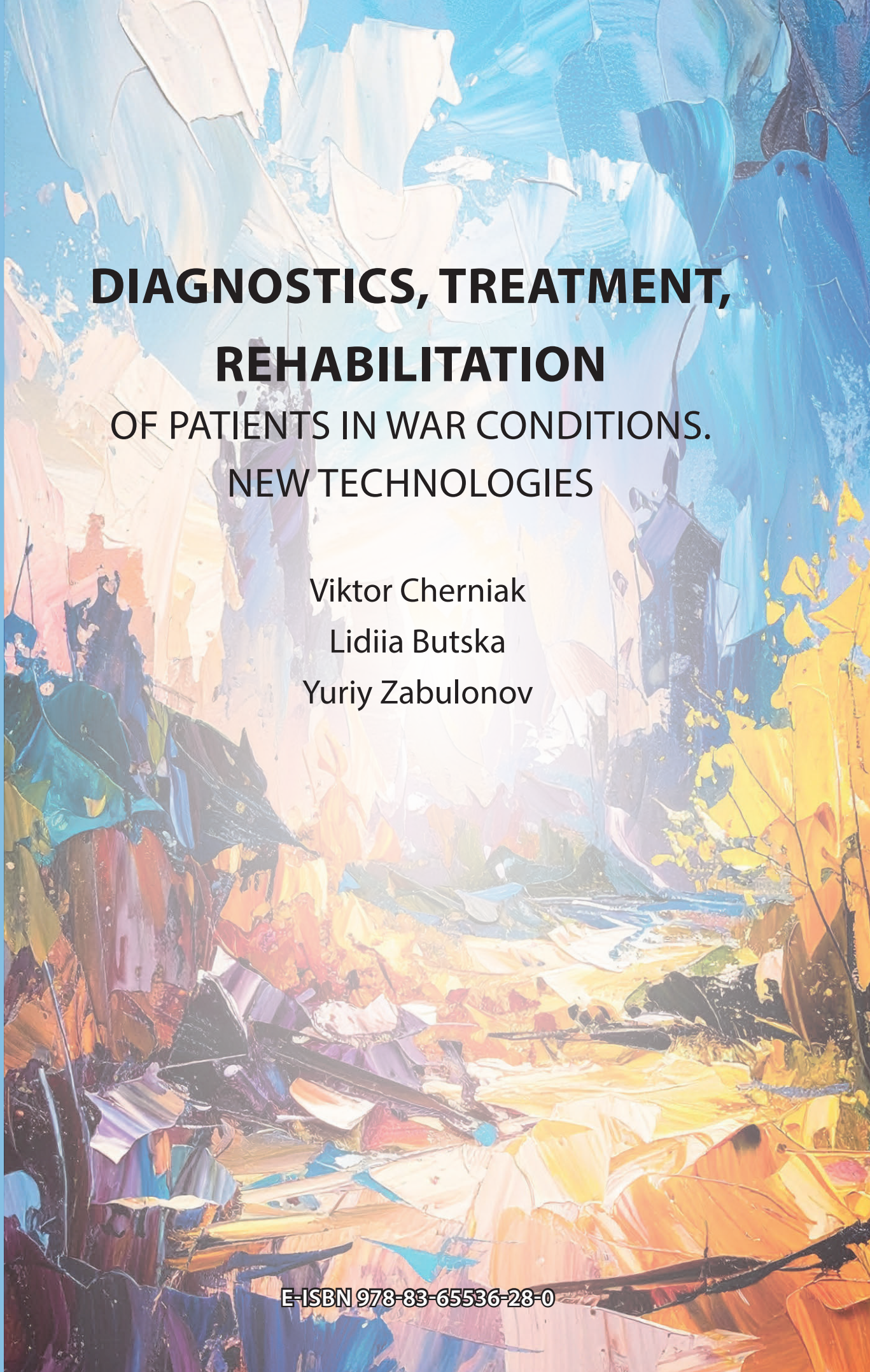

DIAGNOSTICS, TREATMENT, REHABILITATION

OF PATIENTS IN WAR CONDITIONS. NEW TECHNOLOGIES

Viktor Cherniak
Lidiia Butska
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E-ISBN 978-83-65536-28-0

Publisher: ALUNA Publishing House (Poland) Wydawnictwo-Aluna.pl doi: 10.36740/BK2025WAR02

DC 615.847.8+615.837
LBC 53.54

National Academy of Medical Sciences of Ukraine State Institution
«V.K. Gusak Institute of Urgent and Recovery Surgery
of the National Academy of Medical Sciences of Ukraine»

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Research supported by the National Research Fund of Ukraine,
Competition "Science for Strengthening the Defense Capability of Ukraine" (No.2023.04/0145)

Recommended for publication by the Academic Council of the State Institution
«V.K. Gusak Institute of Emergency and Reconstructive Surgery
of the National Academy of Medical Sciences of Ukraine»
Kyiv, Ukraine. Protocol № 3/9/2025 from 19 September 2025

2025

DC 615.847.8+615.837
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Національна академія медичних наук України
Державна установа «Інститут невідкладної і відновної хірургії
імені В. К. Гусака НАМН України»

ДІАГНОСТИКА, ЛІКУВАННЯ, РЕАБІЛІТАЦІЯ

ПАЦІЄНТІВ У ВОЄННИХ УМОВАХ. НОВІ ТЕХНОЛОГІЇ

Віктор Черняк
Лідія Буцька
Юрій Забулонов

Рекомендовано до друку Вченою радою ДУ «Інститут невідкладної і відновної хірургії
ім. В.К. Гусака НАМН України»
(Протокол № 3/9/2025 від 19 вересня 2025 р.)

Підтримано Національним фондом досліджень України
(конкурс «Наука для зміцнення обороноздатності України», №2023.04/0145)

2025

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ABSTRACT

The monograph is dedicated to the latest, original technologies in the field of diagnostics, treatment, rehabilitation of civilian and military patients with severe injuries and wounds. Also the monograph dedicated the general principles of use of multipurpose laser systems in treatment of patients and disabled people at various stages of medical rehabilitation in more detail – modern methods of magnet-laser, laser therapy, on-vessels radiation of blood and therapy are stated by the scanning laser beam. Flow charts of application of multipurpose laser therapy with use of the device «Helios» are provided.

The monograph is designed for military medicine, general practitioners, family and sports medicine, physiotherapists and rehabilitation specialists.

Authors express gratitude to Priemska V for the given help in preparation for the publishing of the monograph.

In memory of Ukrainian researchers, inventors and great scientists who laid the foundation of domestic physiotherapy, being the initiators, developers of new technologies and teachers of professors Samosyuk Ivan Zakharovych and Chuhraev Mykola Viktorovych

Suggested citation

Cherniak, V. A., Butska, L. V., & Zabulonov, Y. (2025). Diagnostics, treatment, rehabilitation of patients in war conditions: New technologies. State Institution "V.K. Gusak Institute of Urgent and Recovery Surgery of the National Academy of Medical Sciences of Ukraine". https://doi.org/10.36740/BK-2025WAR02

Research supported by the National Research Fund of Ukraine, Competition "Science for Strengthening the Defense Capability of Ukraine," No. 2023.04/0145.

ДСТУ 8302:2015 (українське оформлення)

Черняк В. А., Буцька Л. В., Забулонов Ю. Diagnostics, treatment, rehabilitation of patients in war conditions: New technologies [англ.]. – Київ: ДУ «Інститут невідкладної і відновної хірургії ім. В. К. Гусака НАМН України», 2025. – 180 с. DOI: DOI: 10.36740/BK2025WAR02.

Підтримано Національним фондом досліджень України (конкурс «Наука для зміцнення обороноздатності України», № 2023.04/0145).

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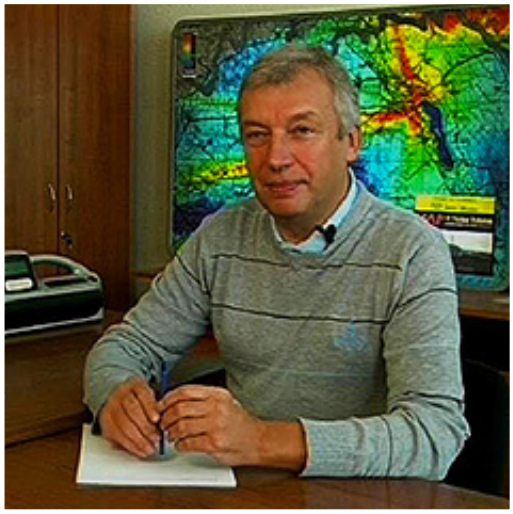

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CONTENTS

ABBREVIATIONS

AP	acupuncture points
BAP	biologically active points
CMF	constant magnetic field
EMF	electro magnetic filed
EMR	electromagnetic radiation
LILR	low-intensive laser radiation
MF	magnetic field
MLT	magnet laser therapy
MLUST	magnet laser ultrasound therapy
MPLT	multipurpose laser therapy
MT	magnet therapy
PMF	pulse magnetic field
POL	peroxide oxidation of lipids
PT	physiotherapy
REG	rheoencephalography
RMF	rotating magnetic field
SBR	secondary biogenic radiation
SP	sonopuncture
TPF	therapeutic physical factors
UCSG	upper cervical sympathetic gangly
UphP	ultra phonophoresis
UST	ultrasonic therapy
US	ultrasound

CHAPTER 1

DIAGNOSIS AND TREATMENT OF COMBAT TRAUMA

Viktor Cherniak

1.1. Introduction

Combat wounds remain a serious medical and social problem, especially in countries experiencing military conflict. In Ukraine, ongoing hostilities have led to a significant increase in the number of patients with combat-related injuries (Salenko et al., 2025). Such traumas are often accompanied by complex medical complications, long-term disability, and severe psychological consequences for the affected individuals (Butska (ed.), 2024).

One of the major challenges in the management of combat wounds lies in the detection and extraction of radiolucent foreign bodies, including glass, plastic, or composite materials, which are invisible on standard radiographic imaging. Their presence complicates both diagnosis and surgical removal (Butska, 2025). Failure to identify and extract these fragments may result in chronic pain, infection of grafted tissues, and secondary complications that further delay recovery.

At the same time, the effective rehabilitation of individuals with combat injuries requires a multidisciplinary approach (Malec et al., 2017), which ensures holistic recovery by addressing not only physical but also psychological and social aspects of healing (Cao, 2025). Recent studies demonstrate that such integrative rehabilitation programs accelerate functional recovery and significantly improve quality of life (Eades et al., 2013).

Given the growing number of combat trauma victims, the integration of innovative diagnostic and therapeutic technologies, along with comprehensive rehabilitation strategies, is essential to optimize clinical outcomes and enhance patients' long-term well-being (Malec et al., 2017; Murray, 2022; Cao, 2025; Korompeli et al., 2025).

1.2. Control of bleeding

Effective bleeding control remains one of the key determinants of survival in battlefield conditions. Including high-quality medical equipment in soldiers' first aid kits is as vital to national defense as weaponry and diplomacy, strengthening a country's capacity to protect human life in combat and civilian emergencies alike. Consequently, developed countries devote considerable attention to improving pre-hospital hemostatic care and the technologies available for emergency bleeding control.

A tourniquet, an instrument for occluding blood flow in cases of arterial or venous bleeding, remains one of the most critical life-saving devices. Delays in drug use often result in preventable fatalities, whereas correct and timely use can decisively preserve life. Proper tourniquet application requires both effective device design and adequate user training to ensure optimal performance in high-stress conditions such as combat, accidents, or mass-casualty incidents.

The historical evolution of the tourniquet is associated with notable contributors including Étienne Morel, Jean-Louis Petit, Friedrich von Esmarch, and Bernhard von Langenbeck, whose pioneering innovations from the 17th century through the Second World War established the foundations of modern hemostatic practice. The advent of windlass-type tourniquets in the late 1990s marked a new stage of development, with the United States playing a leading role in their design and military implementation.

In the wake of the annexation of Crimea and the subsequent war in eastern Ukraine, the rapid advancement of Ukrainian tactical (field) medicine became evident. Within several years, Ukraine has not only restructured its military medical system but also began manufacturing modern hemostatic devices, sharing practical battlefield experience and innovations with the international medical community.

Our research focused on Ukrainian-manufactured tourniquets, including SICH-Tourniquet, Paramedic, Tourniquet-1, ARONIA, and the recently developed BFT-01 tourniquet by Brightfield Ukraine LLC. The BFT-01 represents a compact, efficient, and reliable hemostatic device designed for temporary bleeding control of varying intensity from upper and lower limb injuries.

The tourniquet consists of a reinforced strap equipped with a tightening mechanism and a patented one-way buckle allowing pre-tightening. It can be applied at home, in the hospital or in the field, and under any weather conditions. The device has successfully undergone certification testing and is registered as a medical product in Ukraine in accordance with national technical regulations (Resolution of the Cabinet of Ministers of Ukraine No. 753, October 2, 2013; DSTU 4388). It is classified as a non-invasive, non-sterile Class I medical device without a measuring function.

1.3. Recommendations for Use

Read the instructions carefully before applying the tourniquet.

The tourniquet can be applied independently, including one-handed use.

The recommended maximum time of use is no more than two hours.

The tourniquet should be folded in such a way that allows single-handed application, particularly when self-applying to the opposite limb.

1.4. Warnings

The tourniquet is a single-use medical device.

Do not overtighten the tourniquet – apply only enough pressure to achieve stable bleeding control.

Use exclusively for bleeding control on the upper and lower extremities.

Never apply to the neck or head.

If the tourniquet remains in place for over two hours, do not remove it yourself – this should only be done by qualified medical personnel.

1.5. General Rules for Tourniquet Application

Apply a tourniquet only when absolutely necessary, ideally within 15 – 20 seconds, when severe limb bleeding poses a direct life threat.

Place the tourniquet 5 – 8 cm (up to 10 cm) above the wound on the shoulder, forearm, thigh, or leg.

In combat conditions, if the exact location of the wound is unclear, it is permissible to apply a tourniquet as high as possible on the limb (in the upper third of the arm or thigh).

Avoid placing the tourniquet over a joint or fracture site.

Do not apply over the middle third of the upper arm or the popliteal fossa to prevent nerve injury.

A correctly applied tourniquet will stop bleeding and eliminate distal pulse (e.g., radial or posterior tibial).

If the bleeding has stopped but the pulse persists, do not overtighten further.

Do not cover the tourniquet with bandages or clothing.

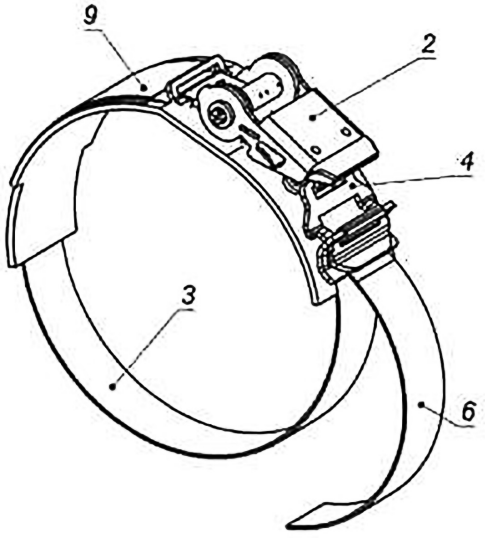
Always record the time of application directly on the device or visibly on the patient's body, marking it with a "T" (Tourniquet, Time).

Casualties should be closely monitored, as severe pain may prompt attempts to loosen the device. Administer analgesics when possible.

1.6. Duration of Tourniquet Application

Application for up to two hours is generally considered safe. Within this period, alternative hemostatic methods or evacuation to a surgical unit should be arranged. If evacuation or replacement of the victim is not possible, it is permissible to loosen the tourniquet for 30 seconds while simultaneously monitoring his condition. If consciousness, breathing, pulse, and skin color remain stable, the maneuver may be repeated up to three times.

One-handed application of the tourniquet (Fig.1).



1. Place the loop over the injured limb above the bleeding site with the buckle facing outward.
2. Pull the free end of the strap to pre-tighten as firmly as possible.
3. Rotate the windlass handle until bleeding ceases and the distal pulse disappears.
4. Secure the remaining strap around the limb.
5. Record the time of application on the information patch using a permanent marker.

Figure 1. Order of use one-handed application of the tourniquet.

Two-handed application of the tourniquet

1. Detach the buckle from the mechanism by pressing the latch.
2. Wrap the strap above the bleeding site.
3. Reattach the buckle to the frame hook.
4. Pull the free end to achieve maximum pre-tightening.
5. Rotate the handle until arterial bleeding stops and the distal pulse disappears.
6. Secure the remaining strap.
7. Record the time of application on the white patch.

Partial loosening of the tourniquet

To slightly reduce the compression, pull the release lever located on the side of the handle.

1. While holding it, move the handle slightly beyond its operational stop.
2. Each subsequent press will release the drum incrementally, easing limb compression in small steps.

1.7. Tourniquet opening and removal

To fully release the compression and remove the tourniquet:

1. Pull the release lever on the side of the handle toward the edge.
2. Move the handle to its maximum open position. This will unlock the toothed drum, stopping compression entirely.
3. Detach the buckle from the mechanism by releasing the latch.

1.8. Advantages of the BFT-01 hemostatic tourniquet

1. Rapid and reliable hemostasis – the metal clasp enables fast loop closure, crucial during severe hemorrhage when every second counts.
2. Ease of use – the simple mechanism allows efficient application without excessive pressure, and includes a quick-release feature.
3. Compactness – small size and lightweight design ensure portability and convenient storage.
4. Safety – made from hypoallergenic materials, minimizing the risk of adverse reactions.

1.9. Pain management, pharmacotherapy of blood rheology disorders, and suppurative-septic complications in gunshot wounds with an applied tourniquet

One of the most important components of successful treatment of the wounded is comprehensive pain control, covering various levels of intensity:

- Mild pain (VAS 10 – 40 mm): *Infugan, Keidex*.
- Moderate pain (VAS 40 – 70 mm): *Infugan, Keidex, Ropilong* at a rate of 6 – 16 ml/hour via epidural catheter.
- Severe pain (VAS 70 – 100 mm): *Infugan, Keidex, Ropilong* at 6 – 16 ml/hour via epidural catheter, and *Nalbuphine*.

Additionally, the use of Yumerox® Inhal is recommended – an individual device for inhalation administration of *Methoxyflurane*.

In severe trauma, disturbances in homeostasis and perfusion are common. Therefore, fluid therapy must be individualized, as both under- and over-resuscitation can lead to adverse outcomes, including increased mortality. The ROSE concept of fluid resuscitation delineates four key stages:

R – Resuscitation (minutes): early fluid replacement to correct hypovolemia and maintain vascular tone.

O – Optimization (hours): prevent complications and fluid overload.

S – Stabilization (days): maintain organ function.

E – Evacuation (days to weeks): restore homeostasis and remove excess fluid.

The inclusion of Reosorbilact, a multifunctional hyperosmolar solution, helps achieve stability during the O, S, and E phases while reducing the risk of fluid overload.

For detoxification: Xylate, Reosorbilact, and Sorbilact are recommended. In cases of arterial ischemia, the "Trio" therapy regimen is used, which includes:

- Basic therapy + Reosorbilact 400 ml/day,
- Latren 400 ml/day,
- L-arginine 100 ml/day.

1.10. Features of primary surgical treatment of gunshot wounds

The primary objective of surgical intervention for gunshot wounds is the radical excision of devitalized tissues. Proper evaluation of the wound trajectory is essential, as the necrotic zone often extends beyond the visible injury margins. The presence of tissue contusion and microvascular thrombosis significantly increases the risk of infection if necrotic areas are not completely excised (Fig. 2).

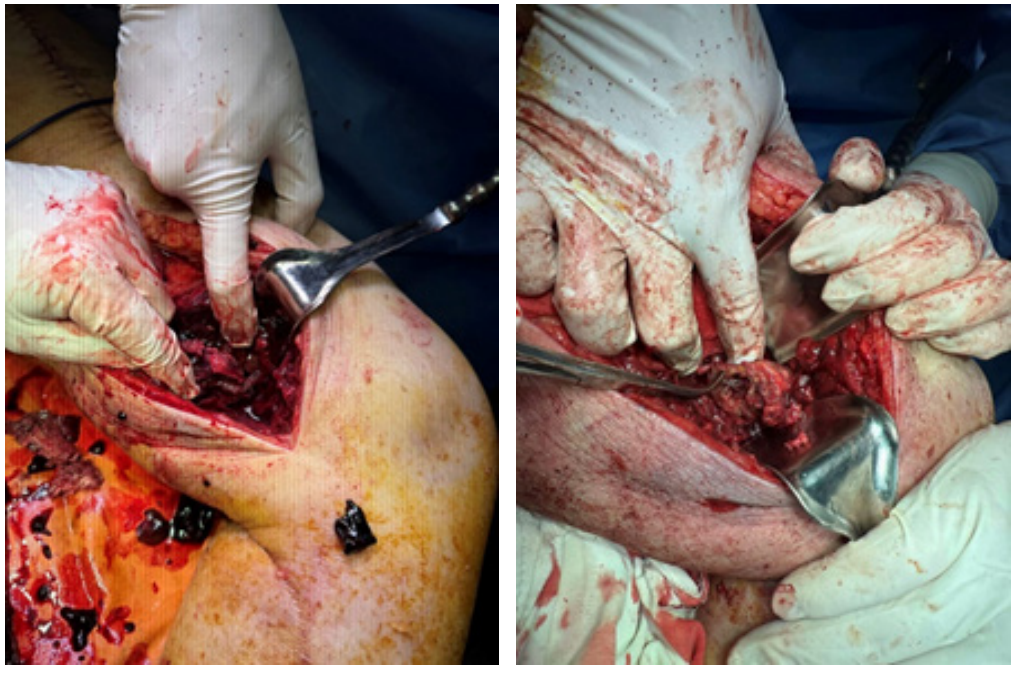


Fig. 2. Stages of primary surgical debridement (а – bleeding control, в – removal of foreign bodies and evacuation of hematoma)

Primary surgical treatment of a wound usually includes the following steps:

1. Wound exploration – assessment of the wound channel and bullet trajectory.
2. Excision of necrotic tissue – removal of non-viable skin, subcutaneous fat, muscles and fascia.
3. Hemostasis – control of ongoing bleeding using tourniquets, clamps, or ligatures.
4. Removal of a foreign body – extraction of metallic and non-metallic fragments, when accessible, avoiding unnecessary tissue trauma.
5. Antiseptic irrigation and drainage – to prevent the development of suppuration.
6. Wound closure – choice between primary, delayed primary, or secondary suturing depending on the extent of contamination and tissue viability.

Due to the frequent contamination of gunshot wounds, primary wound closure is not always appropriate. In cases of extensive tissue destruction or high infection risk, the wound should remain open with adequate drainage, followed by secondary closure after stabilization and infection control.

1.11. Control of Purulent-Septic Complications

Combat injuries are commonly complicated by suppurative-septic infections, primarily due to delayed medical care, extensive tissue damage, and contamination by foreign materials. Thus, effective infection control is a fundamental component of successful wound management.

Prevention and management of septic complications should include:

Complete and timely surgical debridement;

Rational use of systemic and local antiseptics;

Empirical and targeted antibiotic therapy;

Application of sorption-detoxifying dressings (e.g., Sorbact, HydroClean Plus);

Maintenance of adequate wound drainage and oxygenation.

Systemic antibiotic therapy should comply with the principles of pathogen-specific and stepwise administration of antibiotics, accounting for both gram-positive and gram-negative microorganisms. Early empiric administration of broad-spectrum antibiotics is recommended, with subsequent adjustment according to bacteriological test results (Fig. 3).

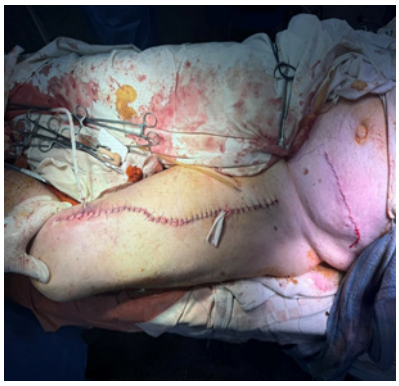
a  b 

Fig. 3. Stages of infection control and wound management (a – primary layered wound suture, b – control of discharge from an almost healed wound)

1.12. Rehabilitation and Recovery

Postoperative rehabilitation for combat-injured patients should be carried out using an individual and multidisciplinary approach (Fig. 4), encompassing physical therapy, psychological support, social reintegration, and, when appropriate, regenerative medicine techniques.

Integrating stem cell-based regenerative therapy into rehabilitation programs contributes to enhanced tissue regeneration, vascular recovery, and neuromuscular repair, improving long-term outcomes and the quality of life of affected individuals.

a  b 

Fig. 4. Multidisciplinary model of rehabilitation and regenerative therapy (a – team of surgeons during the initial surgical treatment of a gunshot wound, b – introducing mesenchymal stem cells to regenerate damaged limb tissues)

1.13. Integrated Strategy for Combat Trauma Management and Multidisciplinary Rehabilitation

The comprehensive management of combat trauma necessitates seamless coordination between emergency medical response, specialized surgical treatment, rigorous infection control, and long-term rehabilitation efforts. Within this clinical continuum, timely and effective bleeding control using advanced tourniquets remains the most critical life-saving measure in battlefield medicine. In this regard, Ukrainian-manufactured hemostatic devices, particularly the BFT-01 tourniquet, have proven to be efficient, reliable, and safe, representing a significant advancement in national medical technology.

Following initial stabilization, adequate surgical debridement and strict infection prevention are fundamental to reducing postoperative complications and ensuring optimal tissue healing. This surgical foundation is further augmented by integrated pharmacotherapy, where the use of rheology-modifying and detoxification agents supports improved microcirculation and accelerates repair processes.

A pivotal stage in this process is the implementation of multidisciplinary rehabilitation, which encompasses all aspects of functional recovery. This approach mandates the synergistic application of preformed physical factors, including ultrasound, laser-magnetic therapy, and acupuncture, alongside tailored therapeutic exercises. Such a combination is essential for modulating pain, stimulating tissue regeneration, and restoring neuro-muscular function. Ultimately, rehabilitation and regenerative medicine constitute essential components of modern combat trauma care, aiming not only at physical survival but also at restoring full functional capacity and ensuring the successful social reintegration of injured service members

1.14. Features of primary surgical treatment of gunshot wounds with foreign bodies – fragments

The invasive pathway of foreign body (FB) penetration is associated with a disruption of the integrity of the integumentary tissues – primarily the skin – followed by the migration of the FB deep into the biological structures. This type of penetration mechanism is usually the result of accidental trauma or the impact of a lethal weapon. The presence of FBs is frequently accompanied by complex wounds and extensive soft-tissue defects. Complications resulting from FB retention include inflammation, delayed or pathological wound healing, and damage to adjacent tissues. Organic FBs (of biological origin), such as plant fragments, often induce intense inflammatory responses, hypersensitivity reactions, or infection, while inorganic FBs commonly provoke severe inflammatory processes and can lead to nonspecific or specific (e.g., tetanus) infections. A particularly important issue in the managing of FBs is their intraoperative detection and navigation.

The extraction of a retained fragment following combat trauma is a technically demanding task that requires not only the surgeon's skill but also high-precision medical equipment that can be safely utilized during surgery. Such equipment must comply with medical safety standards, ensure ease of use, and withstand repeated sterilization as well as exposure to aggressive chemicals and biological fluids. Conventional radiography remains the first-line diagnostic tool for detecting retained fragments. However, to facilitate surgical planning and precise fragment removal, additional imaging techniques are required to provide clearer anatomical landmarks and assess the extent of surrounding tissue damage.

A novel approach involves inserting a flexible, non-rigid elastic probe into the wound channel. When the probe's distal end, protruding beyond an elastic-plastic guiding tube, comes into contact with the wound's internal structures, resistance arises both from the canal walls (muscle, adipose tissue, bone surfaces, vascular, cartilage, and tendon structures) and from any foreign inclusion at its terminus. Detection occurs through changes in the acoustic (noise) emission generated by probe movement within the wound canal and upon direct contact with the FB surface.

The device operates on the principle of altering the vibrational characteristics of a dynamic system composed of a long elastic filament with distributed mass, oscillating within a viscous medium. When the probe encounters a quasi-elastic foreign object, also in viscous contact with an inhomogeneous medium (the patient's tissues), these interactions modify the system's oscillatory parameters. By employing spectral analysis of noise emissions produced by mechanical contact between the flexible probe and the FB, it becomes possible – without additional incisions – to determine the presence, type, and approximate position of a retained object within the wound channel.

The theoretical basis for the development of this innovative detection device had been laid earlier. The search echo signal from a foreign body within a rheological medium Vd(t)V_d(t)Vd(t) can be mathematically expressed as the inverse Fourier transform (IFT) of the product of two independent parameters (Eq. 1):

$$Vd(t)=F-1(P4(f)\cdot Vi\sim(f))(1)V_d(t) = F^{-1} \big(P_4(f) \cdot \tilde{V_i}(f) \big) \tag{1}Vd(t)=F−1(P4(f)·Vi~(f))(1)$$

where Vd(t)V_d(t)Vd(t) represents the Fourier transform of the system's impulse response Vi(t) V_i(t)Vi(t), which defines the spectral characteristics of the system as a linear filter. This includes the frequency response of the transducer, the probing-pulse generator, and the system's receiving cir-

cuitry. P4(f)P_4(f)P4(f) denotes the spatial frequency response (SFR) of the acoustic path, accounting for diffraction, attenuation, refraction, interference, and reflection effects from the foreign object's surface during ultrasound propagation from the probing emitter to the object and back. The SFR itself is the Fourier transform of the spatial impulse response (SIR) of the acoustic path.

An experimental prototype of this innovative detection device was developed and tested in the laboratory using simulated gunshot wounds (Fig. 5 – 8).

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Fig. 5. Laboratory experiment with an animal trachea biomimetic: foreign bodies made of different materials implanted into the lumen

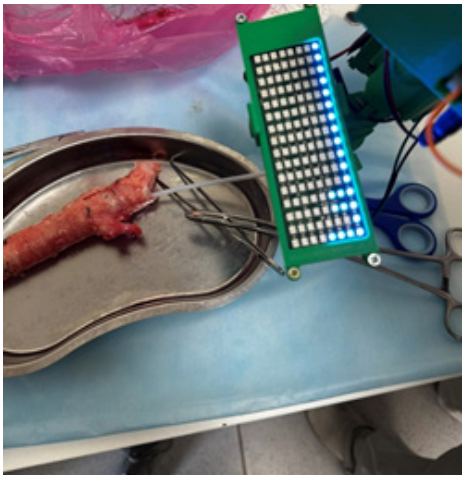


Fig. 6. Laboratory experiment with an animal trachea biomimetic: effective determination of the type and size of fragments using a developed innovative device

Fig. 7. Radiographic control of fragments in the tracheal cavity: effective only for 60% of foreign bodies

Fig. 8. Ultrasonic control of fragments in the tracheal cavity: effective only for 70% of foreign bodies

Subsequent clinical testing have confirmed superior performance compared to ultrasound and radiography in detecting glass, wood, plastic and ceramic fragments. The device's decoder accurately identified the material composition, location, and dimensions of the fragments (Fig. 9 – 11).

Fig. 9. Intraoperative control of the main artery proximal to the injury site

Fig. 10. Visualization of hematoma along the main vessels of the thigh as a result of injury

Fig. 11. Inspection of the surgical wound with a probe to search for debris

The introduction of this detection method into clinical practice has demonstrated high efficiency and simplicity, confirming its applicability during primary surgical treatment to prevent secondary infectious lesions of vascular grafts.

1.15. Procedure for using the device to detect fragments in the human body

The detection device consists of a handle with a base unit and a replaceable probe, which can either be sterilized or produced as a sterile disposable component. The operational process is shown in figures 12 – 15.

Fig. 12. Experimental determination of foreign body quality using an innovative sensor

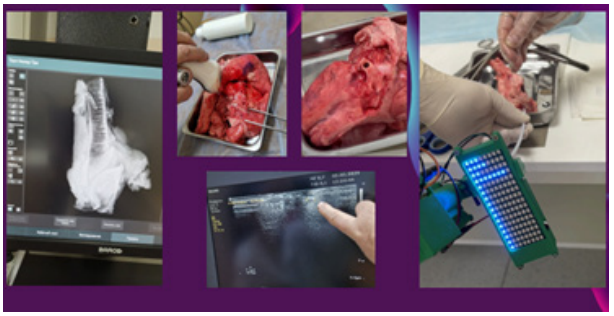


Fig. 13. Determining the nature and size of fragments using an innovative device on various biomimetics with ultrasound and X-ray control

The device is powered by a standard 9-V "crown" , which fits into a compartment located inside the handle.

Fig. 14. Appearance of the information display after connecting the device's battery

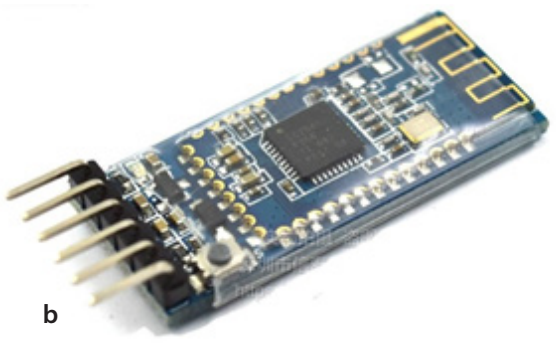


Fig.15. The moment of connecting the replaceable part of the device (A) to the non-sterile base element and memory card view (B)

Fig.16. The device is assembled and ready for use

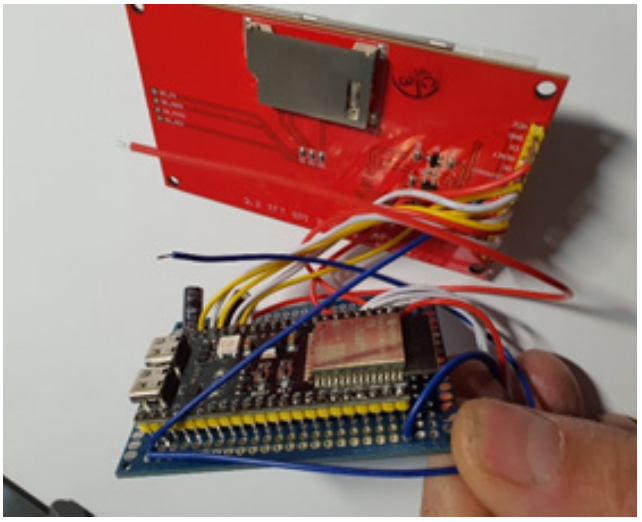


Fig.17. The "brain" part of the innovative device

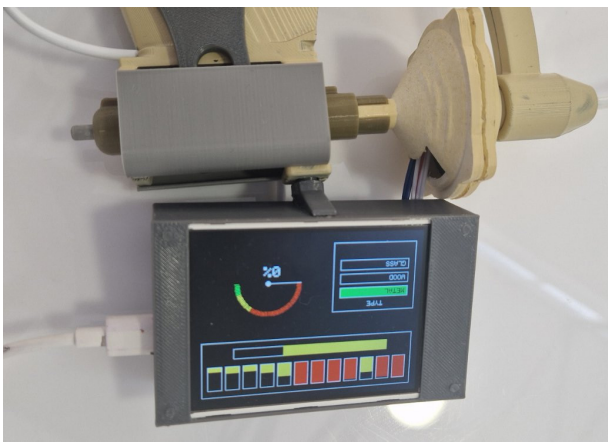
Before use, the working part (the probe) must be sterilized. To remove it, the operator opens the noise-emission fixation chamber and releases the probe by pressing the collet drive as shown in figures 15 – 17.

Once opened, the probe is detached from the holder. After sterilization, reassembly is performed in reverse order, ensuring that the probe passes correctly through the membrane hole and is securely fixed within the collet prior to closing the chamber.

After reassembly, the chamber is closed and the device's operational readiness is verified.

A protective tube is then placed over the probe, forming a rigid structure that facilitates smooth insertion into the wound channel. The probe tip is released only after full insertion and immediately before recording the noise emissions. When the power is turned on, a red indicator illuminates on the handle, and a baseline frequency scale appears on the display as a blue line (Fig. 18).

a



b

Fig. 18. The device is assembled and ready for use with the system on (a), and the indicator shows the characteristics of the fragment (в)

The probe tip is gently advanced into the wound canal until resistance sharply increases; then the tip is released by rotating the handle of the attachment. As the probe moves back and forth, oscillations occur due to its interaction with a foreign body. This data is converted into an analyzed spectrum, displayed on a monitor and providing information on:

- The presence of a foreign body – indicated as distinct spectral peaks, while absence produces a near-Gaussian distribution;
- Type of foreign body – the spectral pattern reflects the elasticity of the material (more elastic materials generate sharper frequency peaks);
- Approximate size – larger bodies maintain longer contact with the probe during motion.

Silence must be maintained during diagnostics, and repeated probe movements are recommended for confirmation. Future integration of machine-learning tools and reference fragment databases will enable automatic detection using LED indicators. The planned device upgrades include mechanical excitation and probe-control modules to enhance identification accuracy and procedural efficiency.

1.16. Advantages of the noise emission method

The method of detecting foreign bodies using noise emission has a number of significant advantages over traditional diagnostic imaging methods:

1. High Sensitivity: This technique demonstrates exceptional sensitivity to the presence of radiolucent or radiopaque fragments that may remain undetected by conventional radiographic or computed tomography (CT) methods.
2. Non-Ionizing and Safe: Since this method does not involve ionizing radiation, it poses no radiation risk to patients or medical personnel. This is particularly beneficial for repeated examinations or long-term postoperative monitoring.
3. Rapid and Accurate Diagnosis: The procedure enables real-time detection of fragments directly within the wound canal, eliminating the need for complex, costly, and time-consuming imaging procedures.
4. Detection of Microscopic Fragments: The system's acoustic sensitivity allows it to identify extremely small fragments that may escape detection even with advanced imaging technologies.

The practical implementation of this method in the field of military medicine has yielded several key outcomes:

1. Improved Fragment Localization: The ability to rapidly and precisely localize retained fragments facilitates prompt surgical decision-making, thereby reducing the duration and invasiveness of operations.
2. Monitoring of Healing Dynamics: The method can be used postoperatively to monitor wound healing by detecting changes in fragment structure or migration during the recovery process.
3. Field Applicability: In battlefield or evacuation settings where access to advanced medical imaging is limited, the compact and autonomous design of the noise emission device enables effective diagnostics under austere conditions.

1.17. Diagnostic algorithm for working with radiolucent fragments

To ensure reliable and safe diagnostics in patients with combat-related injuries involving radiolucent foreign bodies, the following algorithm is proposed:

1. Initial Patient Assessment: Conduct a comprehensive clinical evaluation, including assessment of the general condition and identification of symptoms suggesting the presence of retained fragments, such as localized pain, swelling, or limited mobility.
2. Noise Emission Detection: Apply the acoustic emission device and sensors to capture mechanical noise signals generated through probe interaction with the foreign material.
3. Signal Processing and Analysis: Analyze the acquired acoustic data to determine the fragment's location, shape, material properties, and approximate size using spectral pattern interpretation.
4. Diagnostic Confirmation: To ensure diagnostic accuracy and reliable treatment planning, it is necessary to cross-validate findings using additional imaging methods (radiography, ultrasound or computed tomography), where possible.
5. Clinical Decision-Making: Based on the diagnostic results, determine the optimal treatment pathway – whether surgical removal, conservative management, or continued observation.

This structured algorithm enables efficient and safe management of patients with combat injuries, supporting timely clinical decision-making and reducing the risk of complications.

The use of tactile probing combined with an elastic diagnostic probe, as proposed by Salenko et al. (2025), has proven particularly effective [1]. The use of a wound channel during primary surgical treatment allows for direct fragment detection without additional incisions. Contact between the probe and the foreign body generates vibrational signals that propagate through the elastic medium and are subsequently transformed into measurable noise emissions. Visualization of these emissions via oscilloscope provides a diagnostic signature, which, when compared to reference data, allows for accurate identification of the presence and approximate dimensions of the retained object.

Despite its simplicity and minimal equipment requirements, one limitation of this technique is that diagnostic accuracy depends significantly on the operator's expertise and experience. Additionally, encapsulated fragments or physiological changes over time may alter the spectral patterns observed, requiring careful interpretation and calibration (Salenko et al., 2025).

1.18. Conclusions

Combat-related injuries represent a multifaceted medical and organizational challenge that demands a coordinated interdisciplinary approach integrating emergency response, advanced diagnostics, and evidence-based surgical management. Among the most critical priorities in battlefield medicine remains effective hemorrhage control, which forms the foundation for stabilizing the wounded and preventing fatal complications. The introduction of modern Ukrainian-manufactured tourniquets, such as the BFT-01, underscores the rapid development of domestic tactical medical technology and its compliance with international standards.

Comprehensive pharmacotherapy and pain management are indispensable components of trauma care, ensuring patient stabilization and minimizing the risks of ischemia, shock, and systemic infection. However, one of the most persistent challenges in the surgical management of combat injuries is the detection and safe extraction of radiolucent foreign bodies, which are often invisible to conventional diagnostic imaging.

The development and clinical validation of an innovative acoustic noise emission device for the detection of such fragments represent a major advancement in modern combat medicine. By enabling accurate localization and characterization of retained objects, this method allows for their safe removal during primary surgical treatment, reducing the incidence of secondary infection and postoperative complications.

The clinical success of such interventions is further secured by a personalized multidisciplinary rehabilitation approach. This strategy integrates preformed physical factors, such as laser-magnetic therapy and ultrasound, with acupuncture and tailored exercises. Such a combination is essential for modulating chronic pain, stimulating tissue regeneration, and ensuring the full functional recovery of injured service members.

The proposed diagnostic algorithm, which integrates acoustic emission analysis, real-time signal interpretation, and multimodal confirmation, improves both the accuracy and efficiency of medical decision-making. Furthermore, the device's design ensures its adaptability for use not only in hospital settings but also in field conditions, making it a valuable tool for military medical units.

In conclusion, the integration of advanced bleeding control strategies, multidisciplinary pharmacotherapy, and novel diagnostic technologies marks a significant step toward improving both survival outcomes and recovery quality among individuals with combat trauma. These innovations collectively strengthen the scientific and practical foundations of Ukrainian military medicine, demonstrating its growing contribution to global trauma care.

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CHAPTER 2

AUTOLOGOUS MESENCHYMAL STEM CELLS AS A COMPONENT OF MULTIDISCIPLINARY REHABILITATION IN WAR PARTICIPANTS WITH SEVERE CHRONIC CRITICAL LOWER LIMB ISCHEMIA AND PAIN SYNDROMES

Viktor Cherniak, Lidiia Butska

2.1. Stem cell therapy overview

Stem cells are characterized by their intrinsic ability to self-renew and differentiate into multiple cell lineages, which positions them as a promising instrument in the field of regenerative and reparative medicine [1,2]. Owing to these biological properties, stem cells have become a focal point of modern cell-based therapeutic research and clinical applications. Nevertheless, despite their potential, the advancement of clinical stem cell therapy has been constrained by a range of ethical, legal, and technical considerations [3,4].

Adult stem cells, in particular mesenchymal stem cells (MSCs), represent a practical and ethically acceptable alternative to pluripotent stem cells derived from embryonic or induced sources. Their autologous or allogeneic use bypasses the ethical concerns associated with embryonic derivation and significantly reduces immunogenic risks [5,6]. These features, in combination with their inherent regenerative and paracrine capabilities, have accelerated their adoption in clinical settings.

Recent research emphasize that stem cell therapy represents an emerging therapeutic avenue for several refractory conditions that currently lack definitive treatment strategies [1,2]. Among these, chronic critical limb ischemia (CCLI) stands out as a major clinical challenge, particularly when revascularization through surgical intervention is unfeasible [3,4]. In such cases, MSC-based therapy has demonstrated considerable promise as a last-resort treatment aimed at enhancing angiogenesis, tissue repair, and pain reduction [5,6,7].

A comprehensive review of domestic and international peer-reviewed literature on the therapeutic use of MSCs reveals consistent evidence supporting their regenerative potential [8,9]. However, a notable limitation within the available data is the absence of standardized methodologies for determining optimal MSC dosage in terms of both efficacy and safety [10]. In clinical practice, the approach to treatment is individual: when no contraindications are identified, the physician formulates the therapeutic strategy based on the specific pathology and submits a formal request to an accredited Cord Blood Bank to prepare and expand the therapeutic MSC dose [9,10].

In cases where the use of autologous stem cells is indicated, the patient's own biological material – typically bone marrow aspirate or adipose tissue – is collected under sterile conditions and

forwarded to the cell processing facility for culture and expansion [11]. Before taking samples, each patient provides formal Informed Voluntary Consent for Diagnosis, Treatment, Surgery, and Anesthesia (Form No. 003-6/o), ensuring compliance with bioethical and legal standards.

2.2. Cell therapy procedure

In order to minimize procedural and post-procedural complications, patients undergoing cell therapy receive premedication tailored to their individual clinical status. The pharmacological preparation may include:

- Antihistamines (e.g., chlorpheniramine, dexchlorpheniramine) to prevent allergic responses;
- Glucocorticosteroids (e.g., methylprednisolone, hydrocortisone) to mitigate inflammation and hypersensitivity;
- Prokinetics (e.g., metoclopramide) to reduce gastrointestinal side effects;
- Paracetamol (1 g) for analgesic and antipyretic support;
- Anticoagulants and other adjunct agents as required.

All medications are administered in accordance with the patient's physiological condition and established clinical recommendations.

2.2.1. Algorithm of bone marrow and adipose tissue aspiration

Bone marrow aspiration is performed to obtain the liquid fraction of hematopoietic tissue for subsequent isolation and expansion of mesenchymal stem cells. Similarly, adipose tissue may be collected through lipoaspiration, providing an alternative autologous MSC source. Prior to carrying out of the procedures, comprehensive laboratory and instrumental diagnostics are carried out to confirm indications and exclude contraindications. All manipulations are performed under strict aseptic and antiseptic conditions.

During bone marrow aspiration, anesthesia is achieved through sedation and/or local infiltration under continuous anesthesiologist supervision. Using a Jamshidi-type needle, up to 50 ml of red bone marrow is aspirated from the iliac crest through a small skin incision.

Before sample collection, both the syringe and needle are flushed with heparin solution (5000 IU/ml, 5 ml) to prevent blood coagulation. Immediately after aspiration, the sample is transferred into a sterile 50 ml tube containing an additional 5 ml of heparin solution and gently mixed to ensure homogeneity. The required volume of bone marrow for cell culture generally ranges between 10 to 25 ml, but in some cases it can reach 100 ml depending on the requirements of the laboratory and the desired therapeutic effect.

For adipose-derived MSC isolation, lipoaspiration is performed using a metal cannula attached to a syringe. A tumescent solution containing a local anesthetic and adrenaline is injected into the target area, which ensures anesthesia, minimizes bleeding, and facilitates aspiration. Through a small incision, the cannula is introduced into the subcutaneous tissue, and several controlled back-and-forth movements are executed to collect 20 – 100 ml of adipose tissue. Following the procedure, an aseptic dressing is applied to the incision site.

2.2.2. Algorithm for culturing autologous stem cells

After the marking, the patient is in the operating room, after the processing of the surgical field is given local anesthesia of the area where the bone marrow will be collected. A 1% solution of lidocaine can be used to anesthetize the access site, after which a Frank needle is inserted and the bone marrow aspirate is collected, maintaining all conditions of aseptic and antiseptic.

The obtained bone marrow aspirate in an amount of at least 20 ml should be placed in a sterile container, with the addition of 5 ml of heparin solution (5000 IU/ml). The container with the bone marrow aspirate and heparin should be closed and placed in a container for transportation containing a large amount of ice.

The work is carried out under sterile conditions of a laminar flow cabinet of biological safety class II. The suspension of pure bone marrow, obtained with the help of a dispenser with adjustable volume, should be selected, transferred to a test tube, labeled and sent for phenotyping by flow cytometry.

The cellular material should be diluted one to one with MEM Alpha medium and mixed. It is necessary to add a heparin solution (5000 IU/ml). Carefully, with a 20 ml syringe, tilting the test tube at an angle of 45°, the bone marrow aspirate with the medium should be added along the wall into previously prepared centrifuge tubes with a histopak solution (with a density of 1.077 g/cm3). The bone marrow aspirate should be centrifuged at 450g for 30 minutes at a temperature of 15C°. After centrifugation, bone marrow is obtained, divided into the following fractions: plasma, mononuclear cells, histopak and erythrocytes. The supernatant liquid in the form of plasma and sediment of erythrocytes should be collected for disposal. The cell suspension of mononuclear cells in the form of a white furrow above the histopak together with the plasma should be transferred to another centrifuge tube with a single solution of DPBS and centrifuged again for 15 minutes. The cell concentration is determined by the routine method in the Goryaev chamber or with an automatic Luna cell counter. After that, the cell suspension should be added to bottles with nutrient medium. During monolayer cultivation, the cultures are gradually cleared of weakly adhesive cells, and on the 5th day of cultivation, uniform cell growth is observed over the entire surface of the culture plastic.

By the 10^{th} – 12^{th} day of cultivation, adhesive cells isolated from the bone marrow form 70 – 80% of the confluent monolayer.

During subculturing, the heterogeneity of the initial suspension gradually decreases and after 3-4 passages, the mesenchymal stem cell culture is represented by a population of predominantly fibroblast-like cells.

During each passage, the number of cells increases by an average of 2 times.

After 4-6 passages, the cells should be removed from the specific medium, preserved and transported in appropriate transport containers at a temperature of 2-8°C for transplantation into the ischemic limb of the patient.

Each obtained preparation of MSC cells from bone marrow should be accompanied by an appropriate biotechnological product passport, which contains information on the total number of cells in the preparation, the number of nucleated cells in the preparation, and the viability of the cells. The number of nucleated cells in the preparations varied from 15 to 40 million cells, and the viability was from 89% to 95%. The cell preparation is diluted in 10 ml of physiological solution before administration.

2.3. Transport of Biomaterial

The collected aspirate – obtained from bone marrow or adipose tissue – is immediately transported to a certified biotechnological laboratory in sterile conditions with controlled temperature. During transport, strict compliance with aseptic standards and biosafety protocols is maintained to preserve cellular integrity and viability. The container is sealed, appropriately labeled, and placed in an insulated carrier containing sufficient ice to maintain a temperature of 2 – 8°C until delivery to the processing facility.

2.4. Isolation of Mesenchymal Stem Cells (MSCs)

Upon arrival at the laboratory, the biomaterial undergoes primary processing aimed at isolating mesenchymal stem cells from the collected tissue. Depending on the source, enzymatic digestion (using collagenase or trypsin) or mechanical disaggregation is applied to separate cellular components. The resulting cell suspension is filtered and centrifuged to obtain a purified MSC fraction.

All manipulations are performed in a Class II biological safety cabinet to ensure sterility and minimize contamination risk. After isolation, MSCs are suspended in a specialized nutrient medium and plated into tissue-culture flasks to allow selective adhesion and colony formation. The adherent cell population, characterized by fibroblast-like morphology, is expanded through multiple passages under controlled culture conditions – typically at 37°C in a humidified atmosphere with 5% CO_2.

2.5. Cultivation and Expansion

The cultivation process aims to achieve a therapeutic MSC dose suitable for clinical application. Cell proliferation is monitored daily, with subculturing performed when the monolayer reaches 70 – 80% confluency. Growth kinetics, morphology, and contamination status are routinely assessed microscopically.

During the entire period of cultivation, the cells are subjected to standardized quality checks, which include:

- Sterility testing – to exclude bacterial, fungal, or mycoplasma contamination;
- Viability testing – via trypan blue exclusion or flow cytometry;
- Phenotypic identification – through surface marker analysis ($CD73^+$, $CD90^+$, $CD105^+$, $CD34^-$, $CD45^-$);
- Functional activity assays – assessing differentiation potential and cytokine secretion profiles.

If a therapeutic dose is not required immediately, the expanded MSCs are cryopreserved in liquid nitrogen using a cryoprotective medium containing dimethyl sulfoxide (DMSO) and serum. This allows for long-term storage while maintaining high cell viability and functionality.

2.6. Preparation for Infusion

Prior to administration, the MSC preparation is thawed (if it is cryopreserved), washed, and resuspended in sterile isotonic saline supplemented with human albumin or equivalent stabilizers. The suspension is thoroughly mixed to ensure uniform cell distribution. Each syringe is labeled with patient identification data, cell count, and preparation date.

Before clinical use, the final product is once again checked for sterility and viability, which guarantees compliance with all regulatory and bioethical standards. The entire process – from collection to administration – is documented in accordance with Good Manufacturing Practice (GMP) and Good Clinical Practice (GCP) guidelines.

2.7. Features of Intramuscular Infusion

Intramuscular administration of MSCs is performed according to a predefined anatomical scheme targeting ischemic muscle regions of the affected lower limb. The injection protocol includes the following key principles:

- Each syringe containing the MSC suspension must be gently agitated before injection to prevent cell sedimentation;
- In cases of arterial occlusion above Poupart's ligament, the suspension is injected into both the thigh and lower-leg muscles;
- When occlusion occurs below the knee joint, injections are restricted to the lower leg;
- The distance between adjacent injection sites should not exceed 6 cm to ensure even cell distribution and optimal therapeutic exposure.

All procedures are conducted under aseptic conditions, with the patient under medical supervision to promptly address any adverse reactions. The MSC suspension is administered slowly to facilitate adequate tissue absorption and minimize discomfort.

2.8. Post-procedural patients support

Following cell administration, patients are carefully monitored to assess the clinical response, identify potential complications and assess the long-term results of therapy. Post-procedural care includes observation of local and systemic reactions, wound healing dynamics, and vascular status using non-invasive diagnostic methods such as Doppler ultrasound and ankle-brachial index (ABI) measurements.

Because the biological effects of MSC therapy develop gradually, the maximal therapeutic benefit typically manifests within 1 – 6 months after treatment. Continuous follow-up enables clinicians to evaluate improvements in perfusion, pain reduction, ulcer healing, and functional mobility, forming the basis for personalized adjustments to rehabilitation protocols.

2.9. Clinical Case Summaries

To illustrate the clinical efficacy of mesenchymal stem cell therapy in patients with chronic critical limb ischemia, several representative cases are presented.

Case 1: Female patient, born 1950, diagnosed with critical limb ischemia (CLI) complicated by left-leg shunt thrombosis and a trophic ulcer of the left foot. Following the intramuscular administration of 100 million autologous MSCs, significant improvement in tissue perfusion and progressive ulcer healing were observed within 3 – 6 months.

Case 2: Male patient, born 1968, with CLI secondary to obliterating atherosclerosis and thrombosis of reconstructed vascular segments of the right limb. After treatment with 100 million autologous MSCs, complete ulcer closure and restoration of skin integrity were achieved at six-month follow-up.

Case 3: Male patient, born 1948, presenting with CLI due to left-leg arterial occlusion and necrosis of the first toe. Administration of 100 million autologous MSCs led to marked improvement in local perfusion and healing of necrotic lesions within three months.

Case 4: Male serviceman, born 1957, with post-traumatic CLI following a gunshot wound. After administration of 23 million autologous plus 30 million allogeneic MSCs, the patient demonstrated 25% reduction in ulcer size at three months and complete healing by six months.

Case 5: Male serviceman, born 1965, suffering from post-gunshot ischemia of the left lower limb and necrotic-ulcerative defects of the right foot. After administration of 100 million autologous MSCs, progressive wound healing was documented within three months, with full recovery achieved after six months.

Across all cases, the therapy was well tolerated with no significant adverse reactions. The outcomes confirm the high regenerative potential of MSCs in promoting angiogenesis, reducing ischemic pain, and facilitating tissue repair even in patients with advanced disease resistant to conventional treatments.

2.10. Autologous MSCs in multidisciplinary rehabilitation

The integration of autologous mesenchymal stem cell (MSC) therapy within multidisciplinary rehabilitation programs represents a crucial advancement in regenerative medicine, particularly for patients with chronic ischemic conditions, traumatic injuries, and degenerative disorders resistant to conventional treatment. The primary objective of such a multidisciplinary approach is to optimize functional recovery through synergistic interactions between biological regeneration and structured physical, pharmacological, and psychological rehabilitation.

2.10.1. Conceptual Framework

The underlying rationale for incorporating MSC therapy into comprehensive rehabilitation protocols is based on the dual regenerative and modulatory effects of stem cells. In addition to direct tissue repair, mesenchymal stem cells have a paracrine effect, releasing a wide range of cytokines, growth factors, and extracellular vesicles that modulate the inflammatory response, stimulate angiogenesis, and enhance endogenous repair mechanisms. These biological effects create a favorable environment for functional recovery, thereby increasing the efficacy of subsequent physiotherapeutic and rehabilitative interventions [11].

In a multidisciplinary clinical context, the application of autologous MSCs is strategically synchronized with a comprehensive array of preformed physical factors and therapeutic interventions [12]. This synergistic model integrates advanced photobiomodulation (laser therapy) and magnetotherapy, which serve as potent biostimulators to enhance the secretome activity of the injected stem cells and optimize the microenvironmental niche for tissue repair [15,16]. The inclusion of ultrasound therapy and electrostimulation further promotes neuromuscular excitability and accelerates the resolution of chronic edema [16] .

A critical component of this integrated strategy is the systematic application of acupuncture (reflexotherapy), which targets the modulation of the autonomic nervous system and provides a robust neuro-psychological framework for pain management [13,14]. These physical and reflexive modalities are harmonized with hyperbaric oxygenation, pharmacotherapy, and personalized kine-

sitherapy (therapeutic exercises) [14-16]. This holistic approach aims not only to accelerate the restoration of impaired tissue perfusion and functional mobility but also to fundamentally transform the patient's psychological resilience and overall quality of life, moving beyond symptomatic relief toward biologically driven systemic recovery and long-term functional reintegration.

2.10.2. Clinical implementation

The rehabilitation program typically begins after confirmation of MSC engraftment and stabilization, usually 7 – 14 days following cell administration [6-9]. The protocol involves:

- Kinesiotherapy, including controlled load-bearing and range-of-motion exercises designed to stimulate microcirculation and prevent muscle atrophy;
- Physiotherapeutic modalities (e.g., magnetotherapy, laser therapy, low-frequency electrostimulation) applied to ischemic or atrophic areas to promote local trophic enhancement;
- Pharmacological support, consisting of vasodilators, antioxidants, and metabolic agents to potentiate microvascular recovery;
- Psychological and neurocognitive rehabilitation, aimed at improving motivation, compliance, and psychosocial adaptation, particularly in patients with post-traumatic or post-amputation syndromes.

2.10.3. Regenerative and functional outcomes

Integration of MSC therapy into rehabilitation programs has demonstrated multifaceted benefits. Morphological restoration is accompanied by measurable functional improvements such as enhanced limb mobility, reduced pain intensity, and revascularization confirmed by imaging and Doppler ultrasound studies. In post-traumatic cases, MSCs promote faster granulation and epithelialization of soft tissue defects, reduce fibrosis, and improve skin elasticity and sensory recovery.

Functional outcomes are objectively assessed using standardized scales, including the Ankle-Brachial Index (ABI), Rutherford classification, VAS (Visual Analog Scale) for pain, and Wound Healing Score. In the majority of observed cases, a gradual increase in ABI by 0.1 – 0.25 units, pain reduction by 2 – 4 points on the VAS, and full epithelialization of trophic ulcers within 4 – 6 months were documented.

2.11. Methodology and strategy for clinical implementation of the regeneratively oriented rehabilitation model

2.11.1. Clinical and ethical considerations

From an ethical and procedural perspective, all interventions are carried out under strict compliance with the Helsinki Declaration (2013 revision), national bioethical standards, and internal institutional protocols. Each patient provides written Informed Consent prior to participation, confirming understanding of the experimental nature of therapy and potential risks. Autologous MSCs are preferred whenever possible to minimize immunogenicity and ethical controversy.

The introduction of this combined therapeutic model has contributed to a paradigm shift in rehabilitation medicine – from symptomatic treatment to biologically driven functional restoration, offering new prospects for patients with otherwise untreatable ischemic or post-traumatic sequelae.

2.11.2. Study design and patient population

This study was conducted as a prospective, non-randomized clinical investigation aimed at evaluating the safety and efficacy of autologous mesenchymal stem cell (MSC) therapy in patients with chronic critical limb ischemia (CCLI) of various etiologies. The trial was approved by the Institutional Bioethics Committee and performed in accordance with the Helsinki Declaration (2013 revision) and Good Clinical Practice (GCP) guidelines.

A total of 42 patients (29 males, 13 females; age range 46 – 78 years, mean age 61.3 ± 8.7) with advanced ischemic lesions (Rutherford stages 4 – 6) were enrolled between 2021 and 2024.

Inclusion criteria comprised:

- documented ischemia of the lower extremities, which is not amenable to traditional;
- absence of revascularization options;
- absence of severe systemic infection, active malignancy, or hematologic disorders;
- signed informed consent.
- Exclusion criteria included:
- decompensated heart failure (NYHA class IV);
- uncontrolled diabetes mellitus;
- coagulopathy or platelet disorders;
- pregnancy or lactation;
- inability to comply with follow-up.

2.11.3. MSC collection and processing

Autologous MSCs were obtained from bone marrow aspirate (n = 30) or adipose tissue (n = 12) following standard aseptic procedures. The harvested material was transported under temperature-controlled conditions (2 – 8 °C) to a certified GMP-compliant laboratory.

Cell isolation was achieved using density gradient centrifugation (Histopaque 1.077 g/cm^3) followed by selective culture expansion in Minimum Essential Medium Alpha (MEM-α) supplemented with 10% fetal bovine serum, 2 mM L-glutamine, and antibiotics. Cells were incubated at 37 °C in a humidified 5% CO_2 atmosphere, with media replacement every 3 – 4 days.

Cultures were expanded to 3 – 5 passages, achieving a final yield of 15 – 100 million MSCs per patient, depending on indication and clinical protocol. Each batch was evaluated for viability (>90%), sterility, and phenotypic markers ($CD73^+$, $CD90^+$, $CD105^+$, $CD34^-$, $CD45^-$). All procedures were documented according to GMP quality assurance standards.

2.11.4. Administration protocol

Before the administration of the drug, patients were premedicated (antihistamines, glucocorticosteroids, paracetamol, anticoagulants), tailored to individual tolerance and comorbidities. MSCs were suspended in sterile saline (10 ml) and injected intramuscularly into ischemic zones of the affected limb according to the anatomical scheme

In cases of occlusion above Poupart's ligament, injections were performed into the thigh and lower leg; if occlusion was below the knee, only the lower leg was treated. The distance between in-

jection sites did not exceed 6 cm, ensuring homogeneous cell distribution (introduction of a suspension of mesenchymal stem cells produced by the biotechnology laboratory of the umbilical cord blood bank, cells from other human tissues of LLC "Medical Center M.T.K."). Each procedure was performed under aseptic conditions and ultrasound guidance. The introduction of the biological product was carried out at the REOCELL clinic (Ukraine, Kyiv) [17].

2.11.5. Follow-up and outcome assessment

Patients were monitored over a 6 – 12-month period, with follow-up visits at 1, 3, 6 and 12 months of post-treatment period. Evaluation included clinical, hemodynamic, and imaging assessments:

- Ankle-Brachial Index (ABI) measurements to assess perfusion;
- Doppler ultrasonography to visualize arterial flow restoration;
- Photoplethysmography for microcirculatory analysis;
- Pain intensity (VAS scale) and Rutherford classification for functional evaluation;
- Ulcer healing score and wound photography for objective monitoring;
- Laboratory safety parameters (CBC, liver and renal function tests) at each stage.

Adverse events were recorded, classified, and analyzed according to Common Terminology Criteria for Adverse Events (CTCAE v5.0).

2.12. Results

2.12.1. Safety and tolerability

All patients tolerated MSC therapy without serious adverse events. During the first 24 – 48 hours, mild, transient effects such as local pain at the injection site (19.0%) and low-grade fever (11.9%) were observed, which resolved spontaneously without intervention. No allergic, thromboembolic, or infectious complications were reported throughout the follow-up period.

Laboratory analyses showed no significant deviations from baseline hematological or biochemical parameters, confirming the high safety profile of autologous MSC therapy.

2.12.2. Efficacy Outcomes

At the 3-month follow-up, 85.7% of patients exhibited measurable improvement in peripheral perfusion. The mean Ankle-Brachial Index (ABI) increased significantly from 0.39 ± 0.09 to 0.56 ± 0.12 ($p < 0.001$), with a further progressive rise to 0.64 ± 0.14 by the 6-month mark. Doppler imaging identified newly formed collateral vessels in 68% of subjects, demonstrating the angiogenic potential of autologous mesenchymal stem cells (MSCs) within the multidisciplinary rehabilitation protocol

Pain intensity according to the visual analog scale decreased from 8.2 ± 1.1 at the initial level to 4.3 ± 1.4 after 3 months and to 2.6 ± 1.0 after 6 months. In parallel, the Rutherford classification improved by 1 – 2 stages in 76% of patients.

Trophic ulcer healing was documented in 34 of 37 patients presenting with ulcerative defects at baseline:

- Complete epithelialization – 59.4%;

- Partial reduction (≥50% of area) – 32.4%;
- No change – 8.2%.

In patients with necrotic tissue, demarcation and granulation were observed within 2 – 4 weeks post-therapy, followed by epithelialization within 3 – 6 months.

2.12.3. Functional and rehabilitation outcomes

Integration of MSC therapy into individualized rehabilitation programs resulted in significant functional gains. Objective improvements included:

- increased walking distance (from 45 ± 12 m to 115 ± 30 m by 6 months);
- restoration of voluntary limb movement;
- reduction in trophic edema and cyanosis;
- enhanced muscle tone and tissue elasticity.

Subjective patient-reported outcomes also improved, including reduced fatigue, enhanced thermal sensitivity, and improved quality of life scores on the SF-36 scale ($\Delta = +18.7\%$, $p < 0.01$).

2.12.4. Long-term observations

At the 12-month follow-up, therapeutic benefits persisted in 80% of cases. Only three patients experienced partial relapse of ischemic symptoms, primarily associated with progression of atherosclerotic disease rather than failure of MSC therapy. Importantly, no malignant transformations, ectopic tissue growth, or immune reactions were detected on long-term observation.

Histological analyses of biopsy samples (in two volunteer cases) revealed increased capillary density and reduced fibrosis in the treated regions compared with controls. These findings corroborate the regenerative and angiogenic potential of MSCs in ischemic tissues.

2.13. Discussion

The findings of this clinical investigation substantiate the regenerative and therapeutic efficacy of autologous and donor mesenchymal stem cell therapy as a viable adjunct or alternative to conventional treatment modalities in patients with chronic critical limb ischemia . The results confirm the safety profile, angiogenic potential, and long-term functional benefits of MSC-based therapy, particularly when integrated into comprehensive multidisciplinary rehabilitation programs.

2.13.1. Interpretation of Key Findings

The consistent improvement in hemodynamic indices (ABI increase, Doppler-confirmed neovascularization) and functional outcomes (pain reduction, ulcer healing, limb mobility) highlights the biological efficacy of MSCs in promoting angiogenesis, vasculogenesis, and tissue remodeling. These results align with previously reported studies [3-10], demonstrating that MSCs secrete proangiogenic cytokines (VEGF, FGF-2, PDGF) and exert immunomodulatory effects that restore tissue homeostasis.

The observed progressive improvement over several months post-injection suggests a sustained paracrine and regenerative activity of the transplanted cells rather than an immediate

pharmacological effect. This gradual therapeutic response corresponds to the period of vascular network formation and extracellular matrix remodeling.

From a mechanistic standpoint, the dual regenerative – modulatory action of MSCs – direct participation in neovascularization and indirect stimulation of resident progenitor cells – appears to be the cornerstone of clinical efficacy. The anti-inflammatory and anti-fibrotic effect of cells also contributes to the improvement of the tissue microenvironment and the increase in the effectiveness of physical rehabilitation.

2.13.2. Comparative and clinical context

Compared to conventional revascularization techniques (angioplasty, bypass grafting), MSC therapy provides a minimally invasive, autologous, and ethically acceptable alternative for patient's ineligible for surgery. The absence of serious complications and the possibility of achieving clinically significant results even in cases where other treatment options are not available position mesenchymal stem cell therapy as a revolutionary approach in regenerative vascular medicine.

Importantly, the integration of MSC administration into a structured rehabilitation protocol markedly enhances the therapeutic impact. Functional recovery, muscle tone restoration, and psychosocial reintegration were significantly accelerated in patients who continued active physiotherapy and medical supervision following stem cell infusion. This emphasizes the need to consider therapy using mesenchymal stem cells not as an isolated intervention, but as a biologically active component of an interdisciplinary approach to treatment.

2.13.3. Limitations and future directions

Despite the promising results, it is necessary to recognize a number of limitations. The study cohort was relatively small, and the absence of a randomized control group restricts definitive statistical validation. Furthermore, while autologous MSCs demonstrated high viability and reproducibility, the variability in tissue source (bone marrow vs. adipose) may introduce differences in cellular potency.

Future research should aim to:

- develop standardized MSC dosing protocols and administration schemes;
- investigate the molecular mechanisms of MSC-mediated angiogenesis in ischemic tissues;
- evaluate long-term (>3 years) safety outcomes, including genomic stability;
- explore combination strategies involving MSCs and biomaterial scaffolds, exosomes, or gene-modified cells to enhance efficacy.

To confirm these preliminary observations and to facilitate their introduction into standard clinical practice, large-scale multicenter randomized studies are necessary.

2.14. Conclusions

Autologous mesenchymal stem cell therapy represents a safe, feasible, and biologically effective method for treating patients with chronic critical limb ischemia and related ischemic pathologies resistant to conventional interventions.

The administration of MSCs induces angiogenic and regenerative responses, leading to restoration of local blood flow, pain reduction, and accelerated healing of trophic ulcers.

Integration of MSC therapy into multidisciplinary rehabilitation заprograms significantly improves functional recovery, demonstrating a synergistic effect when combined with physiotherapeutic, pharmacological, and psychological interventions.

The therapeutic efficacy of autologous MSC transplantation is significantly enhanced by a personalized multidisciplinary rehabilitation protocol. The strategic integration of preformed physical factors – specifically ultrasound and laser-magnetic therapy – alongside acupuncture (reflexotherapy) during both pre- and post-injection periods optimizes the regenerative niche, facilitates angiogenic activation, and provides sustained modulation of chronic pain syndromes.

The procedure demonstrated high tolerability and absence of serious adverse effects, supporting the safety of autologous MSC transplantation under GMP/GCP standards.

The therapeutic efficacy observed over 6 – 12 months confirms the sustained biological activity of MSCs and validates their clinical applicability as a regenerative modality in modern vascular medicine.

These outcomes collectively support the inclusion of autologous MSC therapy in the national clinical framework for advanced regenerative and rehabilitative care for patients with chronic ischemic disorders.

2.15. Practical recommendations

1. Patient selection.

Therapy with the use of mesenchymal stem cells should be considered for patients with HLIP stages 4 – 6, unresponsive to pharmacotherapy and not suitable for surgical revascularization. Pre-treatment evaluation must include vascular imaging, laboratory screening, and assessment of comorbid conditions.

2. Cell source and processing:

To minimize immunological risks, it is recommended to use autologous mesenchymal stem cells obtained from bone marrow or adipose tissue.

All manipulations with cells must be carried out at a certified enterprise that meets GMP standards, with strict adherence to biosafety and quality control protocols.

3. Therapeutic administration:

The optimal therapeutic dose ranges from 30 to 100 million viable MSCs, delivered via intramuscular injection into ischemic zones according to the anatomical distribution of vascular lesions.

To ensure accuracy and safety, the procedure should be performed under ultrasound control.

4. Rehabilitation integration:

Post-infusion rehabilitation is mandatory, encompassing physiotherapy, hyperbaric oxygen therapy, and pharmacological support.

Regular follow-up (after 1, 3, 6, 12 months) is important for assessing the functional state and early detection of complications.

5. Documentation and ethics:

Complete clinical documentation, including laboratory certificates confirming the quality, sterility and viability of mesenchymal stem cells (MSCs), must be attached to each case.

All procedures require the patient's informed consent and compliance with ethical standards established by national and international regulations.

6. Research and standardization:

To improve therapy based on MSCs, it is extremely important to continue cooperation between clinicians, bioengineers and cell biologists.

The development of standardized protocols will facilitate reproducibility, safety, and scalability of clinical application across healthcare institutions.

2.16. General Summary

The conducted research confirms that the therapeutic use of autologous mesenchymal stem cells (MSCs), when properly standardized and ethically implemented, holds the transformative potential to revolutionize the management of chronic ischemic and complex post-traumatic conditions. This investigation underscores that the clinical success of regenerative medicine is not solely dependent on the cellular substrate, but rather on the integrated therapeutic environment in which these cells function.

By merging advanced cellular regeneration with a personalized multidisciplinary rehabilitation framework, this approach effectively bridges the critical gap between cellular-level biological repair and systemic clinical recovery. A key finding of this summary is the fundamental role of preformed physical factors – specifically laser-magnetic therapy and ultrasound – which, when synchronized with acupuncture (reflexotherapy), act as essential modulators of the regenerative niche. These modalities facilitate a "priming" effect on ischemic tissues, enhancing the paracrine activity of MSCs and ensuring the stability of the anti-nociceptive response.

Consequently, the proposed model transitions from a traditional symptomatic focus to a biologically driven functional restoration strategy. This integrated paradigm stands as a cornerstone principle of contemporary regenerative medicine, offering a scientifically grounded pathway for the comprehensive physical and psychological reintegration of patients facing severe vascular and traumatic challenges.

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CHAPTER 3

INNOVATIVE PRINCIPLES AND TECHNOLOGIES OF LASER AND MAGNETOLASER THERAPY IN REHABILITATION PRACTICE

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This section focuses on the clinical application of laser and magnetolaser therapy in the treatment and rehabilitation of patients suffering from combat-related injuries, chronic pain syndromes, and stress-induced disorders. The presented materials integrate physiological, anatomical and pathophysiological aspects of the selection of zones of therapeutic influence on the basis of metameron-segmental and systemic principles [1,2].

Special attention is paid to the methodology of transcutaneous and transcranial laser exposure, magneto laser blood irradiation, and scanning laser techniques. The chapter provides detailed clinical guidelines, dosage parameters, and safety considerations for applying multifunctional laser systems in both inpatient and outpatient rehabilitation practice.

Practical recommendations are supported by clinical observations and experience in using these technologies in multidisciplinary rehabilitation centers for war victims [1-6].

3.1. The principles of choosing zones of influence in laser therapy

The selection of therapeutic zones is based on the localization of pathological processes, functional interconnections between organs and tissues, and neuro-reflex mechanisms. Correct zoning ensures targeted photobiomodulation and maximizes clinical outcomes [5-8].

In modern literature on physiotherapy (PT) the main attention is paid to studying the mechanism of action of physical factors, their parameters and to various theoretical aspects of a problem.

The importance of these questions does not raise doubts, at the same time out of due consideration of researchers there is a choice of zones of influence, specificity of the answer at stimulation of this or that area, adequacy of parameters and the factor of influence of a goal and to physiological features of functioning of area or system on which influence is carried out.

Chinese acupoint physiotherapy (physio-puncture) more than 3 thousand years ago raised questions (and successfully solves them) about the place of influence (the choice of points, acupuncture zones), influence time (optimum time of procedure, i.e. the accounting of seasonal, intra-day and other rhythms) and the way of influence providing a method and force of stimulation, a physical factor (acupuncture, an acupressure, warming up or cauterization, etc.). All these ques-

tions remain relevant for modern physiotherapy. Let's stop in more detail on possible options of the choice of zones for multipurpose laser therapy (MPLT).

One of the simplest and sufficiently effective ways of the choice of zones in MPLT is the impact directly on the disease center. For example, in case of lumbago – on painful areas, in case of pathology of the bronchopulmonary system – inhalation, in case of diseases of the hepatobiliary system – in areas of the liver and gall bladder, in case of changes in the knee joints (gonarthrosis) – in the knee joints, etc. A similar approach is widely used in MPLT, however it does not consider pathogenetic mechanisms of developing an illness, and, therefore, does not give the chance to influence more effectively the course of the pathological process. For example, at a gonarthrosis the importance in its development are the vegetative segmentary structures (L1-L3) which are the trophic centers of an innervation of knee joints. Naturally, an additional impact on the corresponding segmentary education, in addition to direct impact on the pathological center will be more effective.

This principle of the choice of zones in practice of FT received the name of metameric or segmentary (metameric-segmentary). The modern approach to physiotherapy is based on the principle of using three main zones, the "three whales": the Zakharyin-Geda zone, as well as the cervical-collar zone and the lumbosacral region. The optimality of choosing these zones has been proven theoretically and confirmed with numerous clinical results.

3.2. Zakharyin-Ged zones and the metameric-segmental principle of the choice of zones in physical therapy

Therapeutic influence on metameric and reflex zones related to visceral organs provides an effective neurophysiological pathway for modulation of pain, muscle tone, and vascular function.

Priority in the description of special zones on a body of the person belong to one of founders of the Russian therapy G.A.Zakharyin, who for the first time clinically found parts of the body with the changed sensation of pain. In the clinical supervision he paid attention to the circumstance that in the presence of pathological processes in internals, the pain proceeding from them often is projected on certain sites of skin. It described the phenomenon of pain, determined by palpation pressing and frequent existence of a hyperalgesia in these sites.

Though so far in the mechanism of emergence of zones of Zakharyin-Ged a lot of things remain not quite found out, nevertheless in pathogenesis of their formation anatomic-functional (metameric) communication between skin and internals via the segmentary device of a spinal cord matters. At the same time, the functional state of the central nervous system (CNS) plays a certain role in the process of their occurrence.

From the modern point of view, the Zakharyin-Ged zone can be considered as a zone with altered sensitivity of the skin and other tissues, that is, with a metameric character, a difficult vasomotor, motor, and trophic reflex, which is a metameric projection of the diseased internal body onto the skin. Pathological changes, skin conductivity, skin temperature, and disorders of surface sensitivity in the form of hyper- or hyperalgesia, as well as changes in the intensity and structure of sweating are revealed in the Zakharin- Ged zones upon palpation.

At the same time, the sizes of zones, their firmness, nature of changes of sensitivity and conductivity can serve as an important clinical indicator in the definition of dynamics of a disease.

However, the value of these zones is important not only for diagnostics, but also for various options of physical therapy. Impact of a physical factor on a concrete Zakharin-Ged zone allows it

to exert impact selectively on a functional condition of a particular organ. Actually, we have an opportunity to direct irritation in the ways «blazed» by an illness, i.e. a peculiar principle of the return influence on information channels is noted: a certain internal body – a certain site of skin, and, on the contrary. Undoubtedly, similar functional communication is carried out by means of the segmental device of the spinal cord.

The community of a vegetative and segmentary innervation of internal bodies and certain metamere (i.e. when as a source of an innervation of any internal body and defined a metameric serve the same segments or the same vegetative structures) is the cornerstone of the metameric-segmentary principle of PT.

Close ties of somatic and vegetative structures at the level of a spinal cord create prerequisites for switching of nervous impulses from somatic department on vegetative and vice versa. For example, impact on metameric of D11-L1 can influence key parameters of functioning of a kidney and adrenal glands.

A similar metameric principle of action of "small" physiotherapy was also described by M.N. Lapinsky and opened by the classics of physiotherapy A.E. Shcherbak and A.R. Kirichinsky. He discovered the application in practice of national doctors of the East on use of so-called alarm points or points of heralds (it nothing else as epicenter of Zakharin-Ged zones) and sympathetic points (the last are located in the same metamere, as internals at which diseases impact on them is recommended).

At the considerable power of a physical factor, the initial response of an organism is caused by neuro-reflex and humoral mechanisms. In these cases, at a threshold or supraliminal value of incentive the segmentary device with inclusion of VNS, and through the last – internals is involved in response. Most likely, the medical effect of impact on Zakharin-Ged zones, the points heralds (alarm), trigger points, just painful points have the similar mechanism, i.e. the metameric-segmentary principle in the basis.

However, convergence of a somatic and visceral afferentation happens not only on neurons of a spinal cord, but also on neurons of a reticular formation, trunk of a brain, a hypothalamus, thalamus and bark of a big brain. These facts are a physiological basis for explanation of efficiency of PT of the visceral pain and other pathology. In these cases, it is about multilevel nervous regulation of functions, i.e. about the system principle of influence in PT.

3.3. System principle of the choice of zones of influence

This principle considers the organism as an integrated system. Stimulation is directed both locally and systemically to restore balance between the nervous, endocrine, and immune systems disrupted by trauma or chronic stress.

In the course of evolution, a multi-level system of regulation of the same functional and dynamic system arose (a special margin of stability of the system, presupposing the existence of 3 or more levels of its regulation). Similar facts formed the basis of the doctrine of P.K.Anokhin and his pupils about functional systems [1-5]. These authors understand the dynamic, self-regulating organizations which are selectively uniting various bodies and subsystems of nervous and humoral regulation for achievement certain, usually useful to an organism, results as functional systems. The breathing system can be an example of the multilevel organization of system. In which it is allocated:

- the motor cortex, providing a conscious (arbitrary) performing respiratory movements, cough;

- the respiratory center of the medulla oblongata, which regulates involuntary (automatic) breathing;
- the segmental apparatus of the spinal cord, providing vegetative-trophic functions as the lightest, and the corresponding nerves and muscles;
- the respiratory muscles and the nerves innervating them;
- the circulatory system;
- the lungs itself and the respiratory tract.

It is quite obvious that the treatment of diseases of the respiratory organs is important, since the effect on different levels (and not only on one!) can be focused on one or another level depending on the cause of the disease.

The system principles of the organization of sensitive (cerebral cortex – subcrustal and stem educations, including a visual hillock – segmentary formations of a spinal cord – spinal ganglia and peripheral nervous receptors) and motive functions are not less indicative (a cerebral cortex – subcrustal educations – a brain trunk – segmentary formations of a back brain – peripheral nerves and bone-muscle-joint apparatus [7-10].

It is natural that at construction of medical and rehabilitation programs it is necessary to consider this principle of the organization of functions of the nervous system.

Thus, a multi-level, systemic approach in rehabilitation of post-stroke patients promotes «association of the separated functions». For example, electrostimulation of paretic muscles (mainly antagonists to spastic) not only prevents their hypotrophy, but also exerts positive impact on neurodynamics of the brain. Impact on subcrustal and stem structures (an electro-dream, central electro-analgesia, an endonasal electrophoresis of delargin or vitamin E on a dimexide, etc.) promotes decrease in a tone of muscles that, apparently, is explained by gradual restoration of cortical and subcrustal relationship, and active influence on reticular-spinal and other ways that define a muscular tone.

Concerning the raised muscular tone, it should be noted that, at many diseases of CNS the spasticity becomes one of the main problems interfering with restoration of motive function [8-11].

A number of modern electrophysiological researches executed at patients with a spasticity showed that the last is not result of violation of any system or any neurophysiological mechanism, and is caused by the whole complex of violations at various levels of functional motive system, though is realized mainly at the segmentary level (a hyperactivity of spinal a-moto-neurons, change of excitability in neuronal ring chains of a spinal cord, pathological strengthening of polysynaptic reflexes, etc.).

The multilevel (systemic) principle of regulation of a muscular tone explains the need of adequate approach for its decrease at CNS pathology, for example, at cerebral spastic infantile paralysis:

- the impact on motor departments of the cerebral cortex, subcortical -stem structures;
- the segmental apparatus of the spinal cord and autochthony muscles of a trunk (the last is provided with a bilateral innervation formation of striopallidar system – from what there are practically no paralyzes of muscles of a trunk) and – on paretic extremities.

A similar approach is realized by V.I.Kozyavkin in the treatment of cerebral spastic infantile paralysis, called it by a polysegmentary method, where, probably, the main role in medical effect is provided with adequate manipulations on all departments of a backbone and its muscles (autochthony muscles, the segmentary device of a spinal cord and stem structures of a brain, the last due to manipulations on a cervical cranial joint) and the general kinesis therapy [11-13].

Application of adequate physical factors (for example, for example, magnetic therapy (MT) of a certain frequency – ion-parametric MT) in the medical rehabilitation of patients with diseases of CNS contributes also to normalization of ionic exchange processes in neuron, first of all due to reduction of carrying out in a cage of Ca2-physical blockade of calcic channels that promotes reduction of excitement of motor-neurons, and according to a spasticity and a flexor spasm.

According to some authors, the antispastic effect of MT surpasses many known antispastic drugs. At the same time, the majority of medications means, as a rule, affects any one link of the pathological system. A significant drawback of antispastic drugs is also the strengthening of the weakness of paretic muscles, which leads to the ineffectiveness of the treatment of impaired motor function after a stroke.

Systemic and multilevel approach is necessary not only at the medical rehabilitation (MR) of patients with CNS diseases, but also at damages of a peripheral part of the nervous system. So, with the consequences of injuries of nervous trunks, polyneuropathy, impact on motive system needs to be carried out at the following levels [14-18]: affected (denervated) muscles, the damaged nervous trunk or nervous trunks; segmentary level, that is segments of a spinal cord which neurons form axons of the corresponding nerves; the suprasegmental centers, that is the afferent centers of a brain, impact on which promote faster regeneration of peripheral nervous structures. In similar cases, it is also important to affect symmetrical zones not of the affected (healthy) party therefore through intersegmental communications (the left and right segments) there is a stimulation of segments of affected nervous structures.

A similar approach in PT can be called multilevel systemic, providing impact on various levels of the functional system and promoting «association of the separated functions». Such an approach can be realized only by methods of physical therapy and is, almost, unrealizable by application of medicinal therapy.

The systemic principle in PT explains a possibility of compensatory reactions of an organism at various pathological states and makes a basis of a sanogenesis [19-20].

This also gives to the doctor the grounds for the choice of optimum zones of influence: in one case the influence on the segmentary apparatus and the struck body is enough, in the other, the connection of stem or cortical departments of a brain or their combination is required.

Analyzing modern approaches to the selection of zones of influence in PT, it is necessary to take into account the dualistic (systemic and anti-systemic) principle of regulation of any function, that is the many phenomena in biology are dual: compensation – decompensation; assimilation – dissimilation; stress – protection; adaptation – disadaptation; prevalence of a tone of sympathetic department of VNS or parasympathetic; pain system – anti-pain action; a depression – euphoria, etc [21-24].

At the same time, in many cases of PT the influence not on a pathologically changed system is preferable but on physiologically safe anti-system.

These data are successfully used in the treatment of painful syndromes when using through-the-skin electro-neuro-stimulations (TENS); we excite mainly the antinociceptive system and that pain is suppressed. It is also important to represent that the activation of neurons of the pain system can arise without direct influence of harmful incentive, and at artificial (often after long reception of some drugs) or natural oppression of activity of anti-pain system: violation of processes of an exchange of serotonin, processes of synthesis of opiate peptides, change of an emotional tone, etc [25-27].

This mechanism of pain development of central origin (suppression of the activity of antinociceptive system) is the cornerstone of the emergence of pain at the masked (latent) depression and disappearing at prescription of antidepressants or adequate methods of physical therapy (an electro-dream, the central electro-analgesia, etc.).

Unfortunately, it should be stated that systemic and systemic-anti-systemic principles in PT remains a little demanded and poorly studied. In east medicine, these principles found broad application in peculiar rules and the theory of 5 primary elements (U-SHIN balance). These rules accurately regulate the relationship of various bodies or systems, for example, of heart and liver, liver and spleen.

Knowledge of these rules helps the doctor to be guided freely in the choice of systems (anti-systems) in each case and, except impact on the pathological system, to choose that system which can help «sick system». Concerning, so-called zonal PT, when the physical influence to be carried out by a factor directly on a projection of necessary body or its certain part, it should be noted a certain progress in this regard [28-30].

For example, pulmonary tuberculosis, which was detected for the first time, demonstrated the effectiveness of using low-frequency ultrasound to detect focal changes in the lungs in combination with anti-tuberculosis chemotherapy. N.V.Karmazina convincingly proved prospects of influence by various physical factors on a spleen for their immunomodulatory influence, and a technique of metaphysical therapy to become classical. There are certain practices on direct stimulation by physical factors of endocrine glands.

Here it is pertinent to remind that in Hindu medicine impact on so-called chakras (in its majority is the skin projection of endocrine glands) is attached special significance with the choice of a certain color for their stimulation (electromagnetic radiation of a certain wavelength) [30-33].

So, the "sexual chakra" (gonads, 1st chakra, chest area) must be influenced by red color; on the chakra located in the middle between the chest and navel (adrenal stimulation, 2nd chakra) – orange; yellow; on the thymus (4th chakra) – green; on the thyroid gland (5th chakra) – blue; on the pituitary gland (6th chakra) – blue; on the pineal gland (7th chakra) – purple or white [33-35]. For decrease the function of a particular gland, we influence opposite (opponent according to Goering) color, i.e. causing opposite reaction (photoreactivation) is required. For example, with hyperfunction of the thyroid gland wearing amber (yellow) beads, this color just is popular and it is an opponent to the blue, stimulating this iron.

3.4. Special or specific zones of influence and their choice in physiotherapeutic practice

Special attention is paid to trigger zones, acupuncture points, and areas of maximum tissue reactivity. Their stimulation enhances regenerative processes and normalizes microcirculation.

In physiotherapy, as was noted above, along with impact on local zones or the center of defeat, is used the choice of the zones based on the systemic, systemic and anti-systemic and metameric-segmentary principles. Already known methods are also used, and new methods of phototherapy are being developed using special or specific areas of exposure [33-35].

So, the cervical and lumbar sections of the spine, the effects of which have been most widely used in physiotherapy, have already been mentioned.

The "authority" of the lumbar area, the impact of which is recommended in the treatment of

many diseases, is based on the influence of the majority of physical factors on function of kidneys and adrenal glands. This principle to a certain extent displays possible reactions of data of bodies in response to their stimulation or stimulation of segmentary zones of their innervation. It becomes clear why the lumbar area is one of the whales of physical therapy [36-38].

Impact on a cervical-collar area and a cervical sympathetic chain, first of all on upper cervical sympathetic ganglia (UCSG), is indicated for use at various diseases of the brain. This is due to the specificity of these zones in relation to function of the brain, its metabolism, cerebrospinal fluid and hemodynamic. It is known from classical neurology that the vegetative centers of segments of a spinal cord (C8-Th2) are the main source of vegetative (sympathetic) providing the head in general and skull contents in particular, including vessels, vascular textures of ventricles of a brain, etc. A peculiar disposer of this innervation in humans is UCSG to which fibers come from vegetative segments (C8-Th2) of a spinal cord. From the last upper cervical sympathetic ganglia, the conductors of autonomic sympathetic afferentation, descending perivascularly into the structure of the external and internal carotid arteries and contacting the autonomic nodes of the face (pterygoid-palatine, auricular, ciliary, and submandibular arteries), go to the structures of the face and brain. At the same time, separate vegetative fibers from the knot enter back roots of the C1-C4 segments and through a cervical between ganglion branches – to the Th1-Th4 segments. It turns out that there is a kind of feedback: C8-Th2 segments form UCSG, and on the specified fibers the kind of feedback arrives from it, actually, to the same segments. Really, the cervical-collar area is a whole one. It is also necessary to emphasize that the second way of vegetative sympathetic providing the head and contents of a skull is the perivascular vegetative texture of a vertebral artery [39-41].

Therefore, the only source of sympathetic innervation of the head are lower cervical and upper chest segments of a spinal cord, its lateral, vegetative horns which in the specified ways go to a brain and other formations of the head. From there is clear an importance of impact on a cervical-collar area.

Let's stop in more detail on the UCSG function and possible mechanisms of action of physical factors at its stimulation.

In 1930 E.A.Asratyan noted the change of development of food conditioned reflexes at UCSG extirpation in dogs. Later, these data were confirmed by other researchers. In a number of pilot studies and clinical supervision the role of the sympathetic nervous system, and in particular UCSG, in autoregulation of brain blood circulation was shown.

It is known that neurogenic, metabolic and myogenic factors play a leading role in the mechanisms of regulation of cerebral circulation, including venous circulation. At the same time, in neurogenic regulation major importance belongs to intracerebral noradrenergic systems (stem structures of a brain, a blue spot, etc.) which exert considerable impact on the UCSG. A change in blood circulation in the vascular textures of ventricles of a brain is connected the hypo- or hyper-production (secretion) of liquor at UCSG pathology.

These data were confirmed with long experiments of electric stimulation of UCSG. There are works demonstrating a change of maintenance of RNA, activity of RNA – elements in subcellular structures of a brain and disappearance of noradrenaline in pineal gland after removal of the UCSG.

In a detailed experimental work, G.A. Sokolova and co-authors (2009) showed the role of UCSG on specialized regulation of a power exchange of a brain and its bark. The authors emphasize that intensive synthesis of proteins, polypeptides, neurotransmitters and other metabolites can be ensured only with continuous power supply in synapses, as well as possible participation of synapses in the transmission of nerve impulses.

The provided data substantially explain the importance of use in PT of the C8- Th2 segments and UCSG zone through which it is possible to influence blood circulation of a brain and its power processes actively. It is also necessary to notice that the cervical-collar area and the specified segments are the source of a sympathetic innervation (through star-shaped knot) bodies of a thorax, including heart. It is not surprising that impact on a cervical-collar zone is one of the most popular in PT, which is one of her "whales" [41-43].

3.5. Transcerebral techniques

Transcerebral laser therapy affects deep brain structures involved in pain regulation, emotional balance, and neuroplasticity. It is applied in patients with post-traumatic stress disorder, neurogenic pain, and sleep disturbances.

The impact on area of a scalp and face by various physical factors was included strongly into practice of PT. One of them (an electro-dream, the central electro-analgesia, an endonasal electrophoresis and an electrophoresis according to Bourguignon) became classical; other options (impact on specific zones of a scalp) are actively developed. The impact on area of a scalp has its own features both from the point of view of the choice of adequacy of a physical factor and its parameters, and area of influence.

So, for example, the endonasal technique and Bourguignon's technique are unique for the reason that at an electrophoresis of medicinal substances through these zones there is an opportunity for medicine to pass the blood-brain barrier. Certainly, these data are considered in clinical practice, however their further improvement is also necessary: studying of a possibility of expansion of quantity of the drugs used in these techniques, options of the combined endolumbar and endonasal introduction of drugs at a serious neurologic illness, etc [1-6].

The technique of transcerebral influence deserves special attention, when, depending on the used physical factor and its parameters it is possible to gain the most various therapeutic effects: analgesic, vasoregulating, immunomodulatory, hormone-regulating, anti-depressive, etc.

Transcerebral techniques of a physiopuncture with «aim» impact on necessary zones of a cerebral cortex (motive, sensitive, etc.) or other functionally important structures are prospective. For example, impact on parasagittal area and projection of the big tank of a brain [3-5].

The choice of the specified zones is explained by the following facts. The parasagittal area in the projection corresponds to the top sagittal sine, there is a considerable concentration of arachnoid villi, and the top (big) anastomotic vein (Trolyar's vein) and parietal emissary vein are localized. These anatomic structures have a direct bearing on venous blood circulation of a brain and cerebrospinal fluid resorption.

The specified zone is important also in other aspects. So, according to Eastern medicine (the epicenter of the parasagittal zone) the important power zone – a point T(XIII)20 or a specific chakra is localized here (by Hindu medicine).

The functional importance of this area has been confirmed by modern research. In the review of literature devoted to melatonin and its role in neuroimmunology S.K. Yevtushenko (1997) pays attention that the pineal gland (epiphysis) is put embryologically in this zone. The role of this gland is fixedly studied now by many scientists. However, it is now known that the gland secretes two important hormones – epithalamin and melatonin. The source of melatonin formation is pinealocyte serotonin, which is constantly contained in the pineal gland of mammals and also in larger quantities

than in other organs. Melatonin on pharmacological properties is less active than serotonin, however its sedative impact on CNS is expressed stronger. The activating effect of serotonin is caused by excitement of serotonin-reactive systems of a reticular formation of the caudal part of a midbrain and the pons. These nuclei, in turn, send the long descending axons to a spinal cord. This serotonergic system probably plays the greatest role in modulation of a nociception, and in total with hormones of an epiphysis and on mood of the person (depressions considerably depend on dysfunction of epiphysis).

These facts also explain the results of high efficiency of phototherapy with the white color of many depressions.

The pineal gland actively influences the body's biorhythms, immune status, and pituitary function. It is interesting that the known fact of influence of light on synthesis of melatonin and serotonin in epiphysis depends on a condition of a peripheral sympathetic innervation. In the case of bilateral removal of top cervical sympathetic ganglions, the specified lighting effects are not observed.

The dependence of the functional activity of an epiphysis on illumination is the important prerequisite for purposeful application of light influence for the purpose of normalization of its functions. At the same time, if direct photostimulation of epiphysis is complicated in view of its deep bedding in a brain (anatomic epiphysis is located in back part III ventricle), impact on it can be mediated – through a zone embryological related, that is through parasagittal area. It is possible that laser pulse radiation of the Infrared range in certain cases can directly influence epiphysis (penetration depth about 7 cm).

Therefore, the impact on parasagittal area at treatment of many diseases, first of all depression, from our point of view, is quite reasonable.

The choice of a projective zone of the big tank of a brain for a laser-stimulation, EHF therapies, etc. is also associated with the importance of this structure. It is known that the big tank of the brain is an important regulator of the movement of cerebrospinal fluid, however, for example, at injuries of a skull it is often involved in a pathological process. Normalization of its function, reduction of jet (inflammatory) changes is the important prerequisite for normalization of cerebrospinal fluid dynamics. It is also necessary to consider that in the area of the tank projection the important stem structures of a brain, including reticular formation are located. Stimulation of these structures is directly bearing to the processes of sanogenesis.

Speaking about the specificity of the zones of influence, it should be noted high sensitivity to physical factors of palms, feet, an auricle, etc.

The zone of a carotid sine, impact on which can cause considerable medical effects, is especially sensitive to MT.

In the choice of zones of influence in PT, hardware methods are perspective: identification of zones with the lowered electro-skin resistance or the increased potential, the «interested» vascular pool on rheoencephalography (REG) or Doppler sonography, etc.

Beneficial in this regard are the variants of acupuncture (systemic, meridian) diagnostics (Nakatany's methods, Akabane, Voll, etc.) allowing not only to reveal pathological system and by that to define Zones of influence, but also to make it at the preclinical level. The last fact especially we mean in prevention of exacerbations of a disease and to control the efficiency of treatment.

Thus, modern PT has wide opportunities in the choice of zones of influence. It is important that each specialist doctor mastered the main of them and skillfully used them in clinical practice, remembering that each zone is individual and requires an adequate physical factor.

3.6. Particular qualities of effect of physical factors on magnetolaser therapy (MLT)

MLT combines the synergistic effects of magnetic and laser radiation. It improves the rheological properties of blood, accelerates wound healing, reduces inflammation, and improves cellular metabolism.

The simultaneous application of a complex of physical factors became one of the important directions in modern physical therapy. The combination of MT with low-intensity laser radiation (LILR) is now widely used.

The impact of LILR on certain zones or tissues of the human located in the constant or pulse magnetic field (MF) received the name of magneto-laser therapy (MLT). The similar option of therapy as follows from the name, provides simultaneous impact on a certain zone of two physical factors: LILR and MT at which the effect of laser radiation amplifies in a magnetic field of therapeutic intensity (10-40 mTl) due to increase in level of absorption of electromagnetic radiation of visible and infrared ranges when biological object is in a magnetic field.

The level of absorption of laser radiation determines the effect of the carried-out laser therapy and expressiveness of the subsequent processes. Here is shown the fundamental law of photobiology which essence comes to the fact that the biological effect can be caused only by the light of such wavelength, which is absorbed by molecules or membrane components of cells. In the near infrared (IR) region, the absorption of light quanta is likely associated with fluctuations in the valence bonds of hydrogen, carbon, nitrogen, and oxygen atoms and an increase in the kinetic energy of molecules. This can explain the uniformity of action of electromagnetic radiation in such a wide range of lengths of waves. The IR spectrum is mainly absorbed in an organism by molecules of water, oxygen, and also some enzymes.

The main physical processes happening in the skin, mucous membrane and other tissues at absorption of light energy are reduced to manifestation of internal photo effect and electrolytic dissociation of molecules and various complexes of an organism.

Under the influence of laser radiation, the electron connected with an atom, having absorbed energy of a photon, passes to higher orbit of rotation and, respectively, atom to become chemically more active, and biochemical reactions take place in a zone of photo stimulation with smaller expense of energy. In addition, at laser radiation of the biological environment the quantity of free electrons increases.

More photons are absorbed and more free electrons are formed on the surface of the tissue than in the depth of the tissue, and this leads to the emergence of a potential difference between them, which, in turn, causes the emergence of a photo-electromotive force (PEMF) and the emergence of photons. And, the more radiation power is, the more pronounced is this effect. An increase of concentration of free carriers – electrons indirectly changes the dielectric permeability (photodielectric effect), a magnetic susceptibility of fabrics, etc.

Another result of influence of LILR is weakening of ionic bonds and the ion – dipolar interactions in molecules and tissues due to the absorbed energy. In this case, ions are freely loaded and electrolytic dissociation occurs. It is also known that laser radiation in the range of wavelengths of 0,8-1,3 micrometers is absorbed mainly by oxygen, water, biological structures (first of all cell membranes) on the resonance mechanism. At the same time, endogenous oxygen is almost the only molecular target for MLT. This leads to the formation of two forms of high-energy singlet oxygen which energy is realized in the

form of a selective photodynamic effect without participation of photosensitizers. In relation to laser therapy problems generation of singlet oxygen will lead, first of all, to impact on cellular membranes, change of antigen properties of bodies and tissues, and also to peroxide oxidation of cyclic connections (the purine and pyrimidine bases, cholesterol, steroid and sex hormones, bilious pigments, porphyrynes, etc.) and aliphatic connections (fatty nonsaturated acids, phospholipids, sphingomyelin, cerebrosides).

Therefore, the expressiveness of influence of LILR (strengthening, normalization or easing the peroxide oxidation of lipids) depends on concentration of singlet oxygen that is on a dose of laser radiation.

During the combined (simultaneous) influence of LILR and MF, besides simple summation of energy arises also other physical phenomena. First of all, it is Kikoin- Noskov's effect: the radiation of tissue in MF leads to emergence of abnormal effect of Zeeman and an electronic paramagnetic resonance that is the selective absorption of EMR by the irradiated substance is connected with transitions of its nuclear electrons between Zeeman's levels of energy is noted. Frequency of the absorbed radiation (resonance frequency) depends on intensity of MT.

The energy of laser radiation pulses is utilized after some of its accumulation in the «dark stage» of pulse bio-stimulation (that is in pauses between laser impulses) only in high-speed and spectrally selective acts of transfer of excitation, cascades of biochemical reactions of catalytic type, labile electronic conditions of molecules in cells of fabrics and physiological substrata in the patient's organism. Laser impulses are capable of renewing, starting periodically (the trigger principle), and also «to feed» with energy similar reactions in case of a local power imbalance at certain diseases.

Thus, knowing the frequency of laser radiation (reciprocal of the radiation wavelength) and changing the power of MF, it is possible to achieve equality of resonant frequency of an electronic paramagnetic resonance and laser radiation that leads to sharp increase in extent of absorption of the irradiated tissue, and, therefore, to increase in photocurrent and efficiency of procedure.

An increase in photocurrent leads to the emergence, due to effect of the Hall, an additional potential difference between the layers of the irradiated tissue located at a different depth that in turn leads to increase in photo EMF, up to several tens of volts (effect of Kikoin-Noskov). It is proved also that MLT actively influences membrane processes in cells and a condition of ions in tissues.

It is known that under the influence of LILR in fabrics free ions are formed (Na+, K+, Ca2+, etc.) which strengthen the processes of a metabolism due to activation of membrane processes. So, for example, energy of ionic bonds of NaCl makes 97 kcal/ moll, but at dissociation in liquid environments of cellular structures these bonds are weakened and do not exceed 10 kcal/moll that makes shares of an electron-volt. Energy of quantum of laser radiation in red and near Infrared ranges of a range about 1,9 eV, and it is quite enough for violation of quite weak electrolytic bonds. However, in parallel, there is a process of a recombination of ions which is slowing down the course of metabolic reactions. Simultaneous impact of the LILR and MF on biological tissues slows down the ion's recombination process. Such combined influence promotes division of free charged particles due to targeting of the electromagnetic field (EMF) proportional to the size of intensity of a magnetic field (effect of the Hall). It should also be noted that the energy quanta of laser radiation in the center of magnetolaser action are capable of breaking the energy bonds between water molecules and charged particles. Tissue ions at radiation of LILR and MT become ordered, dipoles are built along the MF power lines.

If the power lines are sent deep into the irradiated tissue, then the bulk of ions and the polarized molecules are built deep into tissues too, increasing the depth of penetration of radiation. At radiation of LILR in MF each unit of volume of the tissue acquires a bigger amount of energy.

It is quite natural that the mechanism of biological effect of laser radiation, especially in combination with a magnetic field, cannot be settled by any one elementary act; it is defined not only the whole complex of bio-power structures of a separate cell or tissue, but also reactions of an organism in general.

3.7. Medical effects of magnetolaser therapy

The main therapeutic actions include analgesic, anti-inflammatory, microcirculatory, and neurotrophic effects. MLT demonstrates high efficacy in treating ischemic and neuropathic pain after war injuries.

MLT has a complex and diverse effect on the body and leads to the emergence of a significant number of effects, the main manifestation of which is anti-inflammatory, analgesic action and stimulation of reparative processes, the pathophysiological sequence of which may be as follows:

1. Anti-inflammatory action:
   - Activation of superoxide dismutase and catalase:
     - activation of microcirculation;
     - change in level of prostaglandins;
     - immunomodulatory action.
   - Decrease in peroxide oxidation of lipids at correctly picked up LILR dose:
     - alignment of osmotic pressure;
     - decrease in puffiness of fabrics.
2. Analgesic action:
   - activation of neurons metabolism;
   - increase of endorphins level;
   - increase of a painful sensitivity threshold.
3. Stimulation of reparation processes:
   - ATP accumulation;
   - stimulation of cells metabolism;
   - strengthening of proliferation of fibroblast;
   - synthesis of protein and collagen.

It is supposed that the specificity of action of LILR depends on a radiation range since a certain wavelength is absorbed by a particular biological substratum (cells, molecules, etc.). For example, LILR in the UV-range is mainly absorbed by protein substratum (amino acids), and a specific acceptor of radiation (helium – the neon laser) is the enzyme catalase having an absorption maximum in red area of a range (628 nanometers) that practically coincides with the wavelength of radiation of laser radiation of a red range ($\lambda = 0.63\mu m$).

The increase of activity of catalase in certain limits positively influences the antioxidant system. Under the influence of LILR in the red range, the superoxide dismutase enzyme is also activated in tissues, which, as well as the catalase enzyme has an absorption maximum in the red area of a range. All this leads to normalization of the peroxide oxidation of lipids (POL), on condition of adequately picking up EMI doses.

With high power loads and insufficient provision of an organism with natural antioxidants, the processes of POL which are shown with possible exacerbations of a disease to 7-9 sessions of laser

therapy can be reinforced. It is supposed that the strengthening of oxidizing processes in tissues is connected with formation of an active (singlet) form of oxygen since the last has an absorption strip near 640 nanometers (laser radiation of a red range) and, therefore, it is activated, that is its singlet form is formed.

Under the influence of a red range of radiation, microcirculation processes improve, collagen and fibrillogenesis are activated with rapid epithelialization of the wound defect. Activation of mitotic processes can be caused by strengthening of a power exchange in cells of a wound surface and a regional epithelium under the influence of laser radiation of a red range ($\lambda = 0.63\mu m$).

In a near infrared range, the energy of a photon of LILR fluctuates in limits which allow to excite oscillatory processes in molecules of substance and to intensify electronic excitement of atoms.

Therefore, in the mechanism of action, the biological activity of IR-radiation is accompanied by photochemical transformations and substantial increase of thermal molecular vibrations of substances.

As a result of influence of IR-radiation in the in a magnetic field, the tissues come in more excited state and the metabolic processes amplify in them. It promotes to the appearance of free forms of substances, biologically active products of photolysis, and change of the pH of the environment. Power activity of cellular membranes changes, and conformational changes of liquid crystal structures, first of all of the intracellular water. Strengthening of turbulent processes in the proceeding blood and lymph provides fuller reaction of plastic and power components in a common ground with capillaries. The listed effects develop in radiation zones, playing a starting role for development of generalized reaction at the level of tissue, body, system and an organism in general.

There comes activation of the DNA-RNA-protein system, biosynthetic and oxidation-reduction processes in the main enzymatic systems. Magneto laser influence causes increase in formation of macroergs (ATP), mitotic activity of cells, oxygen absorption by tissues, lowers a threshold of receptor sensitivity, reduces duration of inflammatory processes, interstitial hypostasis and tension of tissues, increases blood- groove speed, increases quantity of collaterals, has immunomodulatory effect, activates transport of substances through a vascular wall. Thus, the given clinical supervision and pilot studies prove that medical action of LILR and MF more expressed, than at separate or their consecutive application. At the same time, it was possible to reduce an exposition of impact on the pathological center in comparison with influence duration when using only one factor and to carry out treatment of more deeply located centers.

Besides, it has now been proven that MF of Earth and natural EMF actively influence many vital processes, including endocrine glands, including pineal gland.

The magnetic field of Earth and natural electromagnetic fields influence on:

- Small impregnations of magnetite crystals groups in many cells of live organisms;
- The system of chakras and meridians;
- Paramagnetic properties of water;
- Endocrine glands and, first of all, pineal gland;
- Control of biological rhythms and, first of all, «day and night regimen», and consequently, dream and wakefulness, normal dream or sleeplessness;
- Control of the immune status of the person, and consequently, resistance to diseases and, perhaps, to oncological diseases (these data are intensively investigated today by scientists in many scientific centers);
- Control of the mood of the person, that is, and, in particular, from the level of content of

its hormones depends on a condition of function of the pineal gland, substantially a condition of «depression», «euphoria» or steadiness. It is interesting that all preparations antidepressants work directly «through pineal gland» or indirectly, influencing its function).

- Control of sexual functional activity and condition of a prostate gland. So, for example, it turned out that the southerners who moved to the northern countries extremely often have prostatitis with infinite treatment from various experts. The reason is the lack of sunlight and, naturally, a hypo functional condition of a thyroid gland.
- Control of pain, that is dependence of painful behavior of the person, his tolerance to pain from function of an epiphysis and level of its hormones.

Pilot studies on influence of the combined action of infrared radiation, constant and variable magnetic fields at experimental atherosclerosis conducted by S. M. Zubkov and co-authors (1998; 2000), are important.

An experimental model of a hyperlipoproteinemia was created on rats by their transfer to the non-vitamin diet enriched with cholesterol (CL) and mercazolilum. The object of the study was male rats weighing 250-300 g, which were distributed in the following series. Control series – animals were transferred for the period of experiment (24-28 days) to a non-vitamin diet, but without cholesterol and mercazolilum. Series I was performed on rats with hyperlipoproteinemia, which did not receive any exposure to physical factors; II – rats with hyperlipoproteinemia which were exposed to the cervical-cervical spine (paravertebral at the level of C4-Th5) daily for 10 days with IR radiation (A = 0.87 μm, 5 mW) in combination with a constant magnetic field (CMF) (30 ± 10 mT); III – rats with hyperlipoproteinemia who were influenced by IR-radiation in combination with CMF on the same zone and two-half-period alternating magnetic field (AMF) (50 Hz, 30±10 mT) for 3 min daily within 10 days; IV – rats with hyperlipoproteinemia , which were exposed to the same area for 3 minutes daily for 10 days with IR radiation in combination with CMF and the pulsing one-half-period AMF (50 Hz, 15±10 mT).

In all animals, the authors studied adaptive changes in target organs of this pathology (myocardium, liver, cerebral cortex) on indicators of a protein metabolism and nucleic exchange, the POL level and antioxidative activity (AOA), indicators of activity of kallikrein-kinin system (KKS) and inhibitors of proteinases, content of insulin and thyroid hormones in blood serum.

As a result of comparisons of all the studied indicators at experimental animals, authors came to conclusion that the complex of physical factors (IR-radiation + CMF + the one-half-period pulsing AMF) was optimum (from all three used modes) for restoration of the vasomotor-metabolic and immune violations arising at development of atherosclerosis and also for the correct resolution of inflammatory reactions at the intra vascular level. At the chosen localization of impact on cervical-thoracic area (C5-Th5) of sympathetic ganglions there is a decrease in a tone of sympathetic nervous system and strengthening of the parasympathetic influences providing vasodilator action and change of system region hemodynamics with active participation of kinin system.

In the initiations of reorganizations, authors emphasize an important role as absorbers of IR-radiation, CMF and AMF play water molecules – one of the most widespread connections in an organism. Thus, in water, the IR spectrum with an area of 0.7-0.9 micrometers is characterized by maximum absorption and corresponds to the band of the used IR radiation – 0.87 micrometers. The absorption of IR-radiation in a molecule of water creates conditions for interaction of this radiation with bio membranes at the level of at-membrane layer – a glycocalyx, whose compound components are water molecules. The hydrated ions and polyelectrolyte structures of cytoplasm including water are also systems, sensitive to IR-radiation.

In the MF arise orientation effects of the same molecules of water hydrating membranes or ions. Biological tissue can be considered as optically muddy dia- or the paramagnetic environment in which under the influence of MF there is a certain ordering of structure due to these orientation effects. And when IR-radiation begins to affect such a more ordered structure, dispersion of this radiation (Tyndall's effect) decreases and the arising biological effects become more connected with direct absorption of electromagnetic energy of IR-radiation.

If these two influences (IR-radiation and MF) add the third – pulse MF, then frequency characteristics of this field begin to play an important role. Substantially, the frequency provides the information party of interaction of electromagnetic fields with bio-systems as with its help it is possible to report to the biosystem, a rhythm, adequate for it, and to synchronize its rhythmic characteristic. One of the types of such frequency characteristics are cyclotron frequencies. When matching cyclotron frequencies or multiples thereof to the frequency of the external magnetic field, resonance effects arise for these ions and ensure high efficiency of its biological effect (A.R.Liboff, 1985; A.R.Liboffet al., 1987). It was established that at such combination of CMF and impulse magnetic field (IMF) can change both intracellular and extracellular concentration of calcium and conditioned-reflex activity of mammals (C.F.Blackman et al., 1985; J.R.Thomas et al., 1986).

Revealed by S.M.Zubkova and co-authors (1998), as well as in other researches (V.V.Novikov, M.N.Zhadin, 1995; G.Ponomarenko and co-authors, 1998), the increase of biological activity of the combined action of CMF and AMF with reduction of size of induction of AMF is the testimony of exclusive importance of information exchange of AMF with bio-systems.

Therefore, at the expense of a right choice of a complex of physical factors it is possible to provide more purposeful impact on regulatory systems of an organism, reaching optimum adaptation reactions.

For this purpose, we created the special device for multipurpose laser therapy «HELIOS» which passed necessary technical and clinical tests with high therapeutic effects of many diseases (a hypertensive illness of the I-II rate, stenocardia of tension, neuroses, etc.)

3.8. General principles of multy-functional laser therapy

This subsection defines technical parameters and clinical protocols for combining various laser modes – continuous, pulsed, and scanning – to optimize dose and exposure time.

MFLT is used in two main variants – zonal exposure and transcutaneous laser irradiation of the blood.

At zone influence the choice of zones is carried out by the principles stated in appropriate section of our monograph, and time, parameters, etc. are defined, first of all, by energy of the laser radiation (J/cm^2) and intensity of MF (mT). It is known that at laser therapy the following doses of power influence are used:

- preventive – 0,01-0,3 J/cm^2;
- bio-stimulating – 0,2-0,9 J/cm^2;
- therapeutic – 0,8-10 J/cm^2;
- inhibiting – 10-25-30 J/cm^2;
- damaging – over 30-40 J/cm^2.

Proceeding from the treatment purposes, the necessary dose is chosen which is calculated using the known formula:

$$t = \frac{E * S}{P * K}$$

where:

t – influence time, sec; E – necessary dose of power influence, J/cm^2; S – area of a zone of influence, cm^2; P – power of laser radiation, W; K – radiation efficiency.

When carrying out zonal MFLT it is more often used contact, contact-compression or labile (scanning) technique, less often – remote.

If necessary, with aseptic and antiseptic measures (wound, trophic ulcer, area of fracture of bone, inflammatory infiltrate, etc.) influence the pathological center with the help of the device «HELIOS» in which it is combined in radiators the MF and laser radiation or impose ring ferrite magnets (intensity of a magnetic field about 30-45 mT) and at the same time carry out radiation of LILR at the density of a stream of power of radiation from 4-5 to 20-30 mW/cm^2 that depends on a degree of expressiveness and character of a course of pathological process. An exposition of impact of the specified physical factors on one zone is – 3-10 min., and on one session – not more than 20 min. The course of treatment usually consists of 7-10 procedures, more rare – 15, sometimes – 20. In the absence of clinical effectiveness after the first course of magneto laser therapy in 10-15-20 days it is necessary to carry out a repeated course of treatment.

Some options of MFLT and features of their use are given below. L.N. Budkar and co-authors (1996) studied influence of MLT at 112 patients with malfunction of the pacemaker and carrying-out system of heart (a syndrome of weakness of sinus knot or a syndrome of a vegetative (parasympathetic) depression of sinus knot and the conducting system of heart) that was shown by various options of arrhythmias (ventricular or supraventricular extra systoles). The course of MLT consisted of 15 daily procedures which were carried out by the following technique.

Influence was carried out on the atrial zone by the infrared laser (k = 0,8-0,88 in micron), density of the power of 4 mW/cm^2 and constant MF 10-40 mTl with the general exposition of 12 min.

As a result of MLT more expressed medical effect was noted in patients with a syndrome of weakness of the sinus knot and less significant at VNS imbalance. At the same time authors noted that at a number of patients with arrhythmias the full antiarrhythmic effect was observed, at others was the relief of their current state.

3.9. Through-skin magnet-laser radiation of blood

The method provides systemic effects by irradiating blood through skin projections of large vessels. It stabilizes homeostasis and supports immune and reparative functions.

Until recently, the most common and studied effect on blood was laser radiation, mainly in the red range, in the form of intravenous and percutaneous irradiation of transfused blood and fluids. These procedures are well-deservedly popular among doctors and patients in a type of their rather high efficiency. However, introduction in practice of magnetolaser therapy allowed the use of it and for blood radiation.

At the same time, from the very beginning, it was the option of through-skin influence in a type of a possibility of deeper penetration when combined using these factors.

The advantage of magnetolaser chemotherapy over laser chemotherapy is as follows.

In hemolaser therapy, for a stable controlled positive result, it is required radiation of 1/3 volume of the circulating blood, and at hemo-magneto-laser therapy it is enough of 1/4.

It is explained by the more intensive influence of magneto-laser impacts on blood. Erythrocytes, as we know, contain iron which is paramagnetic and consequently, are capable of being magnetized and gain «new biological properties». The same belongs to catalase enzymes, the active center of which also has atoms of iron.

For laser irradiation of 1/3 of the circulating blood volume, for example, through the cubital vein, it takes about 30 minutes for a person weighing 70 kg, and in order to avoid possible secondary exacerbation during course treatment, the optimal laser radiation power (LR) at the end of the fiber optic should be 1-2 mW.

The procedure of hemo-MLT with not smaller efficiency continues 20-23 min. at the power of LR of 20 mW and magnetic induction of 30 mT. At MLT the phenomenon of a secondary aggravation, as a rule, is not noted. The latter, according to modern ideas, is associated with a change in the intensity of lipid peroxidation. Of course application, for example, of laser therapy, especially of considerable intensity (more than 50 mW) and the considerable duration of procedure (about 30 minutes), after 6-7 procedures the exacerbation of a disease can be noted. In physical therapy and balneology, these facts have been known for a long time and were described in the form of so-called «balneo-reaction».

The possibility of an aggravation at the majority of options of PT is connected with the following factors:

- exhaustion of natural antioxidants in an organism at course treatment;
- enhancement of metabolic processes and lipid peroxidation processes in response to "stressful" (powerful) PT;
- change in hormonal status (activation of prostaglandin system in its thromboxane link, dopaminergic department, etc.);
- In order to avoid a phenomenon of an aggravation it is recommended:
- reception of antioxidants during the course of PT (Vitamin E, A, C, AE-wit, etc.);
- short-term course of treatment (up to 5 procedures) with the subsequent break for 3-4 days;
- selection of adequate capacities (dosages) of physical factors and the factors themselves.

It turned out that MT is a peculiar physical antioxidant that is explained by strengthening of digestion of vitamins of this group from intestine under the influence of MF and their activation in blood, regulation of peroxide oxidation of lipids (the known phenomenon of stimulation the parasympathetic tonus by MT), also other mechanisms are possible.

In any case MLT, unlike purely laser therapy, in the majority of cases does not cause a secondary aggravation that is extremely important in treatment of many diseases (for example, stenocardia, post-stroke patients, a hypertensive illness, etc.).

Through-skin hemomagnetic laser therapy allows to influence, thanks to considerable penetration, not only blood of venous system, but also on arterial, and also directly the ventricles of heart and its auricle filled with blood.

The specified advantages of through-skin hemo-MLT are gradually replacing purely laser methods of influencing the blood.

3.10. Zones of influence for through-skin magnet-laser radiation of blood

The therapeutic exposure is directed to anatomical regions with high vascularization (e.g., carotid, subclavian, femoral areas) to enhance oxygenation and detoxification.

For this purpose, vascular bundles are usually selected in places where they are located most superficially: elbow and popliteal poles, femoral and subclavian arteries, if necessary – carotids and a zone of heart. Influence on smaller arteries or veins are used less often: beam, elbow, etc.

Before the procedure if it influences an artery, its pulsation is defined and then the magneto-laser radiator is established on an artery without special pressure (blood has to pass through an artery). By means of special fastening (cuff) the radiator is fixed for necessary time. Further the device with the set (necessary) parameters of magnetolaser influence is turned on.

For hemomagnetic laser therapy (hemo-MLT), the laser radiation of both red (A=0,63 micron), and infrared (A=0,85-1,00 micron) ranges can be used. The preference is given to the last. The power of red laser radiation should ideally be 5-10 mW, and infrared – 10-20 mW. The power of magnetic induction is from 5 to 50 mT. At such parameters, the duration of influences in one session is 20-23 min. If the parameters, the corresponding recalculation towards increase or reduction of duration of procedure, also is required as well as at bigger (over 70 kg) or smaller (less than 70 kg) patient's weight. However, the time of hemo-MLT for adults, as a rule, should not be less than 15 min., and for children – 10 minutes (the need of radiation of a certain volume of blood). It is also necessary to remember that in one session it is preferable to influence on 4 zones for 5 minutes, then on one zone (a vascular bunch) for 20 minutes. We also prefer frequency modulation of these factors, determining at each patient his basic frequency by number of heartbeats. For example, the number of heartbeats in one minute – 75 beats, then 75:60=1,25 Hz. This frequency is basic for the specific patient and frequency modulation by this frequency or multiple is established by it on the device.

The number of hemo-MLT procedures is defined individually and can fluctuate from 3 to 10-15 on a course of treatment. If necessary, hemo-MLT alternated or combined with other physiotherapeutic procedures (ultrasound, electrotherapy, etc.), as well as with zonal influence of MLT. B.S. Briskin and co-authors (1996) formulated the biological and biophysical effect of magneto-laser radiation as follows.

At the nuclear and molecular level:

- The absorption of light by tissue photoacceptor.
- Electrolytic dissociation of ions (rupture of weak communications).
- The formation of electron excitation.
- The migration of electronic excitation energy.
- Primary photosynthetic effect.
- The emergence of primary photoproducts.

At the cellular level:

- Changing the energetic activity of cell membranes.
- Activation of the nuclear device of cells, DNA-RNA-proteins systems.
- Activation of oxidation-reduction, biosynthetic processes and main enzymatic systems.
- The increase in the mitotic activity of the cells, activation of the processes of reproduction.
- Stimulation of formation of ATP and synthesis of nucleic acids.

- Decrease in intensity of free radical processes.
- The immune-stimulating action.

At the organ level:

- Decrease of the sensitivity of the receptor.
- Reduction of duration of phases of an inflammation.
- Reduction of interstitial edema.
- Increase in absorption by oxygen fabrics.
- Increase of speed of a blood-circulation.
- Increase in quantity new vascular collaterals.
- Activating the transport of substances through the vascular wall.
- Microcirculation improvement.
- Activation of metabolic processes.

At the level of a complete body:

- Anti-inflammatory.
- Analgesic.
- The regenerative, immunocorrective..
- Antiedematous, desensibilizing.
- Improvement of regional blood circulation.
- Bactericidal and bacteria-static effects.

3.11. Therapy by the laser scanning beam

Laser scanning ensures uniform energy distribution over large surfaces, especially useful in treating extensive wounds, burns, and post-amputation stumps.

Therapy by the laser scanning beam is a method of laser therapy at which the laser beam consistently passes the necessary area of influence under the set law. Depending on the beam steering the scanning is divided into automatic and manual.

The principle of change the spatial position of a laser beam with the use of the electromechanical device is the basis for automatic scanning. Such a device received the name of the deflector, or scanner. In modern scanners, the function of beam control under a certain law can be realized with the use of special electronic devices or computer facilities.

The peculiar feature of manual scanning is that the laser beam moves in the necessary direction without use of electromechanical devices (the movement of a beam is operated by hand).

Automatic scanning is applied for remote (surface) influence and for contact influence, when it is necessary to make impact on the deep-lying organs and the pathological centers, usually is applied manual scanning. In both cases the fact that both options belong to laser therapy is essential and, therefore, are subordinated to the general laws of laser therapy.

During the therapeutic effect of the laser beam, at a depth of 0.25-0.3 mm, its coherence and polarization practically disappear due to the optical heterogeneity of living tissue. The optical stream only possessing monochromatic properties gets into depth of tissue. The ability of selective absorption of energy of optical quantum by electrons of the lower orbitals of separate atoms which at the expense

of it can move to higher power levels is the cornerstone of biochemical action of a laser optical stream. Excitement of biomolecules which gain high jet ability is caused by this process. The return of electrons to initial orbitals is followed with emission of the quanta exciting electrons of nearby biomolecules (a phenomenon of secondary action). At the expense of it in red and near infrared ranges therapeutic efficiency of a laser stream increases to 30 and 50% respectively. Excitement of molecules can be carried out also by a non-radiative energy exchange between the electronic excited molecules (photo donor) and the molecules which are in an unexcited state (photo-acceptors).

As a result of numerous studies, it has been noted that low-energy laser influence possesses anti-inflammatory, de-sensibilisation, soothing, antispasmodic, antiedematous and, the most important, the power raising action, stimulates metabolic, regenerative and immune processes. The laser scanning beam therapy approbation which was carried out in various clinical conditions revealed certain specifics of its influence. It turned out that this method is indicated first of all, for the treatment of diseases which are based on violations of neurovascular traffic. It is a wide range of neurogenic and vascular diseases which are long-term. Laser therapy can significantly increase the effectiveness of complex treatment of many chronic diseases by activating the processes of sanogenesis.

In conclusion, it is necessary to give one of the most interesting considerations concerning laser therapy. Since the molecule of each substance has its own specific range of absorption, it is possible to pick up the corresponding wavelength and to directly «stimulate» the necessary organic compound. As a result, the metabolic process proceeding with its participation will accelerate or will be slowed down and that will favorably be reflected in the course of the pathological process.

Thus, the therapy with the laser scanning beam is a dynamically developing branch of laser medicine. The prospects for use are obvious, and introduction in daily medical practice remains only the business of time.

3.12. Main terms and concepts

Key terminology describing laser physics, dosimetry, and photobiological effects is summarized to standardize clinical communication among specialists.

As the terms and symbols applied in laser therapy are rather difficult, and for safe and highly effective work with laser therapeutic machines it is necessary to face rather often various formulas, authors believe what not superfluous will be to remind readers what is meant by these or those expressions and designations which are constantly found in literature on laser therapy.

Active agent – a component of sources of laser radiation. Atoms of active agents have certain levels of energy and are capable of the ordered emission of photons. More than 100 names of active agents are known. Distinguish from them solid-state (a synthetic ruby, crystals, baric glass with neodymium impurity, etc.), gas (helium, neon, xenon, krypton, nitrogen, carbon dioxide, oxygen and their various mixes), liquid (dielectrics, substances activated by rare-earth elements, solutions of organic dyes, etc.) and semiconductor (arsenide – gallium, arsenide-phosphatide-gallium, selenide-lead, etc.).

Wavelength – distance to which the wave extends for the period equal to an interval between two next points fluctuating in one phase. Length of an electromagnetic wave is equal to the ratio of velocity of light to the frequency of fluctuations; a unit of measure – micron.

Influence dose – the energy irradiance of a surface for a certain period; a unit of measure – J/cm^2.

Infrared radiation – the electromagnetic radiation invisible for an eye of the person, which on

the wavelength (0,780-1000 microns) takes the intermediate place between the visible and microwave radiation of millimetric range.

Quantum – a portion of electromagnetic energy of the field.

Coherence – strictly ordered course in time of several oscillatory or wave processes of one frequency.

Monochromaticity – the existence in the radiation the waves only of one length (frequency).

Polarization – acquisition or providing of orientation (polarity); polarization of light consists in transformation of natural light where fluctuations of each electromagnetic wave concerning the direction of its distribution happen in the different planes, in bunches of the polarized light with fluctuations in one plane.

Density of the radiation power (stream) – the relation of the power (stream) of radiation (R) to surface area (S), perpendicular to the direction of distribution of radiation. A unit of measure in laser therapy is mW/cm^2.

Photon – quantum of electromagnetic radiation of optical range.

Frequency of fluctuations – the physical quantity equal to number of the fluctuations made for a unit of time.

3.13. Characteristics of the equipment for the laser scanning therapy

Modern devices with adjustable wavelength, frequency, and scanning patterns are presented, highlighting safety parameters and calibration standards.

Scanning laser therapy is essentially a variant of spatial modulation of optical flow. It is known that the frequency of modulation has a significant effect on the nature of the caused effect. For example, for rendering the stimulating action it is recommended to modulate a laser stream with a frequency of 1-10 Hz, and for a sedation of the body , at a frequency of 20-100 Hz. It is explained by the fact that influence is realized at various levels of integration of regulation of functions (the higher is level, the lower is the frequency). Typically, within a given frequency range, it is better to use lower frequencies for toning, and higher frequencies for sedation.

In principle, the same figures of scanning can be received when using various frequencies, but it is almost not always possible to use frequency more than 100 Hz because of sharp decrease at such frequencies of amplitude of fluctuations. Frequency increases in places of crossing of a trajectory of a beam.

Scanned shapes can be static or dynamic. Static indicators cover only a portion of the total area of the impact site. Therefore they are used in a case when their sizes exceed the most admissible size of the area of influence. Dynamic figures cover all areas at the expense of the constant shift of a trajectory of the movement of a beam. At the same time there is in additionally emerged low-frequency modulation of an optical stream allowing to address influence at the same time to different levels of integration of regulation. Besides, in dynamic figures due to continuous change of places crossings of a trajectory of a beam modulation frequency in each point of space changes that, as we know, counteracts development of effect of accustoming. In this case, the density of the total exposure dose is distributed more evenly. It is often necessary to change the area of exposure and scanning parameters at different stages of treatment. In some cases, it makes sense to change parameters of a dynamic figure during a session.

3.14. Main advantages and disadvantages of therapeutic scanning laser devices

Advantages include non-invasiveness, high precision, and systemic influence. Limitations relate to the need for precise dosing and contraindications in certain systemic diseases.

To the advantages of the scanning laser devices, we should attribute that their application allows influencing the necessary area with the laser stream concentrated in a point with a diameter of 2-3 mm without increasing at the same time a dose and time of procedure and creating conditions of deep penetration of laser energy into tissue.

The disadvantages of scanners include the fact that when treating areas of the pathological process (joints, paravertebral zones of several vertebrae, etc.), it is necessary to defocus the laser beam. At the same time, the bigger spot needed to be received, the more distance from the area of influence needed to have the scanner. This, in turn, reduces the density of power of laser energy that extends the time of carrying out the procedure.

Besides, when using the scanning laser systems, the application of protective goggles is obligatory. It should be noted that the maximum positive reaction of an organism is shown at the density of a stream of energy of 10-50 mW/cm^2. Start of physicochemical and biochemical reactions of an organism happens at the expense of the high spectral and spatial density of a laser optical stream causing its local action and also by low-frequency modulation of laser influence due to scanning. The specified features define a significant increase in the extent of the interface of processes of absorption of energy of photons and activation of free energy of biological systems.

3.14.1. Key parameters

It is known that all photoreactions have light and dark phases. The first is connected with the absorption of a quantum of electromagnetic energy by the substance, and the second is associated with transformation of this energy and its realization in type of biophysical and biochemical transformations. Thus, there is no need to use continuous influence if the process of photoreactions has rhythmic character. There are strong reasons to consider that the quality of the primary photoeffect is determined by influence power density, and its quantity – by the size of area of influence and duration (a power dose per unit area) carrying out procedure. At the same time, rather high density of power at sufficient time of carrying out a procedure is necessary for achievement of a number of effects. The contradiction which is contained in these conditions is eliminated by modulation of a laser stream.

Analysis of experimental data and clinical observations shows that at influence by low-energy lasers specific and nonspecific mechanisms are the cornerstone of therapeutic effects.

Nonspecific action depends somewhat on the wavelength of laser radiation and its coherence, however at the same time specificity in relation to the main power characteristics remains: to the general dose and density of a dose; density of power of a laser beam; to parameters of its modulation. It is important to choose correctly zones and sequence of impact on them in each session, the optimum number of sessions and terms of repetition of courses of treatment.

Clinical and experimental data also indicate that power characteristics of laser influence are defined when carrying out laser therapy. At the same time, it is necessary to provide the optimum combination of several parameters, functionally connected among them (with what there are se-

rious contradictions). On the one hand, the energy flux density must be high enough, and on the other hand, the required area and dose density must be provided. These contradictions are resolved when using a certain method of scanning of a laser beam: density of a stream of power is provided with adjustment of diameter of a laser beam, the dose density by procedure time, and the necessary area of zone by corresponding trajectory of scanning. These parameters become mutually independent within certain limits. Besides, scanning is a special form of pulse modulation – «spatial»; and it is more preferable than usual «temporary», especially at a big porosity of impulses.

It is necessary to emphasize that in the practice of laser therapy the technique of getting the various figures of scanning on Zones of influence advances physiological and clinical understanding of their efficiency. Such a conclusion can be drawn both in relation to density of filling of the scanned surface, and in relation to specificity of the frequencies which are formed when moving a beam on a surface of a biological object. The aspiration to receive a very large number of possible figures of scanning demands use of difficult devices. The doctor constantly appears before the choice: or in advance to agree to the simplified work with the device, having refused a large number of the scanning figures (in most cases in it there is no need), or, having seriously increased material expenses, to pass to work with specialized computer systems. But simple devices have two essential advantages – the doctor can quietly place such a device and the scanner in a bag and to go to the house to the patient.

When developing the principles of calculation of parameters of laser therapy many authors use analogies to ideas of reflex-therapy of the toning, harmonizing and sedative types of influence.

According to these representations, for excitement it is necessary to use an irritant with a high contrast, low frequency, a small dose and short time of influence; for sedative influence these characteristics are opposite; intermediate parameters possess the harmonizing properties. When using laser therapy, it is better to tone with a red focused beam when using complex scan patterns or low modulation frequencies; for sedation, it is better to use infrared defocused continuous radiation. It is necessary to give preference to simple figures or to use high-frequency modulation when scanning

During scanning, it is, as a rule, offered to use so-called «dynamic» figures every time a beam moves on a new trajectory, gradually filling all «shots». However, in practice often it is necessary to come up against a situation when for impact on all chosen surfaces the dose turns out unacceptably big. In this case, it is possible to use «static» figures in which the beam moves on the same trajectories occupying only part of the total area of the influence zone. Actually, the area of such a figure is much less than the area of all zones, however its calculation presents certain difficulties.

Typical recipes and dosages are suitable for use at treatment of «the standard patient». In practice, the sensitivity and reactivity of a sick organism differs significantly from average norms. For their assessment and correction, different experts successfully apply techniques of integrated meridian diagnostics according to Y. Nakatani, three-level system of correction of meridian balance according to D.M. Tabeev and many others. Especially effectively the automated computer options of these techniques work.

At the same time, it should be noted that the advertised computer laser technologies are low-rational recently as they represent the artificial connection of the laser with the computer which is not changing quality of treatment, but significantly increasing its cost. It is necessary to create universal installations that can be operated both autonomously and using the wide capabilities of the computer, without occupying it with routine functions of controlling elementary operations.

3.14.2. Dosage and time of procedure

The effect of a low-energy laser is not destructive, however, some experts are inclined to consider that the majority of clinical results can be explained with adaptation reaction of an organism to the limited (reversible) dosed damage of some elements of biological structures (Butska, 2025). Therefore, on the one hand, the right choice of the influence zone and calculation of optimum dose loadings has to be provided, and with another – adaptation opportunities of an organism have to be considered.

Calculations of the effect of a low-energy laser are based not on the power of an optical stream, but on the power of illumination of bio-object, i.e. power stream density. The power stream density increased by procedure time represents an influence dose. Laser therapy is applied almost exclusively for low (not damaging) capacities of a laser stream – at recalculation on the continuous mode of generation from 1 to 100 mW. Clinical and experimental data show that laser exposure only at power densities above 400 mW/cm^2 has an inhibitory effect on biological tissues.

According to generally accepted standards, if it is necessary to affect a large area, the latter is divided into fields of no more than 80 cm^2, and the total area for one procedure should not exceed 400 cm^2.

When performing calculations of a dose of influence it is necessary to consider the following features:

- the part of the laser stream falling on a surface of skin is reflected (the coefficient of reflection (Cref) of electromagnetic waves of optical range reaches 15-25% by skin);
- the increase the angle of incidence of a beam leads to sharp increase of coefficient of reflection;
- the value of the coefficient of reflection decreases on average by 15% (30-45%),when the cooling area of impact is 5°C;
- **in women** the coefficient of reflection is 5-7% higher, than **in men** (20-30%), at elderly people (60 years and more senior) it is lower in comparison with young people for 7-8%;
- the more dark skin is, the lower is the coefficient of reflection;
- on pigmentation sites the coefficient of reflection reaches 20-32%.

The degree of absorption of the laser stream depends on its spectral characteristics and a type of biological tissue. So, in the red and near-infrared ranges (0,62-1,3 microns) the skin absorbs 25-40% of the falling stream, muscles and bones – 30-80%, parenchymal bodies – to 100%. The only absorbed energy has a biological effect. However, it is extremely difficult to calculate the absorbed dose in clinical conditions, therefore concluding the measurements or calculations of an exposition dose, which is the dose of radiation falling on area of influence.

In respect of the choice of optimum doses of influence it should be noted that only their borders are so far defined. In each specific case, depending on specific features of the patient the dose can strongly vary. Nevertheless, it is considered established that to ensure a therapeutic effect it should be within the range of 0.1-10 J/cm^2. For determination of duration of influence is used so-called main ratio of laser therapy:

$$t = \frac{E * S}{P * K}$$

where:

t – influence time, sec; E – necessary dose of power influence, J/cm^2; S – area of a zone of influence, cm^2; P – power of laser radiation, W; K – radiation efficiency (its size less than 1).

At treatment of wounds, it is possible to use a formula for definition of exact time of influence by the laser:

$$t=(E \cdot S)/ P$$

where t – influence time, sec; E – necessary dose of power influence, J/cm^2; S – area of a zone of influence, cm^2; P – power of laser radiation, W

For receiving the bio stimulating effect the absorbed dose has to be reduced to 0,05-1 J/cm^2. At the same time, it is also desirable to reduce power density. However, too big a decrease in doses is undesirable in the sense that it is possible not to gain any effect at all.

It has been theoretically and experimentally shown that the "saturation limit" of biological tissues for a laser wavelength of 0.63 micrometers (red color) is about 5 J/cm^2. When approaching doses of 10 J/cm^2 it is also more observed inhibiting, and at 30 J/cm^2 the damaging effects. For the infrared range the absorbed doses of a laser stream causing the inhibiting and damaging effects are significantly increased that is caused by lower power of photons.

Pilot studies have shown that depth of penetration of low-energy laser radiation through skin depends on the length of an electromagnetic wave. The maximum transmission of electromagnetic radiation through the skin is in the red and near-infrared ranges (so-called optical transparency of biological tissues). The greatest penetration corresponds to the near infrared range, wavelength from 0,95 to 1,7 microns. In the distant infrared range, there is a sharp decrease in permeability. In fact, these data also defined the choice of the laser type for the therapeutic scanning systems.

3.14.3. The mechanism of action

In the mechanism of action of the laser scanning beam the changes happening at the system level and reaction of homeostatic systems to laser influence are essential. As in the course of evolution the organism was not exposed to laser influence, so it is not adapted to it and reacts, as to the revolting factor. At the same time the same monochromatic light as a part of this world has no the same biostimulating effect as is a habitual factor. For example, sunlight power density (10-100 W/cm^2) which corresponds to the values used in laser therapy, makes the biostimulating effect much smaller. Besides it should be noted that the high therapeutic effect is defined also by the very high spectral density of laser radiation.

Despite all the variety of therapeutic effects of low-energy laser stimulation, data of modern physiology deny existence in the leather of animals and the person of specific photo receptors. Therefore, the neuroreflex shifts registered in experiment in response to laser therapy are the secondary effect caused by changes of an intracellular metabolism. These same treatments also treat endocrine reactions as laser therapy does not cause direct photo-activation of hormones, and endocrine shifts also have secondary character.

A key link in the bio-stimulating effect of laser therapy is the activation of enzymes leading to strengthening of bio-power and biosynthetic processes in cells. Activation of bioenergetic enzymes leads to increase of the ATP level and other substances. Further, the reaction develops in the way of an intensification of proliferation of cells that defines such processes as growth rate and regenerations of

tissues, blood formation, activity of the immune system and system of microcirculation. The stimulating operation of the laser on regeneration processes most distinctly is shown for bone structures, joints, epithelial, muscular tissues, nervous tissues. Stimulation of blood formation is expressed in increase in the number of uniform elements of blood, change of activity of the anti-curtailing system of blood, decrease in SOE. Activation of the immune system is characterized by increase of intensity of division and strengthening of functional activity of immune and competent cells (lymphocytes, leukocytes, etc.) increase in formation of proteins (immuneglobulins). Clinically, this causes a pronounced anti-inflammatory effect, especially in long-term processes. The immunocorrective orientation of laser therapy also defines other clinical effects – desensibilisation.

One of the most essential features of action of LILR is microcirculation stimulation that, in turn, affects a condition of trophic processes in tissues. The concept of microcirculation included not only vascular microcirculation, but also the movement of liquids out of the vascular course. Microcirculation processes are closely connected with processes of metabolism in tissues. Microcirculation provides a metabolism in a tissue microsystem in which the cells are included specific to this tissue, connective tissue structures and the physiological substances emitted by them, the terminations of nervous fibers. Microcirculation can be considered as the system consisting of three links – blood (except capillaries, contains pre-and post-capillary, arteriole, venula, arterial-venula anastomose), lymphatic (lymphatic capillaries and postcapillaries) and intercellular. The last is localized between walls of vessels and cells of the corresponding tissue. Except for intercellular substances, this space is filled with the collagen fibril and fibers operating movement of tissue liquids, and also the cellular elements producing biologically (physiologically) active agents.

Generalizing data of literature about the influence of laser radiation on biological objects, T. Karuand and co-authors (1990) allocate the following levels of realization of response:

- subcellular – the emergence of excited conditions of molecules, emergence of free radicals, stereo-chemical reorganization of molecules, increase in speed of synthesis of protein, RNA, DNA, acceleration of synthesis of collagen and its predecessors, change of oxygen balance and activity of oxidation-reduction processes;
- cellular – change of a charge of electric field of a cell, its membrane potential, increase of proliferative activity;
- fabric – changes in pH of intercellular liquid, morphological changes of activities and microcirculation;
- organ – normalization of function of the organs;
- system and organismal – emergence of reciprocal complex adaptation neuroreflex and neuro-humoral reactions with activation of sympathetic-adrenal and immune systems.

The end result of laser biostimulation is the increase of resistance of an organism and expansion of limits of its adaptation, i.e. decrease in a susceptibility to various diseases.

3.14.4. Medical action

Clinical practice has shown that laser therapy of many diseases quite often surpasses other types of treatment in efficiency and can be applied with success practically in all fields of medicine.

Low-energy laser radiation has anti-inflammatory, desensitizing, soothing, antispasmodic, antiedematous action, stimulates exchange, regenerative and immune processes. Various clinical trials have

shown that laser therapy is indicated, primarily, in the treatment of diseases that are based on disorders of neurovascular communication. It is a wide range of neuro-genic and vascular long-term diseases. Laser therapy is capable of significantly the efficiency of complex treatment of many chronic diseases, intensifying processes of sanogenesis (system of protective and adaptive mechanisms of fight against an illness, recovery and maintenance of health). In such cases, laser therapy can be considered as a specific method. The sequence of the happening changes at laser bioactivation schematically is represented as follows: interaction of a laser stream with specific and not – specific photo-acceptors (start of a complex of photo-physical and photochemical reactions), activation of cellular fermental systems with strengthening of bio-power and biosynthetic processes (an intensification of proliferation of the cells), strengthening of regeneration, blood formation, activity of immune system and system of microcirculation (generalization of local effects of laser therapy by means of neuro-humoral and neuro-reflex mechanisms).

Activation of photobiological processes that occur during selective absorption of laser radiation causes expansion of microcirculatory courses and at the expense of it normalizes a local blood circulation and leads to dehydration of the inflammatory center. Activated humoral factors of regulation of a local blood circulation induce reparative and regenerative processes in tissue and increase phagocytic activity of neutrophils. In irradiated tissues there are phase changes of a local blood circulation and increase in trans capillary permeability of endothelia of vessels of the microcirculatory course. Activation of hemolymph perfusion of the irradiated tissues, along with breaking a peroxide of oxidation of lipids, promotes infiltrative-exudative processes and can be effectively used at knocking over an aseptic inflammation. The restoration of the activity of sympathetic-adrenal system and glucocorticoid function of adrenal glands oppressed by pathological processes arising along with activation of catabolic processes is capable significantly to weaken intensity of a bacterial inflammation by acceleration of its proliferative stage.

Laser stimulation of tissues boundary with the center of an inflammation, or edges of a wound there is a stimulation of fibroblasts and formation of granulation tissue. Formed at absorption of energy of laser radiation the products of proteins microdenaturation, amino acids, and pigments and connecting tissue work as endogenous inductors of reparative and trophic processes in tissues, activate their metabolism. The same also promotes the increase of the proteolytic activity of alkaline phosphatase in a wound. Besides, laser radiation causes destruction and a rupture of covers of microorganisms.

Reduction of pulse activity of nervous terminations C-afferents leads to decrease in painful sensitivity (at the expense of the peripheral afferent block), and also excitabilities of the carrying-out nervous tissues of skin. At prolonged exposure to laser radiation, neuroplasmatic current is activated that leads to restoration of excitability of nervous conductors.

Along with local reactions of the surface tissues of influence zone, the afferent of the impulse modulated by a laser stream from skin and muscular afferents (on the mechanism of axon reflex and by segmentary-metameric communications) forms reflex reactions of internals and the tissues surrounding the influence zone, and also causes other generalized reactions of a complete organism (activation of endocrine glands, a hemogenesis, reparative processes in nervous, muscular and bone tissues).

Thus, generalization of local effects happens due to activation of cooperative processes of transformation and transfer of free energy. They trigger neurohumoral and intercellular mechanisms of regulation of physiological functions and define the final photo-biological effect of laser radiation.

3.14.5. Technique of carrying out procedures

When carrying out procedures of therapy by the laser scanning beam the following factors of safety measures have to be considered: the distance from the scanner to the patient's body, illumination of the room position of the patient in relation to the scanner and availability of carrying out this or that technique.

One of the main requirements is that the lighting in an office has to be bright and to make about 300 Lux (at good lighting a pupil is narrow and hit in the eye of a beam of the laser is less dangerous). Today, many laser therapy specialists consider that it is important not only the wavelength, but also specific properties of laser radiation, such as monochromaticity, coherence, polarization. To find out the role of each factor it is the business of future researchers; however, protection of the field of radiation against hit on it at the same time as a laser beam and a stray light is important for the increase of efficiency of laser therapy. In other words, it is better to carry out the laser scanning therapy in the darkened room, and protection of eyes against the hit of a laser beam is reached by application of special goggles.

Concerning the position of the patient during the procedure it is possible to notice that it is defined by the maximum availability of laser radiation in relation to the defeat center. In most cases the patient during the procedure is in a lying position. When affecting the occipital and cervical-collar regions, it was performed in a sitting position. When affecting the elbow and knee joints, it is necessary to achieve such position of extremities (as a rule, half bent) at which access to joint spaces will be maximum. At this option the choice of no more than two positions of the patient for one procedure is optimum. In the beginning irradiated are the areas which are available only in a sitting position, then the areas which are better to influence in a prone position. In other words, it is desirable to avoid options at which the patient will be forced to lay down, to sit down, and to turn here and there. If the opportunity will be limited only to one position of the patient (lying or sitting), then it is an optimal variant. The procedure has to be the most comfortable and unfatiguing both in psychological, and in the power relation (importance of the choice of parameters of the laser). What will be less «power resistance of channels» (meridians) and other power systems (they at loading get excited), that the effect of treatment will be higher. It is necessary to aspire that the condition of the patient before and during the procedure was as close as possible to relaxation.

In some cases (approximately 5% of patients) at laser therapy the phenomenon of «a secondary aggravation» can be observed. It is connected with exhaustion of the antioxidant system in which an important role is played by vitamin E. During laser therapy, the need for vitamin E increases, and a relative or absolute deficiency may occur, which is manifested by the above phenomenon. It is necessary for its prevention before the beginning and during laser therapy to appoint preparations of α-tocopherol.

In some patients after the procedure drowsiness for 1-2 hours can be noted. It is the favorable sign testifying, as a rule, to the good end result of treatment. However, the absence of these symptoms cannot serve as an indicator of ineffectiveness of treatment.

To increase the effectiveness of laser radiation, it is necessary to perform vacuum or manual massage before procedure, or any other influence raising blood filling in the field of influence.

3.15. Basic principles of the choice of areas for therapy by the laser scanning beam

Zones are selected based on the distribution of pathological changes, neurovascular projections, and the patient's individual pain map.

Being based on the modern principles of application of laser therapy, it is possible to select several especially important recommendations when carrying out the laser scanning therapy.

In each case, taking into account the set medical object defines zones of alleged influence at laser therapy. Most often, a direct (local) effect on the affected organs or their projection and tissues is envisaged to stimulate sanogenetic reactions. In other cases, the medical effect is reached by the mediated action due to laser influence of reflexogenic zones and points of acupuncture. As a rule, the combination of these two approaches significantly increases efficiency of laser therapy. In a serious illness, intravascular laser radiation of blood for rendering the general influence on an organism can be required. It is necessary to consider that for realization of this or that approach it is necessary to have the equipment with the corresponding technical characteristics.

Depending on the nature of the pathological process, depth of location of the struck bodies and tissues and other particular data choose a type of low-energy laser influence and a way of its delivery to an influence zone. For example, for rendering of medical action on superficially located centers (eczema, burns, open wounds, etc.) it is expedient to use scanning by the laser in the red part of a range of radiation in the continuous mode of generation. On the contrary, for deep stimulation, a scanning laser in the infrared range is used, generated by mid-range semiconductor lasers.

An important point as it was emphasized above, in ensuring the medical effect of laser therapy is the choice of influence zone. The total area on one procedure should not exceed 400 cm^2. In case of need to impact on extensive surfaces (skin diseases, burn defeats) carry out radiation on areas no more than 80 cm^2. In these cases, it is recommended to influence in addition to not struck tissues on the periphery of an affected area (within 1,0 – 1,5 cm).

At impact on a projection of internals it is necessary to define the quantity of the irradiated zones and their area in advance. For example, in case of peptic ulcer of the duodenum, one of the scanning options will look like this: the most painful areas in the projection of the duodenum are determined by palpation of the abdominal cavity, by a lobe of the liver, gallbladder, body of the pancreas, and epigastrium. The right subcostal can be irradiated with the scanner of 4x2 cm, a pancreas body projection with the scanner of 5x2 cm, epigastrium with the scanner of 2x2 cm and to influence other areas with a laser spot. The matter is that in this pathology of a projection of a liver, gall bladder, body of a pancreas and an epigastrium are rather painful, but pain «is, as a rule, indistinct» on a rather big area.

In case of various pathologies, in addition to the projection of the affected organ, several more areas are selected for laser exposure that have a functional or energetic connection with the affected organ, as well as segmental zones (as a rule, these are paravertebral areas or Zakharin-Ged zones).

Before the procedure of laser influence on a zone the skin should be degreased by ethyl alcohol for reduction of reflection or are painted by water solution of methylene blue for increase of absorption of laser radiation. The wound surface should be cleared.

In each case the dose and, respectively, the number of areas for laser influence is strictly individualized. It is necessary to increase a dose for lighter sites of skin, and for darker the dose should be reduced (suntan). It is forbidden to influence pigmentary spots, a nevus, angiomas and other new growths owing to the high bio-stimulating effect of laser therapy.

3.16. Combination of other medical factors with therapy by the laser scanning beam

Laser therapy can be safely integrated with pharmacological, manual, and reflexotherapy techniques, creating a multimodal rehabilitation protocol.

Low-energy laser therapy by means of the scanning systems significantly differs from other types of laser therapy. If, for example, at treatment of pneumonia use a contact technique influencing the infrared laser, then in this case there is an opportunity to irradiate the defeat center through a ring magnet. That is influenced by two medical factors at the same time. When carrying out treatment with scanning laser systems there is no such opportunity, but this shortcoming is easily compensated for by the account of carrying out preliminary or subsequent influence by additional factors. By the most effective methods of the combined therapy where the scanning laser systems carry out the main or supporting role, are:

- Laser therapy + EHF-puncture.
- Ultrasound + laser therapy.
- Inducto-thermia + laser therapy.
- Magneto-therapy + laser therapy.
- UHF-therapy + laser therapy.
- Balneo-therapy+ laser therapy.
- Electrotherapy + laser therapy.

Besides, laser therapy, regardless of its workmanship, can be combined with great success with drug therapy. In this case the effect of medicines amplifies, and their dosage manages to be reduced. Besides, the side effect of medicines is in most cases blocked. However, it is peculiar, generally to lasers of a red range of radiation (0,63-0,67 microns).

Usually for one session it is possible to use up to three medical factors: one is preceding laser therapy (its purpose is to increase penetration and therapeutic action of laser radiation), the second is laser scanning therapy, and the third is strengthening action of the previous factors. If the first two factors affect one area (directly on the lesion), then the third factor should be directed at a remote area (acupuncture point, paravertebral zones, zones of segmental innervation, as well as the Zakharin-Ged zone). Let's review several examples of a similar combination.

Diseases of a liver and gallbladder

Magnetotherapy: The area of influence is the right hypochondrium. The amplitude value of magnetic induction is 25 mT. The procedure time is 15 minutes.

The following procedure without interruption: the laser scanning therapy.

The area of influence is the projection of a gallbladder (scanner 4x4 cm) – 6 min. + painful point (spot 1x1 cm) – 4 min. + paravertebral zone Th10-Th12 (scanner, width of scanning is 6 cm) – 7 min.

The following procedure in 20-40 min.

EHF-puncture. The area of influence is two points on a back (PC64 chzho-juy), or legs (PC152 is dan-nan-syue), or on hands (RTD8 pyan'-tou-dyan'). Influence time – 10-15 min. on a point, totally on procedure – till 30 minutes.

Certainly, the specified points are not absolute (though they also are effective at this pathology); the doctor makes the recipe itself or uses ready acupuncture copybooks.

Bronchial asthma

Low-frequency pulse electrotherapy. The frequency of influence is 8,0 Hz. The area of influence is electrodes in position of breast-back. Procedure time – 15 min.

The following procedure without interruption.

The laser scanning therapy. The area of influence: the sinocarotid zone – 2x3 min., a projection of a throat is higher than a thyroid gland – 1 min., breast cutting – 2 min., the breast handle – 2 min., a projection of adrenal glands – 2x1,5 min., paravertebral at the level of Th2-Th5 – 2x2 min.

The following procedure in 40-60 min.

EHF-puncture. The area of influence is two points on a back (PN50 chzhun-guan), or two points on hands (LI-4 (He-Gu), Ney-Guan (P-6), or two points on legs (R4 da-chzhun). Influence time – 15 min. on a point, totally – till 30 min.

Approximately the same scheme of treatment is developed when it is necessary to make a medical impact on several bodies. For example, one patient is disturbed by a liver, intestines and lungs. In this case it is necessary to define two most essential factors: what of specified bodies it is most struck and the therapeutic value (power) of medical factors. Let's assume that most patients are disturbed by asthma, short breath and liver pain. In that case the scheme of treatment can look as follows: a magnet-therapy on area of a liver + laser therapy according to the scheme of treatment of intestines + EHF-puncture according to the scheme of treatment of diseases of lungs and bronchial tubes. In the process of weakening the one of pain syndromes (we will assume, the first signs of damage of a large intestine) one of the medical «released» factors (in this case laser therapy «receded») «is thrown» on treatment of body, the second for the importance. Further the scheme looks as follows: a magnetotherapy on area of a liver + laser therapy according to the scheme of treatment of a liver and gall bladder + EHF-puncture according to the scheme of treatment of bronchial tubes and lungs. Certainly, the patient with such difficult pathology will need 2-3 courses within a year, but the scheme of treatment remains approximately the same.

3.17. The equipment for laser therapy

Overview of the main types of laser therapeutic devices, including portable and stationary systems, with technical characteristics and safety recommendations.

The high efficiency of laser therapy, which increased the need for laser equipment, on the one hand, and the conversion of the military industry, on the other, led to a high interest in the development and production of laser equipment in the republics of the former USSR in the early 1990s.

More than 300 samples of the laser equipment are offered to the consumer today. In different regions of the CIS, and sometimes and in one republic the separate enterprises, using the same laser generators, duplicate the release of the same equipment. Many devices functionally or structurally became outdated. The part of devices has no allowed conclusions for use in this or that area. However, the encouraging tendency to emerge in the market of laser devices of new generation is traced now.

These devices are intended for performance of laser therapy with use of a continuous or variable laser stream with additional modulation at Voll's frequencies.

Various versions of devices with infrared or visible (red) range bands with various power and a design are offered. Devices include systems for impact on the biologically active points (BAP) and reflex zones by contact (with use of various nozzles) or with use of a method of automatic scanning, one and two-wave systems, laser systems for intracavitary influence, laser stimulation of blood and a

hydro-laser shower. These devices work from the alternating current main with a frequency of 50 Hz and a voltage of 220 V, and have the built-in timer. Devices of this brand well proved at treatment of the following diseases:

- allergic disorders (allergic rhinitis, the bronchial asthma localized by the nursery of eczema, allergic conjunctivitis, gastrointestinal allergies);
- cardiovascular diseases;
- local pains of various etiology;
- endocrine system disorder;
- diseases of ENT organs;
- prostate diseases;
- gynecologic diseases;
- diseases of the bone and muscular system;
- exchange and dystrophic defeats, etc.

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CHAPTER 4

PRACTICAL RECOMMENDATIONS FOR THE USE OF LASER SCANNING AND MAGNETOLASER THERAPY IN REHABILITATION, ANTI-AGING, AND SPA MEDICINE

Lidiia V. Butska

Provides practical guidelines, contraindications, and clinical algorithms for the use of laser technologies in rehabilitation of war victims with pain syndromes, vascular, and musculoskeletal disorders.

Contraindications:

- Malignant neoplasms;
- Bleeding tendency;
- Calculous cholecystitis;
- Stage III hypertension;
- Ischemic heart disease (IHD), heart failure;
- Individual hypersensitivity to the factor;
- Acute cerebrovascular accident;
- Severe acute hypotension;
- Acute mental disorders;
- Presence of implanted pacemakers.

Magnetic-laser-therapy (MLT) is effective for various diseases as well as the impacts on common diverse nature of disease pathogenetic links. These common pathogenetic links refers to intracellular hypoxia, leading to a decrease in the body's energy potential (2 molecules of ATP are produced instead of 36-38, activated lipid peroxidation, impaired cellular metabolism, reduced functioning of the mitochondria, the membrane-damaged cell structure, adaptive reactions turn into pathological) (Butska l., Chernyak V., 2025).

The developed MLT techniques allow to influence basic pathogenetic links of the disease and, just as importantly, the processes of sanogenesis.

The method allows to act simultaneously on the three areas, the choice of which is carried out according to known principles of physical therapy, taking into account the recommendations outlined and experience of each individual physician.

However, the most important in the selection of areas for MLT is a multi-level system-principle that allows to «unite» disparate pathological process systems.

It is necessary to take into account the physical characteristics of each factor, their overall impact on the body and a specific organ or area, the depth of penetration into the underlying tissues and other. Thus, the inductor-emitter inducing MP and optical flow in the infrared range, should work on more deep-seated organs including ischemic foci in the brain and other. Inductor-emitter with the MP and optical stream in a red range – at superficial formations or tissues, including the neurovascular bundle and some reflex zones.

The impact of low-frequency ultrasound on a particular area or a projection of the internal organ is the most powerful of the applied, but it should take into account possible contraindications.

In each case, for each patient, in addition to the stimulation of the zones, select the necessary exposure parameters: frequency modulation factors, their power, the duration of the procedure.

In order to achieve a stable therapeutic effect is carried out course treatment, which comprises 3-5 to 20-21 procedures.

In cases of alleged long-term treatment (10 treatments and more – chronic or recurrent disease), the energy capacity of factors used should be increased gradually.

Methods of MLT should take into account the whole complex of medical actions in each case. Hence strictly necessary daily inspection of patients for timely registration of positive (or negative) changes in the condition of the patient, in consultation with experts. For acute diseases, treatment is carried out every day (sometimes 2 times a day) or every other day, chronic – a day or 2-3 sessions per week.

In some cases (with angina pectoris, postinfarction states, hypertension, stroke) when there is a threat of disease exacerbations (for 5-7-th session), the patient should be appointed antioxidants along with MLT (Aevitum 600 mg/day or a multivitamin including vitamins C, E, A).

The procedures are performed with the patient lying down or semi-reclining. The doctor determines the areas of the patient's body will be exposed to ultrasound and MLT. With significant amounts of the affected area, it is divided into zones and irradiated in turn, bearing in mind that the total time of one procedure should not exceed 30 minutes for MLT and 15 minutes for UST.

The areas of influence, pulse repetition frequency and capacity define individually for each patient according to the disease and treatment method. After the procedure, the patient should rest for 30-35 minutes.

Magnetic-laser-ultrasound therapy is not performed in the first 3 days of menstruation. It is advisable for women to start treatment 5-7 days after menstruation.

4.1. Diseases of the digestive system

4.1.1. K25 – Gastric ulcer, K26 – Duodenal ulcer

Peptic ulcer and duodenal ulcer are a chronic, prone to progression disease characterized by the occurrence of ulcer in the gastric mucosa, and (or) duodenal ulcer.

Etiopathogenesis

The etiological structure of peptic ulcer:

- hereditary constitutional factor;

- exogenous factors (neuro-emotional stress, a violation of the regime of the day and meals);
- endogenous factors (nerve reflex action on the stomach and duodenum from the other affected organs, as well as cardiovascular, urinary and endocrine systems.

The emerging with pathological viscero-visceral reflexes violate the regulation of gastroduodenal causing discoordination secretory and motor functions of the stomach and duodenum.

It is possible that a certain role in the pathogenesis of peptic ulcer disease plays a violation of blood circulation, as well as autoimmune reaction caused by infection *H. pylori*.

Treatment scheme

The exposure is carried out before meals or 2 hours after meals (alcohol and smoking are contraindicated, requires an appropriate diet).

5 minutes before the start of the procedure to drink 300 ml of liquid (phyto solutions, mineral water, etc.).

The front panel of the device exhibiting the following procedure parameters (Table 1).

Table 1. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
70-90	9-12	9,5 – stomach ulcer 8,6 – duodenal ulcer	LSB – up to 20 MLT – no more than 25

Method of treatment

Technique of procedures: the zones of influence are given in Tabela 2 and Figere 1.

The LSB is carried out remotely on skin directly or through the medicine applied on skin.

Performance of MLT is carried out contacting along with LSB. Inductors establish on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

1st day:

LSL – the zone SP (stomach projection).

MLT of Red – a zone 8 (paravertebral, projection C8-Th3).

MLT an IR – zone 26 (paravertebral, Th10-Th12 – a segmentary zone of an innervation of a pancreas), a zone 26a (Th5-Th8 – a segmentary zone of an innervation of a stomach).

2nd day:

LSL – a zone 17 (a liver projection).

MLT Red – zone 25 (Th7-Th12 projection segmentary zone of an innervation of a liver),

zone DZ (additional zone, AT 36 epicenter).

MLT IR – a zone 17 (a liver projection), after UST (ultrasound therapy)

MLT Blue – a zone 17 (a liver projection), after UST.

Frequency of carrying out procedures: daily or every other day. The number of procedures on a course of treatment: up to 15.

Repeated treatment: in case if necessary within 30 days.

Possible combination to other methods of treatment:

- diet therapy in combination with psycho-physiological correction;

- medicinal therapy,
- phytotherapy.

Table 2. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT of Red
PZH; 17	26; 26a; 17	8; 25; DZ

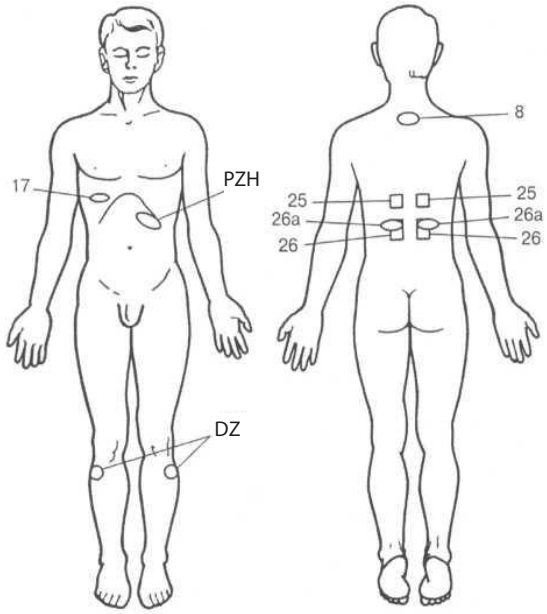


Figure 1. Zones for placing inductors

4.1.2. K70 – Liver toxicity

Nonspecific reactive hepatitis is a disease caused by exogenous acute poisoning acute or chronic liver disease.

Etiopathogenesis

Toxic liver damage is caused by various pathological processes (inflammation, necrosis, degeneration, abnormal regeneration of the liver) due to exposure to toxic substances, as well as in excess of the dose exposure to a substance.

The main groups of toxic agents: hepatotropic poisons, plant poisons, phenols, alcohols, salts of heavy metals, poisons of biological origin (toxins), industrial and household chemicals, etc.

Treatment scheme

Treatment is comprehensive: MLT against the background of active detoxification (plasmaphoresis, dialysis, biological) and conventional therapy. Indications for the MLT are hyperbilirubinemia in excess of 80 mmol/L and increase the level of enzymes ACT and ALT serum blood more than 5 times. At lower rates below 80% of prothrombin and fibrinogen – below 1.8 g/l Execution MLT is not advisable.

The front panel of the device exhibiting the following procedure parameters (Table 3).

Table 3. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
40-60	9-12	37; 50 to alternaten every other day	MLT - 10 times per zone, LSL-20 times

Method of treatment

Position of the patient – lying on his back.

Technique of procedures: the zones of influence are given in Table 4 and Figure 2.

ML inductors install on a projection of the pathological center and paravertebral.

At MLT the Red inductor to move slow roundabouts advance on the zones corresponding to the left and right shares of a liver. MLT IR – is enclosed under the patient paravertebral, not movably (for 3 minutes on the right and at the left).

LSL – remote, LSL – zone 17 (liver projection).

MLT R – Zone 17 (liver projection).

MLT IR – Zone 25 (paravertebral, Th7-L2 liver innervation zone).

MLT Blue – Zone 17 (liver projection).

Venous (non-invasive) blood irradiation.

MLT Red – elbow bends (left, right) – for 20 min. Frequency of carrying out procedures: daily.

The number of procedures on a course of treatment: 6-12.

Possible combination to other methods of treatment:

- diet therapy in combination with psychophysiological correction;
- medicinal therapy;
- phytotherapy.

Table 4. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
17	17	25

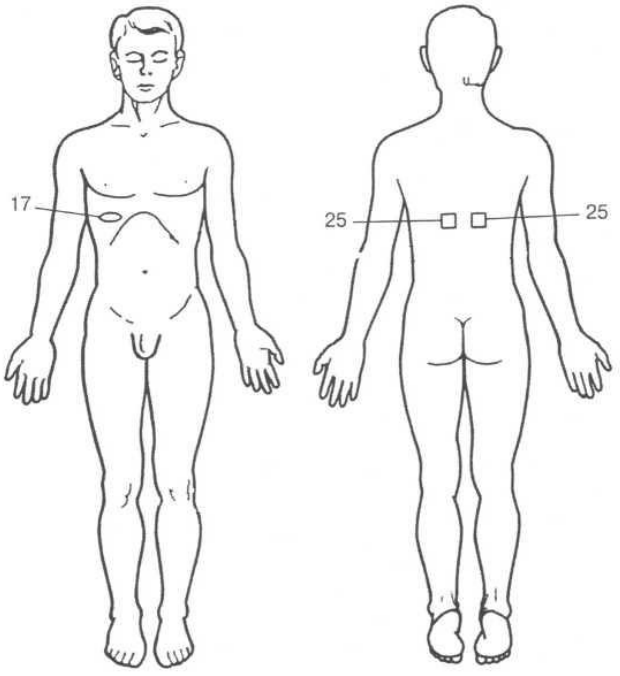


Figure 2. Zones for placing inductors

4.1.3. K71 – Chronic hepatitis

Chronic hepatitis is a disease of inflammatory and degenerative nature of the liver.

Etiopathogenesis

Established etiologic relationship of chronic viral hepatitis with acute viral hepatitis B, C, D, F and G. The development of chronic viral hepatitis is facilitated by such adverse factors as late hospitalization of patients with acute hepatitis, wrong treatment, premature statement, burdened premorbid background, and presence of concomitant chronic diseases, use of alcohol, drugs, and superinfection by other hepatotropic viruses, such as delta virus infection with HBV.

The leading mechanism of liver injury in chronic viral hepatitis is the interaction between virus-containing immune cells with hepatocytes. Patients with chronic hepatitis noted the inadequacy of the immune response, resulting in antigen recognition process on the surface of hepatocytes and their elimination is disturbed and sometimes becomes impossible.

Treatment is complex: MLT on background active of detoxification (plasmapheresis, dialysis, biological) and conventional therapy.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 5).

Table 5. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
60-80	9-12	37-50 (1-3 sessions); 77 (4-10 session)	MLT - 3 on a zone, LSB - 10-15 times

Method of treatment

Position of the patient – lying on his back.

Technique of the procedures: the zones of influence are given in Table 6 and Figure 3.

The inductor established in a projection of the pathological center and paravertebral.

At MLT IR inductor with slow roundabouts movements on the zones corresponding to the left and right shares of a liver. MLT Red – is enclosed under the patient paravertebral, not movably (for 3 minutes on the right and at the left).

LSB – remotely, zone 17 (liver projection).

MLT of Red – zone 25 (paravertebral, Th7-L2 liver innervation zone).

MLT IR – zone 17 (liver projection).

MLT Blue – zone 17 (liver projection).

Venous (non-invasive) blood irradiation.

MLT Red – elbow bends (left, right) – for 20 min. Frequency of carrying out procedures: daily.

The number of procedures on a course of treatment: 10. Repeated course of treatment: in 2-3 weeks.

Possible combination to other methods of treatment:

- diet therapy in combination with psychophysiological correction;
- medicinal therapy;
- phytotherapy;
- laser reflex-therapy.

Table 6. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
17	17	25

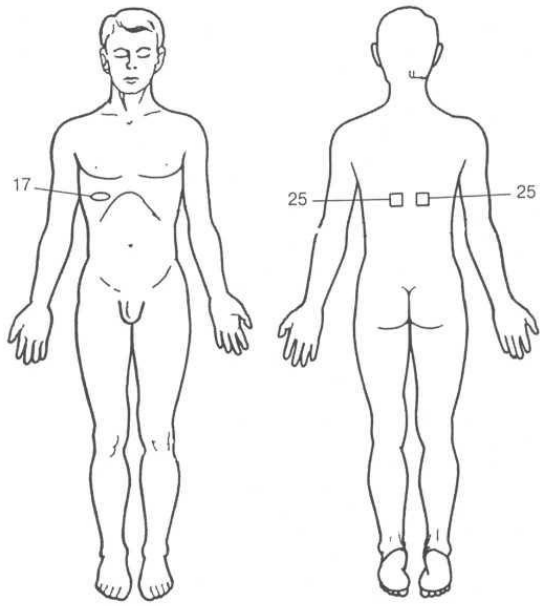


Figure 3. Zones for placing inductors

4.1.4. K86.0 – Chronic pancreatitis

Chronic pancreatitis is a progressive inflammatory disease of the pancreas accompanied by severe violation of its functions.

Etiopathogenesis

The most common causes of chronic pancreatitis are diseases of the stomach, duodenum, liver, gallbladder and biliary tract (hepatitis, cirrhosis, cholecystitis, cholangitis, duodenitis, peptic ulcer disease, particularly ulcer penetrating the pancreas). Chronic pancreatitis occurs in almost 30% of patients undergoing cholecystectomy. Among the reasons for it should be noted nutritional disorders and changes in fat metabolism (errors in diet, alcohol); intoxication, poisoning; changes in the ductal system of the pancreas (primary tumor, stricture, metaplasia of the epithelium of the excretory ducts); contusions pancreas; acute and chronic infections.

An important role in the pathogenesis of chronic pancreatitis plays intraorganic activation of enzymes (protease and lipase) damaging the prostate tissue. Contributing moments for the development of chronic pancreatitis is stagnant secretions caused by a mechanical obstacle in its excretory ducts.

Pathogenesis. Chronic pancreatitis causes severe disorders of parietal digestion and absorption, disruption of metabolism of proteins, fats and carbohydrates.

Treatment scheme

- strict abstention from alcohol;
- enzymatic replacement therapy;
- observance of a diet, frequent fractional food;
- reduction of consumption of animal fats;
- antispasmodic means;
- analgesics, including narcotic;
- the means regulating motor function; peptides (stilamin 3 mg in 8-10 h within 5-6 days);
- correction of exocrine and endocrine insufficiency;
- non-steroidal anti-inflammatory drugs.

The front panel of the device exhibiting the following procedure parameters (Table 7):

Table 7. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
60-80	9-12	37-50, 77 (on pain zones)	LSB – 20 times on a zone; MLT – 15 times in total

Method of treatment

Position of the patient – lying on his back.

Frequency of treatments: daily.

Number of treatments: 10-12.

Repeated treatment: if necessary, after 2 weeks.

Possible combination with other treatments:

- Diet therapy;
- Drug therapy;
- Phytotherapy.

Methods of exposure: stable at the recommended zone (Figure 4, Table 8).

Impact MLT inductors set (stable) on a projection of pathological hearth, or in paravertebral reflex zones and the zone of the medulla oblongata.

MLT R – Zone 4 (zone of the medulla oblongata)

Area 37 (between the inner ankle and Achilles tendon attachment place the left foot).

MLT IR – Zone 25 (paravertebrally, Th10- Th12 segmental innervation area of the pancreas).

Table 8. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
18; 19; 21	25	4, 31

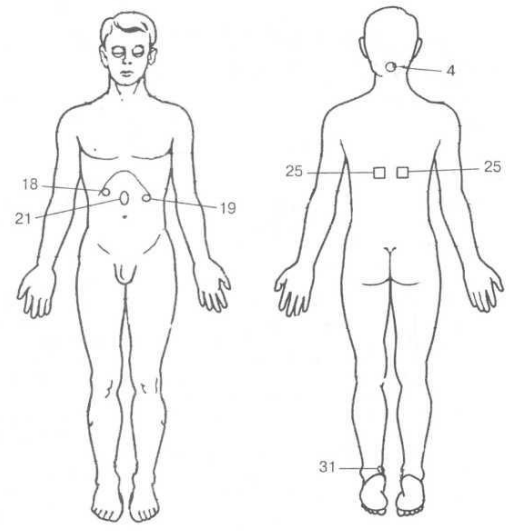


Figure 4. Zones for placing inductors

4.2. Respiratory diseases

4.2.1. A15-A19 – Pulmonary tuberculosis

Tuberculosis is an infectious disease characterized by the formation of specific foci of inflammation in the affected tissue and a pronounced general reaction of the body. The main source of infection is a sick person.

Etiopathogenesis

The causative agent of tuberculosis is the tubercle bacillus or Mycobacterium tuberculosis. It retains its activity for a long time on the objects (clothing, utensils, etc.), Resistant to acids and many disinfectants. The main source of infection is a sick person or a sick animal. The main route of infection – airborne.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 9):

Table 9. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
60-80	12-15	9,4	LSB - 5 on a zone, to 15 totally MLT - do15 times totally

Method of treatment

Position of the patient – lying on his stomach at LSB of paravertebral zones.

Technique of the procedures: the zones of influence are given in Figure 5 and Table 10.

The LSB is carried out remotely on skin directly or through the medicine applied on skin.

The MLT is carried out in contact, together with LSB.The inductor established not movably on a projection of a medulla, the pathological center, paravertebral on area of an innervation of pathological body or reflex zones.

LSB – Zone 23 (paravertebral, Th2-Th5 segmentary zone of an innervation of a lung), zone 16 (a projection of the possible centers of tuberculosis).

MLT Red – Zone 15 (thymus projection), zone 12 (thymus gland), zone 11 (an elbow pole), zone 20 (spleen projection), a zone 10 (palmar surface of brushes).

MLT IR – a zone 8 (a projection of segments of a spinal cord of C7 – Th2), a zone 27 (paravertebral, Th11- L1 zone of an innervation of a kidney and adrenal gland).

Venous (non-invasive) blood irradiation.

MLT Red – elbow bends (left, right) – for 20 min.

ATTENTION!

Usually for one session use 3-4 zones: 1-2 zones for influence with LSB and 1-2 zones for influence of MLT.

Frequency of carrying out procedures: in 1-2 days. The number of procedures on a course of treatment: 15.

Repeated course of treatment: 1,5-2 months conduct 1-3 courses with breaks. Possible combination to other methods of treatment:

- specific antitubercular therapy;
- medicinal therapy;
- phytotherapy.

Table 10. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT of Red
16, 23	27; 8	15; 12; 20; 11; 10.

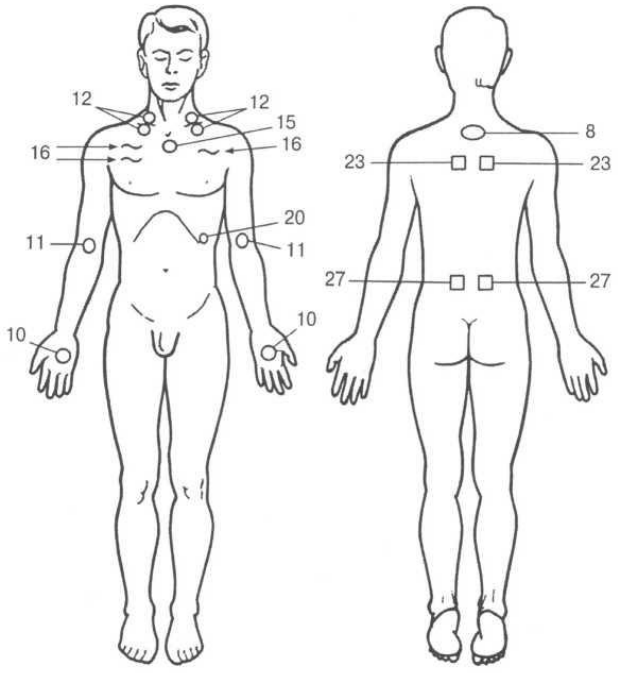


Figure 5. Zones for placing inductors

4.2.2. J18 – Pneumonia

Pneumonia is a inflammation of infectious origin, manifested organic and functional lesions of the bronchi, and interstitial parenchymal tissue, blood and lymph vessels of the lungs.

Etiopathogenesis

The most common cause is gram-positive bacteria: pneumococci (40 to 60%), staphylococcus (2 to 5%), streptococci (2.5%); gram-negative bacteria: Friedlander bacillus (3 to 8%), hemophilic bacillus (7%), viral and fungal infections. Also, pneumonia may develop from exposure of non-infectious factors on chest: ionizing radiation, toxins, allergic agents.

The pathogens of infectious pneumonia penetrate the lungs by bronchogenic, hematogenous or lymphogenous routes. When having a reduced bronchopulmonary protective barrier in the alveoli, develop infectious inflammation, which through interalveolar the permeable walls extend to other departments of the lung tissue. The alveoli formed exudate, which preventing the gas exchange oxygen between the lung tissue and blood vessels. After are developing the oxygen failure and respiratory failure, and in complicated pneumonia – heart failure.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 11):

Table 11. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
40-60	12-15	75-80	LSB – 10 times on one field MLT - up to 15 times in total

Method of treatment

Position of the patient – lying on his back.

Technique of the procedures: the zones of influence are given in Figure 6 and Table 12.

LSB is performed remotely on the skin directly or with the help of a medication applied to the skin.

MLT is carried out in contact, together with LSB. The inductor established not movably on a projection of a medulla, the pathological center, paravertebral on area of an innervation of pathologic body or reflex zones.

ATTENTION!

The surface of a thorax is divided into 6 fields: right and left in front, right and left behind and 2 lateral.

Usually for one session use 2 fields for influence of LSB (excepting area of a breast and heart) and 2 zones for influence of MLT.

LSB – Zone 1 (the right and left field in front of a thorax), zone 2 (the right and left field behind a thorax), zone 3 (the right and left field sideways a thorax).

MLT Red – Zone 15 (thymus projection), zone 4 (medulla zone), zone 10 (palmar surface of a brush).

MLT IR – Zone 23 (paravertebral, Th3- Th6 segmentary zone of an innervation of bronchial tubes), zone 4 (medulla zone), zone 8 (projection of segments of a spinal cord of C8-of Th2).

Venous (non-invasive) blood irradiation.

MLT Red – elbow bends (left, right) – for 20 min.

Frequency of carrying out procedures: daily or every other day.

The number of procedures on a course of treatment: 8-12.

Repeated course of treatment: 1-3 courses with 1,5-2 months breaks.

Possible combination to other methods of treatment:

- medicinal and phytotherapy;
- EHF-puncture.

Table 12. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
1; 2; 3	4; 8; 23	4; 10; 15

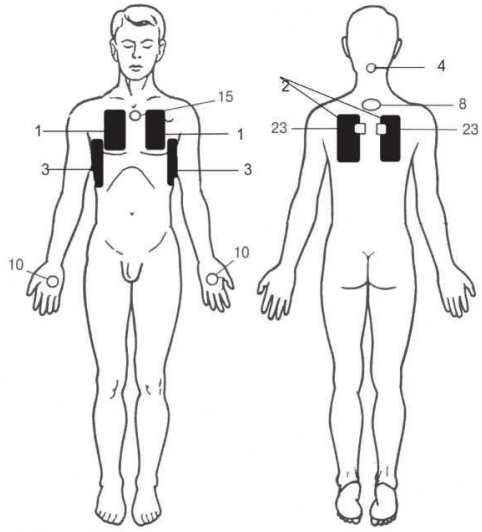


Figure 6. Zones for placing inductors

4.2.3. J.45 – Bronchial asthma

Bronchial asthma is a allergic or infectious-allergic disease, manifested periodically by advancing attacks of breathlessness, having different strength and duration (from several hours to several days).

Etiopathogenesis

The emergence of an attack is caused by spasm of the bronchial tubes, mucous membrane swelling and obstruction of discharge of mucus secreted in abundance. Infectious agents also are an important component in the pathogenesis of asthma, since microorganisms, their metabolic products can act as allergens causing sensitization. In addition, continuous contact supports infection inflammation of the bronchial tree in the active phase, which reduces the body's sensitivity to exogenous allergens.

Procedures on the device "Helios" at bronchial asthma of a noninfectious origin reduced the throat hypostasis level, increases a blood micro-circulation.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 13):

Table 13. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
40-60	12-15	8,0	LSB: zone 5 – 5 times; zone 16 - 7 times; zone 12 - 2 times; MLT - to 10 totally

Method of treatment

Position of the patient – lying on his back.

Technique of the procedures: the zones of influence are given in Figure 7 and Table 14.

The LSB is carried out through the contact environment – 2% Novocain ointment on lanolin; hydrocortisone.

The MLT is carried out in contact, together with LSB.The inductor established not movably on a projection of a medulla, the pathological center, paravertebral on area of an innervation of pathologic body or reflex zones.

LSB – Zone 5 (projection of pheochromic body – lateral surface of a neck), zone 12 (subclavian areas), zone 16 (6-8 intercostal space at the left and on the right).

To alternate zones 5 and 12 every other day.

MLT Red – Zone 4 (medulla zone).

MLT IR – a zone 23 (paravertebral, Th3- Th6 segmentary zone of an innervation of bronchial tubes).

Venous (non-invasive) blood irradiation.

MLT Red – elbow bends (at the left, on the right) – for 20 min.

Frequency of carrying out procedures: in an aggravation stage – daily, at improvement of a state – every other day.

The number of procedures on a course of treatment: 10.

Repeated course of treatment: in a month.

Possible combination to other methods of treatment:

- medicinal therapy;
- laser- and EHF-puncture;
- physio-therapy exercises.

Table 14. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
5; 12; 16	23	4

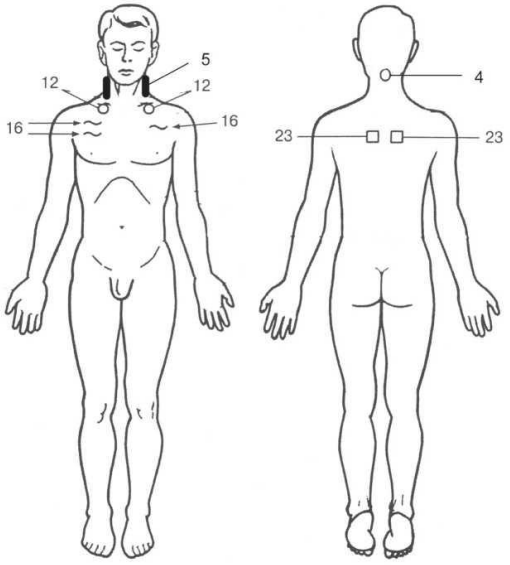


Figure 7. Zones for placing inductors

4.3. Diseases of the sex-urinary system

4.3.1. N11 – Chronic prostatitis

Prostatitis is an acute or chronic inflammation of the prostate (prostate).

Symptoms: a burning sensation or pain in the perineum, frequent urination, fever, pain in the sacrum.

Etiopathogenesis

Chronic prostatitis occurs in the implementation of microorganisms in the prostate tissue and an important role is played by chlamydial infection (60-70% of cases). Equally important are other micro-organisms (viruses, mycoplasmas, Gardnerella, Trichomonas, etc.) and their associations.

Etiological predisposing factors: immune deficiency, age-related changes, hormonal disorders, especially of the venous system. In the development of chronic prostatitis special attention given to poor circulation in the veins of the pelvic and emerging stagnation (hypothermia, inflammation of hemorrhoidal veins, inactivity). Play a role innervation disorders, hormonal changes, immunological disorders.

Procedures on the device "Helios" reduce the inflammatory process, increases blood supply of a prostate gland, intensifies action of pharmacological preparations.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 15):

Table 15. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
40-60	12-15	9,4; 20; 73; 75	LSB – up to 20 MLT – up to 10

Method of treatment

Position of the patient – lying on his back.

Technique of procedures: the zones of influence are given in (Table 16, Figure 8).

The LSB is carried out remotely on skin directly or through the contact environment (medication – hydrocortisone).

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

LSB – Zone 1 (crotch),

zone 27 (paravertebral, Th7-L2 projection segmentary zone of an innervation of kidneys).

MLT Red – zone 36 (plantar surface of foot at the left/on the right),

zone 15 (thymus projection),

zone 30 (popliteal poles on the right/at the left).

MLT IK – zone 28 (Mikhaelis's rhombus),

zone 4 (area of a medulla).

MLT Blue – zone 1 (crotch).

We alternate zones of influence in the following sequence: the 1st day – 1; 27 (LSL); 15; 30 (MLT Red); 4 (MLT IR).

The 2nd day – 1; 27 (MLT Blue); 15; 36 (MLT Red); 28(MLT IR), etc.

Frequency of carrying out procedures: daily or every other day. The number of procedures on a course of treatment: 12-15.

Repeated treatment: in case of need in 30 days. Possible combination to other methods of treatment:

- physioreflex-therapy; psychotherapy;
- medicinal therapy;
- massage of a prostate gland.

Table 16. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
1; 27	28; 4	15; 36; 30

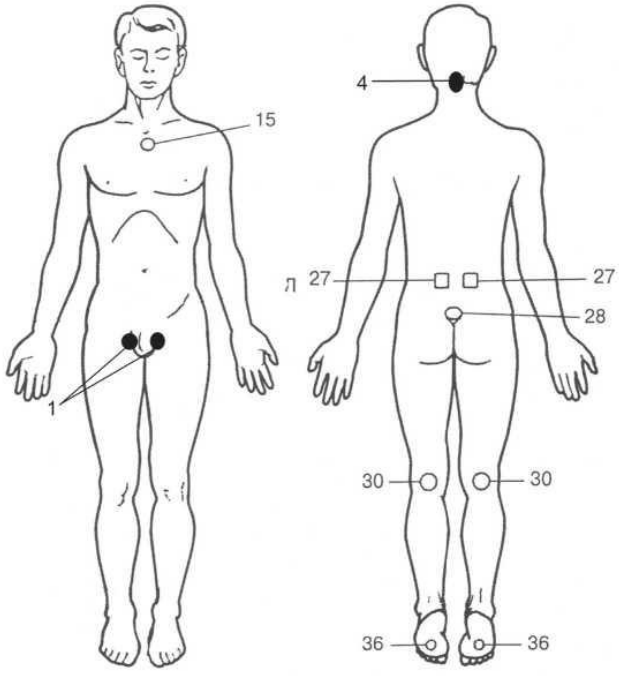


Figure 8. Zones for placing inductors

4.3.2. N11 Chronic pyelonephritis

Chronic pyelonephritis is a nonspecific infectious kidney disease.

Etiopathogenesis

Common causative agents of pyelonephritis are E. coli, enterococci, and staphylococci.

The infection reaches the kidney in the following ways. Hematogenous route: bacteria penetrate the bloodstream and enter the kidney from primary foci of infection (bones, skin, endothelium, etc.) as a result of diseases such as acute tonsillitis, otitis media, abrasions, etc. Ascending urinogenic route: from the lower urinary tract. This process occurs as a result of disturbances in urine dynamics (reverse flow promotes the reflux of urine from the bladder back into the kidney). Ascending through the wall of the urinary tract (ureter).

The renal parenchyma, interstitial tissue, pelvis, and calyces are affected.

Pathogenesis of chronic pyelonephritis:

- Disturbances of urodynamics and lymph flow;
- Effects of immune mechanisms;
- Genetic factors.

Procedures using the "Helios" device reduce inflammation and enhance the effects of pharmacological treatment.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 17):

Table 17. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
60-80-100 accumulates with each session	12-15	3,5; 8,1; 53; 63; 86	LSB – 5 times on a zone Up to15 totally MLT - 3-5 times on a zone

Method of treatment

Position of the patient – lying on his back.

Technique of the procedures: the zones of influence are given in Table 18 and Figure 9.

The LSB is carried out remotely on skin directly or through the contact environment (LSB gel; Vaseline; medicinal preparation).

The MLT is carried out in contact, together with LSB.Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of organs, on area of reflex zones or a zone of a medulla.

LSB – Zone 27 (paravertebral, Th7-L2 projection of a segmentary zone of kidneys innervation).

MLT Red – Zone 36 (a plantar surface of foot at the left/on the right),

- zone 15 (thymus projection),

MLT IR – Zone 27a, 27b (external-internal surface of a stomach, the end of the 12th edge at the left/on the right).

Venous (non-invasive) blood irradiation.

MLT Red – popliteal poles (at the left, on the right) – for 20 min.

Frequency of carrying out procedures: 3-4 sessions daily, the subsequent – in 1-2 days.

The number of procedures on a course of treatment: 14-15.

Repeated treatment: in case of need in 30 days. Possible combination to other methods of treatment:

- physio-reflex-therapy;
- antibacterial drug treatment.

Table 18. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
27	27a; 27b	15; 36

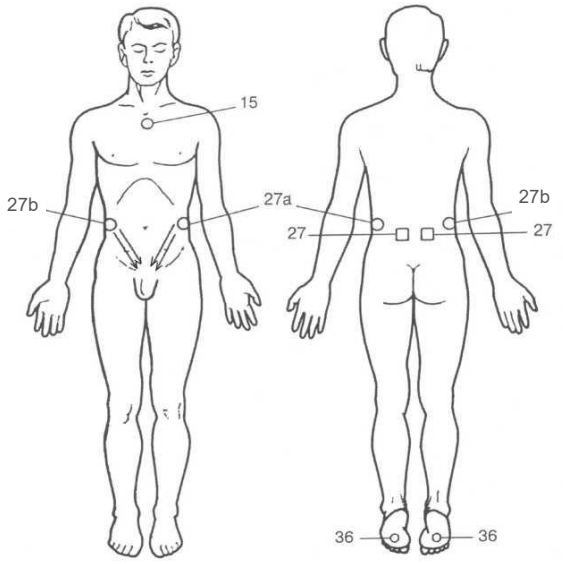


Figure 9. Zones for placing inductors

4.3.3. N20-N23 – Urolithiasis

Urolithiasis is a polietiologic disease characterized by the presence of a stone or more stones in the kidney and / or urinary tract.

Etiopathogenesis

Causes: hereditary disorders of urodynamics, urinary tract infection, gastrointestinal disease, liver and biliary tract, congenital and acquired disorders of urodynamics of the upper and / or lower urinary tract; prolonged immobilization secondary disturbances of activity of enzymes, hormones or deficit / surplus of vitamins; disease leading to kidney stone disease (osteoporosis, leukemia, bone metastases).

The pathogenesis of stone disease is associated with one of the three main hypotheses:

- precipitation of crystallization;
- the formation of the matrix – nucleation;
- lack of crystallization inhibitors.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 19):

Table 19. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
60-80	12-15	Scanning frequency 10-100	LSB - 5 on a zone, up to 20 totally MLT - 3-5 on a zone, up to 15 totally

Method of treatment

Position of the patient – lying on his back.

Technique of the procedures: the zones of influence are given in Table 20 and Figure 10.

The LSB is carried out remotely on skin directly or through the contact environment (LSB gel; vaseline; medicinal preparation).

The MLT is carried out in contact, together with LSB.Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of organs, on area of reflex zones or a zone of a medulla.

LSB – Zone 27v (a projection of pelvis and ureter on the party of uric sand or «a stone path»).

MLT Red – Zone 36 (a plantar surface of foot at the left/on the right), – Zone 15 (a thymus projection).

MLT IR – Zone 27 (paravertebral, Th7-L2 projection of segmentary zone of an innervation of kidneys).

Frequency of carrying out procedures: 3-4 sessions daily, the subsequent – in 1-2 days.

The number of procedures on a course of treatment: is defined by efficiency of treatment (on average 7-10).

Repeated treatment: in case of need in 2 months. Possible combination to other methods of treatment:

- additional electro stimulation or magneto stimulation to ureter or pelvis after the MLT procedure;
- electro stimulation of a bladder, simultaneous with MLT;
- medicamentous therapy;
- the drinking mode (preferably mineral water "Naftusya")
- warm bath before procedure.

Table 20. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
27v	27	15; 36

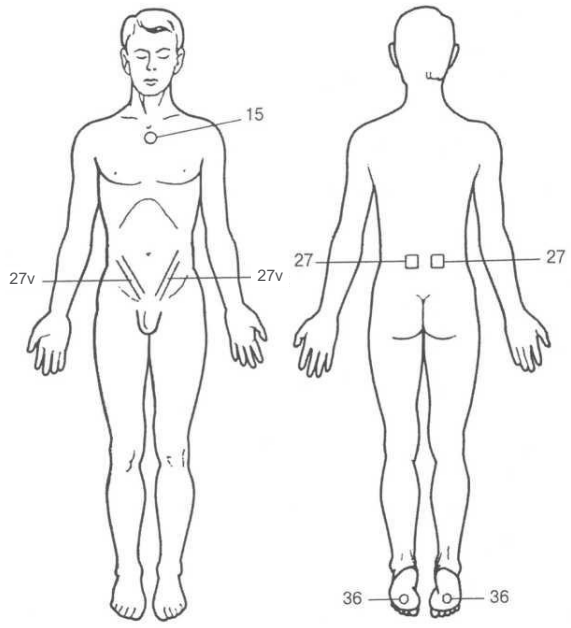


Figure 10. Zones for placing inductors

4.4. Diseases of the circulatory system

4.4.1. I10 – Hypertensive heart disease

Hypertensive heart disease is a persistent increase in blood pressure above the physiological norm (140/90 mm Hg) in patients who are not receiving antihypertensive therapy.

Etiopathogenesis

The basis of this disease is high voltage (increased tone) of the walls of small arteries (arterioles) of the body, which leads to their narrowing and reduction of their lumen. This hampers the movement of blood from one portion of the vascular system (artery) into another (the vein), resulting in pressure on the arterial wall increases.

Stage I: 140-159 mm.Hg. for systolic; 90-99 mm.Hg. for diastolic.

Stage II: 160-179 mm.Hg. for systolic; 100-109 mm.Hg. for diastolic.

Stage III: >180 mm.Hg. for systolic; >110 mm.Hg. for diastolic.

Procedures with use of the device "Helios" are appointed at a combination of a hypertensive illness to backbone osteochondrosis.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 21):

Table 21. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
40-60	9-12	3,3; 9,4; 6; 9,2; 9,5; 65; 96	LSB – up to 10 totally; MLT – up to 10 totally.

Method of treatment

Position of the patient – lying on his back.

Technique of the procedures: the zones of influence are given in Table 22 and Figure 11. The LSB is carried out through the medicine applied on skin.

The MLT is carried out in contact, together with LSB.Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

LSB – Zone 24 (paravertebral, Th1-6 a segmentary zone of an innervation of heart).

MLT Red – Zone 12 (over – and subclavian zones);

- zone 11 (elbow pole on the right/at the left);
- zone 30 (popliteal pole on the right/at the left).

MLT IR – Zone 21 (a projection of a coeliac plexus);

- zone 17 (liver projection),
- zone 31 (projection of a tibial artery on the right/at the left);
- zone 35 (projection of a back artery of foot),
- zone 29 (projection of a femoral artery).

ATTENTION!

For influence of MLT Red and MLT IR use 2-3 zones (from offered) for one session.

Venous (non-invasive) blood irradiation.

MLT Red – popliteal poles (at the left, on the right) – for 20 min. Frequency of carrying out procedures: daily or every other day. The number of procedures on a course of treatment: to 10.

Repeated treatment: in case of need in 30 days. Possible combination to other methods of treatment:

- medicinal therapy; phytotherapy;
- EHF-puncture;
- psychotherapy.

Table 22. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
24	17; 21; 10; 29; 35; 31; 36	12; 11; 30

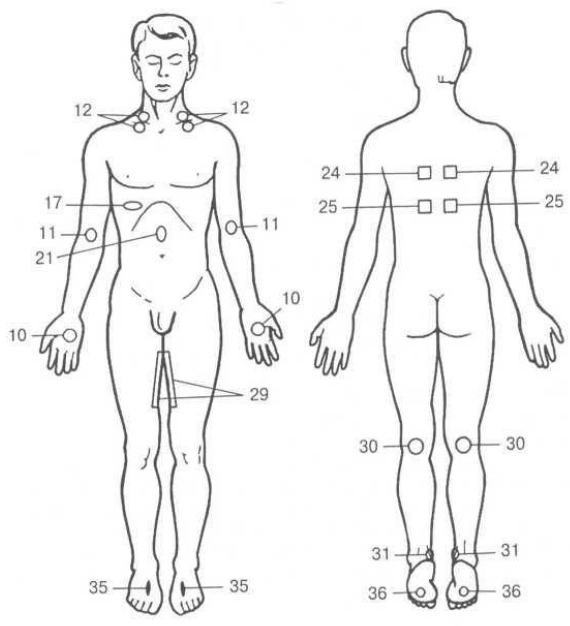


Figure 11. Zones for placing inductors

4.4.2. I22 – Myocardial infarction

Myocardial infarction is a necrosis of individual sections of the heart muscle on the basis of acute ischemia resulting from non-compliance of the coronary circulation of the myocardium requests.

Etiopathogenesis

Risk factors: hypercholesterolemia and hypertriglyceridemia, or more precisely, the presence of hyperlipidemia mainly of type II and IV with a high content of beta-atherogenic and pre-beta-lipoproteins, a decrease in the level of antiatherogenic α-lipoproteins in the blood, impaired glucose tolerance, increased α-globulin levels, signs of blood hypercoagulation and inhibition of fibrinolysis, left ventricular hypertrophy, atherosclerosis with its preclinical and clinical manifestations, hypercholesterolemic xanthomatotic, age over 40 years (especially in men), family history (presence of myocardial infarction in close relatives), limited physical activity, hypertension, diabetes mellitus, obesity, smoking, psycho-emotional stress and stressful situations. The direct risk factors for myocardial infarction include angina pectoris. A high risk factor for myocardial infarction is small-focal myocardial infarction, which refers to intermediate forms of coronary heart disease, and to a true pre-infarction state in 20-30% of cases.

Procedures with use of the device «Helios» are appointed in a reconvalescence stage for the purpose of decrease in sensitivity of zones of a skin hyperalgesia and stimulation of reparative processes.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 23):

Table 23. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
60-80	9-12	43; 95	LSB – up to 10 totally; MLT – up to 15 totally.

Method of treatment

Position of the patient – lying on his back.

Technique of the procedures: the zones of influence are given in Table 24 and Figure 12.

The LSB is carried out through the medicine applied on skin.

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

LSL – zone 12 (over – and subclavian zones).

MLT Red – zone 11 (an elbow pole on the right/at the left);

zone 30 (popliteal pole on the right/at the left).

MLT IR – Zone 24 (paravertebral, Th1-6 a segmentary zone of heart);

zone 21 (projection of coeliac plexus);

zona17 (liver projection);

zone 31 (projection of a tibial artery on the right/at the left);

zone 35 (projection of a back artery of foot);

zone 29 (projection of a femoral artery).

Venous (non-invasive) blood irradiation.

MLT Red – popliteal poles (at the left, on the right) – for 20 min. Frequency of carrying out procedures: 3-4 times a week.

The number of procedures on a course of treatment: 12.

Repeated treatment: in case of need in 30 days.

Possible combination to other methods of treatment:

- medicinal therapy;
- phytotherapy;
- EHF-puncture.

Table 24. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
12	24; 25; 17; 21; 10; 29; 35; 31; 36	11; 30

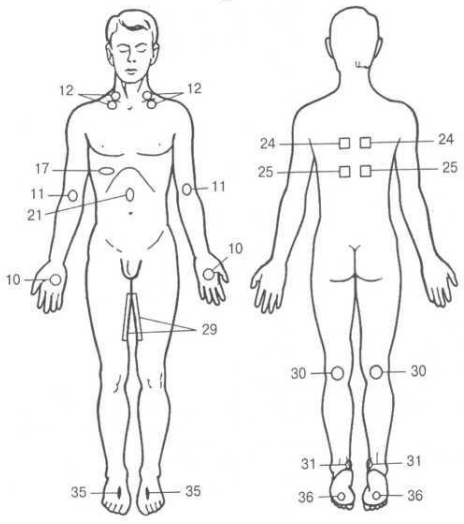


Figure 12. Zones for placing inductors

4.4.3. I49 – Extrasystole (Option 1)

Extrasystole is the most common kind of arrhythmia. Depending on the location of occurrence of arrhythmia is divided into atrial, ventricular and atrioventricular.

Etiopathogenesis

The reason of arrhythmias may be different intoxications – endogenous, the main importance is the hyperthyroidism, and exogenous – digitalis intoxication, taking diuretics (potassium depletion of the body), aminophylline, insulin, as well as the use of strong tea or coffee, excessive smoking.

The immediate cause of arrhythmia is to increase the excitability of the heart muscle in any of its plot. This is possible with the weakening of the automatism of the sinus node, in violation of the sinus impulse propagation in any portion of the myocardium as a result of focal lesions, in connec-

tion with which this outbreak occurs independent excitation pulse. Beats may occur in many parts of myocardium and therefore has a different clinical significance.

Pathogenetic basis it is to increase the automaticity of individual sections of the myocardium, and the possible mechanism of re-entry, as well as trigger mechanism.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 25):

Table 25. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
40-60	9-12	6	LSB - 2 for BAP, for local points; on 1 for BAP for distal. MLT - 15 totally.

Method of treatment

Position of the patient – lying on his back.

Technique of the procedures: the zones of influence are given in Table 26 and Figure 13.

The LSB is carried out remotely on the BAP (biological active points).

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

Laser-puncture – acupuncture points. The recommended recipe:

P1 (2) + MC5 (2);

V15(2) + C7 (2).

MLT Red – Zone 30 (a popliteal pole on the right/at the left).

MLT IR- zone 8 (a projection of segments of a spinal cord of C8-Th2).

ATTENTION!

For influence of MLT Red and MLT IR to use 2-3 zones (from offered) for one session.

Frequency of carrying out procedures: 3-4 times a week. The number ofprocedures on a course of treatment: 12.

Repeated treatment: in case of need in 30 days. Possible combination to other methods of treatment:

- medicinal therapy;
- phytotherapy;
- EHF-puncture.

Table 26. Zones for placing inductors

Zones of influence		
LSB	MLT IK	MLT Red
BAP	8	30

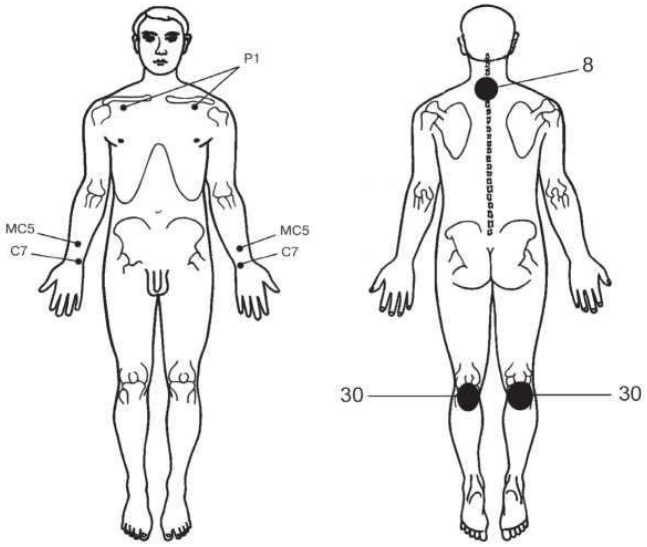


Figure 13. Zones for placing inductors

4.4.4. – I49 Extrasystole (Option 2)

Procedures with use of the device «Helios» are appointed at the violations of cardiac rhythm arising at change of nervous regulation of cardiac activity and increased excitability of cardiac muscle without objective symptoms of organic defeat of cardiovascular system.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 27):

Table 27. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
60-80	9-12	6	LSB - 2 for BAP. LSB – up to 5 on a zone, 15 totally MLT – up to 10 on zone, 25 totally

Method of treatment

Position of the patient – lying on his back.

Technique of the procedures: labile, on the zones of influence, as shown in Table 28 and Figure 14.

Carrying out LSB is carried out remotely or through the medicine applied on skin.

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

LSB – zone 17 (a liver projection),

zone 24 (paravertebral, segmentary heart innervation Th2-6),

zone 25 (projection of a liver and gall bladder).

MLT Red – Zone 30 (a popliteal pole on the right/at the left),

zone 10 (palmar surface of brushes),

zone 12 (over – and subclavian zones),

zone 11 (elbow pole).

MLT IR – Zone 21 (projection of a coeliac plexus),

zone 29 (projection of femoral vessels),

zone 31 (projection of a tibial artery),

zone 35 (projection of a back artery of foot).

Venous (non-invasive) blood irradiation.

MLT Red – popliteal poles (at the left, on the right) – for 20 min. Frequency of carrying out procedures: in 1-2 days. The number of procedures on a course of treatment: 10-15. Repeated treatment: in 3-4 months.

Possible combination to other methods of treatment:

- medicinal therapy;
- diet therapy in combination with psychophysiological correction;
- gymnastics.

Table 28. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
24; 25; 17	21; 29; 31; 35	10; 11; 30; 12

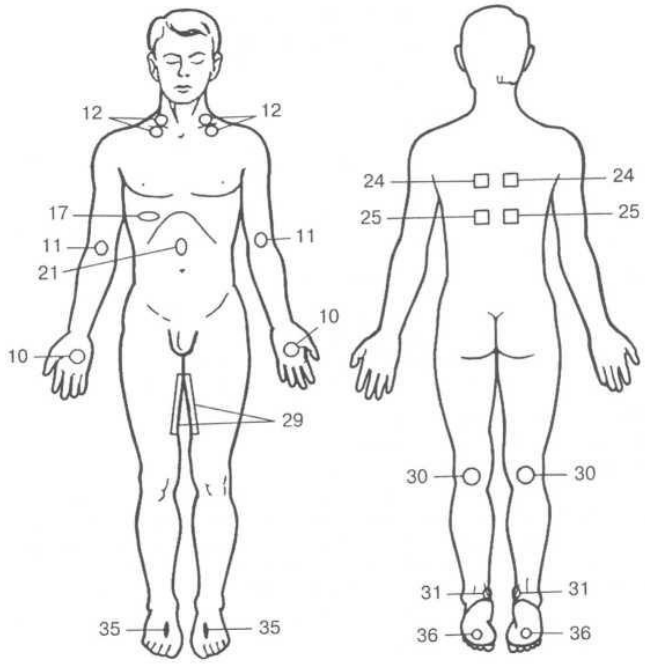


Figure 14. Zones for placing inductors

4.4.5. I20-I25 – Coronary heart disease

The coronary heart disease (CHD) includes several self-addressed forms of heart disease: angina pectoris, focal degeneration, myocardial infarction.

Etiopathogenesis

The basis of coronary heart disease is always is coronary insufficiency, caused by atherosclerosis of the coronary arteries of the heart. CHD contribute to many internal and external factors, called risk factors: lipid metabolism, is usually characterized by high blood cholesterol, hypertension, diabetes, smoking, physical inactivity, prolonged emotional stress.

The basis of the pathogenesis of myocardial ischemia in all forms of coronary heart disease is a mismatch between the demand of the heart muscle for oxygen and nutrients, and their receipt because of narrowing of the coronary arteries. Of great importance in the pathogenesis of coronary insufficiency in ischemic heart disease have impaired platelet function and increase blood clotting, which can impair the microcirculation in the capillaries of the myocardium and lead to thrombosis of the arteries, which contribute to atherosclerotic changes in their walls and the slowing of blood flow in areas of narrowing of the arteries.

The procedures on the device «Helios» promotes decrease in frequency and duration of painful attacks, reduction of quantity of antianginal preparations, improvement of ECG-indicators.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 29):

Table 29. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
60-80	9-12	1,2 (zones 8; 14); 37 (zone 24); 1-10 (zones 17; 25); 9,4 (zones 19, 26).	LSB - 15 totally; MLT - 25 totally.

Method of treatment

Position of the patient – lying on his back.

Technique of the procedures: stable, the zones of influence are shown in Table 30 and Figure 15.

The LSB is carried out remotely or through the medicine applied on skin. Performance of MLT is carried out contactly, along with LSB (remotely).

Venous (non-invasive) blood irradiation.

MLT Red – elbow bends (at the left, on the right) – for 20 min.

Frequency of carrying out procedures: the first week – every other day; the second – in 2 days; the third – 2 times a week.

The number of procedures on a course of treatment: 15. Repeated treatment: in 2-3 months.

Possible combination to other methods of treatment:

- medicinal therapy;
- phytotherapy.

Table 30. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
17; 19; 26	14; 24	8; 25

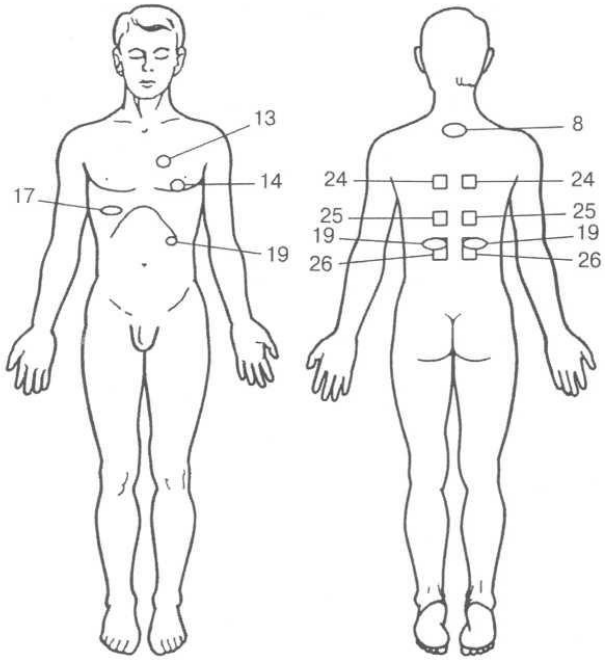


Figure 15. Zones for placing inductors

4.4.6. I63 – Ischemic stroke

Stroke (attack). This term is used for across the different etiology and pathogenesis of the state, which implements the link of an acute vascular accident of the arterial and venous bed. In to a stroke include acute cerebral circulatory disorders, which are characterized by a sudden (within minutes, at least – hours) the emergence of focal neurological disorders (motor, speech, sensory, coordinates, visual, cortical functions, memory) and / or of brain disorders (change of consciousness, headache, vomiting, etc.) that persist for more than 24 hours, or lead to death of the patient in a shorter period of time due to causes of cerebrovascular origin.

Etiopathogenesis

The main causes of intracerebral hemorrhage are hypertension, intracranial aneurysm (including microaneurysms, formed as a result of a traumatic brain injury or sepsis), arteriovenous malformation, cerebral amyloid angiopathy, the use of anticoagulants or thrombolytics, diseases accompanied by hemorrhagic syndrome (leukemias, uremia, thrombocytopenic purpura disease, etc.).

The most common two types of ischemic stroke (cerebral infarction) – thrombotic due to primary thrombotic occlusion of a cerebral vessel, and embolic, due to embolism from a remote source.

Procedures with use of the device «Helios» are carried out during the sharp period (after stabilization of hemodynamics, when there is no threat of life of the patient).

Application of the developed techniques in the first 2 weeks of a disease is the most effective.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 31):

Table 31. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
60-80	6-15	37 (ischemic hearth) 1-10 (rest area)	LSB - 15 -totally; MLT - 25 -totally.

Method of treatment

Position of the patient – lying on his back.

Technique of the procedures: stable, the zones of influence are shown in Table 32 and Figure 16.

The LSB is carried out remotely or through the medicine applied on skin.

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

Venous (non-invasive) blood irradiation.

MLT Red – elbow bends (at the left, on the right) – for 20 min.

Frequency of carrying out procedures: the first 3-4 days – 2 times a day, then 1 procedure a day till 12 in the afternoon from the moment of development of a stroke. The number of procedures on a course of treatment: 10-15. Repeated treatment.

Possible combination to other methods of treatment:

- drug treatment including antioxidant therapy;
- electro-stimulation of paretic extremities from 5 in the afternoon diseases;
- special laying of the patient and possible elements of passive.

Table 32. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
17	1a; 8	6a; 6b

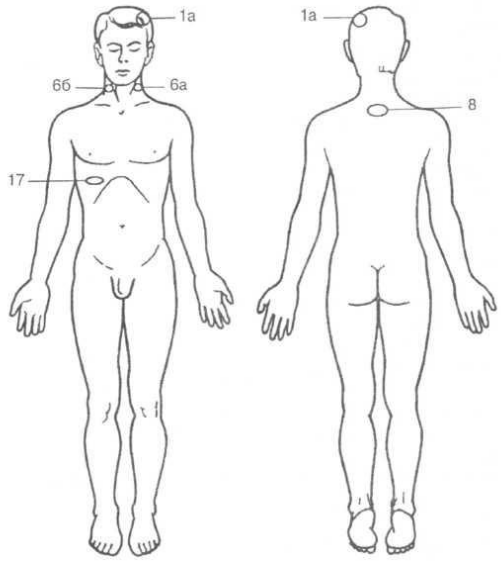


Figure 16. Zones for placing inductors

Methods of MLT in acute ischemia in the basin of the vertebral arteries is similar to that during ischemia in the basin of the carotid arteries.

The only difference is that for the percutaneous laser irradiation of blood is selected projection of the vertebral arteries (under the occipital bone, paravertebrally). Time and exposure parameters, as well as monitoring of treatment efficacy are similar.

4.5. Diseases of the endocrine system

4.5.1. E10-E14 – Diabetes

Diabetes (diabetes, sugar diabetes, diabetes mellitus) is a chronic endocrine metabolic and vascular disease, which is based on absolute or relative deficiency of insulin, leading to disruption of carbohydrate, fat, protein and another types of exchanges, as well as functions of major organs and body systems.

Etiopathogenesis

Diabetes is a multifactorial disease with genetic predisposition. Risk factors for developing type 2 diabetes include: obesity, ethnicity (especially when changing the traditional way of life in the West); sedentary lifestyle; especially diet (high intake of refined carbohydrates and low fiber content); arterial hypertension. Pathogenetically T2D is a heterogeneous group of metabolic disorders, this is what determines its significant clinical heterogeneity. At the heart of it lies the pathogenesis of insulin resistance (decreased insulin-mediated glucose utilization of tissues), which is implemented on the background of the secretory dysfunction of β-cells. Thus, there is a violation of the balance sensitivity to insulin and insulin secretion. Secretory β-cell dysfunction is decelerating 'early' release of insulin secretory response to an increase in blood glucose levels. At the same time the 1st (rapid) phase of secretion, which is emptied vesicles accumulated insulin is virtually absent; 2nd (slow) phase of secretion is carried out in response to hyperglycemia is stabilized permanently in tonic regime, and despite the excess secretion of insulin, blood glucose levels on a background of insulin resistance are not normal.

Carrying out procedures with the device «Helios» promotes reduction of manifestations of cardiovascular disorders, faster compensation of a carbohydrate metabolism without increases in a dose of insulin or glucose-reduce preparations.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 33):

Table 33. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
80-100	9-15	2,4 (zone 17) 9,4 (other zones)	LSB - no more than 15 MLT - totally up to 25

Method of treatment

Position of the patient – lying on his back.

Technique of the procedures: stable, the zones of influence are shown in Table 34 and Figure 17.

Carrying out LSB is carried out remotely or through the contact environment (Vaseline, medicine).

The MLT is carried out in contact, together with LSB.Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

MLT Green – Zone 19a, 19b (pancreas projection in front and behind).

MLT IR (in alternation with LSB) – Zone 26 (paravertebral, at the level of Th10-11 vertebras at the left/on the right).

MLT Green – Zone 19a, 19b (pancreas projection in front and behind).

Frequency of carrying out procedures: the first week – every other day; the second – in 2 days; the third – 2 times a week.

The number of procedures on a course of treatment: to 20 sessions. Repeated treatment: in 2-3 months.

Possible combination to other methods of treatment:

medicinal therapy;

phytotherapy.

MLT IR – Zone 37 (additional area).

The intensity of exposure – 100%, exposure time – 15 minutes per zone.

Table 34. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
17; 19a; 19b	26; 36; 37; 38	36

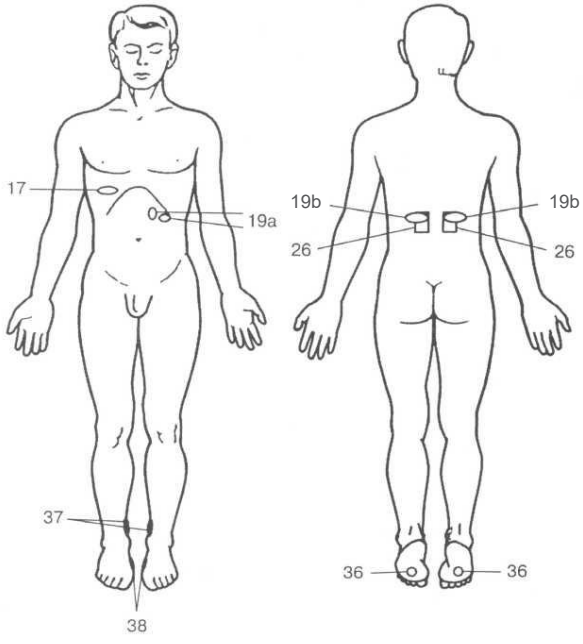


Figure 17. Zones for placing inductors

4.5.2. E06.3 – Autoimmune thyroiditis

Autoimmune thyroiditis is a heterogeneous group of inflammatory diseases of the thyroid autoimmune etiology, in pathogenesis of which is a different expression of the destruction of follicles and follicular thyroid cells.

Etiopathogenesis

The disease develops as the genetically determined defect of the immune response, resulting in T-lymphocytic aggression against its own thyrocyte and their destruction. Pathological significance for the body of autoimmune thyroiditis is almost exhausted by the fact that it is a risk factor for hypothyroidism. The fact of carrier thyroid antibodies, which are markers of autoimmune thyroiditis, multiple greater than the incidence of hypothyroidism in the population, suggests that in most cases the disease does not result in hypothyroidism.

Procedures with use of the device «Helios» are carried out as an independent method, and against replacement therapy of L-thyroxine.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 35):

Table 35. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
80-100	9-15	9,4 (zones TG, 15, 20) 1-10 another zones	LSB - no more than 15 in total; MLT - totally up to 25.

Method of treatment

Position of the patient – lying on his back.

Technique of the procedures: stable, the zones of influence are shown in Table 36 and Figure18.

The out LSB is carried out remotely or through medicine.

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

Venous (non-invasive) blood irradiation.

MLT Red – elbow bends (at the left, on the right) – for 20 min.

Frequency of carrying out procedures: the first week – every other day; the second – in 2 days; the third – 2 times a week. The supporting sessions with use of the device «Helios» on 1 session a week or in 2 weeks depending on efficiency of treatment are possible.

The number of procedures on a course of treatment: 20. Repeated treatment: in 2-3 months.

Possible combination to other methods of treatment:

- medicinal treatment;
- sanatorium treatment.

Table 36. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
20	10; 15	1; 3; 8

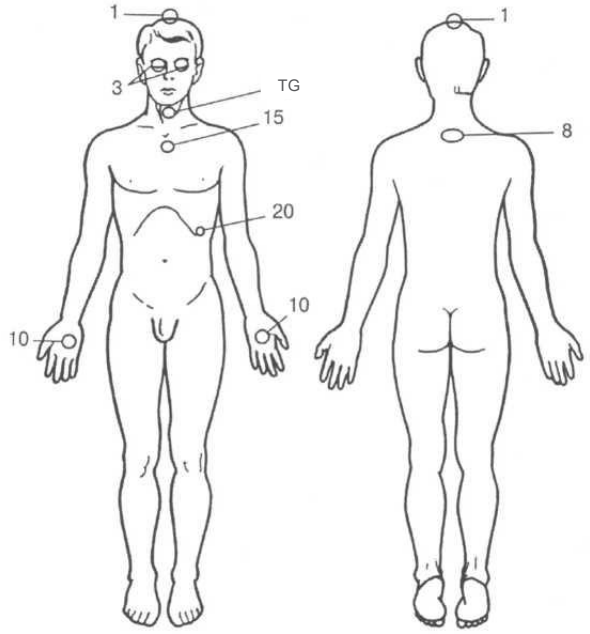


Figure 18. Zones for placing inductors

4.6. Diseases of the eye and adnexal

4.6.1. H47.0 – Optic nerve subatrophy. H35 – Retinitis pigmentosa

Optic nerve subatrophy is a disease of the optic nerve and retina. It most often develops as a result of head injury, cerebrovascular disease, or arachnoiditis. It is characterized by a decrease: the visual functions and pallor of the optic disc.

Etiopathogenesis

Causes: various pathological processes in the optic nerve and the retina (inflammation, degeneration, swelling, poor circulation, compression of the optic nerve damage), diseases of the central nervous system (brain tumors, abscesses, meningitis, syphilitic lesions), hypertension, atherosclerosis, profuse bleeding, intoxication, hereditary reasons.

Pathogenesis: the destruction of nerve fibers and their replacement by glial connective tissue, obliteration of capillaries that feed the optic nerve.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 37):

Table 37. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
40-60	6-15 increasing with each session, and the maximum from the 5th session	The 1-5 th sessions - P1 press The 6-7th sessions - 9,4 The 8-9th sessions - 18 The 10-11th sessions - 37 The 12-15th sessions - 75 The 16-21st sessions - 1-10	LSB - 15 times on zone MLT - 10 times on zone

Method of treatment

Position of the patient – lying on his back.

Technique of the procedures: the zones of influence are given in Table 38 and Figure 19.

The LSB is carried out directly or through the medicine applied on skin.

The MLT is carried out in contact, together with LSB.Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

LSB – Zone 17 (liver projection).

MLT Red – Zone 3 (eyes, influence through close eyelids).

MLT IR – Zone 4a (projection of an occipital lobe of a brain),

– zone 8 (projection of segments of a spinal cord of C8-Th2).

MLT Blue – Zone 17 (liver projection).

Frequency of carrying out procedures: daily the first 5 sessions, the following 5 – every other day, then 3 sessions a week.

The number of procedures on a course of treatment: to 21. Repeated treatment: in two-3 months. Possible combination to other methods of treatment:

- medicinal therapy;
- electrophoresis (endonasal technique) of a hydrocortisone or vitamin E (as a solvent applied 20% solution of a dimeksid).

Table 38. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
17	8; 4a	3

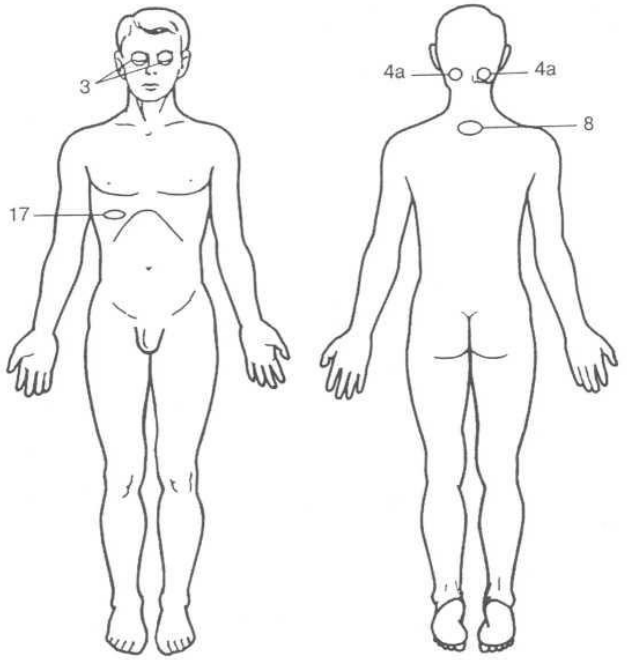


Figure 19. Zones for placing inductors

4.6.2. H00-H59 – Myopia

Nearsightedness (myopia) is blurred vision, especially in distance. When operating in close proximity may occur pain in the eyes, on the forehead and temples.

Etiopathogenesis

It is now recognized that the origin of myopia plays the role of a combination of genetic (polygenic mode of inheritance, often in an autosomal recessive manner), and environmental factors. The impact of the latter may appear as in utero (toxoplasmosis, rubella, toxicosis pregnant women, are often the cause of prematurity), and in the postnatal period (acute and chronic infections, especially accompanied by hyperthermia, prolonged course, weight loss, lack of proteins and food, heavy physical and visual-intensive work).

In the pathogenesis of progressive myopia and its complications plays a role not only abnormal elongation eyes, but the increase of its dimensions (horizontal, vertical, oblique) and volume respectively. In this region of the equator and rear pole eyes in different patients are involved in the pathological process in varying degrees, which leads to damage of various departments of the fundus.

Nearsightedness (myopia) – decrease in visual acuity, especially away. When operating in close proximity may occur pain in the eyes, on the forehead and temples.

Procedures with use of the device «Helios» are appointed at easy or average degree of short-sightedness.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 39):

Table 39. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
40-60	9-15	1-10, alternate with 37 after each session	LSB - to 20 times MLT - 10 on a zone

Method of treatment

Position of the patient – lying on his back.

Technique of the procedures: the zones of influence are given in Table 40 and Figure 20.

The LSB is carried out directly or through the medicine applied on skin.

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

LSB – Zone 17 (liver projection).

MLT Red – Zone 3 (eyes, influence through close eyelids).

MLT IR – Zone 4a (projection of an occipital share of a brain), – Zone 8 (a projection of segments of a spinal cord of C8-Th2).

MLT Blue – Zone 17 (liver projection).

ATTENTION!

Allegedly to perform sessions in the morning hours (10-12h).

Frequency of carrying out procedures: the first 2-3 sessions every other day, the subsequent – 2 sessions a week.

The number of procedures on a course of treatment: 14-15. Repeated treatment: in 2-3 months.

Possible combination to other methods of treatment:

- medicinal therapy;
- special exercises for muscles of eyes;
- electrostimulation of a circular muscle of an eye on both sides;
- acupuncture.

Table 40. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
17	8; 4a	3

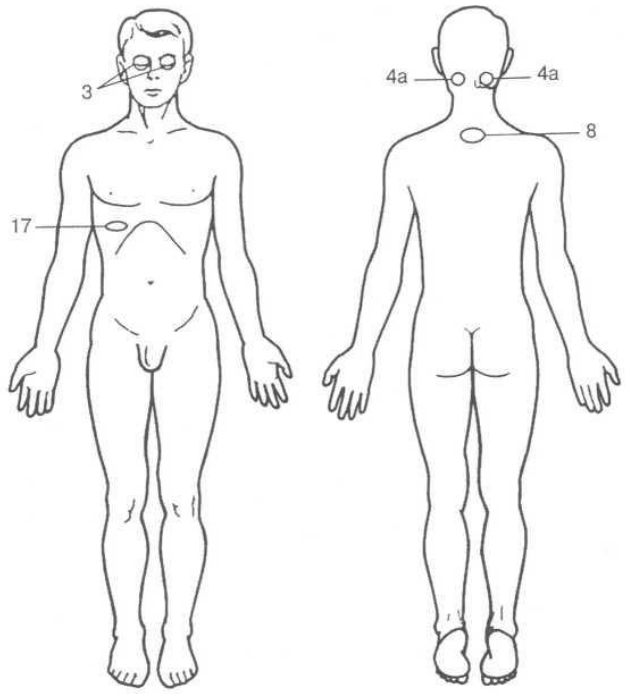


Figure 20. Zones for placing inductors

4.6.3. H36.0 – Diabetic retinopathy

This form of microangiopathy is highlighted in a separate complication of diabetes due to the large, not only medical, but also social value (impact on the quality of life of patients and their ability to work).

Etiopathogenesis

The primary factor that plays a role in the development of diabetic retinopathy is hyperglycemia. Other metabolic disturbances which occur in diabetes to a lesser extent affect the development of microangiopathy retinal vessels.

The first link in the pathogenesis of this case is the failure of retinal vascular wall by the type of microangiopathy in diabetes mellitus. Vascular lesion leads to a decrease in blood perfusion of the retina, leading to the development of chronic hypoxia. In turn, chronic hypoxia causes development dystrophies, in the retina often develop fatty degeneration or calcification occurs. In addition, chronic hypoxia stimulates vascular neogenesis that is compensatory character in terms of hypoxia. Neovascularization occurs due to proliferation of cell wall elements existing vessels.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 41):

Table 41. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
60-80 accruing with each session, maximum from the 5th session	6-15 accruing with each session, maximum from the 5th session	P1 mode to alternate with 37 After each session	LSB - to 20 times MLT - 10 on a zone

Method of treatment

Position of the patient – lying on his back.

Technique of the procedures: the zones of influence are given in Table 42 and Figure 21.

The LSB is carried out directly or through the medicine applied on skin.

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

Possible combination to other methods of treatment:

- medicinal therapy;
- diet therapy in combination with psychophysiological correction;
- iodide potassium solution electrophoresis according to Bourguignon or endonasal.

The intensity of exposure – 100%, the exposure time per zone – 7 minutes.

Table 42. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
17; 19; 26	8; 4a; 25; 26	3; 4a; 6

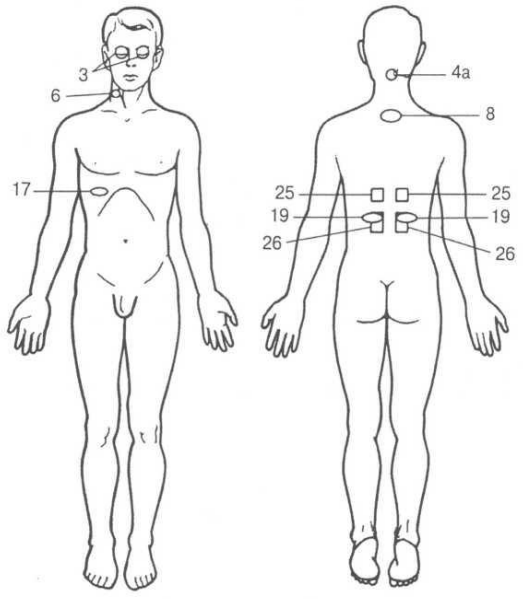


Figure 21. Zones for placing inductors

4.7. Diseases of the skin and subcutaneous tissue

4.7.1. L40 – Psoriasis

Psoriasis is a chronic skin disease that affects the skin, hair, sebaceous glands. The disease has a multifactorial nature. There is at any age, non-communicable. Procedures with use of the device «Helios» are reduced by an inflammation.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 43):

Table 43. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
40-60	9-12	2,5	LSB - 5 on the center, 15 totally MLT - 5 on the center, 20 totally

Method of treatment

Position of the patient – lying on his back.

Technique of the procedures: the zones of influence are given in Table 44 and Figure 22.

The LSB is carried out through the contact environment – the sunflower refined oil. As medicine for an ultra-phonophoresis use a hydrocortisone.

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

LSB – Zone DC (defeat centers); – Zone 17 (liver projection).

At the multiple defeat centers influence a segmentary zone paravertebral by ultrasound with a frequency of 100 kHz.

MLT Red – Zone 11 (an elbow pole on the right/at the left);

zone 30 (popliteal pole on the right/at the left);

zone 20 (spleen projection);

zone 12 (over – and subclavian zones).

Use 1-2 zones for one session.

MLT IR – Zone 23 (paravertebral Th2-5 segmentary zone of an innervation of lungs);

- zone 25 (paravertebral, Th7-L2 a segmentary zone of an innervation of a liver);

- zone 27 (paravertebral, Th11-L2 a segmentary zone of an innervation of kidneys).

Possible combinations of zones of influence.

The 1st day – OP (LSB); 12; 30 (MLT Red); 23, 25, 27 (MLT IR). The 2nd day – 17 (LSB); 11, 20 (MLT Red); OP (MLT IR), etc.

Venous (non-invasive) blood irradiation.

MLT Red- popliteal poles (at the left, on the right); elbow bends (at the left, on the right) – for 10 min.

Frequency of carrying out procedures: daily or every other day.

The number of procedures on a course of treatment: 10-15.

Repeated treatment: in case of need in 30 days.

Possible combination to other methods of treatment:

- medicinal therapy;
- phytotherapy;
- EHF-puncture;
- Tsiu therapy.

Table 44. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
OP; 17	23; 25; 27; 15	11; 30; 12; 20

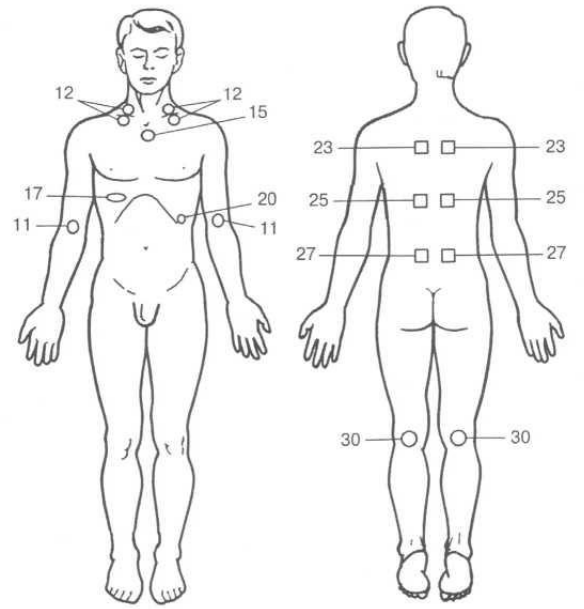


Figure 22. Zones for placing inductors

4.7.2. L43 – Lichen Planus

Lichen planus is a skin disease at which the skin, mucous membranes are affected, more rare nails.

Etiopathogenesis

At the heart of the development of lichen planus are violations of the regulation of immune and metabolic processes leading to inadequate tissue response under the influence of endogenous and exogenous trigger factors. Established family history planus with autosomal dominant inheritance. There are different theories of the disease: neural, viral and toxic-allergic. Well-known cases of lichen planus after stress, effective hypnosis and reflex-segmental therapy, indicating the role of the nervous system in the pathogenesis of the disease. The development of isolated lichen planus has a toxic-allergic version of the mucous membrane of the mouth of great importance. Occurrence planus on the oral mucosa to some extent dependent on the presence of disease in patients with gastrointestinal (gastritis, colitis etc.), Liver and pancreas.

The most common theory of infection (probably viral) and neurogenic origin of the disease. Ill mostly adults.

Performance of procedures with use of the device «HELIOS» promotes reduction of an inflammation.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 45):

Table 45. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
40-60	12-15	1,2; 1,5; 52; 75	LSB - 10-15 - totally MLT - 3 on zone, 20 totally

Method of treatment

Position of the patient – lying on his back.

Technique of the procedures: the zones of influence are given in Table 46 and Figure 23.

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

LSB – Zones 23, 25, 27 (paravertebral, segmentary zones of lungs, a liver, kidneys); zone 17 (liver projection).

MLT Red -zone 11 (elbow pole on the right/at the left); – Zone 30 (popliteal pole on the right/at the left); – Zone 20 (spleen projection); – Zone 12 (over – and subclavian zones).

MLT IR – Zone DC (defeat centers);

Use 1-2 zones for one session.

ATTENTION!

At a verrucous form of a disease the procedures of LSB combine every other day with MLTIR locally.

Possible combinations of zones of influence.

The 1st day – 23, 25, 27 (LSB); 12; 30 (MLT Red); OP (MLT IR). The 2nd day – 17 (LSL); 11, 20 (MLT Red); OP (MLT IR), etc.

Venous (non-invasive) blood irradiation.

MLT Red – popliteal poles (at the left, on the right); elbow bends (at the left, on the right) – for 10 min.

Frequency of carrying out procedures: daily or every other day.

The number of procedures on a course of treatment: 7-12.

Repeated treatment: in case of need in 30 days.

Possible combination to other methods of treatment:

- medicinal therapy;
- diadynamic therapy;
- electro-dreaming.

Table 46. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
23; 25; 27; 17	OP	11; 30; 12; 20

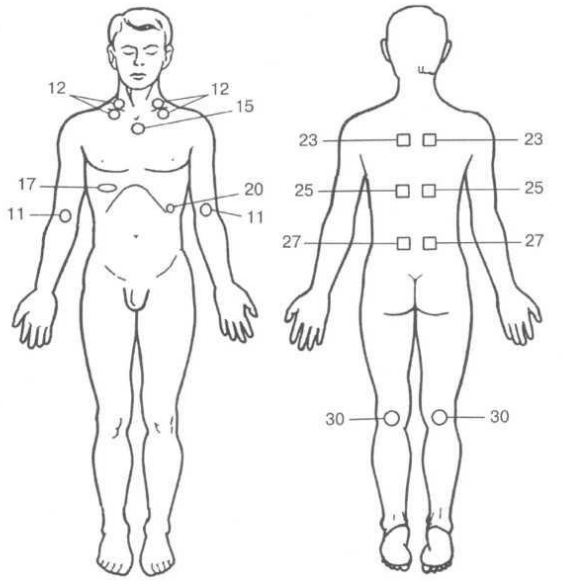


Figure 23. Zones for placing inductors

4.7.3 L20-L30 – Dermatitis and Eczema

Eczema is the inflammation of the superficial layers of the skin of neuro-allergic character arising in response to the influence of external or internal irritants differing in polymorphism of rash, an itch and a long relapsing course.

Etiopathogenesis

It is considered eczema polyetiological disease. The weakness of the immune system in the presence of infectious antigenic stimuli is shown persistence of microbial and bacterial antigens to the formation of chronic recurrent inflammation in the epidermis and dermis. This gives rise to abnormal circulating immune complexes with the damaging formation of microstructures own series autoantigens autoaggressive initiating formation of antibodies.

Carrying out procedures with use of the device «HELIOS» promotes reduction of an inflammation.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 47):

Table 47. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
40-60	9-12	eczema, dermatitis - 0.7; acne vulgaris -1.7; pustular eczema, weakness, fatigue - 2.2; diastolic hypertension - 9.2	LSB – 5 totally MLT - 3 on zone, 20 totally

Method of treatment

Position of the patient – lying on his back.

Position of a radiator: contact.

Technique of the procedures: the zones of influence are given in Table 48 and Figure 24. The LSB is carried out through applied on skin a hydrocortisone.

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

LSB – Zones 23, 25, 27 (paravertebral, segmentary zones of lungs, a liver, kidneys);

MLT Red – a zone 11 (an elbow pole on the right/at the left);

- zone 30 (popliteal pole on the right/at the left);

- zone 20 (spleen projection);

- zone 12 (over – and subclavian zones).

Use 1-2 zones for one session.

MLT IR – Zone DC (defeat centers);

Frequency of carrying out procedures: every other day. The number of procedures on a course of treatment: 10-12.

Repeated treatment: in case of need in 30 days.

Table 48. Zones for placing inductors

Acute stage		
Zones of influence		
LSB	MLT IR	MLT Red
23; 25; 27	OP	11; 30; 12; 20
Chronic stage		
Zones of influence		
LSB	MLT IR	MLT Red
OP	23; 25; 27	11; 30; 12; 20

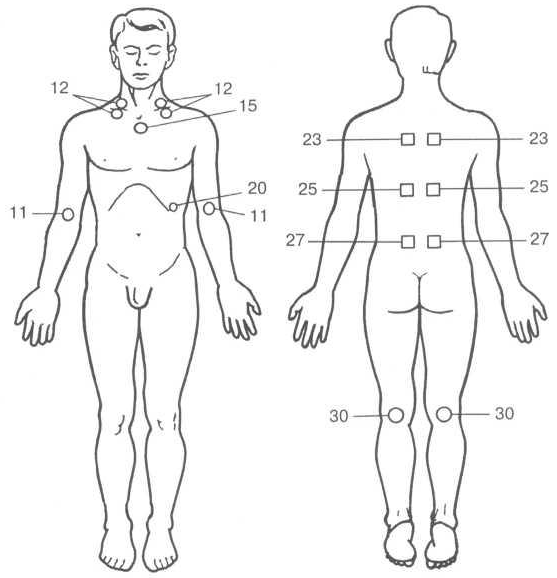


Figure 24. Zones for placing inductors

4.7.4. L20.8 – Neurodermatitis

Neurodermatitis is a skin disease characterized by itching, lichenoid papules, and a chronic, relapsing course. It has a clear seasonal dependence.

Etiopathogenesis

Neurogenic theory of the origin of neurodermatitis leading role in the genesis of the disease removes violations of GNI, which is accompanied by discoordination nervous processes, pathological changes in their strength, balance and mobility.

Allergic theory of the genesis of neurodermatitis gives priority to the body's hypersensitivity to certain food, drugs, chemicals.

Hereditary theory considers the etiology and pathogenesis of neurodermatitis in line with a genetic predisposition to atopy. For example, studies suggest that atopic dermatitis develops in 56-81% of people whose parents (one or both, respectively) also suffered from this disease.

Considering the above, it is likely to be thinking about neurogenic-allergic nature of neurodermatitis and its primary development in individuals with hereditary predisposition. The impetus for the beginning and progression of neurodermatitis can serve as psychogenic factors, intoxication, endogenous and exogenous stimuli (exacerbation of chronic infections, food, inhalation, contact allergens, sun exposure, vaccination), endocrine disorders, and so forth.

Main pathogenetic changes neurodermatitis relate to immune disorders, excessive production of vasoactive substances and violation of the regulation of vascular tone. Pathological changes in the skin neurodermatitis presented acanthosis, intercellular edema (spongiosis), hyperkeratosis, the presence of perivascular infiltrates in the dermis.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 49):

Table 49. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
60-80	12-15	1,7; 1,2	LSB - 5 on a zone; MLT - 5 on a zone, 25 in total.

Method of treatment

Position of the patient – lying on his back.

Technique of the procedures: labile, zones of influence are shown in Table 50 and Figure 25.

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

LSB – Zones 23, 25, 27 (paravertebral, segmentary zones of lungs, a liver, kidneys).

- zone 17 (liver projection).

MLT Red – a zone 11 (an elbow pole on the right/at the left);

- zone 30 (popliteal pole on the right/at the left);

- zone 20 (spleen projection);

- zone 12 (over – and subclavian zones);

- zone 37 (lower third internal shin surfaces);

- zone 36 (plantar surface of feet).

Use 2-3 zones for one session. MLT IK – a zone DC (defeat centers).

Frequency of carrying out procedures: daily. The number of procedures on a course of treatment: 10-12. Repeated treatment: in case of recurrence. Possible combination

- to other methods of treatment:
- medicinal therapy; EHF-therapy;
- diet therapy in combination with psychophysiological correction.

Table 50. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
23; 25; 27	OP	11; 30; 12; 20; 36; 37

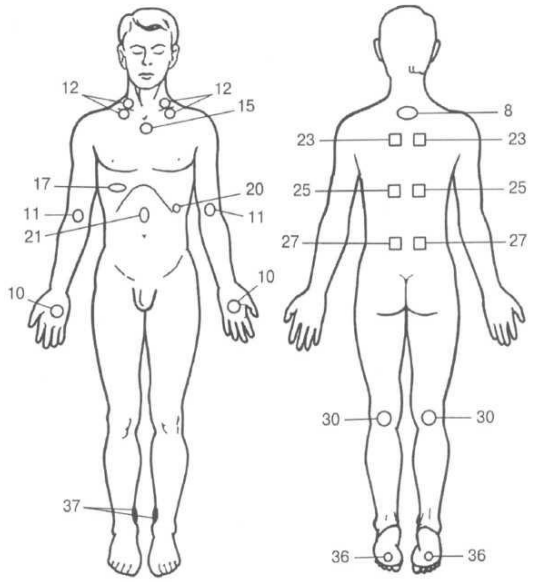


Figure 25. Zones for placing inductors

4.7.5. L94.0 – Localized scleroderma

The disease, in which connective tissue damage seen during compaction. For Scleroderma is characterized by multifocal fibrous structural and morphological and functional pathological processes with severe chronic course and irreversible skin tightening centers, in which there is progressive fibrosis with obliterative lesions arterioles.

Etiopathogenesis

The etiology is unknown. Provoking factors include stressors, acute and chronic infectious diseases, physical stimuli (cooling, sunlight, vibration, ionizing radiation), and chemicals (vaccines and serums). Pathogenesis of scleroderma complicated, complex, with a probability of genetic conditions, but not yet precisely defined set of HLA genotypes. Scleroderma refers to multifactorial diseases with polygenic inheritance. In its pathogenesis, dysfunction of fibroblasts and other cells that form collagen play a key role.

Carrying out procedures with the device «Helios» is effective in a stage of hypostasis, consolidation in combination with resolving action medicines.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 51):

Table 51. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
60-80	12-15	37; 50	LSB - 5 on a zone 20 totally; MLT-5 on a zone, 55 totally.

Method of treatment

Position of the patient – lying on his back.

Technique of the procedures: the zones of influence are given in Table 52 and Figure 26.

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

LSB – Zones 23, 25, 27 (paravertebral, segmentary zones of lungs, a liver, kidneys).

- zone 17 (liver projection).

MLT Red – a zone 11 (an elbow pole on the right/at the left);

- zone 30 (popliteal pole on the right/at the left);
- zone 20 (spleen projection);
- zone 12 (over – and subclavian zones);
- zone 37 (lower third internal shin surfaces);
- zone 36 (plantar surface of feet).

Use 2-3 zones for one session.

MLT IR – a zone DC (defeat centers).

Frequency of carrying out procedures: daily.

The number of procedures on a course of treatment: 7-8.

Repeated treatment: in case of recurrence.

Possible combination to other methods of treatment:

- medicinal therapy;
- EHF-therapy;
- diet therapy in combination with psychophysiological correction;
- prolong climate-therapy.

Table 52. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
23; 25; 27	OP	11; 30; 12; 20; 36; 37

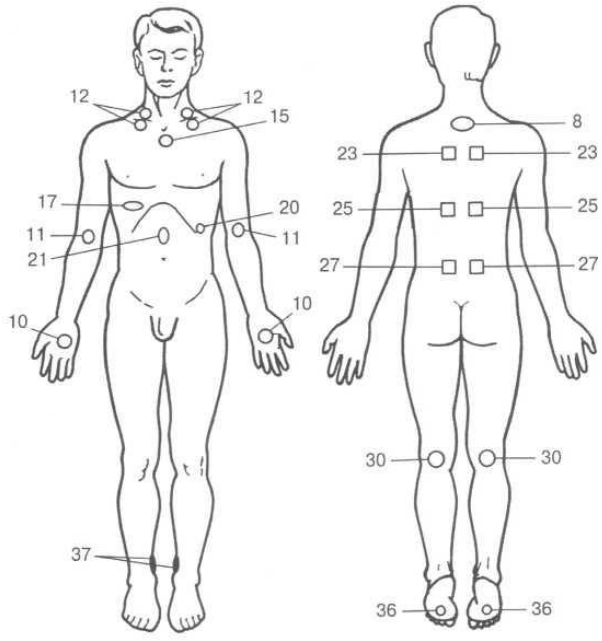


Figure 26. Zones for placing inductors

4.7.6. L91.0 – Keloids (prevention suppuration)

Etiopathogenesis

Scar formation occurs mainly due to the extracellular matrix, including collagen. The extracellular matrix is a supramolecular complex that includes various types of chemical compounds (proteins, polysaccharides, proteoglycans, etc.). Of all collagens proteins constitute the main component of the extracellular matrix and are the most abundant proteins body occupying about 1/3 of all its proteins. Growth of excess extracellular matrix in the rumen occurs as a result of «wound» fibroblasts. In the intact (healthy) skin fibroblasts are responsible for the remodeling of components of the dermis, they destroy the old collagen and lay new. In wounds, injuries, burns and surgical interventions in the sores appear myofibroblasts, which tend to «seal the gap» in the tissues, hard putting the components of the extracellular matrix: collagen, glycosaminoglycans, elastin and other proteins. This is due to the proliferation of fibroblasts and excessive production of extracellular matrix and growth scarring occurs.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 53):

Table 53. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
80-100	12-15	37 and 77 day- after day	LSB-5-10 totally MLT - 2,5-3 on a zone, 7 totally

Method of treatment

Position of the patient – lying on his back.

Technique of the procedures (Table 54, Figure 27): stable, on a wound of 10 cm^2 – 2 fields of influence.

MLT IR place over a wound and around a wound at distance of 3-5 mm.

MLT Red influence directly a zone by a stable technique (contactly).

LSB – a wound, a scar (ZP – a pathology zone).

MLT Red – a zone 10 (a palmar surface of brushes). MLT IR – a zone of a wound, a scar.

Frequency of carrying out procedures: daily. The number of procedures on a course of treatment: 7-8. Possible combination to other methods of treatment:

- medicinal therapy.

Table 54. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
Wound; scar	Wound; scar	10

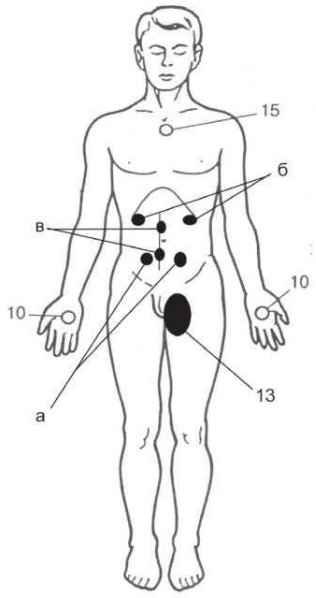


Figure 27. Zones for placing inductors

4.7.7. S00-T98 – Purulent wounds

Damage of integuments and underlying tissues at which pus, hypostasis and a necrosis of tissues, and also absorption of toxins is observed.

Etiopathogenesis

A purulent wound can occur when a clean wound (puncture, cut, chopped, fragmentary, etc.) is infected or formed as a result of an abscess rupture. The causative agents of the purulent process in accidental and surgical wounds are most often the so-called purulent bacteria (staphylococcus, streptococcus, etc.).

Now both in traumatology, and in surgery it is considered to be that any casual wound is infected, that is, contains a certain quantity of bacteria. However bacterial pollution not necessarily involves suppuration. Development of an infection requires a combination of the following factors: sufficient damage of tissues; existence in a cavity of a wound of impractical tissues, foreign matters and the streamed blood; sufficient concentration of pathogenic microorganisms.

MLT is carried out on the cleared wound (purulent allocation absorbs up to 90% of laser radiation).

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 55):

Table 55. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
80-100	12-15	37 the first three days, 75 following.	LSB – 10 totally MLT – 5 on a zone, 10 totally

Method of treatment

Position of the patient – lying.

Technique of the procedures (Table 56, Figure 28): stable, on a wound of 10 cm2 – 2 fields of influence. MLT IR is placed over a surface of a wound and around a wound at distance of 3-5 mm.

MLT Red influences directly a zone by a stable technique (contactly).

LSB – a zone of a wound, a hem.

MLT Red – a zone 10 (palmar surface of brushes).

MLT IK – a zone of a wound, a scar.

Venous (non-invasive) blood irradiation.

MLT Red – popliteal poles (at the left, on the right); elbow bends (at the left, on the right) – for 10 min.

Frequency of carrying out procedures: daily. The number of procedures on a course of treatment: to 13.

Possible combination to other methods of treatment: medicinal therapy.

Table 56. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
Wound; scar	Wound; scar	10

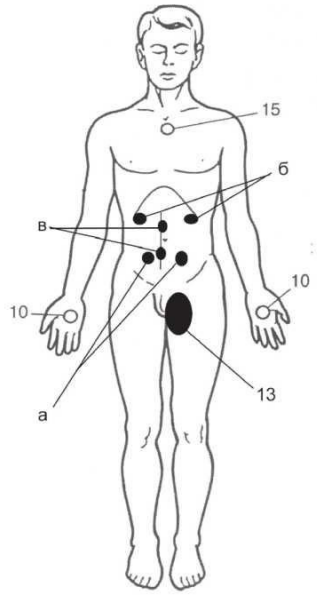


Figure 28. Zones for placing inductors

4.7.8. L02 – Abscess, Furuncle, Anthrax. L03 – Phlegmon, Felon

Etiopathogenesis

There are at penetration into the tissue of a homogeneous or mixed flora pyogenic bacteria (staphylococcus, streptococcus, E. coli and others.). May be formed and therefore without tissue necrobiosis microbial flora, such as when administered under the skin of certain chemical substances or drugs.

The development of acute purulent processes contribute to violations of trophism, circulatory disorders, tissue crush injury in trauma, bruises, weakening the body's resistance. abscess formation usually starts with an inflammatory infiltrate in the center which then decomposes with the formation of white blood cells proteolytic enzymes digest the latest necrotic tissue and products of cellular decay, forming a purulent exudate. On the periphery of the inflammatory focus demarcation shaft formed first by lymphocyte multiplication, and then through the development of granulation tissue and connective tissue sheath (pyogenic shell). Rapidly expanding, granulation tissue is moving to the center of the inflammatory focus, filling defect tissues. Before the formation of granulation shaft of the hearth there is increased absorption of toxic products and bacteria through the lymph and blood pathways, resulting in a total intoxication patient. Education granulating shaft prevents the absorption of toxins and microbes.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 57):

Table 57. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
80-100	12-15	5, 10, 20, 31, 50, 80	LSB – 10 totally; MLT - 2,5-3 on the zone

Method of treatment

Position of the patient – lying / sitting.

Technique of holiday of procedures (Table 58, Figure 29): stable, 2-4 fields around the center.

MLT IR place around the inflammation center at distance 3-5 mm over a surface. MLT Red influence directly a zone by a stable technique (contactly).

LSB – focus zone.

MLT Red – a zone 10 (a palmar surface of brushes).

MLT IR – around the center.

Frequency of carrying out procedures: daily. The number of procedures on a course of treatment: 5-7.

Possible combination to other methods of treatment: – medicinal therapy.

Table 58. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
Center zone.	Around the center	10

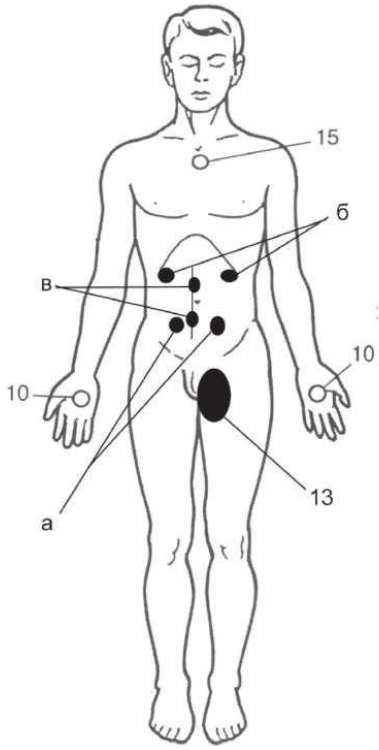


Figure 29. Zones for placing inductors

4.7.9. E14.5 – Trophic ulcers

The trophic ulcer is the long lasting uncured defect of skin and the tissues located under it.

Etiopathogenesis

Varicose trophic ulcers arise in the lower third of a shin against varicose expanded veins more often. Chronic venous insufficiency (at a varicosity, a post-thrombophlebitic disease), deterioration in arterial blood circulation can lead to development of a trophic ulcer (at a hypertensive illness, diabetes, atherosclerosis), violation of outflow of a lymph (lymphedema), a trauma (freezing injuries, burns), chronic diseases of skin (eczema, etc.). The trophic ulcer can develop at some infectious diseases, system diseases (vasculitis), violation of local blood circulation at a long immovability as a result of an illness or a trauma (bedsores).

The violation of a venous bloodstream caused by diseases of venous system leads to deposition of blood in the lower extremities. Blood stands, the cells waste products accumulate in it. Nutrition of tissues worsens. Skin is condensed, conglutinate with hypodermic cellulose. Dermatitis, the becoming wet or dry eczema develop.

Because of ischemia process of healing of wounds and scratches worsens. As a result, the smallest injury of skin at chronic venous insufficiency can be the reason of development of the long-flowing, badly giving in to treatment trophic ulcer. Accession of an infection makes heavier the course of a disease and leads to development of various complications.

The procedures which are carried out by means of the «Helios» promote granulation acceleration.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 59):

Table 59. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
60-80 accruing with each session, maximum from the 5th session	6-15 accruing with each session, maximum from the 5th session	P1 mode to alternate with 37 After each session	LSB - to 20 times MLT - 10 on a zone

Method of treatment

Position of the patient – lying / sitting.

Technique of the procedures (Table 60, Figure 30): stable.

MLT IR place directly on edges of an ulcer or young granulating tissues through one layer of a sterile napkin or a protective film.

MLT Red influence directly a zone by a stable technique (contactly).

LSB – an ulcer zone.

MLT Red – a zone 11 (an elbow pole on the right/at the left).

MLT IR – a zone of edge of an ulcer.

On-vain (noninvasive) radiation of blood.

MLT Red – popliteal poles (at the left, on the right); elbow bends (at the left, on the right) – for 10 min.

Frequency of carrying out procedures: daily. The number of procedures on a course of treatment: 7-8.

Repeated treatment: in a week.

Possible combination to other methods of treatment: medicinal therapy.

Table 60. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
Ulcer zone	Edges of an ulcer	11

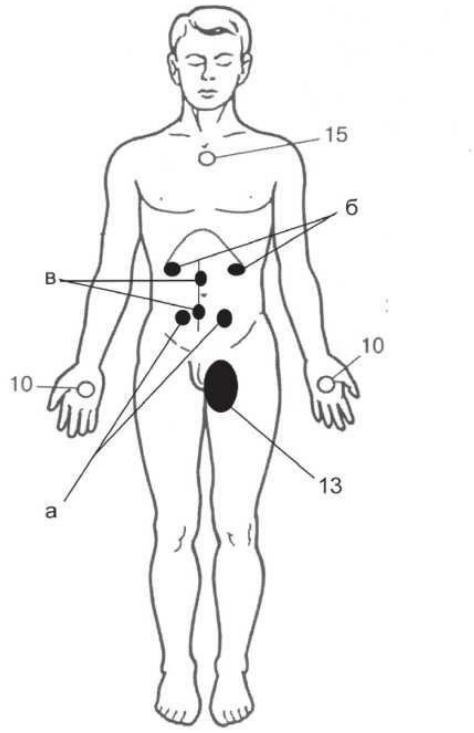


Figure 30. Zones for placing inductors

4.7.10. I80 – Phlebitis and Thrombophlebitis

Thrombophlebitis is an inflammation of the vein walls to form a blood clot in the lumen of the vein. Most often, when it comes to thrombophlebitis of the lower limbs.

Etiopathogenesis

Thrombophlebitis Contributing factors are slowing blood flow, changes in its composition, due to which the blood loses its normal rheological properties. Thrombophlebitis may develop on the background of violations of blood coagulation. Often the root cause of thrombophlebitis is an injury to the vascular wall, endocrine disorders, infections or allergic reactions. A number of diseases can be complicated by thrombophlebitis: varicose veins, purulent infections, hemorrhoids, cancer, blood diseases and heart.

Medical manipulation (long-term catheterization) and surgery on the blood vessels and increase the risk of thrombosis.

Carrying out procedures with use of «Helios» has anti-inflammatory effect, accelerates healing process.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 61):

Table 61. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
80-100	12-15	1,2; 25; 8; 10; 89	LSB - 10 on a zone MLT - 3 on a zone, 10 totally.

Method of treatment

Position of the patient – lying / sitting.

Technique of the procedures (Table 62, Figure 31): stable or labile without compression of tissues.

MLT IR slowly (1 cm/sec.) move on the course of the struck vessel in the direction from the center of a body to the periphery, then transfer over an extremity to a starting point and again contactly slowly move until the end of an affected area. Influence 1-3 zones depending on the extent of a phlebothrombosis.

MLT Red influence directly a zone by a stable technique (contactly).

MLT Red – a zone 15 (a thymus projection).

MLT IR – DZ (defeat zone).

(A nail plate of a thumb on the right/at the left) beginning GI1 the 4th procedure for 2,5 min. on a point, the frequency of modulation is 75- BO Hz.

LSB – a zone 27 (paravertebral, Th11-L5).

Frequency of carrying out procedures: daily.

The number of procedures on a course of treatment: 7-8.

Repeated treatment: in two weeks once a day.

Possible combination to other methods of treatment: medicinal therapy (detoxication, antibacterial).

Table 62. Zones for placing inductors

Zones of influence

Zones of influence		
LSB	MLT IR	MLT Red
27	ZP; GI1	15

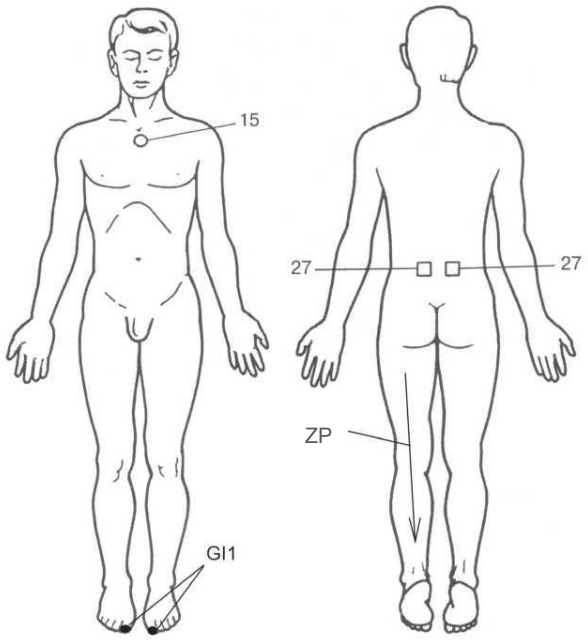


Figure 31. Zones for placing inductors

4.7.11. A46 – Erysipelas

Erysipelas is an anthroponotic acute infectious disease caused by hemolytic streptococci, characterized by fever, intoxication, presence of local focus serous- hemorrhagic skin lesions with a propensity to recurrent course.

Etiopathogenesis

Etiology: b-hemolytic streptococcus group A.

When exogenous variant source of infection – patients with any streptococcal disease (Tonsillitis, pharyngitis, scarlet fever, streptodermia, etc.) or healthy carriers of strep, ways of transmission – airborne, contact; with auto-infection pathogen enters the lesion from endogenous foci of streptococcal infection.

Penetration of MB into the lesion by contact (due to skin microtrauma) or hematogenous-lymphogenous (in case of autoinfection) through activation of mediators of allergic inflammatory reaction, development of serous or serous-hemorrhagic inflammation with erythema, edema and infiltration of affected areas of the skin and subcutaneous tissue, involvement of microvessels, lymphatic capillaries in the process, damage to vascular walls and elimination of streptococci by enhancing phagocytosis and humoral immunity with preservation of skin sensitization, re-penetration of streptococcus, hardening and re-destruction of damaged blood vessels, chronic lymphostasis up to elephantiasis.

Procedures with use of the device «Helios» have anti-inflammatory effect, accelerates healing process.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 63):

Table 63. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
80-100	12-15	5	LSB - 10 on a zone; MLT - 7.5 - vascular bundle, 5 - the affected are

Method of treatment (Table 64, Figure 32)

Position of the patient – lying / sitting.

MLT Red – a zone of on-vein radiation of blood (the area of a vascular bunch, higher than a defeat zone).

MLT IR – DZ (defeat zone).

LSB – a zone 26 (paravertebral, Th11-L1, a projection of a segmentary innervation of adrenal glands and kidneys).

Venous (non-invasive) blood irradiation.

MLT Red – popliteal poles (at the left, on the right); elbow bends (at the left, on the right) – for 10 min.

Frequency of carrying out procedures: twice a day.

The number of procedures on a course of treatment: 7-8.

Repeated treatment: in three weeks the same course every other day. Possible combination to other methods of treatment: medicinal therapy.

Table 64. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
26	ZP	6 (projection of sleepy arteries

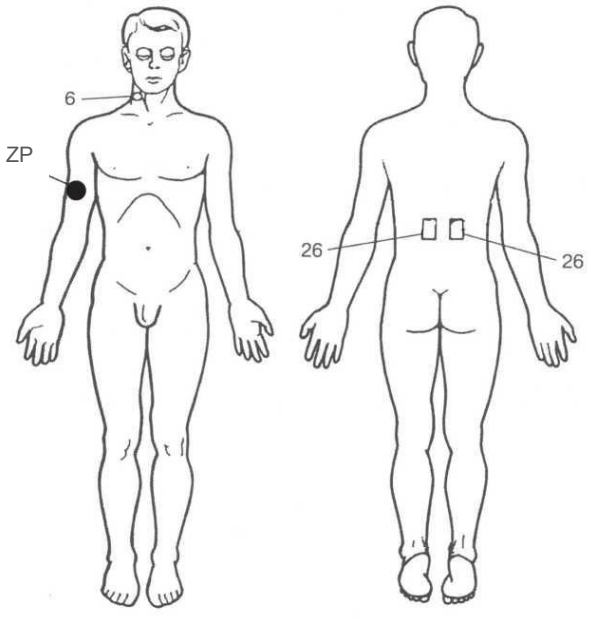


Figure 32. Zones for placing inductors

4.7.12. T20-T32 – Thermal and Chemical Burns

Burn is tissue damage caused by local exposure to high temperatures (more than 55-60°C), aggressive chemicals, electric current, light, and ionizing radiation.

Etiopathogenesis

According to the depth of tissue damage are 4-degree burns. Extensive burns lead to the development of the so-called burn disease, dangerous fatal due to irregularities in the cardiovascular and respiratory systems, as well as the occurrence of infectious complications.

The therapy is indicated for severe exudative inflammation syndrome in superficial burns, for the prevention of complications and stimulation of reparative processes in wounds, for subcutaneous burns to improve blood and lymph circulation in the paranecrotic area and stimulate the formation of a full-fledged granulation cover in the preoperative period for deep burns, and in the postoperative period – to stimulate regenerative processes; for the prevention and treatment of pneumonia and edema, secondary immunodeficiency..

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 65):

Table 65. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
60-80	12-15	75-80	LSB - to 20 times MLT IR - on 6 on zone, to 20 totally MLT Res - up to 15

Method of treatment

Position of the patient – lying / sitting.

Technique of the procedures (Table 66, Figure 33): labile.

Magneto laser influence is performed in early terms after a burn trauma on open wound surfaces through bandages.

MLT Red – Zone 6 (a carotid projection);

zone 10 (palmar surface of a brush on the right/at the left);

zone 36 (plantar surface of feet).

MLT IR – DZ (defeat zone);

zone 8 (projection of segments of a spinal cord of S8-of Th2).

LSB – Zone 27 (paravertebral, Th11-L1, a projection of a segmentary innervation of adrenal glands and kidneys);

zone 17 (liver projection).

MLT Blue – Zone 17 (liver projection).

Venous (non-invasive) blood irradiation.

MLT Red – popliteal poles (at the left, on the right); elbow bends (at the left, on the right) – for 10 min.

Frequency of carrying out procedures: twice a day.

The number of procedures on a course of treatment: 7-8.

Repeated treatment: in three weeks the same course every other day.

Possible combination to other methods of treatment: medicinal therapy.

Table 66. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
17; 27	ZP; 8	6; 10; 36

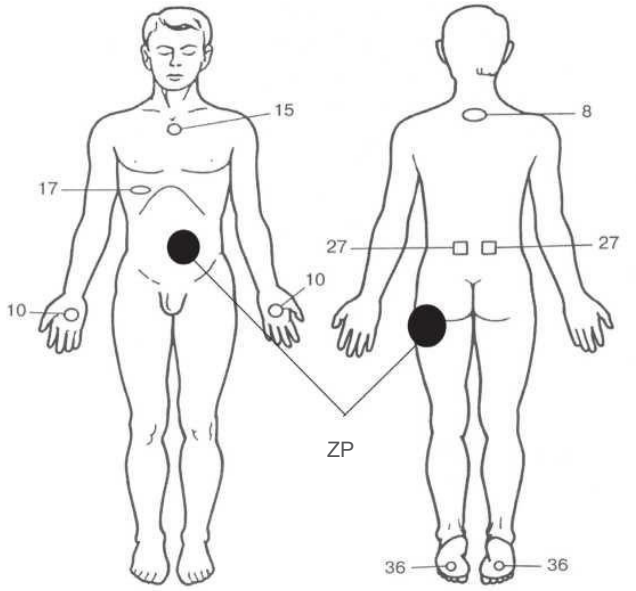


Figure 33. Zones for placing inductors

4.8. Diseases of the musculoskeletal system and connective tissue

4.8.1. M54.4 – Lumbago with sciatica

Sciatica (lumbar and sacral radiculitis) – a syndrome that manifests as pain spreading along the sciatic nerve.

Etiopathogenesis

Mechanical causes: apophyseal osteoarthritis, degeneration of the discs; fractures, sacroiliac dysfunction; limited movement of hips.

Infektsiinnye reasons: epidural abscess or osteomyelitis.

Tumor: Bone tumors (primary or metastatic).

Intradural tumors of the spinal cord.

Metabolic: osteoporosis, osteomalacia, chondrocalcinosis.

The mechanism of lumbago is always the same, regardless of the reasons. At displacement or deformation of the vertebrae and intervertebral discs are excited many painful nerve endings located in the fibrous ring and ligaments surrounding the vertebrae. As a result, there is severe pain and spasm (strong tension and inability to relax), the muscles surrounding the spine.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 67):

Table 67. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
3-5	12-15	75-77	LSB - 3-5 on a zone MLT - 10 on a zone.

Method of treatment

Position of the patient – lying on his stomach.

Technique of the procedures: the zones of influence are given in Table 68 and Figure 34.

The LSB is carried out remotely on skin directly or through the medicine applied on skin. As medicine perhaps preliminary introduction of 5-10 ml of 0,5% of solution of novocaine.

The MLT is carried out in contact, together with LSB.Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla

LSB – the zone PZ (pain zone).

MLT Red – Zone 30 (popliteal poles at the left);

MLT IR – Zone 30 (popliteal poles on the right);

- zone 8 (a projection of segments of a spinal cord of C7-Th2).

Frequency of carrying out procedures: daily or every other day.

The number of procedures on a course of treatment: 7-10.

Repeated treatment: in a month.

Possible combination to other methods of treatment:

- massage (before procedure on the device «Helios»);
- electro stimulation of paravertebral muscles;
- physical therapy.

Table 68. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
PZ	30 on the right; 8	30 at the left

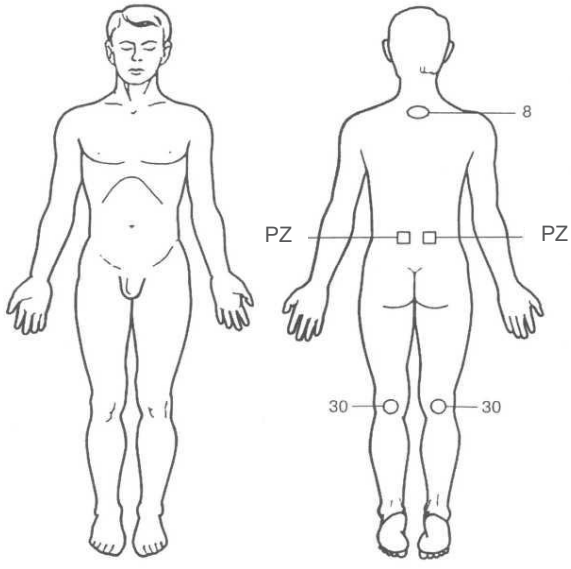


Figure 34. Zones for placing inductors

4.8.2. R52 – Chronic pain syndrome (Pain, not elsewhere classified)

Pain sensations are caused by a variety of agents, but they share a common feature – the real or potential danger of damage to the body. Therefore, pain signal mobilizes body to protect against pathogen restriction and protective function of the affected organ pain.

Etiopathogenesis

Causes of pain: physical (trauma, high or low temperature, high dose of ultraviolet radiation, electric current), chemical (contact with the skin or mucous membranes of strong acids, alkalis, oxidants, accumulation of calcium or potassium salts in the tissues) and biological (high concentration of kinins, histamine, serotonin) factors.

Therapy with use of the device «Helios» is shown at prevalence degenerate and dystrophic changes, followed by a pain syndrome.

The procedures which are carried out with use of the device «Helios» stimulates antinociceptive system (formation of endogenous opiates, melatonin), changes a functional condition of cortical, stem, segmentary and peripheral structures of nervous system and reduces pathological changes directly in a damage zone.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 69):

Table 69. Procedure parameter

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
60-80	12-15	75-77 alternated with 1-10	LSB – 10 on a zone, 15 totally; MLT – up to 25 totally.

Method of treatment

Position of the patient – lying on his stomach.

Technique of the procedures: the zones of influence are given in Table 70 and Figure 35.

The LSB is carried out remotely on skin directly or through the medicine applied on skin.

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla

LSB – Zone 17 (a liver projection);

- zone 21 (projection of a celiac plexus);

- zone 25 (paravertebral, Th7-L2, segmentary zone of a liver).

MLT Red – a zone 30 (popliteal poles on the right/at the left);

- zone 6 (carotid projection on the right/at the left);

- zone 11 (elbow pole on the right/at the left);

- zone 12 (over – and subclavian veins on the right/at the left);

- zone 3 (eyes).

MLT IR – a zone 1 (projective reflex a zone of an epiphysis);

- zone 8 (a projection of segments of a spinal cord of C7 – Th2);

- zone 4 (brain trunk projection).

On-vein (non-invasive) radiation of blood.

MLT Red – popliteal poles (at the left, on the right) – for 20 min. Frequency of carrying out procedures: in 1-2 days. The number of procedures on a course of treatment: 14-15. Repeated treatment: in 2-3 months.

Possible combination to other methods of treatment:

- medicinal therapy; psychotherapy;
- central electro-analgesia or electro dream.

Table 70. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
17; 21; 25	1; 4; 8	3; 6; 11; 12; 10; 36

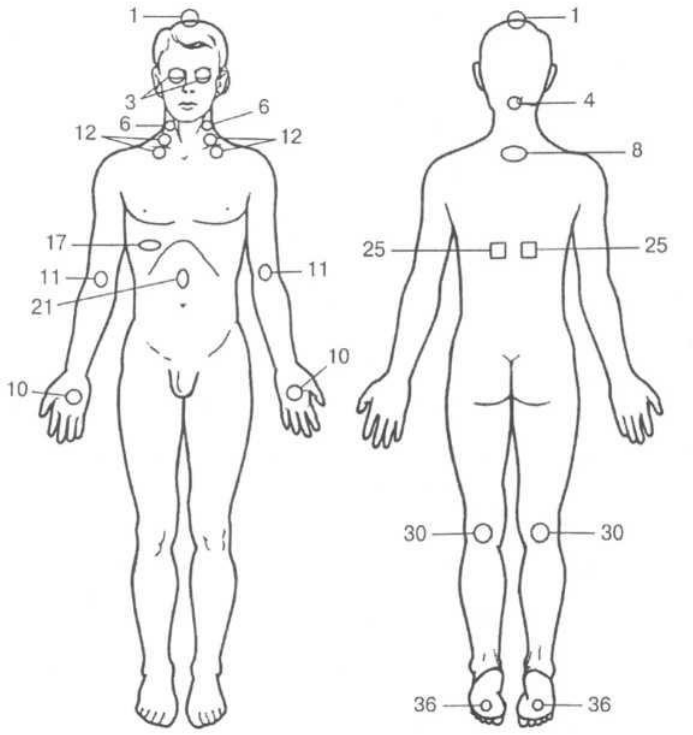


Figure 35. Zones for placing inductors

4.8.3. M79.1 – Myofascial Pain (Myalgia); M60.0 – Myofasciitis;

M62.8 – Miofibrozit; M79.0 – Fibrosis; Fibromyalgia; M72.5 – Fasciitis

Myofascial pain is a non-generalized myofascial non-specific pain caused by dysfunction of myofascial tissue in the muscles and the excitation of irritability (trigger points).

"Myogelosis", "fibrositis", "myofasciitis", "myositis", "fibromyositis", "myalgia" – nonspecific painful induration of muscle tissue, a source of muscle pain.

Etiopathogenesis

Causes: skeletal abnormalities (different length legs, flat feet), repetitive stereotyped movements, leading to fatigue individual muscles; prolonged immobilization of muscles; prolonged compression of the muscles; hypothermia; psycho-emotional stress; pathology of the internal organs. The mechanism of pain includes sensory, motor and autonomic components.

Traumatization of the muscle, leading to the formation of MB, associated primarily with the muscular overload. With continued prolonged muscle contraction suffers intramuscular capillary blood flow, reduced oxygen levels and glucose metabolism is impaired in cells, leading to their damage.

Use of the device «Helios» carry out 0,5-1% of solution of novocaine or 1% of solution of lidocaine hydrochloride in combination with micro injections.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 71):

Table 71. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
80-100	12-15	37,5 alternates with 75-77	LSB - 10 on a zone, 20 totally; MLT - up to 25 totally.

Method of treatment

Position of the patient – lying.

Technique of the procedures: the zones of influence are given in (Table 72, Figure 36).

The LSB is carried out remotely on skin directly or through the medicine applied on skin.

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla

LSB – ZP (zone of pain, TP); zone 17 (liver projection).

MLT Red – Zone 30 (popliteal poles on the right/at the left); – Zone 11 (elbow pole on the right/at the left).

MLT IR – Zone ZP (zone of the reflected pain).

Venous (non-invasive) blood irradiation.

MLT Red – popliteal poles (at the left, on the right); elbow bends (at the left, on the right) – for 10 min.

Frequency of carrying out procedures: in 1-2 days. The number of procedures on a course of treatment: 14-15. Repeated treatment: in 2-3 months.

Possible combination to other methods of treatment:

- medicinal therapy;
- physical therapy; massage.

Table 72. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
ZP; 17	ZP	11; 30

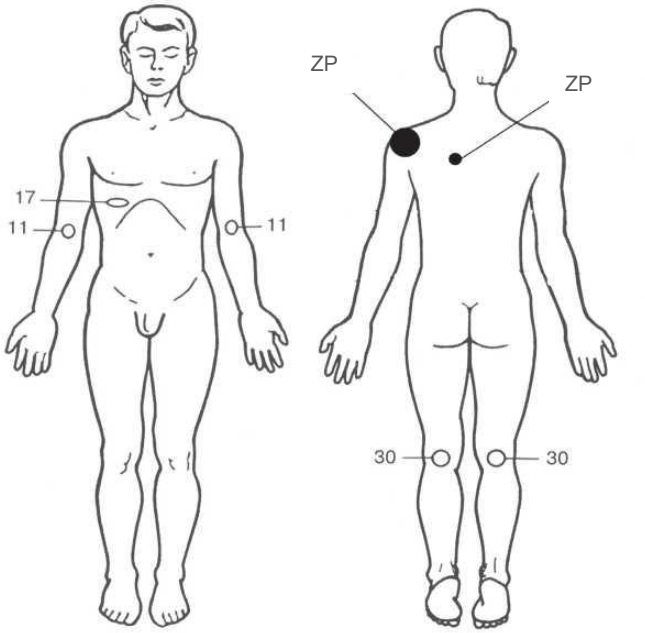


Figure 36. Zones for placing inductors

4.8.4. M05-M14 – Inflammatory polyarthropathies (Rheumatoid arthritis)

Rheumatoid arthritis (RA) is a most common chronic inflammatory joint disease characterized by the formation of tumor-like hyperplasia of the synovial membrane (pannus), which is peculiar to invasive growth with the destruction of articular cartilage and underlying bone.

Etiopathogenesis

Whatever the only etiological factor responsible for the development of RA, not set. It is believed that the disease occurs in genetically susceptible individuals under the influence of various external or internal disturbances – viral or bacterial infection, trauma, including surgery, psycho-emotional stress, medical intervention, age hormonal changes, etc. To date, accumulated ample evidence of genetic susceptibility to RA.

The main pathologic process in RA – the destruction of articular cartilage and subchondral bone ectopic hyperplastic synovial tissue.

Procedures with use of the device «Helios» are appointed at rheumatoid arthritis with the minimum activity of process in the period of not sharply expressed aggravation.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 73):

Table 73. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
1-2 procedure – 60, from 3 procedure -80	12-15	37-50 alternate with 75-80	LSB - 10 on a joint MLT - 10 on a zone, 25 totally

Method of treatment

Position of the patient – lying / sitting.

Technique of the procedures: the zones of influence are given in Table 74 and Figure 37.

The LSB is carried out remotely on skin directly or through the medicine applied on skin.

It is effective the phonophoresis of medicine «Dicasin-1».

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

LSB – Zone 2 (the affected joint);

– zone 28 (paravertebral, a segmentary zone of an innervation of the affected joint).

MLT Red – Zone 30 (popliteal poles on the right/at the left);

– zone 11 (elbow pole on the right/at the left).

MLT IR – Zone 27 (paravertebral, Th11-L1 a segmentary zone of an innervation of kidneys).

Frequency of carrying out procedures: daily or every other day.

The number of procedures on a course of treatment: 8-10.

Repeated treatment: in 2-3 months.

Possible combination to other methods of treatment:

- medicinal therapy;
- inductothermy;
- physical therapy; massage.

Table 74. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
2; 28	27	11; 30

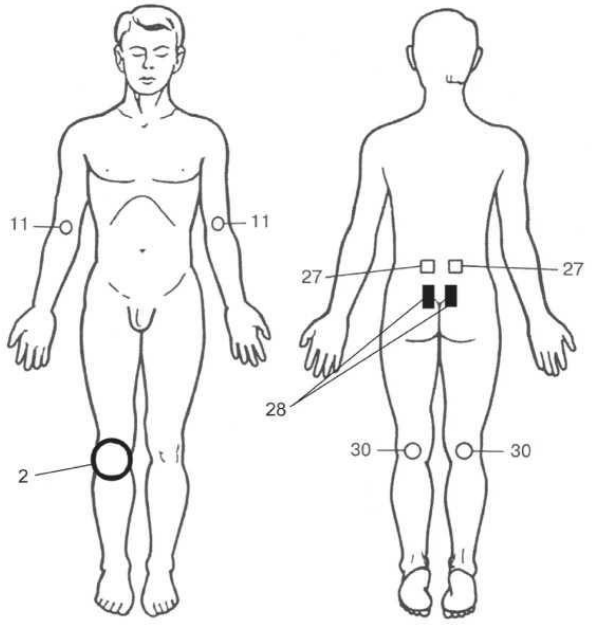


Figure 37. Zones for placing inductors

4.8.5. M15-M19 – Deforming arthrosis

Chronic inflammatory disease of degenerative joints with primary degeneration of the articular cartilage and the subsequent reactive-degenerative processes in the epiphysis articulated bones.

Etiopathogenesis

Pathogenesis of deforming arthrosis is quite complicated. Destructive-dystrophic changes that characterize this pathology are a multifactorial process, often developing gradually and having mild clinical manifestations. Bright symptoms usually indicate the fact, joints seriously affected.

The trigger can be any agent that usually has a harmful effect on hyaline cartilage. Most often, it is a joint injury or chronic microfractures with a violation of the congruence of its contact surfaces, which is a manifestation of dysplasia, systemic lesions of the connective tissue, etc. The impetus for the emergence of osteoarthritis are also unfavorable life and working conditions of the patient, dysfunction of the sympathetic nervous system, pathology neurohumoral level, genetic, immune, endocrine, enzymatic and vascular factors.

In general, a violation of regional circulation, capillary stasis, and develops as a result of this, hypoxia plays an important role in the pathogenesis of deforming arthrosis as contribute to changes in aerobic and anaerobic oxidation reactions.

Procedures with use of the device «HELIOS» are appointed at the phenomena of an ossificans bursitis.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 75):

Table 75. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
60	12-15	18; 77	LSB - 20 totally MLT-10 on a zone, 25 totally

Method of treatment

Position of the patient – lying / sitting.

Technique of the procedures: the zones of influence are given in Table 76 and Figure 38.

The LSB is carried out remotely on skin directly or through the medicine applied on skin.

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

LSB – Zone 2 (the affected joint);

- zone 28 (paravertebral, a segmentary zone of an innervation of the affected joint).

MLT Red – Zone 30 (popliteal poles on the right/at the left);

- zone 11 (elbow pole on the right/at the left).

MLT IR – Zone 27 (paravertebral, Th11-L1 a segmentary zone of an innervation of kidneys).

Frequency of carrying out procedures: daily or every other day. The number of procedures on a course of treatment: 7-10.

Repeated treatment: in 2-3 months.

Possible combination to other methods of treatment:

- medicinal therapy;
- heat-treatment;
- balneo-therapy (baths).

Table 76. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
2; 28	27	11; 30

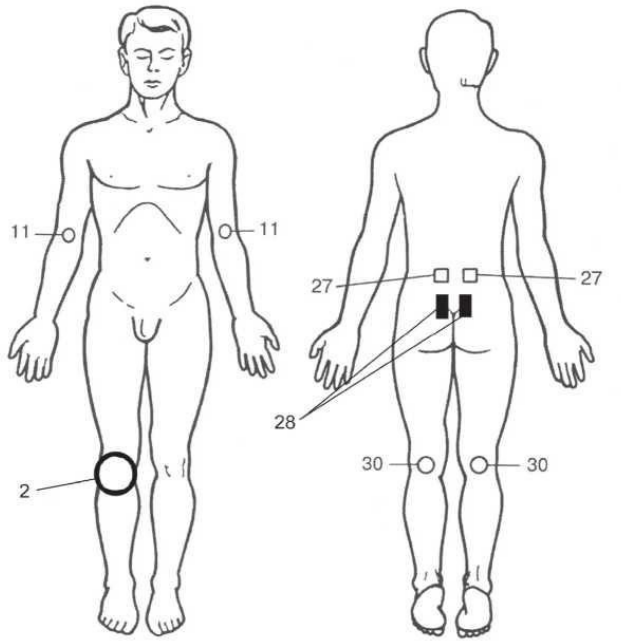


Figure 38. Zones for placing inductors

4.8.6. M10-M14 – Arthritis gouty

It develops against gout.

Etiopathogenesis

The etiology of gout:

Reasons for causing a decrease excretion of uric acid (90%) genetically caused hypothyroidism kidney enzyme systems, dehydration, chronic renal failure, etc.

Reasons causing overproduction of uric acid (10%): – decrease in activity caused by genetically hypoxanthine-guanine phosphoribosyl transferase, increased activity of 5-phosphoribosyl-1-synthetase, myeloproliferative diseases (polycythemia, leukemia), psoriasis, with a predominance of excess food monotonous meat meal, consumption of alcoholic beverages (especially beer, dry wine).

Pathogenesis of gout: uric acid metabolism defects enzymes and other etiological factors overproduction of uric acid, and / or decrease its excretion, hyperuricemia tissue deposition of urate, activation by urate crystals in the glenoid cavity, accumulation of urate crystals in the interstitium and tubules of the kidneys.

Procedures with use of the device «Helios» are appointed after removal of an aggravation.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 77):

Table 77. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
60	12-15	1,2; 18 alternate - with 77	LSB - 10 in the field, 20 totally MLT - 10 on a zone, 20 totally

Method of treatment

Position of the patient – lying / sitting.

Technique of the procedures: the zones of influence are given in Table 78 and Figure 39.

The LSB is carried out remotely on skin directly or through the medicine applied on skin.

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla

LSB – Zone 2 (the affected joint);

– zone 28 (paravertebral, a segmentary zone of an innervation of the affected joint).

MLT Red – Zone 30 (popliteal poles on the right/at the left);

– zone 11 (elbow pole on the right/at the left).

MLT IR – Zone 27 (paravertebral, Th11-L1 a zone of an innervation of kidneys). On-vein (not invasive) radiation of blood.

MLT Red – popliteal poles (at the left, on the right); elbow bends (at the left, on the right) – for 10 min.

Frequency of carrying out procedures: daily or every other day.

The number of procedures on a course of treatment: 7-10.

Repeated treatment: in 2-3 months.

Possible combination to other methods of treatment:

- medicinal therapy;
- diet therapy in combination with psychophysiological correction;
- massage; physical therapy.

Table 78. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
2; 28	27	11; 30

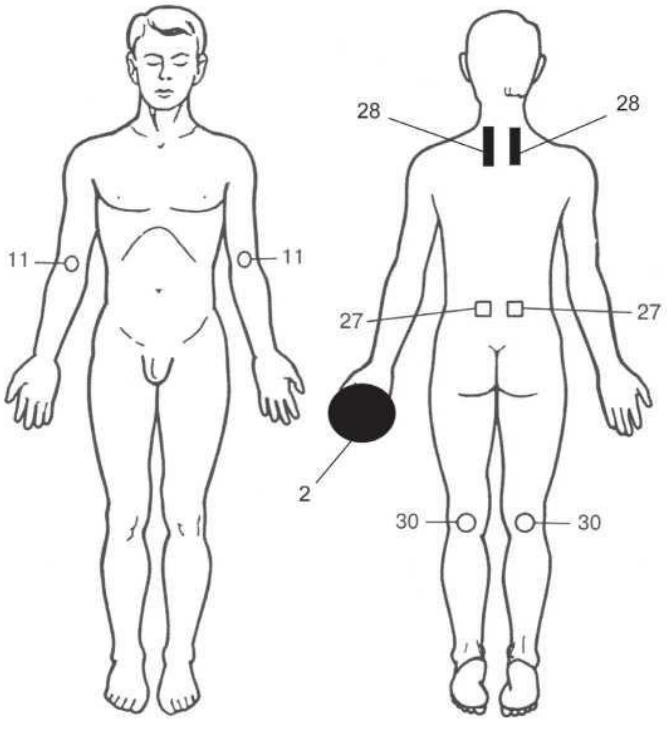


Figure 39. Zones for placing inductors

4.8.7. K07.6 – Calcaneal spur

Plantar fasciitis (plantar fasciitis) – is an aseptic inflammation of the soft tissue at the site of attachment of the plantar fascia to the heel bone. When the deposition of calcium salts in the area formed osteophyte (bony growths) – heel spurs.

Etiopathogenesis

Contributing factors for plantar fasciitis include: excessive pronation (tucking inwards) of the foot when walking; too high or flat arch of the foot; walking, jogging or prolonged standing on a hard surface; overweight; wearing uncomfortable shoes or intercourse; stress the Achilles tendon or leg muscles.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 79):

Table 79. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
80-100	12-15	18 alternates with 77	LSB - 20 totally MLT - up to 10 totally

Method of treatment

Position of the patient – lying / sitting.

Technique of the procedures: labile or stable, zones of influence are shown in Table 80 and Figure 40.

The LSB is carried out remotely on skin directly or through the medicine applied on skin.

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of organs, on area of reflex zones or a zone of a medulla.

LSB – Zone 3 (a projection of a calcaneal spur from a sole).

MLT Red – Zone 30 (a popliteal pole from a calcaneal spur).

MLT IR – Zone 28 (paravertebral, a kidney projection from a calcaneal spur).

At bilateral defeat the procedure alternates every other day. Frequency of carrying out procedures: daily or every other day. The number of procedures on a course of treatment: 15-20.

Repeated treatment: in 2-3 months.

Possible combination to other methods of treatment:

- diet therapy in combination with psychophysiological correction;
- massage; physical therapy.

Table 80. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
3	28	30

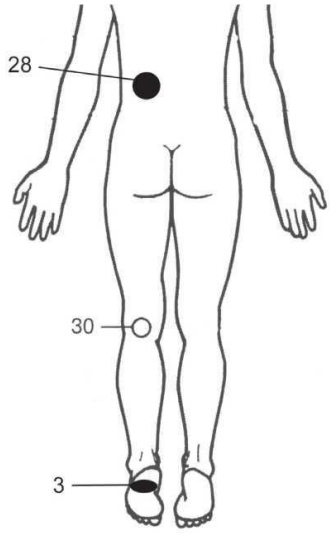


Figure 40. Zones for placing inductors

4.8.8. M65.2 – Calcifying tendovaginitis

Calcifying tendovaginitis is the disease of muscles at which the inflammatory process is localized on an internal surface of a fibrous sinew of a vagina.

Etiopathogenesis

Tendovaginitis can arise as an independent disease or as the provoked inflammatory process of inside sinews of a vagina on the background of the main illness. In the first case, as a rule, consider aseptic (crepitant tendovaginitis). In the second case – infectious (specific and nonspecific). Aseptic tendovaginitis in most cases results from receiving micro injuries in connection with implementation of professional activity or excessively intensive sports activities. It is caused by performance of the same movements with involvement of limited group of muscles therefore there is the wrong distribution of loading.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 81):

Table 81. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
40-60	12-15	9,4; 9,7; 7,7	LSB – 20 totally MLT – 10 totally.

Method of treatment

Position of the patient – lying / sitting.

Technique of the procedures: the zones of influence are given in Table 82 and Figure 41.

The LSB is carried out remotely on skin directly or through the medicine applied on skin.

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of organs, on area of reflex zones or a zone of a medulla.

LSB – Zone 3 (on the sinew course);

– zone 17 (liver projection).

MLT Red – over-vein radiation of blood higher than the place of defeat:

– zone 30 (popliteal poles on the right/at the left);

– zone 6 (carotid projection on the right/at the left);

– zone 11 (elbow pole on the right/at the left);

– zone 12 (over – and subclavian veins on the right/at the left);

MLT IR – Zone 27 (paravertebral, a projection of a segmentary innervation of a liver of Th7-L2).

Frequency of carrying out procedures: daily or every other day.

The number of procedures on a course of treatment: 8-12.

Repeated treatment: in 2-3 months.

Possible combination to other methods of treatment:

- diet therapy in combination with psychophysiological correction;
- massage;
- physical therapy.

Table 82. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
3; 17	27	30; 6; 11; 12

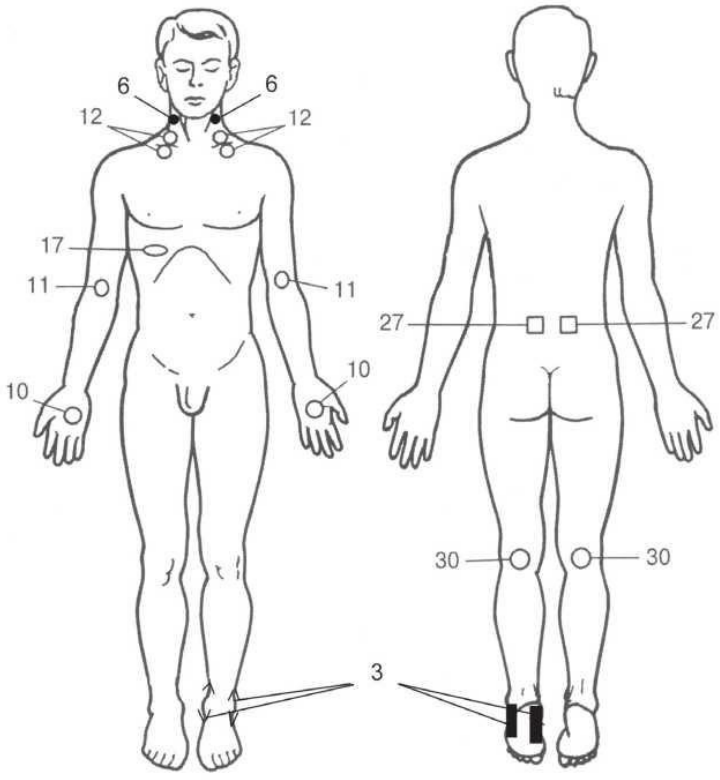


Figure 41. Zones for placing inductors

4.8.9. M79.2 – Cervical neuralgia

Neuralgia (from the Greek: neuron – vein, nerve, and algos – pain) – acute, aching, burning or dull pain along the course of peripheral nerves, which occurs episodically and periodically.

Attacks of pain may be accompanied by pallor or redness of the skin, sweating, muscle twitching. When no movement disorders neuralgia and sensitivity loss, and nerve damage are no structural changes.

Etiopathogenesis

The cause of the disease neuralgia can be very nerve, nerve plexus or the processes developing in the surrounding organs and tissues as a result of injury, infection (influenza, malaria, etc.), quenching, etc. Neuralgia develops mainly in the nerves, where the nerve passes through the narrow channels of the bone and can be easily crushed or infringed its surrounding tissues. Development of the infringement and the emergence of neuralgia may contribute to a variety of factors: hypothermia, inflammation, tumors, trauma, stress, intoxication, circulatory disorders, hernia of intervertebral disks, and so on.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 83):

Table 83. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
80	9-12	3,9; 99	UST - 1-2 on the field, 6-8 in total; MLT - 15 in total.

Method of treatment

Position of the patient – lying/sitting.

Technique of the procedures: the zones of influence are given in Table 84 and Figure 42.

The LSB is carried out remotely on skin directly or through the medicine applied on skin.

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

LSB – Zones 13 (paravertebral C5-Th2).

It is possible phonophoresis of "Dikasin-1" medicine.

MLT Red – Zone 15 (thymus projection).

MLT IR (after LSB influence) – Zone 8 (projection C5-Th2).

Frequency of carrying out procedures: daily or every other day. The number of procedures on a course of treatment: 8-10. Repeated treatment: in two months in case of need.

Possible combination to other methods of treatment:

- medicinal therapy;
- physical therapy;
- sanatorium treatment.

Table 84. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
13	8	15

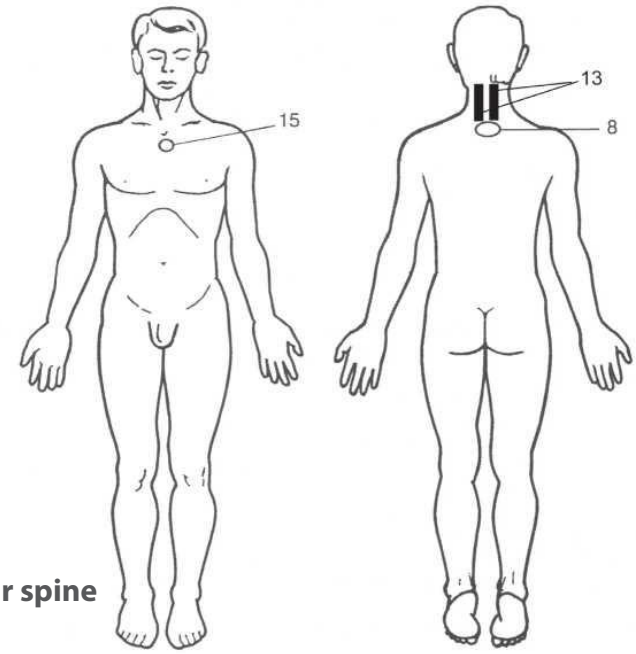


Figure 42. Zones for placing inductors

4.8.10. M79.2 – Neuralgia of the lumbar spine

Etiopathogenesis

Causes of neuralgia of the sciatic nerve (sciatica).

An osteochondrosis, intervertebral hernia, etc., When there is infringement of the roots with the development of sciatic neuralgia.

Injuries to the lumbar spine, hip fractures, pelvic tumor in the area of the passage of the sciatic nerve, infectious and inflammatory diseases of the pelvic organs, hypothermia, weight lifting, bad twist the torso.

Development of sciatica contributes to a sedentary lifestyle, sedentary work and pregnancy.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 85):

Table 85. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
50	9-12	3,9; 99	LSB - 3 on one field; MLT - 5 on a zone.

Method of treatment

Technique of the procedures: the zones of influence are given in Table 86 and Figure 43.

The LSB is carried out remotely on skin directly or through the medicine applied on skin.

Performance of MLT is carried out contact after LSB remotely on A-Shi points (painful points).

LSB – Zones 2, 3 (paravertebral Th2-L5 and on the course of a sciatic nerve (a hip, a shin, foot).

MLT Red – Zone 15 (a thymus projection).

MLT IR (after influence LSB) – Zone A-Shi (painful points).

Frequency of carrying out procedures: daily or every other day.

The number of procedures on a course of treatment: 8-10.

Repeated treatment: in two months in case of need.

Possible combination to other methods of treatment:

- medicinal therapy;
- physical therapy;
- sanatorium treatment.

Table 86. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
2; 3	A-SHi	15

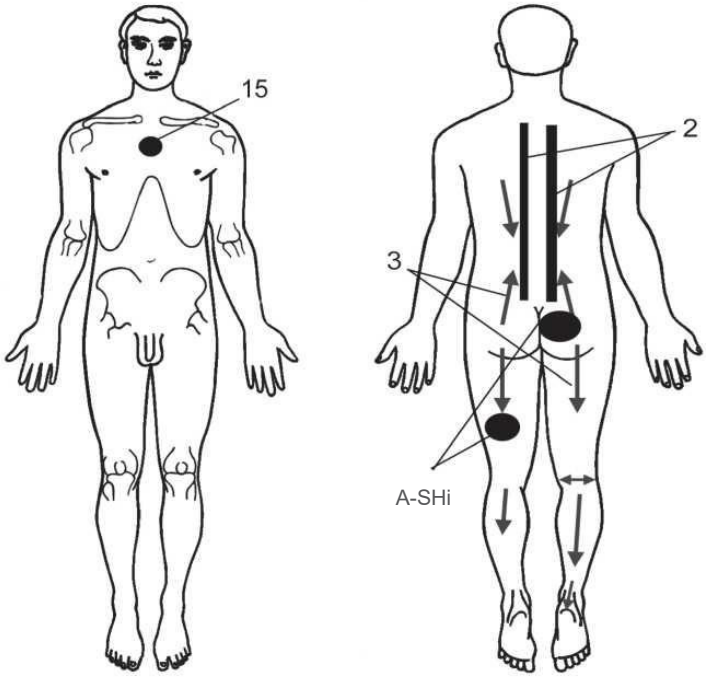


Figure 43. Zones for placing inductors

4.9. Mental and behavioral disorders

4.9.1. F51.0 – Insomnia

Insomnia is dissatisfaction with sleep. Insomnia is the most common complaint of sleep disorders, and the patients have a sense of the quality or lack of restorative sleep function.

Etiopathogenesis

Main causes: stress, neurosis, mental illness, neurological disorders, physical illnesses, psychotropic drugs, alcohol, toxic factors, endocrine and metabolic diseases.

The pathogenesis of insomnia remains insufficiently understood. It typically results from a complex interaction of biological, physical, psychological, and environmental factors. Brain regions involved in the regulation of wakefulness include the tuberomammillary nucleus of the posterior hypothalamus, which contains histaminergic neurons that transmit stimulating signals to the brain-stem areas associated with arousal. From these zones, projections extend diffusely to the cerebral cortex, ensuring the maintenance of wakefulness.

The application of the "Helios" methodology influences the function of the pineal gland and modulates melatonin production, thereby promoting the normalization of the sleep-wake cycle

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 87):

Table 87. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
60-80	12-15	2,4	LSB - 20 totally; MLT - 20 totally

Method of treatment

Position of the patient – lying.

Technique of the procedures: the zones of influence are given in Table 88 and Figure 44. During one session influence is carried out at the same time on three zones by the specified factors.

The LSB is carried out remotely on skin directly or through the medicine applied on skin.

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

LSB – Zone 17 (a liver projection).

MLT Red – Zone 3 (eyes).

MLT IR – Zone 8 (projection C8-Th3 of segments of a spinal cord);

– zone 4 (brain trunk projection);

– zone 1 (embryological projection of an epiphysis).

Frequency of carrying out procedures: daily or every other day.

The number of procedures on a course of treatment: the number of sessions is defined by efficiency of therapy.

Sessions at early awakening should be held in the morning, and at bad falling asleep – in evening (1,5-2 hours before going to bed).

Possible combination to other methods of treatment:

- phytotherapy;
- massage;
- autogenic training;
- psychotherapy.

Table 88. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
17	1; 4; 8	17

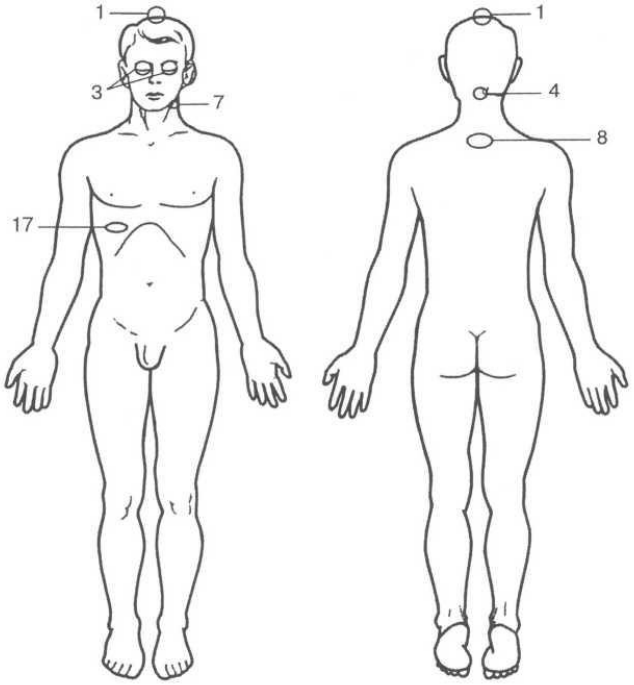


Figure 44. Zones for placing inductors

4.9.2. F32 – Depression

Depression is a mental disorder characterized by the "depressive triad": depressed mood and loss of the ability to feel pleasure, impaired thinking, and inhibited motor activity.

Etiopathogenesis

It is shown that the affective, motor and cognitive disorders with unipolar depression are similar with similar syndromes in lesions of the basal ganglia. Therefore, the hypothesis was suggested that the anatomical substrate of unipolar depression – loss of neural circuits involving the basal ganglia and the prefrontal area.

"Helios" is prescribed for preventive purposes (3-5 sessions every other day) on the eve of the expected deterioration of the condition.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 89):

Table 89. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
60-80	12-15	1-10 (1-mode)	LSB - 10 on a zone, MLT - 10 on a zone, 30 totally.

Method of treatment

Position of the patient – lying.

Technique of the procedures: the zones of influence are given in Table 90 and Figure 45. During one session influence is carried out at the same time on three zones by the specified factors.

The LSB is carried out remotely on skin directly or through the medicine applied on skin.

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

LSB – Zone 17 (a liver projection);

– zone 25 (projection of segments of a spinal cord of Th9-10).

MLT Red – Zone 3 (eyes);

– zone 1 (embryological projection of epiphysis);

– zone 7 (UCSG projection);

– zone 10a (palmar surface of a brush on the right);

– zone 11 (elbow poles on the right/at the left).

MLT IR – Zone 8 (projection C8-Th3 of segments of a spinal cord);

– zone 4 (brain trunk projection);

– zone 10b (palmar surface of a brush at the left);

– zone 12 (over – and subclavian poles).

Venous (non-invasive) blood irradiation.

MLT Red – popliteal poles (at the left, on the right); elbow bends (at the left, on the right) – for 10 min.

Frequency of carrying out procedures: daily or every other day.

The number of procedures on a course of treatment: 3-5 sessions on the eve of alleged deterioration.

Possible combination to other methods of treatment:

- medicamentous therapy;
- physical therapy;
- balneo-therapy;
- psychotherapy.

Table 90. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
17; 25	4; 8; 10b; 12	1; 3; 7; 10a; 11

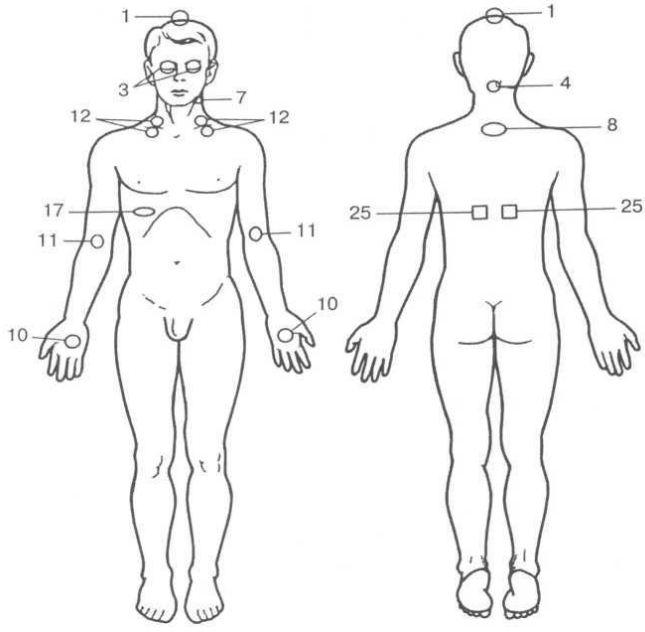


Figure 45. Zones for placing inductors

4.9.3. F40-F48 – Neurotic, Stress-Related and Somatoform Disorders

The main feature is repeated presentation of physical symptoms together with persistent demands of medical examinations, in spite of repeated negative findings and their assurances of doctors that the symptoms have no somatic nature. If the patient has any physical illness, they do not explain the nature and extent of symptoms, or suffering, or patient complaints.

Etiopathogenesis

Causes: stressful stimuli, traumatic brain injuries, infections, intoxication, diseases of internal organs and endocrine glands, as well as the long-term lack of sleep, fatigue, malnutrition and prolonged emotional stress. Neurosis is the result of a collision of conflicting incentives that create a situation of uncertainty reflex response; clinic, so there is a conflict between the impulses. Somatoform disorders explains the activation of neuro-visceral connections that include somatization neurosis.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 91):

Table 91. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
60-80	12-15	2-5	LSB - 10 on a zone, MLT - 10 on a zone, 30 totally.

Method of treatment

Position of the patient – lying.

Technique of the procedures: the zones of influence are given in Table 92 and Figure 46.

The LSB is carried out remotely on skin directly or through the medicine applied on skin.

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

On-vein radiation of blood in the field of carotids (zone 11), frequency is 2-5 Hz, for 5 min. from each party, 1 time in 2-3 days, 5-7 procedures.

At the same time daily: zone 15 (frequency of 75 Hz, time of 1 min.); zone 8 (1 min.); zone 4 (on 8 sec.); zone 5 (20 sec.); zone 17 (2,5-3 min.). A course – 21 days.

LSB – Zone 17 (a liver projection).

MLT Red – Zone 15 (thymus projection);

– zone 11 (projection of carotids on the right/at the left).

MLT IR – Zone 8 (projection C8-Th3 of segments of a spinal cord);

– zone 4 (temporal area on the right/at the left);

– zone 5 (left auricle).

Venous (non-invasive) blood irradiation.

MLT Red – popliteal poles (at the left, on the right); elbow bends (at the left, on the right) – for 10 min.

Frequency of carrying out procedures: daily.

The number of procedures on a course of treatment: 10.

Possible combination to other methods of treatment: – psychotherapy.

Table 92. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
17; 25	4; 8; 10b; 12	1; 3; 7; 10a; 11

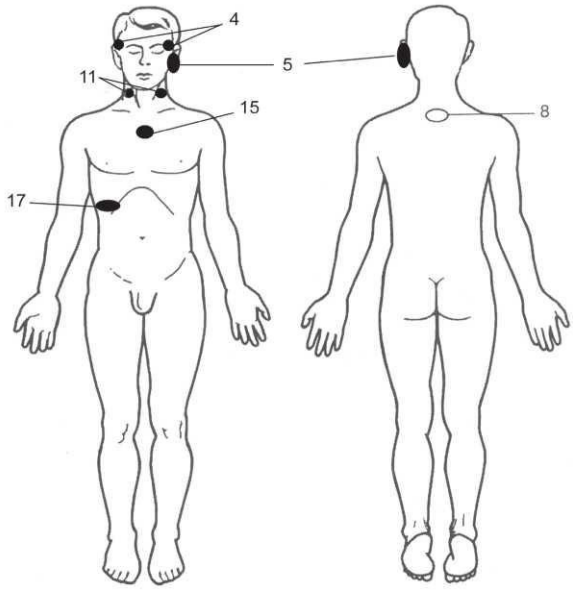


Figure 46. Zones for placing inductors

4.9.4. F01.1 – Multi-infarct dementia

Dementia is a persistent decline in a person's cognitive abilities, as well as the gradual loss of previously learned knowledge.

Etiopathogenesis

The causes of dementia and related disorders are very different. But it is possible to allocate the basic – neuronal death under the influence of deposits formed in the brain. As a result, any suppression of the activity of neurons, or the disruption of the vessels, their feeding.

The causes of senile dementia can be different, moreover, are often found mixed forms of the disease. In addition, the likelihood of developing the disease affects unfavorable factors, the main ones are: age, gender – according to statistics, among the patients more often are women, a genetic predisposition.

Also, the lack of intellectual activity, stresses, intoxications, alcoholism can exert impact on probability of development of dementia.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 93):

Table 93. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
80-100	12-15	9.4 alternated with 1-10 (P1 mode)	UST - up to 7 per zone; MLT -10 per zone, 30 in total.

Method of treatment

Position of the patient – lying.

Technique of the procedures: the zones of influence are given in Table 94 and Figure 47.

The LSB is carried out remotely on skin directly or through the medicine applied on skin.

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

In one session use 3-4 zones with the below-specified parameters.

LSB – Zone 17 (liver projection).

MLT Red – Zone 3 (eyes);

– zone 6 (carotid projection);

– zone 36 (plantar surface of feet);

– zone 10 (palmar surface of brushes);

– zone 38 (internal surface of feet).

MLT IR – Zone 1 (projection of the pineal gland);

– zone 8 (projection C8-Th3 of segments of a spinal cord). Frequency of carrying out procedures: daily, morning hours.

The number of procedures on a course of treatment: 14-15.

Possible combination to other methods of treatment:

- drug treatment;
- diet therapy in combination with psychophysiological correction;
- kinesis-therapy.

Table 94. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
17	8; 1	3; 6; 36; 38; 10

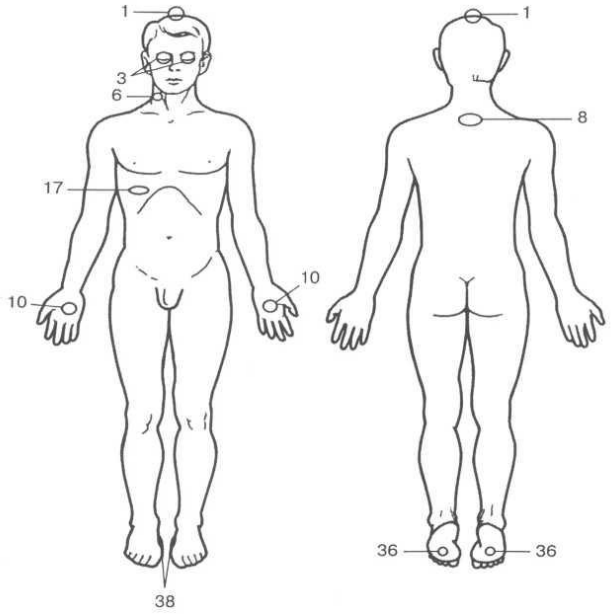


Figure 47. Zones for placing inductors

4.9.5. I15 – Vegetative dystonia (VD) of the hypertensive type

Vegetative-vascular dysfunction (VD) is a common term in medical and diagnostic practice, diverse in origin and manifestations, but basically a functional vegetative disorder caused by a violation of the neurohumoral regulation of vegetative functions.

Etiopathogenesis

These disorders are most frequently observed in the neuroses, physical inactivity, with endocrine disharmony in puberty and menopause, as well as neurosis conditions associated with neuro-mental or physical fatigue, infections, intoxication, withdrawal symptoms in drug addicts and other nature.

The pathogenesis of VD usually involves the regulation of autonomic disorders at all levels – from the cerebral cortex to the peripheral parts of the autonomic nervous system (adrenergic and cholinergic receptors include executive organs) and the regulation of endocrine links.

Treatment scheme

The front panel of the device exhibiting the following procedure parameters (Table 95):

Table 95. Procedure parameters

LSB POWER, mW	INDUCTION, mT	MODULATION, Hz	TIME, min
60-80	12-15	1,2; 1-10	LSB - to 10 on a zone, MLT - 10 on a zone, 30 totally.

Method of treatment

Position of the patient – lying.

Technique of the procedures: the zones of influence are given in Table 96 and Figure 48.

The LSB is carried out remotely on skin directly or through the medicine applied on skin.

The MLT is carried out in contact, together with LSB. Inductors established on a projection of the pathological center, paravertebral on a zone of an innervation of bodies, on area of reflex zones or a zone of a medulla.

In one session use 3-4 zones with the below-specified parameters.

LSB – Zone 21 (a projection of a celiac plexus).

MLT Red – Zone 36a (a plantar surface of feet on the right); – Zone 10a (palmar surface of brushes on the right).

MLT IR – Zone 36b (a plantar surface of feet at the left);

– zone 10b (palmar surface of brushes at the left);

– zone 8 (projection C8-Th3 of segments of a spinal cord);

– zone 27 (paravertebral, Th12-L2 projection zone of a segmentary innervation of kidneys).

MLT Green – Zone 21 (a projection of celiac plexus).

Frequency of carrying out procedures: every other day.

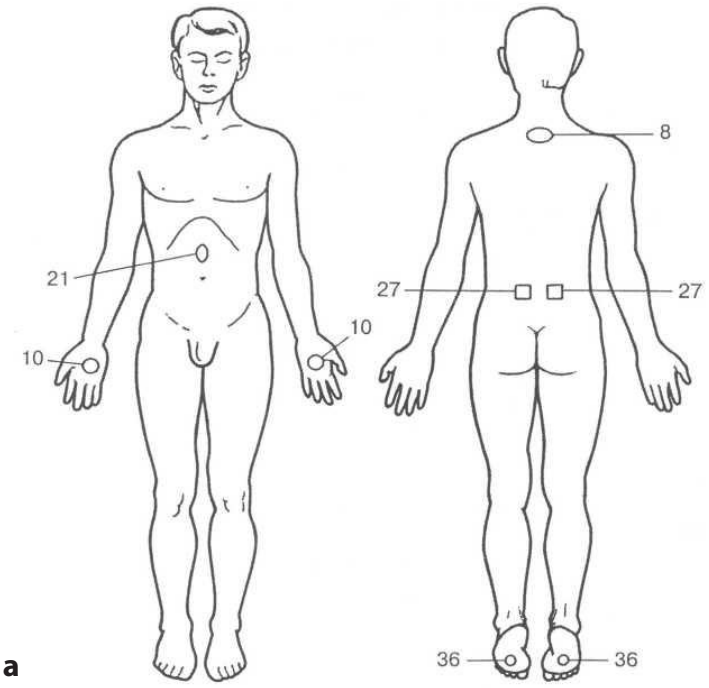
The number of procedures on a course of treatment: 10.

Possible combination to other methods of treatment:

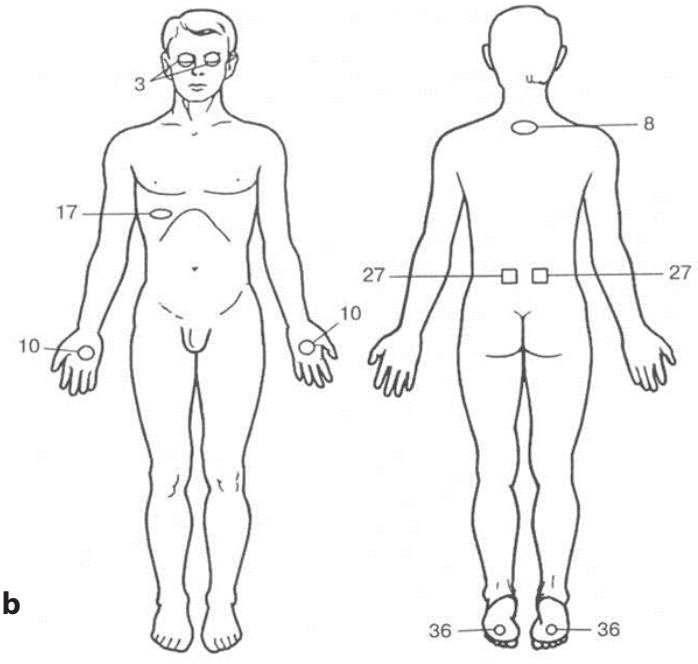
- drug treatment;
- balneo-therapy;
- physical therapy;
- psychotherapy.

Table 96. Zones for placing inductors

Zones of influence		
LSB	MLT IR	MLT Red
21	8; 27; 10b; 36b	10a; 36a



a



b

Figure 48 a,b. Zones for placing inductors

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PUBLISHED BY:

ALUNA Publishing House
Z. M. Przesmyckiego 29
05-510 Konstancin-Jeziorna
POLAND
Wydawnictwo-Aluna.pl

SCIENTIFIC MEDICAL JOURNALS

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Graphic design: Joanna Gębalska
Cover artwork created with the assistance of artificial intelligence (AI).

doi: 10.36740/BK2025WAR02
e-ISBN 978-83-65536-28-0

Printed version:
ISBN 978-83-65536-22-8