Moxibustion for the treatment of pressure ulcers: study protocol for a pilot, multicentre, randomised controlled trial

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ABSTRACT
Introduction: Pressure ulcers are common in the elderly and immobile. Currently, there are few proven effective treatments for pressure ulcers. This trial aims to evaluate the feasibility, efficacy and safety of moxibustion for pressure ulcers.

Methods/analysis: This is a multicentre, two-armed, parallel-design randomised controlled trial (RCT). 30 eligible patients with pressure ulcers will be randomised in a ratio of 1:1 to the treatment group and control group. The participants in the treatment group will undergo indirect moxibustion for 30 min before application of a dressing, one session daily, five sessions weekly for 4 weeks. The pressure ulcer scale for healing (PUSH Tool), visual analogue scale (VAS) and adverse events. All outcomes will be evaluated at the beginning of the study, at the end of the second week, at 4 weeks after randomisation and at 1 and 3 months after treatment cessation.

Ethics/dissemination: This trial has undergone ethical scrutiny and been approved by the ethics review boards of First Affiliated Hospital of Heilongjiang University of Chinese Medicine and Second Affiliated Hospital of Heilongjiang University of Chinese Medicine. The results of this study will provide clinical evidence for the feasibility, efficacy and safety of moxibustion for pressure ulcers.

Trial registration number: ChiCTR-TRC-13003959.

BACKGROUND
A pressure ulcer (ie, bed sore, pressure sore, decubitus ulcer) is defined as a localised injury to the skin and underlying tissue layers affecting the muscle, tendon and bone as a result of constant pressure due to impaired mobility.1 2 Pressure ulcers are often caused by pressure, shear, friction or a combination of these.3 Common sites for pressure ulcers include the back of the head, shoulder blade, elbow, lower back, hip, pelvic bone, ankle and heel.4 Pressure ulcers are generally classified into four stages (stages I, II, III and IV) according to the European Pressure Ulcer Advisory Panel and National Pressure Ulcer Advisory Panel guidelines (EPUAP/NPUAP).3

The prevalence of pressure ulcers across studies varies from 8.8% to 53.2%,5–8 and incidence rates range from 7% to 71.6%.7 9–10 It has been estimated that the annual treatment cost of pressure ulcers ranges from £1.4 to £2.1 billion (Great British pound), which is broadly equal to the total UK National Health Service expenditure on mental illness, or the total cost of community health services.11 Effective and adequate prevention is an important issue for patients, clinicians and policymakers.

Moxibustion is a popular and safe intervention used to manage various conditions, such as breech presentation,12 facial paralysis,13 chronic fatigue,14 knee osteoarthritis15 and type 2 diabetes mellitus.16 In addition, moxibustion has been found to be effective in treating pressure ulcers.17 18 However, most prior case reports, case series or clinical trials were without a control group, resulting in poor quality of these studies. Considering these methodological flaws, we will conduct a multicentre RCT to investigate the effectiveness and safety of moxibustion. The results of this study will provide evidence for the feasibility of a large clinical trial, and yield data to determine the appropriate sample size for future large-scale RCTs of moxibustion in patients with pressure ulcers.

METHODS/DESIGN
Objective
The primary objective of this study is to assess the feasibility of moxibustion treatment for pressure ulcers and obtain preliminary
safety and efficacy data to inform a future, larger RCT in
the same patient population.

Design
This is an assessor-blinded and analyst-blinded, rando-
mised, controlled clinical trial with two parallel arms. The
trial will be conducted at two clinical centres in China:
First Affiliated Hospital of Heilongjiang University of
Chinese Medicine and Second Affiliated Hospital of
Heilongjiang University of Chinese Medicine, between 29
May 2014 and 31 December 2016. This protocol has been
approved by the ethics review boards of First Affiliated
Hospital of Heilongjiang University of Chinese
Medicine and Second Affiliated Hospital of Heilongjiang
University of Chinese Medicine with permission number
HZYELP2014. Written informed consent will be obtained
from all study participants prior to enrolment. JHY will
approach potential participants and invite them to partici-
pate in the study, and CRL will ask them to complete the
consent process.

Eligible patients will be randomised in a ratio of 1:1 to
the treatment group (moxibustion plus dressing) and
control group (dressing), and receive treatment for
4 weeks. Patients will be followed up for 3 months
(figure 1 and table 1). Outcome measures will be assessed
at baseline, as well as at the end of the second and fourth
week after randomisation, and at 1 and 3 months after
treatment cessation. Results will be analysed by profes-
sionals blinded to the group allocation. This protocol has
been registered with the Chinese Clinical Trials Register, a
registry in the WHO Registry Network.

Figure 1  Flow chart of study
process.
broken only after the participant has met all selection criteria and completed the baseline assessments. The participants will know the allocated group, but the outcome assessors and data analysts will be masked to the intervention allocation.\textsuperscript{19}

**Blinding**
In moxibustion research, it is not feasible to conceal allocation from the practitioners. In addition, it is not possible to prevent participants from knowing if they have received moxibustion treatment or dressing intervention, or both. The treatment and assessment will be performed independently. The outcome assessors and the data statistical analysts will be blinded to treatment allocation throughout the study.

**INTERVENTION**

**Treatment group (moxibustion plus dressing)**
The participants receiving moxibustion treatment will be treated indirectly at a distance of 2–3 cm from the wound surface for 30 min per session, with one session daily and five sessions weekly for 4 weeks. In addition, a dressing will be applied in one session daily and five sessions weekly for 4 weeks.

**Control group (dressing)**
The format of the dressing intervention will be the same as in the treatment group.

**OUTCOME MEASURES**
The wound surface area (WSA), proportion of ulcers healed within trial period (PUHTP), Pressure Ulcer Scale for Healing (PUSH Tool) and visual analogue scale (VAS) will be the outcomes used to assess efficacy. Adverse events will be recorded to assess safety.

**Primary outcomes**

**Wound surface area**
The WSA\textsuperscript{20} of the pressure ulcers will be measured by the use of acetate tracing and subsequent planimetric determination. Ulcer tracings will be accomplished by outlining the pressure ulcer circumference onto a transparent film applied directly over the wound. Each ulcer will be traced three times by two assessors, respectively, in order to improve the accuracy of these tracings. A third assessor will determine the ulcer surface area from the wound tracing using a planimeter (KP-21C). All three assessors will be blinded to the identities of the patients and to the treatment group assignments.

**Proportion of ulcers healed within trial period**
Completely healed ulcers will be defined as 100% epithelisation or skin closure without drainage.\textsuperscript{20}

**Secondary outcomes**

**Pressure ulcer scale for healing**
The PUSH Tool\textsuperscript{21} was developed by the NPUAP as a quick, reliable tool to monitor the change in pressure ulcer status. This tool categorises ulcers with respect to surface area, exudate and type of wound tissue. Subscores for each of these ulcer characteristics will be recorded and then added to obtain the total score. A comparison of total scores measured over time provides an indication of the improvement or deterioration in pressure ulcer healing.

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**Table 1** Time of visits and data collection

<table>
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<tr>
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<th>Baseline (−1 Week)</th>
<th>Treatment phase</th>
<th>Follow-up phase (end of treatment)</th>
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<tbody>
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<td>Patients</td>
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<td>Intervention</td>
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<tr>
<td>Treatment group (n=18)</td>
<td>20 sessions of moxibustion plus dressing</td>
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<tr>
<td>Control group (n=18)</td>
<td>20 sessions of dressing</td>
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<td>Outcomes</td>
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<td>WSA</td>
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<td>PUHTP</td>
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<td>PUSH Tool</td>
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<td>Participant safety</td>
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</table>

PUHTP, proportion of ulcers healed within trial period; PUSH Tool, Pressure Ulcer Scale for Healing; VAS, visual analogue scale; WSA, wound surface area.
Visual analogue scale
The pain intensity of pressure ulcers will be assessed using the 100 mm VAS (0, absence of pain; 100, the worst pain imaginable). In order to evaluate the clinical severity and impact on activities of daily life in patients with bedsores, the VAS is selected as a secondary outcome measurement.

STATISTICAL METHODS
Sample size
Although several studies have investigated the effects of moxibustion on pressure ulcers, no RCTs have assessed the effects of moxibustion on pressure ulcers. There is no previous study on which to base the sample size calculation. Therefore, this pilot study will evaluate the efficacy and safety of moxibustion and feasibility of clinical trials. Taking into account the minimum number of subjects necessary to evaluate the efficacy of moxibustion, this pilot study will include 36 participants (18 in each group) with an expected dropout rate of 20%.

Statistical analysis
Data will be analysed by a statistician blinded to the group allocations using the Statistical Package for the Social Sciences (SPSS) V.17.0 statistical software package. Significant levels will be reported at $p<0.05$. Data analysis of baseline characteristics, and of primary and secondary outcomes will be based on the intention-to-treat (ITT) principle. If an adjustment for possible baseline incomparability is needed, analysis of covariance will be conducted. If the measurement data of WSA, PUSH and VAS have non-normal distributions, the Wilcoxon rank sum test will be used. If the measurement data have normal distributions, the t test will be used. In the case of proportions, the $\chi^2$ or Fisher exact test will be applied (eg, PUHTP).

Patient safety
Any adverse events (described as unfavourable or unintended signs, symptoms or diseases occurring after treatment) related to moxibustion treatment will be observed and reported by patients and practitioners during each patient visit. In addition, all vital signs and adverse events will be measured and recorded at each visit.

Quality control
All staff will be required to undergo special training before participating in the trial. For example, staff will be trained to select participants and to conduct the moxibustion intervention. The monitors will check study protocol compliance and informed consent documents and assess the progress of the study, including participant recruitment, moxibustion intervention and data quality, at each centre once a month. Dropouts and withdrawals from the study will be recorded through the intervention and follow-up periods.

DISCUSSION
The objective of this study is to evaluate the effectiveness and safety of moxibustion for treating pressure ulcers. We designed this study to determine the efficacy and safety of moxibustion in the treatment group (moxibustion plus dressing) versus the control group (dressing). The results of this study will determine if moxibustion is an effective therapy for pressure ulcers.

The outcomes of WSA, PUHTP, PUSH Tool and VAS are well-evaluated pressure ulcers. This pilot study will provide data on the efficacy of moxibustion for pressure ulcers through a follow-up period of 3 months after the completion of the treatment. An assessment of these outcomes will also be needed in a future long-term clinical trial.

In addition to appropriate outcome measures, the use of an appropriate control group is a critical issue in designing a high-quality clinical trial. The purpose of this study is to clarify whether moxibustion is effective in patients with pressure ulcers, and we have planned a pragmatic design using a dressing intervention in the control group. This pragmatic trial comparing moxibustion plus dressing with dressing alone can provide evidence focused on the effectiveness of moxibustion.

In conclusion, this pilot, assessor-blinded and analyst-blinded, multicentre RCT will investigate the efficacy and safety of moxibustion for pressure ulcers, assess the feasibility and relevance of a moxibustion therapy study design, and provide a clinical foundation for future, large-scale, multicentre clinical trials.

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Contributors
J.-hY and Q.-zS contributed equally to this work. Q.-zS and Z.-rS conceived the study and designed the study protocol. J.-hY and C.-rL drafted the manuscript. Q.-zS and Z.-rS sought funding and ethical approval. All authors contributed to the further writing of the manuscript as well as read and approved the final manuscript.

Competing interests
None.

Patient consent
Obtained.

Ethics approval
The ethics review boards of First Affiliated Hospital of Heilongjiang University of Chinese Medicine and Second Affiliated Hospital of Heilongjiang University of Chinese Medicine.

Provenance and peer review
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