

Capacitive Aspects of Diagnosis by Oriental Traditional Medicine. Regard on Electrography through Electroluminescence

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Abstract-The paper purpose is to make a link between the technical approaches regarding energy storage using (super)capacitors and the phenomena that happens in the living organisms, phenomena explained by both Western and Oriental medicine.

Human body is a very complex and heterogeneous living organism, characterized by volume distribution of its elementary constituents, organized in a unitary structure that allows specific functionalities. The role of capacitances in explaining the organism functionalities as well as to diagnose/heal different illnesses is essential.

Starting from the wide presence of capacitances in the bioelectromagnetic models, the paper refers first to few capacitive aspects in medicine, as the "double layer" concept. But the wide presence of capacitors also plays an important role in applying different diagnostic/treatment techniques based on the Oriental Traditional Medicine (OTM). Many of them focused on the electric impedances determination of the acupuncture points placed on the body surface. After mentioning these techniques, the paper describes the electrography through luminiscence and gives examples on how the electrographic images can be interpreted based on OTM for getting a diagnostic orientation. In a cohort study, for more than 80% of the more than 300 subjects, the diagnostic supposition get by this method was confirmed by the allopathic diagnostic. This recommends the method as a cheap and quick way for diagnostic orientation, with direct benefits on costs and time in diagnosis.

I. INTRODUCTION

The human body, as well the living organisms in general, are characterized by an electromagnetic activity, called bioelectromagnetism. This governs the proper operation of body components, from the cells up to the organs. So, in the process of diagnosis or healing, the study or use of the body's bioelectromagnetic proprieties is necessary. The theory of bioelectromagnetism deals mainly with electrophysiological models of bioelectric generators, excitability of tissues, and the behaviour of bioelectric and biomagnetic fields in and around the volume conductors formed by the body [1].

Segments of human body may be modelled by electrical circuits. Complex electric circuitry consists of conductors, capacitors and (less) inductances. Resistive component reflects mainly proportion of liquids comprised in the tissue together with liquid properties of current conductance depending on concentration of different ions. Capacitive component reveals integrity of cell membranes. Phase angle is in bioelectrical impedance analysis used as an indicator for disease, hydration and nutritional status. Better overall health status should correspond with higher phase angle [2].

Capacitances are important both in allopathic and complementary medicine. Concepts as "double layer" are often used to describe biophysiological phenomena. The most common example can be the cell membrane that represents an interface between two worlds: the intracellular environment and the extracellular environment. The bi-lamellar structure of the membrane, consisting of a double layer electrically-charged, separated by a layer of a non-polar lipid, and reproduces biologically a microcapacitor (two conductive layers separated by a dielectric). The cell with a membrane is therefore capable of storing electrical charges.

Although the capacitance is localized to cellular membranes, because studies concerns with multicellular compactums, which extent continuously through a three-dimensional region, the capacitance becomes distributed and not discrete, as well also the resistances and "batteries" (generated by the electrochemical processes) are.

Different models of the biofield sources are used to model different body components, based on the elementary monopole, dipole or transmembrane current sources. Their distribution in a volume creates an equivalent volume source density. In the case of the active-fiber bundle of finite or infinite length with circular cross-section, as happens in the cardiac muscle where the cells are highly interconnected, the source arising in the bundle as a whole can be approximated as a dipole sheet, or a *double layer*. The double layer source model is considered by many to be fundamental to electrocardiography [1].

The complementary medicine, as acupuncture and related fields belonging to the oriental traditional medicine (OTM), has a different approach and philosophy than the allopathic one, but uses capacitance and other electrical parameters of the body, skin or different body parts, to get diagnosis interpretations or various healing processes.

In acupuncture and related fields it is assumed that there are special pathways in the body, called meridians, which are connected to main body systems, such as cardio-vascular, respiratory, digestive, etc. In this concept the pathways are exposed

to the surface of human body in so called acupuncture points localized on skin surface. Health is achieved through the harmonious balance between the complementary forces of Yin and Yang. The interaction between them creates the so called "energy" Qi that flows through meridians. Any illness corresponds to a deficient, excessive, or stagnant movement of Qi in the meridians. By inserting a fine needle in certain locations of human body one generates and transmits certain kinds of bio-signals travelling along the meridians system. It is assumed that these fine needles have a balancing action, resulting in improving health condition. Researchers found that beside this Qi regulatory action yields an increase of body cellular-membranes electric capacity [3]. So, even that meridian system is different from the nervous system and Qi has a not completely revealed nature, the Qi balancing result in the modulation and increase of the cellular membrane capacity, meaning a health improvement.

Nowadays, even it's physical and medical characterization remains not totally revealed or is subject for scientific disputes, acupuncture and related techniques are widely used as complementary diagnostic and therapeutic tools. Many of them focused on the electric impedances determination of the acupuncture points placed on the body surface. After mentioning these techniques, the paper describes the electrography through luminiscence [4] and gives examples on how the electrographic images can be interpreted based on OTM for getting a diagnostic orientation.

II. ELECTRICAL CHARACTERISTICS OF THE ACUPUNCTURE POINTS, A BASIS FOR DIAGNOSTIC/THERAPEUTIC PURPOSE

Skin impedance at acupuncture points (acupoints) has been used as a diagnostic/therapeutic aid for more than 50 years. The acupoint has a lower electrical resistance and a greater electrical capacitance than normal skin. In literature [5] is stipulated an AP resistance of tens kilohms, with 20-50% lower than the normal skin and an AP capacitance few hundred times greater than that of the normal skin.

The electrostatic potential can be assessed by means of different oscillatory circuits. When measured by contactless unipolar methods, the electrostatic potential has the mean values around 100 pF for an adult and 20 pF for a child. Positive or negative deviations from these values reflect the patient's uncommon surface charging caused by an energetic unbalance. Researchers are also evaluating the electrophysiologic properties of acupoints as a possible means of understanding acupuncture's mechanism.

The electric potential of acupoints also is elevated compared to nonacupuncture points, and potentials' cyclical variations have a span of 3-5 seconds and amplitudes of 0.1 mV.

Dumitrescu and Amoyel (1989) [6] have done a systemic description of the electrodermal activity of the skin as follows:

- Passive proprieties: DC electrical resistance, AC electric impedance, electric capacity
- Active proprieties: surface electric potential, endogenous electric potential (organic or muscular)
- Electrodermal reflexes (with perspiration origin, controlled by the vegetative nervous system) : resistance reflex (Fere) and potential reflex (Tarhanoff)
- Slow electrodermal variations: variations due to stress, due to high electromagnetic fields or other intense physical agents.

It is not enough identifying acupoints or measuring their electrical resistance and capacitance without interpreting by means of acupuncture theory.

In the allopathic approach, the human body is governed by the autonomic nervous system as a signal carrier, via both the sympathetic and parasympathetic branches. This influences secretion, smooth muscle response, blood vessel response, electrocardiogram, heart rate variability, etc. It also operates as a signal conductor in a "detection" mode of operation. In acupuncture and other OTM there is also a Meridian system, consisting in an array or network system with the capacity to generate and transfer the signals complimentary to the nervous system. It is believed that inserting a fine needle in certain locations of human body generates and transmits certain kinds of bio-signal travelling along the Meridians system to certain organs (it is a quite common reaction of acupuncture patients to feel a travelling sensation) to balance the "Qi" in whole body.

The capacitive methods used for assessing the energetic balance are applied in special acupuncture points to evaluate the intern or extern energy. More practical and profitable are the capacitive measurements done in acupoints where the meridian energy Qi crosses with blood pathways. A low dielectric constant in these points means a good energetic state of the correlated organ or viscera, while an increased value of the dielectric constant is an energy deficiency sign. Once the diagnosis of the interior-exterior unbalance is established, the classical therapeutic acupuncture schemes can be applied for balancing [7]. Unfortunately, the equipments needed for applying the capacitive method involve very rigorous shielding and this led to a less utilisation in the practical use.

To comprehensively assess the diagnostic, therapeutic and mechanistic implications of acupoints skin impedance, a device capable of reliably recording impedances from 100 k Ω to 50M Ω at multiple acupoints over extended time periods is needed. Most traditional methods for measuring skin impedance have used a current source of 1–25 μ A (micro-Ampere), although in the Ryodoraku method, a moist electrode that applied a current of 200 μ A was used. (It should be noted, however, that the Committee on Electrocardiology recommends currents of 10 μ A or less for patient-connected leads [8]).

In the acupoint impedance measurement, an important issue is the used frequency. At low frequencies (under 20Hz) the AP impedance is few times lower than the normal skin impedance, but it is very difficult to localize the point because, for a probe displacement less than 1mm, the measured impedance value became that for the normal skin. At high frequencies (over 500Hz) the normal skin impedance is very close to the AP impedance. A good choice for the measuring frequency could be somewhere between 20 and 200 Hz, probably 100 Hz for a good noise rejection [9].

Experiences with measurement techniques confirm the fact that results may be heavily dependent on some of the following measurement characteristics: skin surface, presence of sweat glands, electrode geometry and polarizability, contact pressure, time fluctuation of electrical properties, etc. To overcome these issues, a novel Scanning Kelvin Probe (SKP) to measure surface electrical potential without actually touching the skin was proposed by Gow et al. [10]. This SKP method relies on capacitive coupling between the probe and the sample, and was previous used different technical areas as metal work function determination, dopant profile characterization in semiconductor devices, metal corrosion analysis, or liquid-air interface characterization. But the limitations don't disappear: the Kelvin Probe is sensitive to ambient field and hysical movement artifacts, and potential measurements were affected by superficial structures such as hairs and subcutaneous veins. More, the prolonged scan time for each site may predispose the topographic map to a number of unintended effects (lateral displacement of the hand/wrist, changes in local circulation), and subject fatigue.

Impedance analysis of acupuncture system deserves further attention along the need for improved understanding of physical mechanisms behind basic functioning of this relatively broadly used medical modality.

Different authors didn't found significant differences in average electrical potential between acupuncture point and adjacent control sites [10], [11]. The simple analysis of the passive or active proprieties of the skin points cannot reveal electro- and thermodynamic characteristics of the acupoints compared with the periproximale inactive zones. In correlation with the potential relief get by the electrography through electroluminescence, the "open window/closed window" or "fenestration/occlusion" phenomenon has been revealed [12]. Comparative with the "zero" of the closed window, in open window it manifests variable electromotive potentials that are independent on the surface electrical charges, doubled by synchronous thermal and variations. This phenomenon can explain some of the acupoints parameters modifications during development of different pathologic processes.

III. DIAGNOSTIC ORIENTATION BY ELECTROGRAPHY THROUGH ELECTROLUMINESCENCE

The first electrographic images have been obtained by Kirlian in 1940, which used a device based on a high voltage and high frequency power source. Unlike Kirlian technique, Dumitrescu et al. (1976) used a single high voltage impulse, with determined shape and known polarity, to get electrographic images (Fig.1). Because one of the armatures is the subject's hand or foot (biologic armature), the external circuit of the source can be considered an incomplete capacitor. Two phenomena yield: one consisting in polarisation of the electrical charges from the surface and inner of the biologic tissue and the second consisting in the streamer-type discharges at the periphery of the living structures. The polarisation is the result of interaction of the external electric field (explorer) and the biologic one (probe).

Analysing the electrographic images of patient's hand and foot (extremities of the acupuncture meridians) and using the OTM principles, some information about the health state of the patient can be derived. These informations are not value quantified, but are subtle and qualitative, leading to a quick orientation in diagnostic.

The interpretation of the electrographic images has a series of variants. The proposed method considers as a reference the "normal" electrographic image, meaning the one that corresponds to a healthy person and has a homogenous and uniform distribution of streamers. (Fig.2). Comparing with this electrographic image the one of a certain patient, one gets a quick and simple orientation in diagnosis, shorting the correct and complete identification of the illness. The method was verified by the authors in a cohort study on over 300 subjects, confronting the classical allopathic with the OTM electrographic diagnostic.

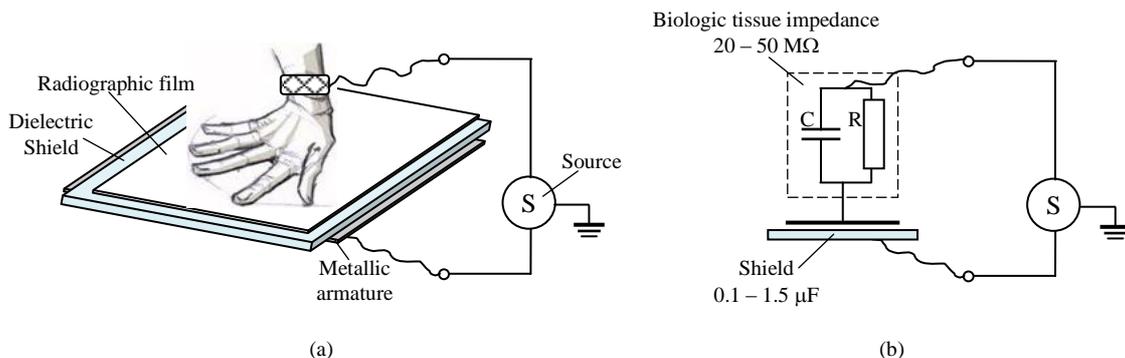


Fig.1. Electrographic device: (a) principled schematic as an incomplete capacitor; (b) equivalent electric model [4].

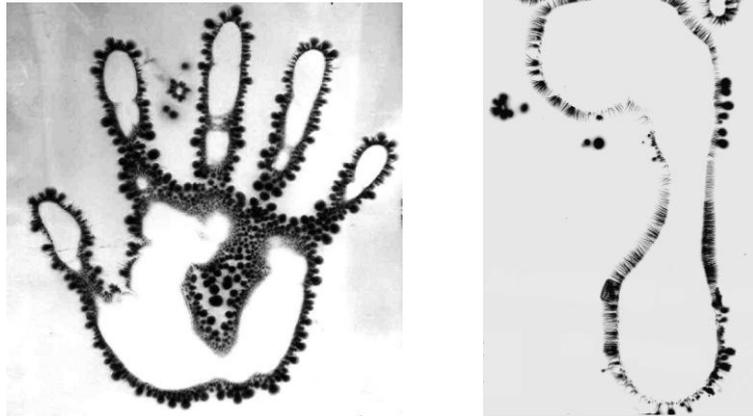


Fig.2. Reference as „normal” image of an electrography

There have been analysed the shape and distribution differences of the streamers (elongations, thickenings, no uniform distributions, conglomerations or rarefactions, streamers absence) concluding in the energetic deficiencies present on the patient's acupuncture meridians and so a diagnostic. For over than 80% of the subjects, the study results have shown an excellent coincidence of the Western with the Oriental diagnostic.

In the following some examples of diagnostic orientations are given. Fig.3 presents a hand electrographic image of a 50 year old patient. At the level of the little finger (correspondence with the fire loqe, cord and small intestine) an intense bioelectric activity is revealed by the very elongated streamers. In acupuncture, the Fire loqe is related to the psycho-emotional energy (Shen energy) that seems to be in excess in this case. More, on the psychosomatic plane, the small intestine meridian is linked with the introversion, the syndromes of lack of energy and self-confidence, qualm excess, regrets [13]. The patient was diagnosed with reactive neuroasthenia, transformed later in photodepressive syndrome.

In Fig.4 there is an absence of the second toe image, meaning the “energetic fingerprint” absence of the Stomach meridian, which is responsible with the digestive function, both in proper and figurative sense. The patient was diagnosed by Western classical methods with duodenal ulcer.

For another patient, the foot electrography given in Fig.5 has no representation for the big toes and others. The big toe is connected with the spleen-pancreas and liver meridian. In acupuncture, spleen belongs to the Earth loqe and is involved in the metabolic and nutritive activity, mainly of the conjunctive tissue and joints. Liver specifically feeds the whole body muscles. The patient was diagnosed with diabetes mellitus and duodenal ulcer. The hand electrography of the same patient shows a

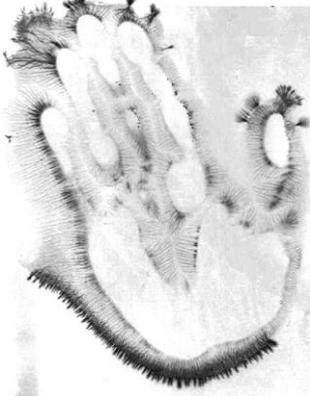


Fig.3



Fig.4

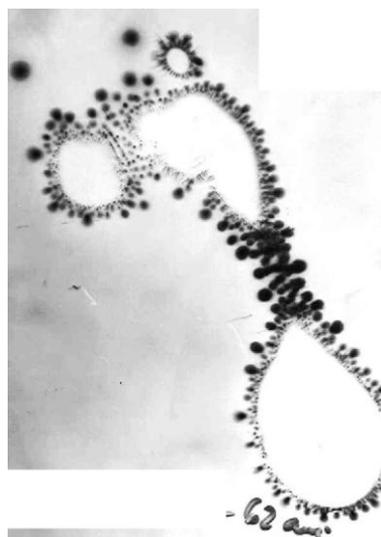
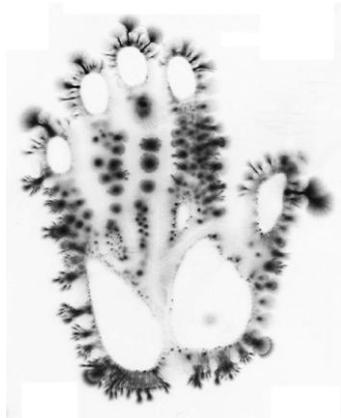


Fig.5

streamer conglomeration at the forefinger level, corresponding to the Large intestine meridian, which shows the organism toxicity level. The patient has confirmed that he followed for years a cortisonic treatment, which explains the high body toxicity level.

In Fig.6 there is an absence of the hallux impress. For interpretation, the age and gender of the patient have been also tacked into account. The 23 young woman looked very unsatisfied and behaved angry with all the people around. In acupuncture, the anger is the specific feeling related to liver, which involves hormonal disorder in women, as breasts inflation, mammary nodules or dysmenorrhea. The young woman confirmed she suffered amenorrhea for more than four months.



Fig.6.

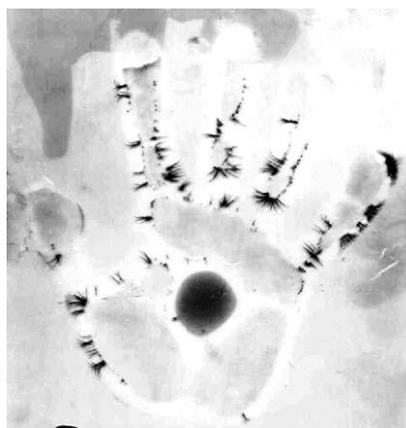


Fig.7

There are situations when the electrographic images cannot be interpreted (Fig.7), mainly when patient are subjected daily and for a long period of time to stress and to the very exciting rhythm of modern life. The better electrographic images results after a period of calm and rest, in that the excitants like coffee, alcohol etc. have been avoided.

IV. CONCLUSIONS

The capacitive phenomena are wide spread in living organism, beginning with the cellular level and up to multi cellular compactums. Different electric circuits composed mainly by resistances and capacitors are used to model different parts of the human body. Beside this, lot of diagnosis or treatment techniques uses capacitive measurements and/or devices. The capacitive aspects play a major role in the health state assessing and management.

Determination and interpretation of the skin impedance at acupuncture points has benefited by special attention as a diagnostic/therapeutic means. Nowadays, the concept of integrative medicine is more and more considered as the necessary future approach in health management. This idea is based on better understanding and wider use of the OTM, as a scientific-based alternative or complementary method. The electrography through electroluminescence represents an interesting and cheap alternative in getting a quick diagnostic orientation. The rapid knowing of the narrowed area for deeper medical investigation has positive consequences regarding costs and time. The good potential in diagnostic orientation recommends the described method for improvements and the electrographic device for up-to-date modernization.

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