

MICROWAVE RESONANT THERAPY: NOVEL OPPORTUNITIES IN MEDICAL TREATMENT

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Abstract. Microwave Resonant Therapy (MRT) is a novel medical treatment, which represents a synthesis of the ancient Chinese traditional knowledge in medicine (acupuncture) and recent breakthroughs in biophysics. Affecting the appropriate acupuncture points by the generator of high frequency microwaves (52-78 GHz), remarkable clinical results of the treatment are being achieved. In this paper biophysical basis of the MRT, its technical details, medical indications and contraindications, and clinical effects are presented.

Keywords: *Acupuncture, microwave resonance therapy (MRT), biophysical basis, technical details, indications and contraindications, clinical effects*

INTRODUCTION

The *yin-yang* concept of acupuncture, as a network of energy-information processes of an organism, originating from the very embryological development, represents one of the most specific and most useful segments of the renowned *Chinese traditional medicine* [1-3]. The Western science has included acupuncture through the World Health Organization, but not its very archaic philosophy. In the definition of contemporary scientific acupuncturology it can be said that acupuncture deals with somatotrophic representation of organs and tissues on the surface of the body, on the extra-bioactive acupuncture (trigger) skin points. By their biophysical activation one can accomplish effects which are manifestation of the nervous (peripheral, autonomous, and central) and endocrine systems, owing to interaction and integration of sensitive stimuli. Out of numerous effects of acupuncture stimulation, the most significant in prevention, therapy, and rehabilitation are analgesia, broncho-vasodilation, and immunological responses.

In Chinese tradition the word acupuncture means insertion (*acus* - needle), and is related to the insertion of needles in strictly specific locations on the skin (*acupuncture points*), which regulates the flow of the *qi* entity within its energy paths (*meridians*), interconnecting appropriate acupuncture points. According to Chinese tradition, the meridians are interconnected into two symmetric (and mutually independent) energy-information somatic networks, one on each side of the body. Each network consists of 12 meridians - having correspondence to 12 visceral organs: 6 *fu* (*yang*) hollow organs (large intestine, triple warmer, small intestine, stomach, gall bladder, urinary bladder), which transform food into energy and blood, and 6 *tsang* (*yin*) solid organs (lung, pericardium, heart, spleen, liver, kidney), which receive energy and blood from the *fu*-organs, and refine and distribute energy within the body.

The *qi* entity is flowing equally and simultaneously throughout both sides of the body. The time of maximal *qi* activity of each meridian is 2 hours, giving rise to a complete 24 hour circulation of *qi* through all 12 meridians! Each organ has its hour of entrance (when maximal 2-hour activity of the organ begins) and its hour of exit of *qi* (when minimal successive 2-hour activity of the organ begins): by corresponding acupuncture stimulation during its maximal activity it is most efficient to decrease activity of the organ, and during its minimal activity it is most efficient to increase activity of the organ. The stylized display of the daily dynamics of *qi* circulation is depicted in Fig.1: the successive regularity of alternative sequence of the paired *yin-yin* and *yang-yang* organs can be noticed.

Beside 12 paired meridians, which are great double circulation of the *qi* entity, Chinese tradition has also depicted 2 middle meridians, the back one and the front one, independent of the great double *qi* circulation. These central meridians do not correspond to organs but their functions, being stimulated in the case the meridians of the organs do not react appropriately upon stimuli.

There are 794 (397 + 397) extra-bioactive points (acupuncture points) on the body. The points can be stimulated by insertion metallic needles, but also by heat, pressure, magnets, weak laser beam, ultralowfrequency currents, microwave resonance, aeroionic, and biotherapeutic stimulation [1-3].

Indian traditional medicine, and especially one of its most prominent representatives, *swara yoga*, is also acquainted with an energy system analogous to

the Chinese acupuncture system: in Indian terminology the *qi* entity is known as *prana*, and *meridians* as *nadis* (14 of them being basic, like in acupuncture, although three of them being of special medical and spiritual significance: *ida*, *pingala*, and *shushumna*) [4].

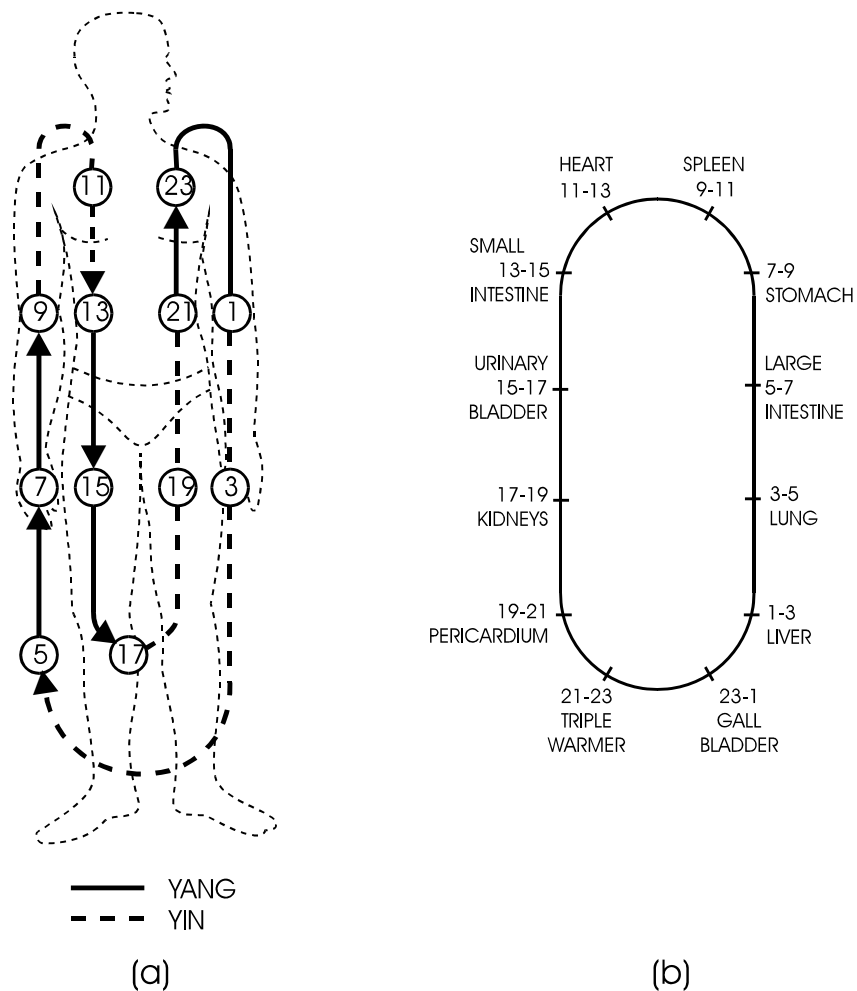


Figure 1 Stylized display of traditional Chinese representation of circulation of the *qi* entity within the human body: (a) during 24 hours, and (b) hours of maximum activity of the organs; actually, each side of the body has its independent circulation of *qi* [2].

BIOPHYSICAL MECHANISMS OF THE ACUPUNCTURE REGULATION

Besides its practical medical aspects, Chinese traditional medicine is deeply colored with mystical connotations, which was one of the reasons why Western science has been hardly accepting experiences of Eastern tradition. The second reason was that within the 12 visceral organs corresponding to the 12 paired meridians, Chinese tradition has not included the brain and endocrine glands: however, in the past few decades it was found that the acupuncture system was in close functional interaction with both central nervous system and endocrine system, as well as with peripheral and autonomous nervous systems [1-3].

The final reason was a lack of clear anatomical basis of the Chinese acupuncture system. However, new investigations of *gap junctions* (specific intercell channels, Fig.2) have shown their significantly increased concentration inside the acupuncture points and meridians [5].

It is well known that the cell membranes have an extremely significant role in communications between cells. The evolutionary older type of intercell communications is achieved through gap junctions, transporting metabolites and regulatory molecules between inexcitable cells, and also ionic electrical signals between excitable cells (of the cardiac muscle, smooth muscles, epithelial liver cells, neurons with electrical synapses, acupuncture points and meridians) - while the evolutionary younger type of intercell communication is mediated by electrochemical transmitters, through neurons separated by a cleft. Gap junctions are depicted in Fig.2, wherefrom is seen that normal intercell separation of 20 nm is lowered to 3.5 nm at the gap junction of excitable cells, which enables direct transmission of electrical signals by ionic currents flowing through such channels (electrical synapses). All gap junctions consist of a pair of cylinders (connexons), one in the presynaptic and the other in the postsynaptic cell. The cylinders meet in the gap between the two membranes and contact, by means of homophilic (cell specific) interactions, to establish a communicating channel (~ 1.5 nm in diameter) between the cytoplasm of the two cells. Each cylindrical connexon (~ 7.5 nm in length) is made of six identical protein subunits (connexins) - which have a function to selfassemble connexon hemi-channel and to recognize its counterpart hemi-channel and complete conductive channel. The whole such process is very flexible and depends on the current cell environment [5]. The very conductivity of the gap junction can be modulated by intracell pH-factor, Ca^{2+} -ions, neurotransmitters and second messengers, and even by voltage - which change conformational state of connexon (like the shutter in a camera).

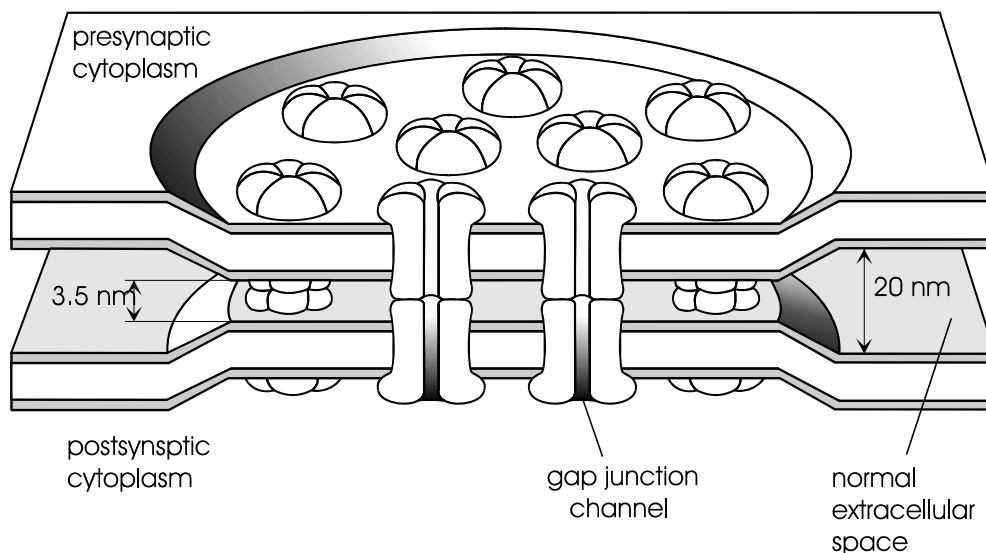


Figure 2 A three-dimensional model of the gap junction channel based on X-ray diffraction studies [5]. Each apposite cell contributes half of a channel (hemi-channel) called a connexon. Each connexon (~ 1.5 nm in diameter) is formed from six hexagonally arranged protein subunits (~ 7.5 nm in length) called connexins. At gap junctions the cells are only ~ 3.5 nm apart, in contrast to normal separation of ~ 20 nm.

A better organization of cell structures and an ionic basis of the *qi* entity of the acupuncture system is also suggested by ~ 10 times lower skin electrical conductivity of the acupuncture points in respect to the surrounding tissue, as well as much higher reabsorption of aeroions in these points [2].

Ionic acupuncture currents, and accompanying electromagnetic fields, have ultralowfrequency (ULF) and microwave (MW) components, i.e. the MW component is modulated by the ULF component [6,7]. In support to the ULF nature of ionic currents in acupuncture channels, one can cite the resonance ULF (~ 4 Hz) stimulation of the acupuncture analgesia endorfin mechanism [8]. On the other hand, the evidence for the MW component of ionic acupuncture currents is provided by resonant MW (~ 50-80 GHz) therapy, efficient even in very serious diseases [9-11].

Theoretical predictions of the biophysical model of altered states of consciousness [6,7] also imply an ionic nature of the *qi* entity of the acupuncture system, with possibility of its partial displacements from the skin surface in these states. In this context, the displaced part of ionic acupuncture structure would have a function of an "optical" MW neural network, modulated by ULF brainwave introspective information or visual sensory information perceived in altered states of consciousness. In the framework of the model, the *qi* entity has its theoretical interpretation in *ions*, out of which the *positive ions* having activating influence (catabolic, *yang*) flowing predominantly through the right circulatory part of the acupuncture system, while the *negative ions* having inhibiting influence (anabolic, *yin*) flowing predominantly through the left circulatory part of acupuncture system. Therefore, the role of acupuncture stimulation might be the balancing of activity of the positive and negative ions within the body, corresponding to normal healthy condition. This also implies the significance of aeroionic balance [7,12] and regular rhythmical breathing, recognized in Indian tradition: according to swara yoga [4] the rhythmical breathing through nose is especially important, in order to inhale as many as possible aeroions within the two (of three) most significant *nadis* (the left *ida* and the right *pingala*, with their entrances in corresponding nostrils). This is recommended in fresh and nonpolluted air, when even some excess of negative ions (*yin*) exists, with the relaxing healthy influence on the body; in the same context, in closed environments a microclimate engineering can be recommended by applying aeroionizers which produce an excess of negative ions.

BIOPHYSICAL AND TECHNICAL ASPECTS OF MRT

The inventors of the microwave resonant therapy (MRT), former Soviet scientist Sit'ko and his coworkers Andreev, Beli, and Zhukovskiy (stimulated by previous theoretical research of Frolich, and empirical results of Nedzveckiy and Cherkasov [9]), proposed in early Eighties that acupuncture system is a dynamic structure, differentiated at the locations of maximums of three-dimensional standing waves, formed as a result of the reflection of coherent microwave (~ 100 GHz [13]) Frolich excitations of molecular subunits in the cell membranes and proteins - supported also by other investigations which have demonstrated that differentiation of gap junctions (of higher density at acupuncture points and meridians) is slightly sensitive to voltage [5]. On these grounds Sit'ko and his coworkers have developed the MRT method and officially introduced it in 1989, the same year being awarded gold medal at the International exposition in Brussels, and shortly afterwards the MRT was introduced worldwide [9].

In that context the explanation for efficiency of the MRT, as noninvasive nonmedicamentous medical treatment, should be sought [7]: some disorders in the organism give rise to deformation in the three-dimensional standing wave structure of electrical field of the organism in MW region, which influences corresponding changes in spatial structure of the acupuncture system, and consequently its resonant frequency, resulting in some disease. During the therapy, applying the MW sound at corresponding acupuncture point the excited acupuncture system of the patient is relaxing to the previous healthy condition, while reaching its normal resonant frequency response upon the wide spectrum MW source - and following to physiological mechanisms of the acupuncture regulation [1-3] the organism biochemically overcomes the disease.

Both the narrow and wide spectrum MW generators can be used in the therapeutic practice [9]. The narrow spectrum MW generators with changeable narrow frequency band are far less suitable in practice, because of much longer seeking of the resonant frequency, dependant on individual properties of the organism and subjective state of the patient, which can result in therapeutic mistakes and overdosing. The wide spectrum MW generators enable simultaneous excitation of all possibly resonant MW frequencies, and an organism continuously resonantly responds to currently appropriate (and changeable during therapy) frequency.

It is experimentally demonstrated that the organism is resonantly sensitive to the 1% frequency changes in MW range of 52-78 GHz, as observed in the EEG, ECG, pulse normalizing, change in tension and respiratory rhythm [9,10]. Up to 10 mW low-power microwave generators, of the output power density of $0.2-5 \mu\text{W}/\text{cm}^2$ - much lower than biologically limited $10 \text{ mW}/\text{cm}^2$ during 8 hours, as prescribed by USA National Standards, or $10 \mu\text{W}/\text{cm}^2$ during 8 hours, as prescribed by Russian and Ukrainian National Standards [9] - are power supplied by the $220 \pm 22\text{V}/50\text{Hz}$ a.c. The output power density as well as the seance duration significantly influence the MW absorbed dose and corresponding MRT bioeffects, which can be biostimulative for low-level therapeutically recommended doses of typical 20-minute daily MRT treatments (causing local temperature increases up to 38°C , with maximally fast bioeffect), and biodepressive and even biodestructive for much higher doses (causing much higher and harmful local temperature increases) [9].

For an individual MW dose prescription, the monitoring of the level of mitochondrian SDG enzyme in lymphocytes of peripheral blood was suggested [9,10], because the metabolism of lymphocytes can be used as the sickness degree index. It has been proved that the lymphocyte system "remembers" former state of health, has the information about the present one, and points out the succeeding changes that can occur in the further development of the illness.

The mobility of the MRT apparatuses (with the exception of the stationary generator) enables their use in various conditions, beginning with home conditions when the doctor comes to the house of the patient, then through emergency and urgent help, all the way to stationary institutions (physiotherapeutic cabinets, climate sanatoriums, coronary units, orthopedic-surgical and neurological institutions).

MEDICAL ASPECTS OF MRT

The evaluation of the clinical and economical efficiency in the former USSR, during the period 1989-1992, included more than 10000 patients with different pathology taken in 17 institutions: the results of the MRT research showed high treatment efficiency (60-95%), depending on the kind of disease, state of the evolved pathological processes, and individual differences of patient's organism [9]. The number of seances is 5-20, mostly 10 (except in very difficult stadiums of diseases when it has to be prolonged), the healing process is shortened 1.5-2 times, and there are no negative side effects. So, the high clinical and economical efficiency of MRT can be pointed out.

In the moment of establishing resonant frequency the patient's sensory response can be manifested as local, system (related to organ or system), and general (only in a small percentage of the patients the sensory response was missing: 1-3% (Kiev), 4-6% (Moscow), and 0.2% (Belgrade) [9-11]).

Local reaction appears in 74% of the patients [10], as a feeling of warmth, pricking, weight, goosflesh, bites, or cold at the contact point.

System reaction appears in 97% of the patients [10].

General reaction appears in 32% of the patients [10] in the form of comfortable and uncomfortable reactions. Comfortable reactions appear in the form of quiet colors in front of the sight (green, blue), feeling of warmth within the body, drowsiness, feeling of pleasant relaxation and weakness in muscles, ease within entire body, which can be registered in the change of tension, pulse, ECG and EEG rhythms, and respiratory normalization. Uncomfortable reactions can appear sometimes when colors begin to run away or when one sees bright colors or feels suffocation, when further MRT stimulation should be terminated, and continued later on but with lower dose.

Transient negative reactions might appear sometimes in the form of the symptom enhancement, followed by positive response. That transient aggravation might appear at the very beginning of the treatment, or after 2-3 seances, or in the middle of the treatment. Nevertheless, after 2-3 seances most of the patients react with general emotional and biophysical enthusiasm. A list of diseases which can be treated by MRT is still open, being continuously extended.

To date, the MRT has been indicated in: (1) surgery, (2) orthopedic and traumatology, (3) cardiovascular disorders, (4) urology, (5) gynecology, (6) dermatology, (7) gastroenterology, (8) pulmology, (9) upper respiratory tract, (10) cardiology, (11) neurology, and (12) oncology.

The MRT is contraindicated in the cases of: (1) acute pain in abdomen, demanding an operation, (2) pregnancy, and (3) menstruation cycle.

The recommended MRT treatment at an acupuncture point is maximum 10 minutes, while the duration of the whole treatment is maximum 20 minutes, applied daily or bidaily. The 10 treatments in a course are applied, with minimum pause of 21 days and optimal of one month, in the case a repeated course is necessary. The courses of prophylaxis are advised every 6 months.

Our experience [11] during the four year period 1993-96, based on medical practice with 497 patients, is summarized in Table 1. The results are very encouraging, confirming the high effectiveness of MRT.

Table 1. The results of MRT therapy on 497 patients, during the four year period 1993-96, in private medical practice "LAV" in Belgrade [11]

DISORDER	No. of patients	CLINICAL EFFECTS		
		Without change	Improvement (up to 70%)	Satisfactory (above 70%)
TRAUMATOLOGY	22	-	7	15
MUSCULAR AND ORTHOPEDIC	95	6	11	78
RHEUMATOLOGY	18	-	-	18
GONARTHROSIS	23	2	-	21
COXARTHROSIS	8	-	5	3
LUMBAGO	23	4	2	17
SPONDILOSIS	13	-	2	11
MYALGIO	5	-	-	5
PERYARTHROSIS HUMER.	5	-	2	3
UROLOGY	5	-	-	5
CYSTITIS CHR.	5	-	-	5
GYNECOLOGY	2	-	2	-
MYOMA UTERI	2	-	2 ^a	-
DERMATOLOGY	6	-	4	2
NEURODERMATITIS	5	-	3	2
ALOPETIO AREATA	1	-	1	-
GASTROENTEROLOGY	24	-	1	23
ULCUS VENTRICULI	12	-	1	11
GASTRITIS	12	-	-	12
PULMOLOGY	22	2	3	17
ASTHMA	22	2	3	17
ALERGOLOGY	4	-	2	2
ECZEMA	2	-	2	-
CONJUNCTIVITIS CHR.	2	-	-	2
UPPER RESPIRATORY TRACT	36	2	4	30
TUSSIS PROLONGATA	3	-	3	-
SINUSITIS CHR.	21	2	1	18
RHINITIS VASOMOTORICA	2	-	-	2
TONSILLITIS CHR. EGZ.	10	-	-	10

IMMUNOLOGICAL DEFICIT	8	-	1	7
CIRCULATION INSUFFICIENCY OF THE LOWER EXTREMITIES	7	-	-	7
NEUROLOGY	144	7	30	107
DCP (GROWTH 2-5 YEAR)	4	-	2	2 ^b
DCP (GROWTH 7-10 YEAR)	2	-	2 ^c	-
PAIN IN NEUROLOGY	138	7	26	105
CEPHALEA	57	-	13	44
MIGRAINE	6	2	1	3
SY. VERTIGINOSUM	3	-	-	3
NEURALGIO N. TRIG	3	-	2	1
PARALYSIS PLEXUSBR	2	-	2	-
SY. CERVICALE	8	-	1	7
CERVICOBRACHIALE	4	-	2	2
LUMBOISCHIALGIO	28	1	-	27
RADICULOPATHIO L-S	23	4	2	17
HEMIPARESIS POST CVI	4	-	3	1
PSYCHIATRY	83	-	8	75
ONCOLOGY	2	-	2 ^d	-

^a Reduction of myoma in both patients.

^b Patients start walking after 10 applications.

^c They are not walking, but the muscular spasms lessen.

^d Without any pain till 3 days.

CONCLUSION

In this paper biophysical basis, technical details, medical indications and contraindications, and clinical effects of the Microwave Resonant Therapy (MRT) were presented.

MRT is a novel medical treatment developed in former USSR, which represents a synthesis of the ancient Chinese traditional knowledge in medicine (acupuncture) and recent breakthroughs in biophysics. Affecting the appropriate acupuncture points by the generator of high frequency microwaves (52-78 GHz), remarkable clinical results of the treatment were demonstrated in surgery, orthopedic and traumatology, cardiovascular disorders, urology, gynecology, dermatology, gastroenterology, pulmonology, upper respiratory tract, cardiology, neurology, and oncology during the last decade - the MRT being contraindicated only in the cases of acute pain in abdomen demanding an operation, pregnancy, and menstruation cycle.

The high effectiveness of the MRT has also been confirmed in our practice, as depicted in Table 1, revealing significant improvement in 81.5%, moderate improvement in 15.1%, and insignificant changes in only 3.4% cases.

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