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EXPERIMENTAL STUDY ON THE LOW-INTENSITY MILLIMETER-WAVE ELECTRO-MAGNETIC STIMULATION OF ACUPUNCTURE POINTS

V.P.Lysenyuk, M.D., Sc.D., F.I.C.A.E.
I.Z.Samosyuk, M.D., Sc.D., F.I.C.A.E.
Y.N.Kulikovich, M.D.
A.K.Kozhanova, M.D., Ph.D.

Ukrainian National Medical University, Kiev, Ukraine
Kiev Medical Academy for Post-Graduate Education, Kiev, Ukraine
Physiology Institute of National Academy of Sciences, Kiev, Ukraine
Rehabilitation Center "Aman", Pavlodar, Kazakhstan

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Abstract:

The aim of this study was to investigate the effects of the millimeter-wave bioresonance therapy on acute inflammation and stressful conditions in experimental models. Licking reaction in mice as a component of the hypersensitive state evoked by subcutaneous formalin (0.03 ml of 1% solution) injection into the right hind paw was monitored. Different parameters of electro-magnetic stimulation (frequencies 43 GHz and 61 GHz, intensities from 0.1 to 7 mW/cm^2, the exposure time for 3 min. or 10 min.) applied to ipsilateral acupoint St.36 were studied. It was found that the millimeter-wave bioresonance therapy improved the condition of expertimental animals, accompanying by diminution of licking reaction which was registered for every 10 min. during 2 hours after the formalin test start. Effect of 10 min. irradiation was more demonstrative than 3 min. (frequency 61 GHz, intensity 0.1 mW/cm^2). Stimulation with frequency of 61 GHz suppressed licking reaction more deeply than 43 GHz under equal intensities. Most beneficial effects have been observed when minimal (0.1 mW/cm^2) intensity of electro-magnetic stimulation was used.

Key words: Electro-magnetic field, Millimeter-wave bioresonance therapy, Acupuncture points, Formalin test, Licking reaction, Parameters of electro-magnetic stimulation.

INTRODUCTION

Scientific evidences concerning a key role of intrinsic electro-magnetic fields in a number of essential functions have accumulated. They include embryonic morphogenesis, wound healing, bone remodeling under the mechanical stress, some aspects of immune and hormonal responses, information transmission in the nervous system. These processes may be influenced significantly by external sources of electro-magnetic radiation even at the very low-intensity level [1-6]. The pronounced sensitivity of the body to the extremely low frequency range (0.1 - 1,000 Hz) and the microwave range (100 MHz - 100 GHz) attracts an attention because of, on the one hand, possible health hazard for different personnel exposed to those fields in the course of their occupations, on the other hand, the challenge to the latest theories on interaction between electro-magnetic radiation and living tissues. The weak fields have been observed to produce chemical, physiological and behavioural changes only in frequency and intensity based on non-linear wave fenomena. According to the recognized soliton theory for interactions between protein molecules in living tissues and electro-magnetic fields, there exists an opportunity to predict resonances in submillimeter-wave bands.

Possibility of such an influence on metabolic processes stimulated the development of a new method of treatment with the aid of electro-magnetic generators in the millimeter wavelength range, corresponding to 30-300 GHz frequencies. Experience of clinical application of the millimeter-wave bioresonance therapy showed its effectiveness for the regulation treatment and improvement of the body resistance [7-10]. Even though this method has been widely used on patients, no systematic analysis of its basic mechanisms has been made in animal models of pathological conditions.

The aim of the present study was to investigate effects of the millimeter-wave bioresonance therapy on acute inflammation and stressful conditions in experimental animals. Special attention has been paid to tipical parameters for the low-intensity millimeter-wave electromagnetic stimulation of acupuncture points: frequency range of 61±4GHz, exposure orders of duration around 10 min., power density less than 10mW/cm^2 (as prescribed by USA National Standards the biologically limited dose is 10mW/cm^2 during 8 hours).

MATERIALS AND METHODS

70 adult male mice weighing 22-33 g were used for experiments. Animals were kept under the standard housing conditions with free access to food and water. Tests were undertaken in quiet surroundings, always in the morning between 9.00 and 12.00. Focus of acute inflammation was created by means of subcutaneous formalin (0.03 ml of 1% solution) injection into the right hind paw (fig. 1). Formalin test is well-known as a model

of the hypersensitive state [11]. The behaviour hypersensitive reaction after the formalin injection consists of two phases. The first phase lasts for 5-10 min. and depends on nociceptive activation. The second one is associated with acute inflammation. It begins in 10-15 min. after injection. Its expression is the greater substantially and duration achieves 60-120 min. and more.

Immediately after the formalin injection , experimental mice (n=60; 6 groups) were exposed to electro-magnetic irradiation in the millimeter wavelength range which was applied to the point at the ipsilateral paw corresponding to acupoint St.36 in man using medical electro-magnetic stimulator AMAT-04 (joint production of Switzerland - Russia - Ukraine). Stimulation parameters were the following: frequencies of 43GHz and 61GHz; intensity of 0.1mW/cm^2, 0.6mW/cm^2, 2.0mW/cm^2 and 7.0mW/cm^2; duration for 3 min. and 10 min. Control mice (n=10) were kept under the unplugged stimulator for 10 min. after formalin injection.

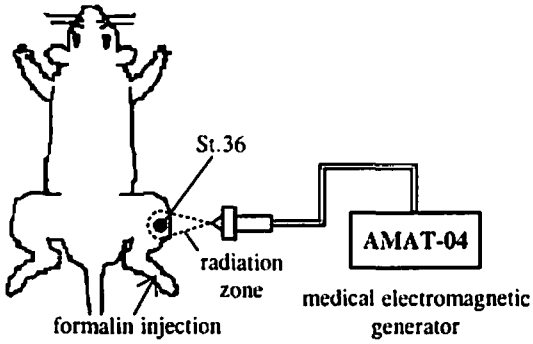

Fig.1. Schematic diagram showing site of formalin injection and electro-magnetic irradiation in the mouse.

Behaviour reactions in experimental animals were monitored in 10 min. from the formalin test start. The most informative component of hypersensitive conditions was a licking reaction. The beginning and the end for every licking cycle were registered by means of computerized system. Duration of licking reaction was estimated for every 10 min. during 2 hours. Then the total time of licking reaction was calculated as a sum of all cycles. The values were presented as the means ± SEM (Standard Error of the Mean). Data were analysed by Student's t-test to determine significance. Differences with $p<0.05$ were considered statistically significant.

RESULTS

Licking reaction in control group (n=10) as a component of hypersensitive conditions evoked by formalin injection was monitored for 2 hours (fig. 2). It was the most prominent for the first 30 min. of observation. Then after some lowering, a new rise was registered at the beginning of the second hour though it was less powerful. Total duration of licking reaction for 2 hours amounted to an average value of 23.8±2.1min.

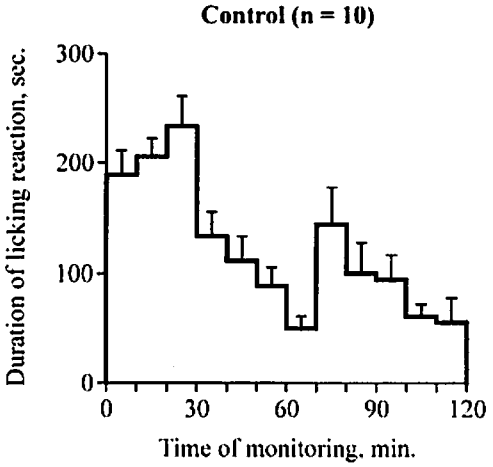

Fig.2. Duration of licking reaction (sec.) in control mice.
Each column represents duration of licking reaction expressed as the mean and SED for every 10 min. during 2 hours (120 min.) of monitoring. The beginning of observation (0) was corresponded to the 10th min. after formalin injection.

Licking reaction in all experimental groups of mice under electro-magnetic stimulation of acupoint St.36 was considerably weaker than in control. Its expression was conditioned by parameters of low-intensity millimeter wavelength electro-magnetic irradiation.

Duration of electro-magnetic stimulation and licking reaction. Immediately after formalin injection, 2 experimental groups of mice (n=10 for each group) were exposed to electro-magnetic irradiation with the same frequency (61GHz) and intensity (0.1mW/cm^2) but different duration of stimulation: Group 1 for 3 min. and Group 2 for 10 min. Differences in duration of licking reaction for both groups in comparison with control

were highly significant ($p<0.001$). Electro-magnetic stimulation caused a substantial shortening of duration: 11.8±2.1min. in Group 1 and 8.8±1.7min. in Group 2 (please compare with 23.8±2.1min in control). As shown in fig.3 effect of 10 min. stimulation was more demonstrative than 3 min. under equal frequency and intensity.

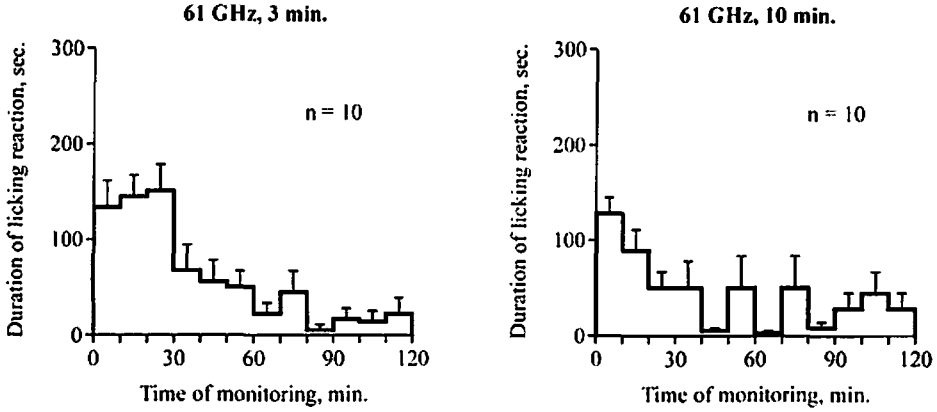

Fig.3. Duration of licking reaction (sec.) in experimental mice after electro-magnetic stimulation (61GHz, 0.1mW/cm^2) of acupoint St.36 with the different exposure time (3 min. or 10 min.).
See Fig.2 legend for explanations.

Frequency of electro-magnetic stimulation and licking reaction. Comparative study of efficacy for the different frequencies under equal intensity (2.0 mW/cm^2) revealed that a stimulation frequency of 61 GHz (Group 3; n=10) influenced licking reaction more than frequency of 43 GHz (Group 4; n=10) (fig.4). Duration of licking reaction was 14.1±2.3 min. in Group 3 and 16.8±2.0min. in Group 4. The most beneficial effect was observed for the second hour of monitoring. Duration of licking reaction in Group 3 was only 4.2±1.6min. The same index in Group 4 averaged almost two-fold value of 8.2±1.7min. Both frequencies showed statistically significant differences in comparison with control ($p<0.05$).

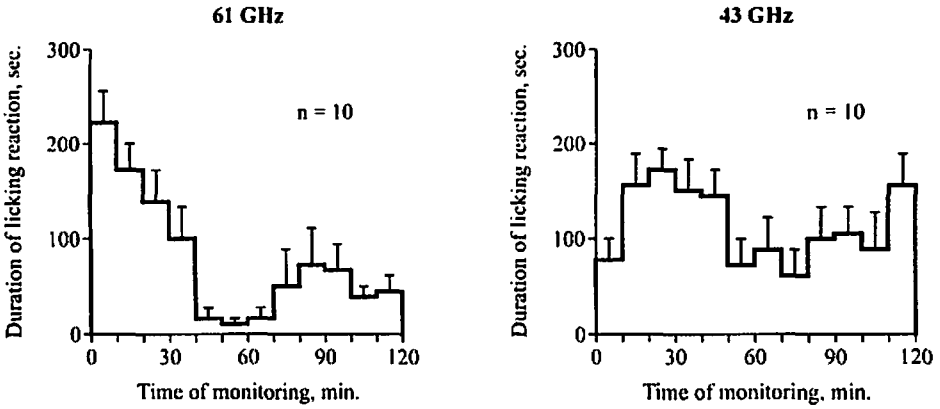

Fig.4. Duration of licking reaction (sec.) in experimental mice under different frequencies (43GHz or 61GHz) but the same intensity (2mW/cm^2) and exposure time (10 min.) of electro-magnetic stimulation.
See Fig.2 legend for explanations.

Table 1. Dependency of licking reaction evoked by formalin injection on different intensities of electro-magnetic (61 GHz) stimulation applied to acupoint St.36 for 10 min.

Power density, mW/cm^2	Duration of licking reaction, min.		
	for the first hour of monitoring	for the second hour of monitoring	for two hours of monitoring
0 (Control)	15.6 ± 1.5	8.2 ± 1.2	23.8 ± 2.1
0.1 (Group 2)	6.1 ± 1.1***	2.7 ± 0.7***	8.8 ± 1.7***
0.6 (Group 5)	11.3 ± 1.5*	5.0 ± 0.9*	16.3 ± 1.9**
2.0 (Group 3)	9.8 ± 1.4**	4.2 ± 1.6*	14.1 ± 2.3**
7.0 (Group 6)	10.7 ± 1.1**	5.0 ± 1.2*	15.7 ± 2.1**

Significance vs control: * $p<0.05$; ** $p<0.01$; *** $p<0.001$.

Intensity of electro-magnetic stimulation and licking reaction. 4 groups of mice (n=10 for each group) were given a 10-min. stimulation of ipsilateral acupoint St.36 with the same frequency of 61 GHz but with the different power densities: 0.1 mW/cm^2 (Group 2), 0.6 mW/cm^2 (Group 5), 2.0 mW/cm^2 (Group 3), 7.0 mW/cm^2 (Group 6). Most beneficial effects have been observed when minimal (0.1 mW/cm^2, Group 5) intensity of electro-magnetic stimulation was used (Table 1).

DISCUSSION

Experimental data obtained confirm the numerous clinical observations concerning effectiveness of the millimeter-wave bioresonance therapy in case of various hypersensitive conditions. According to results of the present investigation, a frequency optimum lies around 61GHz. Effect of 10-min. stimulation is more demonstrative than 3 min. Power density of electro-magnetic stimulation should be minimal in this situation. It is obvious the latter two parameters are interconnected. So problem is in the millimeter-wave absorbed dose and corresponding bioeffect.

The contemporary epidemiology of exposure to electro-magnetic fields mentions some hazard influences induced by relatively low-energy irradiation in submillimeter wave band [12].

Y.Omura and M.Losco [13] described in detail the harmful effects of microwave irradiation on normal human subjects using the Bi-Digital O-Ring Test Dysfunction Localization and Molecular Identification Methods. When body was exposed, at a distance of 0.5-2m, to microwaves with frequency of 2.45 GHz and power of 450W, the induction of various transitional abnormalities was revealed. They included circulatory disturbances with increase in Thromboxane B_2 and decrease in Acetylcholine as well as appearance of precancer substances Oncogen C-fos Ab1, Oncogen C-fos Ab2, and Integrin $\alpha_5\beta_1$. It means that prolonged, repeated exposure to this electro-magnetic irradiation or other similar or higher frequencies without any protection may contribute to the possible development of cancer cells if additional cancer-related virus infection, mercury deposits and other factors coexist.

The modern device for the millimeter-wave bioresonance therapy works at the very low-energy level to avoid undesirable electro-magnetic influences (in the former Soviet Union the most strict standard of 0.01mW/ cm^2 for 8 hours or 0.1mW/cm^2 for 2 hours or 1mW/cm^2 for 20 min. a day was established). As regards, power of the low-energy electro-magnetic stimulation is of no particular significance from the information poin of view. However, results obtained with the aid of the Bi-Digital O-Ring Test showed an

existence of the individual energy thresholds for bioresonant state which can fluctuate considerably [14]. Its magnitude under circumstances of the synchronizing information signal may depend on the specific molecular mechanisms of interaction between an external field and cellular oscillators, the modulation and time parameters of electro-magnetic fields, the noise level in the biological system as well as difference in frequencies between the synchronizing and sunchronized oscillators. Energy thresholds tend to diminish in case of the favourable combination for these factors. Besides, energy thresholds are influenced by the space parameters of electro-magnetic stimulation that is now understood as precise coordinates of acupuncture system.

The problem of low-energy electro-magnetic stimulation is also related to fundamental issues such as "hormesis" which is the paradoxical phenomenon that any toxic compound or harmful factor becomes a stimulating agent at a lower concentration (dose) [15]. This non-specific stimulation of a large number of physiological processes can be considered as an explanatory model for the low-intensity millimeter-wave electro-magnetic stimulation as well.

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