Materials of Conferences

STRUCTURE OF PROGRAM-CONTROLLED BIOTECHNICAL SYSTEM OF ULTRASONIC THERAPY THE PARODONTOSIS

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Research applicability

It is known that ultrasonic therapy with therapeutical frequency 1 MHz is widespread used for treatment of many chronic diseases, including gingivae. Ultrasonic decreases algesthesia and exasperates microcirculation, corrects metabolic disturbance in tissues [3,4,5,6,7,8]. Last years low-frequency ultrasonic is used along with high-frequency ultrasonic in medical practice. In physical medicine low-frequency ultrasonic is usually carried on two frequencies: 22 and 44 kHz while treating ENT-diseases [2,9,10,11]. In comparison to high-frequency, low-frequency ultrasonic gets into tissues deeper, has more antiedematous apparent antibonding and depolymerizing action, changes more vascular and epithelial penetrance, shows more phoretic activity [9].

Medications like “Barvinok”, “Tanzillor”, “Stomaton-1” are used for low-frequency ultrasonic therapy. All these medications do not work in biocontrolled mode [2].

Bio-controlled low-frequency ultrasonic treatment methods are also used for treatment of parodontium tissues [13, 14].

Bio-controlled interferential therapy is also used for parodontosis treatment [10].

We should also mark, that there’s no information pointing the necessity of carrying out any complex research about program-controlled methods of ultrasonic current biostimulation either in Russian or foreign references.

To sum up what has been said we should mark that while developing biotechnical systems of ultrasonic therapy, it is important to find solutions providing synchronic biomodulation of mechanical vibrations in tissues together with program-controlled ways of it realization.

The research is done in accordance with task group plans about chronobiology and chronomedic in RAMS, and also with scientific line of the department under specialty 05.13.01: ”Development of universal methods of chronodiognostics and biocontrol on the basis of biocyclic models and algorithms using parameters of biological feedback” and prevention and disease treatment special program “Health” and development of material-technical base of healthcare in Belgorod region.

Research aim and objects

Development of biocontrol system approaches aimed at individualization and enhancing the efficiency of treatment of phlogistic and dystrophic diseases of gingivae by programmed biosynchronization and biocontrol with the help of ultrasonic action.

To reach the desired goal we should complete the following tasks:

- to make a reappraisal of perspective directions, connected with enhancing the efficiency of non-pharmacological remedial measures by using technical biocontrolled means;
- to form biocycled program-controlled models of current impulse patterns, which provide the fixed spectrum of ultrasonic vibrations in the form of influence programs aimed at treatment of acute, subacute, chronic onset of gingivae diseases;
- to develop a structure of program-controlled module of ultrasonic therapy biotechnical system aimed at treatment of acute, subacute, chronic onset of gingivae diseases.

Materials and research methods

In accordance with the fixed goals, we have developed a program-controlled device for biocontrolled ultrasonic signal generation. This biotechnical system includes pulse transformer, breath transformer, microcontroller. The device also consists of analog-to-digit converter (ADC) and digit-to-analog converter (DAC), polarity transformer and ultrasonic radiation head.

The device is energized from five successively connected accumulators, strain from which comes to a voltage converter block. Strain +5 V, -5V is formed in it – for operating amplifier and other active system elememnts energizing and also reference potential 4,096 V for correct analog-to-digit convertation.

Sample ultrasonic signal in the form of impulse currents with frequency about 1 mHz, modulated by signals of low-frequency 7-13 Hz is generated in digital form with regard of fixed in microcontroller ROM program realized algorithms.

Incoming analog signals of pulse and breath are digitized in microcontroller ADC and are added with sampled, modulated ones by low-frequency 7-13 Hz, ultrasonic impulse signals frequency 1 mHz. By means of DAC digital total signal is transformed into analog unipolar with capacity 12 bits, and in signal polarity converter it becomes analog bipolar. The required polarity of output strain up to 15 V is a program set by function key block 8. The signal is cleared from hindrance in a filter and goes to ultrasonic radiator head.

Biocontrolled device of ultrasonic signal generation, by means of special program in microcontroller ROM, allows cycle functioning, including cycle interval in 360 ticks of the blood. Duration of the work includes 300 ticks of the blood and a pause duration is 60 ticks of the blood. The quantity of cycle repeats is set depending on procedure duration: 1-6 repeats (5-30 biological minutes). In this case calculation of set quantity of ticks of the blood is done in a variable which is preliminarily set to zero. Alike cycle func-

tioning duration is due to synthesis periodicity of information RNA, necessary for amino acid elongation at ribosomes.

Biological feedback includes breath, cardiovascular system, breath and pulse detector, and microcontroller with ADC, DAC, signal polarity converter and ultrasonic radiator.

Biocontrol with the help of an influence change of ultrasonic impulse currents is in cycle strain vibrations on the ultrasonic radiator (piezocrystal), created by a summed signal of pulse and breath. These low-frequency cycle vibrations of pulse and breath are added to impulse, modulated LF, ultrasonic signal. In a moment of systole and inhale impulse amplitude is the biggest, and in the moment of diastole and exhale is the least. Shape of such kind of impulses are like modulated waves, which have a shape of a spindle from three to five seconds while normal breath and to ten seconds while resonance breath.

Analyzing the results, we came to a conclusion about necessary realization of three modes of action:

$$t_{узи.inhale} = \begin{cases} 0{,}02 + n \cdot P(T,N), & when\ R = 1 \\ T - 0{,}02 - n \cdot P(T,N), & when\ R = 2 \\ T/3, & when\ R = 3 \end{cases} \quad t_{узи.exhale} = \begin{cases} T - 0{,}02 - n \cdot P(T,N), & when\ R = 1 \\ 0{,}02 + n \cdot P(T,N), & when\ R = 2 \\ T/3 & when\ R = 3 \end{cases}$$

where *R*- is influence time; *T*-is influence impulse period; *n* – number of tick of the blood in a breath cycle; *P* –excess to impulse duration, depending on influence period *(T)* and number of ticks of the blood, which fall on breath cycle fase *(N)*.

Conclusions

1. There are formed deterministic models of patterns, which provide the fixed spectrum of ultrasonic vibrations in the form of influence programs aimed at treatment of acute, subacute, chronic onset of mucosa gingivae diseases and distinct by program-controlled way of biostimulation of low-frequency electrical beats in parodontosis tissues.

2. A structure of a program-controlled biotechnical system of ultrasonic therapy, characterized by modularity and suitable for mucosa gingivae diseases treatment, distinct by cycle functioning of work and pause mode change with biological seconds counting.

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paradontium vessel edema, microcirculation weakening in an arterial part of capillary bed and without visible defects.

If we introduce concept *impulse filling coefficient (K3)*, reflecting percentage of ultrasonic impulse presentation time from period K3=($t_{узи}$/t) *100, where $t_{узи}$ – is ultrasonic impulse presentation time, *T*- impulse period, then depending on the influence mode it's necessary to realize the following algorithms: 1)in case of paradontium vessel edema we should reduce the filling coefficient during inhale and increase it during exhale; 2) in case of microcirculation weakening in an arterial part of capillary bed we should increase the filling coefficient during inhale and reduce it during exhale synchronously with the ticks of the blood; 3) without visible defects impulse filling coefficient should be about 33%. Ultrasonic impulse duration during inhale and exhale is defined from the following correlation:

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UREAPLASMAS AUTODEFENSE AND RATIONAL ANTIBIOTIC THERAPY

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At present, the great number of schemes and the preparations are being existed, having used at the urogenital ureaplasmosis medical treatment, but the majority efficiency from them is being left at the low level, and, that is why, the adequate therapy search is also being left rather actual.

Main Target

It is necessary to study the ureaplasmas sensitivity spectrum to the most accessible and the widely – used antibiotics at the practice, for the purpose of medical treatment efficiency rising of the urogenital ureaplasmosis.

Materials and Methods

64 women have been examined with the urogenital ureaplasmosis. Finally, the diagnosis has been completely confirmed by the clinical and laboratory methods.

The Omsk Scientific and Research Institute (SRI) media of the natural and focal infections have already been used for the ureaplasmas identification. The sensitivity determination for the antibiotics has been carried out at the ureaplasmas exposure in the titer, which is more than 10,000 ESR. So, the ureaplasmas sensitivity for the antibiotics has been determined by means of the «Ureaplasma –АЧ» and «Microplasma – АЧ» test – systems (the city of Saint – Petersburg).

Findings of the Investigation

The ureaplasmas have been appeared to be much steady to the tetracycline in 53,1% (e.g. 34 strains) and have been sensitive in 46% (e.g. 32 strains). To the macrolides first generation representative – the stability erythromycin has been made up 43,6% (e.g. 28 strains), the sensitivity – 54,4% (e.g. 36 strains).

The ureaplasmas have already been appeared the highly sensitive ones to the lincosamides representative – the clindamycin: they are sensitive 71,9% (e.g. 46 strains), steady – 28,1% (e.g. 18 strains), and the aminoglycosides – to the gentamicin: they are sensitive 71,9% (e.g. 46 strains), steady – 28,1% (e.g. 18 strains). The simultaneous stability to these both preparations has been observed only in 9,4% (e.g. 6 strains).

The highly sensitivity has already been appeared to the doxycycline: they are sensitive 87,5% (e.g. 56 strains), steady – 12,5% (e.g. 8 strains). The sensitivity to the macropen has already been made up to the 90,6% (e.g. 58 strains). The simultaneous stability to them has been observed in 6,3%.

The Main Conclusions. The ureaplasmas singled out strains highest sensitivity have been shown to the doxycycline and to the macropen. So, the doxycycline and the macropen use is quite able to be recommended for the medical treatment scheme inclusion in the cases of the mixed – infections.

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THE INTESTINAL MICROCIRCULATION BED STRUCTURE

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The small intestine vascular bed has its multilayer structure. The microcirculatory bed (MCB) linear interfascicular segments of the flat mesentery are being transformed into the entodermal canal circulatory segments: the subsero – muscular segment contours – the external (e.g. the mesenteric arcus and the vascular plexuses) and the internal ones (e.g. their submucosal plexus), and the last one – and this is the