Reviewer's report

Title: Electrical Impedance along Connective Tissue Planes Associated with Acupuncture Meridians

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Reviewer: Stephen Birch

Reviewer's report:

This is a good and innovative study that should be published with some small modifications.

- Minor Essential Revisions

1/ The modern Chinese acupuncture literature generally suggests that the channel flows at the depths at which de qi™ is obtained. De qi™ is generally said to occur at the recommended depth of insertion given for each acupuncture point. If the hypothesis of the research team is correct that the channel system is associated with connective tissue structures and that these structures possess the property of decreased impedance, it will be important that all measurements be made at the correct depth for each channel. The measurement electrodes were inserted to the same depth of 10mm. It is therefore important to see if the regions of the spleen channel (between SP-6 and SP-7) and the pericardium channel (between PC-3 and PC-4) lie at the same depth or at least will be penetrated by 10mm deep electrodes.

Historically, in Ling Shu chapter 12, it is recommended that the spleen channel be needled somewhat deeper than the pericardium channel. This suggests that the channels may not lie at the same depths. Since both historical and modern textbooks give a recommended depth of insertion for each acupoint, it is possible to see if the segments of the spleen and pericardium channels that were measured lie at the same depth by looking at the recommended needling depths of the 4 spleen and pericardium points that lie immediately above and below each measured segment. Each acupoint is given a range of recommended needle depths such as 0.5-1.0 cun from which the mean depth can be calculated.

The needling method used to generate the hypothesis that acupuncture needles entwine connective tissue and that the connective tissue below each point may correlate to the channels (Langevin et al. 2002) is the modern Chinese method. This method was developed to elicit the sensory stimulation that is called de qi™ in modern texts (Birch, Felt 1999), thus I shall examine only modern texts and not historical texts. The table below gives the mean depth of insertion recommended from five modern Chinese texts or modern Chinese based texts.

<table>
<thead>
<tr>
<th></th>
<th>Modern Chinese texts</th>
<th>Modern Chinese texts SP-6</th>
<th>Modern Chinese texts SP-7</th>
<th>Modern Chinese texts PC-3</th>
<th>Modern Chinese texts PC-4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anon (1980)</td>
<td>0.75 cun</td>
<td>0.75 cun</td>
<td>0.65 cun</td>
<td>0.65 cun</td>
<td></td>
</tr>
<tr>
<td>O'Connor, Bensky (1981)</td>
<td>1.75 cun</td>
<td>1.25 cun</td>
<td>0.75 cun</td>
<td>1.25 cun</td>
<td></td>
</tr>
<tr>
<td>Cheng (1987)</td>
<td>0.75 cun</td>
<td>0.75 cun</td>
<td>0.6 cun</td>
<td>0.75 cun</td>
<td></td>
</tr>
<tr>
<td>Ellis et al. (1988)</td>
<td>0.65 cun</td>
<td>0.65 cun</td>
<td>0.6 cun</td>
<td>0.65 cun</td>
<td></td>
</tr>
<tr>
<td>Qiu (1993)</td>
<td>1.25 cun</td>
<td>1.25 cun</td>
<td>1.25 cun</td>
<td>1.0 cun</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>1.03 cun</td>
<td>0.93 cun</td>
<td>0.77 cun</td>
<td>0.86 cun</td>
<td></td>
</tr>
</tbody>
</table>

While the minimum depth of insertion for each point is similar, the mean recommended depths are different suggesting that the spleen channel lies deeper than the pericardium channel. The region
between SP-6 and SP-7 lies around 0.98 cun deep while the pericardium channel region between PC-3 and PC-4 lies around 0.84 cun deep. One can thus see that the general indicated depth of needling for the spleen channel region that was measured is about 17% deeper than pericardium channel region that was measured.

This offers another interpretation of the findings of this study: that the electrodes may have been able to make better contact with the pericardium channel than the spleen channel because the fixed electrode depth of 10mm may have been too shallow to have made good contact with the spleen channel. This possibility should probably be discussed by the authors in the paper.

2/ Page 12: in citing a number of other studies that attempted to measure electrical impedance the authors state â€˜two electrodes were used to introduce a constant electrical currentâ€™. This is inaccurate. One of the faults of many of the cited studies was that they used constant voltage rather than constant current measurements which can produce artifacts that make the findings of those studies difficult to interpret. Thus the sentence probably needs to be modified.

- Discretionary Revisions

3/ Omura and others (Omura 1987, Falk et al 2000) suggested that high frequency measurement current (such as the 3.3 kHz used in the study) can damage tissues and thus lower electrical impedance, while low frequency (2-5 Hz) does not appear to do this. How was this issue addressed in the study or did other considerations counter this possibility?

4/ The 4 electrode method seems to be a standard method for measuring impedance in the physical sciences, such as measuring the electrical impedance of the earth. However, to my knowledge the earth does not generate a current of injury upon insertion of a needle into it, but living bodies do generate currents of injury. While, as the authors argue, the method may be able to bypass some of the artifactual problems of other measurement approaches that have been used when attempting to measure the electrical impedance of the skin, it may introduce other artifacts. Is there evidence that the act of insertion of the measurement electrodes does not influence the findings in living adaptable biological tissues such as the human arm and leg due to effects from the current of injury? Are there any thoughts about how this may produce artifacts in the study?

References


What next?: Accept after minor essential revisions
Level of interest: An article of importance in its field

Quality of written English: Acceptable

Statistical review: No

Declaration of competing interests:
I declare that I have no competing interests