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Research Article

THE USE OF PHYSIOTHERAPY IN PATIENTS WITH HEARING IMPAIRMENT AND EAR NOISE

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ABSTRACT

Damage to the inner ear can be a consequence of both acute and chronic diseases: infectious diseases, poisoning, stress, injuries, diseases of the cardiovascular system and many other conditions. The purpose of this work was to study the effectiveness of a new complex method of treating SNHL on the audiotone device. Electrostimulation has a positive effect on the peripheral structures of the auditory analyzer, on metabolic processes and the state of cerebral hemodynamics associated with the release of biologically active substances, endogenous opioid peptides into the bloodstream and cerebrospinal fluid. This method of treatment was used in 40 patients with chronic sensorineural hearing loss, who were under our supervision for 6 months. After the course of treatment, noise stopped in 24 patients, the intensity of noise decreased in 12 patients, the nature of noise changed, and 5 patients showed an improvement in hearing acuity by 10 Db and speech intelligibility. The obtained data indicates the effectiveness and expediency of using a complex method of treatment on the "audioton" device for CSNHL and recommends it as an independent method of treating ear noise.

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KEYWORDS

Sensoneural hearing loss, auditon, magnetic therapy.

INTRODUCTION

As you know, the problem of hearing loss is a problem both medical and social. According to the World Health Organization, 5-8% of the population suffer from hearing loss, 65-93% of them due to sensorineural hearing loss (SNHL) [8]. Throughout the history of otorhinolaryngology, attempts to cure SNHL have not stopped. This section of otorhinolaryngology is the most difficult, but also the most promising section. Damage to the inner ear can be a consequence of both acute and chronic diseases: infectious diseases, poisoning, stress, injuries, diseases of the cardiovascular system and many other conditions. Given the current socio-economic conditions of people's lives, as well as the constant impact of sharply changing environmental factors, we can expect a further increase in vascular diseases leading to the development of hearing loss [9]. The annual increase in the number of patients with this pathology makes it necessary to search and develop the most effective methods of treatment of SNHL, which can significantly improve the effect of therapy, facilitating the social rehabilitation of this contingent of patients [4,9]. Currently, many methods of treatment of SNHL have been proposed, but the desired effect has not been achieved [1, 10]. The purpose of this work was to study the effectiveness of a new complex method of treatment of SNHL on the audiotone device, which includes three functional blocks: an electrostimulation unit (a source of pulsed electric field (PEF); a magnetotherapy unit, or a unit for creating a low-frequency electromagnetic field (an alternating magnetic field source (AMF); light stimulation unit (low-intensity laser radiation source). The device was invented by the Metromed research and production company on the basis of Omsk State Technical University, registered in the state Register of inventions on 20.10.97 [7].

Electrical stimulation unit: includes a voltage pulse generator with passive and active electrodes. the pulse generator provides smooth

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regulation and change in the frequency of output pulses (10-150 Hz) in continuous or intermittent modes, as well as smooth regulation of the amplitude of the output pulses (10-180 V) at a low supply voltage (9V) [7].

During the implementation of the electrical stimulation stage, the nerve-receptor apparatus of the cochlea of the inner ear is injected into the auditory canal and the endural electrode is installed until it comes into contact with the eardrum or in its absence in the eardrum area to irritate the supplied pulsed electric current. The endural (active) electrode is a holder of a dielectric material ending in a loop of titanium wire moistened with a solution of a medicinal substance (for example, 1% ATP solution; or 1% nicotinic acid solution; 0.05% proserin solution; 0.5% galantamine or 1% dibazole solution, etc.) gauze turunda impregnated with a medicinal substance, its diameter should be 1/3 smaller than the lumen of the external auditory canal. Through the ear funnel made of polymer material, gauze turunda is smoothly and freely introduced until it comes into easy contact with the eardrum. The second passive (peripheral) electrode, made in the form of a metal cylindrical rod, is fixed by the patient's hand with a short circuit to the patient's body and the formation of an active-reactive circuit. After that, they set the frequency of the output pulses, turn on the electrical stimulation unit of the device and continuously adjust the amplitude of the output pulses, starting from zero and increasing until the patient feels a wave-like tingling in the depth of the auditory canal [7]. The procedure time is 5-10 minutes per ear, the number of procedures is 10-12 per course. Electrostimulation has a positive effect on the peripheral structures of the auditory analyzer, on metabolic processes and the state of cerebral hemodynamics associated with the release of biologically active substances, endogenous opioid peptides into the bloodstream and cerebrospinal fluid [2]. Electrostimulation causes compensatory and adaptive protective rearrangements in the receptor cells and above the membrane complex of the spiral organ, leads to the elimination of a number of ultrastructural disorders, activates the processes of energy and secretory intracellular metabolism, providing a reduction in hearing thresholds by an average of 15 dB. Morphological changes occurring in the spiral organ under the influence of various damaging factors are often characterized as metabolic stress (hair cells). Indicators of such stress at the ultrastructural level are - changes in

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individual intracellular organoids, for example: mitochondria or simultaneous violations of the ultrastructure of various cell organoids. In the experiment [2] it was revealed that endural electrical stimulation has a positive effect on the internal structures of the receptor cells of the spiral organ. The intracellular reaction is expressed not only in an increase in the number of mitochondria, but also in an increase in the number of free ribosomes, tanks of the rough endoplasmic network, and numerous contacts of mitochondria with intracellular membranous structures. Such morphological features are characterized as indicators of the intensification of metabolic and secretory processes in the cell [2]. Due to the fact that one of the factors ensuring the normal operation of the spiral organ is the adequacy of energy processes to the functional load, the appearance of a large number of mitochondria in the receptor cells of the spiral organ of experimental animals after endoural electrical stimulation is important.

The magnetotherapy unit includes a source of alternating magnetic field (a source of AMF) and a device (including a fluoroplastic ear funnel and a magnetic endural rod) for endural processing of the neuropeptor apparatus of the cochlea of the inner ear of the AMF, pivotally connected to the fixator of its position in the auditory canal in the form of a holder, as well as a suspension device for moving, orienting fixation the positions of the sources of AMF relative to devices for endoural processing of the neuroceptor apparatus of the cochlea of the inner ear of AMF, inserted into the lumen of the external auditory passages of the patient, the placement of the ear funnel with a magnetic endural rod into the focus of the AMF produced by the source of the AMF, its configuration changes, and the magnitude of the field strength at a distance of 45-50 mm from the source increases, on average, twice. This ensures the irradiation of an alternating magnetic field into the depth of the hearing organ being processed, located in the depth of the pyramid of the temporal bone at a distance of 35-40 mm from the surface of the skull, by transporting it through a magnetic endural rod, as well as the excitation of mechanical vibrations of the rod with a frequency of 50-100 Hz [7]. The procedure takes 10-20 minutes. The number of procedures is 10-12. The first serious study of the properties of a magnet belongs to the English physicist, court physician William Hilbert, published in 1600. The fundamental work "on the magnet, magnetic bodies and the large magnet of the earth", which

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noted the presence of medicinal properties of the magnet. It is now known for sure that the magnetic field is one of the most important regulators of life on earth. All structural moments of matter are sources of magnetism, as they have a magnetic moment and, consequently, magnetic properties. An increase in ionic activity under the influence of the AMP is a prerequisite for stimulating cellular metabolism, magnetohydrodynamic inhibition of the circulation of conducting fluids in a living object, which has a significant effect on the flow of biological fluids in large vessels. Magnetotherapy gives a decongestant effect, has an antispasmodic effect, analgesic and sedative effect, has a positive effect on general hemodynamics, neurodynamics and microcirculation (including in the inner ear) [3].

Light stimulation unit: includes a complex of a semiconductor laser and a fiber light guide. The working tip of the flexible fiber optic is inserted into the ear funnel inserted into the external auditory canal. During the procedure, the tympanic membrane or, in its absence, the tympanic cavity of the middle ear is irradiated with a parallel or slightly divergent beam of low-energy laser radiation, taking into account the total dose of laser irradiation - 75-300 J/cm2, which provides a therapeutic effect [7]. The light energy of a low-energy laser contributes to the regulation of biological processes in the body, causes a change in the energy state of the "biological plasma" towards an increase in its density, the intensity of recombination processes, i.e., changes the biological and chemical parameters of tissues, a pronounced stimulating effect on regeneration processes (including the auditory nerve), mobilizes the immune system [5]. The energy saturation of the "biological plasma" leads to the stimulation of metabolism, i.e. redox processes, and on this basis creates conditions for autoregulation of biological processes [6]. Invitro experiments with a direct assessment of the catalase and peroxidase activity of mitochondria confirmed that it is the peroxidase activity of mitochondria that increases under the action of laser radiation [5]. Since mitochondria have a close connection with other cellular membrane structures - the nucleus, lysosomes, ribosomes, etc., these organelles are also involved in the cell's response to laser radiation. A study of the blood filling of tissues exposed to a low-energy laser revealed a slight increase in the blood flow rate in these tissues, an increase in the vascular lumen (vasodilation

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effect, which is very good for compression of A. vertebralis against the background of cervical osteochondrosis and hypertension syndrome).

This method of treatment was used by us in 40 people with chronic sensorineural hearing loss who were under our supervision for 6 months, the duration of the disease ranged from 6 months to 15 years. The age of the patients ranged from 50 to 75 years, including 24 women and 16 men [10]. All patients underwent a comprehensive examination. The main complaints before treatment were: hearing loss, ear congestion, noise, ringing in the ears, sleep disturbance against the background of noise, decreased ability to work. According to the degree of SNHL: 1 st. - 12, 2 st. - 16, 3 st. - 12. The course of treatment on the Audiotone device was 10-12 procedures, in combination with taking vascular drugs [10].

After the course of treatment, noise stopped in 24 patients, noise intensity decreased in 12 patients, the nature of noise changed, in 4 patients - without dynamics (3 st. HCNT, the duration of the disease is 6 and 15 years). according to the data of tonal audiometry, hearing thresholds of 10-30 db decreased in 13 patients (1-2 st. CSNHL) at high frequencies, 5 patients showed an improvement in hearing acuity by 10 dB and speech intelligibility (3 st. CSNHL), 2 patients - without dynamics. At the same time, the best results were obtained in patients with 1-2 st. CSNHL [10].

Example: A 57-year-old patient complained of hearing loss on the left, left ear congestion for 6 months. From the anamnesis - 6 months ago, he suffered otitis externa on the left, treated on an outpatient basis with gentamicin, after which the above complaints appeared a week later. Concomitant diseases: curvature of the nasal septum, vasomotor rhinitis, grade 1 GB. BP at the time of examination 130/90. The examination carried out: UAC-b/o, OAM-b/o, radiography of the cervical spine - signs of osteochondrosis by type of instability c2-c4, REG pulse blood filling is sufficient in both hemispheres. Increased arteriole tone. Venous dysfunction, extracranial effects. ACT, APTT is within the norm. EEG data for violation of bioelectric activity of the brain were not revealed, there is no MEHO displacement md 7,7 ms 7,7. The conclusion of the optometrist: visus 1.0/1.0. a course of treatment was carried out on the audiotone device. After 5 procedures, complaints stopped, a control audiometry was performed, after a course of treatment, REG control was carried out in 2

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weeks. Normalization of arteriole tone, blood pressure 120/80, 115/80 throughout the course of treatment and 2 weeks after it (vasodilation effect) [10]. The data obtained indicates the effectiveness and expediency of using a complex method of treatment on the audiotone device for CSNHL and recommend it as an independent method of treating ear noise against the background of various forms of hearing impairment.

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