Reviewer's report

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

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Reviewer: WA Tiller

Reviewer’s report:

Evaluation and Recommendation

This is a nice clean study and a very good beginning on a difficult experimental problem that will require much more work by this excellent team before the central question can be adequately answered. They did as well as one could with the procedure they used and the findings are provocative but not revealing. The Reviewer’s technical comments are attached and these must be seriously considered before taking the next step in this study.

The central problem here is that the medium being investigated electrically is multiphase and thus heterogeneous, with each phase probably being anisotropic in electrical properties. Their central question is “can one determine an overall channel of electrical impedance minimum through this complex medium that one could associate with an acupuncture meridian?”

This Reviewer would like to see this paper published but only after a mandatory revision to the discussion section that reflects the true essence of the experimental difficulty here (as sketched by the Reviewer’s technical comments). Two or three paragraphs to make the reader aware of the real difficulty here should be sufficient.

Reviewer’s technical comments

1. Some experimental data exists to suggest that an acupuncture point (A.P.) on the surface of the skin has a diameter ~1 mm and that its centroid may wander ~4-5 mm from day to day.
2. Some experimental data on biological materials exists to suggest that they are mostly of a semiconductor type and that, for heterogeneous biological materials, one must expect that electrical heterojunctions with diode-like characteristics will be present at all internal interfaces between different biological structures so AC currents do not eliminate internal charge storage effects.
3. Some experimental data from surface electrode techniques on skin have shown that at least two in-series, electrical response systems are present: (a) one with a frequency-dependent admittance whose relax time constant is in the ~1-10 m sec range (Motoyama) and (b) one with a frequency-dependent admittance whose relaxation time constant is ~1-10 sec (Voll).
4. In the experimental set-up for the present study, the current electrodes are ~5 cm apart and ~1 cm deep into the skin. Thus, in the plane of the skin, one expects the map of current flow lines to bulge out in the middle regions to ~5 cm for isotropic properties. However, because the volume being sampled is both anisotropic in electrical properties and heterogeneous in structure, one does not know the current density map point-to-point but only the total integral current flowing between the two outer electrodes. Thus, with this measurement technique, as is, one cannot obtain a reliable electrical impedance map. The present technique is only well suited for measurements one single phase materials with relatively isotropic properties.
5. The use of the words “control electrodes” are meaningless here and taking the difference between meridian and control just yields some level of anisotropy (if you actually knew the current density profile). I think you need a two dimensional array of central electrodes where, with constant
AC current, you measure both the voltage profile and phase angle difference profile relative to this total driving current. Then, you drive the two outer electrodes (former current electrodes) at constant AC voltage (same frequency) and use your inner electrodes to measure a new voltage distribution profile and phase angle profile. From such an array of information, it is possible to get a much, much clearer picture re the authors initial question for this study.