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**DYNAMIC
ELECTRONEUROSTIMULATION
Theoretic and practical aspects
of diagnostic and therapy**

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DYNAMIC ELECTRONEUROSTIMULATION

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**EFFICIENCY OF APPLICATION OF
ELECTRONEUROSTIMULATION FOR TREATING
LESIONS OF THE OPTIC NERVE**

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At present, search for efficient methods of treating diseases of the organ of vision resulting in irreversible changes of visual functions till its total loss is among most topical issues in ophthalmology. Diseases of the optic nerve occupy one of the highly important places in ophthalmology and are one of the main causes of blindness and impaired vision.

Purpose of the work: to examine therapeutic efficiency of the method of electrotherapy in prophylaxis and treatment of optic atrophy of different etiology. Dynamic electroneurostimulation was applied based on exposure of reflexogenic zones and acupuncture points in the paraorbital region with short bipolar current impulses of different frequency, form of which changes depending on the values of electrical impedance of tissues in the subelectrode zone. The principle of “biological feedback” is used.

Dynamic electroneurostimulation of the paraorbital zone was carried out with the “DENAS+” apparatus with external paraorbital electrode (EPE) “DENS-glasses”. Duration of treatment for each zone and the procedure as a whole was determined in compliance with indications for treatment. Duration of impulse series was from 0.3 to 5.5 seconds. Impulse frequency – 10 Hz. Duration of one stimulation procedure was 3-7 minutes. Treatment course included 10 procedures of electrostimulation.

94 patients (149 eyes) in the age from 15 to 87 years were examined. Of them, 80 patients (123 eyes) had complex drug and electro-pulse treatment. 14 patients (26 eyes) were included into the control group, which had only pharmacotherapy. For assessment of treatment efficiency, functional and hypotensive results were taken into account. After the treatment course, a positive effect was registered in all patients. Basic changes occurred in the peripheral visual field: it

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expanded in 73 % of patients in total from 256 ± 15.6 to 306 ± 11.7 degrees ($P < 0.05$). Reduction of the size of central and peripheral scotomas, which is the evidence of partial restoration of conductivity of optic nerve fibers and the retina, was registered. Central visual acuity after treatment increased in 38 % of patients on average from 0.67 ± 0.03 to 0.73 ± 0.02 ($P > 0.05$). Electro-oculogram (EOG) and electroretinogram (ERG) clearly showed the tendency toward improvement of metabolic processes. EOG displayed increased Arden coefficient to the normal values. EGR displayed increased “a”-wave amplitude from 35.5 ± 2.30 to 59.2 ± 3.96 mcV ($P < 0.05$). After comparative analysis of clinical and functional eye indexes, the most positive effect was registered in patients who had electropulse exposure in addition to traditional therapy in the complex treatment. The best results were registered in patients with vascular and inflammatory pathology of the optic nerve.

APPLICATION OF DYNAMIC ELECTRONEUROSTIMULATION FOR TREATING CHILDREN'S PSORIASIS

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Assessment of clinical efficiency of dynamic electroneurostimulation (DENS) for treating psoriasis of children in the age from 12 to 17 years was carried out in the skin diseases clinics of Saint-Petersburg Pediatric Academy.

The children were divided into two groups: main group included 20 persons; the control group included 15 persons. Children of the main group had basic therapy and DENS; children of the control group had only basic therapy. Both groups included children with extensive psoriasis at the progressive stage. 70 % of patients in both groups had an accompanying diagnosis of biliary dyskinesia; 30 % of patients had chronic tonsillitis.

The main group had DENS by the following methods: direct projection of the complaint – in the “therapy” mode at frequency 77 Hz, energy range (ER) 2, stable method of application during 10 minutes. Universal zones (the zone of posterior middle meridian, the zone of “consent points”, and the zone of hands) were treated in the “test” mode – ER 2

with subsequent treatment of latent trigger zones (LTZ) in the “therapy” mode at frequency 77 Hz, ER 2. Immune zones: 7SP, projection zone of adrenal glands, he-gu zone were treated in the “therapy” mode at frequency 77 Hz, ER 2; projection zones of intestines and liver – in the “therapy” mode at frequency 77 Hz, ER 2, stable or labile method of application (in the absence of plates on the abdomen skin) during 15-20 minutes. Not more than 2-3 zones were treated during one procedure, treatment time – 30-40 minutes. Treatment course lasted 20-25 days. Psoriatic eruptions were treated with “Malavtilin” cream before DENS procedure.

When in the hospital, all children had basic therapy: 10 % solution of calcium gluconate I.M., vitamin therapy, hepatoprotectors, sorbents, external therapy (2 % salicylic ointment, Unna’s cream, papaverine ointment, 5 % methyluracil cream). Children with universal skin affection had disintoxication therapy (I.V. drop-by-drop solutions of hemodesis and reamberine).

Patients of the main group had improvement of the general state of health by the 4th-5th day of treatment course: skin itch decreased, eruptions of new psoriatic papule stopped, other skin eruptions were flattened and bleached, desquamation of eruptions decreased.

In the control group, the same process dynamics was observed only after 16-17 days after treatment start. Patients of the main group with tonsillogenous psoriasis had successful (for the first time!!!) improvement of the process on skin without use of antibiotic therapy. One patient of the main group had a severe form of psoriasis exudativa with arthropathia. Starting from the first DENS procedures, edema and joint painfulness were reduced considerably. This girl had treatment courses in our skin diseases clinic several times. However, it was this time when, in spite of accompanying psoriatic arthritis, improvement of the skin process came two times faster than usual.

Patients with DENS-therapy unlike patients of the control group had more pronounced increase of vitality and intensification of positive emotions and physical activities. Moreover, these children became more stable from the psychological point of view as compared with the control group. By the results of our research, in children having DENS in complex treatment of psoriasis, stabilization of regress of the skin process begins within shorter terms, which reduces the period of staying in the hospital, improves life quality and makes the treatment process pleasant and comfortable.

**ASSESSMENT OF CLINICAL EFFICIENCY OF DYNAMIC
ELECTRONEUROSTIMULATION IN PATIENTS WITH
ESSENTIAL HYPERTENSION OF 2-3 STAGE**

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High importance in reduction of blood pressure is attached to non-drug therapy. A specific non-drug therapy can become an initial stage of treatment of patients with slight blood hypertension, and prevent hypertension development in patients with a high risk of cardiovascular complications. In addition, non-drug methods enable to control BP under lower doses of hypotensive preparations.

Purpose of the research: to assess clinical efficiency of dynamic electroneurostimulation (DENS) in complex treatment of patients with essential hypertension of 2-3 stage.

Patients and methods. The main group (Main gr.) consisted of 25 people in the age from 48 to 65 years, average age – 53+1.7; 15 men (60 %) and 10 women (40 %). The control group (Control gr.) consisted of 25 people. The groups correlated by age, gender and duration of the disease. Concurrent pathology in both groups: CHD, angina pectoris of 2nd-3rd functional class; some patients had in their past history coronary stenting or coronary artery grafting, pancreatic diabetes of the 2nd type – subcompensated form in more than 50 % of cases.

All patients had general clinical investigation, EKG, daily EKG and BP monitoring, veloergometry (VEM) according to standard order of procedures.

Patients of both groups had standard basic hypotensive therapy: APF inhibitors in medium-therapeutic doses, beta-blockers, diuretics.

Additionally the main group had DENS by standard methods (combination of corporal zones and auricular points). Duration of the treatment course was 10 days.

Results and discussion.

1. By the data of daily monitoring in the main group, inclusion of DENS-therapy into complex treatment of patients with essential hypertension resulted in reduction of average BP in 88 % of patients without changing the basis therapy. The degree of reduction of daily average pressure in patients was from 10 mmHg to 20 mmHg and more. The results are given in table 1.

Table 1

	10-20 mmHg		More than 20 mmHg		Without dynamics	
	Main gr.	Control gr.	Main gr.	Control gr.	Main gr.	Control gr.
Average daily blood pressure	20	6	2	-	3	19
Systolic blood pressure	15	5	5	1	5	20
Diastolic blood pressure	19	6	1	-	5	19

The majority of patients had average BP stabilized during course treatment within the limits of up to 20 mmHg. No changes in the BP level in the control group were registered in 19 patients, whereas in the main group which had additional treatment with DENS only 3 patients did not have their BP changed.

2. Analysis of the data of daily EKG monitoring has revealed that patients who have additional dynamic electroneurostimulation of corporal zones and auricular points had a reduced number of heart rate disorders by 56 %. And in the control group who had only basis treatment, reduction of the amount of disorders was registered only in 24 % of cases.

3. Clinically all patients noted good tolerance of procedures, improvement of the general state of health and sleep. No negative effects and side effects were registered.

Thus, at regular course application of DENS, stabilization of the course of essential hypertension and improvement of the patient's quality of life can be achieved.

DENS-THERAPY IN COMPLEX TREATMENT OF MYOPIA OF CHILDREN AND TEENAGERS

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Dynamic electroneurostimulation is a modern method of reflexotherapy, which can be applied when treating eye diseases both as monotherapy and in the complex with other methods of physical treatment.

The article presents the results of complex treatment of myopia and accommodation spasm which included DENS-therapy, color and magnetostimulation and accommodation training. Reliable efficiency of the proposed method of treatment was observed, which is confirmed by increase of visual acuity by 0.14 on average, reduction of the accommodation tone by 0.3 diopters, increase of the reserves of relative accommodation (RRA) by 2.98 diopters, improvement of other functional indexes. This allows us recommending the proposed method of treatment for application in the ophthalmologic practice.

Key words: dynamic electroneurostimulation, color and magnetostimulation, accommodation training.

A need for prophylaxis of myopia development is caused by its vital role in the amount of eye diseases (25-35 %) and its trend for dynamic growth [1, 3]. Myopia progressing is associated with an increasing world computerization. In this connection, elaboration of modern efficient methods of myopia treatment using the principle of “biological feedback” is a task of great importance. Mechanisms of influence of the therapeutic factors, which comprise complex therapy, make eye hemo- and hydrodynamics normal, improve microcirculation by usage of their complementary influence and increase of visual functions and, thus, promote prevention of myopia development.

Purpose of the present research was to study therapeutic efficiency of the complex method of treating accommodation spasm and myopia including dynamic electroneurostimulation (DENS), color and magnetocorrection (CMC) and accommodation training. For this, we carried out treatment of noncomplicated myopia of the slight and medium form and accommodation spasm of 33 patients (66 eyes) in the age from 8 to 19 years.

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Table 1
Distribution of Supervision Depending on Refraction, Gender and Age of Patients

Number of Patients			%
Gender	<i>male</i>	13	39%
	<i>female</i>	20	61%
Age	<i>8 - 13 years</i>	19	58%
	<i>13 – 18 years</i>	14	42%
Number of Eyes			%
Refraction	<i>Em – Hm</i>	12	18%
	<i>Slight Myopia</i>	30	45%
	<i>Medium Myopia</i>	24	36%
	<i>Total</i>	66	100%

Methods of examination and treatment. Examination was carried out by standard methods and included visometry with optimal correction and without it, determination of dynamic and static refraction, accommodation tone, reserve of the positive part of relative accommodation (RRA), reserve of distance accommodation (RDA), critical flicker fusion frequency (KFFF) to red and green colors.

Dynamic electroneurostimulation of the paraorbital zone was carried out with “DENAS+” apparatus with external paraorbital electrode (EPE) “DENS-glasses”. DENS was applied in the MED program and “therapy” mode at frequency 77 Hz with 5 minute exposure. The principle of this method operation lies in therapeutic influence on reflexogenic zones and biologically active points of the paraorbital area with short bipolar current impulses of different frequency, which form changes depending on the impedance of tissues in the subelectrode zone. The principle of “biological feedback” is applied.

“Rucheek” apparatus (“Medoptika TAK-2”) was applied for accommodation training, effect of which is achieved by discrete serial presentation of signs at fixed distances from the eye. Under occlusion of the eye not in function, monocular principle of operation was followed. Accommodations trainings were carried out with optimal correction for long distance vision. Training course consisted of 10 procedures, 5 minutes for each eye.

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1-2 minutes after the accommodation training, treatment by method of color and magnetostimulation with apparatus “Medoptika CMS-11” was applied. Function of the apparatus is based on stimulation of the optic tract with synchronized light and magnetic pulses. Pulses frequency was synchronized with the patient’s bloodstream pulse. Magnetic field exposure was carried out on the area of orbital cavity, temporal region at the external edge of the orbital cavity, on auricular-temporal region in the optic chiasm projection, on the occipital region in the projection of cortical part of the visual analyzer. Treatment course consisted of 10 procedures carried out every third day.

Results of treatment. During the research good tolerance of the proposed treatment course was registered in all patients. It was registered, that 96 % of patients had asthenopia effects disappeared or considerably diminished as well as visual efficiency significantly increased. During the efficiency analysis of treatment in compliance with the proposed method, a reliable improvement of functional indexes of eyes is revealed in general (table 2, table 3).

Table 2
Dynamics of Particular Functional Indexes of Eyes under the Influence of Complex Treatment

Functional Indexes	Before treatment M±m	After treatment M±m	P
Visual acuity	0.26±0.04	0.4±0.03	<0.05
Dynamic refraction (dptr)	2.92±0.7	2.62±0.08	<0.05
RRA, (dptr)	3.95±0.08	6.93±0.07	<0.01
RAA, (dptr)	3.4±0.08	6.4±0.09	<0.01
KFFF red, (Hz)	47.9±0.9	50.5±0.8	<0.05
KFFF green (Hz)	44.1±0.6	44.6±0.7	>0.05

Before the treatment course visual acuity without correction was 0.26 ± 0.04 ; after the treatment course it was increased to 0.41 ± 0.03 , on average by 0.14 ($p < 0.05$). And increase of visual acuity by 0.3 and more was discovered in 38 % of cases.

Weakening of dynamic refraction was observed on average by 0.3D from 2.92 ± 0.08 dptr to 2.62 ± 0.08 dptr ($p < 0.05$). Accommodation tone determined as difference between a dynamic and static refraction was reduced from 0.33 dptr to 0.02 dptr ($p < 0.05$).

A statistically reliable increase of the reserve of absolute accommodation by 2.96 dptr from 3.4 ± 0.08 dptr to 6.4 ± 0.09 dptr ($p < 0.01$) was observed. The reserve of relative accommodation increased by 2.98 dptr ($p < 0.01$) and on average was 6.93 ± 0.07 dptr. Restoration of the accommodation reserve to the age standards was observed in all patients, whereas before treatment indexes of RRA norm were observed only in 50 % of cases. And the group with high RRA indexes (> 6.5 dptr) amounted to 45 % as compared with 8 % before treatment (Fig. 1).

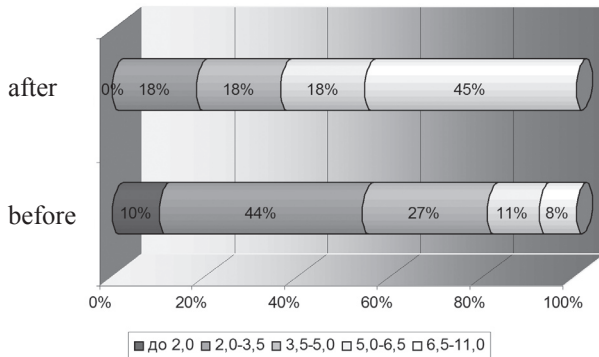


Fig. 1. Distribution of RRA before and after the Treatment Course

During study of KFFF indexes, their improvement from 47.5 ± 0.8 Hz to 50.26 ± 0.78 Hz ($p < 0.05$) to the red color and from 43.8 ± 0.75 Hz to 44.3 ± 0.52 Hz ($p > 0.05$) to the green color was observed.

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Table 3
Functional Indexes of Eyes Depending on the Initial State of the Clinical Refraction

Functional Indexes	Static Refraction		
	Hm - Em	Slight Myopia	Medium Myopia
	<i>n=12</i>	<i>n=30</i>	<i>n=24</i>
Visual Acuity	<i>0.15±0.02</i>	<i>0.2±0.02</i>	<i>0.05±0.01</i>
Dynamic Refraction, (dptr)	<i>(-)0.06±0.06</i>	<i>(-)0.43±0.08</i>	<i>(-)0.25±0.06</i>
RRA, (dptr)	<i>2.06±0.09</i>	<i>4.1±0.07</i>	<i>2.03±0.07</i>
RAA, (dptr)	<i>2.0±0.05</i>	<i>3.14±0.08</i>	<i>3.34±0.09</i>
KFFF red, (Hz)	<i>3.0±0.5</i>	<i>1.33±0.2</i>	<i>3.75±0.4</i>
KFFF green, (Hz)	<i>0.9±0.6</i>	<i>0.66±0.8</i>	<i>2.14±0.8</i>

Analysis of indexes dynamics depending on the eyes refraction value (table 3) shows that during treatment in compliance with the proposed methods, the most pronounced results were achieved when treating slight myopic refraction. It can be associated with direct stimulating influence on the weakened ciliary muscle and not only by reflex influence to which accommodation spasm is “more responsive”.

Thus, the proposed treatment course, which includes dynamic electroneurostimulation, color and magnetocorrection and accommodation training improved functional adaptive mechanisms of the visual analyzer and is an efficient method in the complex treatment of the accommodation spasm and slight and medium myopia.

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DYNAMIC ELECTRONEUROSTIMULATION
AFTER EXCIMER-LASER SURGERIES IN
COMPLIANCE WITH LASEK TECHNOLOGY

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Influence of dynamic electroneurostimulation (DENS) on engraftment of the corneal flap after excimer-laser surgeries, possibilities of increasing functional results and reducing rehabilitation periods was studied in 30 patients as well as DENS influence on ophthalmology-ergonomic indexes which influence visual efficiency in the post-operative period. The results are the evidence that DENS applied after excimer-laser surgeries have a joint multi-component effect: have a pronounced analgetic and anti-edema effect, results in acceleration of engraftment of the corneal epithelial flap, promotes more qualitative regeneration of the cornea, improvement and faster restoration of visual functions, provides for increasing and faster stabilization of the refractive effect, increase of its forecast accuracy.

Key words: dynamic electroneurostimulation, ophthalmology, excimer-laser surgeries.

Nowadays excimer-laser surgery is a basis for refractive operations for myopia correction. The basic methods are LASEK (EPI-LASIK) and LASIK (INTRA-LASIK). Any surgical methods have their certain disadvantages. These include pain syndrome in the early postoperative period, defective engraftment of the corneal flap as well as prolonged restoration of visual functions which influence visual capacity. In the scientific literature a great attention is given to the issue of corneal flap engraftment after excimer-laser surgeries [5, 9].

A relation between the speed and nature of corneal epithelial flap engraftment and degree of its transparency in the future was discovered, which in its turn influence the refractive result of the surgical operation carried out [2, 3]. Assessment of professional capabilities of the organ of vision in patients after refractive operations is also of great interest. A number of authors note that some functions such as low-contrast visual acuity, spatial contrast sensitivity, blinding sensitivity are restored after surgeries within the periods up to 6 months. "Dry eye syndrome" occurring transiently and some other complications are the biggest problem of modern refractive surgery. A bulk of practical investigations is connected with drug treatment of these complications.

Along with the above, electrostimulation is known to be applied in ophthalmology for treatment of different pathologic processes [1, 4, 6, 8, 10]. A positive influence of electrostimulation for resolving many problems can be noted.

The purpose of the present research is to study influence of dynamic electroneurostimulation on engraftment of the corneal flap after excimer-laser surgeries in compliance with LASEK technology and possibility of improving functional results as well as reduction of terms of visual functions restoration which is especially important in professions making raised demands of the visual analyzer.

Materials and methods. ViDENS sets consisting of transcutaneous electrostimulator “DENAS+” and external paraorbital electrode “DENS-GLASSES” were applied for the research. DENS results after refractive surgeries for myopia were studied in 30 patients (60 eyes) – 15 men (50.0 %) and 15 women (50.0 %) in the 23-47 years (on average 30.4 ± 0.8 years). Myopia degree varied from -5.0 to -16.0 dptr, average value -9.79 ± 0.25 dptr. Patients in the main and control groups were selected as to have approximately equal degree of myopia, corneametric data and extent of operation. For research excimer laser MEL-60 (Germany) was used.

DENS was carried out starting from the 1st day after the surgery. Treatment was applied in the paraorbital zone in the MED program, and then in the “THERAPY” mode at frequency 77 Hz during 10 minutes; in the cervical-collar zone – in the “TEST” mode, with treatment of found latent trigger zones in the “THERAPY” mode at frequency 77 Hz – 3-5 minutes for each zone. Each patient had 12-14 procedures.

For assessment of the results in the main and control groups, the following tests were carried out:

- check of visual acuity with correction;
- check of low-contrast visual acuity with help of the projector of test signs – Carl Zeiss Jena at 18 % contrast;
- reserve of relative accommodation;
- terms and quality of corneal flap engraftment and subjective sensations.

Results and discussion. All patients in the main group had a pronounced analgetic effect registered – intensity of the sensation of pain was lower and pain relieved earlier than in the control group.

No intolerance of procedures, allergic reactions were registered in the main group. A special attention was paid to the manifestation degree

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of the postoperative reaction. Degree of corneal syndrome in the main group was less and corneal epithelial flap engraftment was faster.

Two variants of corneal epithelial flap engraftment were discovered: favorable – full engraftment and unfavorable – a small edge defect of the flap with edematous edges and areas of loose flexible engraftment.

A favorable variant of cornea epithelization was registered (100 % of cases) in all eyes in the main group which had DENS.

In the control group, which did not have DENS, favorable variant was registered in 47 (78.3 of cases). In 13 eyes (21.7%) an unfavorable variant of corneal epithelial flap engraftment was registered, which was accompanied by the corneal syndrome. A direct relation between a edema degree of the corneal epithelium and nature of its healing was registered: the more the edema – the worse the healing.

Terms of corneal epithelial flap engraftment in the main group were shorter than in the control group. Terms of corneal epithelial flap engraftment in the main group did not exceed 48 hours in 100 % of cases; in the control group – only 37 eyes (61.7 %) had engraftment during 48 hours, 21 eyes (35.0 %) – 72 hours, 2 eyes (3.3 %) had corneal epithelial flap engrafted in the later period.

Table 1.
Terms of Corneal Epithelial Flap Engraftment

Time of research	Group with DENS (number of eyes – 60)		Control group (number of eyes – 60)	
	Number of eyes	%	Number of eyes	%
48 hours	60	100	37	61,7
72 hours	0	0	21	35,0
>72 hours	0	0	2	3,3

Visual acuity was restored earlier in the group, which had DENS. The difference during the first week of observation was especially obvious.

After one week and one month, visual acuity without correction in the main group was also higher. We also think it important to note the fact that uncorrectable visual acuity one month after the surgery was higher than the maximum correctable visual acuity before the surgery in both groups.

*Table 2.
Dynamics of Visual Acuity in Patients of the Main and Control Groups*

Time of research	Group with DENS (number of eyes – 60)	Control group (number of eyes – 60)
<i>Before surgery</i>	<i>0,73±0,01 (with maximum correction)</i>	<i>0,73±0,01 (with maximum correction)</i>
<i>1 week*</i>	<i>0,64±0,01</i>	<i>0,57±0,01</i>
<i>1 month</i>	<i>0,86±0,02</i>	<i>0,85±0,02</i>
<i>*P < 0,05</i>		

As myopic eyes initially have lower functional capabilities than emmetropic ones, it is an important task to increase these functions (such as accommodation reserve, low-contrast visual acuity, spatial contrast sensitivity) to achieve a good refractive result after the surgery [7]. It is very interesting that low-contrast visual acuity in the control group decreases after the surgery and restores to the initial level only one month after the surgery. In the group of patients who had DENS, this index surpassed the level before the surgery.

Conclusions

1. Dynamic electroneurostimulation after excimer-laser surgeries has a positive multi-component influence. It has an analgetic and anti-edema effect, accelerates the time of corneal epithelial flap engraftment, and reduces the risk of complications, which have influence on the optic result of the surgery.
2. DENS promotes faster restoration and improvement of visual functions having direct influence on refractive effect of the surgery and faster restoration of visual capacity.
3. DENS is an efficient method of increasing efficiency of excimer-laser surgeries. Simplicity and convenience of its application allows recommending it to patients for treatment courses at home for improvement of visual functions.

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**APPLICATION OF DYNAMIC
ELECTRONEUROSTIMULATION (DENS)
IN COMPLEX CONSERVATIVE TREATMENT
OF PATIENTS WITH OSTEOPOROSIS**

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The purpose of the research was to study possibilities of application of dynamic electroneurostimulation (DENS) in complex conservative treatment of patients with osteoporosis. 65 women were participating in the research. Clinical and functional manifestation of osteopenia and osteoporosis were assessed before the treatment course and after 6 and 12 months. DENS application increased efficiency of treatment which was expressed in analgetic effect and positive dynamics achieved by the results of ultrasonic densitometry.

Key words: dynamic electroneurostimulation, osteoporosis, pain syndrome, mineral density of the bone tissue.

Application of polyfunctional apparatuses DiaDENS is not a very widespread method of treatment in orthopedic and trauma hospitals. Method of dynamic electroneurostimulation (DENS) promotes improvement of the adaptation reaction and develops self-regulating body capabilities.

Purpose of the research. Purpose of the present research was to study possibilities of DENS application in complex conservative treatment of patients with osteoporosis.

Research materials and methods. 65 women in the age from 35 to 49 working in difficult industrial environments were under examination. Average age of patients was 44.3 ± 2.5 years. All patients were divided into three groups: 1st group consisting of 20 women had a traditional osteotropic therapy (Vitrum calcium D3, calcitonin, artron-complex); 2nd group consisting of 35 women had a complex therapy including DENS; 3rd control group consisted of 10 women with normal indexes of mineral density of the bone tissue. All groups correlated by age and clinicoroentgenological picture of disease activity. The examined patients did not take preparations influencing metabolism of the bone tissue before. They did not have diseases of the thyroid gland, kidneys, pancreatic diabetes. The patients had main complaints about pains in the back and large joints, weakness and so on.

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Clinical and functional manifestation of osteopenia and osteoporosis were assessed before the treatment course and after 6 and 12 months. Mineral density of the bone tissue (MDBT) was analyzed by the method of ultrasonic densitometry with help of the densitometer Achilles-express (Lunar, USA).

DiaDENS-DT apparatus was applied for procedures of dynamic electroneurostimulation. For electrodes disposition we followed the general layouts proposed by J.S. MaiLzheimer (1978), adjusting them to certain clinical manifestations of the disease.

Results of own researches. Improvement of the state of health was noted by all patients of the 1st and 2nd group by the end of the first month of therapy. The pain and general weakness were reduced which contributed to expansion of the motor activities, sleep normalization and improvement of the mood. In the 1st group after 6 months, pains were reduced in 5 patients, 14 women noted periodical pains in the back and large joints. After 6 months, stiffness index increased by 2 % ($p>0.5$), after 12 months – by 3.5 % ($p<0.05$). In the 2nd group after 6 months, general weakness and effects of asthenoneurotic syndrome were reduced. Acute pains were absent. After 6 months, stiffness index increased by 4.5 % ($p<0.05$), after 12 months – by 6 % ($p<0.05$). In the 3rd group after 6 months, stiffness index decreased by 1.5 % ($p>0.5$), and after 12 months – by 2 % ($p>0.5$).

Improvement of women's state of health and positive dynamics in increasing of the mineral density of the bone tissue registered in the 2nd group are the evidence of a positive result of complex therapy, improvement of the bone "quality". Patients of the 1st group had a positive dynamics of treatment, but no significant changes in the quality of life were registered. In the 3rd group, reduction of bone tissue "quality" and patients' state of health was registered as affected by exogenous and endogenous factors. Biochemical indexes of bone metabolism correlated with indexes of mineral density of the bone tissue.

Conclusions

Thus, dynamic electroneurostimulation enables to increase efficiency of complex treatment for patients with osteoporosis, has a pronounced analgetic effect, and almost has no contraindications and is worthwhile for application at orthopedic and traumatology institutions.

**EXPERIMENT OF USING DENAS APPARATUSES IN
COMPLEX TREATMENT OF OSTEOARTHRISIS DEFORMANS**

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Osteoarthritis deformans (OAD) is a dystrophic disease of joints caused by affection of the articular cartilage. Disease occurrence gradually increases as the people grow older and reaches its maximum at 60-65 years of age. Usually primary (idiopathic) and pulmonary OAD are distinguished. OAD is called primary (idiopathic) when it was not possible to find out an immediate cause of its occurrence. Pulmonary OAD is a consequence of different diseases, traumas and maldevelopment of the musculoskeletal system. At that, large joints of lower extremities (knee- and hip joints) are mainly affected as well as first metatarsophalangeal articulations. Several causes or risk factors of disease development can often be found in patients with osteoarthritis. In addition, one patient can have a combination of both primary and pulmonary osteoarthritis.

For OAD treatment, complex therapy [5] is the most effective. Selection of treatment methods depends on the stage and period of the disease. During acute conditions of the disease a complex of measures is applied aimed at liquidation of the pain syndrome, improvement of the tissues trophism and blood circulation in the affected extremity, increase of the joint stability.

At early stages when the articular cartilage is not affected to a certain extent and with absence of contraindications, the so-called chondroprotective drug therapy is indicated. Therapeutic effect of these preparations in OAD treatment is associated with a favorable influence on the malfunctioning metabolism of the articular cartilage which slows the process progressing down. A clinically pronounced effect of these preparations is achieved only under conditions of their regular and long application [5, 6].

Non-efficiency or short-term effect of repeated course of conservative treatment under progressive disease is an indication for surgical treatment of OAD. Basic criteria of the before-operational treatment to be considered inefficient are the following: continuous pains, increase

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of deformations and joint instability, restriction of joint movement. Modern methods of OAD surgical treatment are aimed at correction of existing biomechanical disorders. Under osteoarthritis of hip and knee-joints a good clinical results with a positive roentgenological dynamics can be achieved with help of extraarticular correcting osteotomies. Their efficiency can be explained by influence on the basic links of the pathological process, improvement of centering of the mechanical axis of the extremity, joint congruence and stability, increase of the contact surface of the articulated joint surfaces, influence on active muscular components of joint stabilization, positive influence on the local micro-circulation [2, 6].

Unfortunately, factors resulting in beginning and progressing of OAD usually fail to be eliminated. Nevertheless, doctors should aim at their detection and correction. In addition, search for new economical and efficient methods of treatment and rehabilitation of patients is also of great importance. According to some sources [8, 9] a good clinical effect in patients with OAD was achieved when applying dynamic electroneurostimulation (DENS) in complex treatment. This method of electrical treatment has some peculiarities, which enable to achieve a high efficiency and, at the same time, is very easy for application [1, 9]. During DENS application, exposure is on biologically active zones and points with short current impulses of low frequency, which change their form in response to change of the skin electrical resistance in the subelectrode area.

During DENS procedure, optimization of functioning of anti-nociceptive and trophic process in the pathologically changed tissues and organs is achieved due to local, segmental-reflex and general reactions. This provides for analgetic, anti-inflammatory, anti-edema and trophostimulating effects [1]. Thus, DENS application for treating arthrosis deformans is well-grounded theoretically.

Purpose of the present research was to assess DENS efficiency and its influence on dynamics of clinical and laboratory indexes of patients with acute OAD of joints of extremities in the polyclinics conditions.

Materials and methods.

31 patients with osteoarthritis deformans of knee- and hip joints of I-II degree were examined. Patients were divided into groups by the method of random nonrepeated sampling. The patients were divided into two groups (main group – 19 people, and control group – 12 peo-

ple). Average age of patients of the main group was 53.3 years (from 30 to 78 years), of the control group – 57.4 years (from 24 to 80 years). Average duration of the disease in the main group was 5.53 ± 2.6 years, in the control group – 2.75 ± 5.75 years (from one to 10 years). All patients passed an X-ray examination of joints. Before treatment patients of both groups had pain syndrome (100 %), edema of the affected joints (32.2 %), restriction of joints movement (100 %), reduction of the muscle strength (100 %). Dynamics of clinical symptomatology was assessed on the 5th and 15th days from the beginning of the treatment course. No significant differences by age, gender, degree of process activity and duration of the disease in the compared groups are present. Patients of the main and control groups had similar drug therapy; in addition, patients of the main group had dynamics electroneurostimulation (DENS).

DENS was applied in compliance with the recommended procedures [1]. Individual treatment recipe was selected for each patient at each treatment procedure. Zones were selected in accordance with the current clinical presentation. Skin surface over the affected joint was treated in the THERAPY mode at the maximum power level. Dynamics of the pain syndrome was the criteria of sufficiency of exposure on the said zone. Treatment was finished when the pronounced analgetic effect was achieved (total relief or considerable reduction of pain). After that, the skin area symmetrical to the affected joint was treated in the TEST mode at the comfortable power level. The procedure was finished with treatment of universal zones; the trigger zones found, they were treated in the THERAPY mode at the comfortable power level (on average 3-5 minutes per each zone). Course apparatus treatment was finished after total regress of the pain syndrome.

Mathematical treatment of the research materials was carried out by methods of variation statistics [7] with application of the Microsoft Excel and Biostat software package. Significant differences were assessed by the Student's criterion.

Results of the research and discussion.

In the main and control groups, dynamics of the following marker indexes for control of treatment efficiency were assessed: disorder (restriction) of affected joints movements, change of the muscular tone, pain syndrome, clinical analyses. Before the treatment course, 4 (21 %) of 19 patients of the main group had complaints of painfulness

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in the affected joints under loads, the rest of the group had a continuous pain syndrome. 4 patients (33.3 %) in the control group had a pain syndrome under loads and 8 had a continuous pain syndrome. In the main group, a significant positive dynamics was observed starting from the 3rd-4th day of the treatment beginning. Total relief of the pain syndrome was observed in all patients who had DENS by the 6th day from the treatment beginning (5.21 ± 0.77). Similar results in patients of the control group were achieved only by the 25th day of the therapy course (19.25 ± 6.92). Other clinical symptoms had similar regress.

Significant differences in patients of the main group were observed when assessing the muscle strength and mobility disorders in the joint on the 5th day. In the control group, significant differences showed up only on the 15th day from the treatment beginning (Table 1).

Table 1.
Dynamics of Marker Clinical Indexes in Patients who had DENS-therapy and in the Control Group

Indexes	Main Group (DENS) n=19			Control Group n=12		
	Before treatment $\chi \pm \delta$	5th day $\chi \pm \delta$	15th day $\chi \pm \delta$	Before treatment $\chi \pm \delta$	5th day $\chi \pm \delta$	15th day $\chi \pm \delta$
Restriction of joint movement, degrees	10.84 ± 6.47	5.79 $\pm 7.12^*$	5.0 $\pm 5.8^*$	11.25 ± 13.34	10.42 ± 13.89	4.58 $\pm 8.64^*$
Reduction of muscle power, points	1.21 ± 0.54	0.32 $\pm 0.58^*$	0.26 $\pm 0.45^*$	1.33 ± 0.78	1.17 ± 0.71	0.67 $\pm 0.89^*$

**p<0.01*

No changes were registered in clinical analyses both in the main and in the control groups.

Conclusion:

With application of dynamic electroneurostimulation for patients with osteoarthritis a pronounced and fast analgetic effect was observed, regress of basic clinical symptoms was accelerated, treatment periods were reduced. Thus, we can make a conclusion that application of dynamic electroneurostimulation for patients with acute OAD of joints of the extremities is well grounded and advisable.

Taking into account chronic nature of the disease and relative simplicity of DENS methods in combination with high efficiency of the therapy, further research should be aimed at development of optimal individual strategies of application of the apparatus therapy at home depending on the stage of the disease.

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**COMPLEX ASSESSMENT OF EFFICIENCY OF DYNAMIC
ELECTRONEUROSTIMULATION UNDER VERTEBROGENOUS
CERVICAL AND LUMBAR RADICULOPATHIES**

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The purpose of the research was to assess influence of dynamic electro-neurostimulation (DENS) on intensity of the pain syndrome in patients with vertebrogenous cervical and lumbar Radiculopathies. DENS efficiency was assessed in 31 patients of the main group as compared with the control group (26 people) in compliance with 10-rate visual and analog scale of pain. More pronounced and earlier pain relief was registered in patients who had DENS, good tolerance of procedures can also be noted.

Key words: vertebrogenous cervical and lumbar radiculopathy, pain syndrome, visual and analog scale of pain, dynamic electro-neurostimulation.

According to some scientists, vertebrogenous cervical and lumbar radiculopathies can be found more often in working-age population [1]. They are accompanied with a long-term and quite often fixed loss of working capacity because of pronounced pain syndrome. At present, complex measures aimed at reduction and relieving of the stable pain syndrome, reduction of the duration of temporary incapacity for work as well as prevention of recurrence of the disease are taken.

Dynamic electro-neurostimulation (DENS) is a method of non-drug treatment based on exposure on reflexogenic zones and acupuncture points with impulses of electric current, form of which depends on the amount of electrical resistance (impedance) of the skin surface in the subelectrode zone. The therapeutic action of DENS is based on reflex mechanisms actuated by stimulation of receptors in reflexogenic zones and acupuncture points. As a result, treatment with DiaDENS apparatus results in a chain of mechanism responses.

It is known that for successful treatment with the method of reflexotherapy it is important to be exact with three main rules: to select correct type, place and time of the procedure. The following factors influence individual appreciation of pain: gender, age, emotional and physical state of the patient. Information provided by the patient about changes in pain depending on the type of therapy is also of importance.

With lumbosacral radiculitis, the fifth lumbar root and the first sacral root are affected. The patients have pain in the lumbar region, which becomes acute during movements in the lumbar region and a corresponding extremity. During examination, a reflex tension of long muscles of the back in the zone of a corresponding spine part is revealed. Palpation of paravertebral points in the region of the lumbar spine causes acute pains. Positive symptoms of Laseg, Neri's tension are revealed. With cervical radiculopathy, the fourth, fifth and sixth cervical roots are mainly affected. Due to pronounced pain syndrome, the head position becomes forced, pains expand also on the upper part of the arm, arm and suprascapular zone. During examination, hypoesthesia in the innervation zone of one or another root becomes apparent.

Absence of adequate criteria for assessment of sensations of pain and factual methods of measuring pain intensity is often a cause for diagnostic and medical pitfalls.

The purpose of the present research was to assess DENS influence on intensity of the pain syndrome in patients with vertebrogenous cervical and lumbar radiculopathies.

Patients and methods of research. 57 patients (25 women and 32 men) in the age from 35 to 70 years had a treatment course in the department of emergency neurology of the republic scientific center of emergency medical aid. After arriving to the hospital, all patients had typical signs of vertebrogenous cervical (17 patients) or lumbar (40 patients) radiculopathy with acute pains intensified during movement. Three fourths of the patients had a pain syndrome caused by supercooling, one fourth of patients – by lifting heavy loads.

All patients were divided into two groups: the main group who had DENS procedures by the methods described by authors [2] in addition to standard therapy included 31 patient; the control group which had only standard therapy included 26 patients.

DENS was carried out with DiaDENS-DT apparatus. Zones of local painfulness were treated at frequencies 10, 77 and 140 Hz. Energy level of treatment was selected individually. Starting time of the exposure was 5 minutes with gradual daily increase of the procedure duration up to 20 minutes. Total therapy course consisted of 6-10 procedures.

To make therapy results more objective, all patients of the main and control groups were asked to assess intensity of the pain syndrome daily by visual and analog scale of pain (VAS) by 10-point system.

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At the same time, examination of DENS influence on indexes of blood pressure and heart rate before and after the procedure was carried out.

In the hospital, patients had glucocorticosteroids, non-steroid anti-inflammatory preparations, analgesics, tranquilizers, paravertebral blocks, physiotherapeutic procedures as a standard drug therapy.

Results of the research and discussion. During the first examination, patients of the main and control groups had a pain syndrome of similar intensity (Fig. 1).

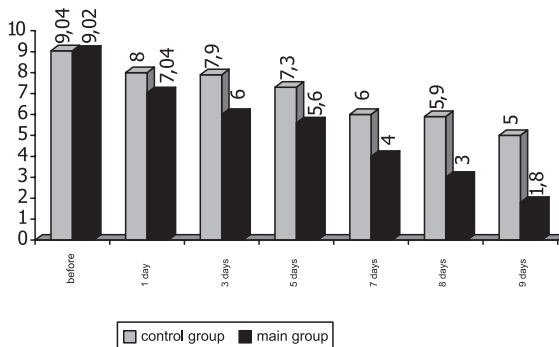


Fig. 1. Dynamics of Pain Syndrome Intensity (according to VAS) in Patients with Vertebrogenous Cervical and Lumbar Radiculopathies under DENS Influence

Before the treatment, patients of the main group had intensity of the pain syndrome as 9.04 ± 1.30 points, patients of the control group – 9.02 ± 1.00 points. A considerable reduction of pain syndrome intensity of the patients of the main group was registered on the 3rd-4th day of the treatment course, in the control group the same effect was achieved only by the 9th-10th of patients' stay in the hospital (Fig. 1). 31 patients of the main group who had complex treatment with DENS application had not only a significant regress of the pain syndrome but increase of the range of active motions in the spine as well as stabilized psychoemotional state.

It should be noted that patients for whom DENS was applied needed paravertebral blocks less often, they had less need for additional prescription of glucocorticosteroids and non-steroid anti-inflammatory preparations.

The complex assessment of the patients' state also included measurement of the blood pressure (BP) level under DENS procedure influence.

DENS effect lied in reduction of the patients' initially raised BP. In this way, average value of the initial systolic BP before the DENS procedure in the first group was 140 ± 3 mmHg, diastolic BP was 80 ± 2 mmHg. After the DENS procedure, reduction of the average value of BP was registered: systolic – to 122 ± 3 mmHg, diastolic – to 70 ± 2 mmHg. In this connection, patients with concurrent arterial hypertension had less need for intensive hypotensive therapy during the DENS course.

No negative results were registered during the DENS treatment course.

Thus, DENS-therapy in the complex treatment of patients with vertebrogenous cervical and lumbar radiculopathies enables to reduce considerably the terms of pain relief, doses of drugs, the need for medicinal and drug blocks during the treatment course. DENS-therapy is remarkable for absence of side effects and good tolerance by the patients. Stable analgetic effect is preserved during the whole treatment course.

Conclusions

1. DENS has a positive influence on patients with vertebrogenous cervical and lumbar radiculopathies at the nociception level in the form of reduction of intensity and duration of the pain syndrome.
2. DENS application results in positive therapeutic action both after one procedure and during the treatment course. However, more stable effect and reliable positive dynamics can be evident during the treatment course as a whole.
3. DENS results in reduction of BP of patients with concurrent arterial hypertension.
4. DENS application due to efficiency for treatment of pain syndromes enables reducing the dose of analgesics, glucocorticosteroids and non-steroid anti-inflammatory preparations.

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DENS APPLICATION IN COMPLEX TREATMENT OF BURNS

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In spite of certain success achieved during the past decades in burns medicine, the problem of relieving a pain syndrome under thermal in-

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juries is not resolved completely. Introduction of modern high-efficient preparations for general anesthesia of the burnt is under development now. However, side effects of the majority of these medicines set severe restrictions to their practical use. In this connection, a new trend in the clinical burns medicine is being developed with application of non-drug methods of pain relieving in patients with thermal injuries.

Application of the method of dynamic electrostimulation (DENS) in local treatment of the burnt is one of the prospective trends for resolving this problem.

The purpose of the present work was to assess DENS influence on intensity of the pain syndrome and terms of burning wound healing.

55 burnt with the burn area from 5 to 30 % of the skin surface were included into the research, average age was 34.6 ± 1.6 years. The patients were divided into two groups: main (25 people) and control (20 people). The main group had DENS from the DiaDENS-DT apparatus in addition to drug therapy. The procedures were carried out once a day. An individual recipe of treatment was selected according to the recommended methods. Patients of the control group had only standard conservative treatment. To make the results more objective, patients of the main and control group were asked to assess intensity of the pain syndrome daily, the course of the wound process was examined at the same time.

Of 25 patients who had complex therapy with DENS application, all had a positive therapeutic effect in the form of pain syndrome relief, increase of active motions and improvement of the general state of health. Analgesic effect of the DENS-therapy was registered after 1-2 procedures. Reduction of the pain syndrome was registered by the 5th-6th procedure. As regards the wound process, reduction of inflammatory effects, terms of acceleration of wound cleansing and epithelization were registered. In the control group, the pain syndrome lasted out during much longer periods (up to 2-3 weeks), terms of cleansing and healing of the burning wound were also longer.

Thus, inclusion of DENS-therapy into complex treatment of the burnt promotes reduction of the pain syndrome and acceleration of epithelization of the burning wound.

PART TWO

EFFICIENCY OF THE DENS METHOD FOR TREATING DISEASES OF GASTROINTESTINAL TRACT OF DOGS

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In the recent nine years, electroreflexotherapy (ERT) which is a universal method aimed at regulation of stress reactions and adaptation both in men and animals in all its physiological and clinical presentations is applied for diagnostics and treatment of noncontagious diseases of people and animals.

Method of non-invasive exposure on the body – transcutaneous dynamic electroneurostimulation (DENS) is one of the ways of ERT introduction.

DENS is carried out with application of portable transcutaneous electrostimulators DENAS, DiaDENS and ZooDENS which have a function of monitoring impedance of the skin surface for managing parameters of exposure depending on the nature of electrical reactions of tissues in the subelectrode zone.

The method consists of therapeutic influence on reflex zones and acupuncture points (AP) with short bipolar current impulses of different frequencies, form of which changes depending on the values of total electrical resistance (impedance) of tissues [4].

This method became a widely spread one in clinical practice when treating a wide range of diseases including musculoskeletal system, nervous system, internal organs and auricular diagnostics and therapy [1, 2, 3, 5, 6].

Treatment was provided for ill dogs with the diagnosis of gastroenteritis which had clinical presentations in loss of appetite, inertia, recurrent vomiting (of some dogs), presence of white incrustation on the root of tongue, palpatory tenderness of the abdominal wall, dejection discharge with odor nuisance and brown-and-green color with mucus streaks. The diagnosis was confirmed by the clinical and biochemical blood examinations.

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Based on the analysis of these indexes two groups of animals were formed – one experimental group (13 dogs) and control group (3 dogs). The examination was carried out on outbred dogs in the age of 1-3 years kept in store in the hospital of the veterinary clinics of MGUBP.

After diagnostics of acute gastroenteritis, the experimental group of animals was put on dynamic electroneurostimulation with ZooDENS apparatus. 14 DENS procedures were carried out, of which 10 were basic ones and four– fixating. Duration of one procedure – 15 minutes. Hence, treatment course lasted 14 days.

During therapeutic procedures AP located on the abdomen surface along the stomach, spleen, pancreas and liver meridians were selected. These meridians go parallel in the zone of abdomen close to each other [3, 6, 7, 8]. It is known that the stomach, duodenum, spleen and liver are closely connected physiologically. That is why exposure on AP of these meridians, in our opinion, should have had a positive effect for treating gastroenteritis. It should be noted that sparse hair on the dogs' abdomen area enabled to carry out treatment of AP of these meridians efficiently. During DENS procedures, no negative reactions (anxiety, aggression and other undesirable actions) from the dogs-patients were registered.

According to observations and clinical examinations homeostasis restoration occurred gradually. First, dogs had an appetite, motion activity increased, dejection formed. The latter was also gradual. First, odor nuisance was changed to a normal one, then color changed to light-brown. Then, dejection gradually became thicker. On the 7th day, thicker dejection consistency was formed with mucus streaks in some dogs. By the end of the 10th day, dejection of eight dogs was finally formed. In five dogs separate inclusions of liquid mucus were observed. Additionally four procedures were carried out, after which vomiting stopped, inclusions of liquid mucus disappeared as well as white incrustation on the root of the tongue and painfulness of the abdomen wall. A positive effect of the DENS therapy on the clinical state of the dogs is confirmed by the results of clinical and biochemical blood examinations shown in table 1. The examinations were carried out before the first treatment procedure, then after the 10th and 14th procedure.

A software package of applied statistics STADIA was used for calculations. Test for normalcy of distribution revealed disparity of certain samplings to Gauss distribution. That is why a distribution-free method of examination was taken as a basis, this method enables to work with

the available ranges – criterion of differences of the Wilcoxon deviation (position); the Student’s criterion was used as an additional one. For the main group the parameters of the biochemical examination are given taking into account standard deviation.

For the control group of animals, traditional therapy (TT) was carried out with application of Levomycetin, Sulfaguine, activated charcoal, tannin preparations, decoctions of camomile and flax seeds. The diet included digestible carbohydrates and proteins (boiled meat, fish, eggs). Lactate and fat-containing products were excluded.

Two groups of samplings were processed statistically – “before the first procedure” and “after the 10th procedure”, as well as “before the first procedure” and “after the 14th procedure”. The results were put into table 1 as “+” in case of significant differences and as “-” in case of absence of the same.

Table 1. Results of the Biochemical Blood Examination

Parameters of the Biochemical Examination	Standard	Average Values of the Parameter									
		Before the 1st procedure	After the 10th procedure	Crite- rion		After the 14th procedure	Crite- rion		Control group (TT)		
				Student's	Wilcoxon's		Student's	Wilcoxon's	Before the 1st procedure	After the 10th	After the 14th
Crude protein in blood serum, g/l	59 ...76	86 ±5	79±4	+	+	70 ±5	+	+	84.9	84	70.1
Serum albumin, g/l	26 ...40	42.1 ±1	41.8 ±1.2	-	-	40.1 ±1.7	+	+	42.5	41.7	39.3
Globulin, g/l	24 ...37	43.6 ±5.6	38.8 ±4.4	+	+	30.2 ±4	+	+	42.4	42.3	30.7
Alkaline phosphase, mmole/l	0.4 ...1.4	1.86 ±0.6	1.67 ±0.5	-	-	1.2 ±0.27	+	+	1.98	2.0	1.14
Fructose-1,6 diphosphate aldolase, units/l	11 ...17	11.4 ±0.7	11.0 ±0.5	-	-	11.0 ±0.1	-	+	11.2	10.8	11
Sorbitoldehydrogenase, w/L	3.1 ...7.6	5.2 ±1	5.0 ±0.9	-	-	4.35 ±0.7	+	+	5.9	5.7	4.5
GLDG, w/L	24 ...219	149 ±43	130 ±40	-	-	102 ±40	+	+	144	144	93.5
AST, mmole/l	0.6 ...0.64	0.7 ±0.07	0.64 ±0.04	+	+	0.61 ±0.01	+	+	0.7	0.66	0.61

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<i>ALT, mmole/l</i>	0.2 ...0.42	0.83 ±0.1	0.61 ±0.2	+	+	0.37 ±0.07	+	+	0.84	0.87	0.4
<i>Rites coef- ficient</i>		0.92 ±0.3	1.1 ±0.3	-	-	1.6 ±0.34	+	+	0.82	0.76	1.32
<i>GTP, u/L</i>	1 ...9.7	10.6 ±1.2	10.2 ±1.2	-	+	7.6 ±1.7	+	+	11	11.2	7.4
<i>LDH, IU/l</i>	17 ...193	97 ± 27	90 ±29	-	-	85 ±33	-	-	101	101	99.3
<i>α-amylase, IU/l</i>	350 ... 1650	1325 ±277	1212 ±287	-	-	1113 ±237	-	+	1421	1306	1174
<i>Plasma ammonia, mmoleN/l</i>	15 ...40	27 ±9.7	26.8 ±8.4	-	-	24.7 ±8.5	-	-	30.3	30.5	27.6
<i>Sodium in blood serum, mmole/l</i>	183 ...196	201 ±2.4	193 ±6.8	+	+	184 ±2.3	+	+	201	202	186
<i>Potassium in blood serum mmole/l</i>	4.6 ... 6.1	2.47 ±0.16	2.9 ±0.34	+	+	3.1 ±0.2	+	+	2.53	2.55	3.22
<i>Crude ferrum, mcmmole/l</i>	3.9 ...12.7	10.2 ±2.3	10.6 ±2.2	-	-	11 ±2.1	-	-	10.1	10.3	11.5
<i>Cholesterol, mmole/l</i>	2.88 ...9.23	5.2 ±0.83	4.9 ±0.77	-	-	4.8 ±0.8	-	+	6.77	6.3	7.2
<i>β-lipoproteins *10-3 g/l</i>	250 ...280	257 ±21	256 ±16	-	-	257 ±14	-	-	252	250	253
<i>Bilirubin to- tal mcmmole/l</i>	2.05 ...3.4	2.4 ±0.3	2.3 ±0.25	-	-	2.1 ±0.12	+	+	2.44	2.41	2.16
<i>Conjugated bilirubin, mcmmole/l</i>	0 ...0.17	0.05 ±0.04	0.04 ±0.04	+	-	0.03 ±0.04	+	-	0.1	0	0.03
<i>Unconjugat- ed bilirubin, mcmmole/l</i>	2.05 ...3.4	2.4 ±0.26	2.34 ±0.2	-	-	2.1 ±0.09	+	+	2.4	2.4	2.1

Thus, the results of the statistical analysis from table 1 show that significant changes of such indexes as globulin, aspartate aminotransferase (AST), alanine aminotransferase (ALT), crude protein, sodium and potassium in the blood serum were found after the 10th procedure; and significant changes of such indexes as alkaline phosphase, sorbitoldehydrogenase, bilirubin, Y-glutamyltranspeptidase (GTP) were found after the 14th procedure. A positive dynamics and significant changes of parameters of the biochemical blood contents confirmed

that we were right in setting the duration of the treatment course.

During DENS treatment a significant reduction of cholesterol on the 14th day was revealed, while during TT its level grew higher.

No changes of such parameters, which were within the normal range, e.g. crude ferrum, β -lipoproteins, plasma ammonia, were observed.

DENS efficiency as regards traditional therapy was assessed by the fitting criterion of distributions χ^2 . The hypothesis for efficiency assessment was as follows: an assumption of absence of differences between distributions of average values of norm indexes, average values of indexes after the DENS treatment course and the same indexes after TT.

The results of the statistical analysis revealed absence of significant differences in distributions after the DENS treatment course ($\chi^2 = 4.8$) and traditional therapy ($\chi^2 = 6.3$) from average norm indexes with $P = 0.99$. And they stand on the significance axis of criteria values as follows: $\chi^2 = 4.8$ (DENS) $<$ $\chi^2 = 6.3$ (TT) $<$ $\chi^2_{crit.0.05} = 28.8$, where $\chi^2_{crit.0.05} = 28.8$ – critical value of χ^2 for $N = 18$ and $P = 0.05$.

The result obtained in such a way is the evidence that treatment is efficient in both cases. But DENS as monotherapy surpasses TT as the obtained values of χ^2 for the DENS course are less different from the normal range than that for the TT course.

Based on the research carried out the following was determined:

1. Application of ZooDENS apparatus on AP located on stomach, liver, pancreas and spleen channels in the abdomen area of dogs with the diagnosis acute gastroenteritis resulted in total recovery of 13 dogs by the 14th day. Improvement of the clinical state of dogs after treatment with ZooDENS apparatus came on the 7th day whereas in the control group, which had traditional therapy, this result was achieved on the 10th day.

2. Negative influence of drugs on functions of dogs' internal organs is possible with traditional methods of treatment, which did not occur with application of ZooDENS apparatus.

3. High efficiency of ZooDENS apparatus enables to apply it as monotherapy of acute gastroenteritis of dogs and recommend it for introduction into veterinary medicine practice.

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**INFLUENCE OF "DENAS" APPARATUS ON THE
STATE OF RELATIVELY HEALTHY DOGS AND DOGS
SUFFERING FROM ATOPIC DERMATITIS**

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Based on experimental and clinical examinations many authors consider therapeutic effect of electroreflexotherapy to be provided by multi-level reflex and neurochemical reactions which trigger a series of control and adaptive mechanisms [1, 3, 4, 7 and other].

It relieves pain, restores microcirculation, metabolism in the inflammation focus, stimulates formation of biologically active substances, cures synthesis of active substances and activity of the immune system [6].

The mechanism of therapeutic action of transcutaneous electro-neurostimulation consists of increase of the volume of afferent pulsing, thus, limiting the transmission of pain impulses in the spinal cord and activating endogenous analgetic system of the body [6]. Opiates and opioids [1, 2, 5] produced by the enkephalinergic neurons play an important role in activation of these systems. According to some data [6], electrostimulation causes activation of neurons of the gray substance with parallel depression of activity of pain neurons of the afferent impulse conduction. According to the diagram of the same authors, inhibition of impulse transmission from afferent pain neurons through relay neurons of sensor nuclei of the thalamus to the cerebral cortex is realized by three mechanisms.

The first mechanism is based on presynaptic neurons depolarization. It is these neurons that are activated through acupuncture points by electrostimulation. The second mechanism is provided with activation of inhibitory interneurons under pulsation influence, which arrives by recurrent collaterals of axons of relay neurons. The third one – production of opiate-like substances by enkephalinergic neurons results in presynaptic depolarization of synaptic endings of pain afferents. And enkephalinergic neurons are activated by the central gray substance of cerebrum, electrostimulating effect on which was mentioned above.

The problem of applying electroneurostimulation in veterinary lies

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in the variety of species as acupuncture points are species-specific.

Purpose of the research was to study influence of dynamic electro-neurostimulation (DENS) from “DENAS” apparatus on certain blood indexes of relatively healthy dogs and dogs suffering from atopic dermatitis.

Specifications of the apparatus include two modes of operation, frequency in the TEST mode – 10 Hz, in the THERAPY mode – 77 Hz, impulse duration from 0.3 to 5.5 sec., amplitude – 50 V, regulation of duration of the first phase of impulse – 5-200 msec.

The first experiment was carried out on relatively healthy dogs that had certain physiological parameters and blood indexes under auricular DENS examined.

Six dogs of Staffordshire breed were selected for the experiment. They were subdivided into control and experimental groups, three dogs in each group taking into account the principle of pair analogs by the live weight, age, gender and breed.

The following background indexes were examined before the experiment: temperature was measured through rectum (T), heart rate (HR) was stethoscoped, breathing rate (BR) was determined by excursion of the thorax, blood pressure was measured on the caudal artery. General state of health was stated according to the information provided by the dog's owner. Erythrocytes and leucocytes in blood were examined in the Goryaev chamber by standard methods; hemoglobin – in the Sali's hemometer, ESR – in the Panchenkov apparatus.

After that, the experiment was started with exposure on auricular acupuncture points of experimental animals with “DENAS” apparatus. Electroneurostimulation was carried out once a day in the TEST mode, repeated five times at intervals of 2-5 seconds. Conditions of maintenance and alimentation did not change during the whole experiment. Physiological indexes were registered once a day during 21 days. When the background indexes were examined, the blood was drawn on the 10th and 21st day of the experiment.

As a result of the analysis of background data we found out that in spite of external health indexes such as good appetite, high motor activity, playfulness, satisfactory condition of hair covering, absence of disorders in defecation and urination and others, certain physiological and hematological indexes fell short of standards. For instance, dogs of both groups had low leucocytes content – in the control group 3.6 % lower, in the experimental group – 15.5 % lower than the physiological

standard (table 1). It is known from literary sources that dogs living in a megapolis with high degree of pollution have a chronic immunodeficiency which causes not only poor lymphocytic activity but also leucopenia.

DENS application evidently increases activity of the immune system, at least the amount of leucocytes in the experimental group increased by the end of the experiment to 7.37×10^{-6} , whereas in the control group, the amount of leucocytes actually did not change. No significant differences in dynamics of the erythrocytes, hemoglobin and ESR level between the control and experimental groups were registered (table 1).

*Table 1
Hematological Indexes of Dogs Treated with DENS
(average data, n=3)*

Blood Indexes	In the beginning of the experiment				After 10 days				After 21 days			
	Erythrocytes, $\times 10^{-9}$	Leucocytes, $\times 10^{-6}$	Hemoglobin, g/l	ESR Mm/h	Erythrocytes, $\times 10^{-9}$	Leucocytes, $\times 10^{-6}$	Hemoglobin, g/l	ESR Mm/h	Erythrocytes, $\times 10^{-9}$	Leucocytes, $\times 10^{-6}$	Hemoglobin, g/l	ESR Mm/h
Control gr.	5,9	5,8	14,0	0,2	5,6	6,25	16,0	-	6,2	5,07	14,3	0,2
Main gr.	6,3	5,07	13,5	0,2	5,7	6,2	15,3	0,2	6,17	7,37	14,5	0,2

Standard erythrocyte content in canine blood – $5.5-8.5 \times 10^{-9}$, leucocytes – $6-17 \times 10^{-6}$, hemoglobin – 12-18 g/l, ESR – 0.2-1.5 mm/h.

When examining physiological indexes in dynamics, reduction of the heart and breathing rates was observed. Application of electroneurostimulation did not produce any significant changes in the animals' state. But according to their owners, experimental animals had general state of health improved which manifested itself in improvement of appetite, higher motor activity when walking, improvement of the state of hair covering. As regards physiological indexes, we should point out normalization of the blood pressure of dogs which had DENS therapy (table 2).

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Table 2
Physiological Indexes of Dogs Treated with DENS
(average data, n=3)

Indexes	T (C°)		HR per minute		BR per minute		Blood pressure, mmHg	
	In the beginning of the experiment	Average during the experiment	In the beginning of the experiment	Average during the experiment	In the beginning of the experiment	Average during the experiment	In the beginning of the experiment	Average during the experiment
<i>Control gr.</i>	38,2	38,6	61,0	66,3	39,3	38,6	125 /87	135 /88
<i>Main gr.</i>	38,5	38,3	74,0	72,5	32,0	34,9	137 /80	122 /81

Physiological indexes of dogs: T – 37.5-39.0 C°; HR – 80-120 beats per min.; BR – 14-24 respiratory movements/min; blood pressure: max. – 120, min – 80.

The second experiment was carried out on dogs suffering from atopic dermatitis. Atopic dermatitis is a genetic disease proceeding as allergic reactions. The animal has an increased sensitivity to antigens after contact with which other animals have no allergy developed. Immunoglobulin IgE plays the main role in pathology development, but there are other factors such as IgG, Langerhans cells, T-lymphocytes, eosinophils which participate in pathogenesis. There is a genetic susceptibility to this disease, but it is invasion of parasites, viral infections, vaccinations and other body states which can be an initiating agent.

Disease pathogenesis lies in the fact that specific IgE (or IgGd) is fixed on tissues mastocytes, especially skin. When an allergen is fixed on IgE, a mastocyte degranulates with release of inflammatory mediators.

Release of inflammatory mediators results in infiltration of tissue by inflammatory cells (eosinophils, neutrophils, macrophages), inflammation and tissue damage which corresponds to the second stage of the allergy.

Clinical presentation becomes apparent from four months to seven years but in 70 % of cases between one and three years. Some canine breeds can have these presentations apparent at two months of age (akita, chow-chow, golden retriever, shar-pei), especially when both parents are atopic dogs. Sneezing and conjunctivitis can be the symptoms of allergy. It is also often combined with food hypersensitivity.

The first symptoms are the following: itching and erythema in the area of uncontaminated skin. Itching is usually apparent on the face, feet, axillary space, abdomen or combination of different zones. Otitis and conjunctivitis is apparent in 40-80 % of atopic dogs.

According to some sources, pyotraumatic dermatitis, furunculosis is apparent in more than 68 % of atopic dogs. An apparent seborrhea is observed in 12 % of atopic dogs. Hair usually becomes dryer. Atopic dogs are predisposed to other types of dermatitis, particularly to malassezia dermatitis, especially in the interdigital zone. Inflammation of anal sinuses can also develop. Some dogs have seasonal recurrent bacterial folliculitis or furunculosis accompanied by itching or even without it. 80 % of dogs and 90 % of cats have non-seasonal itching. Rare symptoms are the following: rhinitis, asthma, and cataract, disorders of gastrointestinal tract and urination, hormonal hypersensitivity.

A preliminary diagnosis is set based on the history, symptoms and laboratory tests which exclude other diseases.

Treatment includes specific immunotherapy (hyposensitization) and non-specific treatment. Specific immunotherapy consists of subcutaneous introduction of incremental doses of the causal allergen (allergens) in order to attain hyposensitization. Non-specific therapy of itching includes bathing, application of fatty acids, antihistamine therapy, and non-steroid anti-inflammatory preparations.

As both specific and non-specific therapies are not always efficient, it is necessary to search for additional methods of treating this pathology.

We consider application of “DENAS” – the apparatus for dynamic electroneurostimulation – for application as one of the methods of non-specific therapy. For this, we carried out a search experiment on four Shar-Pei dogs. The following dogs were studied during the experiment: No. 1 – ill during two years; No. 2 – ill during one year; No. 3 – ill during four years; No. 4 – ill during three years.

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Before the experiment anamnesis was obtained, blood was taken for biochemical, hematological and immunological examinations. Samples of blood were taken in the morning from the subcutaneous forearm vein after 18-hours starvation. The following indexes were determined in blood: amount of erythrocytes and leucocytes, hemoglobin; lymphocytes: T-lymphocytes in %, T-lymphocytes ($\times 10^{-6}$), B-lymphocytes in %, B-lymphocytes ($\times 10^{-6}$); TB index; phagocytic activity in % and phagocytic index in conditional units (CU).

As regards biochemical indexes, the following content was examined in blood: aspartate aminotransferase (AST), alanine aminotransferase (ALT), cholesterol (CHOL), creatinine (CREA), amylase (AMYL), glucose (CLUC), urea (UREA), crude protein (PROT), protein fractions (albumins, a1-globulins, a2-globulins, b-globulins, g-globulins). Biochemical examinations were carried out with COBAS MIRA apparatus.

When the background blood indexes were determined, we treated the direct projection of liver and affected skin zones with "DENAS" apparatus in the THERAPY mode once a day during 14 days.

After DENS treatment we obtained the following data (table 2):

Animal No. 1. – albumins level decreased but still was above normal and was 39.8 %.

In animal No. 2 after DENS treatment, reduction of AST level from 48 to 41 U/l, ALT level from 156 to 122 U/l was observed; creatinine level was still quite high and was 123 mmole/l, a-amylase concentration reduced and the trend for increase of crude protein from 56.8 g/l before the therapy to 58.3 g/l by the end of treatment was observed.

In animal No. 3 after the therapy, reduction of the AST level to 24 U/l, some increase of ALT level to 27 U/l, increase of cholesterol to 5.9 mmole/l, reduction of creatinine level from 107 to 80 mmole/l and a-amylase were observed by the end of the experiment. Double increase of urea content in blood was observed which is the evidence of intensive protein metabolism in the liver as it is this organ in which deactivation of toxic ammonia into nontoxic urea in the Krebs ornithine cycle.

In animal No. 4 in the end of the experiment, we observed reduction of AST concentration to 26 U/l and increase of ALT to 39 U/l, cholesterol level reduced, but still was above normal (7.7 mmole/l), creatinine concentration became 1.4 times less.

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*Table 2.
Biochemical Indexes of Canine Blood*

No. of Animal		Bili-rubin, mmole/l	AST, U/l	ALT, U/l	Choles-terol, mmole/l	Cre-atinine, mmole/l	Amy-lase, U/l	Glucose, mmole/l
1	Initial	3,74	29	16	5,4	108	2799	2,2
	After 14 days	2,67	30	17	5,8	132	2751	2,1
2	Initial	3,17	48	156	7,7	123	1742	3,5
	After 14 days	3,17	41	122	7,6	126	1550	4,4
3	Initial	3,56	33	22	4,6	107	2394	3,6
	After 14 days	2,25	24	27	5,9	80	1910	3,5
4	Initial	3,33	33	29	6,1	121	2033	2,8
	After 14 days	2,17	26	39	7,7	85	1601	2,9

Table 2 (continuation)

No. of Animal		Urea, mmole/l	Crude protein, g/l	Albu-mins, %	a1,%	a2,%	b,%	g,%	A/G
1	Initial	2,2	71,3	41,90	11,8	4,89	27,59	13,76	0,72
	After 14 days	2,2	75,0	39,84	11,7	5,32	33,3	9,75	0,66

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2	Initial	5,5	56,8	48,49	9,28	9,92	22,1	10,22	0,94
	After 14 days	7,2	58,3	46,93	9,75	8,85	26,25	8,21	0,88
3	Initial	6,0	63,2	47,17	7,85	9,02	24,9	11,1	0,89
	After 14 days	12,4	63,2	43,8	9,02	9,64	28,57	8,97	0,78
4	Initial	6,5	63,3	50,46	10,73	6,53	18,77	13,5	1,02
	After 14 days	11,8	61,3	42,97	11,2	8,32	27,89	9,61	0,75

Dogs Nos. 1, 2 and 4 had immunohematological indexes improved (table 3). Amount of erythrocytes increased in No. 1 by 21 %, in No. 2 by 8.7 %, in No. 4 – by 18.5 %; hemoglobin level was normalized in No. 2 and 3. The same animals had increase of the amount of leucocytes due to an observed increase of the amount of neutrophils and monocytes which is a favorable symptom under acute septic and toxic processes. Increase of T-lymphocytes E-ROL took place in No. 4 – twice as much, in Nos. 1 and 2 – 1.5 times more.

Their TB index has a positive value and approaches the normal value (1.38; 1.36; 1.45) (normal range 1.5-2).

Phagocytic activity of neutrophils increased in No. 1 by 28 %, in No. 2 – by 18 %, in No. 4 – by 40 % and neutrophils receptivity of all animals remained on the same level.

Nos. 2 and 3 had blood dilution. ESR reached the level of 2.0 mm/h instead of the background one of “0” (normal range 2.0-3.0 mm/h).

In the end of the experiment the amount of erythrocytes, hemoglobin, leucocytes, T-leucocytes E-ROL, TB index of No. 1 remained at the background level but B-lymphocytes M-ROL increased. Phagocytic activity was reduced by 25 % with neutrophils receptivity increased almost three times as much.

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Table 3
Immunologic Indexes of Canine Blood

No. of Animal		Erythrocyte $\times 10^9$	Hemoglobin G%	Leucocytes 10^6	ESR, mm/hc	Lymphocytes $\times 10^6$	T-lymphocytes, E-ROL %
1	Initial	5,6	13,2	10,5	0	7,56	44
	After 14 days	6,8	16,2	6,25	0	3,50	64
2	Initial	5,7	11,4	5,25	0	3,62	50
	After 14 days	6,2	15,6	6,50	2,0	2,66	60
3	Initial	4,9	11,8	5,50	0	3,19	36
	After 14 days	4,1	12,8	5,75	2,0	2,01	36
4	Initial	5,4	13,8	4,25	0	2,21	28
	After 14 days	6,4	15,3	7,20	0	1,94	55

Table 3 (continuation)

No. of Animal		T-lymphocytes E-ROL $\times 10^6$	B-lymphocytes M-ROL %	B-lymphocytes M-ROL $\times 10^6$	TB Index	Phagocytic activity, %	Phagocytic index, CU
1	Initial	3,33	36	2,72	1,22	36	5,81
	After 14 days	2,24	44	1,54	1,45	50	5,83

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2	<i>Initial</i>	1,81	44	1,59	1,13	52	6,31
	<i>After 14 days</i>	1,6	44	1,17	1,39	48	8,21
3	<i>Initial</i>	1,15	45	1,44	0,80	40	5,14
	<i>After 14 days</i>	0,72	52	1,05	0,69	30	14,23
4	<i>Initial</i>	0,62	40	0,88	0,70	20	7,02
	<i>After 14 days</i>	1,07	40	0,78	1,38	28	7,82

Conclusion:

- DENS application for relatively healthy dogs had a positive influence on activity of the immune system which manifested itself in normalization of the total amount of leucocytes.

- In the group of relatively healthy dogs during DENS treatment we registered a trend for normalization of the blood pressure, improvement of appetite, increase of the motor activity.

- DENS application as a non-specific therapy for atopic dermatitis resulted in improvement of hair covering, had a positive influence on abnormal biochemical indexes towards normalization.

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APPLICATION OF DENS FOR TREATING MASTITIS OF COWS AND ITS INFLUENCE ON MILK PRODUCTIVITY

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KAZGATU NAMED AFTER S.SEIFULLIN, ASTANA, KAZAKHSTAN

The article gives the results of researches carried out on 25 milch cows. The purpose of the work included assessment of DENS efficiency in the complex treatment of cows' mastitis as well as influence of dynamic electroneurostimulation on quality and quantity of milk of healthy cows. Application of DENS apparatus in the complex with traditional measures enabled to reduce both period of recovery from mastitis and restoration of milk productivity of animals by 1.5-2 times. DENS application for healthy animals resulted in increase of milk productivity without using of hormone-like materials.

Key words: dynamic electroneurostimulation, mastitis of cows, milk productivity.

Cow mastitis is one of the factors which deteriorates the quality of milk and reduces productivity of the dairy farming.

According to World Veterinary Health Organization, mastitis damages dairy farming to a greater extent than all other cow diseases taken together. It results in early rejection of cows, deficiency of milk and calves, worsening of biological, technological and nutritious properties of milk, increase of calves' sickness rate as a consequence of feeding them with beestings or milk of animals with mastitis, increased amount of infertile cows, expenses for diagnostics, treatment and so on. In addition to economic damages, mastitis causes social damage also, as mastitogenous microbes provoke diseases of humans and especially children [1].

In spite of a wide assortment of drugs available nowadays, it is not always possible to achieve a stable and long positive effect. The necessity of a long course application of pharmacotherapy, possibility of drug resistance and side effects, mainly functional nature of this pathology require search for new non-drug methods of correction, among which physiotherapy play a leading part.

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Among a wide range of physical factors, a special attention is paid to impulse currents which enable to have more pronounced reactions as compared with continuous generation mode and reduce energy load on the body considerably. Advantages of the impulse therapy over other methods of physiotherapy are also the following: safety and specificity under individual selection of parameters, slow development of adaptation to exposure, possibility of effective influence on the peripheral and central nervous system [2, 3].

The main purpose of the therapeutic help to animals with mastitis is to eliminate an inflammatory process in tissues of the udder and restore milk productivity. The selection of this or that drug or combination of several drugs and their therapeutic efficiency depend on many factors including the clinical form of mastitis, inflammation stage, general state of the animal, presence of concurrent diseases. That's why a treatment complex should include methods and means which can promote liquidation of concurrent diseases.

For achieving a good therapeutic effect, selection of an appropriate method of therapy and completion of treatment are of great importance. Nowadays, many methods and means are suggested for treatment of mastitis. And it is often that some methods are recommended as universal, suitable for all cases of mastitis. Dynamic electroneurostimulation (DENS) which has successful application in the medical practice is one of such methods.

In connection with the above, we aimed at assessing the possibility of application of the DENS-therapy for treatment of cows' mastitis and as a stimulator of increasing quantity and quality of milk.

Experimental animals were divided into five groups:

1st group, experimental (1-O) – ill cows having DENS-therapy;

2nd group, experimental (2-O) – ill cows having a combined treatment with application of DENS-therapy and standard methods;

3rd group, control (3-K) – ill cows having treatment according to the plan developed at the dairying (traditional treatment);

4th group, experimental (4-O) – healthy animals receiving DENS;

5th group, control (5-K) – healthy animals not receiving any stimulation.

A traditional treatment of mastitis used at the dairying consisted of application of 10 ml of septogel intracysterially and 1200000 units of

bicillin-3 intramuscularly.

In the first three groups of animals, therapeutic effect of DiaDENS-DT apparatus was determined for treatment of pyocatarrhal mastitis. Assessing the stimulating effect for increasing the quantity and quality of milk was carried out in the 4th and 5th group.

Experiments were carried out in 25 milch cows of black-speckled breed (n=5). Records of the general clinical state, hematological indexes, indexes of milk quality and daily milk yield were kept.

In the beginning of the experiment, indexes of temperature, pulse, breathing in the groups with mastitis exceeded the normal values. After therapeutic measures, reduction of indexes to the normal values, which was more pronounced in the group with application of the combined treatment (standard and DENS-therapy) was observed. For instance, on the 5th day of treatment, cows of this group had temperature $38.04 \pm 0.02^\circ\text{C}$, cows of the control group – $38.98 \pm 0.06^\circ\text{C}$, cows of the group which had only DENS-therapy – $38.69 \pm 0.06^\circ\text{C}$.

Main hematological indexes were within the normal range except for calcium content in the beginning of the experiment. In the group with combined treatment (traditional and DENS) it was 6.92 ± 0.14 mg/% in the beginning of the experiment, on the 11th day of treatment – 10.5 ± 0.12 mg/%. At the same time, in the group with only DENS treatment, calcium content was 6.82 ± 0.27 mg/% in the beginning of the experiment, and on the 11th day – 9.9 ± 0.07 mg/%; in the control group – 7.1 ± 0.14 and 9.31 ± 0.14 mg/% correspondingly.

According to the data in table 1, such indexes as fat content, protein, density and meal before therapeutic procedures were below normal values; acidity was high. As a result of therapy, these indexes were normalized faster in the group which had complex treatment of mastitis, i.e. with application of DENS and traditional treatment. For instance, fat content in the group with complex treatment was $2.74 \pm 0.12\%$ in the beginning of the experiment, on the 9th day of treatment – $3.43 \pm 0.32\%$, in the group with only DENS therapy – $3.28 \pm 0.42\%$ on the 9th day, and in the control group – $2.94 \pm 0.26\%$, which is below normal values.

In the group with complex treatment, increase of daily milk yield was also observed. For instance, on the 12th day of treatment it was 16.68 ± 0.27 liters which is 14.9 % more than in the group with application of DENS only, and 24.6 % more than in the control group.

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Table 1.
Results of Laboratory Analysis of Cow's Milk

Indexes	Group	Time of Examination				
		Before treatment	3rd day of treatment	6th day of treatment	9th day of treatment	12th day of treatment
Fat content, %	1-O	2.86±0.04	2.93±0.20	3.14±0.34	3.28±0.42	3.34±0.34
	2-O	2.74±0.12	2.76±0.37	3.18±0.52	3.43±0.32	3.64±0.42
	3-K	2.51±0.17	2.38±0.48	2.72±0.37	2.94±0.26	3.07±0.39
Protein, %	1-O	2.64±0.2	2.79±0.17	2.97±0.25	2.94±0.14	3.26±0.15
	2-O	2.59±0.09	2.67±0.15	2.99±0.09	3.03±0.15	3.37±0.11
	3-K	2.65±0.24	2.73±0.12	2.89±0.17	3.13±0.13	3.22±0.17
COMO	1-O	7.41±0.36	7.97±0.50	7.25±0.415	7.81±1.03	7.61±1.01
	2-O	7.54±0.21	7.61±0.67	8.08±0.59	8.16±0.56	7.9±0.41
	3-K	7.25±0.27	7.13±0.66	7.83±0.58	7.87±0.5	8.05±0.4
Density, A	1-O	28.94±0.47	30.83±0.86	30.5±0.66	31.66±0.59	29.8±0.96
	2-O	29.12±0.43	29.82±0.83	30.34±0.77	29.86±0.74	30.14±0.66
	3-K	28.68±0.53	28.74±0.834	29.52±0.83	29.94±0.74	30.86±0.65
Acidity, °T	1-O	19.5±0.05	19.52±0.18	19.14±0.32	17.44±0.3	16.62±0.23
	2-O	19.37±0.31	19.16±0.24	18.3±0.14	17.06±0.16	16.54±0.12
	3-K	19.33±0.19	19.34±0.23	18.82±0.29	18.08±0.24	17.16±0.19
Daily yield, l	1-O	10.86±0.41	11.42±0.37	12.38±0.34	13.72±0.3	14.2±0.41
	2-O	11.47±0.11	12.96±0.41	14.38±0.38	15.8±0.35	16.68±0.27
	3-K	10.2±0.31	10.4±0.29	11.04±0.31	12.28±0.40	12.58±0.35

Figure 1 shows the dynamics of protein content increase during the treatment period by different methods. Increase that is more intensive was observed in the group with complex treatment; in this group protein content was 3.37 % on the 12th day. In the group with only DENS application and control group with traditional treatment, protein content was approximately equal – 3.26 % and 3.22 % correspondingly.

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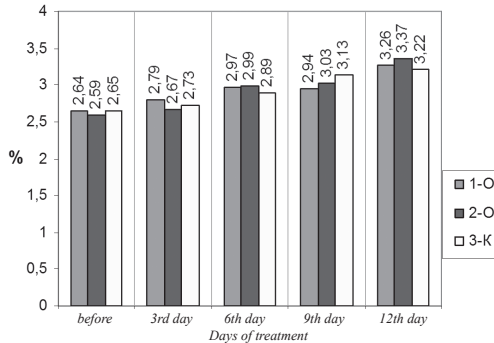


Fig. 1. Dynamics of Protein Content Changes in the Milk of Cows with Mastitis

Experiments for determination of possibilities for increasing the milk ejection with help of DiaDENS-DT apparatus were carried out in 10 milch clinically healthy cows of black-speckled breed. Records of the general clinical state, hematological indexes, indexes of milk quality and daily milk yield were kept.

No significant changes were registered in the observed groups as regards general clinical indexes (temperature, pulse, breathing) – all indexes were within the normal range for healthy animals.

The observed hematological indexes were also within the normal range and corresponded with the state for healthy animals. However, in the group of animals, which had DENS, an insignificant increase of the hemoglobin, erythrocytes and crude protein content was observed (Fig. 2).

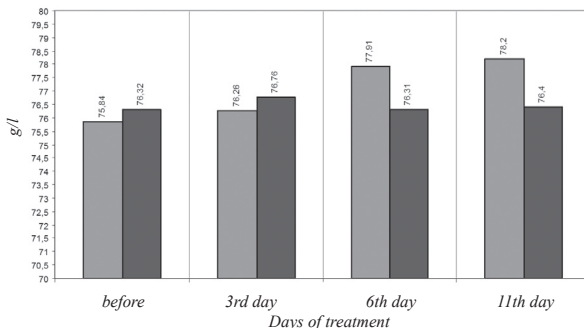


Fig. 2. Dynamics of Crude Protein Content in Blood

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Figure 2 shows the trend for increase of the crude protein content in blood of animals that had dynamic electroneurostimulation. On the 11th day of DENS-therapy, content of the crude protein increased by 2.3 % as compared with the control group.

When examining qualitative indexes of milk during the experiment, increase of the fat content, protein, milk density and quality of daily milk yield was observed in the group which had DENS treatment (Table 2). For instance, density index before DENS application was 1028.51 ± 0.03 kg/m, on the 9th day of stimulation with the apparatus – 1030.0 ± 0.32 kg/m, in the control group – 1028.24 ± 0.17 and 1028.34 ± 0.31 kg/m correspondingly.

Table 2.
Results of Laboratory Analysis of Cow's Milk

Indexes	Group	Time of Examination				
		Before DENS	3rd day	6th day	9th day	12th day
Fat content, %	4-O	3.54 ± 0.09	3.59 ± 0.26	3.64 ± 0.08	3.72 ± 0.072	3.91 ± 0.05
	5-K	3.49 ± 0.21	3.52 ± 0.15	3.49 ± 0.2	3.46 ± 0.17	3.5 ± 0.24
Protein, %	4-O	3.16 ± 0.07	3.19 ± 0.15	3.23 ± 0.09	3.27 ± 0.13	3.38 ± 0.16
	5-K	3.19 ± 0.28	3.16 ± 0.15	2.99 ± 0.17	3.21 ± 0.13	3.18 ± 0.32
COMO	4-O	7.54 ± 0.37	7.82 ± 0.25	7.37 ± 0.49	7.96 ± 0.36	8.05 ± 0.22
	5-K	9.71 ± 0.19	9.64 ± 0.51	9.82 ± 0.52	9.67 ± 0.48	9.79 ± 0.53
Density, kg/m	4-O	1028.51 ± 0.03	1028.46 ± 0.13	1030.06 ± 0.26	1030.0 ± 0.32	1029.94 ± 0.06
	5-K	1028.24 ± 0.17	1028.06 ± 0.36	1028.56 ± 0.31	1028.34 ± 0.31	1028.82 ± 0.42
Acidity, °T	4-O	16.81 ± 0.19	16.86 ± 0.17	16.5 ± 0.16	16.9 ± 0.1	16.62 ± 0.11
	5-K	16.69 ± 0.21	16.98 ± 0.08	16.86 ± 0.07	16.94 ± 0.09	16.64 ± 0.08
Daily yield, l	4-O	26.97 ± 0.51	27.36 ± 0.48	28.4 ± 0.74	28.62 ± 0.68	29.08 ± 0.96
	5-K	26.81 ± 0.47	26.94 ± 0.45	26.69 ± 0.32	27.06 ± 0.49	27.14 ± 0.35

Dynamics of fat content changes is given in Figure 3. For instance, in the group which had DENS therapy, the percentage of fat content in milk on the 6th day increases to 3.64 %; in the control group this index was 3.49 %. On the 12th day, fat content in the experimental group was 12.2 % higher than in the control group at the same time. Acidity index during all examination period remained the same in both groups.

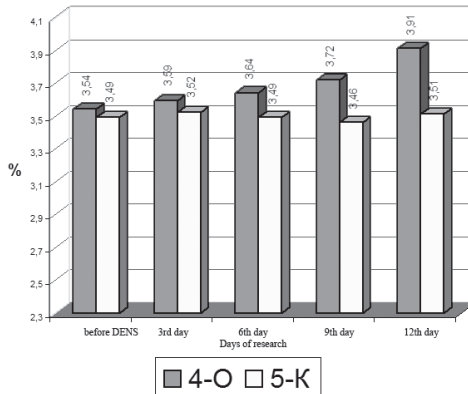


Fig. 3. Dynamics of Fat Content in Cow's Milk

Thus, by the results of our experiments the conclusion can be made about presence of therapeutic properties of DiaDENS-DT apparatus,, which is more pronounced in complex treatment with traditional therapy. With application of DENS the terms of mastitis treatment became shorter and milk productivity restored by the 5th-6th treatment day, whereas in the control group which had only traditional treatment, recovery was achieved by the 8th-9th day but for all that an initial quantity of milk yield was not restored. Hence, application of DiaDENS-DT apparatus in complex treatment of mastitis makes the disease period 3-4 days shorter and restores the initial milk productivity.

In addition, this apparatus showed good results on healthy cows as a reflex stimulator which increases milk productivity as regards quantitative and qualitative indexes without application of any hormone-like materials, that is very prospective for obtaining ecologically clean milk.

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