

## THE AURICULAR DENS-PUNCTURE PHYSIOLOGICAL EFFECTS STUDY

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Introduction of DiaDENS line electrostimulators with remote point electrode to medical practice opens up new possibilities of DENS-puncture application for medical purposes. It is known, that auricular electropuncture has some advantages over impact on some other points. First of all, this is due to high efficiency and responsiveness to the impact. This is conditioned by great innervation of an auricle and its powerful neuro-reflex connections with the structures of the brain stem [3]. The other advantage of auricular electropuncture is the possibility of sufficiently accurate determination of arrangement of points for impact and periodical control of results of treatment with the help of auricular diagnostics, which got new possibilities after "BIOREPAIR" technology development [6].

Selection of impulse sequence frequency is important at the time of determination of parameters of electropuncture impact with electrostimulators of alternating current assistance. However, currently there is no common opinion on this question due to small number of special researches devoted to auricular points stimulation optimization when treating different pathological manifestations. For instance, in some reflex therapy guidance an effect on auricular, as well as on corporeal points with low frequency current (1 to 10 Hz) is recommended; it is recommended to use stimulation frequencies that correspond to electroencephalogram alpha-rhythm of human being (8-12 Hz) when treating functional disorders of CNS (neurasthenia); herewith, all auricular points that are included in a "formula" are stimulated with equal frequency [5]. Meanwhile, European school of auricular medicine founder P. Nogier [7] basing on the data received from carried researches suggested to utilize different frequencies for stimulation of different anatomical zones of auricle:

- Internal part of hircus and interhircus notch - 2.28 Hz;
- cavity of concha - 4.56 Hz;
- upper part of helix and upper crura of antihelix - 125 Hz;
- posterior part of helix from Darwinian tubercle to posterior auricular sulcus- 18.25 Hz;
- peripheral part of helix - 36.5 Hz;
- posterior part of earlap - 7.3 Hz;
- anterior part of earlap - 146 Hz.

However, impact evaluation method (by pulse wave change) that was used by P. Nogier is not accurate enough and is only a qualitative method. Besides, impact on the same point by different frequencies quite often causes multidirectional effect on radial artery pulsation; at the same time, absence of pulsation change is not an evidence of absence of effect from auricular point impact. At the time of auricular points impact genetic reactions are realized through changes of functional activity of CNS structures which, in turn, change an activity of sympathetic and parasympathetic parts of vegetative nervous system (VNS) [3]. This, in turn, causes change of radial artery pulsation and other effects. Application of more accurate and up-to-date research methods (for example, functional activity of VNS) is necessary for more precise evaluation of results of auricular points stimulation by different frequencies. It is rational to use an analysis of VNS condition as such method applying registration of heart rate variability (VHR). This research method demonstrated high self-

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descriptiveness when analyzing functional state of the body both in normal condition and in different unhealthy conditions that cause neuro-vegetative regulation disorder [1, 8].

Study of impact of different frequencies electrostimulation of auricular points on functional activity of VNS is a purpose of present work. In order to achieve this goal we were solving the following problems:

1. Evaluation of 200, 77, 77/10, 10, 5, 4 Hz frequencies impact on functional activity of VNS;
2. Effects of impact by different frequencies on points of different anatomical regions and points of same anatomical area comparison;
3. Minimal effective duration of impact determination when stimulating auricular points by different frequencies.

### **Materials and methods of the research**

36 almost healthy volunteers under test and 18 people suffering from overweight and obesity of 1 -2 stages participated in the research. 4 to 20 researches were made with each of subject of the experiment, and electrostimulation of auricular points by different frequencies was carried out in different days in order to eliminate a summation effect.

VHR registration was accomplished with the help of "Orto-Science" and "Orto-expert" (Russia) development package in the background, during auricular points electrostimulation and 1 - 30 minutes after stimulation was over. Indices during and after stimulation were analyzed with the help of "Orto-expert" program that included evaluation of heart rate indices (mode, mode amplitude, tension index (TI), heart rate, indices of spectral analyses of heart rate) in a sitting position and after rising to feet. Comparison of indices in a sitting position and after rising to feet allowed to evaluate a vegetative reactivity and vegetative activity support.

Points of different anatomical zones were used for study of different frequencies' effects of auricular electrostimulation: points of upper and lower bowl, upper crura of antihelix, triangular fossa, tragus and earlap. Electrostimulation of stated points was carried out by means of remote coaxial point electrode during 2 minutes at the comfortable energy level. For continuous registration of heart rate parameters «Orto-Science» complex program was used at the time of necessary impact duration determination in order to get a functional activity of VNS change effect. An impact on auricular points was carried out during 1 to 5 minutes at a comfortable energy level.

### **The results of the research and their discussion**

200 Hz frequency action evaluation was carried out in a group of 22 people. An impact was made on the points of different anatomical regions. In the zone of lower bowl an application was carried out on auricular points (AP) 100 (heart) or 101 (lungs), in the zone of earlap at AP 10 (tonsils), in the zone of upper bowl AP92 (urinary bladder), in the zone of earlap at AP10 (tonsils) and AP8 (eye). Electrostimulation was carried out during 2 minutes. Stimulation of only one point was accomplished at the day of the study. An effect of outcome was evaluated within 30 minutes. Reliable changes of vegetative regulation state, vegetative reactivity and vegetative activity support were not registered integrally in the group. Also no reliable difference in indices was received when stimulating points of

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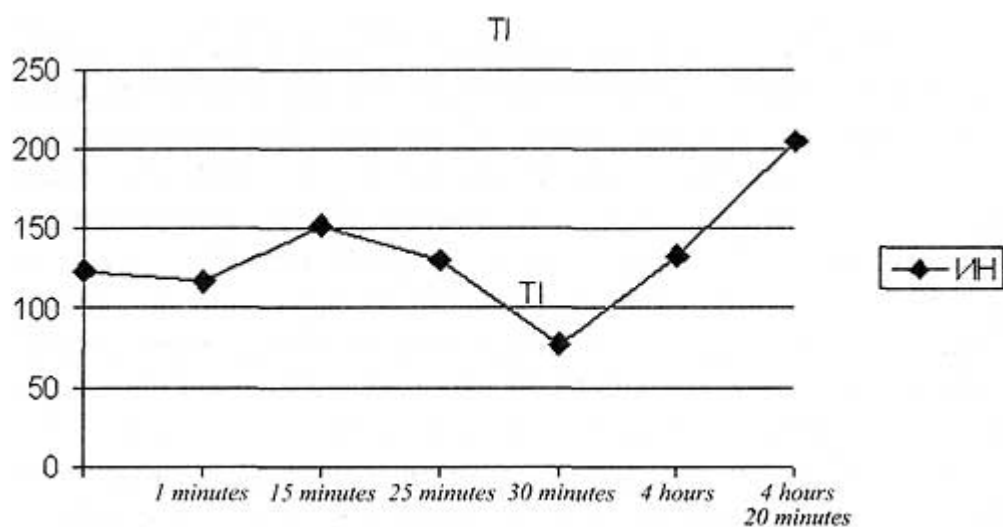
different zones.

77 Hz frequency action study was carried out in a group of 25 people. An application was made on the same points as with DENS-puncture at frequency 200 Hz. Data received is an evidence of the fact that 77 Hz frequency has a pronounced sympathotonic effect when affecting points of upper and lower bowl (AP 100, 101, 103, 92, 88, 91), as well as earlap points (AP 10, 8) and points of triangular fossa (AP 55, 58). When registering heart rate variability this effect becomes apparent in heart rate (HR) increase, mode amplitude increase (moA) and increase of heart rate tension index (TI). L/H index increase (ratio of power of slow and fast rates), which is also an evidence of sympathetic activation, and power increase of superslow spectrum component VLF, which is an evidence increase of humoral contribution to VNS activity regulation, were detected during spectral characteristics analyses. This corresponds with data of previously carried researches of DENS effect at 77 Hz frequency on the cervical collar zone and the zone of segmental innervation of internal organs. A pronounced anti-inflammatory, antioxidant, anaesthetic and other effects were demonstrated in these researches, which allows to consider DENS with stated frequency to be an activation therapy alternative [2]. The results that were received are an evidence of the fact that 77 Hz frequency except for a local action has an activation therapy effect which does not depend on an area of stimulation application and, apparently, is determined by impact on CNS brain stem structures.

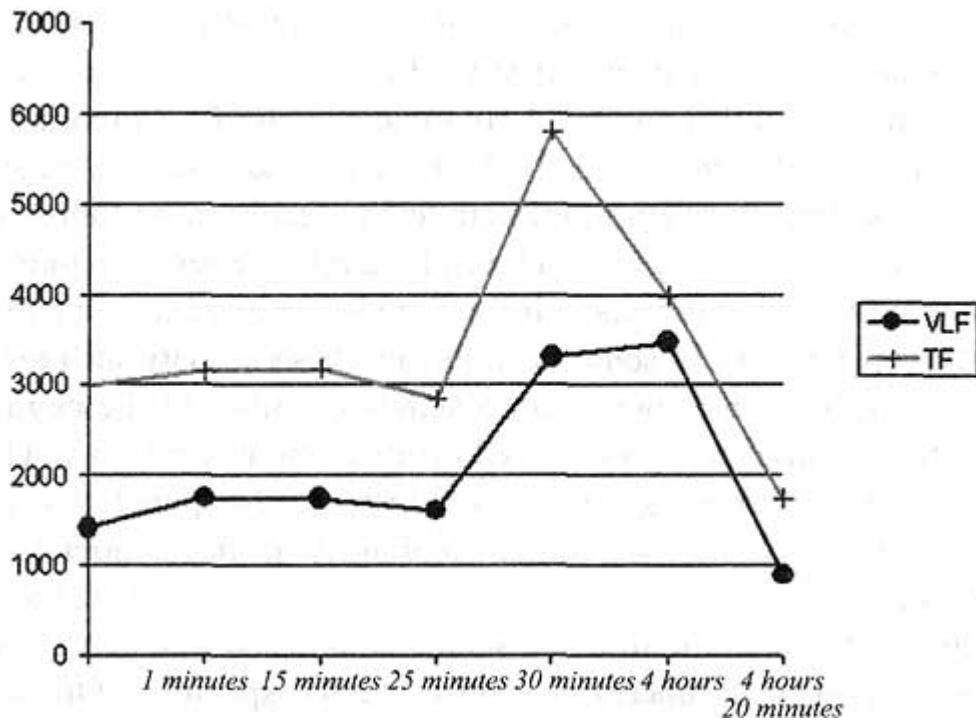
On the contrary, application of 10 Hz frequency for the same points stimulation causes parasympathetic effect, which is expressed in heart rate decrease, moA and TI lowering, and high-frequency (Hf) component increase during spectral analysis of undulatory structure of a heart rate. However, some points have certain specific of such effect realization. So, when having 10 Hz frequency stimulation of API00 (heart) parasympathotonic effect is mainly realized at the expense of nervous mechanisms, when having AP10 (tonsils) stimulation, this effect is chiefly realized at the expense of humoral mechanisms activation. Similar but more pronounced effect was received when stimulating auricular points at 77/10 frequency. When having DENS-puncture with stated frequency application heart rate, TI, moA decrease was observed as well, and that is an evidence of sympathetic tone of VNS lowering, RMSSD-index increase, which is associated with parasympathetic impact activation. Unlike 10 Hz frequency, DENS-puncture at 77/10 frequency causes an evident ( $P < 0,01$ ) increase of TF index - total spec-tram power of heart rate undulatory structure. From physiological point of view these data could be interpreted as lowering of heart rate management centralization, which corresponds with lowering of neuropsychic stress and increase of adaptation level. Similar psychotropic effect of stated mode was described for cervical collar zone stimulation [4].

More complicated and ambiguous effects were registered when studying low frequencies of 4-5 Hz. In this case, physiological effect and vegetative regulation change orientation depended on the point of stimulation and electroanomaly of the point existence (and consequently, possible pathology of the corresponding organ). Reliable changes of vegetative regulation were not determined during AP49 point (knee) application in the area of upper crura of antihelix; parasympathetic effect was received during AP87 (stomach) point application; impact on API00 (heart) caused multidirectional effects in people with dominant initial sympathetic and parasympathetic tone of VNS. At the same time, stimulation of this point with the 4-5 Hz frequency caused lowering of TF index in all the

people under study (total power of wavelength spectrum), and that is an evidence of regulation centralization increase and adaptation level lowering, that is these frequencies are unfavorable for an impact on this certain point. An interesting data was received when stimulating API8 (hunger) point at 4 Hz frequency. This point is used for appetite lowering and reduction of pathological attraction to food when treating overweight and obesity. The following data was received after stimulation of this point at 4 Hz frequency during 2 minutes in 18 people under study (pictures 1, 2). At the background before the stimulation all the subjects of an experiment felt hunger because followed the low-calorie diet, also they had their last food intake about 2-3 hours ago. Vegetative regulation indices indicated moderate increase of neuropsychic stress (TI about 130 standard units) and VNS activity shift towards sympathytonia (L/H is more than 5 standard units). At the beginning right after stimulation a pronounced sympathetic effect (moA, TI, L/F increase, RMSSD decrease) is registered after DENS-puncture of API 8 during 2 minutes at the threshold of feeling frequency. And activation of both nervous and humoral components of sympathetic activation is happening. It is possible to make such a conclusion due to VLF index increase - power of superslow waves of HRV spectrum. On the opposite, 15 minutes after the stimulation an increase of parasympathetic system activity, psycho-emotional stress reduction and adaptation level increase is registered. This tendency reaches its maximum 30 minutes after the stimulation. Particularly at this time the majority of subjects of an experiment felt feeling of hunger weakening, anxiety and annoyance reduction. An effect was seen during 3-4 hours after stimulation was over. After that, a slow return to the initial level of indices of vegetative regulation and psycho-emotional state occurred.

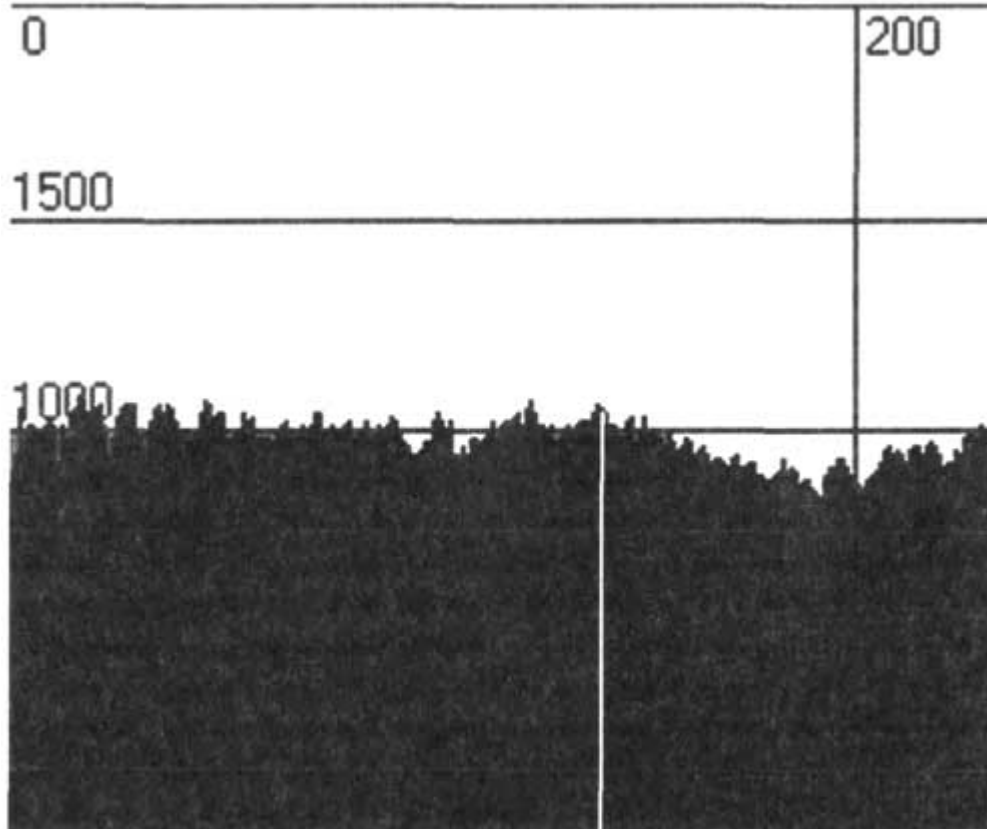


Picture 1. TI dynamics after AP18 stimulation. X-axis is time after AP18 stimulation cessation, Y-axis is TI value in standard units.



Picture 2. Dynamics of superslow component (VLF) and total power (TF) of VHR spectrum after API8 stimulation. X-axis is time after API8 stimulation cessation, Y-axis is power of spectrum value in standard units.

Application of VHR for evaluation of DENS-puncture effects on auricular points allowed to solve the problem of minimal necessary duration of application with different frequencies and duration of stimulation effect maintenance. Moment of change of rate character and its undulatory structure (acceleration or deceleration of pulse rate, appearance or disappearance of waves in a spectral structure, etc.) was traced in the continuous operation of stimulation with the help of "Orto-Science" program. Picture 3 demonstrates an effect of API 8 stimulation at 4 Hz frequency.



Picture 3. Heart rate acceleration and undulatory structure change on the 141-st second of stimulation. The beginning of rate indices change on the 141-st second is marked by white line.

Using this approach, we analyzed necessary time of application for different points and frequencies. It was determined that higher DENS-puncture frequency is faster the primary effect of stimulation would come. For 77 Hz frequency this time made up 18 to 45 seconds for different people under study, for 10 Hz frequency - from 34 to 89 seconds, for 4 Hz frequency - from 58 to 156 seconds. A positive correlation between minimal necessary duration of stimulation and electroanomaly of the point was discovered as well. Electroanomaly was evaluated by means of "BIOREPAIR" auricular diagnostics method. Results that were received could be explained through intensification of reflex connections of auricle points, that correspond with projections of the organs with dysfunctions, with CNS structures through which a medical effect of auricular therapy is mediated.

#### **Conclusions:**

1. Different DENS-puncture frequencies has different impact on VNS tone.
2. Orientation of action on VNS tone does not depend on the point of application for some frequencies (for example, 77 Hz and 77/10 Hz).
3. 10 Hz frequency when effecting all the tested points has similar parasympathetic effect, however, humoral contribution is expressed more or less depending on the point of stimulation.
4. 4 and 5 Hz frequencies could cause multidirectional effects of vegetative regulation change when effecting different points.
5. Higher frequencies of electrostimulation cause more rapid effect of vegetative tone change.
6. Speed of stimulation effect approach positively correlates with the level of electroanomaly of the

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point.

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