip mobilityscore	●										
Inclusion/Exclusion criteria	●										
Random allocation		●									
INTERVENTIONS:											
TEA treatment		○	○	○	○	○	○	○	○		
Sham TEA treatment		◎	◎	◎	◎	◎	◎	◎	◎		
Concurrent treatment		●	●	●	●	●	●	●	●		
ASSESSMENTS:											
B-ultrasonography	●									●	
H-B Grade	●				●				●	●	●
Lip mobility score	●				●				●	●	●
Blinding test		●				●					
Safety assessment		●	●	●	●	●	●	●	●	●	●
Adverse events		●	●	●	●	●	●	●	●	●	●

Note: ●Common in both groups. ○TEA group only. ◎Sham group only. H-B Grade: House-Brackmann

Figure 2

Schedule of enrollment, interventions, and assessments

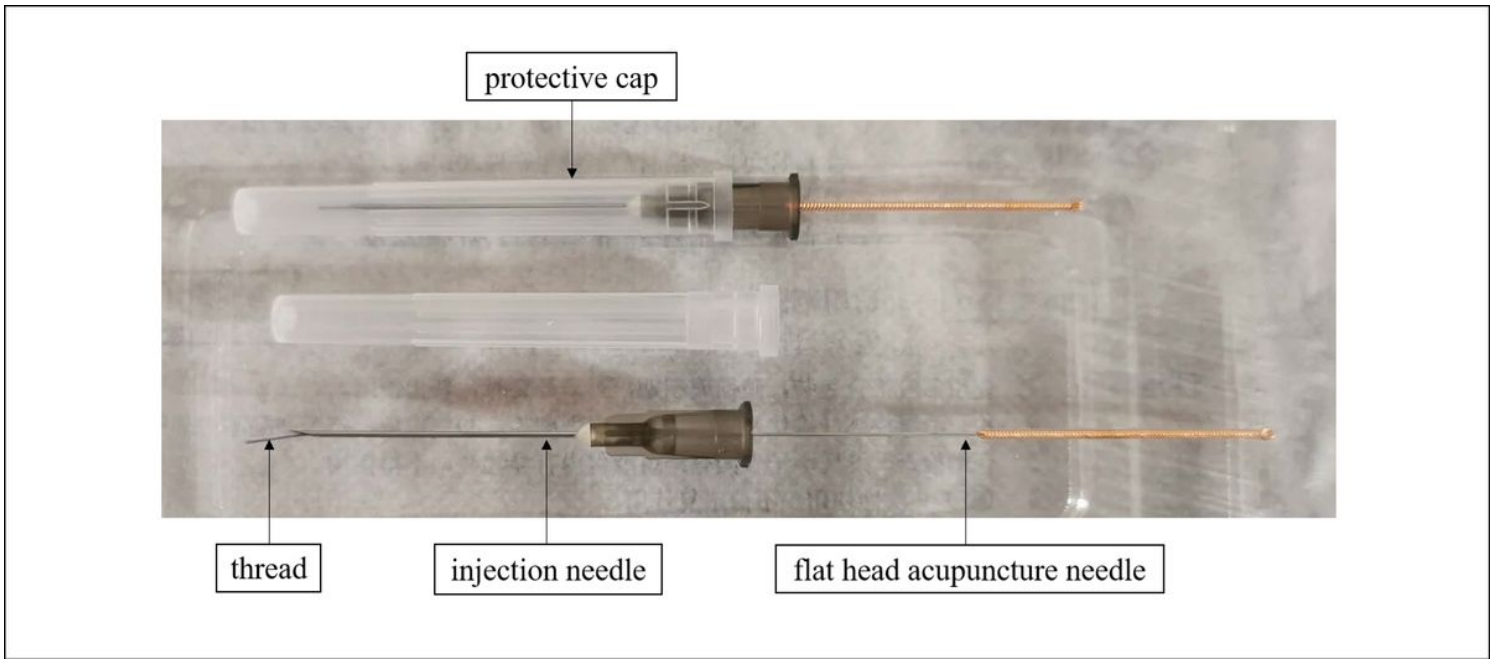

Figure 3

Parts of a thread-embedding acupuncture device.

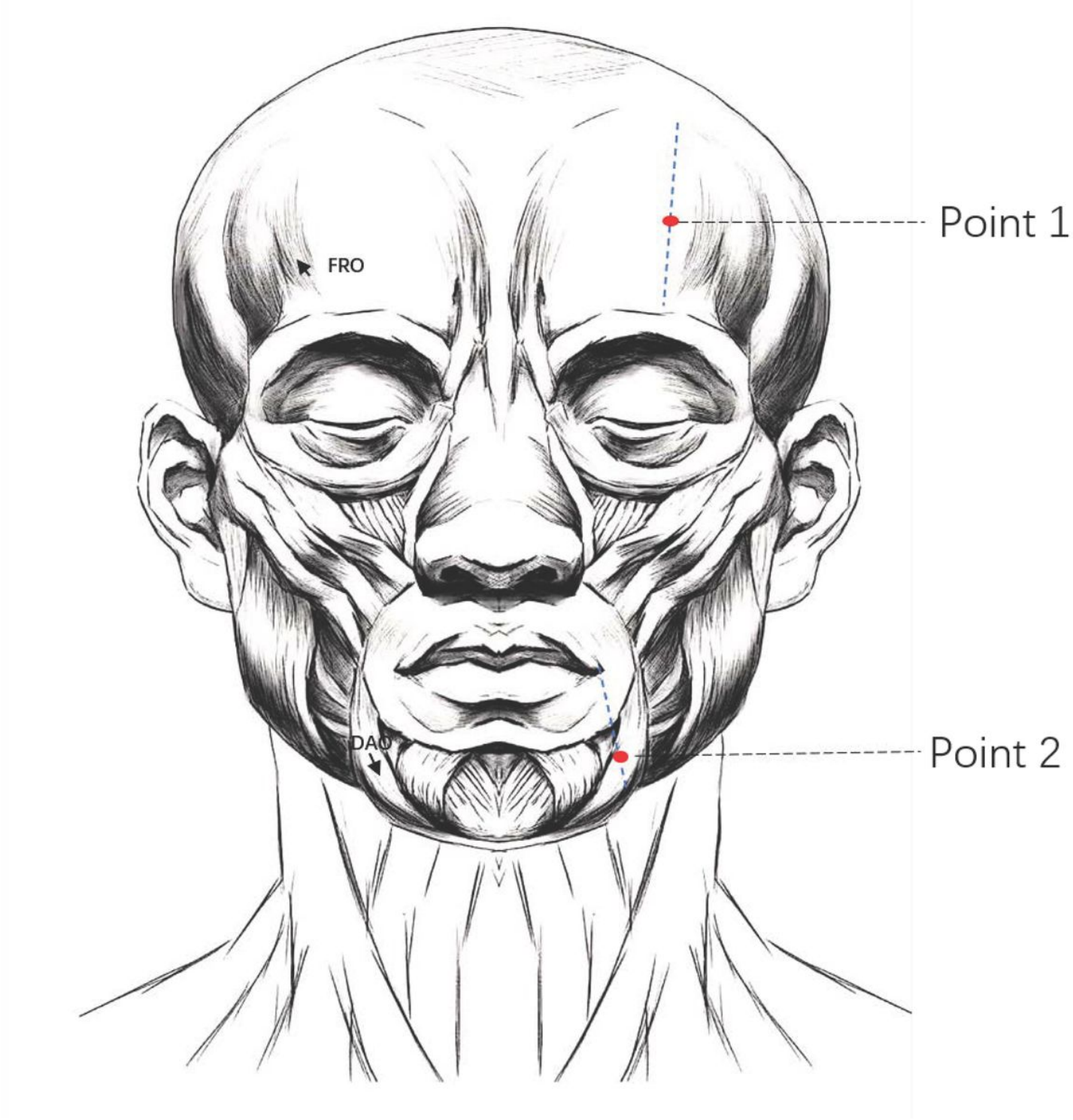

Figure 4

Location of the two operation points.

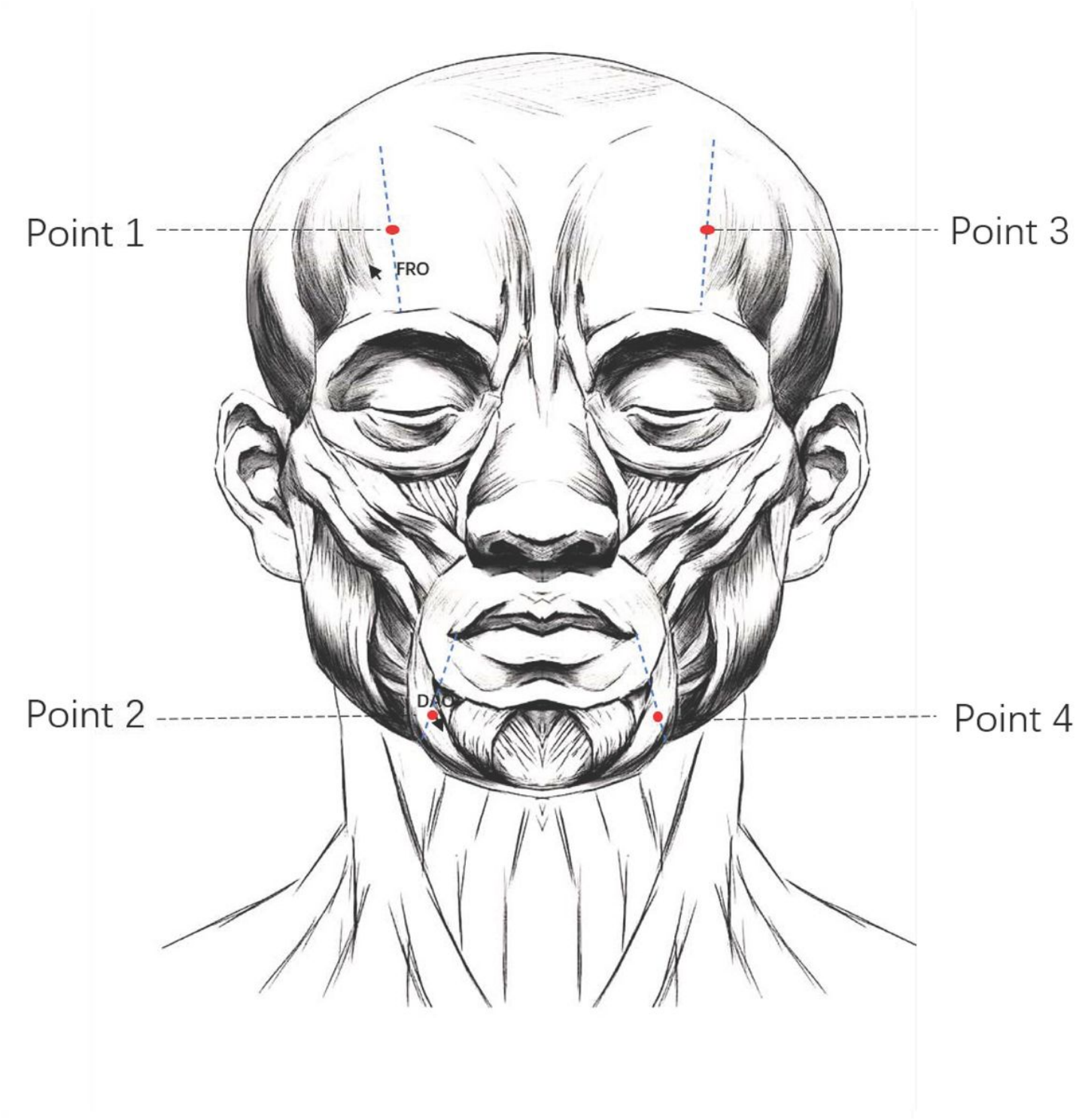

Figure 5

Location of the four operation points

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SupportingFile1Informedconsent.doc
- SupportingFile2SPIRITchecklist.doc