Оригинальная статья/ Original Article
УДК 616.009/534.3/615

MUSIC & DRUG THERAPY OF NEUROTIC DISORDERS: SMART TECHNOLOGIES OF HEALING

Shushardzhan S.V.
Academy of Medical Rehabilitation, Clinical Psychology and Music Therapy, Moscow, Russia

Abstract

This article is devoted to modern trends of interdisciplinary integration in medicine, in particular, the use of technological innovations of scientific music therapy in clinical pharmacology to achieve higher treatment results and reduce side effects from drugs. Advanced scientific research conducted over the past thirty years has helped to reveal the algorithmic nature of the influence of music on vital systems of the body and to use the powerful resource of acoustic effects to create smart healing technologies. As an example, the article presents the impressive results of a clinical study of combined music and drug therapy for insomnia in combination with other symptoms of neurotic disorders.

Keywords: music, medicine, smart, technology, healing, insomnia, neurotic, disorder

ТЕРАПИЯ НЕВРОТИЧЕСКИХ РАССТРОЙСТВ МУЗЫКОЙ И ЛЕКАРСТВОМ — УМНЫЕ ТЕХНОЛОГИИ ИСЦЕЛЕНИЯ

Шушарджан С.В.
Академия медицинской реабилитации, клинической психологии и музыкотерапии, Москва, Россия

Аннотация

Данная статья посвящена современным тенденциям междисциплинарной интеграции в медицине, в частности, применению технологических инноваций научной музыкотерапии в клинической фармакологии для достижения более высоких результатов лечения и снижения побочных эффектов от лекарственных средств. Передовые научные изыскания, проводимые в течение последних тридцати лет, помогли раскрыть алгоритмическую природу влияния музыки на жизненно важные системы

организма и использовать мощный ресурс акустических воздействий для создания умных технологий исцеления. В качестве примера в статье представлены впечатляющие результаты клинического исследования комбинированной музыкально-лекарственной терапии бессонницы в комплексе с другими симптомами невротических расстройств.

Ключевые слова: музыка, лекарство, умный, технология, исцеление, бессонница, невротический, расстройство

* **Полная версия данной статьи на русском языке опубликована в предыдущем номере журнала** *(Шушарджан С.В. ТЕРАПИЯ НЕВРОТИЧЕСКИХ РАССТРОЙСТВ МУЗЫКОЙ И ЛЕКАРСТВОМ — УМНЫЕ ТЕХНОЛОГИИ ИСЦЕЛЕНИЯ // Медицина и Искусство. 2025. №. 1. С. 68-93. DOI: https://doi.org/10.60042/2949-2165-2025-3-1-68-93).*

INTRODUCTION

The reader may be surprised to see the title of this article. What could be the connection between a product of human culture, which is music, and a medicine, a chemical substance? Well, let's figure out how, by avoiding clichés and trivial approaches, we can come to smart healing technologies.

Clinical pharmacology is one of the leading and dynamically developing branches of modern medicine. A huge number of drugs, of which more than 17 thousand are registered in Russia alone, open up wide opportunities for doctors of various specializations to provide effective assistance to patients with most of the most common diseases.

However, working with drugs often has some of side effects. This place demands on doctors to have good knowledge and practical skills in the application of scientifically based methods of individualization of pharmacotherapy [1]. According to the Food and Drug Administration (FDA), the frequency of severe consequences caused by taking tested drugs averages up to 10 cases per 100 hospitalizations; the average cost of economic losses from severe consequences is $2,000. The annual economic damage from complications of pharmacotherapy is estimated at $2 billion [2].

In this regard, doctors need to compare the available information on the benefits and harms, pharmacodynamics and pharmacokinetics of each drug, placebo and nocebo effects, and choose the optimal route of drug administration. It is known that drugs can be administered to the body through the gastrointestinal tract (enteral route), and bypassing the gastrointestinal tract

(parenteral route).

The choice of the route of administration of the drug will determine the nature of the pharmacological effect, the speed of its onset, severity, and duration [3]. Parenteral methods that ensure the fastest possible entry of the drug into the body include: injections (intramuscular, subcutaneous), infusions (intravenous, intra-arterial). Parenteral methods also include inhalation and application of the drug to the skin (transdermal route).

Enteral methods most often use the administration of drugs orally through the mouth (oral route); its variety is the sublingual (sublingual) method, as well as the administration of drugs into the rectum (rectal route).

It has been shown that the ingestion of any substance, regardless of the method of administration, is accompanied by the absorption of the drug into the blood, which indifferently carries it throughout the body, including to the target organ [4].

Moreover, most drugs are toxic substances, often causing allergic reactions and other side effects.

Adverse drug reactions (ADRs) are a leading cause of morbidity in developed countries and represent a significant burden on healthcare resources. Many countries spend 15% to 20% of hospital budgets on the treatment of drug-related complications [5].

Therefore, increasing the targeting of the effects of drugs, the desire to reduce doses and duration of their administration and, as a consequence, reducing the likelihood of side effects are an urgent task in medicine.

One of the innovative ways to solve this problem is the use of pharmacological drugs in combination with musical and acoustic effects using Scientific Music Therapy Technologies.

RESOURCES OF SCIENTIFIC MUSIC THERAPY

A History of Music Therapy briefly

Helpful for health utilize of music incorporates a long history. Hippocrates, Aristotle, and others ancient sages a long time back were attempting to treat with music apprehensive and mental patients. There are some documentary mentions. They allude to distinctive periods and civilizations and deliver a clear thought that music in medicine has been utilized, but the clarifications of restorative impacts were based on myths, supernatural speculations, or devout sees. It was only in the second half of the 20th century that music therapy began to be

widely practiced as an independent profession in the United States and various European countries.

Currently, music therapy methods are widely used in institutions in many countries in various socially significant areas: psychology, clinical medicine, rehabilitation practice, etc. [6, 7].

At the same time, two main directions of music therapy have formed in the world system: traditional, based on an intuitive-empirical approach, and evidence-based and technological, characteristic of the Russian scientific school, the origins of which arose in the 19th century [8, 9].

Systematic development of scientific music therapy began in Russia in the early 1990s, with clinical and experimental studies by the author of this article [10]. Further were written some books, monographs, textbooks, and more than 450 scientific publications. Candidate and doctoral dissertations were defended, and 11 patents for inventions were received.

In 2003, after the Russian Ministry of Health approved the manual for doctors «Methods of Music Therapy» this direction received official recognition and permission for use [11].

Definition and basic concept of scientific music therapy

Scientific music therapy (SMT) is an innovative interdisciplinary direction that deals with the comprehensive study of the patterns of influence of musical and acoustic signals on the human body, other biological objects, as well as the development of effective treatment and preventive methods and biotechnologies.

The main doctrine of SMT is the Neurohormonal-Resonance Theory, which has proven that not only the organs of hearing react to sounds, but also the skin, internal organs, tissues, and even cells (Fig. 1).

Direct sound interventions on organs, tissues, and cells affect their functional state according to the principle of resonance, causing inhibition or activation of vital systems.

The impact of Acoustic Energy on the Hearing Organs triggers general Neuroendocrine Reactions in the body through the Sensory System.

We managed to reveal the main patterns of this process and reflect them in the theory of algorithms-regulators that is another important position of the SMT.

This became possible thanks to modern experimental diagnostic technologies, which made it possible to deeply study the characteristics of complex reactions of the body – psychological, physiological and biophysical – that arise in response to musical influences.

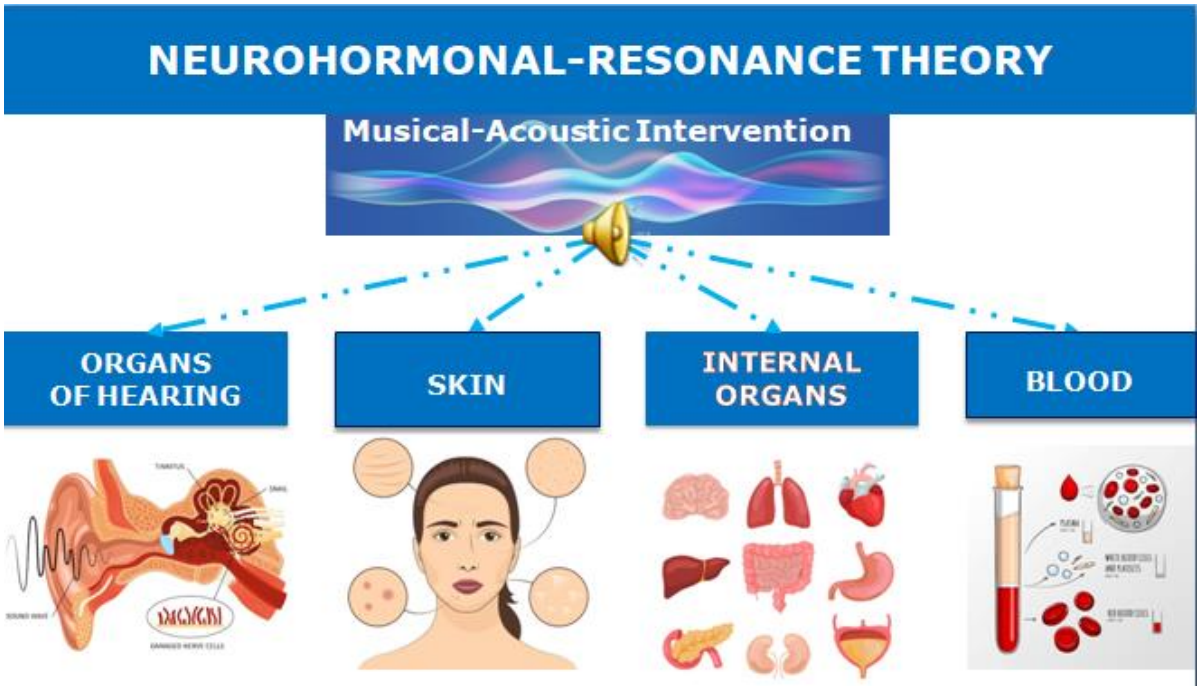

Fig. 1. *Scheme of the influence of musical-acoustic interventions on the body according to the neurohormonal-resonance theory*

Рис. 1. *Схема влияния музыкально-акустических интервенций на организм согласно нейрогуморально-резонансной теории*

In the course of these researches, three main Musical-Acoustic Algorithms were discovered (S – sedative, T – tonic and HR – harmonizing), which differ from each other in Frequency, Amplitude, the Intensity of Sound Impact, certain musical characteristics.

In experiments (1996–2020) it was shown, that different algorithms of Direct Musical - Acoustic Impacts significantly change the Vital Activity of Cells cultured in Vitro: in some cases, Activate, in others, Inhibit [12].

Moreover, each algorithm cause characteristic changes in the state of the nervous system and the level of hormones in the blood.

Some following regularities were experimentally revealed.

S-algorithms inhibit the activity of the cerebral cortex and stimulate the activity of the parasympathetic nervous system, which causes mental and muscle relaxation, slows down the heart rate and lowers blood pressure. S-algorithms reduce an elevated blood level of adrenaline, noradrenalin and cortisol.

T-algorithms act in exactly the opposite way.

HR algorithms bring the nervous and hormonal systems into a state of equilibrium and stability, which has a positive influence on the body, including the anti-aging effect.

The use of the algorithms found is the key to the methods of scientific music therapy aimed at stabilizing the psyche, optimizing the hormonal background and vital systems of the body.

SMT methods and technologies

Currently, more than 50 digital NMT programs and technologies have been developed, which provide significantly higher efficiency, both when used independently and in combination with other treatment methods, including medications.

There are receptive, active and high-tech methods that can be used in the music therapy process [13].

The peculiarity of active methods is that the patient himself takes an active part, for example, playing musical instruments or singing under the supervision of a specialist.

In receptive methods, the patient, being in a comfortable position, passively receives one of the music therapy procedures.

High technologies are distinguished by the use of hardware, software and artificial intelligence.

Special precedence is given to digital music therapy programs and modern telemedicine technologies, which allow taking online medical individual and group sessions for people who need the treatment and psychological support.

Clinical studies have shown the effectiveness of scientific music therapy methods in the treatment of various disorders: stress, fatigue, emotional burnout, neuroses, psychosomatic disorders, premature aging, etc. (Shushardzhan S.V., Eremina N.I., Shushardzhan R.S., 1993-2023).

The following therapeutic effects of Music Therapy have been identified:

- ✓ Adaptogenic: *sedative (calming), tonic, stabilizing;*
- ✓ Endocrine *(correction of hormone levels in the blood);*
- ✓ Stress-limiting;
- ✓ Analgesic *(pain-relieving);*
- ✓ Hypotensive *(lowering blood pressure);*
- ✓ Hypertensive *(increasing blood pressure);*
- ✓ Regenerative, etc.

A valuable property of Music Therapy is its numerous health-improving effects, which include an increase in the body's reserve capacity and resistance to psychophysical stress. Moreover, the options for therapeutic and health-improving effects in the form of general calming or toning, lowering or raising

blood pressure, pain relief, etc. depend directly on the method of musical influence. Therefore, the combination of Music Therapy with medications becomes especially effective when there is a meaningful combination of the previously described basic algorithms of musical and acoustic effects with pharmacological drugs according to the principle of synergy.

Let's consider some music therapy methods and technologies shown to work in the combination with drug's therapy.

Digital Music Psychotherapy

We have developed a number of digital music therapy multi programs based on regulatory algorithms. Thus, the «Music of Health» set consists of different treatment programs that are used for stress, neuroses, insomnia, psychosomatic disorders and decreased quality of life.

Music Therapy is carried out in the form of receptive audio sessions (Fig. 2).

Fig. 2. *Audio session of Digital Music Therapy*

Рис. 2. *Аудио сессия цифровой музыкотерапии*

List of programs in the «Music of Health» series:

№ 1 «Antistress & Insomnia»

№ 2 «Easy Breathing & Neurasthenia»

№ 3 «Hypertension & Hypotension»

№ 4 «Mental Health and Development»

№ 5 «Depression & Overwork»

№ 7 «Energy +»

№ 8 «Hypertension & Nervous Overstrain»

№ 9 «Therapy of Fear and Anxiety».

Each program has a special name, reflecting the direction of therapeutic action, is accompanied by brief instructions and intended for both independent use and in combination with drug therapy.

Structurally, any of the digital programs in this series consists of 4 separate Therapeutic Playlists (TPL) with music tracks of different algorithmic profiles, which are marked with a corresponding icon.

As a rule, one of the TPLs is selected for one music therapy session, the most suitable for each specific case. This creates convenience in work. It opens up the possibility of a flexible approach to correctional work, and to consider the patient's individual characteristics.

It should be noted that the previously described musical algorithms-regulators are rarely in their pure form. Thus, the harmonizing algorithm HR can have a slight tonic effect and then be designated as HR (+), or with a slight sedative effect, in which case it is marked with the icon HR (–). As an example, let's look at digital Music Therapy program № 3 «Hypertension & Hypotension», designed to correct blood pressure (Table 1).

Table 1. *Structure of the digital Music Therapy program «Hypertension & Hypotension»*

Таблица 1. Структура цифровой программы музыкотерапии «Гипертония & Гипотония»

Program № 3 «Hypertension & Hypotension»	TPL **1**	TPL **2**	TPL **3**	TPL **4**
Number of tracks	4	4	4	3
Sound duration (min.)	20	20	20	20
Dominant Algorithm	HR(+)	HR(+)	HR(–)	S

In the program we are analyzing, TPL 1 HR (+) and TPL 2 HR (+) have a mild

tonic effect and are therefore used in people prone to low blood pressure.

3rd TPL HR (–) causes a mild sedative effect and is indicated for use in individuals with a tendency to high blood pressure.

4th TPL with a dominant S algorithm causes deep relaxation and is accompanied by a decrease in blood pressure, which is used in the treatment of severe arterial hypertension.

A reasonable combination of Algorithmically Constructed Musical Masterpieces with corresponding Pharmaceutical Preparations ensures mutual enhancement and prolongation of the therapeutic effect, with a possible reduction in the doses of the medicinal substances used. Music Psychotherapy sessions can be held both in specially equipped wards and at home. Patients should listen to therapeutic music programs for 20–30 minutes.

Any computer system with speakers or headphones is sufficient for this. Doctors of any specialty, nurses, psychologists, etc., as well as individuals without special training, can successfully use digital music therapy both in professional treatment and preventive work and for self-treatment at home, including online.

Virtual Music-Art Therapy (VMART)

This is an innovative method of Psychotherapy and Personal Development in the form of separate algorithmically organized audiovisual digital programs, which use world masterpieces of painting and musical art.

Remarkable landscapes, forests and fields, high seas, medieval castles and bright characters, sunsets and sunrises, seasons, all these picturesque creations as if come to life against the background of brilliant music (Fig. 3).

Fig. 3. *Virtual music-art therapy*

Рис. 3. *Виртуальная музыко-арт-терапия*

Clinical researches in different age groups have shown that if to use VMART for people who suffer from emotional lability and increased Anxiety, in 84% of the cases the Neurotic Symptoms fade away and the emotional state stabilizes, which was objectively confirmed by psycho-diagnostic tests of Luscher, Taylor, and example, 88% of the patients of the main group noticed the aesthetic pleasure of watching Virtual Music-Art Therapy programs and an increased interest to musical art and painting.

Thanks to digital performance, effective and easy-to-use VMART programs can be transmitted online to smart phones, personal computers and televisions.

Vocal Therapy

Vocal Therapy is a well-known healing and wellness method developed in 1993 by the author of this article. It is based on the principles of classical singing and a special voice training system (Fig. 4).

Fig. 4. *Vocal Therapy session*

Рис. 4. *Сессия вокалотерапии*

Vocal therapy is aimed at developing and strengthening of the respiratory system, vibration-acoustic stimulation of the activity of the vital organs, the optimization of higher nervous activity and increasing of the body defenses.

It was found out that the systemic use of vocal therapy causes marked positive dynamics of indicators of lung capacity, and also positively gets into the psycho-emotional state and the memory of patients [14].

One of the main healing mechanisms of Vocal Therapy is the vibration of internal organs — a kind of sound massage. For the first time in the world, we

began to record such vibrations and analyze them through computer system.

It has been established that vocal vibrations significantly increase blood flow in vital organs. It turned out that each organ has its own resonant note, causing maximum blood flow.

If vocal training is carried out after taking a drug, the phenomenon of vibration activation of blood flow in the target organ can be used to increase the effectiveness of targeted drug therapy.

We used this effect in medical practice.

SMT high technologies

This category includes hardware and software methods such as Meso-Forte Therapy and Acutone Therapy.

Meso-Forte Therapy is a breakthrough technology of health preservation and anti-aging therapy based on the combined use of audio music therapy, local magnetic-acoustic effects on the skin and reparative cosmetics (Fig. 5).

Fig. 5. *Meso-Forte therapy*
Рис. 5. *Мезо-Форте терапия*

Meso-Forte Therapy increases the body's reserve capacity, stabilizes the neurohormonal system, causes complex regenerative reactions and a biorevitalization effect [15].

Acutone Therapy is another hardware and software technology for activating regenerative processes, reducing pain and anti-stress therapy using synchronous vacuum-magnetic and musical-acoustic effects, in combination with therapeutic ointment applications (Fig. 6).

A medicinal ointment, for example with an anesthetic and anti-inflammatory

substance, can be applied to the trigger zones.

Then Acutone devices are attached, in the form of cans with a magnetic tip and a micro-earphone, through which musical and acoustic signals are transmitted.

Fig. 6. *Acutone Therapy with the device for Vacuum-Magnetic and Musical-Acoustic Impact*

Рис. 6. *Акутон-терапия с устройством для вакуумно-магнитной и музыкально-акустической терапии*

Acutone Therapy is effective healing technology. It is used to treat diseases of the musculoskeletal system, psychosomatic disorders, stress, and fatigue.

The possibilities of combining high technologies of NMT and drug therapy will be considered in more detail in a separate article.

THE CONCEPT OF COMBINING DRUGS WITH MUSIC THERAPY

A method for potentiating the therapeutic effect, which is achieved by combining musical-acoustic and medicinal effects, has been patented in Russia [16].

The concept of the method, which is called Music Pharmacotherapy (MPhT), is that the patient first takes the drug in any way, as prescribed by the attending physician. Then, upon reaching the peak of the therapeutic concentration of the drug in the blood, the body is exposed to acoustic signals of the audible spectrum, in the form of one of the above methods, technologies or programs, the choice of which is determined by the individual characteristics of the patient and the clinical tasks at hand. Some factors play an important role in this

regard.

1) Pharmacodynamic properties of the drug used

It is known that all reference books and instructions for drugs must indicate: chemical composition, single dose, frequency of administration, which depends on the properties known for all drugs approved for use: the period of achieving therapeutic concentration in the blood and the time of elimination (half-life) from the body.

It is clear that the last indicator determines the time parameters, beyond which it is inappropriate to carry out combined action, since the medicine will be absent from the body after a certain period of time.

The peak accumulation time of the drug is optimal for combined action on the diseased organ, since it allows for the most active delivery of the drug to the appropriate area. Information on each drug prescribed for treatment should be obtained from the relevant reference books, and after receiving the necessary data, a plan of musical and acoustic effects is drawn up.

For example, the antibiotic levomycetin is easily absorbed from the gastrointestinal tract. After oral administration, the maximum concentration in the blood is created after 1–3 hours. For 4–5 hours after a single dose of the drug, the therapeutically active concentration is maintained in the blood, and then a significant decrease in concentration occurs. It is excreted from the body mainly in the urine [17].

Therefore, the optimal time for acoustic impact in this case is 2–4 hours after taking levomycetin. Medicines that are taken orally are absorbed from the gastrointestinal tract and most often reach maximum concentration in the blood after 1–3 hours, which is maintained for a certain time.

Therefore, the optimal time for musical and acoustic influence is 1.5–4 hours after oral administration of the drug.

When medicinal substances are administered parenterally, their concentration reaches a therapeutic level in the blood much faster, for example, when administered intravenously, immediately, at the moment of administration, literally «at the tip of the needle». In this case, acoustic exposure can be prescribed 10–15 minutes after the injection. Further, if the period of drug elimination is no more than a few hours, then the acoustic exposure is subsequently linked to the time of administration of the drug.

If a prolonged-release drug is used, the therapeutic concentration of which can last up to several days, acoustic exposure is prescribed in a more relaxed mode,

depending on the mode of performing other procedures, nutrition, etc.

2) Method of Musical-Acoustic Influence

The determining factor in choosing a method or technology of Music Therapy is the diagnosis of the underlying disease, the treatment and rehabilitation tasks facing specialists and the individual and personal characteristics of the patient.

In principle, all methods of conducting Music Therapy can be divided into Distant and Contact.

Distance methods include Digital Music Psychotherapy, Virtual Music-Art Therapy and all those technologies that use contactless sound delivery, and the main mechanism for perceiving signals is auditory. The leading response of the recipient's body in this case is Neuroendocrine Reactions, which, as indicated above, can be controlled using Musical-Acoustic Algorithms-Regulators.

Combined administration of medications with a remote version of acoustic impact is indicated when using the following groups of drugs:

- Sleeping pills
- Tranquilizers
- Analgesics
- Cardiovascular agents
- Immunomodulators
- Biogenic stimulants.

Contact methods of sound exposure include: Meso-Forte Therapy; Acutone Therapy; Vocal Therapy, which causes Vibrations of Internal Organs with the sounds of one's own voice, as well as other technologies using local acoustic intervention through special technical devices. This method of delivering sound causes activation of regional blood circulation, which enhances the delivery of the drug to the target organ and provides a pronounced organotropic effect.

Combined administration of drugs with a contact version of acoustic impact is indicated when using the following groups of drugs:

- Antimicrobial agents
- Local anesthetics
- Drugs that enhance the excretory properties of the kidneys
- Choleretic agents
- Enzyme preparations;
- Amino acids;
- Biogenic stimulants;
- Drugs containing bee and snake venom.

MUSIC PHARMACOTHERAPY OF NEUROSES: A CLINICAL STUDY

Materials and methods

For complex treatment using Music Pharmacotherapy ***(MPhT)***, a group of 51 patients of different sexes and ages with a history of psychological stress, suffering from neurotic disorders against the background of sleep disorders of varying severity, was selected.

Two groups were formed using random selection: the main group ***(MG)*** consisting of 25 people, and the control group ***(CG)*** consisting of 26 people.

Participants in both groups received basic sedative drug therapy ***(DT)*** in the form of taking meprobomate tablets at a starting dose of 0.4 × 3 times a day. Subsequently, the dose of the drug and the frequency of administration were adjusted depending on the dynamics of the patients' condition.

Patients in the main group additionally received music psychotherapy sessions for two weeks using the digital program «Antistress & Insomnia», developed for stress control and treatment of neurotic disorders with sleep disorders.

The therapy was carried out remotely in the morning and evening according to the following scheme. 30 minutes after the first dose of the drug, all patients in the MG had a morning session of music therapy.

The tracks broadcast were TPL 1 or TPL 2, which, based on the program structure presented in the Table 2, belong to the dominant algorithm HR(+).

The goal of the morning sessions was Psychophysiological harmonization, stabilization of the emotional state, and creation of a positive mood.

30 minutes after the evening intake of the drug, the 2nd session of music therapy was held, concluding the day cycle.

Here, the tracks TPL 3 and TPL 4, related to the HR (–) algorithm, were used. Listening to them causes psychophysical relaxation and a hypnotic effect.

The course of treatment lasted 2 weeks.

Before and after the full completion of the clinical study, all participants in the program underwent a comprehensive examination twice, which included:

- questioning, examination, a test for individual characteristics of musical perception (S.V.Shushardzhan, 2005),

- Comprehensive psycho diagnostics using computer expert systems (V.P.Zaitsev, T.A.Ayvazyan, 1989).

The last one included the Luscher color test and the WAM method (well-being, activity, and mood).

Table 2. *Structure of the digital music therapy program «Antistress & Insomnia»*
Таблица 2. *Структура программы № 1 «Антистресс &Бессонница»*

Program № 1 «Antistress & Insomnia»	**TPL 1**	**TPL 2**	**TPL 3**	**TPL 4**
Number of tracks	5	5	5	5
Sound duration (min.)	21	20	17	16
Dominant Algorithm	HR(+)	HR(+)	HR(–)	HR(–)

The results of the studies were processed using methods of variation statistics. When comparing the distributions of various indicators for different groups, the Student criterion was used.

Results

In terms of their composition (age, gender of subjects, complaints), the main and control groups were quite close. Comparative dynamics of the main complaints presented by participants in the MG and CG before the start and at the end of the clinical research program are presented in the Table 3.

Initially, all participants in both groups complained of insomnia.

At the same time, in the MG, a mild form of insomnia, which is characterized by difficulty falling asleep, increased sensitivity of sleep with normal duration, was observed in 12 patients (48%).

Moderate insomnia, in which the duration of sleep is 2–3 hours below the physiological norm, as well as difficulty falling asleep and disturbing dreams, was detected in 8 patients (32%).

Severe insomnia with sleep duration of up to 3–4 hours per day, pronounced anxiety, and a feeling of exhaustion upon awakening were detected in 5 patients (20%).

The following initial structure of insomnia manifestations was determined in patients in the control group: mild insomnia in 14 people (54%), moderate insomnia in 9 (36%), and severe insomnia in 3 participants in the clinical study

(12%).

Table 3. *Comparative dynamics of the main complaints presented by participants in the OG and CG*

Таблица 3. *Динамика жалоб основной (ОГ) и контрольной (КГ) групп после МФТ* и ЛТ*

Complaints / symptoms	**Number of patients presenting complaints**			
	MG *(n=25)*		***CG*** *(n=26)*	
	Before MPhT	***After MPhT***	***Before DT***	***After DT***
Insomnia	*25*	*5*	*26*	*17*
Anxiety	*16*	*7*	*18*	*11*
Mood instability	*20*	*6*	*22*	*14*

Thus, the frequency and form of insomnia manifestations among the MG and CG participants before the start of treatment were comparable.

As a result of the repeated examination at the end of the clinical program, the number of complaints of insomnia among the MG patients decreased by 80%. At the same time, the dose of meprobomate in 20 people was reduced by the end of the MFT course to a single dose at night in the amount of 0.2.

Improvement in condition was found in 4 patients (16%), the condition without any particular dynamics — in one participant (4%). By the end of the clinical program as a whole, a 43% decrease in drug intake was found in the MG compared to the initial level.

The number of complaints of anxiety decreased by 2.3 times, and of unstable mood — by 3.3 times.

It was found that patients in the MG fell asleep faster, slept deeper and

longer, and felt more rested upon awakening than patients in the CG, in which the number of complaints of insomnia decreased by 36%, but the consumption of medications did not change significantly.

The survey and observation data correlated with the results of psycho diagnostics.

The comparative dynamics of the scales based on the results of the WAM test in both groups is presented in the Table 4.

Table 4. *Dynamics of average values of WAM indicators in MG and CG*
Таблица 4. *Динамика средних значений показателей САН в ОГ и КГ*

Scale	***MG (n=25)***		***CG (n=26)***	
	Before MPhT	***After MPhT***	***Before DT***	***After DT***
Well-being	3,8	5,4	4,1	4,3
Activity	4,2	5,1	3,6	4,7
Mood	4,0	5,5	3,9	4,4

After the MPhT, a stable trend ($p \leq 0.05$) towards an increase in the WAM test scales was noted in the MG group: Well-being - + 42.1%, Activity - + 21.4%, Mood - +37.5%.

In the CG, positive dynamics were noted at the level of statistical error.

The dynamics of the anxiety index based on the results of the Luscher test is presented in Fig. 7.

In the main group, a 4.4-fold decrease in the anxiety index was revealed ($p \leq 0.05$), while in the control group, a statistically insignificant tendency towards a 1.3-fold decrease was recorded.

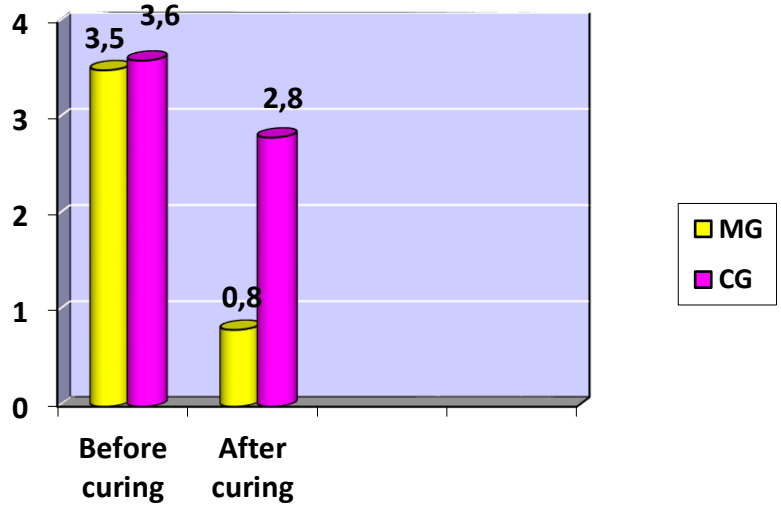

Fig. 7. *Comparative dynamics of the anxiety index in the MG and CG*
Рис. 7. *Сравнительная динамика индекса тревоги в ОГ и КГ*

CONCLUSIONS

1. The use of meprobomate in tablets (0.2 x 4 times a day) in combination with audio sessions of digital music psychotherapy (the Anti-Stress-Insomnia program) showed the effectiveness of such a combination in the treatment of insomnia in people suffering from neurotic disorders. Sleep in the MG was completely normalized in 80% of cases, and the intake of medications decreased by 43% compared to the baseline. At the same time, the number of complaints about anxiety decreased by 2.3 times, and about unstable mood - by 3.3 times.

2. According to the results of clinical observation and objective examination data, monotherapy with meprobamate was less effective than combined music pharmacotherapy. The number of complaints by the end of the research program in the CG decreased by only 36%, with 80% in the MG, while the consumption of drugs in this group did not change significantly.

3. Patients in the MG fell asleep faster, slept deeper and longer, and felt more rested upon awakening than patients in the CG. A correlation was found between the observation results and the dynamics of psycho-diagnostic scales. Thus, in the MG group, after the MPhT course, a stable trend towards an increase in the WAM test scales was noted - Well-being: + 42.1%; Activity: + 21.4%; Mood: +37.5%. A 4.4-fold decrease in the anxiety index was found ($p \leq 0.05$). In the control group, insignificant positive dynamics were noted at the level of statistical error.

The mechanism of enhancing the effect of drugs with the help of external

musical and acoustic effects consists in synchronizing the therapeutic effects of both methods. In this clinical study, the sedative effect caused by a chemical drug in the form of meprobomate is combined with complementary Psycho physiological reactions that occur in response to the musical and acoustic effects of the digital program «Antistress & Insomnia» in the form of HR(+) and HR(–) algorithms. The summation of the pharmaceutical and musical-therapeutic effects provides a pronounced psychotropic therapeutic effect.

A natural question arises: how difficult is it to carry out such combined therapy in practice? The easiest way is to use ready-made, proven SMT technologies built on an algorithmic basis, in this case we are talking about the «Antistress & Insomnia» program. Its availability to medical personnel and its use according to the scheme described above will provide the necessary musical-therapeutic effect without causing any technical difficulties. The program will also enhance the effect of drugs prescribed by a doctor to a patient suffering from neurotic disorders.

The second way is to study at our special courses on scientific music therapy. This will allow you to delve deeper into this promising area and will open up a real opportunity for listeners to effectively use the high potential of scientific music therapy technologies in clinical practice. The clinical study conducted is a vivid illustration of the prospects of the approach of combining drug therapy and music, based on the principle of complementarity and synergy.

And if Pharmacology has long been based on evidence in a detailed study of the mechanisms of the effect of drugs on the human body, then scientific music therapy, which has substantiated the Neurohormonal Theory and the Doctrine of Acoustic Algorithms-Regulators, has stood on a solid fundamental basis for effective forecasting and clinical application of its methods or technologies.

The principle of a Complementary Combination of Musical-Algorithmic Effects and Drug Therapy was the prerequisite for the creation of the method of Music Pharmacotherapy. With the help of this approach, it was possible to obtain encouraging results not only in the treatment of Neurotic Disorders, but also in Arterial Hypertension, Bronchial Asthma, Psoriasis, Premature Aging and other serious health problems. In the near future, separate publications will be devoted to this.

But there is another important result of this project. The interdisciplinary approach we used in the targeted selection of scientifically proven and complementary treatment and health methods with a Synergy of beneficial effects

at the output laid the foundation for a new paradigm of Smart Healing Technologies, which, as we believe, should belong to the future.

ADDITIONAL

Information about the authors:

Sergey V. Shushardzhan, Doc. Sci. (Med), Professor, CEO «Academy of Rehabilitation Medicine, Clinical Psychology and Music Therapy» E-mail: medart777@yandex.ru, ORCID ID: http://orcid.org/0000-0003-0945-7704

Author's contribution:

The author confirms his authorship according to the ICMJE criteria.

Source of funding:

This study was not supported by any external sources of funding.

Disclosure:

The authors declare no apparent or potential conflicts of interest related to the publication of this article.

Ethics Approval:

Not applicable.

Consent for Publication:

Not applicable.

ДОПОЛНИТЕЛЬНО

Информация об авторах:

Шушарджан Сергей Ваганович, доктор медицинских наук, профессор, ректор Академии восстановительной медицины, клинической психологии и музыкальной терапии, e-mail: medart777@yandex.ru, ORCID ID: http://orcid.org/0000-0003-0945-7704

Вклад авторов:

Автор подтверждает соответствие своего авторства, согласно международным критериям ICMJE.

Конфликт интересов:

Автор декларирует отсутствие других явных и потенциальных конфликтов интересов, связанных с публикацией настоящей статьи

Источник финансирования:

Данное исследование не было поддержано никакими внешними источниками финансирования.

Этические утверждения:

Не применимо.

Согласие на публикацию:

Не применимо.

References / Список литературы

1. Resource of the professional medical association of clinical pharmacologists of St. Petersburg. Available at: https://clinicpharm.ru/ publications/klinicheskaya-farmakologiya/klinicheskaya-farmakologiya-v-sovremennoy-meditsine/.

2. Bates D.W., Boyle D.L., Vander Vliet M.B., et al. Relationship between medication errors and adverse drug events. J General Int Med. 1995;10(4):199–205. Doi: 10.1007/BF02600255.Modell's drugs in current use and new drugs, 2000.

3. Pharmacology: textbook / ed. A.A. Svistunova, V.V. Tarasova. — 4th ed., electronic. — M.: Laboratory of Knowledge, 2021. — 771 p.

4. Clinical pharmacology and pharmacotherapy: textbook / edited by S. V. Okovity, A. N. Kulikov. - Moscow: GEOTAR-Media, 2022. - 848 p.: ill. - DOI: 10.33029/9704-6291-1-PHA-2022-1-848. ISBN 978-5-9704-6291-1.

5. Qing-ping, S., Xiao-dong, J., Feng, D. *et al.* Consequences, measurement, and evaluation of the costs associated with adverse drug reactions among hospitalized patients in China. *BMC Health Serv Res* **14**, 73 (2014). https://doi.org/10.1186/1472-6963-14-73.

6. Shushardzhan S.V. Guide to music therapy. Moscow, Medicina, 2005. 478 p.

7. Giordano F., Scarlata E., Baroni M., Gentile E., Puntillo F., Brienza N., Gesualdo L.. Receptive music therapy to reduce stress and improve wellbeing in Italian clinical staff involved in COVID-19 pandemic: A preliminary study. The Arts in Psychotherapy. 2020, 70, September 2020, 101688/Received 16 June 2020, Revised 8 July 2020, Accepted 11 July 2020, Available online 15 July 2020. URL: https://doi.org/10.1016/j.aip. 2020. 101688.

8. Bekhterev V.M. Issues related to the treatment and hygienic significance of music1916; (4): 105–124.

9. Dogel I.M. The influence of music and the colors of the spectrum on the nervous system of humans and animals. Kazan, Tipo-litografiya Imperatorskago universiteta, 1898. 141 p.

10. Shushardzhan S.V., Shushardzhan R.S. From Empiricism to Science - the development of Music Therapy. Collection of scientific papers and articles of the conference with international participation «Art Therapy as a factor in the

formation of Social Health» /scientific ed. Savich L.E., Shushardzhan S.V. Kazan, Publishing House of Kazan State Institute of Culture, 2015.

11. Razumov A.N., Shushardzhan S.V. Music therapy methods (a manual for doctors). Moscow, *izd. RNCVM i K MZ RF*, 2002. 29 p.

12. Shushardzhan, S.V. Scientific Music Therapy technologies in Mental Health Improving and Rehabilitation of patients after Coronavirus Disease. In: The COVID-19 Aftermath, Volume I: Ongoing Challenges. Edited By Nima Rezaei under exclusive license to Springer Nature Switzerland AG 2024, eBook ISBN 978-3-031-61939-7, ISSN 0065-2598, Series E-ISSN 2214-8019, Advances in Experimental Medicine and Biology, Springer, Cham, 2024, p.X,702. DOI: 10.1007/978-3-031-61943-4.

13. Shushardzhan S.V. Classification of the main directions, methods and technologies of music therapy and prospects for their application. *Reflexotherapy and complementary medicine*. 2014. No. 4. P. 51.

14. Shushardzhan, S.V. Vocal therapy, teaching aid / S.V. Shushardzhan. - Moscow: AMR KP MT, 2023. - 77 p. - ISBN 978-5-600-03855-4.

15. Shushardzhan S.V., Allik T.L., Eremina N.I. Meso-Forte — Innovative Method for Musical-Acoustic Psychotherapy and Neurohormonal Correction with Anti-Aging Effect: Clinical Study. *Bulletin of Rehabilitation Medicine*. 2022; 21 (1):79-85. https://doi.org/10.38025/2078-1962-2022-21-1-79-85.

16. Shushardzhan, S.V.: The method for potentiating the therapeutic effect by a combination of musical-acoustic and medicinal effects. Patent No. 22240146. The Federal Service for Intellectual Property, Patents and Trademarks (2004).

17. Vidal's Drug Handbook. Available at: https://www.vidal.ru/search?q =levomycetin.