Niels Jonassen

Acupuncture and Atmospheric Ions

New experiments look at the effect of acupuncture needles on the number of ions arriving to a body in an electric field.

For centuries, acupuncture—the subcutaneous insertion of needles in certain parts of (mostly) the human body—has been practiced for diagnostic as well as remedial purposes. Plenty of reports have noted the surprising effects of acupuncture on many types of diseases or discomforts. It should be stressed, however, that these reports are normally anecdotal, often collections of single cases, and are rarely based on strict scientific investigations such as double-blind tests, etc. These reports also fail to explain why and how acupuncture works (if it does).

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Volumes are written about acupuncture practices relative to various ailments. Almost all of these treatises talk about meridians and acupuncture points, but very little can be found in terms of explaining scientifically why the insertion of a needle in one of these points should have any kind of effect.

For the sake of the argument, assume that meridians and acupuncture points are scientific facts and that they represent especially sensitive zones of the body. Is there then a way that a needle in such a point might interact physically with the environment?

It has been suggested that a flow of unipolar atmospheric ions plating out on the skin of a grounded person gives rise to effects similar to those claimed to be associated with acupuncture.[1] If it is assumed that a static electric field exists around the person, the needle will distort the field (see Figure 1) and attract (more) atmospheric ions to the person. The ions will be neutralized when arriving at the needle, resulting in a current through the body, possibly along meridians or other paths of low resistance.

I decided to demonstrate this effect. However, the currents involved in these processes are very low (on the order of 10^{-14} A, or even lower). Therefore, it would have been extremely difficult to measure directly the current flowing to a person caused by an acupuncture needle. Even a person's unavoidable movements (e.g., breathing) would interfere negatively with the measurements.

Experiment

It was decided to try to simulate the situation shown in Figure 1. The setup used for the simulation is shown in Figure 2. Between two metallic field plates (0.35×0.35 m^2) at a distance d, an electric field is established. One plate was connected to a high-voltage supply; the other plate was virtually grounded through an electrometer. The field plates were placed about 0.5 m above the floor in an approximately 70-m^3 room. The electrometer was connected to a recorder because the presence of persons in the room during measurements would interfere with the results.

If the voltage difference between the field plates is V, an electric field exists between the plates with the mean value of

$$E = \frac{V}{d} . \qquad (1)$$

With the experiments performed in this investigation, the voltage V was negative; i.e., negative ions were driven toward the plate connected to the electrometer (and positive ions in the opposite direction).

A series of measurements were performed where the voltage V and the distance d were varied. For each value of V and d (i.e., for a given field strength E, Equation 1), the mean value of the current I to the electrometer was calculated from the charge q integrated over the measuring time t by

$$I = \frac{q}{t} . \qquad (2)$$

In the first series of measurements, both field plates were planar and even. To simulate the effect of an acupuncture needle, a sewing needle was mounted in a hole in the field plate connected to the electrometer. Figure 3 illustrates the difference between the two situations. Figure 3a shows the homogeneous field with no needle, and Figure 3b shows the distorted field around the needle.

Figure 4 shows an example of the relationship between the current I and the mean field strength E with and without a needle. It appears that the relationship is linear with the inclinations.

$$\text{No needle} = \frac{dI}{dE} = 2 \cdot 10^{-17} \frac{A}{V \cdot m^{-1}} = 2 \cdot 10^{-17}\ \Omega^{-1} \cdot m \ . \qquad (3)$$

$$\text{Needle} = \frac{dI}{dE} = 2.5 \cdot 10^{-17}\ \Omega^{-1} \cdot m \ . \qquad (4)$$

Equations 3 and 4 indicate that the presence of the needle causes 25% more ions to collect on the metal plate. The results

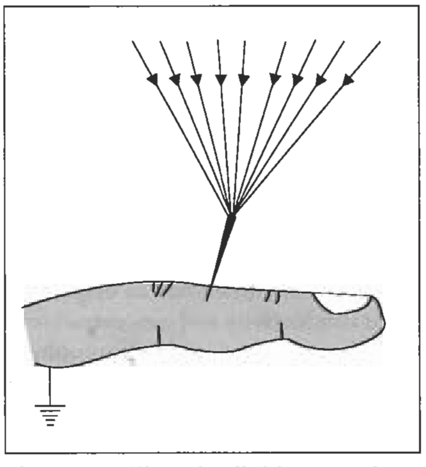

Figure 1. Electric field around an acupuncture needle.

shown in Figure 4 are typical of the relationship of the values with and without a needle. A series of 25 sets of measurements were performed. The actual currents varied considerably from day to day, and even within the same day. These fluctuations are due to variations in the natural ion concentrations caused primarily by changes in the aerosol density. To a lesser degree, variations in the ion production rate also cause fluctuations. However, when the measurements were performed in a stable period (at least 5–6 hours), the results were consistent with the needle giving rise to an increase in the current of 15–25%.

The relationship expressed in Equation 3 obviously reflects the concentration and mobility of the negative ions in the room. If the area of the collecting plate is S, the relationship can be expressed as

$$\frac{dI}{dE} = \frac{d(S \cdot di)}{dE} = S \cdot \frac{dI}{dE} \ , \qquad (5)$$

where i is the current density, i.e., current per unit area ($A \times m^{-2}$). As the area S is $0.35 \cdot 0.35\ m^2$, Equations 3 and 5 lead to

$$\frac{dI}{dE} = \frac{1}{S} \cdot \frac{dI}{dE} = \frac{2 \cdot 10^{-17}}{dE} = 1.63 \cdot 10^{-16}\ \Omega^{-1}\ m^{-1} \ . \qquad (6)$$

The relationship between field strength and resulting current density is Ohm's law (in differential form)

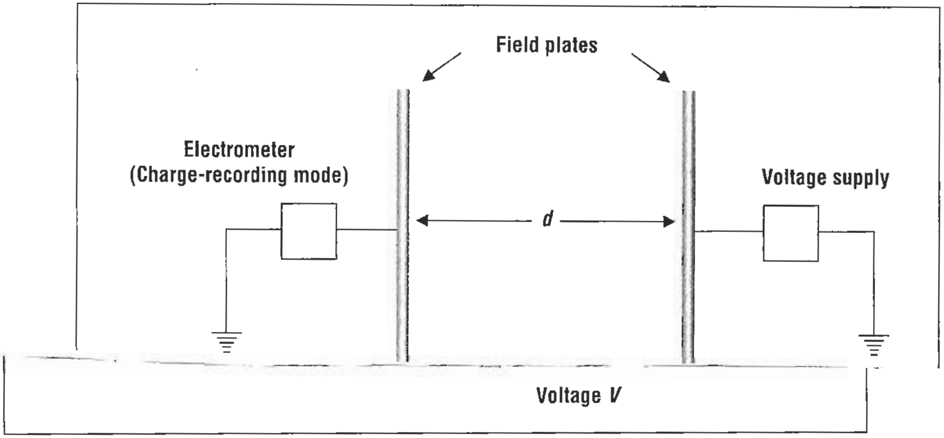

Figure 2. Experimental setup without acupuncture needle.

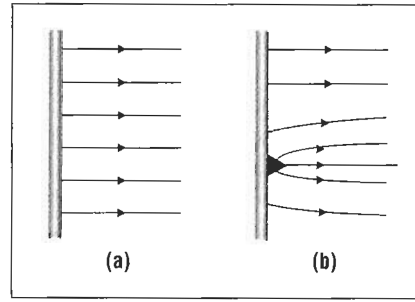

Figure 3. Electric field without and with needle.

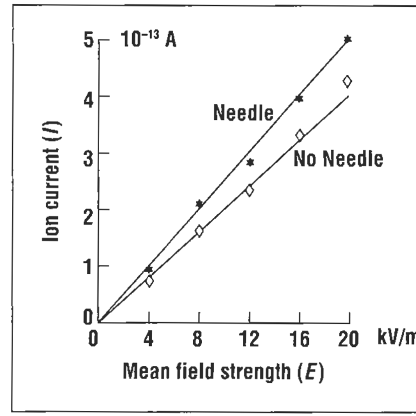

Figure 4. Current *I* as a function of the mean field strength *E*.

$$i = \gamma \cdot E \,, \qquad (7)$$

where γ is the (polar) conductivity. Equation 7 can also be written as

$$\frac{dI}{dE} = \gamma \,. \qquad (8)$$

From Equations 6 and 8, Equation 9 can be derived as

$$\gamma = 1.63 \cdot 10^{-16}\, \Omega^{-1}\, m^{-1} \,. \qquad (9)$$

The conductivity γ can be written as

$$\gamma = n\, e\, k \,, \qquad (10)$$

where e is the electronic charge, and n and k are the concentration and mobility, respectively (in this case, the negative ions). As $e = 1.6 \times 10^{-19}$C and $k = 1.8 \times 10^{-4}\ V^{-1}s^{-1}$, Equations 9 and 10 lead to

$$n = \frac{\gamma}{e \cdot k} = \frac{1.63 \cdot 10^{-16}}{1.6 \cdot 10^{-19} \cdot 1.8 \cdot 10^{-4}} = 5.6 \cdot 10^{-6}\ \text{ions} \cdot m^{-3} = 560\ \text{ions} \cdot cm^{-3} \,. \qquad (11)$$

Conclusion

It has been demonstrated that a conductive needle protruding from a conductive surface in an electric field will cause more ions to arrive at the surface than would be the case if the needle were not there. In addition, it was also demonstrated that it is possible from the measurements described to deduce the polar conductivity and concentration of (in this case) the negative atmospheric ions.

In the introduction, it was suggested that the effect of an acupuncture treatment could be partly explained by weak currents through the body being enhanced by the acupuncture needles distorting an electric field and attracting more atmospheric ions. It should be stressed that this explanation presupposes the existence of an electric field around the person being treated. This explanation also assumes that the person is sufficiently grounded. There are situations in which a person would be in a field-free environment, and thus the effect described above would not take place. On the contrary, however, modern buildings often have surprisingly high field strengths from charged insulative materials.

This article is not intended to explain whether or how acupuncture works. Rather, it has presented some ideas about a possible relationship between the effect of acupuncture needles and the number of ions arriving to a body in an electric field. The number of ions attracted to single needles by the action of an incidental field is extremely low and so are the resulting currents. Therefore, instead of using needles inserted in discrete (acupuncture) points, a more-effective method may be to spray the skin with an abundance of unipolar ions. The charge from the neutralized ions would find its own way through the body along the paths where the current has the greatest effect. That method is basically the idea behind the project described in last issue's column. More studies are under way. In about a year, the findings should confirm whether the theory is sound.

1. Niels Jonassen, "Are Ions Good for You?" in Mr. Static, *Compliance Engineering* 19, no. 7 (2002) 24–29.

Niels Jonassen, MSc, DSc, worked for 40 years at the Technical University of Denmark, where he conducted classes in electromagnetism, static and atmospheric electricity, airborne radioactivity, and indoor climate. He is officially retired and divides his time among the laboratory, his home, and Thailand, writing on static electricity topics and pursuing cooking classes. He can be reached at mr.static@scientist.com. ■