

# A Semi-quantitative Method to Study Electrical Properties of Acupuncture Points

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**Abstract**—An invasive method has been developed for a measurement of voltage response of acupuncture points themselves at different frequencies from 10 to 80Hz. The input voltage for each frequency varied from 100 mV to 1000 mV or 200 mV to 1000 mV. The output voltage response to input voltage has a linearity property under the same frequency, and the output voltage response to input voltage exhibit non-linearity under different frequencies. A simple model is developed to explain the unique characters of acupuncture points that the acupuncture points are a resistor-and-capacitor combined system.

**Index Terms**—Acupuncture points, voltage response, frequency, non-linearity.

## I. INTRODUCTION

There are more than 2000 acupuncture points, some of them also known as biological active points, nonuniformly distributed on human body. Acupuncture therapy has great effect on many medical disorders. Based on National Institute of Health (NIH) Consensus Panel's consensus statement, acupuncture clearly works to treat a number of conditions, including nausea from chemotherapy, surgery and pregnancy, and pain after surgery (including dental surgery). Acupuncture may also be an effective adjunct therapy for a number of other condition, including stroke rehabilitation, relieving addictions, headaches, menstrual cramps, a variety of muscle pains, carpal tunnel syndrome, tennis elbow, low back pain, osteoarthritis, and asthma. But why do acupuncture needles work when they are inserted to right acupuncture points, and how they work? This is a thousand-year puzzle. Acupuncture points play very important roles in acupuncture therapy. Electrical properties of acupuncture points have been studied since 1950s [1]-[4] and studies show that they have lower electrical resistance than their surrounding tissues and the impedance around them is frequency-dependent [5]-[10]. Most studies about their electrical properties are performed by using direct current

measurement or polarized electrodes [11]-[13]. People have

developed many methods to measure the physical properties of skin surround acupuncture points [10]-[16]. All of these measurements are non-invasive, and the electrodes used in these studies are 3-8 mm diameter. These results are variable and related to the measurement conditions. But in the acupuncture therapy, the used needles are 0.25-0.13 mm diameters, and are punch into skin about 10mm. Studies have pointed out that the measurement results of physical properties of skin are related to such measurement conditions as the pushing pressure applying on electrodes, tissue displacement, electrodes size, and contact of electrodes on skin [7]-[11]. However, all these studies investigated the skin around acupuncture points, not acupuncture points themselves. The significance and detail of electrical properties of acupuncture points themselves are unknown at present and more research and reliable measurement are needed. Therefore, in order to improve the reliability of measurement and to reveal the electrical properties of acupuncture points and meridian system comprehensively, we use an invasive method, punching the needle into the skin, and developed a new experimental protocol in this work.

## II. METHOD AND RESULTS

Three acupuncture points compose a simplest network. The input and output response of electrical properties of each acupuncture point can be studied. Therefore, three acupuncture points, i.e., Quchi (L11), Hegu (L14), and Shoushanli (L10) are selected. They are located on Shoushaoyang meridian at the right arm, as shown in Fig. 1(a). Three tests (Test #1, Test #2 and Test #3) are designed, as shown in Fig. 1(b), (c), and (d). Three normal steel stainless acupuncture needles with a diameter of 0.15 mm as used by most acupuncturists are inserted into these three points, respectively. The experiments are performed on healthy human subjects (male, age 30-40 years) guided by a clinical doctor and an acupuncturist.

In Test #1 shown in Fig. 1(b), the signal was input from Quchi (L11) and Hegu (L14). The voltage amplitude is set as 150, 200, 250, 300, 350, 400, 450, 500, 550, 600, 700, 800, 900, and 1000 mV, and for each voltage the frequency is set as 10, 20, 30, 40, 50, 60, 70 and 80 Hz. Then the voltage and frequency responses of between Quchi (L11) and Shousanli(L10), and  $V_2$  between Hegu (L14) and Shousanli(L10) acupuncture points are measured. In Test #2 as shown in Fig. 1(c), input voltage  $V$ , as set to 200mV, 300mV,

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