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NON-PHARMACOLOGICAL SEDATION BY PHOTO-TRIGGERING OF BRAIN BIORHYTHMS

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Introduction. *In otorhinolaryngology, as well as in other fields of clinical medicine, often the question of sedative therapy arises. Sedative medication use is not appropriate always and it can cause side effects or can be incompatible with other medicines. The question of sedative therapy arises in psychosomatic conditions, caused by tinnitus, labyrinthopathies, that may have diverse origins, but are accompanied, in any case, by acoustic or vestibular stress.*

Rhythmical, pulsating light and/or sound stimulators are able to make some changes in person's behavior; her mood, her working ability, stimulate its activities or lead to a calm state, relaxation. In 30th German doctor Hans Berger has found, that using visual stimulators of a certain frequency can cause certain «electroencephalogram samples» and with changing the frequency of the stimulator the frequency of bioenergy under cord can change. In 90th in Germany there was the so-called «Mind machines» («brain machines») created, which were able to increase intellectual activity «remove» fatigue, build resistance to stress and others with eye irritation by flashing light with appropriate frequency. Now we know that rhythmical visual stimulation (VS) and, even more, audio-visual stimulation (AVS) can cause positive and lasting physiological effects from the state of relaxation to the state of activation and increased attentiveness. Authors consider that the Schumann's frequency «quasi - frequencies of good weather» are causing the mental state of life satisfaction, peace.

Material and methods. *The device, that this department staff developed is different, as well as it's generated with the proposed, using opto-electronic, system and its light stimulator is programmed on to the eye area with the flexible fiber body. FS starts with stimulation frequencies in the α - rhythm (10 Hz) and for 10 minutes the frequency is reduced to 4 Hz (τ - wave), and for the next 5 minutes. - to 2 Hz (δ - waves). After this the frequency rises again to 7 Hz for 5 minutes and for 1 min. increases to 10 Hz and up to 99 Hz. The device was used as a supplementary treatment for chronic tinnitus and was seen as a method of psychosomatic stabilization.*

Results. During the experimental application of the method in the treatment of 20 patients with chronic subjective tinnitus turned out that the effectiveness of sedation by photo triggering was positive (subjective noise reduction, improving performance audiometric) in 56.2% of patients. However, the negative impact on the patient's condition is not found in any case.

Discussions. Preliminary studies indicate that the effect of sedation during stressful situations that can occur in any area of medicine, including otorhinolaryngology, can be achieved without the use of drugs such as way of brain waves photo triggering. The method was particularly effective in treating of tinnitus. This allows us to continue research in a wider range.

Perspective. It is hoped that the application of the photo triggering technique is promising as well as the treatment of post-traumatic stress syndrome, in sports medicine and other areas of medicine.

Conclusions. The intermittent light stimulators, that have the frequency equal to the brain biorhythms frequency, are capable to trigger mentioned biorhythms and cause a corresponding emotional state. By brain biorhythms triggering the relaxing state can be achieved without using of drugs. The proposed device has several advantages over existing devices. The effectiveness of the procedure may be estimated by using the biofeedback - controls provided in the presented model. The application of the photo triggering technique may be used in the treatment of post-traumatic stress syndrome, in sports medicine and other areas of medicine.

Key words: Tinnitus, acoustic stress, triggering, optical stimulation, cerebral waves

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НЕМЕДИКАМЕНТОЗНА СЕДАЦІЯ ФОТОТРИГЕРУВАННЯМ БІОРИТМІВ МОЗКУ

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Вступ. У кожній ділянці клінічної медицини виникають ситуації, коли етіотропне чи і патогенетичне лікування необхідно доповнити симптоматичним. В оториноларингології це, переважно, вушні шуми та вестибулопатії. Серед таких методів значне місце посідає седация, передусім медикаментозна, яка, проте, має низку побічних дій.

У літературі описане явище, коли чергування за певною частотною програмою спалахів світла (фотостимулів) може викликати стан седация, і навіть сон. Проте відомі способи фотостимуляції не передбачають засобів локалізації фотостимулів на зорові рецептори, програмування частот упродовж лікувального сеансу та контролю за його перебігом. Здійснення такого контролю впродовж сеансу енцефалографічними методами вимагає складної кошовної апаратури, електричного контакту з тканинами голови пацієнта, та, що дуже важливо, не дає змоги безперервно та оперативно отримувати інформацію про

реакцію пацієнта на сеанс і, тим самим, ускладнює оцінювання його успішності.

Матеріал і методи. *Створено робочу модель приладу для немедикаментозної седації шляхом частотного фототригерування біохвиль мозку. Прилад вирізняється тим, що створений за допомогою запропонованої випромінювальної оптико-електронної системи програмований світловий подразник локалізується на ділянку органа зору гнучкими світловодами.*

Результати. *Експериментальним застосуванням методу в комплексному лікуванні 20 хворих із хронічним суб'єктивним вушним шумом підтверджено ефективність седації фототригеруванням (суб'єктивне зменшення шумів, покращення аудіометричних показників) у 56,2 % пацієнтів. Водночас негативного впливу на стан пацієнта не виявлено в жодному випадку.*

Обговорення. *Попередні дослідження показують, що ефекту седації за стресових ситуацій, які можуть виникати в будь-якій ділянці медицини, в тому числі, оториноларингології, можна досягти без застосування медикаментів, а саме способом фототригерування біохвиль мозку. Спосіб виявився ефективним у лікуванні, зокрема, вушного шуму. Це дає нам право продовжити дослідження в ширшому діапазоні.*

Перспективи. *Сподіваємося, що застосування фототригерування виявиться перспективним також при лікуванні синдрому посттравматичного стресу, в спортивній медицині та інших ділянках медицини.*

Висновки. *Переривчаста фотостимуляція з частотою мозкових біоритмів здатна викликати відповідні біоритми мозку і відповідний емоційний стан. Седативного ефекту можна досягти фототригеруванням без застосування ліків. Запропонований пристрій має низку переваг перед пристроями, які застосовувалися дотепер. Ефективність процедури може бути оцінена за допомогою біологічного зворотного контролю, передбаченого в запропонованій моделі. Застосування фототригерування може бути перспективним при лікуванні синдрому посттравматичного стресу, в спортивній медицині та інших ділянках медицини.*

Ключові слова. *Вушний шум, акустичний стрес, тригерування, оптична стимуляція, біохвилі мозку*

INTRODUCTION

In otorhinolaryngology, as well as in other fields of clinical medicine, often the question of sedative therapy arises. Sedative medication use is not appropriate always and it can cause side effects or can be incompatible with other medicines. The question of sedative therapy arises in psychosomatic conditions, caused by tinnitus, labyrinthopathies, that may have diverse origins, but are accompanied, in any case, by acoustic or vestibular stress.

As is known, rhythmical, pulsating light and/or sound stimulators are able to make some changes in person's behavior, her mood, her working ability, stimulate its activities or lead to a calm state, relaxation. The fire flame flashing causes calm, tranquility, relaxation. Tibetan monks have used sunlight, aimed to mirror on the

eye area to stimulate the brain processes activity. The shamans and ancient healers have used the rhythmical sounds of drums and/or rhythmical dance moves to cause the calm state, or, conversely, excitement.

In 20th of the last century the bioenergy of brain was invented, and in 30th German doctor Hans Berger has found, that using visual stimulators of a certain frequency can cause certain «electroencephalogram samples» and with changing the frequency of the stimulator the frequency of bioenergy under cord can change.

We also know, that flashing light that the driver sees, the moving avenue lined with trees, can cause, under certain conditions (speed of movement, frequency trees), the driver's state of slumber or even a short sleep, and thus is able to wreck (Tönies). Psychologist Marion Bönsch-Kauke (Germany) in a monograph about how to become smarter through chess says that chess players achieved the best results in a state of alpha brain activity.

The same author mentions that the doctor (an aviation medicine specialist), chess player and chess historian, Victor Malkin achieved the good player results, previously causing the relaxation (Entspannung) and concentration using the rhythmically flashing lamp. In 90th in Germany there was the so-called «Mind machines» («brain machines») created, which were able to increase intellectual activity «remove» fatigue, build resistance to stress and others with eye irritation by flashing light with appropriate frequency.

Now we know (Bruno Gasser) that rhythmical visual stimulation (VS) and, even more, audio-visual stimulation (AVS) can cause positive and lasting physiological effects from the state of relaxation to the state of activation and increased attentiveness, positively influencing on brain activity structures, firstly- the limbic structures (Amygdala, Hypothalamus), and a number of biofeedback-parameters, neurotransmitters production and brain circulation.

This, by the way, can increase athletes comprehension, promote the learning skills, improve older people memory. The authors are using the AVC in cases of insomnia, pain, including premenstrual syndrome, at tinnitus. To understand the method, we have to mention the brain biorhythms influence on person's feelings.

Person's states, caused by the predominance of certain brain biorhythms. Beta state (β) is characterized by brain biorhythms frequency within 30-13 Hz. Someone shares this state on beta-1 (13-20 Hz) and beta-2 (20-40 Hz). Beta state covers quite a wide range of states with the transition from alertness (vigil) to the ability to analyze problems with the tension, stress, haste and imbalance. High Beta or

Gama (γ) - condition is characterized with frequencies from 30-40 to 500 Hz. The creative ability, creative work and the susceptibility to this condition are limited. The examples of beta status can be driving, manual labor, sports, shopping. Alpha state (α) is characterized with brain biorhythms from 12 to 8 Hz. This is the calm state. It is characterized with keen attentiveness, facilitate concentration, increased learning ability and memorizing up to a sense of body and spirit union. This is the state of relaxation and balancing vigilance with intact (vigil). It is believed, that with alpha state the production of self-sedating neurotransmitters enhances. It is also believed, that the actual prevalence of the alpha rhythms in person's state causes the inspiration («The muse came!»). Theta state (τ) is characterized with frequencies from 7 to 4 Hz and is considered to be the state of meditation. This is the state of relaxation, deep spiritual creativity, sensibility, easy access to the rich world of images. Theta state time we experience in a deep sleep and meditation when the rich world of associations and connections activates. Theta waves are being excited also under the psychedelic drugs influence. Delta State (δ) is characterized with frequencies from 3 to 1 Hz. This is the state of deep relaxation that occurs in a deep sleep, including hypnotic trance.

The lowest human's alpha rhythms and theta rhythms bordering alpha rhythms (7,83 Hz) are corresponding to the frequency of Schumann waves, electromagnetic frequencies of Earth. Actually these frequencies determine that a person is creative in a state, that has a resonant frequency as the planet (Schumann resonance). The Schumann frequency helps wound healing, super-learning and express reactions to the environment.

Winfried Otto Schumann (1888-1974) – German physicist, Munich Technical university professor. In 1912 he defended his doctoral thesis about electric high voltage. He worked in the high voltage laboratory of Brown, Boveri & Com. In 1920 he became a professor of Jen university and later - the Munich Technical University, where he organized the Laboratory of Electrophysics, which was later released in electrophysical college. In 1952 he worked with spherical cavity and, based on calculations, he suggested the existence of electromagnetic waves resonating in space Earth. This phenomenon later was given the name of the researcher. At the start of researchers, the calculations proved, that the oscillation frequency in resonating spherical cavity «Earth-ionosphere» space are about 6.10 Hz, so that is embedded in the boundary between alpha and theta brain biorhythms. The scientist believed that humanity for millions of years lived and acted under the natural resonance influence that «tunes» our brains to the appropriate frequency biorhythms. Than

the scientist transferred its researchers to Herbert König, who defined that the resonance frequency of the Earth is 7.83 Hz. Schumann's resonance wavelength is equal to 38 000 km; that is corresponding to the perimeter of the Earth, spreading with the speed of light, it goes around the planet 8 times per second. A number of environmental factors: the lightning, the solar flares, mechanical transport can break this response. From another point, the lightning as a powerful source of low-frequency electromagnetic energy can be the primary source of Schumann resonance waves excitation. The proof of indissoluble connection of humanity with Schumann's resonance is the scientists associated with NASA research. They found, that astronauts, detached from the influence of resonance for a particular period of time, after returning to Earth feel overwhelmed and disoriented, like a child, divorced from the mother. To prevent this, it was proposed to establish a spaceship device that generates artificial Schuman waves. It is believed, that the Schumann's frequency is due to the frequencies of human hippocampus and all mammals. Biophysicist W. Ludwig believes that these frequencies are human's biological norm (Ludwig, Betner and Lyene). The absence of these frequencies vibrations causes the deterioration of general health, headache, heart rate changes and respiration rate (Anderson Phelps). These authors consider that the Schumann's frequency «quasi - frequencies of good weather» are causing the mental state of life satisfaction, peace. Catching the tinnitus problem, we met the cases, where the conventional treatment, including sedatives, did not give the desired effect. In most cases, these were patients with significant disease duration and conditioned state of auditory stress. In such cases S. Tönnies applied the non-drug methods of frequency photo stimulation.

The aim of fotostimulation is:

- auditory stress reduction
- development of self-care ability and self-regulation in the pain,
- reduction of phenomena accompanying pain: fear, depression, hysterical reactions, the loose of the ability to concentrate and sleep.

The first attempts of photo stimulation date back to 70th. It was used as the treatment of migraines, some stress, convulsive gnashing of teeth. Development of non-pharmacological sedation methods. The method we chose as the prototype, provides the frequent optical trigger of brain waves toward the low τ and δ - waves, thus achieving a deep relaxation state and therefore the noise burden reducing. There was used the non-pharmacological sedation method of frequency photo triggering of brain biorhythms with the device, that was further developing with

the department of National University «Lviv Polytechnic» (ProfessorKozhukhar O. T. group).

MATERIALS AND METHODS

The device, that this department staff developed is different, as well as it's generated with the proposed, using opto-electronic, system and its light stimulator is programmed on to the eye area with the flexible fiber body. The continuous monitoring of the patient is provided on the opto-electronic control system base by automated analysis of variables over time optical performance of peripheral body of the patient.

The procedures are carried out twice a week for an average of five weeks. FS starts with stimulation frequencies in the α - rhythm (10 Hz) and for 10 minutes the frequency is reduced to 4 Hz (τ - wave), and for the next 5 minutes. - to 2 Hz (δ - waves). After this the frequency rises again to 7 Hz for 5 minutes and for 1 min. increases to 10 Hz and up to 99 Hz. The device was used as a supplementary treatment for chronic tinnitus and was seen as a method of psychosomatic stabilization.

RESULTS

The combined treatment with the use of this technique was used to 20 patients, when the conservative treatment has not produced the desired effect. In these patients, compared with the group of patients (34) that was treated without the use of this technique, was noticed the decrease of noises and some improvement of audiometric parameters, as well as the psychosomatical stabilization. The effectiveness of this method was positive in 56.2 % of patients. There was not detected any negative impact of this method on the patient's condition. Tinnitus in patients, treated for the scheme, was greatly reduced or stopped. The device and method was demonstrated at the First All-Ukrainian Congress «Medical and Biological Informatics and Cybernetics» with international participation, in June 2010, Kyiv, in the international forum «Science and Technology», April 2011, Białowieża, Poland, on 4th international innovation technology in medicine forum, December 2010, Białystok, Poland.

Currently, the development of a new model of the device that provides the ability to control photo stimulation efficiency and allows us to study the options of phototherapy programs, changing its parameters, is ending. The device also provides the methods of monitoring the effectiveness with the biofeedback-control principle. It is hoped that the use of methods of photo triggering is also promising in the post-traumatic stress syndrome treatment, in sports medicine and more.

DISCUSSIONS

Preliminary studies indicate that the effect of sedation during stressful situations that can occur in any area of medicine, including otorhinolaryngology, can be achieved without the use of drugs such as way of brain waves photo triggering. The method was particularly effective in treating of tinnitus. This allows us to continue research in a wider range.

PERSPECTIVE

It is hoped that the application of the photo triggering technique is promising as well as the treatment of post-traumatic stress syndrome, in sports medicine and other areas of medicine.

CONCLUSIONS

1. The intermittent light stimulators, that have the frequency equal to the brain biorhythms frequency, are capable to trigger mentioned biorhythms and cause a corresponding emotional state.

2. By brain biorhythms triggering the relaxing state can be achieved without using of drugs.

3. The proposed device has several advantages over existing devices. The effectiveness of the procedure may be estimated by using the biofeedback - controls provided in the presented model.

4. The application of the photo triggering technique may be used in the treatment of post-traumatic stress syndrome, in sports medicine and other areas of medicine.

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