RESEARCH ARTICLE

Influence of organism regulation process on the condition of biologically active points

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Abstract

Human body is an open energy system. Aggressive environment forces us to adapt to modern social and economic conditions, technogenic factors and increasing psychological, physical and informational overload. Physiological self-regulation is realized both at the level of individual functional system as well as through their interaction. These are the most important factor in achieving physiological, psychological and social adaptation.

Biologically active points (BAP), are projected onto the skin areas of the highest activity of the system of interaction, which unites the integuments of the body, nervous system, internal organs. In them at different depths (from several millimeters to several centimeters) nerve receptors are located, which perceive the effect and transmit them to the internal organs. The functional properties of BAP allow them to participate in the processes of regulating the energy balance of the body.

The purpose of this study is to measure changes in the physical parameters of BAPs involved in the energy exchange.

In this study BAPs were impacted in two ways. In the first method, experiment participants concentrated mentally to affect the exchange of energy and information in the body. In the first method, organs or energy centers were impacted by the participant himself within his or her internal bodily environment. In the second method, external BAP activation was employed. Laser radiation with wavelength of 0.63 ÷ 0.65 μm and power output power no more than 5 mW.

BAP status was assessed by methods of functional diagnostics, i.e measurement of electrical potentials (Foul method) and measurement of infrared radiation on the body surface (thermal imaging method).

Despite the differences in impact mechanisms, both methods produce the same effect: an increase in the ability for adaptation and normalization of the functional body state. Thermal imaging is a method for objective monitoring the results of energy-information exchange in the body. Thermal field of the body surface reflects individual characteristics of an organism. Changes in thermal field parameters provoked by self-regulation correspond with individual differences related to person's physiological and psychological state.

Key words: psychophysiology, self-regulation, biologically active points, infrared radiation.

1. Introduction

Human body is an open energy system. Harmful influences originating from the man-made and natural environments require an individual to adapt to modern socio-economic conditions, technogenic effects, psychological and physiological stress and information overload. Regulatory processes in the body take place both at the level of specific functional systems as well as through their interaction.[1] These internal regulatory processes play a key role in successful physiological, psychological and social adaptation.[2] Theory, research in the field of self-regulation and applications in various disciplines were consecrated in the book[3]. Methods and technologies for changing and monitoring of physiological parameters associated with self-regulation were discussed in the articles[2,4]. Modern researches are devoted to different facets of emotion regulation and person functional states associated with various activities.[5-9]

One's capacity for self-regulation is an individual trait. Such capacity implies being able to manage own level of energy and psychological state. Studies[10] demonstrate positive effects that psychotechnics have on internal self-regulatory processes in the body and its functional status.

Biologically active points (BAPs) are the projections on the skin of the interaction's centers of internal organs and body systems. The interaction is carried out through the transmission of nerve impulses and neurohumoral reactions. The density of nerve receptors is increased in the BAP area. They can be found at a different depth (from several millimeters to several centimeters) below the skin. BAPs are stimulation-sensitive and transmit stimuli to internal organs.[11] The functional properties of the BAPs allow them to participate in the processes of regulating energy balance in the body. Such properties differ from the properties of the surrounding skin areas.[12] In comparison with neighbouring skin areas, BAPs are characterized by a relatively low electrical resistance. Normally, there is a difference in electric potentials between the surface of the skin and the underlying tissues. Therefore, a weak alternating electric current constantly passes through the BAP. The current characteristics depend on the parameters of the external electric field, the physiological state of the BAPs themselves and a state of an organism as a whole. Heat transfer of the skin surface in the BAP zones is more intense than in other skin areas due to more intense metabolic processes.[13]

A change in the functional state of the organs and systems of the human body causes a change in the intensity of infrared radiation in the BAP regions. The reason is a change microcirculation of blood and oxidative processes in the BAP regions, which are connected by reflex pathways with these organs and body's systems. Thermal express diagnostics of internal organs is based on this phenomena.[14] Application of thermal imaging methods in medical diagnostics has been investigated in research papers. [15,16]

The central notion of this study is that a subject, by making a certain conscious effort, is capable of modifying the exchange of energy-information in his/her body, which in turn is reflected in the state of the BAPs. Such modifications in the state of the BAPs were checked with infrared thermography and electrophysical measurements. The impact on the state of the BAPs produced by a subject's

conscious efforts was compared with the impact of their exposure to laser radiation. Studying physical properties of BAPs under various influences is relevant for developing methods of regulation of the state of the body.

The purpose of the study is to determine the change in the state of the biologically active points involved in the process of bioenergetic metabolism. In the study the BAPs were stimulated externally as well as internally (through consciousness concentration and breathing).

2. Methods

The experiment involved respondents aged 21 to 23 years in the amount of 40 people. Participants in the experiment did not have special training in mind control. Identifying gender differences was not the task of research. All respondents provided written assent prior to testing.

The research strategy for changing the state of the BAPs with psychotechnics included three stages: 1 - determining the origin state of the BAPs; 2 - participant performs a self-regulation session using psychotechnics; 3 - determining the state of the BAPs after the self-regulation session. The self-regulation session lasted twenty minutes.

At the first and third stages, the state of the BAPs was assessed by method measure electric potentials (Deka-Foll device) and thermal imaging method (Testo 885-2 thermal imager).

Modifications in radiation temperature indicate a response of the functional systems to external and internal influences. Below thermal modifications in areas surrounding specific BAPs are discussed.

Biologically active points on the body surface look different in the thermograms below. On figure 1 there are three types of thermal representation of the BAPs: 1 - the local minimum of temperature with closed area boundaries (“cold point”); 2 - the local maximum of temperature with closed area boundaries (“hot points”); 3 - the area with curved open boundaries ("non-localized BAP"). The names of BAPs are given in accordance with the book[17].

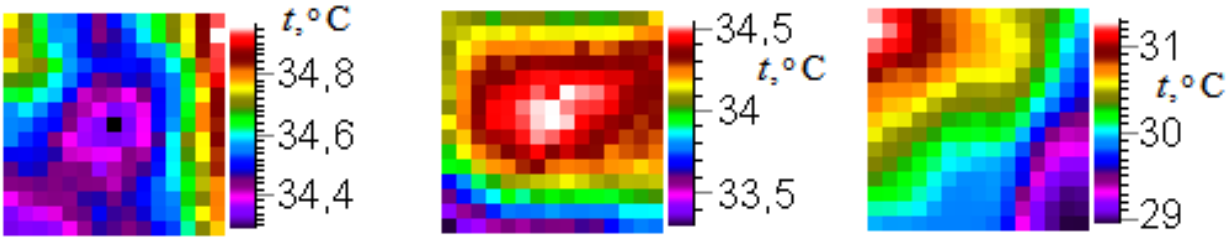

Figure 1. Types of thermal representations of various BAPs (images 15×15 pixels enlarged six-fold)

BAP radiation temperature is measured within a circle with a diameter of fifteen pixels. For type 1 BAPs we calculate the minimum temperature in the area. For type 2 BAPs we determine the maximum temperature in the area. Additionally, for type 3 BAPs we define the average t_{av}, maximum t_{max} and minimum t_{min} temperatures as well as the standard

distribution within the area limited by a circle with a diameter of 15 pixels.

In figure 2 points mark the location of the BAPs on the thermogram. Points for the type 1 BAPs correspond to the local minimum of temperature. Points for the type 2 BAPs correspond to the local maximum of temperature. On the thermogram (figure 2) the cold BAPs are PC2, IG18 and PC19. All the other BAPs are hot. In figure 3 each type 3 BAP is situated in the area limited by a circle with a 15 pixel diameter.

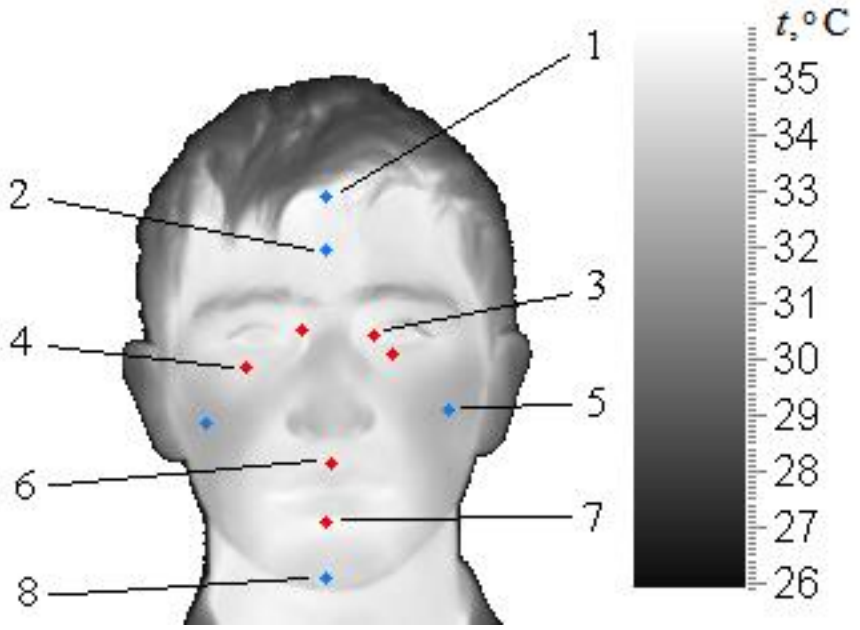

Figure 2 Facial thermogram, BAP marks: 1 – VG24, 2 – PC2, 3 – V1, 4 – E1, 5 – IG18, 6 – VG27, 7 – VC24, 8 – PC19

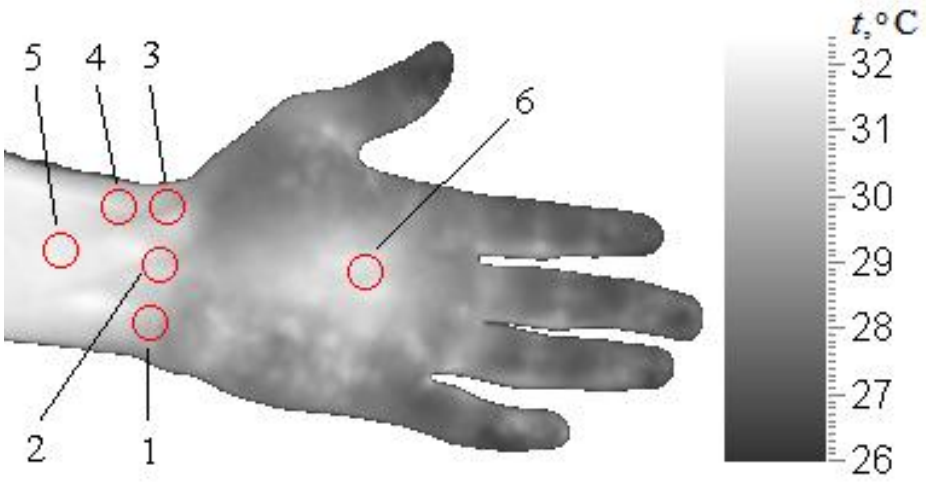

Figure 3. Hand thermogram, BAP marks: 1 – C7, 2 – MC7, 3 – P9, 4 – P8, 5 – MC6, 6 – MC8

The changes in radiation temperature that occurred in the BAPs as a result of internal

influence created by the application of the two self-regulation techniques are discussed below. These techniques are as follows: R1 – "breathing through" the biologically active point C7 on the left wrist, R2 – "breathing into the brain".

The research strategy for changing the BAP state with laser radiation included three stages: 1 – determining physical parameters of a BAP before its exposure to laser radiation; 2 – exposing a given BAP to low-energy laser radiation with the VedaLaser laser device; 3 – determining electric potential and radiation temperature of a BAP after its exposure to laser radiation.

The Deka–Foll device measures electric potential φ in a BAP. The values φ are measured in arbitrary units relative to the normal range. Normally, φ ranges from $\varphi_1 = 50$ to $\varphi_2 = 65$. As a first step, "problematic" BAPs are identified, meaning those whose φ is outside the normal range. These BAPs were stimulated with VedaLaser. They were exposed to low-energy laser radiation with a wavelength of $0.63 \div 0.65$ μm and the output power no more than 5 mW. The exposure time was 4 minutes.

3. Changing the state of the BAPs as a result of internal and external influence

Self-regulation sessions R1 and R2 were performed by participants in 4 groups of 10 people. Typical individual changing the state of the BAPs with psychotechnics are discussed below.

Radiation temperature t of the facial BAPs and its changes Δt that was produced after session R1 and session R2 are presented in table 1. Radiation temperature of the BAPs of the hand before the self-regulation session is shown in table 2. Radiation temperature of the BAPs of the hand after the self-regulation session is presented in table 3 and table 4. Table 5, 6 and 7 show the change in the temperature of the BAPs of the hand that occurred as a result of the self-regulation sessions.

Sedative point C7 is one of the fundamental points of the heart meridian C.[17] It is located at the radial edge of the tendon of the wrist ulnar flexor. The self-regulation technique called "breathing through the biologically active point C7" aims at achieving mental balance by regulating the heart functions.

Table 1: Temperature of the BAPs on the face before and after the session

BAP	before R1	after R1	after R2

	t_0, °C	t_1, °C	Δt_{10}, °C	t_2, °C	Δt_{21}, °C	Δt_{20}, °C
VG24	34.62	34.47	-0.14	35.12	0.65	0.51
PC2	34.3	34.17	-0.13	34.95	0.78	0.65
V1 right side	35.01	34.91	-0.1	35.49	0.58	0.48
V1 left side	35.28	35.00	-0.28	35.59	0.59	0.31
E1 right side	34.55	34.18	-0.37	34.82	0.64	0.27
E1 left side	34.42	34.3	-0.12	34.76	0.46	0.34
IG18 right side	31.15	31.78	0.63	32.39	0.61	1.24
IG18 left side	30.98	31.63	0.65	32.50	0.87	1.52
VG27	34.68	34.46	-0.22	35.21	0.75	0.53
VC24	34.85	34.62	-0.23	35.66	1.04	0.81
PC19	32.87	33.39	0.52	34.18	0.79	1.31

Resulting from the self-regulation session R1, the radiation temperature in the BATs C7, MC7 and P9 located in the wrist fold increased ($\Delta t_{10} = t_1 - t_0 > 0$). At the same time the radiation temperature in the BATs P8, MC6, MC8 decreased (Δt_{10} <0). These changes are presented Table 5. The biggest change t_{av} was found in the BAT C7 and equals 1.47 °C. The standard deviation (SD) of the temperature distribution in the area that surrounds the C7 BAP decreased by 1.9 times (tables 2 and 3).

The BAP C7 electric potential φ was measured by the Foll method. One electrode was held in the participant's right hand while the other electrode was placed on the C7 BAP. After the self-regulation session R1 the electric potential at the C7 point rose up to $\Delta\varphi_{C7} = 15$.

For the BAPs located on the face (figure 2), except for IG18, PC19, the temperature change was $\Delta t_{10} < 0$. For IG18 and PC19 it was $\Delta t_{10} > 0$ (table 1). In addition, after the self-regulation session R1, the temperature leveled off in the symmetrical BAPs V1(right) and V1(left).

Table 2: Temperature of the BAPs on the hand before the self-regulation session

BAP	t_{0max}, °C	t_{0min}, °C	t_{0av}, °C	SD, °C
C7	30.99	29.02	30.13	0.48
MC7	31.57	30.23	30.97	0.26
P9	31.24	29.52	30.34	0.44
P8	31.52	30.41	30.9	0.26
MC6	32.01	31.59	31.81	0.1
MC8	31.65	30.9	31.32	0.14

Table 3: Temperature of the BAPs on the hand after the self-regulation session R1

BAP	t_{1max}, °C	t_{1min}, °C	t_{1av}, °C	SD, °C
C7	32.18	31.09	31.60	0.25

MC7	31.98	30.81	31.48	0.25
P9	32.03	29.74	30.56	0.56
P8	31.47	30.04	30.85	0.38
MC6	31.94	31.41	31.66	0.13
MC8	31.52	30.64	31.19	0.24

The obtained results indicate redistribution of the energy in the direction of the C7 BAP.

The relationship between conscious breathing and neuronal activity is the subject of modern research.[18,19] The basis is the important human's neurophysiological characteristics. Namely, the ability to control one's breathing rhythm along with the ability to modify own brain activity by conscious breathing, dependence of the synchronism the rhythms neural signals and body rhythms on breathing.

In the brain stem there is a nerve chain responsible for communication between the brain and respiration. This neural chain also regulates emotional responses. Organism is a holistically coordinated system. Neurohumoral reactions play an important role in the regulation of such system. A self-regulation technique named "breathing into the brain" aims at enhancing cerebral circulation and harmonizing the work of the functional body systems.

Table 4: Temperature of the BAPs on the hand after the self-regulation session R2

BAP	t_{2max}, °C	t_{2min}, °C	t_{2av}, °C	SD, °C
C7	33.41	31.91	32.78	0.38
MC7	33.5	32.59	33.09	0.24
P9	33.72	32.61	33.08	0.23
P8	33.76	33.12	33.46	0.17
MC6	33.89	33.71	33.81	0.03
MC8	33.33	32.7	33.05	0.14

The radiation temperature t_2 increased in all the studied BAPs after the self-regulation session R2 compared to the initial temperature t_0 and the radiation temperature t_1 after the self-regulation session R1 (tables 1, 6 and 7). The largest temperature increase Δt_{20} on the face was identified in the "cold" BAPs: IG18 and PC19 (table 1). The temperature standard deviation for the hand's BAPs, except for MC8, decreased. For MC8 it returned to its original condition, so as it increased after the R1 session (table 2, table 3, table 4). The range of average temperatures between the studied hand's BAPs decreased from 1.68 °C to 1.03 °C (table 2, table 4).

Thus, self-regulation sessions resulted in a more even distribution of energy and a more harmonious work of the functional body systems.

Table 5: Temperature change after the self-regulation session R1

BAP	Δt_{10max}, °C	Δt_{10min}, °C	Δt_{10av}, °C
C7	1.19	2.07	1.47

MC7	0.41	0.58	0.51
P9	0.79	0.22	0.22
P8	-0.05	-0.37	-0.05
MC6	-0.07	-0.18	-0.15
MC8	-0.13	-0.26	-0.13

Table 6: Temperature change after the self-regulation session R2 relative to the previous state

BAP	Δt_{21max}, °C	Δt_{21min}, °C	Δt_{21av}, °C
C7	1.23	0.82	1.18
MC7	1.52	1.78	1.61
P9	1.69	2.87	2.52
P8	2.29	3.08	2.61
MC6	1.95	2.30	2.15
MC8	1.81	2.06	1.86

Table 7: Temperature change after the two self-regulation sessions

BAP	Δt_{20max}, °C	Δt_{20min}, °C	Δt_{20av}, °C
C7	2.42	2.89	2.65
MC7	1.93	2.36	2.12
P9	2.48	3.09	2.74
P8	2.24	2.71	2.56
MC6	1.88	2.12	2.00
MC8	1.68	1.80	1.73

The average values of BAPs temperature changes for all participants are shown in figure 4 and figure 5. The probability f of an increase BAPs temperature with psychotechnics is shown in figure 6 and figure 7. The error in measuring the radiation temperature by Testo 885-2 is 0.02 °C. The change in BAPs temperature $|\Delta t| > 0.02$ °C was taken into account.

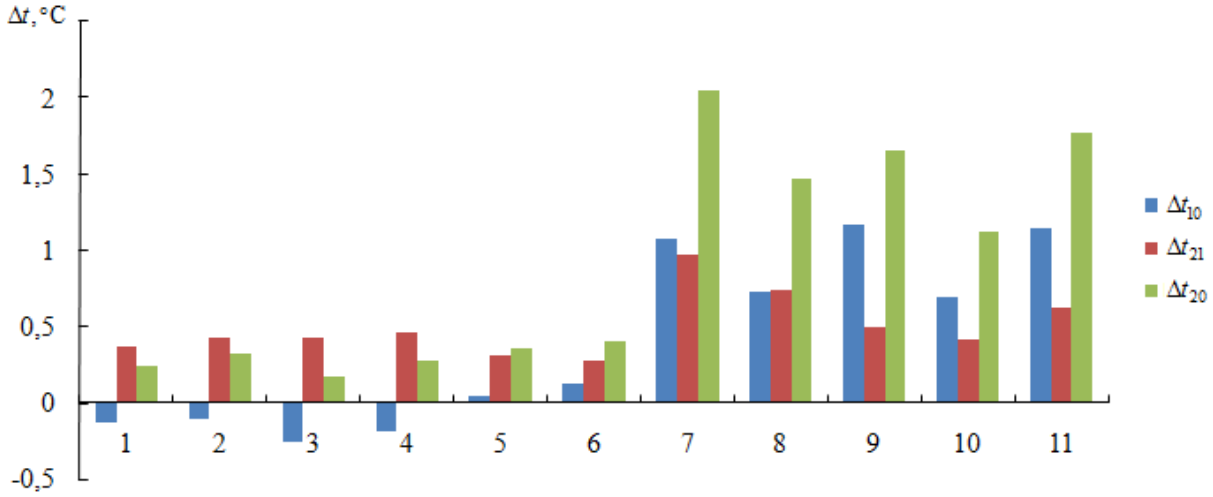

Figure 4. Changing the average values of facial BAPs temperature with psychotechnics: 1 – VG24, 2 – PC2, 3 – V1 right, 4 – V1 left, 5 – E1 right, 6 – E1 left, 7 – IG18 right, 8 – IG18 left, 9 – VG27, 10 – VC24, 11 – PC19

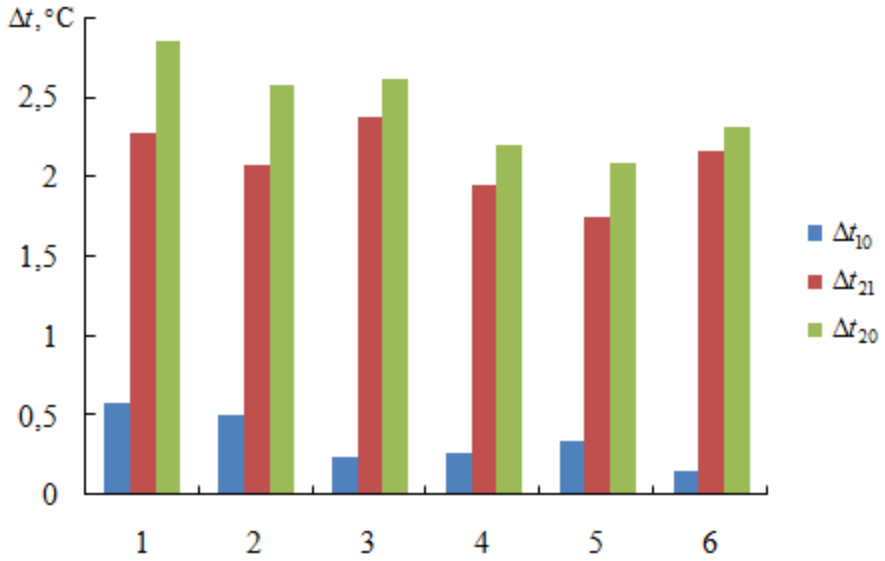

Figure 5. Changing the average values of hand BAPs temperature with psychotechnics: 1 – C7, 2 – MC7, 3 – P9, 4 – P8, 5 – MC6, 6 – MC8

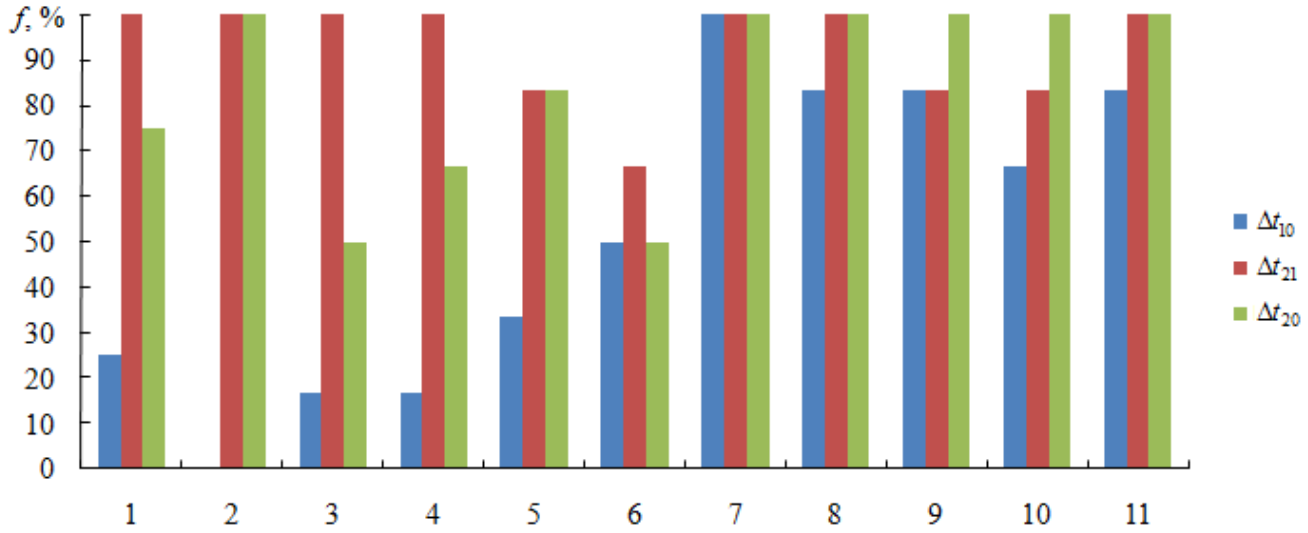

Figure 6. Probability of an increase facial BAPs temperature with psychotechnics:
1 – VG24, 2 – PC2, 3 – V1 right, 4 – V1 left, 5 – E1 right, 6 – E1 left, 7 – IG18 right, 8 – IG18 left, 9 – VG27, 10 – VC24, 11 – PC19

The probability of an increase temperature in BAP C7 for session R1 is 50% (figure 7). The likelihood of an increase in C7 electric potential for session R1 is also 50%. The efficiency of the R2 self-regulation session is significantly higher than R1. Most of the participants successfully coped with psychotechnics of consciousness concentration and breathing.

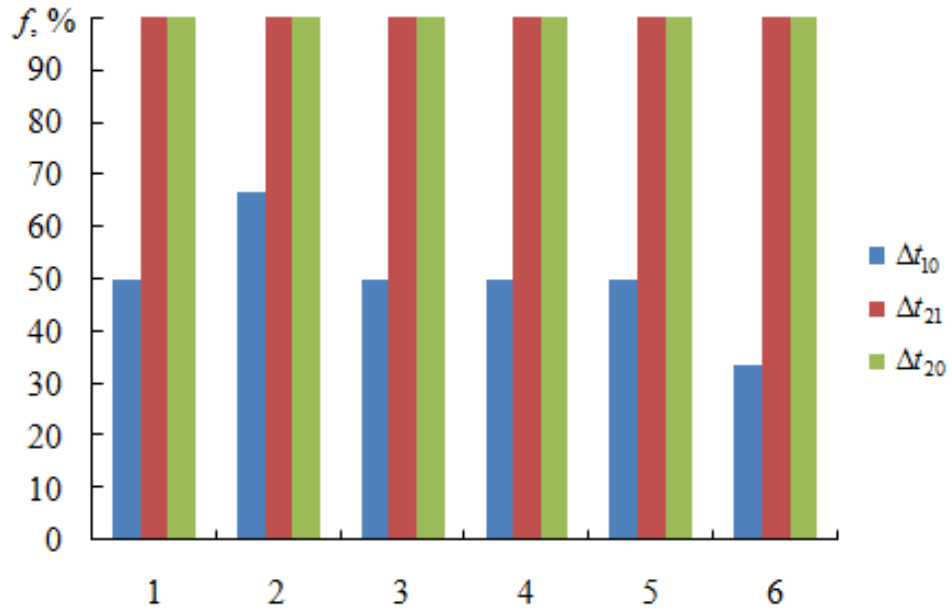

Figure 7. Probability of an increase hand BAPs temperature with psychotechnics: 1 – C7, 2 – MC7, 3 – P9, 4 – P8, 5 – MC6, 6 – MC8

Below are the results of external stimulation of the BAPs with VedaLaser radiation. The choice of BAPs was individual for each participant. Therefore, the results cannot be generalized. In a number of cases, the following pattern was observed.

The following biologically active points were stimulated: PC99, MC9, C7 and MC6. The prior-to-stimulation electric potentials and radiation temperatures are given in table 8. Electric potentials and radiation temperature of the BAPs after exposure to VedaLaser radiation are given in Table 9.

Table 8: Electric potentials and radiation temperature before exposure to laser radiation

BAP	φ	t, °C	Meridian
PC99	35	32.2	Lung
MC9	35	26.4	Pericardium
C7	25	30.7	Heart
MC6	20	30.6	Pericardium

Table 9: Electric potentials and radiation temperature after exposure to laser radiation

BAP	φ	t, °C	Meridian
PC99	45	28.8	Lung
MC9	50	24.6	Pericardium
C7	65	30	Heart
MC6	20	30.3	Pericardium

Table 10 presents the difference in the values of the electric potential $\Delta\varphi$ and radiation temperatures Δt, which were measured before and after the exposure to laser radiation.

Table 10: Difference in the values of the electric potentials and radiation temperatures in the BAPs

BAP	$\Delta\varphi$	Δt, °C	Meridian
PC99	10	–3.4	Lung
MC9	15	–1.8	Pericardium
C7	40	–0.7	Heart
MC6	0	–0.3	Pericardium

As a result of the exposure, the electric potential of PC99 approached the normal range, MC9 and C7 entered the normal range, and MC6 did not change. The temperature at each test point decreased.

Let us compare the results obtained after using the "breathing through the biologically active point C7" psychotechnics and exposure to VedaLaser radiation. In the first experiment, its electric potential and temperature increased. In the second experiment, the electric potential in C7 increased while the temperature decreased.

4. Conclusions

Two ways to stimulate the mechanisms of self-regulation of the body are investigated. In the first experiment, the self-regulation psychotechniques affected the functional body systems as a whole. Increase in the electric potential and temperature in the biologically active points indicates metabolic activation in the internal organs and systems as well as a more intense blood circulation resulting from viscoderm sympathetic reflex. In this case, the dynamics unfolds in the direction from the center to the periphery, that is, has a centrifugal nature.

In the second case, low-intensity laser radiation activates (excites) biologically active points, thus changing the cell membrane permeability. Consequently, the membrane potential also changes, which leads, to the change in the electrical potential of a biologically active point. This harmonizing effect strengthens the intracellular functions and accelerates metabolism inside the cells. As a result, the amount of oxygen absorbed by the cells increases. Unlike in the first case, energy is distributed in the direction from a biologically active point to internal organs, while temperature in the area around a biologically active point decreases. Here, the energy-information exchange processes are centripetal in nature.

Despite their different effects, both methods lead to the same result: improvements in adaptation capacity and the functional state of the body. Thermal imaging is a tool which allows to objectively measure modifications that occur in the energy-information exchange in the body. Thermal field of a body surface reveals individual characteristics of an organism. Changes in one's thermal field proceeding from the application of self-regulation techniques assume individual differences. Such individual differences relate to one's physiological and psychological state.

The results obtained in the course of the study indicate reduction in functional and psychoemotional stress. Such stress proceeds from intensification of physiological processes which occur in the body as a response to physical and intellectual load. During recovery, the intensity of physiological processes decreases, which allows the internal self-regulatory mechanisms do their work and leads to normalization of the body's functional state.

Measurements of the effect of the self-regulation sessions on the functional state of the body confirms that these techniques lead to a positive change in one's functional and psychoemotional state.[10] How effective the techniques are depends on a person's ability to concentrate, his/her individual physiological characteristics and psychological traits.

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