Changes in finger temperature and blood flow in response to different frequencies of transcutaneous electroacupuncture at LI4 (hegu).

Interim analysis and ‘real life’ methodological issues: many factors, missing data and a multiplicity of measures

Background
- In previous studies, we used finger plethysmography to assess pulse rate variability as a measure of autonomic function. Here we use it to assess local blood flow, itself an index of sympathetic activity, along with skin temperature measurement. Both are commonly used to assess arousal/relaxation levels.
- We also calculated the pulse transit time (PTT), which has been used to assess arterial stiffness, systolic blood pressure and the effects of stress, but has never before been investigated in acupuncture research.
- Transcutaneous electroacupuncture (TEA) is a noninvasive variant of electroacupuncture (EA). The literature is inconsistent about the effects of EA or TEA stimulation frequency on blood flow and temperature.
- The main purpose of this poster is to explore the effects of TEA frequency on local blood flow, PTT and temperature.

Methods used to assess effect/change
- Data means or medians
- Data raw, or processed to correct for artefacts
- Values compared directly in different slots (DIRECT)
- Ratio (or difference) of slot values compared to baseline (BASE)
- Ratio (or difference) of values compared in slots immediately before and after any 2 slots of interest (PRE-POST)
- During stimulation, or 5 or 10 minutes post-stimulation
- Compare findings for raw and corrected data
- Corrupted/missing data omitted (‘Good’) or included (‘All’)
- Non-parametric comparisons and correlations
- Correlation ratio eta (η) − indicating relative importance of factors
- Sample size estimation, and Cohen’s effect size (d or dz)

Some treatments factors considered
- Participant (& Age, Gender)
- Prior experience (acup, EA, TENS)
- Presence of muscle twitch
- Slot sequence

Which factors are important? Some numerical results

<table>
<thead>
<tr>
<th>Blood flow</th>
<th>Eta (η)</th>
<th>Sample size for significance</th>
<th>Cohen's d (or dz)</th>
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<tbody>
<tr>
<td>Hz</td>
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<td>Temperature</td>
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Salient RESULTS

Fig 3. TEA at 2.5 Hz consistently but not significantly resulted in greater blood flow, and 80 Hz in longer PTT, than at the other two stimulation frequencies (frequency effects on temperature were inconsistent, small and not significant):

Fig 4. Left: For most participants, the association between skin blood flow and temperature was significant and positive, with both tending to peak together shortly after TEA. Right: However, over the session time both decreased overall:

Conclusions
- Further recruitment of participants is planned to consolidate our findings, in part because some data was missing or corrupted.
- PTT may be helpful in assessing short-term changes in acupuncture-related research, but only if high sampling rates are used.
- Future analysis should use multilevel modelling to take account of multiple factors and their interactions.

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Left: Sensors and electrodes: fingertip BVP, one ECG electrode on right forearm, and TEA electrodes at LI4 and ulnar edges of both hands.

Right: ECG and BVP traces. Showing BVP amplitude and peak-to-peak PTT.

Fig 1

Objectives
To assess how treatment factors such as stimulation frequency contribute to changes in local blood flow, skin temperature and pulse transit time (PTT)

Protocol
17 participants each attended for a single session consisting of 10 consecutive 5-minute ‘slots’. In the second, fifth and eighth slots, TEA was applied bilaterally at LI4 (hegu) at three different frequencies (2.5 Hz, 10 Hz and 80 Hz), in counterbalanced order and at a ‘strong but comfortable’ intensity. Using finger photoplethysmography, with a thermistor on the same finger, the blood volume pulse (BVP) and temperature were monitored throughout. Electrocardiograph (ECG) signals were collected from wrist electrodes [Fig 1]. Blood flow was assessed from smoothed and unsmoothed measures of BVP amplitude, and pulse transit time (PTT) from the lag between the ECG ‘R’ and BVP systolic peaks [Fig 2].

Technical challenges encountered
- Thermistor did not work for 5 participants (missing data)
- Data drop-out of unknown origin and pattern in 62 slots (38%)

Some other factor findings

Fig 5. Prior experience (of any of acup, EA or TENS) enhances blood flow (p<0.001 during and after Stim) and PTT (p=0.04 during Stim):

Fig 6. Muscle twitch in the left hand only (L) results in lower blood flow than no twitch; bilateral twitch leads to more blood flow than L or R twitch, but R twitch appears to enhance PTT more than bilateral twitch (n.s.):

Further information available at www.qeeg.co.uk/electroacupuncture/bloodflow, also accessible through the QR code at the head of this poster.

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Where next?
- Further recruitment of participants is planned to consolidate our findings, in part because some data was missing or corrupted.
- PTT may be helpful in assessing short-term changes in acupuncture-related research, but only if high sampling rates are used.
- Future analysis should use multilevel modelling to take account of multiple factors and their interactions.

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