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Photoluminescence of Bioceramic Materials and Bioceramic Resonance

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Abstract

The development of photoluminescent of BIOCERAMIC(PLB) and BIOCERAMIC resonance are based on BIOCERAMIC material, is a kind of non-ionized radiation spectrum emitting material possesses characteristics of weakening effect on water hydrogen bonds. The effect is corresponding to our previous medical-biological studies, such as microcirculation enhancement. Herein, a review is to conclude our previous study on therapeutic effect of PLB or BIOCERAMIC resonance. They are include: glucose level control on diabetics by animal model; improved motor activity on middle cerebral arterial occlusion(MCAO) of rats by PLB treatment; normalizing ability to the mean current level measurement of acupuncture points on skin by PLB irradiation; enhanced propagated sensation along meridians' (PSM) phenomenon with clinical benefits by PLB effect on different meridian channels; combine effects of PLB and BIOCERAMIC resonance on many disorders such as insomnia, migraine(a chronic sympathetic nervous system disorder) and other autonomic nervous system disorder, associate clinical improvements. Thus, application of BIOCERAMIC technology for complementary therapy has scientific evidence based with good expectation.

Running title: BIOCERAMIC therapy

Key words: BIOCERAMIC; Resonance; photoluminescent; Meridian; Diabetics; parasympathetic; ANS

I. Introduction

A series of studies completed by using BIOCERAMIC technology〔1-26〕,are include application of devices with photoluminescent of BIOCERAMIC(PLB) and BIOCERAMIC resonance〔21-26〕. The setup of PLB and BIOCERAMIC resonance, is based on BIOCERAMIC material (obtained from the Bioenergy laboratory, Bioenergy Development Ltd, Taoyuan, Taiwan, China)〔1-26〕. BIOCERAMIC is a kind of non-ionized radiation spectrum emitting material〔1-26〕, which possesses characteristics of visible light-induced luminescence. In our previous study using Fourier transform infrared spectroscopy (FT-IR), was found hydrogen bonding weakening change on BIOCERAMIC irradiated water. In addition, other of our previous publication studied on viscosity, volatility, temperatures of water crystallization, surface tension, diffusion, solubility of solid particles, and changes in pH of acetic acid by BIOCERAMIC treated water,

was found of decreased in viscosity and surface tension (contact angles), but increased in the solubility of solid particles, temperatures of water crystallization, and acidity of acetic acid. Thus, the weakening of water hydrogen bonds caused by BIOCERAMIC irradiation is concluded. This finding is correspondent with our previous medical-biological studies, such as microcirculation enhancement〔1-3〕.

Since water possesses important properties required for life-giving processes, under weakening of hydrogen bonds, it allows water to act in diverse ways under different conditions. By break up cluster of water molecules that linked by strong hydrogen bonds, which may change of properties water in living environment〔3〕. Hydrogen bond weakening effect should be one of the key working mechanisms to explain BIOCOERAMIC's effects on physical-biology and physical-chemistry.〔1-3〕. In particularly, we have reported BIOCERAMIC to normalize psychological stress conditioned elevated heart rate and blood pressure as well as oxidative stress-suppressed cardiac contraction〔10〕. It also significantly decreases in muscle stiffness and pain relief on myofascitis of shoulder. BIOCERAMIC was also reported help relieve dysmenorrheal by regulating the autonomic nervous system (ANS) proven by heart rate variability (HRV) result〔17〕.

Another study using analysis of HRV, by performed Harvard step test on candidates, was showed BIOCERAMIC significantly increased the high-frequency (HF) power spectrum. The result reflects parasympathetic nerve is activated by BIOCERAMIC〔11〕. Device of PLB is based on the BIOCERAMIC's characteristics of luminescent effect with photoexcitation within infra-red ray spectrum; all the previous mentioned physical-biology and physical-chemistry effects of BIOCERAMIC〔1-21〕 could be amplified during visible wave pass through the BIOCERAMIC material and then propagate to long distance or through deep penetration of living tissue〔22-23〕. PLB uses a visible light source of light-emitting diodes (LEDs), which emit a wavelength of a visible light spectrum between 390 to 750 nm. The visible light spectrum has the characteristics of deep optical penetration depth. On the other hand, the function of BIOCERAMIC resonance device is also base on BIOCERAMIC's characteristics that being amplified during sound wave pass through the material and then spread to long distance or deep penetration of living tissue. By selecting specific infrasound frequencies of sound wave, BIOCERAMIC resonance produces vibration with different human tissues or organs. According to our previous studies, BIOCERAMIC resonance with infrasound frequencies achieved vibration of specific meridian channels described by Traditional Chinese medicine(TCM), which brings to clinical benefits〔24-25〕. It was then begun animal and human trials, under permissions with a series of IRB approvals: IACV CApproval No: LAC-101-0093, TH-IR0014-0001, TMU-JIRB 201207024, TMU-JIRB 201210029, TMU-IRB CRC-02-08-08, TMU-JIRB 201007004 and TMU-JIRB 201105006.

II. Therapeutic effect of PLB on diabetics using animal model

Sprague-Dawley rats were used for streptozotocin(STZ) induction for diabetics. STZ treated rats were identified as diabetes based on urine glucose levels above 2.5 mol/L. The non-treated diabetic rats were further confirmed by a progressive increase in urinary glucose. About 5 days after STZ

injection, the diabetes non-PLB group is progressive increase of their glycosuria during the examination. The fluctuation range of glycosuria in diabetes of non-PLB group was not lower than 2.6 mol/L. There is statistically significant decreased urinary glucose on diabetic rats with PLB treatment; it reflects the amelioration of hyperglycemia. There are significant differences of measured urine glucose between diabetic rats of different degree of glycosuria. Base on the results, the improvements of glycosuria are in descending order as: low glycosuria subgroup >moderate glycosuria subgroup > high glycosuria subgroup. To explain the possible mechanism of how PLB ameliorate hyperglycemia, a previous cell study was done, it found BIOCERAMIC treatments resulted in a tendency to promote glucose diffusion into C2C12 cell line and decreases in glucose. The increased uptake of glucose by the cell culture after PLB treatment may be due to the increased permeability of glucose through the cell membrane. Thus, the changes in the physical properties of water may promote the diffusion of solutes, the changes in the physical properties of water may promote the diffusion of solutes, improving the transport of substances across the cell membrane from the blood into cells 〔21〕. Nitric oxide is beneficial for diabetics for glucose metabolism 〔21〕, and BIOCERAMIC irradiation was proved of promoting amount of nitric oxide (NO) through calcium-dependent nitric oxide synthetase [5,12]. Therefore, the increased uptake of glucose by the cell culture after PLB treatment (Figures 1) may be due to the increased permeability of glucose through the cell membrane and and calcium dependent nitric oxide production.

III. PLB irradiation on Middle Cerebral Arterial occlusion(MCAO) in Rats

One of our previous studies was to find out the possible rehabilitation effect of PLB on stroke, by using animal stroke model of transient middle cerebral artery occlusion(MCAO). Sprague-Dawley rats were used to induce MCAO by advancing a 4-0 surgical nylon suture into the internal carotid artery (ICA) to block the origin of the MCA. We selected the most poor performance post MCAO rats that needed to spend more than 200 seconds of completing the tunnel maze running, which represented significant neurological defect. The selected MCAO rats were allowed to continue next experiments, and were used for treadmill experiment under different speed of treadmill roller, and then assessing the possibility of PLB on improvement of fast running performance and restoration of muscular fatigue〔24〕(figure 2). It was found PLB irradiation promoted treadmill exercise completion rate and average speed, no matter slow or fast speed of treadmill, as well as better restoration of muscular fatigue after intense exercises. Thus, PLB irradiation may help to improve motor performance of rats in stroke model.

IV. PLB's effects on Acupuncture Points

We measured the meridian current by using a MEAD Me-Pro, 6th generation (Hanja International CO. Ltd., Taoyuan, Taiwan, China) device, which yielded electrodermal measurements of the 24 Ryodoraku meridian points base on traditional Chinese Medicine〔22〕. The measurements begin using a low current, which is probably gradually increased to a maximal value of 200μA. The electrical conductivity readings for the meridian points are recorded into a computerized system. According to the results of the mean overall meridian

current, the technician selected the most abnormal current level on meridian channels and its specific Ryodoraku meridian points. The lowest current level meridian measurement and highest current level meridian measurement were both selected. We calculated and compared before and after PLB irradiations on the mean current levels of each candidate about normalizing ability of PLB irradiations on extremely high and moderately high current level group and also on extremely low and moderately low current level group on different meridian channels. It was showed that PLB irradiation has complementary effects on the current flow of abnormal meridians returning to its normal current level〔22〕(figure 3).

V. PLB treatment for different chronic illnesses by selecting 'trigger points' and 'propagated sensation along meridians' (PSM) phenomenon

The patients we chosen suffered from differing chronic and acute illnesses that severely affected their usual sleep patterns and life quality. The patients we selected for PLB irradiations(figure 4) were first given a physical examination to search for local tenderness and propagated sensation along meridians (PSM) phenomenon. PSM is sensed or felt along the subjects' skin and connected a road map that corresponds to a section of meridians after receiving traditional acupuncture(figure 5). We also combined the concept of Traditional Chinese Medicine's twelve main meridian branches and used at least three different points of local tenderness to connect a road map that corresponded to one of the twelve main meridian branches.

According to protocol PLB irradiation was applied to those skin points that rest along the meridian channel after the BIOCERAMIC silicon stickers were firmly placed onto the subjects. PLB irradiation on the selected meridian channels lasted a minimum of 60 minutes and was conducted two times a week. Clinical observation and subjective descriptions were recorded at interviews that followed each session. According to the results, about 30% of the candidates started to feel or sense propagated sensation along meridian channels. There were about 43.8% candidates found with clinical improvements under objective observations. Amongst, lower leg or feet edema are the most remarkable objective improvement (100%). We also found PLB irradiation of specific meridian channels; have beneficial results on different chronic and acute illnesses. Based on the traditional Chinese concept of pathogenesis, the stagnation occurring in extremely tiny channels within the human body is a key cause of the manifestation of many diseases. We found the procedures of selecting meridians for PLB irradiation through methods of 'local tenderness skin points' and 'PSM' proved to be both practical and successful. It also seems to validate the old traditional Chinese theory of"*butongzetong"*and "*tongzebutong*" 〔23〕.

VI. Clinical observation on human trial during BIOCERAMIC resonance

The candidates received BIOCERAMIC resonance were set at infrasound frequency (with vibration frequency: 10Hz) for one hour(figure 6).

Clinical observation and subjective descriptions were recorded at interviews that followed the experiments.

About 70% candidates who received BIOCERAMIC resonance set at specific infrasound (vibration frequency: 10 Hz) 〔25-26〕, have a subjective description of 'Propagated Sensation

along Meridians' (PSM). The sensation may initiate from one to about twenty minutes. PSM is a phenomenon in which a sensation moves along meridians during stimulation of an acupuncture point. Two assumed mechanisms of PSM during acupuncture are included neuro-modulation〔27〕and degranulation of histamine from mast cells that occurs on the route(meridian channel) which leads to expansion of capillaries and increase of blood perfusion and interstitial fluid, sending simultaneously a continuous sensate signal to control nerve system〔27-29〕. PSM was described in our previous study while using PLB on acupuncture points, but the proportion was only about 30%〔23〕

For more explanation of the strengthening and inducing effect of PSM phenomenon by operating BIOCERAMIC resonance device, we should reviewed physiology of blood flow in arteries. As we know, the regular beating or contraction, of the heart propagate the blood with a regular pulse rate, which is the rate determined by palpating over the location of a peripheral or central artery. The pulse wave in the whole arterial system can be decomposed into many distributed stationary waves associated with the harmonic components of the periodic force exerted by the heart〔30-31〕. Any wave that is repeated regularly can be represented by a Fourier series with the wave shape described as the sum of a set of sinsoidal waves, whose frequencies are integral of the multiples frequencies and repetition of the wave. It is similar to the harmonic analysis of musical sounds with over-tones that widely used in the physical sciences of acoustic engineering. By using Fourier analysis, pulse wave of peripheral artery are decomposed into a series of harmonic (sine) waves, base on the fundamental heart rate frequency〔30〕. There were total of ten harmonic waves could be decomposed by using modern pulse digital analysis device through Fourier transform analysis〔30-32〕. According to interpretation of Wang WK el al, although not measurable, there is an addition 11^{th} harmonic frequency placed after the 1^{st} to 10^{th} units. Moreover, a twelfth frequency is recognized as the sum of the eleven harmonic frequencies in terms of energy, to become totally 12 units. According to Wang el al.'s opinion〔31〕, the harmonic infrasound frequencies of the heartbeat being the main frequency components in the propagated pressure wave correspond to the twelve different meridian channels of TCM, described in ancient Chinese medical test book (The Yellow Emperor's Inner Classic) published over 2500 years ago. Acupuncture points and meridian channels are deduced to closely relate to microcirculation. BIOCERAMIC's effects on hydrogen bond weakening for fluid and microcirculation is the key factor of its effect. Adding the physiological concept of aforementioned deduction, when BIOCERAMIC resonance produces infrasound frequency at 10Hz, it also provides different sound harmonic frequencies at above or below 10 Hz. The harmonic frequencies of pulse wave may selectively interfere with the same input frequencies from BIOCERAMIC resonance device; so that BIOCERAMIC's effect is easily pass through the specific meridian channel by produced larger amplitude oscillation (figure 7).

VII. Combination therapeutic effects of PLB and BIOCERAMIC resonance

Practically, we had collected many cases such as insomnia, migraine(a chronic sympathetic nervous system disorder) and other autonomic nervous system disorder (such as one of the hyperkinetic facial movement disorder), were achieved clinical

benefit or remission by using PLB and BIOCERAMIC Resonance. The possible effects of PLB and BIOCERAMIC resonance into two parts: (1) directly by BIOCERAMIC function; (2) indirectly by stimulation of meridians under concept of TCM. As mentioned above, both PLB and BIOCERAMIC resonance are based on the fundamental effects of BIOCERAMIC, such as hydrogen weakening effect and in turn to affect numerous reported physical-biology, physical-chemical and medical changes. As mentioned above, our previous studies indicate parasympathetic nerve is activated by BIOCERAMIC. By assumption, the direct effect of BIOCERAMIC on these patients is through ANS regulation, including comfort of 'stress' and 'anxious', is one of the reasons with our observed clinical outcomes mentioned above. On the other hand, traditional acupuncture on meridian system of TCM was already proved to have the merits on these kind of disease. The application of BIOCERAMIC in turns of PLB and BIOCERAMIC resonance on meridian and acupuncture point, is to replace traditional acupuncture or amplified the outcome without possible complication of invasive procedure. 〔33-37〕.

VIII. Conclusion

By physical induction of a series of biological effect (eg. hydrogen bond weakening and microcirculation improvements), the direct application of PLB and BIOCERAMIC resonance technologies was found advantage on hyperglycemic control, post stroke rehabilitation, insomnia, migraine(a chronic sympathetic nervous system disorder) and other autonomic nervous system disorder; it also indirectly achieved clinical benefits through acupuncture points and meridian channel of TCM concept. We believe that the value of this new technologies of BIOCERAMIC have the promising future for therapies.

IX. Acknowledgement

No conflict of interest in this study

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Figures

Figure 1:PLB treatment on STZ induced diabetic rats in metabolic cages, with continuous urine collection

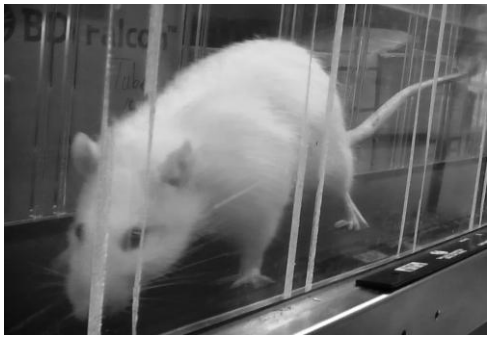

Figure2: Treadmill performance of MACO rats without and with PLB treatment

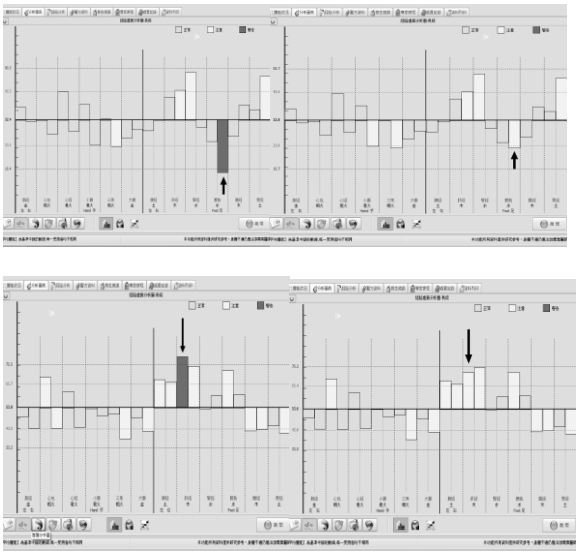

Figure 3 : (right upper and lower) Two examples of candidates with extremely high and low current levels measured by instrumental measurements; (left right upper and lower) after PLB irradiation of 15 minutes, there are remarkable normalization of current levels on the two specific meridian channels.

Figure 4: PLB treatment on human trial

Figure 5a&b:An example of PSM(left)on face, with

roadmap indicating meridian of stomach according to TCM concept(right)

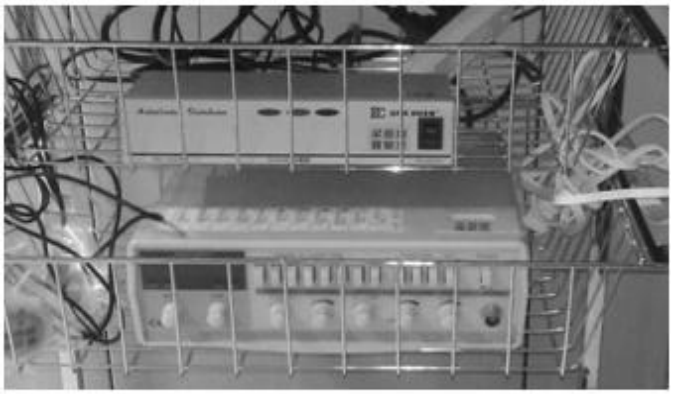

Figure 6: Infrasound frequency producing platform of BIOCERAMIC resonance

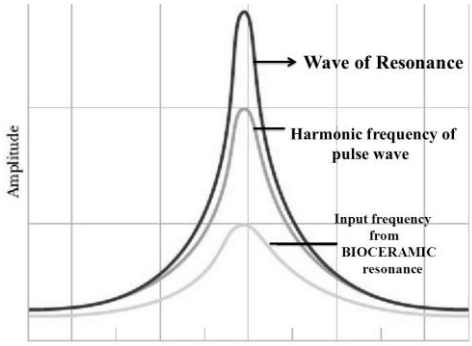

Figure 7: Resonance effect is created by specific input infrasound frequency interfere with specific harmonic frequency of pulse wave