

Infrared Radiation Spectrum of Acupuncture Point Daling (PC 7) in Patients With Coronary Heart Disease

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ABSTRACT

Background: The infrared spectrum analysis can reveal subtle changes of the body's infrared radiation. It provides a good method to research the specificity of acupoints.

Objective: To compare the acupoint infrared radiation spectra of patients and healthy volunteers to determine whether patients' spectra carry distinctive pathological information.

Design, Setting, and Participants: The study included 50 patients with coronary heart disease (CHD) and 47 healthy adults (controls). The study was performed in the Cardiology Department of Longhua Hospital affiliated with Shanghai University of Traditional Chinese Medicine in Shanghai, China.

Intervention: The head of the highly sensitive infrared spectrum detection device was placed against Daling (PC 7) and Taichong (LR 3) bilaterally.

Main Outcome Measures: Infrared radiation intensity.

Results: Infrared radiation intensities of 47 out of 146 detected wavelength spots significantly differed in the CHD patients at PC 7 vs those of controls ($P < .05$), while only 24 wavelength spots at LR 3 showed significant differences. By the χ^2 test, these differences between the 2 points were statistically significant ($P = .002$). At 2- to 2.5- μm related to energy metabolism, the intensity at PC 7 of the CHD patients on both sides was significantly lower than that of controls, while the intensity of LR 3 only on the left side was significantly lower than that of controls (all $P < .05$), and the right side had no difference ($P > .05$).

Conclusions: The data suggest that the changes of infrared spectrum at PC 7 in CHD patients may reflect distinct pathological changes. This may be the result of hypoactive energy metabolism in the acupoint area. Acupoints may have certain relationships to certain organs.

Key Words: Infrared Radiation, Spectrum, Coronary Heart Disease, Acupuncture Points

INTRODUCTION

THE HUMAN BODY IS A NATURAL biological infrared radiant point that emits 1 ~ 30 μm constant infrared spectrum. The infrared radiation of the body can reflect metabolic change of organs and tissues of various parts of the body. The physiological activities of the body contain

thousands upon thousands of biochemical reactions that constantly emit infrared photon from the surface of the body. The infrared photon is a type of information carrier that can provide information covering various levels of life activities such as oxidant metabolism, information transfer, photosynthesis, cell division, cancer, cell apoptosis, and cell growth regulation.¹

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In recent years, infrared technology has been widely used for diagnosis and treatment of diseases as well as for research on characteristics of meridians and acupoints.²⁻⁵ However, the temperature of the body surface is greatly affected by physiological factors like sweating and environmental factors such as cross-ventilation, so that the infrared radiation imaging techniques that mainly detect the temperature of body surface have certain limitations. In the total infrared radiation of the body, more than 90% is thermal radiation; therefore, a great deal of information is disclosed by the body temperature; infrared spectrum can reveal those subtle changes and make up the disadvantage of infrared radiation imaging techniques. In the present study, we used a newly developed infrared radiation spectrum detecting system that features high sensitivity, low noise, a wide wavelength range, and stable performance.⁶⁻⁸

The acupuncture point is not only the point for puncturing, but also the point that can reflect diseases, especially the Yuan Source Points. In the first chapter of *Spiritual Pivot (Ling Shu)*, it is said that the 12 Yuan-Source Points can reflect the diseased conditions of their corresponding organs. In the 12 regular Meridians, there are 2 meridians directly related to the heart: Heart and Pericardium. Although *Inner Canon (Nei Jing)*, the Yuan-Source Point of the Heart Meridian is Shenmen (HT 7), in *Spiritual Pivot (Ling Shu)*, the Yuan-Source Point of the Heart meridian is Daling (PC 7), which is based on the theory that the heart is the king housing the mind, and the pericardium protects the heart from the invasion of pathogens.⁹ Influenced by such doctrine, the points of the Pericardium meridian are often used to treat cardiovascular diseases, such as Daling (PC 7) and Neiguan (PC 6), while the points of Heart meridian are often used to treat mental and psychological disorders.

The purpose of the present study was to use this well-developed device to determine whether the infrared radiation spectrum at acupoint Daling (PC 7) in patients with coronary heart disease (CHD) differs from those at Daling (PC 7) in healthy adults, and whether Daling (PC 7), the Yuan-Source Point of Pericardium meridian, has specificity to the heart, by comparing its infrared spectrum with that of Taichong (LR 3), the Yuan-Source Point of the Liver meridian.

METHODS

Study Participants

Fifty CHD patients (aged 43–72 years; mean age, 58 years) were recruited using the World Health Organization diagnostic criterion for ischemic heart disease¹⁰ and referred by cardiologists in the cardiology department of Longhua Hospital, which is affiliated with the Shanghai University of Traditional Chinese Medicine, China. Forty-seven healthy volunteers (aged 38–64 years; mean age, 51 years) were the control population. “Healthy” was defined

as normal body temperature and no known autonomic nervous system dysfunction, CHD, or systemic disease.¹¹ All participants signed a consent form.

Experimental Procedure

We used a highly sensitive system for detecting the infrared radiation spectrum on the surface of the human body (PHE201, Shanghai Institute of Technical Physics of Chinese Academy of Science, Shanghai) (Figure 1). The experiment was performed under quiet, controlled environmental conditions: mean (SD) temperature, 22°C (3°C); minimal air flow; relative humidity, 45%–65%; and shielded from electromagnetic radiation and sunlight.

Participants arrived at the laboratory 30 minutes prior to the experiment and sat quietly with both forearms and feet exposed so that they could become acclimatized to the testing conditions. Acupoints Daling (PC 7) and Taichong (LR 3) were selected as testing points. Daling (PC 7) is in the middle of the transverse crease of the wrist, between the tendons of palmaris longus and flexor carpi radialis. As a control point, Taichong (LR 3) is on the dorsum of the foot, in the depression distal to the junction of the first and second metatarsal bones. The head (3 mm in diameter) of the detector was gently placed against the point to be scanned. Daling (PC 7) and Taichong (LR 3) were scanned on every participant for 1.5 minutes each.

While the wavelength between 1.5–16 μm was scanned by the infrared spectrometer, radiation intensities were recorded automatically every 0.2 μm . A total of 73 wavelength spots were recorded during the 1.5 minutes. Scanned data were automatically saved into a computer database for statistical analysis. The operator was blinded to the group assignment.

Statistics

The SPSS 10.0 software package was used (SPSS Inc, Chicago, IL), and the independent samples *t* test was applied to compare intensities of infrared radiation of Daling (PC 7) and Taichong (LR 3) on the CHD patients vs that of controls. Pearson χ^2 test was used to compare numbers of wavelength spots at Daling (PC 7) and Taichong (LR 3) on the CHD patients and the healthy participants. The test level $\alpha = .05$ or less was considered significant in all cases. The infrared radiation spectrum diagram was generated by Excel; the x-axis shows the values of the wavelength from 1.5–16 μm , and the y-axis shows the corresponding infrared radiation intensities.

RESULTS

Our preliminary analysis showed no significant difference between CHD patients and controls in the overall infrared radiation spectrum at Daling (PC 7). The major

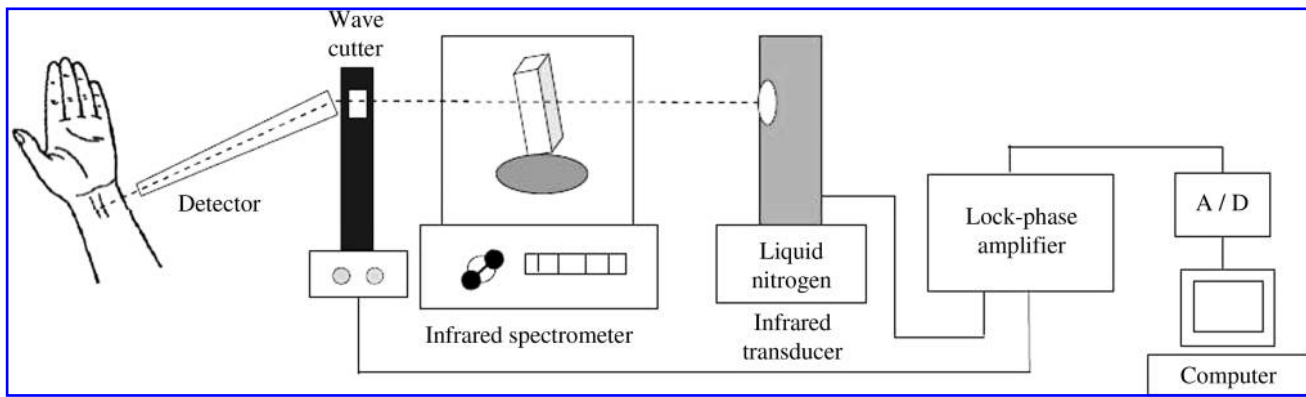


FIG. 1. Highly sensitive infrared radiation spectrum detecting system.

radiation range was from 7.1–15.9 μm , with a major peak of radiation around 10 μm . The same results were obtained from Taichong (LR 3) (Figure 2).

A further analysis of infrared radiation intensity was then performed. Of the 73 detected wavelength spots of infrared radiation intensity at right Daling (PC 7), 28 wavelength spots in the CHD patients were significantly different from that of controls (P values from .04 to <.001). At 11 wavelength spots, from 1.5–3.5 μm , the infrared radiation intensities of the patients were significantly lower than that of the controls (from $P = .006$ to $P = .002$), while from 4.9–6.5 μm , 11.3 μm , and 14.9 ~ 15.9 μm , the infrared radiation intensities of 17 wavelength spots in the patients were significantly stronger than that of controls (from $P = .04$ to $P < .001$).

Of the 73 detected wavelength spots of infrared radiation intensity at left Daling (PC 7), 19 wavelength spots in the

CHD patients were significantly different from that of the controls (from $P = .047$ to $P = .003$). At 12 wavelength spots, from 1.5–3.7 μm , the infrared radiation intensities of the patients were significantly lower than that of controls (from $P = .03$ to $P = .003$); from 5.1–5.7 μm and 15.9 ~ 15.9 μm , the infrared radiation intensities of 7 wavelength spots in the patients were significantly stronger than that of controls (from $P = .047$ to $P = .006$) (Figure 3 and Figure 4). Bilaterally, there were 47 wavelength spots significantly different in the CHD patients' Daling (PC 7) vs those of the controls.

Of the 73 detected wavelength spots of infrared radiation intensity at right Taichong (LR 3), at only 1 wavelength spot (4.5 μm) were the infrared radiation intensities of the patients significantly stronger than that of controls ($P = .049$).

At left Taichong (LR 3), 23 wavelength spots in the CHD patients were significantly different from that of the controls (from $P = .04$ to $P = .001$); at 15 wavelength spots, from 1.5–4.3 μm , the infrared radiation intensities of the patients were significantly lower than that of controls (from $P = .03$ to $P = .001$); from 5.1–5.7 μm and 15.3 ~ 15.9 μm , the infrared radiation intensities of 8 wavelength spots in the patients were significantly stronger than that of the controls (from $P = .04$ to $P = .003$). Bilaterally, there were 24 wavelength spots significantly different in the CHD patients' Taichong (LR 3) vs those of the controls.

The Pearson χ^2 test showed a significance with more wavelength spots at Daling (PC 7) ($n = 47$; 32.19%) than those at the control point Taichong (LR 3) between the CHD patients and the controls ($n = 24$; 16.44%) ($P = .002$).

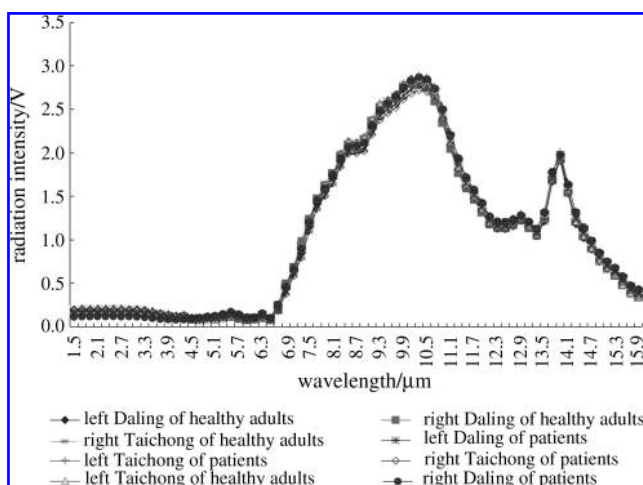


FIG. 2. Infrared radiation spectra of Daling (PC 7) and Taichong (LR 3) in coronary heart disease patients and healthy controls. The scanned wavelength was 1.5–16 μm and the scanning space was 0.2 μm , for a total of 73 wavelength spots detected.

DISCUSSION

Presently, infrared radiation imaging techniques and infrared radiation spectrum analysis are the 2 main methods in the research on infrared radiation characteristics of acupuncture and moxibustion. The former mostly reflects the

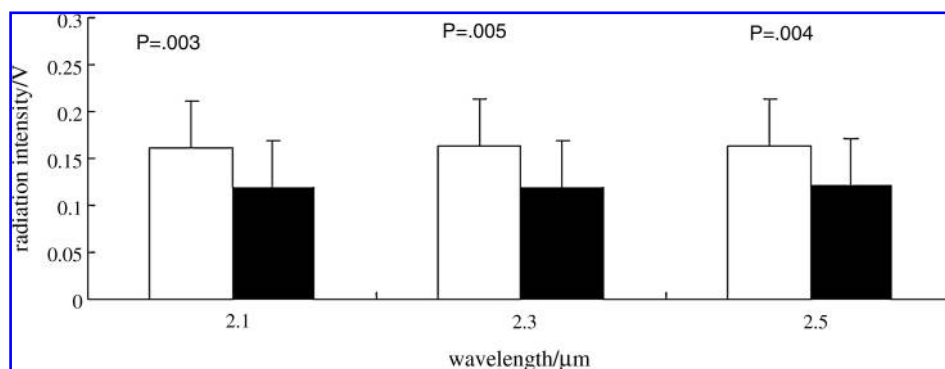


FIG. 3. Comparison of infrared radiation intensity at right Daling (PC 7) in patients and controls between 2.1–2.5 μm .

changes of body temperature along the meridians in both physiological and pathological conditions as well as the changes of body temperature produced by sedating or reinforcing manipulations in the acupuncture point areas. The latter has made great headway in the studies on the characteristics of infrared spectrum of acupuncture points and the mechanism of moxibustion treatment.^{6,7,12,13} The infrared radiation imaging techniques can only detect 3–6 μm radiation, which is rather narrow and cannot present a complete wide-band spectrum produced by the human body in a total natural state. It is hard to distinguish the nuance of acupuncture points and meridians by roughly comparing the temperature of radiation as the infrared radiation spectra showed in Figure 2; i.e., there was no significant difference in the spectra of Daling (PC 7) and Taichong (LR 3) of both CHD patients and controls. It indicates a similarity in total amount of radiation so that spectrum analysis and comparison of radiation intensity on each wavelength spot must be done. It typically showed the obvious limitation of the infrared radiation imaging techniques and the advantage of infrared radiation spectrum analysis.

The temperature of the body surface is about 33°C or 306 K; so that according to the above formula, the wavelength of the greatest radiation intensity of the human body is about 9.47 μm . The radiation peaks emitted by Daling (PC 7) and Taichong (LR 3), in both healthy adults and CHD patients in this study, concur with the results produced by

Wien's law of displacement¹⁴ and tally with our previous research^{6,8,12,15} and observations by Ovechkin and colleagues.⁵

Daling (PC 7) is the Yuan-Source Point of the Pericardium meridian, as is Neiguan (PC 6).⁸ It is also a commonly used acupuncture point for treating heart disease. Taichong (LR 3) is the Yuan-Source Point of the Liver meridian, which is often applied to treat the symptoms and diseases due to overactivity of Liver Yang such as headache, vertigo, and hypertension. Taichong (LR 3) has certain effects on relaxing vessels in the brain and exciting brain tissue.^{16–18} By comparing infrared radiation intensity at 146 detected wavelength spots from 1.5–16 μm bilaterally, it was found that the infrared radiation intensities of CHD patients at Daling (PC 7) differed significantly from that of the controls at 47 (32.19%) wavelength spots. However, at Taichong (LR 3), there were only 24 (16.44%) wavelength spots bilaterally in the CHD patients that significantly differed from that of controls. Such differences between Daling (PC 7) and Taichong (LR 3) were statistically significant. The results suggest that the pathological changes in CHD patients correspond to the specific change of the infrared radiation intensities at Daling (PC 7). In our previous study on infrared radiation of Neiguan (PC 6) in CHD patients, it was also found that Neiguan (PC 6) has such specificity.^{8,19} Hence, acupuncture points of same meridians likely have similar characteristics.

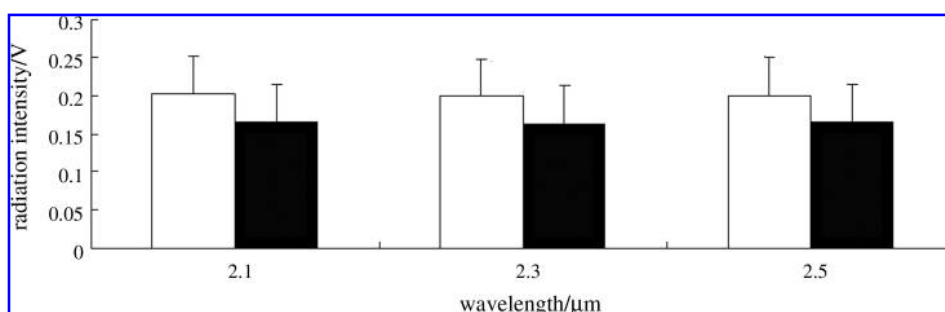


FIG. 4. Comparison of infrared radiation intensity at left Daling (PC 7) in patients and controls between 2.1–2.5 μm .

The peak of spontaneous infrared radiation of acupoints between 2 and 2.5 μm is probably related to energy conversion of ATP into ADP.^{12,20,21} ATP is the uppermost energy substances of organisms.²² Most of ADP can be phosphorylated into ATP by the energy released by oxidation and decomposition of glucose, fat, and protein. Consequently, energy is conserved inside the ATP molecule. As calculated in Planck's quantum energy formula, $E_n = nh\nu$ ($n=0,1,2,3\dots$), when the energy produced by 1 ATP molecule converting into ADP is not completely used by a biochemical reaction but radiates in the form of photon, the wavelength of the photon is around 2.5 μm . We have already found that the infrared spectrum of human acupuncture points and the infrared spectrum emitted by ATP hydrolyzation both have a distinct radiation peak around 3 μm when both are deducted by the background radiation of black bodies of same temperature.²¹ This indicates that the infrared spectrum of acupoints contained the message of ATP metabolism. We also found that the acupuncture area is rich in phosphate.²³ Phosphate is an important component of ATP; the profuse phosphate element in the acupuncture point area is probably related to profuse ATP in that area, which indicates stronger energy metabolism in the acupuncture point area.

Our previous research showed that the radiation peak of acupuncture point at 2–2.5 μm is obviously higher than that of nonacupuncture point, which indicates that the content of ATP in the acupuncture area is richer and its metabolism is more active.^{6,8} In this study, around 2.5 μm , the infrared radiation intensities of both left and right Daling (PC 7) in CHD patients were significantly lower than that of controls, which indicates lower energy metabolism in acupuncture point areas in a diseased condition. In the theory of Traditional Chinese Medicine (TCM), the Heart dominates blood and vessels, and Heart Qi pushes blood in an endless cyclic flow. The above-mentioned results tally with the pathogenesis of CHD in TCM, i.e., deficiency of Heart Qi resulting in weak push, bringing about blood stagnation in meridians and collaterals that pertains to the heart and pericardium. As a result, it is reflected in relevant acupuncture points. However, the liver stores blood. When the liver affects the cardiovascular system, it often affects the regulation of peripheral blood volume when the body is in different physiological conditions like static state or dynamic state. Around 2.5 μm , only left Taichong (LR 3) had lower infrared radiation intensity in CHD patients than in controls. This result indicates that compared with Taichong (LR 3), the Yuan-Source Point of Liver meridian, Daling (PC 7), the Yuan-Source Point of Pericardium meridian, can reflect the decrease of the heart function in dominating blood and vessels in CHD more comprehensively. This also indicates the relative specificity of Daling (PC 7) to the heart. Furthermore, it shows that Yuan-Source Point relates specifically to its pertaining organ. In our previous research, it was also found that Taiyuan (LU 9), the Yuan-Source

Point of the Lung meridian, had a definite correlation between its infrared radiation and the pulmonary function.^{24,25} With regard to the biological and physiological significance of the changes at the rest of the wavelength spots, it is still unclear which needs further research.

CONCLUSIONS

The infrared radiation spectrum is a sort of manifestation of energy of the human body or a sort of manifestation of Qi. The study on infrared radiation spectra of different acupuncture points in the same disease provides experimental basis for the relative specificity of acupuncture points to the relevant internal organs, and also provides a theoretical basis for clinical selection of acupuncture points as well as the selection of wavelength in moxibustion produced by infrared radiation.²⁶

The limitation of this study was that we had not compared the results with the nonacupuncture points. In addition to this study, we have many questions worth exploring: since the infrared spectra of Daling (PC 7), the Yuan-Source Point of the Pericardium meridian, and Neiguan (PC 6), the Luo Connecting Point of the Pericardium meridian, can both have sensitive changes in CHD patients, how will they change in other heart diseases? And after proper treatment, will their radiation intensities return to normal, especially around 2–2.5 μm ? These issues will be studied in our further research.

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DISCLOSURE STATEMENT

No competing financial interests exist.

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