

**Exploring the Mechanism of Grounding Combined with Acupuncture in
Relation to Electrical Properties: A Theory Analysis and Proposal**

A Capstone Project

By

David Kyung Hoon Kim, L.Ac.

Capstone Advisor: Dr. Lixing Lao

Virginia University of Integrative Medicine

Fairfax, Virginia

July 2019

Acknowledgements

The Chinese medical text book Hunag Di Nei Jing which was written at least 2000 years ago, is registered with UNESCO as one of humanities precious legacy works. This medical text was written so that people living in harmony with nature in the ancient oriental civilizations, could easily understand medicine based on their knowledge. Such understanding has passed through many generations to the present, and has helped to cure many diseases. The Yin/Yang and Qi theory as noted in Hunag Di Nei Jing is something many people interested in oriental medicine want to understand. I tried to describe this theory with the perspective that the hypothesis of Yin/Yang and Qi can describe the physiological phenomenon and mechanism of the human body based on the modern understanding of natural physiology. Within the last 2000 years there have been no changes in human physiology and flow in nature; although there are differences in the advancement and knowledge of these time periods, I am convinced it is possible to draw parallels in understandings. Even though Huang Di Nei Jing was written 2000 years ago, if it illustrates a correct knowledge base in their time; as time passes it still has the potential to illuminate knowledge which it was based on. Considering this, first I would like to express my gratitude and respect to the author of Hunag Di Nei Jing, for providing a base which I can explore the grounding method in application with acupuncture. If exploring of knowledge continues with respect and gratitude towards works of the past, works 2000 years later can continue to have the same kind of profound significance. Finally, I would like to take this opportunity to express my gratitude to all of you who have provided opportunities for such research through my DAOM program. My beloved wife and children – Young Hee, Isaac, Rebecca, Brother Hyung Yong and Founder Jane, Dr. Lao, Dr. Choo, Dr. Fang, Sam's Dad and Mom and my beloved Classmates, I will always remember.

Abstract

Grounding combined with acupuncture is a method of delivering negative ions from the earth through a needle that is inserted into the targeted tissue area of the body. This mechanism is based on electrical properties as well as polarity and its characteristics, which is a portion of the Traditional Chinese Medicine theory in the energetic systems of the human body. Scholars in modern science have long studied the interaction between negative ions and positive ions in cells and they began to recognize the relationship between the healing mechanism and cell polarities. For the last 70 years practitioners have been using the principle of negative ions and devices using negative ions in clinical treatment; due to the accumulation of positive studies and findings about human health regarding negative ions. Recently some health practitioners have been using patches on the surface of the skin in order to incorporate “grounding” into their practice. It is the author’s hypothesis, that compared to patches on the surface of skin, the possible efficacy of acupuncture needles with grounding may produce greater results because acupuncture needles go directly into the targeted tissue area to bring negative ions from the ground in to the region. Therefore, adding the grounding process to acupuncture treatment may augment acupuncture’s health benefits. Clinical research data in the near future is essential to provide robust evidence.

Table of Contents

Chapter 1: Introduction.....6

 Overview.....6

 Huang Di Nei Jing and Polarity.....6

 Scientific Discoveries that Add Light to Understanding of the Yin/Yang and Qi.....7

 Wound Healing Mechanisms of Cell Migration due to Electrical polarity.....10

 Electrophysiological Test of Guinea Pig Skin and Human Skin.....11

 Mechanism of Ion Pumping Cord Effect.....11

 The Hypothesis.....12

 Examining the Potential.....12

 Research Objective & Overview.....14

 Glossary of Relevant Terms.....15

Chapter 2: Literature Review.....16

 One-Hour Contact with the Earth’s Surface (Grounding) Improves Inflammation and
 Blood Flow.....16

 Effects of Grounding on Body Voltage and Current in the Presence of
 Electromagnetic Field.....17

 Grounding after Moderate Eccentric Contractions reduces Muscle Damage.....17

 Emotional Stress, Heart Rate Variability, Grounding, and Improved Autonomic Tone:
 Clinical Applications.....18

 The Effect of Earthing (Grounding) on Human Physiology.....18

Chapter 3: Methodology.....20

 Introduction.....20

Exploring the Mechanism of Grounding Combined with Acupuncture in Relation to Electrical Properties: A Theory Analysis and Proposal	5
Selection Criteria and Search Methodology.....	20
Inclusions and Exclusions Criteria.....	20
Data Analysis and Synthesis.....	21
Chapter 4: Results.....	22
One-Hour Contact with the Earth’s Surface (Grounding) Improves Inflammation and Blood Flow.....	22
Effects of Grounding on Body Voltage and Current in the Presence of Electromagnetic Field.....	23
Grounding after Moderate Eccentric Contractions Reduces Muscle Damage.....	23
Emotional Stress, Heart Rate Variability, Grounding, and Improved Autonomic Tone: Clinical Applications.....	24
The Effect of Earthing (Grounding) on Human Physiology.....	25
Chapter 5: Discussion.....	27
Possible Efficacy of Grounding with Combined Acupuncture Treatment.....	27
Additional Clinical Value.....	30
Conclusion.....	32
References.....	34

Chapter One: Introduction

Overview

The common denominator of Oriental understanding and Western approach to the health of the human body is that both are systems for maintaining health; but generally, there is a perception that these two understandings play differing roles. As the perception that all things in the natural world are forming an organic cooperative system has begun to develop, a shift that narrows that gap between the western approach and eastern approach has begun to take place. In modern times, some researchers have begun to realize that a matrix of energy movement that connects all parts of an organism to each other is represented in terms of Yin, Yang and Qi by HDNJ. Scholars in the East and West have recognized that it has the same concept of creating and maintaining an organic form. Due to the result of clinical trials that show how acupuncture can treat many diseases, scientists have shown interest in the results, and have desired to discover the mechanism of acupuncture. As data-driven modern science evolves, many efforts have been made in recent decades to combine the principles of Traditional Chinese Medicine (TCM) diseases based on oriental culture, and Western medical understanding of numerical approaches. The focus of this review is to compare and establish a connection with the scientific discovery of electrical properties and its polarity in human physiology. Electrical properties that are derived from grounding through positive and negative ions can be utilized with practice in conjunction with Acupuncture treatments. This may be associated with the understandings of the TCM balancing mechanism Yin and Yang, the flow of Qi, as well as the benefits of the grounding combined with acupuncture technique(接地針法).¹

Huang Di Nei Jing and Polarity

Discovery of electricity was made back in the 18th century.² Soon after, scientists determined the atmosphere's polarity charge was positive (yang nature).³ Polarity and its character of electricity is a portion of the Traditional Chinese Medicine theory in the energetic systems of the human body, in relation to Oriental Medicine. A medical text called "*Huang Di Nei Jing*" (HDNJ), which is directly translated to "Inner Canon of the Yellow Emperor", dating back to at least 2,000 years, already recognized the importance of polarity and electronic movement in human body. An explanation of bio-electronic movement which covers a part of the definition of Qi runs parallel to that of chapter 17 of the *Ling Shu*; which observed, "... Therefore, Yang channel operates the channel energy of the Fu organs, and the Yin channel operates the channel energy from the Zang organs. The Yin and Yang channel energies pour into each other like a ring, terminate and start again without end."

《靈樞 脉度 第十七》¹⁷ 故陰脉榮其藏。陽脉榮其府。如環之無端。莫知其紀。終而復始。).

An example of this that would be helpful to understand, is that electricity traveling through a wire generates an electromagnetic field.⁴ The areas of study include electrical, or electromagnetic fields produced by living cells. The mechanisms and operations of tissues or organisms have been well established; for example, the cell's membrane potential and the electric currents that flow in nerves and muscles, are a result of action potentials.⁵ This term can also refer to the ability of living cells, tissues, and organisms, to produce electrical fields and the response of cells to electromagnetic fields.⁶ These are very identical to the illustrations of *Huang Di Nei Jing* which considers the human being as a dynamic energetic system that is interconnected and held together by the laws of action, reaction, alternation of polarity, and its electricity.

Scientific Discoveries that Add Light to Understanding of the Yin/Yang and Qi

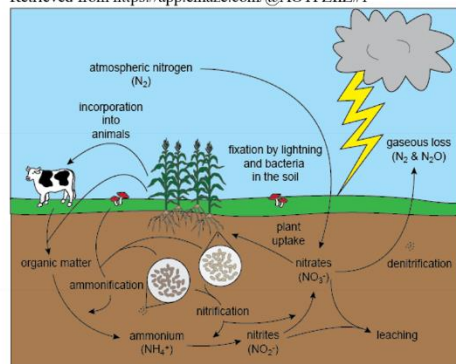
Yin/Yang and Qi are one of the core principals of ancient Chinese medicine. They are considered the energy or natural force that constantly interacts with the surrounding nature throughout the universe. One of the concepts of Yin and Yang and it's qi have a similar relationship to modern days understanding of polarity. Part of chapter 2 from the Huang Di Nei Jing's Su Wen illustrates the interrelationship between the balancing mechanism of earth's polarities, heaven's polarities, and nature's cycle for supporting living beings including humans on this planet. There are many different translations and interpretations of *Huang Di Nei Jing* on the internet, but there are two translations that are of popular interest. One is directly translated from text and the other paraphrases the meaning of the text into modern language. For example, Su Wen Chapter 2-1 (四氣調神大論篇 第二, 第一章)

-中略-, 夏三月, 此謂蕃秀, 天地氣交, 萬物華實.

(Direct translation): ...The three months of summer, they denote opulence and blossoming. The qi of heaven and earth interact and the myriad beings bloom and bear fruit.⁷

Figure 1.1: Nitrogen Cycle

Retrieved from <https://app.emaze.com/@AOTFZIIZ#1>



(Paraphrased translation): ... In the months of Summer there is an abundance of sunshine and rain. The Heavenly energy descends, and the Earthly energy rises. When these energies merge there is an intimate connection between Heaven and Earth. As a result, plants mature, and animals, flowers and fruit appear abundantly.⁸

Both translations are well harmonized with the understandings of negative energy in the ground (Yin), positive energy in the atmosphere (Yang); the author attempted to connect the concept of

the Nitrogen Cycle, and the interpretation of the words, which “interact”, and have an “intimate connection” from both translations. These translations also fit well into the “nitrogen fixation” by the earth (ground) and atmospheric components of lightning mechanism.⁹ In nature, a balancing of the discharging mechanism happens through lightning. This type of charging process is still being studied by modern scientists. On Earth, the lightning frequency is approximately 40–50 times a second or nearly 1.4 billion flashes per year.¹⁰ This context is highly reliable in understanding the concept of Qi descending from heaven, and Qi rising from earth. This is a simple but very clear illustration of the earth’s polarities, which explains the agricultural society of the people whose life style and understanding of nature was limited, and how the positive electrons from the heaven (atmosphere) and negative electrons from the earth (ground) “interact” and “myriad beings bloom and bear fruit” more than 2000 years ago.

Another example is the portion of chapter 75 of Ling Shu; which observed, “Jiě huò’ method is to observe the harmony of yin and yang and supplement it, if it is insufficient; and reduce it if there is overflow. In this way it is easy to move each other to make equilibrium to treat disease.”

(《靈樞, 著至教論篇 第七十五》解惑者 . 盡知調陰陽補寫有餘不足 . 相傾移也).

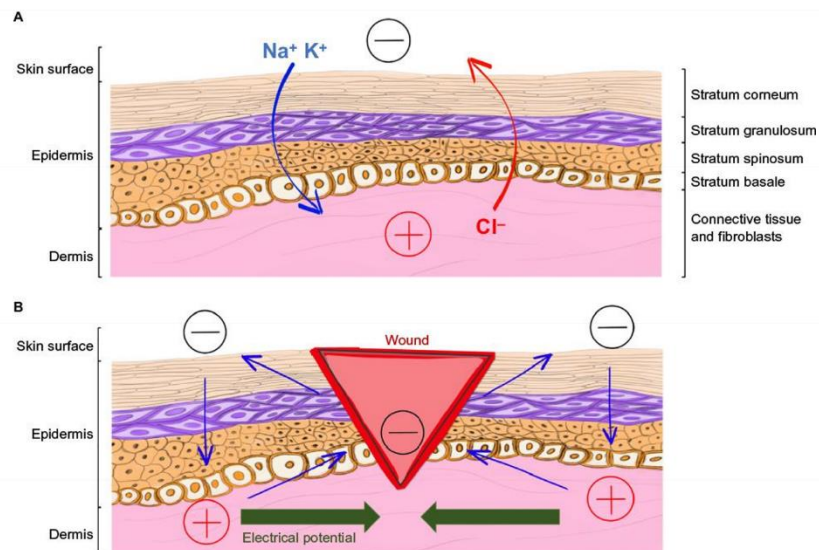
The author is in agreement with the Jiě huò’ statement above. It is suggested that the author of the Jiě huò’ statement had knowledge of the overall mechanism in balancing the electrical flow related with human diseases despite their interpretations of bioelectric mechanism in their time, like the way heaven and earth are balanced through lightning, can also be governed by balancing the flow. In modern times, there are more scientific understandings of bioelectric balancing mechanism in human body.¹¹ The next two examples explain how some modern scientists and an acupuncture practitioner’s discoveries were correlated with the illustration of ‘Jiě huò’ method in Huang Di Nei Jing.

Wound Healing Mechanisms of Cell Migration Due to Electrical Polarity

One of the common functions of all migrating cells is that there is polarization along the migration axis.^{12,13} Following Peters' (1885) observation of the rapid movement of epithelial cells over the surface of a fresh wound,¹⁴ this function was later documented by Lash J. W. (1955). He injected individual skin cells with carmine granules. Using a microscope, Lash was able to follow migrations of injected cells.¹⁵ Lash found that there was a wave of mobilization of epidermal cells due to electrical polarity, which detach from the underlying basement lamina and from a sheet that migrates toward the center of wound.¹⁵ Lash's finding can explain one of the mechanisms of acupuncture treatments for wounded conditions. Illustration below explains such activities.¹⁶

Figure 1.2: Cutaneous Endogenous Bioelectric Current Before and After Injury.

Retrieved from https://www.researchgate.net/publication/316310162_A_current_affair_Electrotherapy_in_wound_healing



Electrophysiological Test of Guinea Pig Skin and Human Skin

In 1982 Baker, Jaffe, and Venable reported a detailed electrophysiological test regarding the properties of guinea pig skin and human skin. The guinea pig was tested because it has hairless epidermis that are free of hair and glands.¹⁷ Baker, later measured 17 normal volunteers of male and female to collect the data of transcutaneous voltage.¹⁸

Figure 1.3: Wound Healing Mechanism due to Electrical Polarity

Retrieved from <https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1365-2133.1983.tb07673.x>

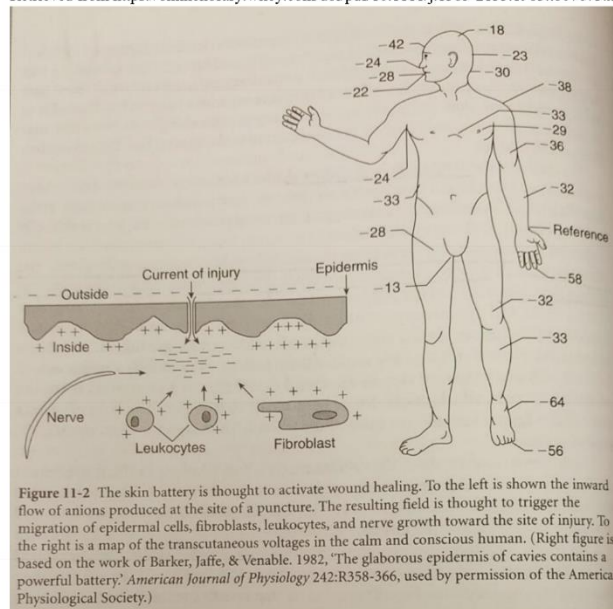


Figure 11-2 The skin battery is thought to activate wound healing. To the left is shown the inward flow of anions produced at the site of a puncture. The resulting field is thought to trigger the migration of epidermal cells, fibroblasts, leukocytes, and nerve growth toward the site of injury. To the right is a map of the transcutaneous voltages in the calm and conscious human. (Right figure is based on the work of Barker, Jaffe, & Venable. 1982. 'The glabrous epidermis of cavies contains a powerful battery.' *American Journal of Physiology* 242:R358-366, used by permission of the American Physiological Society.)

Baker measured the amount of electricity in each part of the body, he found that the resting potential of skin is about 100 to 200 millivolts near the cut, with the inside positive.¹⁷ Dr. Barker suggest that the field in the skin helped guide the movements of cells that close the wound, a process known as *reepithelization*, which restores

the epithelial barrier function.¹⁷ He measured the amount of electricity in each part of the body, and the picture above shows the measurements. It also leads to indications of the mechanisms of cell migration due to their polarities.¹⁸

Mechanism of Ion Pumping Cord Effect

Figure 1.4: Ion Pumping Cord

Retrieved from <https://www.dulwichacupuncture.com>



In the 1950s, out of his search for a simple bio-electromagnetic treatment of burns came the invention of the germanium diode, ion pumping cords (IP cords); which was invented by Dr. Yoshio Manaka (1911-1989).¹⁷ Due to the understandings of the relationships between the direction of polarity and the channels; he thought that if he

could deplete the crowded and stagnated ions with a positive charge at the burn site, he could relieve the pain and help heal the wound. He claimed that he used IP cords to treat many patients and his experience supported the hypothesis. Dr. Yoshio Manaka developed methods which used IP cords that could be applied to treatment of diseases. The concept of the IP cord, which relies on electrical polarity, has been known for over 50 years among acupuncture practitioners as a beneficial treatment method utilizing the balancing mechanisms of Yin and Yang in nature.¹⁹

The Hypothesis

It is the author's hypothesis that adding the grounding process, which is related to negative ions; acupuncture treatment may augment acupuncture's health benefits. Compared to patches on the surface of skin, grounding with combined acupuncture needles may produce greater results because the acupuncture needles penetrate into the targeted tissue area directly, and bring negative ions from the ground into the targeted region. This application could contribute to the treatment outcomes of acupuncture in patient care.

Examining the Potential

Culture that has been developed independently in the East and West have merged towards the direction of mutual appreciation, in modern times. Likewise, treatment methods that have been used by different professions have also been used in integration with one another. This movement is in line with timescales that require patient-centered holistic treatment which addresses use of all appropriate therapies to bring benefits in human health. Therefore, this study is designed to create a bridge for the potential of clinical values related to patient care which can be brought out by a combination of grounding procedure and acupuncture.

Research Objective & Overview

The objective of this study is to collecting related data to understand the mechanism of grounding and review articles which conduct treatment with negative ions and using patches combine with grounding. Study results are followed: Rapid reduction of inflammation, Rapid reduction or elimination of chronic pain, Dynamic blood flow improvement to better supply the cells and tissues of the body with vital oxygen and nutrition, Reduced stress, Increased energy, Improved sleep, Accelerated healing from injuries and surgery.²⁰

Glossary of Relevant Terms

Action Potential: The brief (about one-thousandth of a second) reversal of electric polarization of the membrane of a nerve cell (neuron) or muscle cell. In the neuron an action potential produces the nerve impulse, and in the muscle cell it produces the contraction required for all movement. Sometimes called a propagated potential because a wave of excitation is actively transmitted along the nerve or muscle fiber, an action potential is conducted at speeds that range

from 1 to 100 meters (3 to 300 feet) per second, depending on the properties of the fiber and its environment. (<https://www.britannica.com/science/action-potential>)

Cell Migration: Cell migration is the process by which cells move from one location to another by adopting different motility modes, such as mesenchymal, amoeboid or collective migration. Cell motility is observed in unicellular organisms, is essential for the development and maintenance of multicellular organisms, and is also involved in immune responses and pathological conditions. (<https://www.nature.com/subjects/cell-migration>)

Cell Polarity: Cell polarity is the asymmetric organization of several cellular components, including its plasma membrane, cytoskeleton or organelles. This asymmetry can be used for specialized functions, such as maintaining a barrier within an epithelium or transmitting signals in neurons. (<https://www.nature.com/subjects/cell-polarity>)

CK (Creatine Kinase): Creatine kinase (CK) is an enzyme found in the heart, brain, skeletal muscle, and other tissues. Increased amounts of CK are released into the blood when there is muscle damage. This test measures the amount of creatine kinase in the blood. (<https://labtestsonline.org/tests/creatine-kinase-ck>)

HRV (Heart Rate Variability): Heart rate variability (HRV) is the fluctuation in the time intervals between adjacent heartbeats. HRV indexes neurocardiac function and is generated by heart-brain interactions and dynamic non-linear autonomic nervous system (ANS) processes. HRV is an emergent property of interdependent regulatory systems which operate on different time scales to help us adapt to environmental and psychological challenges. HRV reflects regulation of autonomic balance, blood pressure (BP), gas exchange, gut, heart, and vascular

tone, which refers to the diameter of the blood vessels that regulate BP, and possibly facial muscles. (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5624990/>)

Nitrogen Cycle: The nitrogen cycle is the set of biogeochemical processes by which nitrogen undergoes chemical reactions, changes form, and moves through different reservoirs on Earth, including living organisms. Nitrogen is required for all organisms to live and grow because it is the essential component of DNA, RNA, and protein. (www.visionlearning.com/.../6/The-Nitrogen-Cycle/98)

Nitrogen Fixation: Nitrogen fixation plays an important role in the earth's ecosystem as it enables plants to utilize nitrogen as natural fertilizer and then put oxygen back into the atmosphere. (www.businessdictionary.com/definition/nitrogen-fixation.html)

Reepithelization: Epithelialization is an essential component of wound healing used as a defining parameter of a successful wound closure. A wound cannot be considered healed in the absence of re-epithelialization. (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4086220/>)

SEMGs (Surface Electromyograms): The signal represents the anatomical and physiological properties of muscles; in fact, an EMG signal is the electrical activity of a muscle's motor units, which consist of two types: **surface** EMG, and intramuscular EMG. (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3821366/>)

Resting Membrane Potential: The membrane potential of a neuron when it is at rest (as opposed to, for example, being in the midst of an action potential). The resting membrane potential for a neuron is typically around -65 to -70 mV, although it varies depending on the particular type of neuron in question. (<https://www.britannica.com/science/resting-potential>)

Chapter Two: Literature Review

One-Hour Contact with the Earth's Surface (Grounding) Improves Inflammation and Blood Flow

The protocol for this pilot study was approved by BioMed IRB of San Diego, California and it is one of its kind to determine the effects of grounding on blood circulation, especially focused in the face, torso and lower extremities. 40 middle-aged volunteers of men and women were recruited to participate. The subjects were randomly divided into two groups, the grounded and sham-grounded for the double-blind procedure. It was conducted at a single center: Total Thermal Imaging (TTI), La Mesa, California in 2014. Three professionals from different fields; cell biology, thermal imaging, and human science were working together to see if grounding administered for one hour is beneficial to the circulation of blood. Each group asked to sit in a comfortable recliner chair which was equipped with a grounding mat, pillow and patches. The grounding systems were either grounded via a wire to the grounding port of a power outlet, or virtually grounded. Changes in blood flow and temperature during the experiment were measured using an infrared imaging camera. Detailed criteria for fair experimentation were applied. This research ruled out some important points that may affect the experiments which make it distinctive in this area of research. The following is a brief summary of the content; 8 x 8x 10 cubic feet size of room temperature was controlled within the range of $70.0^{\circ}\text{F} \pm 1.0^{\circ}\text{F}$ and humidity was kept within 25% - 50%, fluorescent lighting was used and windows were covered to avoid solar infrared effect on the thermal images, subject put on a cotton gown and was led to the Thermal Imaging room, the subject was given thermal equilibration for 15 minutes to normalize body temperature. While sitting on a stool, thermal images of the face, neck, and torso were taken, following the Thermal Imaging Protocol. Later, each subject was given 10 minutes

to relax before the 1-hour grounding/earthing (or sham-earthing) session began. After this, post-session thermal imaging was taken.²¹

Effects of Grounding on Body Voltage and Current in the Presence of Electromagnetic Fields

The purpose of this study was to determine if grounding to an electromagnetic field occurring in a normal residential environment would produce a harmful current. The study consisted of a design with a duration of 5 to 15 minutes per participant in order to obtain the experimental value. The 50 participants in the study consisted of 23 males between 12 and 77 years and 27 females between 13 and 79 years of age. Each participant was instructed to touch the lamp with their hands, and then the experiment proceeded by measuring the current at a distance of 1-foot after releasing the lamp, and then measured at a 3-foot distance.²²

Grounding after Moderate Eccentric Contractions Reduces Muscle Damage

The purpose of this pilot study was to investigate grounding effects on muscle soreness, through a creatine kinase (CK) and complete blood count measurement, including a self-report on pain. CK is an enzyme used for testing muscle inflammation. Thirty-two healthy young men were recruited and randomly divided into grounded (n=16) and sham-grounded (n=16) groups for the study. All subjects were males between the ages of 18 and 24 years, weighed between 66 and 84 kilograms, and were between 171 and 185 cm tall. The characteristics of this study was not for the people who complained of pain but for healthy young men. During day 1 and day 2, they were told to performed 200 half-knee bends in 10-minute period at a cadence of 20 half-knee bends every minute to create eccentrically damaging calf muscles. The subjects were seated

and connected to grounding patches on their quadriceps and they placed their bare feet on earthing mats. For a period of 4 hours, participants were either grounded or sham-grounded. The experiment continued on the third and fourth days with blood monitoring and grounding, but no exercise was given.²³

Emotional Stress, Heart Rate Variability, Grounding, and Improved Autonomic Tone:

Clinical Applications

Figure 2.1: Grounding System Showing Patches, Wires, and Box Connecting to a Ground Rod (Not Shown)

Retrieved from <https://pdfs.semanticscholar.org/844f/a28756f93afbb1777d336bedd12cd04fdb11.pdf>



Heart rate variability (HRV) represents one of the most promising evaluation tools for risk identification of cardiac patients. This study hypothesized that grounding might improve HRV due to previous investigations which have shown that grounding exceedingly affects skin conductance

within seconds. Twenty-eight relatively healthy individuals participated in the study. The subjects were equally divided into two groups: 14 men and 14 women. TENS type of patches were placed on each of the subject's palm and foot. The switch was off for the first 40 minutes to assess the base line measurement, then, the switch was turned on for the next 40 minutes, to assess actual measurements. The switch was off another 40 minutes, and the measurement device continued to record the session. The session was completed in a total of 120 minutes. The same individuals participated in another two-hour non-grounding session.

The Effect of Earthing (Grounding) on Human Physiology

In 2006 Chevalier, Mori and Oschman published a double-blinded pilot study documenting the effects of earthing/grounding on 58 healthy adult subjects to determine the effects of grounding on both physiological and electrophysiological aspects of the human body. In this study, there were groups randomly assigned to earthing (grounding) (n=28) or sham (n=30) groups. An I-410 biofeedback system made by J & J Engineering was used to measure four different parameters: electroencephalogram (EEG), surface electromyograms (SEMGs), blood volume pulse (BVP), and heart rate (HR). All of the subjects sat in their recliner comfortably with a conductive ground patch attached on their soles. They were all relaxed for 28 minutes before the grounding system was switched on, and then they received grounding (or sham grounding) for another 28 minutes.

Chapter Three: Methodology

Introduction

The objective of this study is to research the possible efficacy of grounding combined with acupuncture treatment. Utilizing this opportunity for analysis, it is possible to observe how ancient TCM text in HDNJ's Yin and Yang theory can be related with the modern discovery of electrical properties as well as polarity and its properties in the healing mechanism. This chapter will discuss how research methods are used, and how the gathered information is used for research purposes.

Selection Criteria and Search Methodology

By combining multiple studies found online, despite the limited amount of data related to grounding and acupuncture; enough credible data was found in grounding. This can produce similar effects as acupuncture. Research data and studies related to grounding were collected from sources that were mostly between the dates of January 1st, 2004, until December 31st, 2018. The data of these studies including the ones reviewed in Chapter 2, were derived using key words and phrases such as, "grounding" along with "human body", "grounding" and "stress", "grounding" with "harmful" from the databases of PubMed, EBSCOHOST, Google Scholar databases. Full text articles or abstracts related with grounding, or earthing were selected. The study was conducted on the researcher's personal computer and taken place in the researcher's home and at the VUIM library.

Inclusions and Exclusions Criteria

The research excluded most older articles and reviews that did not conduct statistical analysis. The inclusion criteria, related with the grounding patch study consisted of; double blinded studies and published in peer-reviewed articles, and articles in English as well as human-controlled trials. Inclusion criteria also included all accredited search terms used, as well as articles from different countries.

Data Analysis and Synthesis

Upon conducting the search, which consisted of reviewing over 21 articles, 10 articles were selected. After further filtering of articles that were found and including only those that met the researcher's inclusion and exclusion criteria, the search concluded with 5 articles chosen for the capstones systemic review. The data collected was analyzed to establish a foundation for the topic of grounding, as well as bridging the ideology of the efficacy of supplementing acupuncture with grounding in promoting beneficial healing results.

Chapter Four: Results

One-Hour Contact with the Earth's Surface (Grounding) Improves Inflammation and Blood Flow

Thermal imaging clearly demonstrated improved circulation of fluids, including blood.²¹ As a result, there was evidence of improved blood circulation in the face, torso and lower extremities.

Following are some of thermal images;

Figure 4.1 Thermal Images of the Face and Torso before and after Treatment

Retrieved from http://file.scirp.org/pdf/Health_2015081716010615.pdf

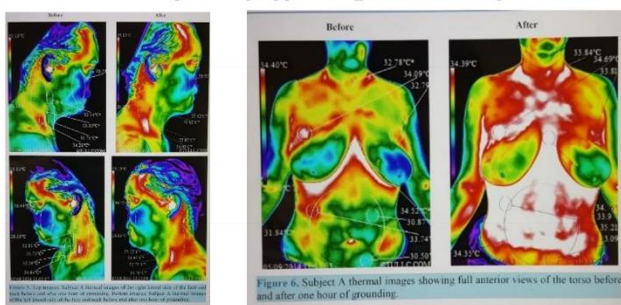


Figure 6. Subject A thermal images showing full anterior views of the torso before and after one hour of grounding.

Figure 4.2 Thermal Images before (1), after (2) and after One Day (3) of Grounding

Retrieved from http://file.scirp.org/pdf/Health_2015081716010615.pdf

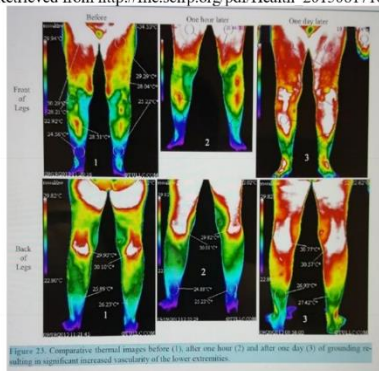


Figure 23. Comparative thermal images before (1), after one hour (2) and after one day (3) of grounding resulting in significant increased vascularity of the lower extremities.

Based on this study, it appeared that even one-hour of grounding stimulates body fluid regulation and peripheral blood circulation in the autonomic nervous system, promoting blood circulation

throughout the face, torso and lower extremities. Therefore, this research suggested that grounding may help with skin tissue repair, health, vitality, optimize facial appearance and may translate into better health.²¹

Effects of Grounding on Body Voltage and Current in the Presence of Electromagnetic Fields

The study concluded that the normal EMF present in a house when a person is grounded is too low to cause harm to the human body.^{26,27} Below is a diagram derived from this test.²²

Figure 4.3: Result of Voltage and Current Measurement

Retrieved from The Journal of Alternative and Complementary Medicine Volume 22, Number 9, 2016 pp. 758

TABLE 1. VOLTAGE AND CURRENT MEASUREMENTS

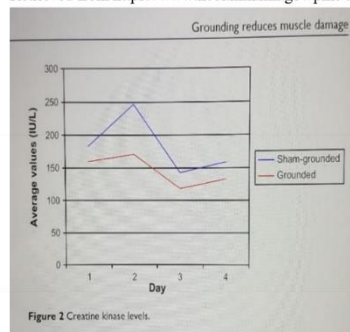
	Voltage measurements						Current measurements			Resistance Calculations		
	(V)						(μ A)			(k Ω)		
	Ungrounded			Grounded			T	I'	3'	T	I'	3'
Avg	6.87	1.22	1.01	0.151	0.019	0.016	2.62	0.78	0.54	76.07	27.10	30.88
SD	1.68	0.22	0.19	0.044	0.006	0.006	1.48	0.20	0.12	33.21	9.26	11.18

T, touching the lamp; I', one foot from the lamp; 3', three feet from the lamp; Avg, average; SD, standard deviation.

Grounding after Moderate Eccentric Contractions Reduces Muscle Damage

Figure 4.4: Creatine Kinase Levels

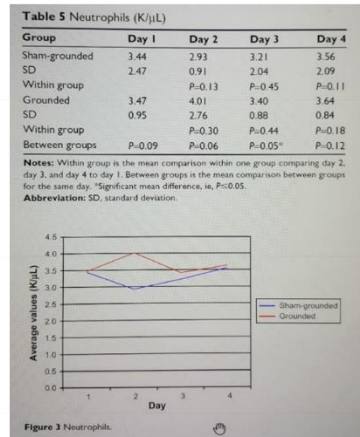
Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4590684/>



The level of CK which indicates muscle inflammation was significantly increased in the sham group on the second day but not in the grounded group. Third day, the two groups' CK levels returned to pre-exercise status.²³ This graph indicates a healing effect of grounding by reducing the loss of CK in the damaged muscles.

Figure 4.5: The Level of Neutrophils

Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4590684/>



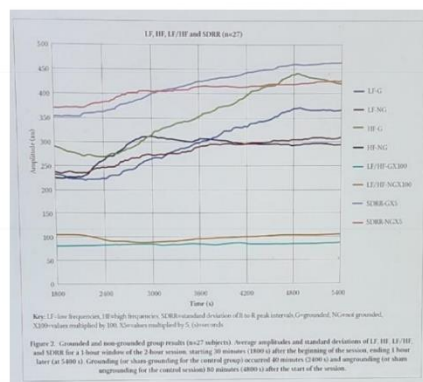
Laboratory tests showed difference in blood markers. The level of neutrophils in the blood tells the progression of inflammation, as shown in the graph, significant changes in neutrophils levels in blood have been observed. On second day, the grounding groups had an increase in neutrophils, whilst the sham grounding group had decreased level of neutrophils. Forth day, the two groups' neutrophils levels returned to the first day

status. Study suggested that to better understand how grounding affects neutrophils and how it affects inflammation, more research from different age groups who suffer from similar ailments is needed for further understanding.²³

Emotional Stress, Heart Rate Variability, Grounding, and Improved Autonomic Tone: Clinical Applications

Figure 4.6: Grounded and Non-Grounded Group Results

Retrieved from Integrative Medicine Vol. 10 No. 3 June/July 2011



This hypothesis was confirmed by the fact that the HF (HF-G, green line) shows similar tendencies as LF graph (LF-G, the cornflower blue line). At the end of the 40-minute periods, HF increased by 33% for the non-grounded group, and by 63% for the grounded group-about double the non-grounded group increase.²⁴

The Effect of Earthing (Grounding) on Human Physiology

Figure 4.7: Graph of Right RMS SEMG Recording

Retrieved from <https://www.dietametabolica.es/grounding/EffectsofEarthingonPhysiology.pdf>

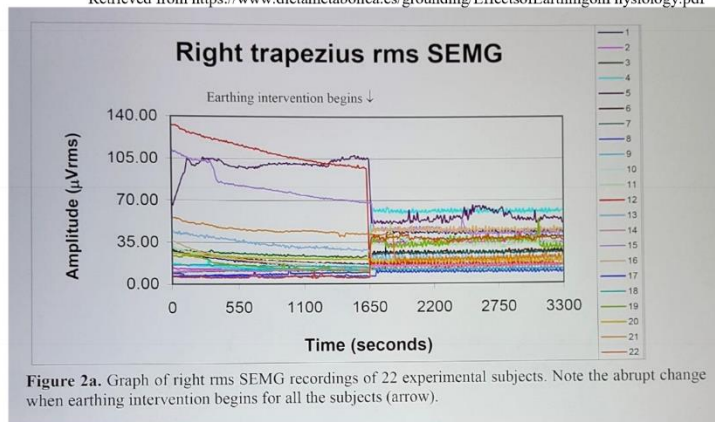


Figure 2a. Graph of right rms SEMG recordings of 22 experimental subjects. Note the abrupt change when earthing intervention begins for all the subjects (arrow).

Figure 4.8: Graph of Left RMS SEMG Recordings

Retrieved from <https://www.dietametabolica.es/grounding/EffectsofEarthingonPhysiology.pdf>

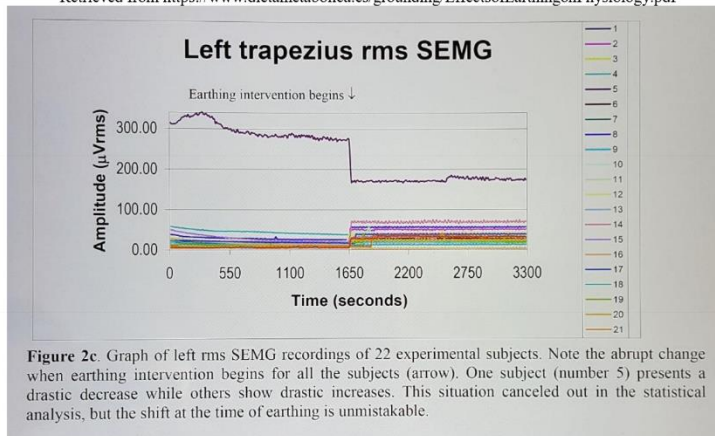


Figure 2c. Graph of left rms SEMG recordings of 22 experimental subjects. Note the abrupt change when earthing intervention begins for all the subjects (arrow). One subject (number 5) presents a drastic decrease while others show drastic increases. This situation canceled out in the statistical analysis, but the shift at the time of earthing is unmistakable.

Above results show changes in trapezius muscle tension in two subjects, measured with electromyography.²⁵ At the moment the grounding lead is connected, there is a virtually instantaneous normalization in tension. Muscles that are tense relax, and muscles that are hypo toned develop normal tension. The hypo toned muscle was obtained from an individual

experiencing acute pain from an injury the day before the test, and the hypo toned muscle (lower trace) was obtained from an individual with normal fatigue. Earthing reduced BVP in 19 of 22 earthed subjects and 8 of 30 unearthed control subjects. This happened steadily throughout the earthing period. HR was unaffected. EEG measurements taken for both sided hemispheres and a sudden change of left side hemisphere activity was noticed. However according to this study, the EEG recording requires more trials to further understand this result. Earthing produced statistically significant and nearly instantaneous reductions in overall stress levels and tensions in the body as measured by electroencephalograms, electromyograms, and blood volume pulse. Taken together, the physiologic changes indicate reductions in overall stress levels and tensions, and a shift in autonomic balance upon earthing/grounding.²⁵

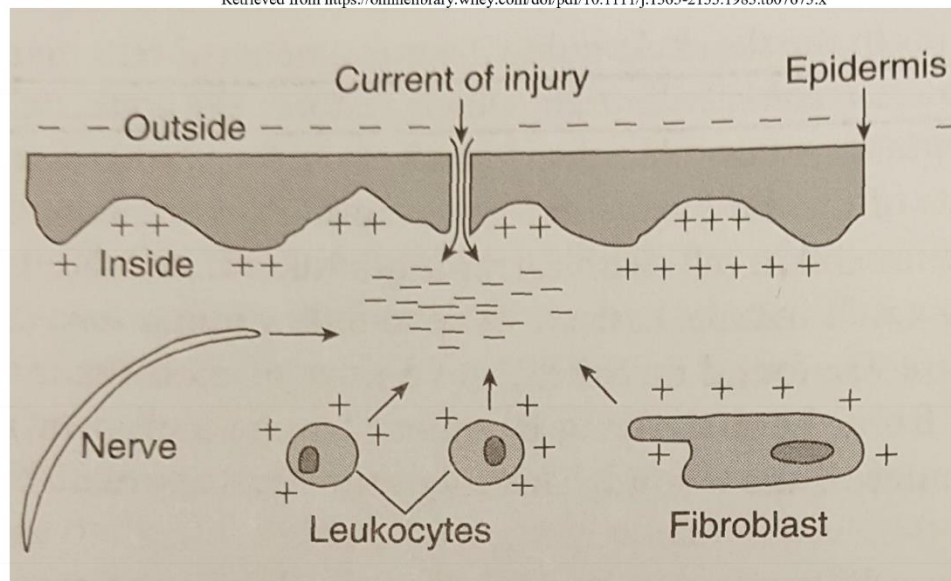
Chapter Five: Discussion

Possible Efficacy of Grounding with Combined Acupuncture Treatment:

In connection with the illustration below, Dr. Barker argued that “The resulting field is thought to trigger the migration of epidermal cells, fibro blasts, leukocytes, and nerve growth toward the site of injury”.^{19,20} Dr. Barker did not consider grounding, but he explained his own observations of the function of the body’s restoration when it hurts.^{19,20}

Figure 5.1: Wound Healing Mechanism due to Electrical Polarity-Close Up

Retrieved from <https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1365-2133.1983.tb07673.x>



Grounding with combined acupuncture needles are expected to produce greater and faster results, versus the body’s own natural speed of healing process or applying patches on the skin. This is because needles go into the deeper tissue and bring negatively charged ions (anions) from the ground. Thus, it may speed up and trigger migration of positively charged cells to the targeted area. In addition to acute injuries, grounding acupuncture can also help treat chronic inflammation deep in the body, because it can be delivered to the targeted area directly and

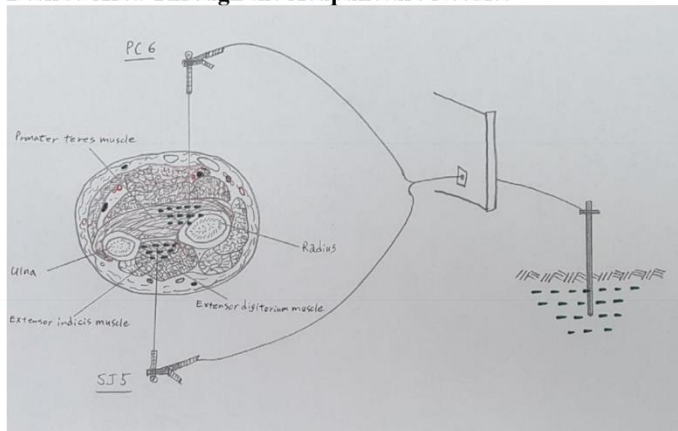
through acupuncture meridians. That is the same method which is illustrated in the balance of Yin and Yang to treat the body, in the HDNJ. The pictures and illustrations below compare between patches and acupuncture effect and scope of their work.

Figure 5.2: Patch on the Skin

Retrieved from <https://intuition-physician.myshopify.com/products/grounding-patch-kits-targeted-therapy>



Figure 5.3: Effective Delivery of Negative Charged Ions (Anions) from the Ground to the Desired Area Through the Acupuncture Needles



The above explanation suggests that Carpel Tunnel Syndrome could be effectively treated. This can be done by the effective delivery of negatively charged ions (anions) from the ground to the desired area through the acupuncture meridians. Applying a grounding technique to acupuncture-accessible treatment will indeed open up many possibilities. For example, it may be effective in

treating acute pain, chronic inflammation, muscle aches, insomnia, depression, etc., conditions requiring a rebalancing of polarity.

Figure 5.4: Shoulder Rheumatoid Arthritis Condition

Retrieved from <https://www.arthritis-health.com/video/shoulder-rheumatoid-arthritis-video>



Figure 5.5: Effective Delivery of Negative Charged Ions (Anions) from the Ground to the Shoulder area Through the Acupuncture Needles

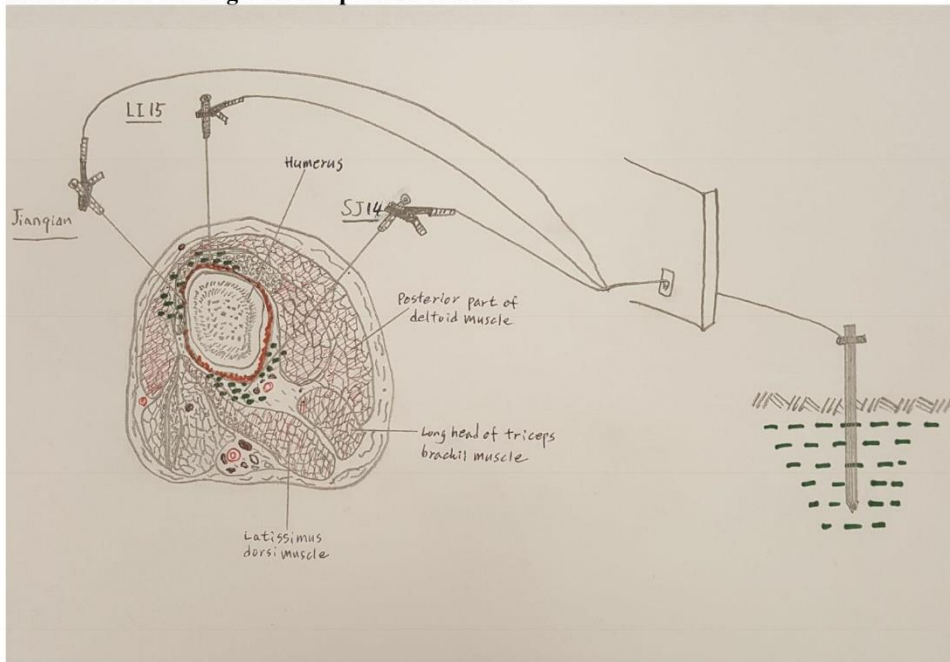
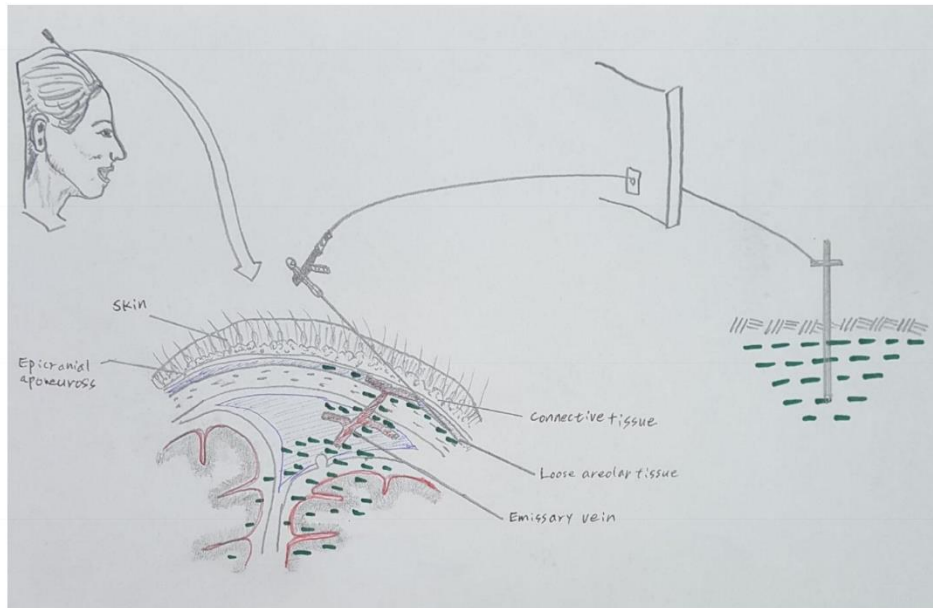


Figure 5.6: Illustration Explaining the Possible Efficacy of Grounding with Scalp

Acupuncture



Additional Clinical Value:

To maintain proper function, the cells, neurons, and tissues in the human body require a resting state.^{28,29} It is the author's hypothesis that the basic reequipment of resting state in the cells are equally required by the body which assembles these cells and tissues and neurons. Therefore, to maintain a healthy condition, the human body needs rest. A busy lifestyle, stress, and EMF can make it difficult to restore a health rhythm.^{30,31,32,33} Maintaining a regular biorhythm through rest is important because it helps break down the lactic acid which is one of the first line of requirements that cells and organs have to maintain optimal condition for their functions. Most of those actions occur through sleep, and during other periods of rest. According

to researchers, the average voltage of a resting membrane potential is around -70mV .^{34,35,36,37} The

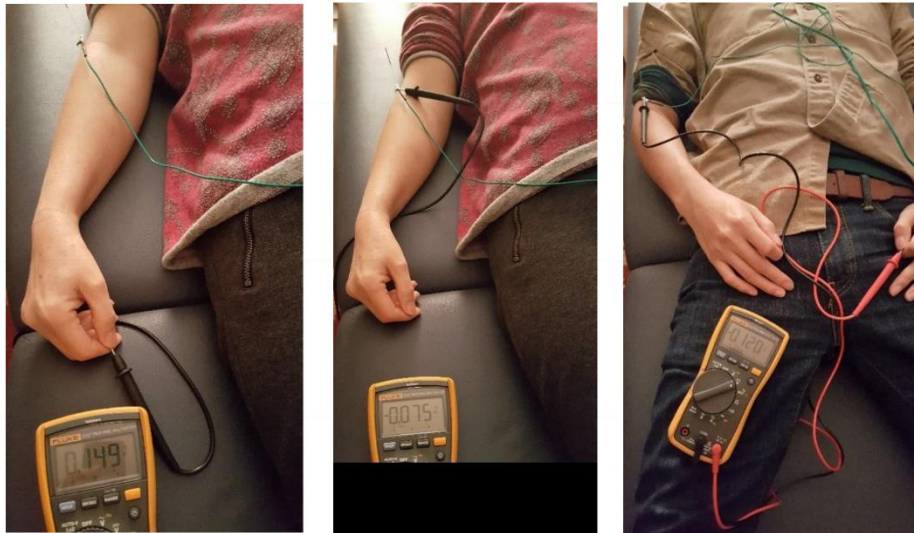
Table 1 below shows the measurements of several studies that have been found since.^{34,35,36,37}

Table 1: Cell Types in Relation to Resting Potential

Cell types	Resting potential
Hair cell (Cochlea)	-15 to $-40\text{mV}^{(a-1)}$
Skeletal muscle cells	-95 $\text{mV}^{(a-2)}$
Smooth muscle cells	-60 mV
Astroglia	-80 to -90 mV
Neurons	-60 to -70 $\text{mV}^{(a-3)}$
Erythrocytes	-8.4 $\text{mV}^{(a-4)}$
Chondrocytes	-8 $\text{mV}^{(a-3)}$
Aorta Smooth muscle tissue	-45 $\text{mV}^{(a-3)}$
Photoreceptor cells	-40 mV

Amongst the flow and fluctuation of voltage in the body, grounding acupuncture also can produce similar values consistently during the treatment. The **figure 5.7** demonstrates that effect. It is the author's hypothesis that given the overall relevance, the relationship of values that can be measured in the grounding acupuncture and resting potential are considered worthy of clinical research. Considering such a value, it may also be worthy to research the effect of grounding with acupuncture treatment in areas of: headache, acute/chronic pain, arthritis, inflammation, autoimmune disease, chronic tiredness, stroke, insomnia, anxiety, depression, palpitation, various stagnations, leaky gut, etc.,

Figure 5.7: Demonstration of Voltage Changes due to Acupuncture with Grounding



Conclusion:

Portions of acupuncture based on traditional HDNJ and TCM understandings of healing mechanisms can be related to the modern understanding of electrical property as well as polarity and ion movement within cells.^{38,39,40} According to modern research, the natural mechanism for healing includes the migration of negative ions to a wounded area. An example of this was demonstrated by the ion movement within the wound healing mechanism of Dr. Baker's and other scholars' studies. Recently, some practitioners utilized patches on the skin as an effective way to facilitate the movement of negative ions, thus promoting healing. In comparison, it is reasonable to hypothesize that by using acupuncture needles in conjunction with grounding, it would be an effective means of attracting negative ions. This may also produce great results, due to being able to specifically target a tissue area by utilizing acupuncture needles to attract negative ions from the ground, and thus promote healing. This application can contribute to

treatment outcomes of acupuncture in patient care. In order to develop a comprehensive understanding of the efficacy of grounding combined with acupuncture treatment, it requires additional clinical research in the near future.

References

1. James L. Oschman, PhD. Second Edition (2016). Elsevier Ltd. Energy Medicine: The Scientific Basis. (pp. 313).
2. François Leblanc, Karen Aplin, Yoav Yair, Giles Harrison, Jean Pierre Lebreton, M. Blanc. (2008). Springer US. Planetary Atmospheric Electricity (pp. 151).
3. J. Alan Chalmers. (1957). Pergamon Press. Atmospheric Electricity: Chapter 10 The Thunder Cloud (pp. 211)
4. Martin Bojowald. (2013) WILEY-VCH. The Universe: A View from Classical and Quantum Gravity. (pp. 25-27).
5. Gary G. Matthews. (2009). Cellular Physiology of Nerve and Muscle. (pp. 71).
6. Shu-Ang Zhou, Mitsuru Uesaka. (2006). International Journal of Engineering Science 44. (pp. 70-71).
7. Paul U. Unschuld, Hermann Tessenow, Zheng Jinsheng. (2011). University of California Press California. Huang Di nei jing su wen An Annotated Translation of Huang Di's Inner Classic-Basic Questions. (pp. 46).
8. Maoshing Ni.(1993). SHAMBHALA. The yellow emperor's classic of medicine A New Translation of the NEJING SUWEN with Commentary. (pp. 5).
9. Hans Volland. (1995).CRC Press Handbook of Atmospheric Electrodynamics Volume I Chapter 8. (pp.189-201).
10. Oliver John E. (2005) Springer. National Oceanic and Atmospheric Administration. Encyclopedia of World Climatology. (pp. 452)
11. Franklyn Sills. (1947). North Atlantic Books California. Craniosacral Biodynamics Volume One (pp. 246-248).
12. Albrecht Schwab, Anke Fabian, Peter J. Hanley, Christian Stock. (2012). Institute for Physiologie. German. Role of ion channels and transporters in cell migration.
13. Jurgen Bereiter-Hahn, A. Gedeom Matoltsy, K. Sylvia Richards. (). Springer. Biology of the Integument 2. (pp. 443-471).
14. <https://onlinelibrary.wiley.com/doi/abs/10.1002/jez.1401280103>

15. James W. Lash. (1955). Department of Zoology, University of Chicago, Illinois. Studies on wound closure in urodeles. Vol. 128. (pp. 13-28).
16. Jerome Hunckler Achala de Mel. (2017). "A current affair: electrotherapy in wound healinh". Journal of Multidisciplinary Healthcare Dove press
17. Barker AT, Jaffe LF, Venable JW Jr. (1982). American journal of Physiology. Mar;242(3): R358-66.
18. Foulds IS, Barker AT. (1983) The British journal of dermatology. Human skin battery potentials and their possible role in wound healing.
19. Yoshio Manaka, Kazuko Itaya, Stephen Birch. (1995). Paradigm Publications, Brookline, MA. Chasing the Dragon's Tail (pp. 60-63, 102-107)
20. Clinton Ober, Stephen T, Sinatra MD, Martin Zucker. (2009). Basic Health Publications. INC. Earthing The most important health discovery ever! (pp. 5).
21. Gaetan Chevalier, Gregory Melvin, Tiffany Barsotti. (2015). Scientific Research Publishing Inc. CA. One-Hour Contact with the Earth's Surface (Grounding) Improves Inflammation and Blood Flow Health. Vol. 07 (9). (pp. 1022-1059).
22. Brown R, (2016) Journal of Alternative and Complementary Medicine. Mary Ann Liebert, Inc. Effects of Grounding on Body Voltage and Current in the Presence of Electromagnetic Fields. PMID:27454187 Vol. 22 (9). (pp. 757-759)
23. Brow R, Chevalier G, Hill M. (2015 Sep 21). Journal of Sports Medicine. Grounding after moderate eccentric contractions reduces muscle damage. Vol. 6, (pp. 305-317).
24. Gaetan Chevalier, Stephen T. Sinatra. (2011 Jun/Jul) Integrative Medicine. Emotional Stress, Heart Rate Variability, Grounding, and Improved Autonomic Tone: Clinical Applications. Vol 10. (3). (pp. 16-21).
25. Gaetan Chevalier, Kazuhito Mori, James L. Oschman (2005). The effect of Earthing (grounding) on human physiology. Retrieved from https://www.researchgate.net/publication/241219438_The_effect_of_Earthing_grounding_on_hu man_physiology
26. Philip J. Landrigan, Ruth A. Etzel. (2013). Oxford University Press. Textbook of Children's Environmental Health: Exposure to Radiofrequency Electromagnetic Fields, Including Those from Mobil Phones. (pp. 386).

27. Peter Stavroulakis. (2003). Springer-Verlag Berlin Heidelberg New York. Biological Effects of Electromagnetic Fields: Mechanisms, Modeling: 2 Mechanisms of Action of EMFs on Biological Systems. (pp. 4-5,13-14)
28. Epifanova OI, Polunovsky VA. (1986). Elsevier. England. Journal of Theoretical Biology. Cell cycle controls in higher eukaryotic cells; resting state or a prolonged G1 period? Vol. 120 (4). (pp. 467-477).
29. ZiMian Wang, Zhiliang Ying, Anja Bosity-Westphal, Junyi Zhang, Britta Schautz, Wiebke Later, Steven B Heymsfield, Manfred J Muller. (2010). Published online. PMCID: PMC2980962. PMID: 20962155.
30. Salama OE, Abou EL Naga RM. (2004). Lippincott Williams. The Journal of the Egyptian Public Health Association. Cellular phones: are they detrimental? Vol. 79 (3-4), (pp. 197-223).
31. Nikita Mary Baby, George Koshy, Anna Mathew. (2017) Indian J Endocrinol Metab. The Effect of Electromagnetic Radiation due to Mibil Phone Use on Thyroid Function in Medical Student Studying in a Medical College in South India. Vol. 21 (6) (pp. 797-802).
32. Perry F. Wilson, Arthur R. Ondrejka, Mark T. Ma; John M. Ladbury. (1988). U.S. DEPARTMENT OF COMMERCE. Electromagnetic Fields Radiated From Electrostatic Discharges-Theory and Experiment (pp. 2).
33. Philip J. Landrigan, Ruth A. Etzel. (2013). Oxford University Press. Textbook of Children's Environmental Health: Exposure to Radiofrequency Electromagnetic Fields, Including Those from Mobil Phones. (pp. 386).
34. Ashmore, J. F.; Meech, R. W. (1986-07-24). "Ionic basis of membrane potential in outer cells of guinea pig cochlea". *Nature*. **322** (6077): 368–371.
35. Retrieved from
<https://web.archive.org/web/20151107043159/http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/M/Muscles.html>
36. Lewis, Rebecca; Asplin, Katie E.; Bruce, Gareth; Dart, Caroline; Mobasheri, Ali; Barrett-Jolley, Richard (2011-11-01). "The role of the membrane potential in chondrocyte volume regulation". *Journal of Cellular Physiology*. **226** (11): 2979–2986.
37. . Cheng, K; Haspel, HC; Vallano, ML; Osotimehin, B; Sonenberg, M (1980). "Measurement of membrane potentials (psi) of erythrocytes and white adipocytes by the accumulation of triphenylmethylphosphonium cation". *J. Membr. Biol*. **56** (3): 191–201.

38. Butler MT, Wallingford JB. (2017). *Natures Reviews Molecular Cell Biology*: Jun;18(6). (pp. 375-388).
39. Wilson PD. (2011). *Biochim Biophys Acta* Oct;1812(10):1239.
40. Lee CC, Cheng YC, Chang CY, Lin OM, Chang JY. *Sci Rep.* (2018) Nov 30;8(1):17477