



RESEARCH ARTICLE

Investigation of Electrical Responses to Acupuncture Stimulation: The Effect of Electrical Grounding and Insulation Conditions

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Abstract

Acupuncture in Oriental medicine has been widely used as a core therapeutic method due to its minimal side-effects and therapeutic efficacy. However, the electrical response to acupuncture stimulation (ERAS) has not been clearly studied under acupuncture conditions that might affect the efficacy of acupuncture therapy. In this study, the ERAS was objectively investigated by measuring meridian electric potentials (MEPs) when the electrical grounding conditions of the operator and subject were varied, and when the insulation conditions of acupuncture needle were varied. MEPs between Sang-geoheo (ST37) and Ha-geoheo (ST39) of the Stomach Meridian (ST) were measured by stimulating Jok-samni (ST36) with an acupuncture needle. For non-insulated acupuncture stimulation (NIAS), the average MEP peak was 148.6 ± 20.6 when neither the operator nor the subject were electrically grounded, 23.1 ± 8.8 when the subject only was electrically grounded, 348 ± 76.8 when the operator only was electrically grounded, and 19.9 ± 4.7 when both the operator and the subject were electrically grounded. The MEPs presented various magnitudes and patterns depending on the electrical grounding conditions. The MEP pattern was very similar to that of the charge and discharge of a capacitor. For insulated acupuncture stimulation (IAS), the average MEP peak was 20 ± 4 in all electrical grounding conditions, which is not a significant electric response for acupuncture stimulation. In terms of electricity, this study verified that acupuncture therapy might be affected by acupuncture conditions such as (1) the electrical grounding condition of the operator and the subject and (2) the insulation condition of the acupuncture needle.

1. Introduction

External biological stimulations cause electrical and chemical reactions that affect important biological activities in human life. In Oriental medicine, acupuncture is also considered to cause such reactions, thereby allowing unbalanced physiological conditions to recover to normal balanced physiological

conditions. In Western medicine, the physiological principle of acupuncture has been explained as a nerve and endocrine cell regulation process based on cytology [1,2]. In addition, the principles of acupuncture are also supported by the following studies: the effect of acupuncture anesthesia is delivered through cerebrospinal fluid [3] and sensory system is activated by neural complex sensory or nerve

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receptor [4,5]. The study done by Cho et al was remarkable in that it uncovered the acupuncture principle [6]. However, even though acupuncture stimulation results in brain responses, it might not be true that all acupuncture responses occur only through the nervous system, because the biological response to external stimulation is much faster than possible through the nervous system [7]. This means that biological pathways other than the nervous system might be involved in acupuncture responses. As a result, acupuncture might be considered a transfer of electric energy through nervous or connective tissue [8,9].

It has been reported that acupuncture stimulation seems to generate ion-electric-charge [10], which is transferred through various biological pathways [11]. In addition, it is well known that the effect of acupuncture therapy depends on the amount of electric charge or the acupuncture stimulation frequency [12,13]. In terms of electricity, acupuncture stimulation of the Meridian circuit amplifies small currents and voltages generated by this circuit [8,14]. This electricity may result from electric potential due to the current generated by stimulation of acupuncture points by an acupuncture needle or the chemical reaction between the acupuncture needle and the hypodermis [15,16]. The chemical reaction can be considered to have the same effect as the electric reaction because it affects ion distribution and bioelectrical charge.

Meridians can be considered ion-electric-charge pathways. Blocking the ion-electric-charge in a meridian results in unbalanced negative and positive charge and therefore pain and the development of various diseases. Acupuncture alters the excessive or deficient condition of the ion-electric-charge to allow normal health to be restored. This implies that acupuncture is closely related to the transfer

of bioelectrical charge. However, acupuncture based on meridian theory does not always result in positive therapeutic outcomes but results in various therapeutic outcomes even when identical methods are used. Various acupuncture methods have been developed for different therapeutic purposes. However, current studies do not provide quantitative methods that can objectively evaluate the effect of acupuncture.

At present, acupuncture as a treatment modality has poor significance and reliability due to its low reproducible outcomes even under identical experimental conditions. To partially address this issue, the aim of this study was to objectively investigate the effects of electric grounding and insulation conditions in acupuncture stimulation by measuring meridian electric potentials (MEPs) between operator and subjects. The MEPs were measured in four different electrical grounding conditions of the operator and the subject for the non-insulated and insulated acupuncture stimulation (NIAS and IAS).

2. Materials and Methods

Figure 1 shows the experimental setup. Ten male subjects (24 ± 2.3 years old) without a medical history related to ST participated in the experiment. Acupuncture was performed by a professional acupuncture operator to minimize the operator-dependent errors. Jok-samni (ST36) was selected as an acupuncture point for the stimulation and Sang-geoheo (ST37) and Ha-geoheo (ST39) as the acupuncture points for the MEP measurement. Three ST acupuncture points were selected because they are established as the standard acupuncture points by the WHO (World Health Organization).

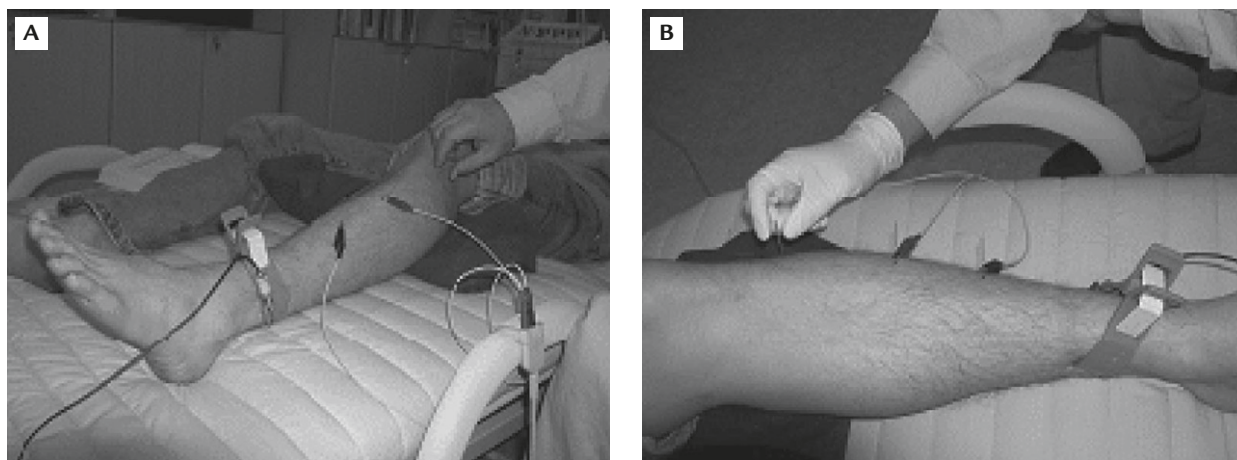


Figure 1 Experimental set-up to measure MEP for acupuncture stimulation: (a) non-insulated and (b) insulated acupuncture stimulation.

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