HEALTHCARE MINISTRY OF RUSSIAN FEDERATION
RUSSIAN ACADEMY OF MEDICAL SCIENCES

MAGNET INFRARED LASER APPARATUS "MILTA-F" TYPE FOR THERAPY AND DIAGNOSTICS IN MEDICAL PRACTICE

Instructions for physicians
in two parts

Second edition, revised and enlarged
PART 1

(MIL-therapy)

Moscow

2000

Apparatus “MILTA-F” is recommended for the application in medical practice by Committee on New Medical Technologies of Ministry of Healthcare and Medical Industry of Russian Federation

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Apparatus “MILTA-F-8-01”

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MAGNET INFRARED LASER APPARATUS FOR THERAPY AND DIAGNOSTICS: Instruction for physicians in two parts. Second edition, revised and enlarged. PART I (MIL-therapy). Authors: Cand.Med.Sc. Builin V.A., Dr.Med.Sc. Alexejev Yu.V., Cand.Med.Sc. Antonova G.A., Cand.Techn.Sc. Balakov V.F., Dr.Med.Sc..Sheina A.N.

This practical handbook on laser therapy generalises previously published practical recommendations how to work with laser apparatuses and laser radiation for therapeutic purposes. Semiconductive lasers have a number of advantages in comparison to gas lasers. These advantages are: dimensions, design, simplicity and flexibility in managing all the parameters of laser radiation.
Practical application of semiconductive laser apparatuses of "MILTA-F" type for therapy and diagnostics (and its latest model -"MILTA-F-8-01")with an in-built photoregistor is described in details. The apparatus is designed for a wide range of therapeutic effects and may be used by physicians in policlinics and specialised hospitals, in sanatoriums and curative-prophylactic institutions, in curative-diagnostic centres as well as at home under doctor's supervision.
The proposed Instructions are written for practising physicians of different specialities, for listeners of medical postdiploma courses and specialised laser therapy courses, as well as for other users.
Part 1 (MIL-therapy)
Part 2 (MIL-reflexotherapy)

The Instructions have been approved by Healthcare Ministry of Russian Federation and by Russian Academy of Medical Sciences.

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Apparatus "MILTA-F-8-01" has been elaborated and is produced by ZAO "Scientific Production Alliance - Space Apparatus Construction" in co-operation with OOO "Symbol". Apparatuses of "MILTA-F" type are protected by licenses of Russian Federation and are recommended for serial production and application in medical practice by Healthcare Ministry of Russian Federation.
Medical co-performers: Moscow Medical Stomatology Institute named after Semashko N.A., Moscow Scientific Research Institute for Emergency and First Medical Aid named after Sklifosovski N.V., Physiotherapeutic Department of Russian Medical Academy of Postdiploma Education.
These serially produced apparatuses correspond to Technical Standards approved by Gosstandard of Russian Federation. Trade mark "MILTA" is registered. Logotype "MILTA" is a registered trade mark.
Apparatus "MILTA-F-8-01" has Certificate of Conformity from Gosstandard of Russian Federation and Hygienic Certificate from Sanepidnadzor of Russian Federation.

LIST OF ABREVIATIONS AND SPECIAL TERMS

A - amper, SI unit of electric power.
BP- blood pressure
ACTG - adrenocorticotrophic hormone
APERTURA - a slot in laser protective body through which laser radiation comes out.
V- volt, a SI unit of electric tension, electric moving force (emf), difference of electric potentials.
VA - volt-amper, a unit of total capacity of electric power
Wt - watt, a SI unit of active capacity
Hz - a unit of frequency. 1 Hz - frequency of periodical process, in which one cycle of process lasts for 1 sec
J - joule , a unit to measure work or a dose (1J= Wt·s)
Dipole electric - a summation of two equal by absolute value opposite dotty charges (-e,+e) located from each other at some distance *l*.
Kg- kilogram
IR - infrared (the range of the electromagnetic radiation).
LT - laser therapy
mWT - millwatt (1 mWt=10^{-3} Wt)
mWT - microwatt (10^{-6} mWt)
MIL - magnetic infrared laser (irradiation, therapy)
mkm - a unit for measuring length (1 mkm=10^{-6} m=1000nm)
MLT - magnetic laser therapy
mTl - millitesla, a SI unit of magnetic induction
LILR - low intensive laser radiation
SLRB - supervenous (subcutaneous, transdermal) laser radiation of blood
nm - nanometer, unit of length measurement (1nm=10^{-9} m)
ns -nanosecond (1ns=10^{-9} s)
CMF -constant magnetic field
POL - peroxide oxidation of lipids
RVG - reovasography
RECOMBINATION - an act of reunification of a positive ion and a free electron, which leads to the formation of an ion and a neutral atom (a molecule)
s - second
USI - ultrasound investigation
FEGDS - fibroesophagogastroduodenoscopy
CNS - central nervous system
EMF - electric moving force
ECG - electrocardiogram
EEG - electroencephalogram
LED- a light-emitting diode
BP- blood pressure

INTRODUCTION

Currently, physicians of all countries use in their practice more and more actively non-medicamentous approaches for therapy regulating organism functionability both in combination with drugs and as a monotherapy. Progress of medical science, technology and clinical medicine has been significantly defined by the achievements in the sphere of quantum electronics. Optic quantum generators, especially medical lasers, have inexhaustible possibilities which are evidently demonstrated by the results of treatment of various pathologies revealed in man.

Lasers have been implemented into medical practice comparatively recently, about 30 years ago. Nevertheless, advantages of their application in medicine are evident and impressive. Studies on biostimulative effects of low intensive laser radiation have discovered wide perspectives of laser application in almost all fields of medicine. Russian laser medicine is one of the world's leaders in the nomenclature of apparatuses, in the scale of investigations, in the depth and volume of instructive materials how to treat patients and use lasers in almost all fields of modern medicine. Laser therapy utilises low intensive radiation of gas and semiconductive lasers (laser therapy) and light-emitting diodes (LEDs) (phototherapy).

Laser or optic quantum generator is a technical unit which emits light in a very narrow range of the spectrum as a directed highly coherent monochromatic polarized beam, i.e. the stream of electromagnetic radiation of one colour highly organised in space and time. One of the basic characteristics of laser radiation is its spectral parameter or wavelength. Laser therapy utilises radiation within the range of the wavelength from 0,3 up to 10,06 mkm (from ultraviolet to infrared). Opposite to medicamentous treatment laser therapy is a topical, dose-dependent and non-invasive approach; cells and tissues are effected from the outside and consequently, routine biological processes are normalised. Laser- and phototherapy regulate metabolism, circulation, immunity, as well as improve non-specific organism resistance (mioprotective, radioprotective effects). Laser therapy is completely safe in adequate doses.

Experimental and clinical investigations (Alexandrov M.T. et al, 1996, Alexejev U.V., 1999, Baibekov I.M. et al, 1996, Briskin B.S. et al,1996, Gladkikh S.P. et al, 1996, Zubkova S.M., 1991, Kozlov V.I. et al, 1993) have showed that the application of LILR in the near IR spectrum (0,83-1,3 mkm) for treating patients

appears to be more effective in many cases in comparison with LILR in the visible range of the spectrum (red, green, blue). Laser therapy effectiveness significantly increases when short-pulsed IR LILR is combined with continuous IR LED radiation and with CMF: magnet infrared laser therapy, ***MIL-therapy***. Different combinations of these radiations are designed in serially produced apparatuses "MILTA" (**M**agnetic-**I**nfrared **L**aser **T**herapeutic **A**pparatus) and in the apparatuses of a new generation - "MILTA-F" type. The construction of the apparatus makes it possible to use combined radiation effects*: laser+LED; laser+ magnet; LED+magnet; laser+LED+magnet*.

Apparatuses "MILTA-F" have an in- built biophotometer which allows to clarify diagnosis and to predict the course of pathologic process, to control this process as well as to prescribe the optimal dose of laser- and photoirradiation for every patient according to his individual sensitivity to IR radiation. Different biologic tissues have different spectral optic characteristics. These characteristics depend on patient's age, his physiological and pathophysiological parameters as well as on the changes in his psychoemotional state. IR-testing (biophotometry) is performed in the apparatus simultaneously with MIL-therapy.

Specialised optic attachments (for acupuncture, rectal, otorhynolaryngological, dental, gynaecological therapy) allow doctors of different specialities to use a portable apparatus "MILTA-F" in hospitals, policlinics, curative-diagnostic centres, sanatoriums, curative prophylactic institutions and at home.

Clinical trails at leading scientific institutions of Russia and abroad as well as long-lasting experience with MIL-therapy have confirmed "MILTA-F" reliability, safety and high therapeutic effectiveness.

The Instructions are recommended for physicians of various specialities who have finished courses of advanced and postdiploma medical studies. The Instructions are not intended to serve as a text-book on laser therapy. The List of Literature enclosed at the end of the Instructions will help the readers to enlarge and deepen their knowledge in this perspective field.

1. MECHANISMS OF BIOLOGIC AND THERAPEUTIC EFFECTS OF INFRARED RADIATION FROM LASERS AND LEDS.

Laser application in medicine is based on the interaction of light with biologic tissues. Photobiologic effects directly depend on laser radiation parameters : wave length, intensity of light energy and time of exposure to biologic tissues (dose). IR LILR in the range of wavelength 0,85-1,3 mkm (thermal radiation) penetrates into biologic tissues as deep as 6-7 cm . The depth of penetration of this kind of radiation into tissues is defined as a distance for which the amplitude of electric field decreases by **e** times and the density decreases by $\mathbf{e}^{2}$ times (**e**=2,71 - the basement of natural logarithms). Comparatively powerful (1-10 Wt) and short (70-150 ns) impulses of IR LILR make tissues of biologic objects more transparent for low intensive (10-100 mWt) continuous IR LED radiation due to the effect of saturation electronic state population in the atom capsules of biologic tissues.

IR radiation is absorbed by oxygen, water, several enzymes and biologic structures (first of all, by cell membranes). Heat increases oscillatory energy in biomolecules and is utilised by the organism fluids. The absorption of light energy is a key moment on which the intensity of further processes depends. The basic law of photobiology says that **biological effects may be caused only by the light with such wave length which is absorbed by separate molecules-acceptors or cellular membranes**. Uneven LILR distribution and light absorption in different structures cause heat unbalance in biological tissues. It may lead to the deformation of cellular membranes (due to changes in the osmotic pressure) and to changes in their electric potential which consequently effect the metabolic processes and is one of LILR biophysical, trigger mechanisms.

LILR with the wavelength from 0,9 to 1,3 mkm directly generates highly energetic singlete (excited) oxygen without any photosensitizers participation. The latter effecting cellular membranes changes tissural antigen features, leads to structural changes in a number of compounds including those with double chemical bonds - its acceptors (purin and pirimidin basements, cholesterol, steroid and sex hormones, bile pigments, porfirins, etc.) and aliphatic compounds (fatty non-saturated, phospholipids, sphyngomielin, cerebrosides). It is quite obvious, that the character of oxidative-reductive reactions strictly depends on the concentration of singlet oxygen; hence, on the dose of laser effect. Laser pulses periodically, with definite frequency activate the above-mentioned process (so-called “trigger

principle”) and “feed” catalytic biochemical reactions with energy if some local energy misbalance occurs, for example, in any pathology.

Formation and transformation of labile products of photobiological process developing in tissues (such as free radicals, ion-radicals of oxidated and reduced forms, peroxides and other substances) occupies a comparatively short period of time but this period is extremely important for further development of biochemical and physiological reactions. As a result, the intensity of oxidative-reductive and biosynthetic processes is changed, metabolic processes in biological tissues are normalised, blood and lymph circulation is restored due to the dilatation of functioning capillaries and due to the opening of new ones. After several MIL-therapy sessions one can see the increased net of capillary system because of the growth of new capillaries (neovasculogenesis).

This multistage process may be presented in the following way: light quantum absorption ⇒ primary photophysical act ⇒ intermediate stages including the formation of photosensitized products in tissues or the transportation of energy on cell membrane components ⇒ triggering neurohumoral reactions ⇒ the final biological effect.

Response of a biological object to LILR impact at cellular and tissue level and adequate changes in the neurohumoral regulatory link form the final result of photobiological process developing through the mechanisms of urgent adaptation in the organism. Links defining this process frequently respond to the instant local situation developing under a pathologic process but, not because of the photobiological effect itself. Hereof comes a relative simplicity and fewness of the primary photobiophysical acts in the organism, but various and multiformed responsive reactions different by their secondary manifestations and final results.

Light is a main physical factor which supplies life on the Earth. LILR impacts bioobjects with therapeutic doses which do not cause any pathologic changes in cells; so, such radiation could be estimated as an adequate physiological irritant - signals which cause changes in natural physical-chemical, biophysical, biochemical and physiological processes. It gives a possibility to interfere with the course of a pathologic process at its any stage and to achieve a staged and consecutive restoration of the homeostatic balance.

2. MECHANISMS OF BIOLOGIC AND CURATIVE EFFECTS OF THE CONSTANT MAGNETIC FIELD. MAGNETIC-LASER THERAPY.

In the natural environment living beings are incurring the impact of the Earth magnetic field, local magnetic anomalies caused by mineral deposits, etc. Artificial magnets and generators of magnetic fields have been successfully applied for therapeutic purposes in modern medicine for a long time. Constant magnetic field (CMF) of any intensity from 10 up to 100 mTl may be considered as a non-specific irritator of biological tissues. It is defined that CMF of therapeutical tension (10-60 mTl) changes the orientation links - electrostatic interaction between dipoles (for instance, in the membrane phospholipid component), ion links and ion-dipole interactions (for instance, in chelate bonds). It also affects induction and dispersion links (for instance, in complex lipoproteid submolecular complexes retained in specific structures by electrostatic forces).

CNS, blood and endocrine system are living structures most sensitive to CMF. In CNS we can see a protective inhibition with a slight elevation of irritation threshold, i.e. exitation is decreased. In the endocrine system we can see a moderate functional activity of thyroid and genital glands, trophic hypophysis hormones (except ACTG), the increase of glycocorticoids secretion in the adrenal cortex. Retardation of catabolic and synthesis processes, as well as anti-inflammatory effects are also observed. Biological effects may be seen right after the first CMF application.

CMF vasodilatative and disagregative effects (5-10 mTl) are mostly developed at the microcirculation level while the systemic circulation is left almost intact. It is explained by the fact that biological effects of low intensive CMF coordinate three main balance parameters: microcirculation, vasodilatation, disagregation. CMF interacts with moving electrically charged particles, in particular, with the erythrocytes. It determines CMF selective effect at blood coagulation, microcirculation and microvessels permeability.

Therapeutic effects of LED and laser radiation (especially infrared) at biological tissues are significantly increased in the magnetic field. It takes place because of the multilevel and diversely directed activation of microcirculation, because of the increase in the activity of tissue metabolism, because of the intensification of humoral element functions as well as other factors determining more active functions in a biological object. LILR destroys electric bonds between ions, water molecules and ions, whereas CMF prevents ion recombination. The

pointed electric moving force (EMF) is much more higher under the combined LILR and CMF effect than under their separate effect; the depth of penetration of laser radiation into tissues is increased because of the dipoles reorientation. Clinical application of LILR combined with CMF has been called *magnetic laser therapy*, **MLT**.

Experiments have shown that MLT in therapeutic doses restores the intracellular Ca2+ balance in pathologically changed tissues and organs because of the activation of endogenous mechanisms decreasing Ca2+ permeability of cellular plasma membrane. It is known that the modification of intracellular Ca2+ balance is seen in cardiovascular pathology, renal insufficiency and other diseases. Metabolic and structural changes in cells and subcellular formations taking place under MLT determine a strong regenerative effect of MIL-therapy.

Non-specific, trigger character of MIL-therapy is transmitted through the central nervous system and finally is revealed in the systemic reactions. Location of MIL-therapy is not important because any part of the body is connected to this or that organ through CNS. Curative effect of MIL-therapy is determined by the biostimulation and mobilization of the existing energetic potential and is manifested as immune-modulating, desensibilising, neutrophic, anti-inflammatory, anesthetic, antiedematous, regenerative, normalizing blood rheology and hemodinamics, hypocholesterolemic. It has determined a wide range of indications for MIL-therapy and variety of therapeutic approaches.

MIL-therapy is effective in different diseases because it impacts their common pathogenic chains by the combination of its mechanisms. LILR spectrum of non-specific regulative effects may be compared with the adaptogens of different nature, vitamins, polinonsaturated fat acids, irreplacable aminoacids (which are not synthesized in the organism), natural antioxidants, metabolically active substances, immune modulators and immune stimulators. To achieve better effect in MIL-therapy it is important to have an integral approach to the analysis of the disease and to the ways of its treatment.

3. MAIN AREAS FOR THE APPLICATION OF IRRADIATION FROM APPARATUSES OF "MILTA-F" TYPE

Indications for MIL-therapy

Therapy: ischemic heart disease, angina at strain and at rest, postinfarction cardisclerosis, hypertension, vegeto-vascular dystony, digestive organs disorders, joint diseases.

Surgery: wounds, burns, frost bites, bone fractures, traumatic injuries of the internal organs; infiltrates, purulent processes in soft tissues and bones, proctitis, paraproctitis, fissures of the rectum, furuncules, carbuncules, phlegmons; phlebitis, trombophlebitis, obliterating endarteriitis, trophic ulcers, hemorrhoids, lymphadenitis, heels.

Endocrinology: Thyroiditis, diabetes mellitus, endocrinopathies.

Neurology: osteochondrosis, radiculitis, neck-shoulder syndrome; neuritis and neuralgia of different localization; neurosis, Parkinson disease, disseminated sclerosis.

Gastroenterology: gastritis, duodenal and gastric ulcer; pancreatitis, diffuse injuries of the liver, liver cirrhosis, biliary duct dyskinesia , acute and chronic cholecystitis, jaundice, colitis.

Pulmonology: bronchitis, asthma, acute and chronic pneumonia, tuberculosis, pneumosclerosis, pleuritis.

: *Otolaryngological disorders:* auricle eczema, eczema of external auditory passage; otitis, salpyngootitis; rhinitis, sinusitis, tonsillitis, adenoids, pharyngitis, laryngitis.

Urology: acute and chronic pyelonephritis, urolithiasis, cystitis, uretritis; prostatitis, pathology of spermatogenesis, Peironi disease; anuresis, neurotic sexual disorders.

Obstetrics and gynecology: ruptures of the perineum during delivery, fissures of the nipples, lactation mastitis; mastopathy, dysfunctional uterine bleeding, endometritis, parametritis, endocervititis, erosions of the uterine cervix, acute and chronic adnexitis, chronic salpyngoophoritis; vulvovaginitis, vulva craurosis, infertility.

Dermatology, cosmetology: neurodermitis, eczema, exudative erythema, psoriasis, allergic dermatitis, herpes, warts, abscessing acnes, epidermophitia; baldness, prophylactics of skin aging.

Dentistry: non-complicated dental caries, pulpitis, periodontitis, parodontosis; herpetic stomatitis, desquamative glossitis, injuries, ulcers and erosions of the mouth mucous; pemphigus cheilitis, chronic fissures of the lips, chronic sialoadenitis.

Pediatrics: disorders of broncho-pulmonary system , digestive organs, infectious skin diseases, post-delivery and post-operative complications.

In sport medicine "MILTA-F" can be applied for shortening sportsmen rehabilitation after overstrains, traumas and for the activation of productive psychological state before competitions.

Contraindications for MIL-therapy

- malignant neoplasms of any location;
- benign neoplasms inclined to progressing; systemic blood diseases, leukosis;
- pregnancy at any stages, hyperplastic processes in the uterine cavity, benign genital tumors;
- acute infectious diseases
- infectious processes caused by anaerobic bacteria;
- severe pathologies of cardio-vascular system (a crisis form of hypertension, cardio-vascular insufficiency stage III); strokes; lung diseases with lung insufficiency stage III; decompensed liver and renal failure;
- fever of unknown ethiology;
- photodermatitis and photodermatosis, porphirine disease, discoid and systemic lupus, rosacea;
- mental disorders in the exacerbation stage.

This Instructions describes to its readers the treatment of the diseases mostly frequently met in patients.

4. TECHNICAL PARAMETERS OF THE APPARATUSES OF "MILTA-F" TYPE

The apparatus "MILTA-F" is designed to work in the environment with room temperature from +15C up to +35C and humidity not more than 80%. The apparatus is switched on and off according to the instructions written in the

" Passport with Technical Explanation and Instructions". Model "MILTA-F-8-01" differs from the previous models by significant functional changes (including a new type of biophotometer) and larger functional capabilities (Table 1).

Table 1

Technical characteristics of the apparatus “MILTA-F-8-01”

Parameter	Dimension	Value
Radiation wave length of impulse laser and super luminescent LEDs, limits	mkm	0,85...0,95
Output power of the continuous LED radiation. Regulated (in terminal aperture)	mWt	0...120
Power density of LED radiation (in the terminal aperture)	mWT/cm2	0...25
Duration of laser radiation impulse	ns	150
Frequency of laser impulses during • internal start of laser • external start of laser	 Hz Hz	5; 10; 50; 80; 150; 600; 1500; 5000; 0...5000
Output power of laser radiation in the impulse (in the terminal aperture). Not less than	Wt	4,0
Average capacity of laser radiation in the terminal aperture • at impulse frequency 5000 Hz • at impulse frequency 5 Hz	 mWt mkWt	Not less than: 3,5 3,5
Average density of laser radiation in the terminal aperture • at impulse frequency 5000 Hz • at impulse frequency 5 Hz	 mWt/cm2 mkWt/cm2	 0,78 0,78
Magnetic induction on the magnet axis in the platitude of terminal aperture	mTl	20...80
Area of the terminal aperture	cm2	4,5
Number of digital discharges of photoregistrators (depending on the apparatus model)	pieces	2 (3)
Duration of a single exposure (depending on the apparatus model)	min	0,25; 0,5; 1 2,5; 10; 15 or about 2,5
Net	V, (Gts)	220+-10% (50) or 110+-10% (60)
Power consumption	V*A	not more than 25
Apparatus weight	kg	2,2
Dimensions	mm	240x215x115

An in-built photoregistrator provides a possibility to measure IR-radiation reflection coefficient from the object, to diagnose, to control the treatment, to verify an individual radiation dose (see Article 8). The adjustment of the required LED IR radiation power is performed via a photoregistrator during the terminal allocation in the apparatus box. Photoregistrator indications correspond to LED radiation capacity in mWt. Apparatus "MILTA-F-8-01" also performs a computerized analysis of biophotometric data and their synthesis in a graphic form, as well as an individual management of treatment process via a special computer program. A computer is supplied only if it is an order from a customer. Due to the customer's wish an additional second curative terminal may be enclosed to the apparatus. With the second terminal it is possible to perform the joint effect on a pathological focus, to reduce twice the time of MIL- procedure.

Only the model "MILTA-F-8-01" and its further modifications provide the adjustment of the required level of LED IR radiation power; this Instructions are written considering these particular features. If other modifications of "MILTA-F" apparatus in which LED radiation power is maximal (approximately 100 mWt) are used, it is important to correct the time of exposure (so as to correct the irradiation dose). For instance, if the exposure time given in the Instructions for LED IR-radiation power of 50 mWt is 2 min, that means that for other "MILTA-F" models working at their maximal LED radiation power the exposure time should be reduced up to 1 min.

Apparatuses of "MILTA-F" type are adapted for working with lightguide attachments (Annex 1, Fig. A). These attachments deliver laser and LED IR radiation directly to the target part on the patient's body, namely, to the target acupuncture point. Before the application a condom is placed on the gynecological and proctological attachments No. 1-3, and a rubber tube may be put on the attachments No. 4 and 5; it allows a patient to fix the attachment in his mouth with his teeth n (Annex 1, Fig. A). Coefficient of radiation transmission via attachments is within the range of wavelengths 0,8-0,9 mkm, but not less than 0,5. A transitive spigot with thread for connecting the attachments to the curative terminal and six types of lightquide attachements are delivered with the apparatus as a complete set, or the list of this set may be changed according to the customer's wish . The set may additionally be equipped with sun glasses and brackets (terminal adapter) (Annex 1, Fig. B).

Attachments are pre-sterilized manually as it is demanded in Regulations of Russia Healthcare Ministry.

Instruments are wiped with a gauze moistened in some disinfecting solution. Sterilization of lightguides is performed in 6% hydrogen peroxide solution. Regime of sterilization should meet the requirements of Russia Healthcare Ministry and standards criteria OST 42-21-2-85. Sterilization may also be performed by sinking the object into the solution of 0,5% chlorhexidine dissolved in 70% alcochol for 3-5 minutes. After sanitary treatment the face surface of the attachment must not have any white layer . If it is still present, wipe it with a dry napkin.

Distribution of the vector of magnetic induction value ***b*** according to the magnet radius ***r*** and according to the distance from the magnet platitude along its axis ***l*** is presented in Annex 2.

5. SAFETY MEASURES

Only persons older than 18 and without any medical contraindications mentioned in Order No 555 dated 27.09.89 of Healthcare Ministry of USSR (after 14.03.96 Order № 90 of Healthcare Ministry of RF) are allowed to work with lasers. The above mentioned contraindications are the following:

- chronic recurrent skin diseases;
- decrease of vision acuity more than 0,6 on one eye and more than 0,5 on the other eye (the vision acuity is defined with correction).

The following limits of refraction anomalies revealed sciascopically on the worst eye are acceptable: short-sightedness not more than 6,0 D; in normal i-eye fundus - up to 10,0 D; far-sightedness depending on the correction - up to 6,0 D; complex short-sighted and far-sighted astigmatism in meridians of the most value - not more than 3,0 D; simple short-sighted, simple far-sighted astigmatism - not more than 3,0 D.

- cataract;
- vegeto-vascular dystony, astenic, astenic-vegetative, hypothalamic syndrome.

The staff working with medical lasers should obligatory undergo a preliminary examination before offering a job; they also must have regular medical examinations while they work with lasers (USSR Healthcare Ministry, Order № 700 dated19.06.81).

One may start working with the apparatus only after getting acquainted with its technical parameters and its instruction manual. The staff which is subject to work with laser apparatus should undergo special trainings on safety regulations. Persons which are temporary subject to work with lasers should be instructed on safety demands and proper sanitation during their work with lasers; they should also be supervised by one of the permanent employees.

*It is **strictly prohibited** to look at the aperture of curative terminal (an output slot for optic-laser radiation) when apparatus is switched on*. **It is prohibited** to put any glittering things causing mirror reflection of the emitted laser beam, if not necessary. **It is prohibited** to leave a working laser without any control or to use home-made cutouts.

Individual protective means (protective glasses) should consider LILR wave length and light-filter optic density. A sign of laser danger "Be careful! Laser radiation!" should be put at the door of the room where laser therapy is performed as it is prescribed by standard regulations GOST 12.4.026-76 (Annex 3). There is no need to do some special re-equipment of the room for lasers "MILTA-F".

6. WORK GUIDELINES

While working with the apparatus one should fulfil all recommendations described in its technical characteristics and instruction manual.

Every day before work the apparatus should be checked for:

- functionality of net wire and cable of the curative terminal;
- curative terminal integrity;
- lightening of digital indicators and light-indicators at the power unit;
- lightening of light-indicator on the curative terminal;
- a sound alarm when turning laser on and off.

A physician, specialist in MIL-therapy, defines an area on patient's body for MIL-therapy while the patient is in the recumbent or siting position. After that the curative terminal (the terminal) is applied to this area. Sometimes it is more convenient to use two terminals simultaneously. The terminal surface is preliminary treated with 96 % ethyl alcohol; or, a protective cover (enclosed to the set) is fixed on it. If the effected area is large, it is divided into zones which are irradiated one by one. A total time for one session is usually 6-8 minutes. It is not recommended to have the exposure longer than 10 minutes. Zones for irradiation

and LILR frequencies are defined by a physician individually for every patient depending on the pathology treated and MIL-therapy possibilities.

For treating large areas, for instance, large joints, bronchi and lungs or large wounds, burns, frostbites two terminals simultaneously are applied. Such an approach reduces session duration. Experimental and clinical investigations have shown that 4-6 min of MIL-irradiation (irrespective of the location) are enough for developing a full range of systemic reactions in the organism. After the session a patient must have a rest during 10-15 min (the period of the most intensive reactions of cardio-vascular system).

Women are recommended to start MIL-therapy after the 5th-7th day of their menstruation. In the first 3 days of menstruation MIL-therapy is not performed (except some special treatment).

7. COMMON PRINCIPLES OF THERAPEUTIC METHODS FOR MIL-THERAPY.

MIL-therapy methods have to take into consideration the whole complex of medication in every particular case. So, patients have to be examined by the physician every day to register positive (or negative) changes in their state, to have consultations with other specialists (if necessary), to make regular lab investigations (blood, urine, ECG, USI, FEGDS, etc.) for the correction of medicamentous and physiotherapeutic doses. MIL-therapy appears to be the most resultative in functionally reversible phases of the disease; though, lately, new techniques have found their application in more severe cases and in more marked pathological changes.

Physiotherapeutic procedures exhaust, to some extent, organism's adaptative mechanisms because these procedures cause some expenditure of energetic resources. So, MIL-therapy is not recommended in the complex treatment with several procedures prescribed which may totally exhaust organism reactive abilities. Not more than two physiotherapeutic procedures, including balneo-treatment, are possible during one day. In this case a light-curing procedure (local impact on a pathological focus) should precede the other physiotherapeutic procedure (which may have an impact on the whole organism). MIL-therapy may be combined with massage and curative physical culture in patients having no tendency to disease exacerbation and to neuro-vegetative lability; as well as it is not indicated to patients with a severely expressed pain syndrome. In the combination with the two

other physiotherapeutical procedures laser session is performed 15-30 min (and more) before the massage or physical culture. The effect of increasing ion permeability of skin under MIL-impact optimises the effects of drug-induced electrophoresis and phonophoresis. These procedures are performed one after the other (without any time interval). But MIL-therapy precedes the electrophoresis and phonophoresis (at the same area). It is not recommended to perform MIL-therapy on the same day with X-ray and radio-isotope investigations.

MIL-therapy combined with drug therapy increases effectiveness of the latter one, especially in severe and complex cases. The effectiveness of treatment is also increased by subcunateous laser radiation of blood (SLRB). Recovery period is shorter and has better results when MIL-therapy is combined with phitotherapy, diet, drug therapy, massage and curative physical culture.

A common (optimal) principle for treating patients with different pathological processes is the following: *MIL-therapy is performed by courses usually consisting of 7-8 daily sessions (procedures) up to 12 per each course (or the first 5 procedures are performed daily, the others - every other day); duration of the procedure more than 10 min is not reasonable; chronic diseases are treated longer - 2-3 courses with 8-10 daily procedures per each course and 2-3-week intervals between the courses; after that there is a six- month interval and the course treatment is started again .*

MIL-therapy is administered with care to sensitive, emotionally excitable and labile patients, as well as to children before 12. When prescribing MIL-therapy to these patients exposure time should be decreased by twice.

Usually, pain syndrome decreases and patient’s condition improves after 2-3 MIL-therapy sessions.

One can regulate average output power of laser radiation by changing LILR frequency, thus regulating the energy dose. The higher is the frequency, the higher is the dose that objects receives and, visa versa , the lower is the frequency, the lower is the dose (during the same time unit). Besides, LILR frequency from 100 up to 1000 Hz considerably affects the speed of different biochemical reactions in the organism.

In acute pathological processes accompanied by pain syndromes (acute radiculitis, neuralgia, etc.) it is recommended to perform MIL-therapy with frequency 1500, 5000 Hz. The following rule should be observed: the more acute is

the process and the stronger is the pain, the higher is the impulse frequency and the longer is exposure to the lesion (up to 5-6 min). Normally, these parameters of treatment are applied on the first day to control the acute pain. When pain is not severe, as well as in chronic disorders with trophic disturbances (the course treatment is performed) frequency 50, 80, 150, 600 Hz is recommended.

For laser stimulation of the nerve-muscular apparatus having damage of skeleton muscles (reduction of tone, atrophy or paresis and paralysis) impulse frequency is chosen depending on damage severity: in severe cases - low (20-80 Hz), in mild cases - higher (80-150 Hz).

In the acute stage (inflammatory processes) LT is used in pulsed regime and with low doses (for instance, to perform the irradiation without lightguides) using mostly a segmentary-reflex approach. In subacute period LT is administered more widely, in low doses. Pulsed laser irradiation combined with CMF is applied topically to the diseased area. The intensity of light-curing irradiation increases in chronic stages (as described above).

Some patients have increased sensitivity to LT, **individual responses to MIL-therapy** are possible. Hypersensitivity could hardly be estimated as the complication to LT because such individuals quite often demonstrate hypersensitivity to many other inductors (for instance, to drugs, magnetic field, electric procedures). This reaction is observed rarely. It usually develops within some hours or on the first day and has different manifestations. More commonly patients may have drowsiness or irritation and causeless anxiety, slight and short dizziness, not sharply marked intermittent headache, common muscular tenderness, feeling of weakness or weariness, psychological discomfort. Different patients reveal one or more signs; duration of these adverse-effects lasts several minutes, rarely 1-3 hours. These reactions disappear spontaneously and do not need any special care. But if the patients still demonstrates unfavourable reactions to LT despite the changes in treatment parameters, MIL-therapy should be discontinued.

Even more rarely vegeto-vascular reactions of two types develop: 1) BP elevation, painfulness in joints; 2) some BP decrease, pale skin, chills, weakness. Normally, these reactions occur in such patients during other procedures too (for instance, during blood sampling from a finger).

The first reaction usually develops in 1-2 hours after the session and can last from several minutes up to 5-8 hours. In such a case the patient is prescribed rest or

application of proper hypotensive drugs, analgetics, tranquilizers. These conditions are of no danger and need no cancellation of LT. Reactions of the second type develops within the first 3-5 min after LT beginning. Medicative measures are the same as in other similar conditions, i.e. ammonia, cardio- or vascular drugs, horizontal position with elevated extremities, etc. MIL-therapy is not cancelled but the correction of doses and regime has to be done (shorter sessions, less irradiation power, another approach, combination of acting factors, observation of the prescribed regime: sufficient sleep, rest, proper nutrition).

Therapeutic effect in MIL-therapy is achieved in different ways: directly to the target tissue (wound, ulcer) or through healthy skin and mucous (subcutaneously, transdermally on the zone of the projection of organs, blood vessels -SLRB, nervous bundles; via an intra-cavital approach when special optic lightguides are used). There is a *contact* way when the terminal is in contact with the irradiated surface and a *distant* way (or non-contact) when the terminal and irradiated surface have some space in between (Fig.1). The lightguide terminal is placed stationary on the object (a *stable* method) or it moves above the focus (a *labile* method).

CURATIVE TERMINAL

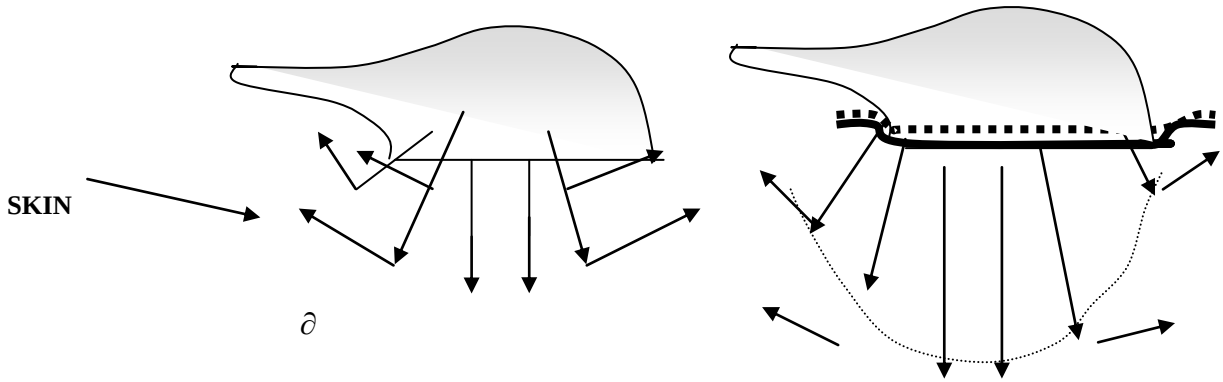


Fig.1 Distant 1 and contact 2 approach in MIL-therapy

Blood and fat are the basic substances absorbing IR radiation. In contact approach when laser slightly compresses tissues (thus arresting superficial blood circulation and reducing fat layer thickness) the depth of IR light penetration is increased by almost 3 times in comparison to a distant approach. So, under close contact LILR reaches all dermal and subdermal nervous and vascular plexuses, superficial muscle layers and capsules of the majority of joints. Due to the simultaneous stimulation of the correspondent structures in the vegetative and somatic nervous system (so -

called, a space summation of irritation) we have a complete range of organism responses.

The non-contact (distant) method has its own advantages. On one hand, lightguide sterilization is not necessary. On the other hand, distant lightguide positioning allows to perform stable and labile ways of treatment. However, such lightguide placement brings a considerable radiation loss (30-40%) because of the reflection from the object surface. A final decision what approach to use is a choice of a doctor and therapeutic tactics.

Pediatrics. Because of age specificity it is advisable to apply MIL-therapy in children mostly using the distant method (stable or labile, a distance from the terminal to the body surface is 0,5-1 cm) and observing some definite parameters presented in Table 2.

Table 2

Parameters of MIL-therapy in pediatrics

Age	LED radiation power, mWt
New-borns, aborted, weakened	12-15 (+CMF)
Children from 3 up to 7-10 years	25-30(+CMF+LILR)
Children from 7 up to 12-14 years	40-45(+CMF+LILR)

Note: CMF induction, pulse power of IR LILR for this apparatus are constant values.

MIL-therapy techniques described below (namely, areas of irradiation) used in traumatic injuries, surgical or internal disorders are applicable in pediatrics as well . However, the procedure duration should not exceed 4-5 min.

7.1. Surgical disorders

The structural basis of MLT stimulating effect on wound healing process lies in microvessels changes, dilatation and increased neovascularization because of the intensification of endothelial cells proliferative activity . Under MIL-treatment the basis for connective tissue is formed: first of all, fibrocytes, barrier-protective and regulative function of macro- and microphages, plasma cells, eosinophils and especially mast cells. MLT reduces the duration of all healing phases without any qualitative changes in the wound process.

Peritonitis.

Timely and correctly performed MIL-therapy improves the results of treatment in patients with peritonitis, decreases mortality and the rate of complications, reduces terms of hospitalisation.

A marked therapeutical effect is achieved after the application of combined treatment : antibiotic lavage of the abdominal cavity and MIL-therapy in post-operative period.

In **localised form** of peritonitis 4 zones (Fig.2 A, zones 1, 2, 3,4) on the abdominal wall along the wound margins are irradiated for 2 min on each zone. Impulse frequency is 50 Hz at the first 3 procedures, further - 50 Hz; LED radiation power is 40 mWt. After that the projection of crural vessels (Fig.2 A, zones 5, 6) is irradiated. The course of treatment consists of 3-7 procedures.

Histamine and serotonin levels decrease after the first MIL-therapy procedure while in the control group their normalisation takes place only on the 3th-5th day after the operation. After 3-5 procedures we observe rapid decrease of inflammative process in the peritoneum, intensification of reparative processes with the reconstruction of the mesothelial layer, rapid POL decrease, normalisation of endorphin level.

Diffused forms of peritonitis

MIL-therapy is performed in the combination with traditional medicamentous therapy as prescribed below: 1 procedure - SLRB on the area of crural vessels (Fig.2 B, zones 3, 4) with exposure time 5 min on every side of the body (frequency 10 Hz, LED radiation power 40 mWt). Afterwards, the upper third of the sternum with exposure and the left subclavicular vascular bundle are irradiated for 2 min each (Fig.2 B, zones 2 and 1, respectively).

2 procedure is performed 4-6 hours after: the irradiation of the abdominal cavity at 6 points (iliac area, right and left subcostal areas, along the surgical wound in two zones) with exposure for 2 min on each zone (Fig.2 B, zones 7, 8, 9, 10, 5, 6). The treatment by this scheme is performed for two days. After that MIL-therapy is performed once a day on zones 7, 8, 9, 10, 5, 6 (Fig.2 B) for 2 min on every zone (frequency 80 Hz, LED radiation power 50 mWt) during 5-7 days.

MIL-treatment results in the elevation of relative and absolute number of lymphocytes, but the discharge of functionally inadequate macrophages is absent; antioxidant system is activated thus leading to the utilisation of POL products in the

exchange processes and to the reduction of endogenous intoxication. Reduction of biogen amines level up to normal limits within 5-7 procedure confirms a marked anti-inflammatory MIL-effect. The rate of post-operative complications, duration of treatment, mortality rate decrease in the average by 1,5-2 times.

A combination of hemosorption and extra-corporal MIL-impact to the blood has proven to be very effective. The maximal effect is observed after 2-4 hemosorption procedures (if necessary - with the administration of immune stimulators: Na nucleates, T- activin, etc.) under the reduction of marked endotoxicosis. 250 ml of blood are irradiated for 4-5 min (LED radiation power 60 mWt, laser radiation impulse frequency 50 Hz). Radiation sessions are performed every other day between hemosorption operations; later, every day (the course of treatment - 8-10 procedures and more). Control of the immune status of the organism is an important moment so as it helps to define the optimal amount and repetition factor of procedures necessary for receiving the maximal stimulating effect. Increase of macrophages functional activity at first LT sessions is a favorable prognostic sign.

Diagnostics and prognosis in peritonitis are significantly simplified with biophotometry. Low values of the reflection coefficient (RC) indicate unfavorable course. In uncomplicated peritonitis RC normalisation occurs on the 8-9 day (see Article 8).

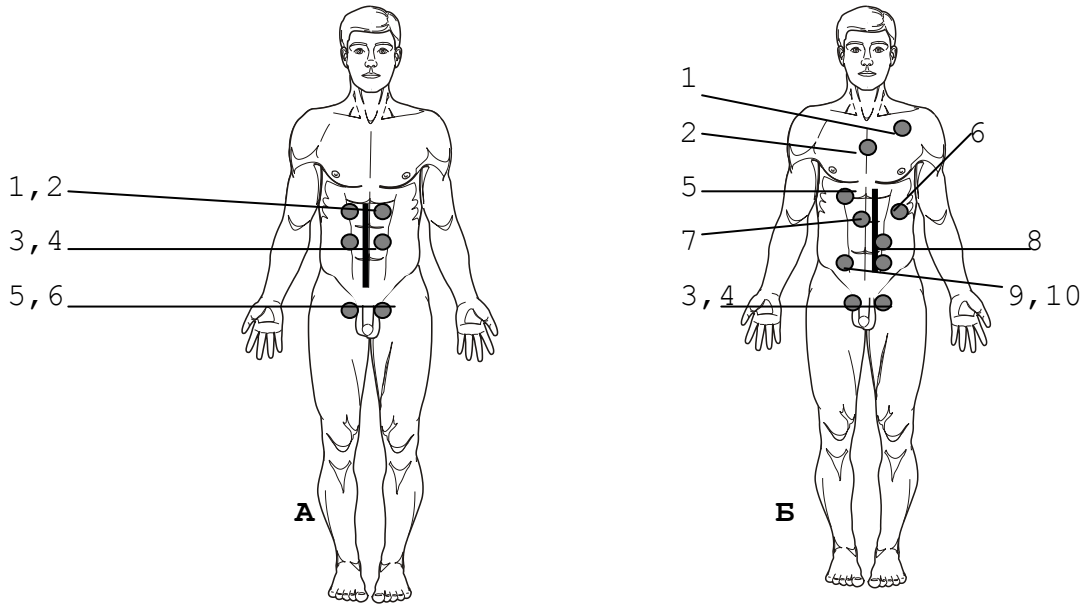


Fig.2. MIL-therapy in localised (A) and diffused (B) forms of peritonitis.

Clean wounds and fresh post-operative scars

MIL-therapy of clean wounds and fresh post-operative scars (as prophylactics of suppuration) is performed on the second day (after a trauma, surgery) and then every day in the morning during first several days; after that every other day depending on the course of wound process. The curative terminal is placed 3-5 mm above the wound surface covering its periphery (the wound of 10 cm^2 is irradiated for 2 min; during one session 2-4 zones are irradiated depending on wound dimensions)

(Fig .3). Frequency is 5 Hz during first 3 days, 50 and 80 Hz - later. LED radiation power is 30 mWt. There are 7-8 sessions in one course.

Reparative processes are more active comparing to patients who did not received MIL-therapy; it is obvious after the second procedure, maximum - after the 6th (intensity of granular tissue growth increases, DNA and RNA synthesis is activated, the amount of acid mucopolysakharids which are mediators of fibroblast proliferation is increased). The healing has the primary tension without rough scarring.

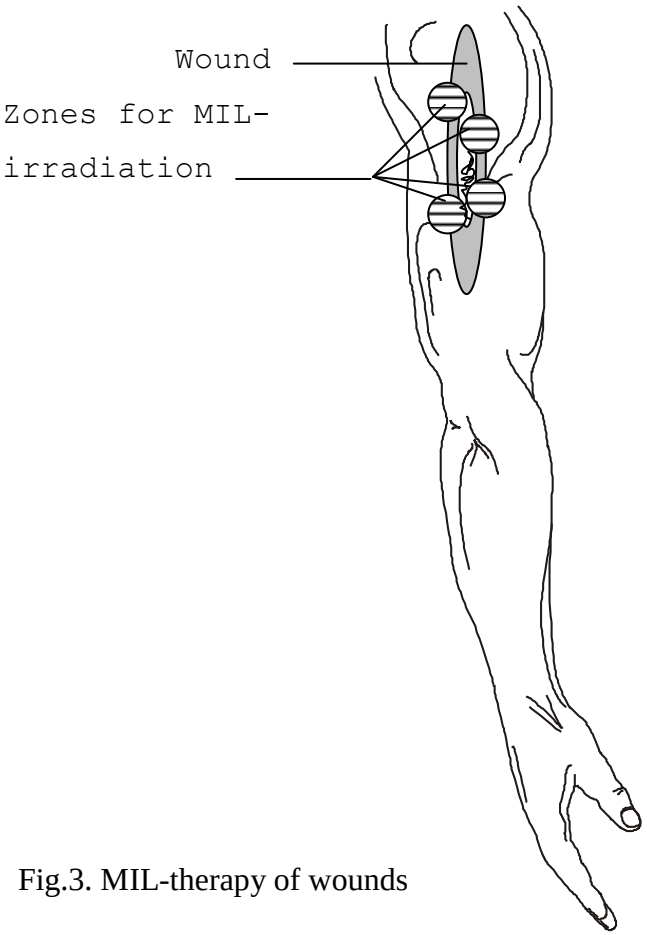


Fig.3. MIL-therapy of wounds

Gunshot wounds

MIL-therapy is the same as in clean wounds. After the second procedure hyperemia on the skin, edema around the wound, perifocal inflammation and pain decrease. By the 7-8 procedures pain disappears, wound defect is filled with the granular tissue; after that epithelisation develops starting from the wound edges; the wound is reduced by two times in comparison to the controls; afterwards epithelisation slows down. Healing (complete epithelization) takes place, in the average, by the 22nd day (in the control group - by the 29th day) with good cosmetic and functional results.

Purulent wounds

To treat purulent wounds the course of MIL-therapy may be enlarged up to 13 procedures. Frequency is 50 Hz at the first 3 sessions, after that - 80 Hz, LED radiation power is 50 mWt. Exposure time is about 10 min. Before laser session the treated wound has to be clarified from debris and drugs (pus secretion absorbs up to 90% of laser radiation). Sometimes it is better to perform MIL-irradiation through a sterile gauze bandage. It is very important to keep to the rules of sterilisation while sterilising the terminal surface (wiping with 96% ethyl alcohol and fixing a protective sterile membrane on the terminal). After MIL-therapy the wound is treated in the usual surgical way.

Two MIL- procedures are enough to control signs of inflammation (in the controls after 5-6 days); normal granular tissue is developing on the 4th-5th day in the wound. Terms of invalidity are reduced by 1,5-2 times in comparison to the traditional treatment.

Purulent disorders of soft tissues

To treat purulent processes in soft tissues (abscesses, phlegmons, mastitis, whitlows, furuncles, carbuncles, inflammative infiltrates), when purulent abscess is formed, a surgical intervention, a flowing-puncture lavage, drainage or other surgical manipulations are performed depending on the location of purulent focus. MIL-therapy is performed in combination with medicamentous treatment at 2-4 zones around the focus (Fig.5), exposure 2 min on each zone with LED radiation power of 50 mWt. Every subsequent procedure is performed with a new frequency value in the following order: 5, 10, 50, 80, 150, 600, 1500 Hz (every course consists of 5-7 daily procedures).

Slowly healing and non-healing wounds, trophic ulcers.

Before laser treatment slowly healing and non-healing wounds, trophic ulcers are cleaned by hydrogen peroxide or other solutions commonly used in surgical practice for removing purulent-necrotic debris. MIL-therapy is started only after the examination of the lesion for possible malignization. A laser terminal is put directly on the ulcer margins and newly-formed granular tissue at zones 2-4 (Fig.4) either on the protective membrane or on one- layer sterile gauze in a contact way. In large ulcers MIL-irradiation is performed by moving the terminal slowly from ulcer periphery to its center. Impulse frequency is 50 Hz, LED radiation power is 60 mWt, exposure is up to 5 min. After that MIL-irradiation is done on the thymus projection (zone 1) and on the projection of left subclavicular vascular bundle (zone 2) for 2 min. The course of treatment - 7-8 procedures. The repeated course with frequency 80 Hz and LED radiation power 40 mWt is performed 6-7 days after. Exposure on the ulcer is 4-6 min, after that the popliteal fossa (zone 3) and the inguinal vascular bundle (zone 4) on the diseased extremity (exposure for 2 min each) are irradiated.

Laser effectiveness for treating purulent wounds and trophic ulcers is increased when proteolithic enzymes immobilized on synthetic bandage materials are added.

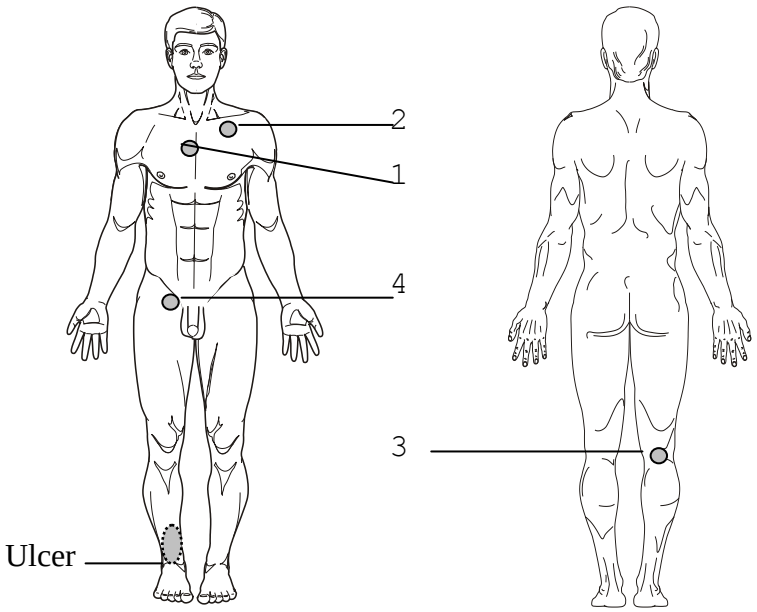


Fig. 4. MIL-therapy in slowly healing and non-healing wounds

Erysipelatous Inflammations

MIL-therapy is performed together with desintoxicative and antibiotic therapy twice a day (Fig. 5): SLBR on the vascular bundle above the effected zone (zone 1), frequency 5 Hz, exposure 7 min., LED radiation power 40 mWt. Then the pathologic focus is irradiated (frequency 1500 Hz, exposure 5 min) contactly at several zones or distantly with the labile method; LED radiation power is 30 mWt.

If patients have Erysipelatous inflammation on the face, MIL-irradiation is performed on the carotid area (zone 2) at both sides (2 min each), frequency 5 Hz. After that irradiation is done parasternally to the right and to the left at the II-III intercostal region (zones 3) for 2 min on each zone (frequency 5 Hz) and on the inflammation (frequency 50 Hz, exposure 2 min). LED radiation power is 40 mWt.

The course of treatment consists of 7-8 sessions. MIL-therapy course is repeated in 3 weeks, but sessions are performed once a day.

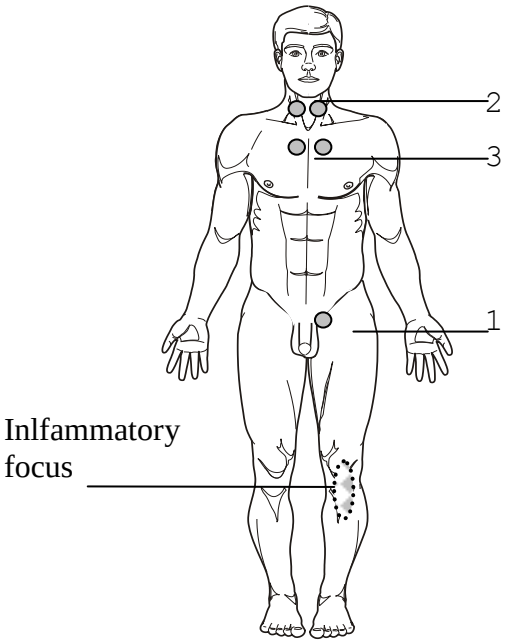


Fig. 5. MIL-therapy in Erysipelatous inflammations

Burns

MIL-therapy is indicated in the syndrome of marked excudative changes in superficial burns; for the prophylactics of burn deepening and for the stimulation of reparative processes in subdermal burns; for improving blood and lymph circulation in the paranecrotic zone and for the stimulation of patent granular layer in pre-operative period in case of deep burns as well as and in post-operative period - for

the stimulation of regenerative processes; for prophylactics and treatment of pneumonia and for controlling secondary immune deficiency. Strategy and tactics for MIL-therapy in policlinics, hospital and specialised medical institutions are chosen depending on the prognosis which is given to a burnt patient.

MIL-therapy is contraindicated: for patients with extended deep burns and unfavorable or doubtful prognosis when patient is in burn shock; for burnt patients with acute respiratory insufficiency, acute renal-liver failure; acute stroke; non-compensated Diabetes mellitus, acute alcohol delirium, epilepsy.

MIL-therapy is performed at the early stages after trauma on the opened wound surfaces (distantly at a distance of 5-6 mm from the wound surface) or through bandages. Frequency is 80 Hz, LED radiation power is 20 mWt, exposure to one zone is 8 sec. till necrotic masses are rejected and 4 sec. after the removal of necrotic debris. 3-4 zones on 1% of the injured area are irradiated, duration of MIL-therapy session is 3-5 min (up to 35 zones). Simultaneous application of two terminals makes the procedure much more effective if the injured area is large. The course of treatment in case of necrosis and in pre-operative period (on the opened wound) is 5 procedures; in the post-operative period (at dressings through the bandage) - as it is prescribed, but not more than 5 procedures.

Under MIL-therapy wound healing process is usually more smooth. It also reduces terms of pre-operative preparation by 4 days on the average. The graft taking increases up to 95-100% (85-90% in the control). Terms of hospitalisation for burns of II-IIIA stages are reduced to 2-2,5 weeks on the average (the same index without MIL-therapy is 3-4 weeks).

7.2. **Acute thrombophlebitis of the extremities**

MIL-therapy is performed contactly in the labile or stable way (without any compression to soft tissues!) on 1-2 zones in the area of thrombosis or phlebothrombosis. Impulse frequency is 1500 Hz, LED radiation power is 70 mWt. The terminal is slowly moved (with the speed sbout 1cm/sec) along the injured vessel from the body centre to its periphery during 2 min. Then the terminal is carried over the extremity, returned to the initial point and moved to the end of the injured region again (Fig. 6). After that the vascular bundle above the injured vessel (zone 1) and the inguinal bundles (zone 2) are irradiated with exposure 2 min on every zone (frequency 150 Hz, LED radiation power 60 mWt). There are 7-8

sessions in the course. In two weeks the treatment by the same scheme is repeated but this time it is done in a day.

Postthrombophlebitic syndrome in the exacerbation stage

The treatment is the same as for the acute thrombophlebitis (Fig. 6). Blood coagulation system must be controlled every week.

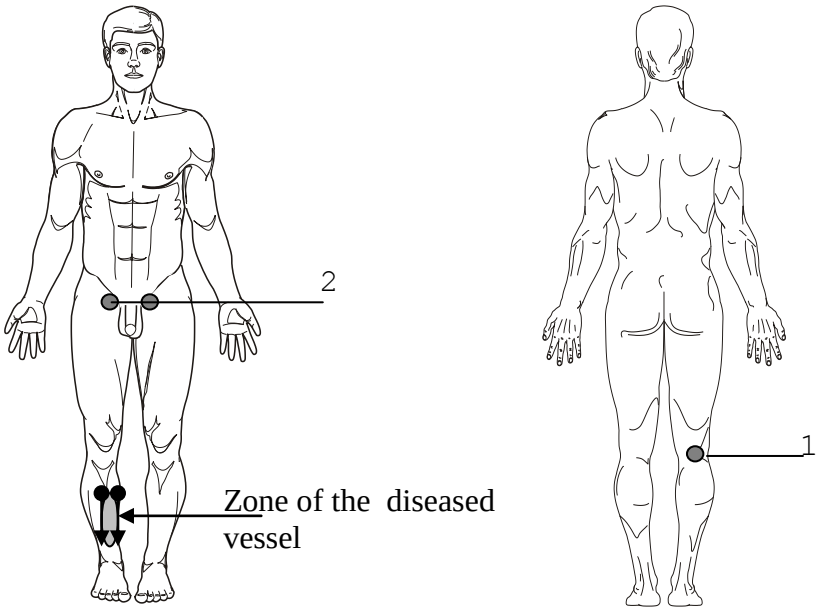


Fig. 6. Zones for MIL-irradiation in thrombophlebitis, postthrombophlebitic syndrome, traumas.

7.3. Traumatic injuries of long tubular bones, tendons, muscles

Bone fractures

MIL-therapy can be started right away after the trauma happened. MIL-therapy as a part of complex treatment in fractures activates regenerative processes in osseous tissue. Under such treatment fractures consolidate by 1,5-2 times quicker. MIL-therapy is also indicated in case of metallosynthesis. If a patient's injured extremity is in the plaster of Paris, a hole is cut in it and the terminal is inserted into this hole at a distance of about 1 cm from the skin surface (exposure 5 min). Then the vascular bundle of the injured extremity above the fracture is irradiated (Fig. 6, zones 1 or 2) with 2 min. exposure. Impulse frequency is 50 Hz, LED radiation power is 80 mWt. In a day the frequency of impulses is changed (80, 150, 600, 1500, 5000, 1500 Hz). The first five procedures are performed daily, after that - every other day. The course of treatment consists of 12 procedures.

Fractures complicated by fistulas, osteomyelitis, trophic ulcers (in particular, in diabetes mellitus) are treated similar to slowly healing and nonhealing wounds and trophic ulcers.

Traumatic periostitis

MIL-therapy is performed contactly on the diseased zone. Impulse frequency is 50 Hz, LED radiation power is 60 mWt, exposure is 2 min; during one procedure 1-3 zones are irradiated on the diseased area. After that the irradiation is performed on the projections of big vascular bundles on the injured extremity (Fig. 6, zones 1 or 2) with exposure 2 min. The course of treatment consists of 2-8 daily procedures. In case of necessity MIL-therapy course is repeated in two weeks (7-8 procedures every other day).

Epicondilitis (entezopathy)

MIL-therapy is performed contactly (Fig. 7) on the painful zone (1) at the site of tendon attachment to the bone. The terminal moderately compresses soft tissues. Impulse frequency is 80 Hz, LED radiation power is 80 mWt, exposure is 2 min. Starting from the 4th procedure the irradiation is additionally performed on CVII area paravertebrally (zones 2) 1 min to each side and at ThX level (zones 3) 1 min to each side (MIL parameters are the same). The course of treatment consists of 12 daily procedures. MIL-therapy course may be repeated in 2-3 weeks every other day under the same scheme.

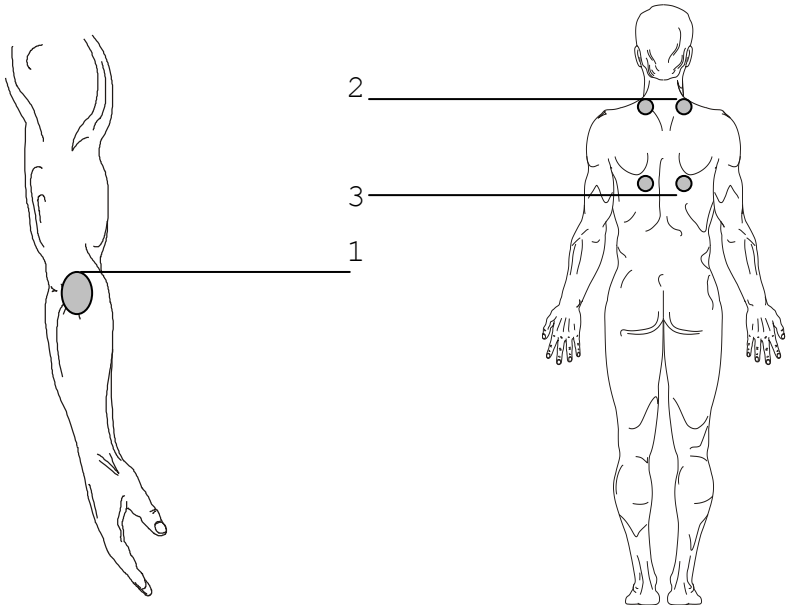


Fig. 7. Zones for MIL-irradiation in epicondilitis

Tendovaginitis. Myositis.

MIL-therapy is performed locally on the injured tendon or muscle (Fig. 8) contactly without any compression to soft tissues; impulse frequency is 50 Hz, LED radiation power is 50 mWt, exposure is up to 5 min. After that the liver projection is irradiated during 2 min. (zone 2), paravertebrally at CVII level (zones 1) for 1 min; the adrenal gland projection (zone 3) is irradiated too. The irradiation is performed with impulse frequency 80 Hz, LED radiation power 70 mWt. The course of treatment consists of 8 daily procedures. MIL-therapy course may be repeated in 2 weeks, but procedures are performed every other day.

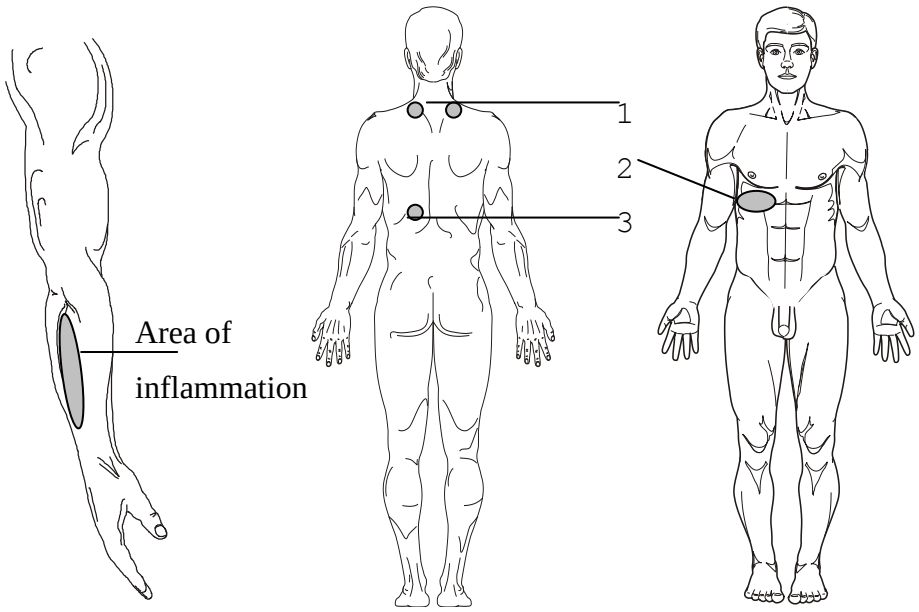


Fig. 8. MIL-therapy in tendovaginitis, myositis

7.4. **Disorders of bones and joints of metabolic and inflammatory etiology**

Metabolic polyarthritis, deforming arthrosis, osteoarthrosis, arthralgias, psoriatic arthropathy, shoulder-blade periarthritis, bursitis, posttraumatic arthrosoarthritis, osteochondrosis of the spine column, etc.

MIL-therapy is performed after X-ray and other diagnostic investigations as monotherapy or in combination with diet, phitotherapy, medicamentous therapy, massage, curative physical culture.

The terminal (better two simultaneously) is applied with a light compression of soft tissues on lateral joint surfaces in the projection of joint aperture (the extremity is in a half-bent position) to the painful places revealed during palpation (joint sacs, ligaments, places of attachment of tendons to bones) (Fig. 9).Joints on

the hand are irradiated from the dorsal and palmar surfaces, joints on the feet - from the dorsal and plantar surfaces (impulse frequency 50 Hz, exposure 1 min, LED radiation power 30 mWt). The cubital, wrist and ankle joints flexor and extensor surfaces are irradiated ; the humeral, knee and coxofemoral joints are irradiated on the front, back and lateral surfaces (impulse frequency is 80 Hz, LED radiation power is 50 mWt, exposure is 1-2 min on each zone). The spinal column is irradiated contactly on paravertebral zones bearing in mind the data obtained after X-ray investigation (impulse frequency is 50 Hz, exposure is 1-2 min on each zone, LED radiation power is 60 mWt, duration of the procedure is not more than 10 min).The course of treatment consists of 10-12 daily procedures. In case of necessity MIL-therapy is repeated in 2-3 weeks. Every year patients may have 3-4 courses of MIL-therapy.

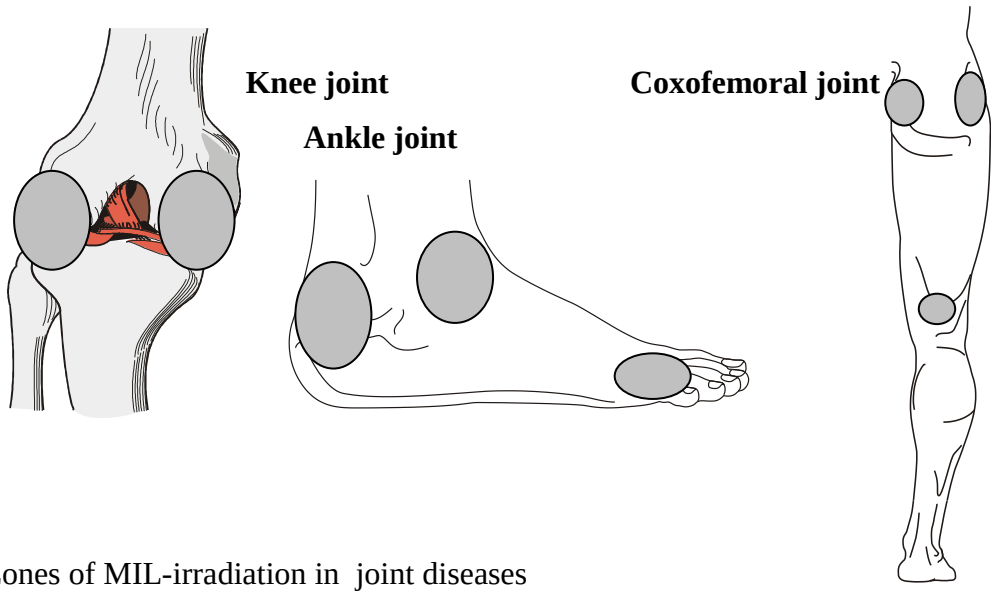


Fig. 9 Zones of MIL-irradiation in joint diseases

Rheumatoid arthritis

This disease is caused by "hyper production" of auto-antibodies to different types of collagen. Impairments in the connective tissue synthesis is the main sign of the disease. Pathologic process becomes chronic. Most common complaints are: morning constraint, arthritis of 3 and more joints, symmetrical arthritis, rheumatoid nodules, presence of the rheumatoid factor.

Anti-inflammatory drugs are the basis of the treatment: derivatives of pirazolone, indolvinegar acid, propion acid, phenilvinegar acid, oxicams, derivatives of chinazolones, corticosteroids, immune depressants-cytostatics, alpha-

aminochinoline drugs. In majority of patients the activity of the process correlates with the presence of sulfurpositive rheumatoid factor (RF-1 180+-95, by Speranski).

If phagocytic activity is significantly decreased, it is recommended to administer extracorporal MIL-therapy after hemosorption (1-2 procedures) or after the course of treatment with immune modulators. Tendency to increased macrophageal activity is the optimal period for MIL-therapy administration, but if such tendency is not observed after the first procedures, then the patient must continue his anti-inflammatory and immune modulator therapy as well as have additional hemosorptions (up to 5). As a rule, it is enough for normalising basic phagocytosis parameters. Taking into consideration the common LT effect, a physician should use one of the two MIL-therapy schemes.

1. An optimal scheme: 1-4 hemosoprbtions 1-2 times a week (depending on the process activity); between these procedures extracorporal MIL-irradiation of 250 ml blood (impulse frequency 80 Hz, LED radiation power 60-70 mWt, exposure 5 min) is performed. There are 8-12 sessions in the course.
2. Extracorporal radiation of blood may be replaced by MIL-therapy consisting of 8 - 12 sessions every day (5 Hz, LED radiation power 50 mWt) subcutaneously, the stable method (Fig. 10) on the cubital vascular bundles (zones 1) for 2 min on each bundle and on the adrenal glands projection (zones 2) - for 1 min. Then the diseased joints are irradiated (one session lasts up to 10 min). On the day of hemosorption no MIL-therapy is performed.

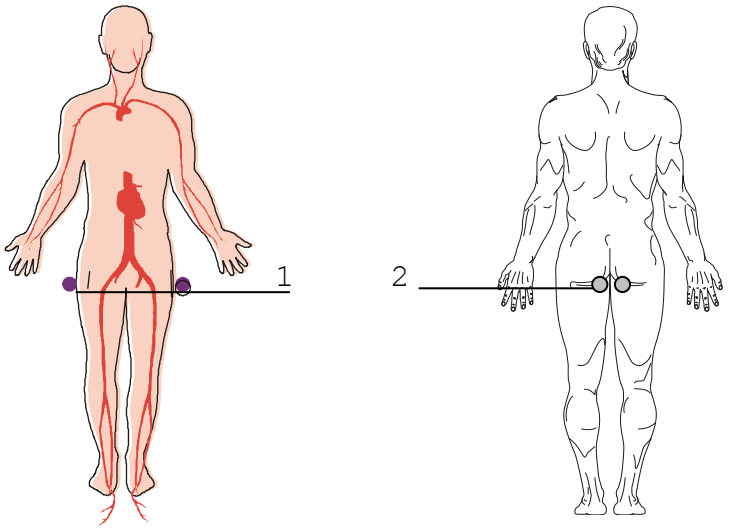


Fig. 10 Zones for MIL-irradiation in rheumatoid arthritis

Calcaneal spurs

The first course of MIL-therapy (Fig.11) consists of 10 daily procedures. Irradiation is applied to zone 1 - a calcaneal spur projection on the plantar surface of the foot; then on the site of Achilles tendon attachment to the heel bone (zone 2), and starting from the 4th procedure to zone 3 on the internal or external heel surfaces (patients often show this painful point by themselves or a physician may find it by palpation). Impulse frequency is 50 Hz, LED radiation power is 80 mWt, exposure to one zone is 2 min.

After 2 weeks the treatment is repeated (10 daily procedures for a course), but with frequency 80 Hz. In case of necessity the third course of MIL-therapy with frequency of 600 Hz and LED radiation power about 90 mWt is performed two weeks after the second course. If a patient demonstrates resistant to MIL-therapy, it may be repeated under the same scheme in 6 months.

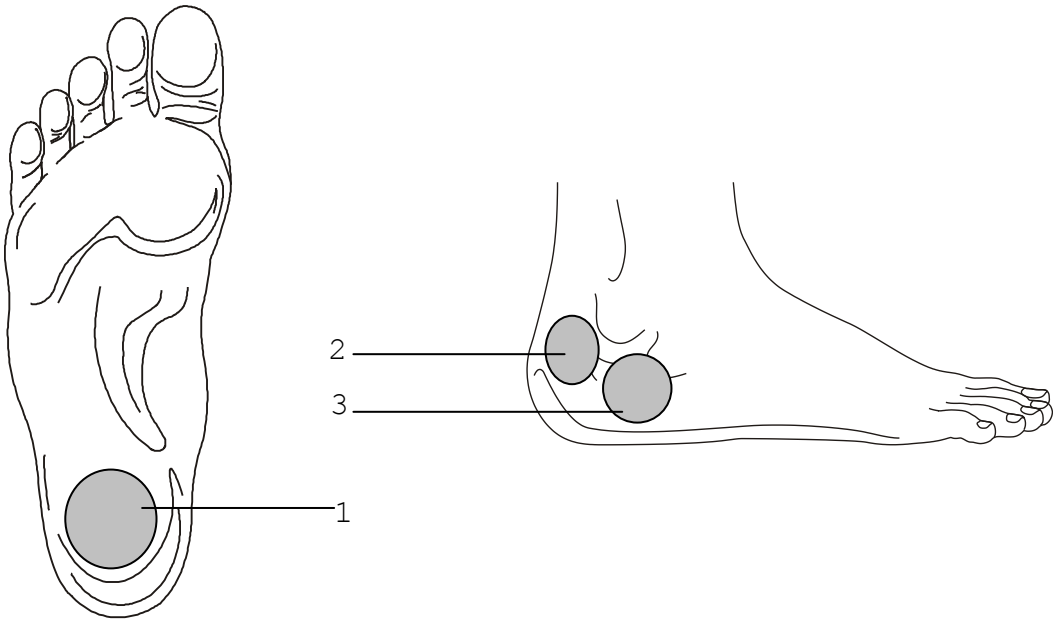


Fig. 11 Zones for MIL-irradiation in calcaneal spurs

7.5. **Disorders of the nervous system. Psychoneurology.**

Neuralgias, neuritis, radiculitis, polyneuritis

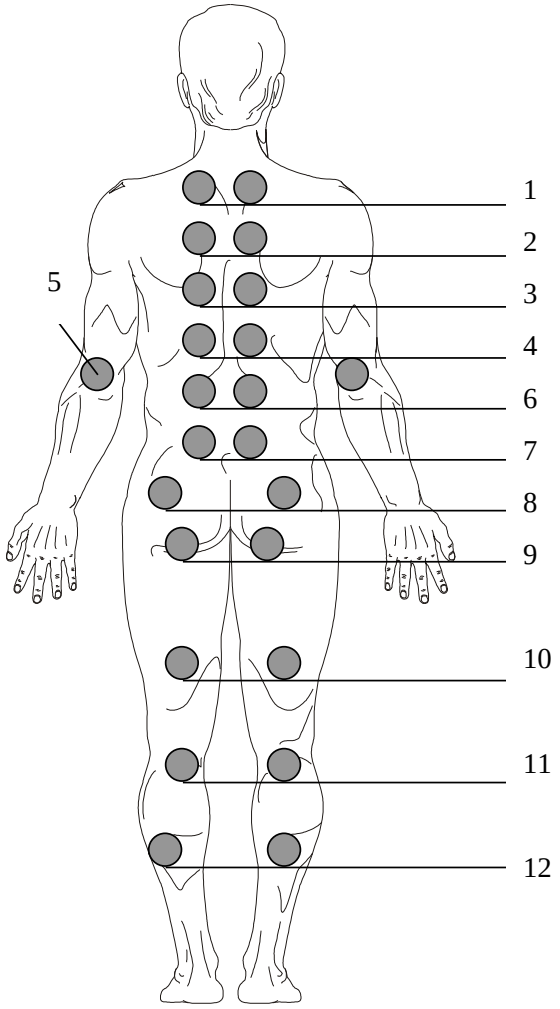
Indications for MIL-therapy are determined by its analgesic, anti-inflammatory, anti-edematous effects. During MIL-therapy the areas corresponding to topographo-anatomic projections of the nervous trunk and innervation zones, as

well as points at the exit of corresponding nervous routs are irradiated paravertebrally.

The terminal is put to the nerve bundle exit (Fig.12) (impulse frequency 1500 Hz, LED radiation power 40 mWt, exposure 0,5-1 min). After that the terminal is slowly moved along the injured nerve trunk (along lines 1,2 or 3) during 1-2 minutes (impulse frequency 10 Hz) slightly touching the skin surface. If there is edema along the diseased nerve trunks, it is recommended to set frequency to 5 Hz at the beginning of the treatment (2-3 procedures) and then to change it to 80 Hz. Next zone of irradiation is the projection of the upper neck sympathetic node (zone 4) on the affected side (under the lower jaw angle) with the exposure 1 min , impulse frequency 150 Hz.

As a rule, a marked analgesic effect is observed after 1-2 procedures. The course of treatment consists of 8-10 daily procedures. In case of necessity the treatment is repeated in 2 weeks (7-8 procedures every other day). To correct the scheme and MIL-therapy doses (see Article 8) it is advisable to control of the dynamics of biophotometric parameters in the diseased zone.

Complex treatment (a combination of drugs, balneology, point massage with MIL-therapy) is most effective in case of accompanying disorders. MIL-therapy is combined with the massage starting from the 5-6th procedure for treating radiculitis and radiculoneuritis, reflex syndromes of neck osteochondrosis, headaches of myofacial genesis.



Borderline nerve-psychic disorders

Modern medicine considers that nowadays, borderline nerve-psychic disorders are most frequently met which are represented by the following pathologies: pre-nosologic disorders (neurotic reactions) without a complete complex of syndromes; neurosis-like and psychopathic-like conditions caused by somatic diseases (in different internal diseases); borderline nerve-psychic disorders including neurosis and psychopathies. Among different forms of borderline nerve-psychic disorders the most sensitive to MIL-therapy are neurosis-like disorders accompanying somatic disorders and caused by vegetative-vascular changes, metabolic impairments and impairments of homeostasis itself.

The projection of the upper neck sympathetic node

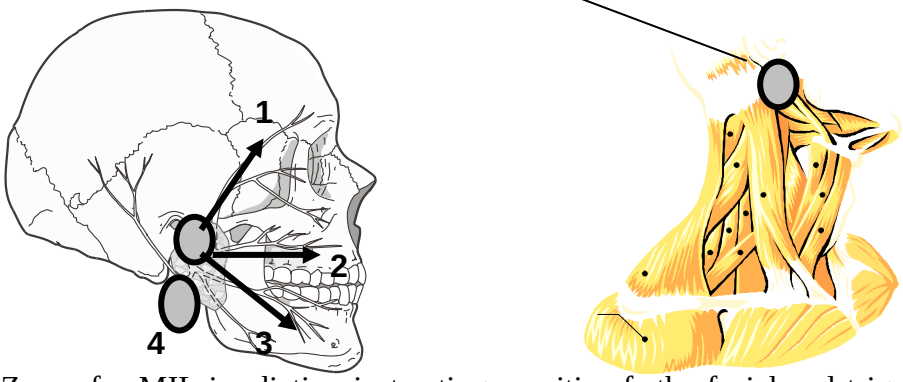


Fig. 12. Zones for MIL-irradiation in treating neuritis of the facial and trigeminal nerves, neuralgias

MIL-therapy prescribed at the pre-clinic stage of syndrome complex formation in nerve-psychic disorders, for example, in neurotic reactions (pre-clinical stage, pathophysiologic phase, hormone-metabolic stage, etc.) may help to bring down the dosage of the administered psychotropic and other drugs even to their total cancellation.

MIL-therapy procedure. Treatment is performed out-patiently (Fig. 13). LILR is done to the carotids area (zone 2) with frequency 5 Hz and LED radiation power 50 mWt, exposure 4 min to each side once in 2-3 days (5-7 procedures for the course). Every day MIL-procedures (10 procedures) are done on the thymus projection (frequency 80 Hz, exposure 0,5 min), on the 7th neck vertebrae (zone 5; impulse frequency 80 Hz, exposure 8 sec), on the temporary areas (zone 3; frequency 80 Hz, exposure 8 sec), on the left auricle (zone 4; frequency 150 Hz, exposure 20 sec) and on the projection of the liver (frequency 80 Hz, exposure 2 min.). All the course lasts for about 3 weeks.

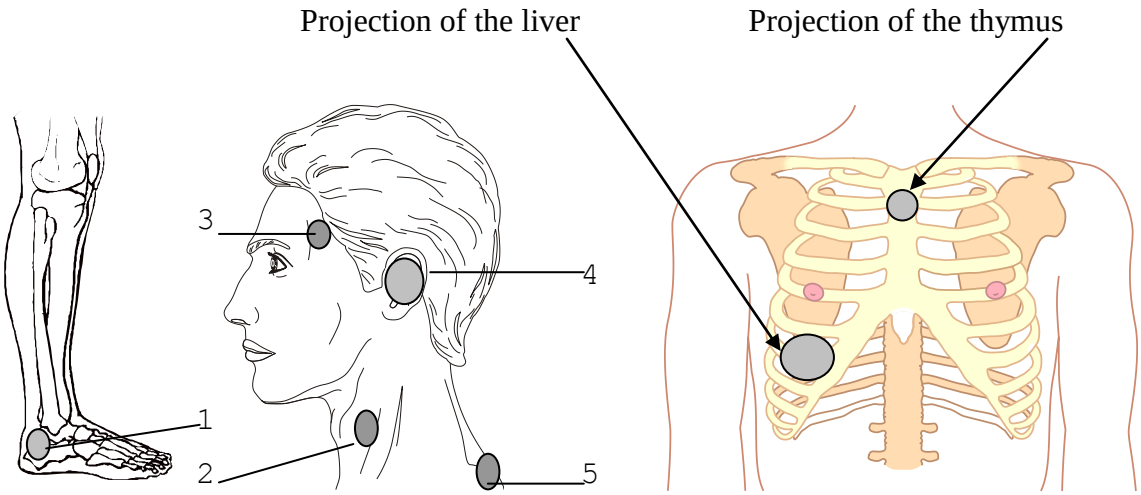


Fig. 13. Zones for MIL-irradiation in treating borderline nerve-psychic disorders

Repeated courses of MIL-therapy under the same scheme (5-10 procedures every other day) are done in 4-5 months during the remission and in case when the patient has some psychotraumatic and stress factors.

MIL-therapy for patients with some clinical symptoms of nerve-psychic disorders is performed out-patiently by the scheme described above. The course consists of 8-12 procedures daily or every other day, LILR duration is 10 min (5 min on each zone 2). In addition every other day MIL-irradiation is done on the area of Achilles tendon attachment to the heel bone from the outside (zone 1) on both feet with exposure 0,5-1 min on each foot, impulse frequency 150 Hz and LED radiation power 60 mWt. While administering MIL-therapy a physician may change a dose of the prescribed psychotropic drugs up to their cancellation. Repeated course of MIL-therapy is performed in 1,5-2 months. After that MIL-therapy is performed once in 9-12 months despite of the presence or absence of clinical signs.

As a rule, after 2-4 LT combined sessions one can observe a marked reduction of symptoms of the above mentioned disorders; at the end of the course the symptoms are sharply decreased; further the vegetative lability may disappear completely; general psychophysical state, capability to work and psychosocial adaptability improve. Hypochondrical signs, phobias usually decrease in 1-2 weeks after LT course is over; and, they disappear completely after psychotherapy and psychocorrection.

7.6. **Atherosclerotic injuries of arteries in the lower extremities**

Indications for MIL-therapy are the following: compensated or sub-compensated state of peripheral circulation in patients with atherosclerotic occlusions in the terminal part of the abdominal aorta and in the magistral arteries of lower extremities (lesions in the aorta-iliac and femoral-genual segments), obliterative endartheriitis (including the one complicated by trophic ulcers).

Irradiation is done contactly with a light compression to soft tissues (Fig. 14) on the projection of lumbar sympathetic ganglions paravertebrally at the level ThX-ThXII-LIV (zones 1, 2, 3) and on the projection of vascular-nervous bundles on the ankles and feet (zones 4, 5) as well as on the area of affected segment of the diseased vessel (usually zones 6,7 or 8). Impulse frequency is 50 Hz, LED radiation power is 40 mWt at first three procedures, then 80 Hz at the next three procedures and 50 Hz for procedures 7 and 8; exposure to one zone is 2 min.

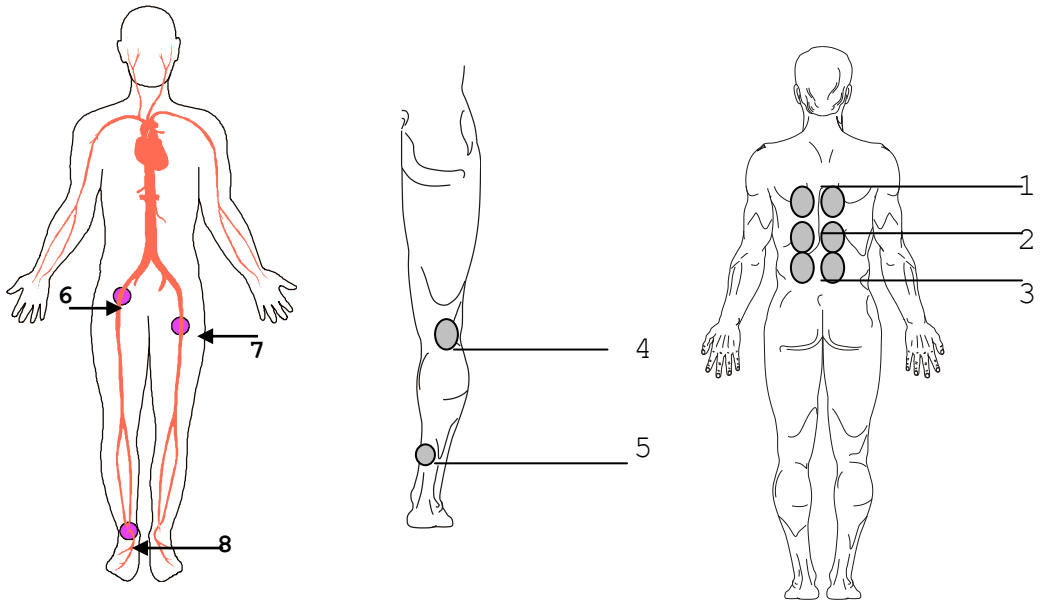


Fig. 14. Zones for MIL-irradiation in treating atherosclerotic injuries of lower extremities

The optimal course of treatment consists of 7-8 daily procedures. In two weeks the next course of 8 MIL-therapy sessions is performed every other day (impulse frequency 80 Hz at the first three procedures, after that the frequency is changed at every procedure in the following order: 150, 600, 1500, 5000, 1500 Hz). After three-month break the course is repeated. The next course is done after longer interval in 6 months. The treatment is performed under the same scheme.

Reovasographic data show that under MIL-therapy there takes place the activation of the depressed arterial blood in-flow, improvement of venous out-flow, positive changes of the vascular tone (MIL-irradiation with frequency 150 and 1500 Hz is mostly effective for venous out-flow and vascular tone). Thermographic data show that in the majority of patients there is a significant reduction of longitudinal temperature gradient (by 23-26% in comparison to the initial values), elevation of muscular blood circulation in diseased extremities (by 25-28% on the average).

If the above recommended LT scheme does not bring satisfactory results, it may be replaced by other MIL-therapy scheme applicable for this pathology. Extracorporal MIL-irradiation of blood is performed every other day (from 8 up to 12 procedures) in combination with medicamentous therapy (Miskleron, Nicotine acid, Complamin, preparations of unsaturated fatty acids). LED radiation power is

70 mWt, laser impulse frequency is 50 Hz, exposure is 4 min, blood volume is 250 ml. A marked clinical effect proven by instrumental and laboratory investigations has been achieved in 70% of patients.

After the treatment patients have less pronounced feeling of cold and chill in the diseased extremities, they also feel less pain during walk. Trophic changes in the skin promote better healing. Temperature elevation and improved blood circulation are also observed in the diseased extremities. Lipoproteinemia decreases.

7.7. **Diseases of the gastro-intestinal tract**

Stomach and duodenal ulcer

MIL-therapy is indicated in patients with recurrent ulcers having persistent exacerbative course or in patients who are allergic to medicamentous therapy.
MIL-treatment begins only after the patient's thorough examination (gastroscopy, X-ray, biopsy) because in some patients a chronic gastric ulcer may be the first manifestation of malignant process. MIL-therapy is not indicated in patients who have been operated on for malignant neoplasms.

MIL-therapy has to be combined with traditional treatment. The terminal is applied (roughly) to the ulcer projection (Fig.15), as well as to painful places revealed by palpation on the front abdominal wall (zones 3, 4, 5) and paravertebrally at ThVII - LIII (zones 6, 7, 8). During one session 6-7 zones are irradiated. Impulse frequency is 80 Hz, LED radiation power is 70 mWt, exposure to one zone is 1-2 min. Left subclavicular area (zone 2) and carotids (zones 1) are irradiated transcutaneously in a day with 1 min. exposure on each zone. The course consists of 10-12 daily procedures. MIL-therapy may be repeated in 2 weeks (if indicated).

Decrease of inflammation and pain, improvement of microcirculation and rapid reconstruction of the connective tissue on the ulcer defect fundus are observed during endoscopic examination after 1-2 MIL-therapy procedures.

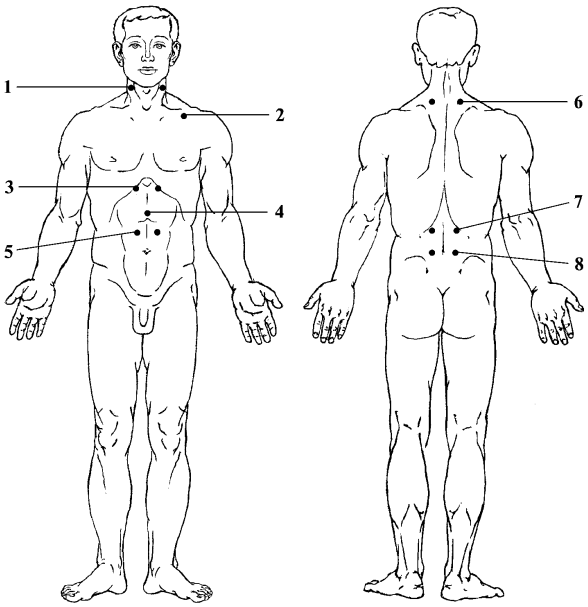


Fig. 15. Zones for MIL-irradiation in treating ulcers

While analysing cases with ineffective MIL-therapy results it has been shown that there is no statistically significant correlation of effectiveness with patients' sex, age, duration of the disease or the thickness of subcutaneous adipose cellulose. One of the main factors determining the absence of dynamic ulcer scarring is a surgery in anamnesis (ulcer suturing, selective vagotomy, etc.). "Mirror" ulcers and ulcer defects more than 1,5 cm are prone for longer treatment.

Gastritis, duodenitis, dyskinesia of the digestive tract

Gastritis and duodenitis are treated as ulcers. For dyskinesia of the digestive tract the approach is the following (Fig. 16): irradiation of gallbladder area (zone 2), left subcostal area (zone 3), right iliac area (zone 5) for 2 min on each zone, on the umbilicus (zone 4) - 1 min. Frequency is 80 Hz, LED radiation power is 60 mWt. In addition to LILR SLRB is performed every other day (zone 1)(frequency 5000 Hz, LED radiation power 30 mWt , duration 1 min.). This course has 8-10 procedures.

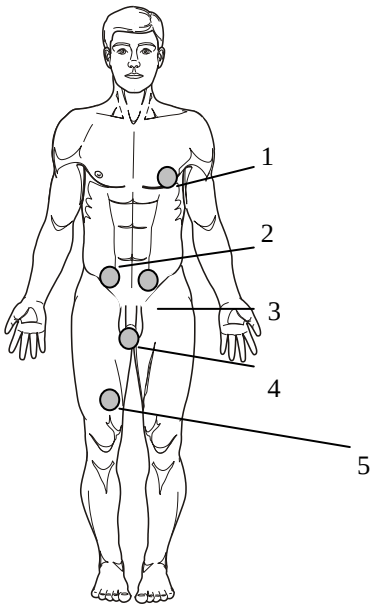


Fig. 16. Zones for MIL-irradiation in treating gastritis, duodenitis and dyskinesia of the digestive tract

Diseases of the liver and gallbladder

Topical MIL-irradiation decreases inflammation in the liver and gallbladder, normalises their function, reduces spasms of the preliver bile tract, improves bile colloidal stability. Consequently, local immunity impaired by the pathologic process is improved. Contraindications for MIL-therapy are the following: gallbladder dropsy, nonfunctioning gallbladder, mechanical hepatocholedoch occlusion (because during MIL-irradiation the secretion of liquid from the gallbladder mucous is stimulated), destructive cholecystitis.

Acute liver failure

Acute liver failure caused by acute exogenous poisonings or exacerbation of chronic liver disorders is treated with a complex approach: MIL-therapy is performed simultaneously with active detoxication (plasmapheresis, biologic dialysis) and conventional therapy. Indications for MIL-therapy: hyperbilirubinemia higher than 80 mkmol/l and elevation of AST and ALT enzymes in patient's blood serum more than by 5 times. If patient's blood prothrombin is less than 80% and fibrinogen is less than 1,8 g/l, MIL-therapy is not a reasonable treatment.

During MIL-procedure a patient lays down on the back; the terminal is put (Fig. 17) to the stomach projection in the right subcostal area along the medlavicular line (zone 1) and is slowly moved with round movements over the

projection of the left and right liver lobes during 5 min (impulse frequency 50 Hz, LED radiation power 30 mWt). After that the thymus (zone 2) and the left subclavicular area (zone 3) are irradiated for 2 min each zone. The course has 10-12 daily procedures.

The effectiveness of complex treatment in liver failure is assessed by the clinical picture, by laboratory analyses and by the data of ultrasound and radioisotopic investigations.

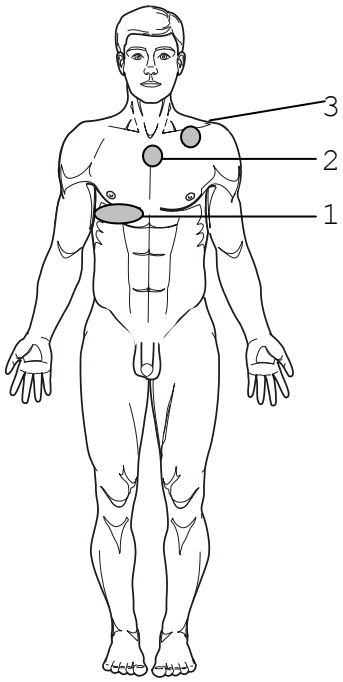


Fig.17. Zones of MIL-irradiation in treating acute liver failure

A positive effect of the described method is caused by the activation of liver blood circulation due to the increased arterial in-flow; This effect is evident, as a rule, after 5-6 procedures. Pains in the liver are reduced, liver dimensions are reduced, bilirubin level is normalised, transaminase activity is decreased by 40% on the average, and the activity of the malon aldehyde is decreased by 12%. Hepatographic investigation reveals improvement of microcirculation clearance function in the liver. All basic values of liver functional state are usually normalised by the 10th procedure. Such clinical picture indicates that MIL-therapy has fulfilled its task and is to be cancelled; however, the patient continues his conventional conservative therapy. MIL-therapy reduces terms of treatment in patients with liver failure by 5-7 days on the average.

Chronic hepatitis

The problem of chronic hepatitis attracts physicians' special attention because of the increasing morbidity of virus hepatitis which leads to aggressive hepatitis in 80% of cases. Despite a long lasting experience of a-interferone application in clinical practice a constant positive effect is received in less than 50% of patients. Experimental and clinical investigations have approved a stimulating effect of MIL-irradiation liver regenerative processes.

The terminal is put (Fig. 18) onto the skin (by a contact stable method) in the liver projection (zones 1 and 2), then to zone 5. Exposure on each zone is 2 min. Impulse frequency is 50 Hz for the first three procedures, 80 Hz - later; LED radiation power is 50 mWt. Treatment - 10-12 procedures.

After 2-3 weeks the second course of treatment is performed (10 daily procedures). The liver area (zones 1 and 2) and left subcostal area(zone 3) along the mediaclavicular line are irradiated (80 Hz, LED radiation power is 70 mWt, exposure is 2 min); then MIL-irradiation is done parasternally (zones 4) at the second intercostal level (impulse frequency is 50 Hz, exposure is 2 min on each zone), at the inguinal vascular bundle (zone 5) from one side (impulse frequency is 80 Hz, exposure is 2 min).

Biophotometry data taken in the liver projection area can help a physician to prognose the recovery processes and to correct MIL-therapy (see Article 8).

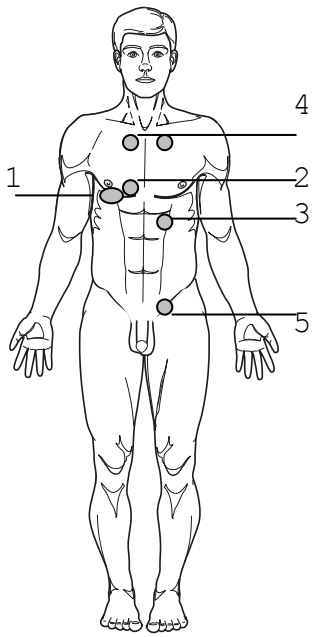


Fig. 18. Zones for MIL-irradiation in treating chronic hepatitis

Chronic cholecystitis

The terminal is put onto the skin (Fig. 19) on the gallbladder projection (zone 4) and paravertebrally to the right on a painful zone (zone 2) at ThV up to ThXII area (defined by palpation). Then the thymus projection (zone 3), left subclavicular area (zone 1) and right iliac area (zone 5) are irradiated. Impulse frequency is 50-80 Hz, LED radiation power is 50 mWt, exposure is 2 min on each zone. The course has 10-12 procedures.

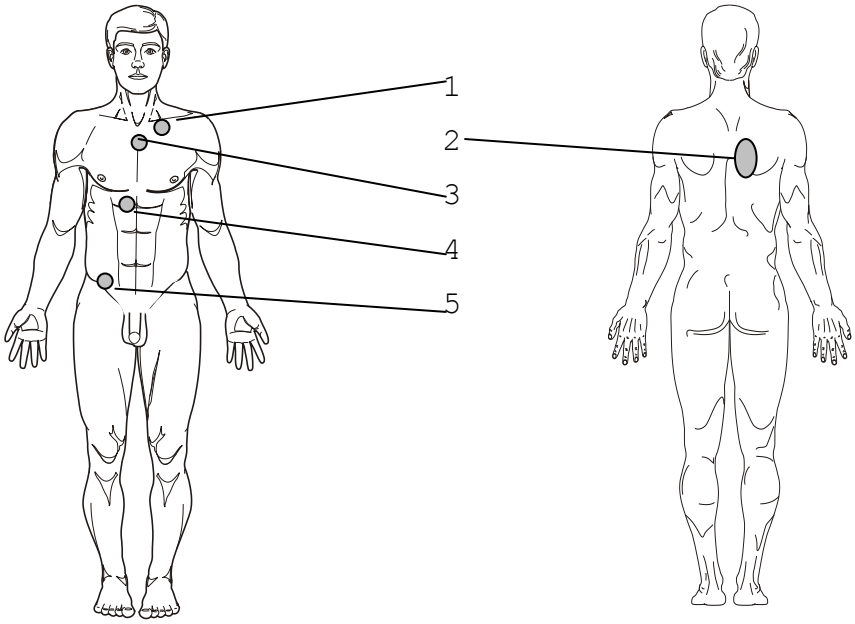


Fig. 19. Zones of MIL-irradiation for treating chronic cholecystitis, dyskinetic disorders in the biliary system

Dyskinetic disorders in the biliary system

Gallbladder hypokinesy and its combination with Oddi sphincter spasm are clinically manifested by the feeling of heaviness, discomfort in the right subcostal area. Objective investigations (fractional chromatic duodenal probing, cholecystography, liver and gallbladder USI, microscopic and biochemical bile investigations) do not reveal signs of inflammation in the bile ducts. Half of the patients have elevated alkaline phosphotase in their biochemical blood tests which indicate the development of initial stages of liver functional deterioration caused by the formation of cholestatic syndrome.

MIL-therapy is performed as an independent method (drugs are cancelled). The terminal is put (Fig. 19) on the zone of gallbladder projection (zone 4), after that on the painful zones in the epigastric region (defined by palpation), on 1-2

zones paravertebrally to the right from ThV up to ThVII (zone 2) and on the right iliac area (zone 5). Impulse frequency is 50 Hz, LED radiation power is 70 mWt, exposure is 2 min on each zone. For complete erradication of pain syndrome 2-5 procedures of MIL-therapy are required (in combined dyskinesia - 6-8). During such treatment dyspeptic syndromes disappear too. The course consists of 10-12 procedures. Laboratory and diagnostic investigations show the elimination or marked reduction of liver cholestasis, marked positive dynamics in biochemical bile indexes.

Chronic pancreatitis

The terminal is put onto the skin (Fig. 20) in the gallbladder projection (zone 1), paravertebrally on the painful zone on the left (zone 2) from ThVII up to ThIX. Impulse frequency is 50 Hz, LED radiation power is 70 mWt, exposure is 2 min on each zone. Then the painful zones in the epigastrial region (zone 3), in the area of umbilicus (zone 4) and the left subcoastal area (zone 5) are irradiated. Impulse frequency is 80 Hz, LED radiation power is 50 mWt, exposure on each zone is 1 min. The number of zones for one procedure is 5-6. The course has 10-12 procedures daily or every other day.

After two weeks the second course is performed (7-8 daily procedures). MIL-irradiation is done to the zone of gallbladder projection (zone 1), to the painful left subcostal area (zone 5), to the left subclavicular area (zone 6). Impulse frequency is 50 Hz, LED radiation power is 50 mWt, exposure time to one zone is 2 min.

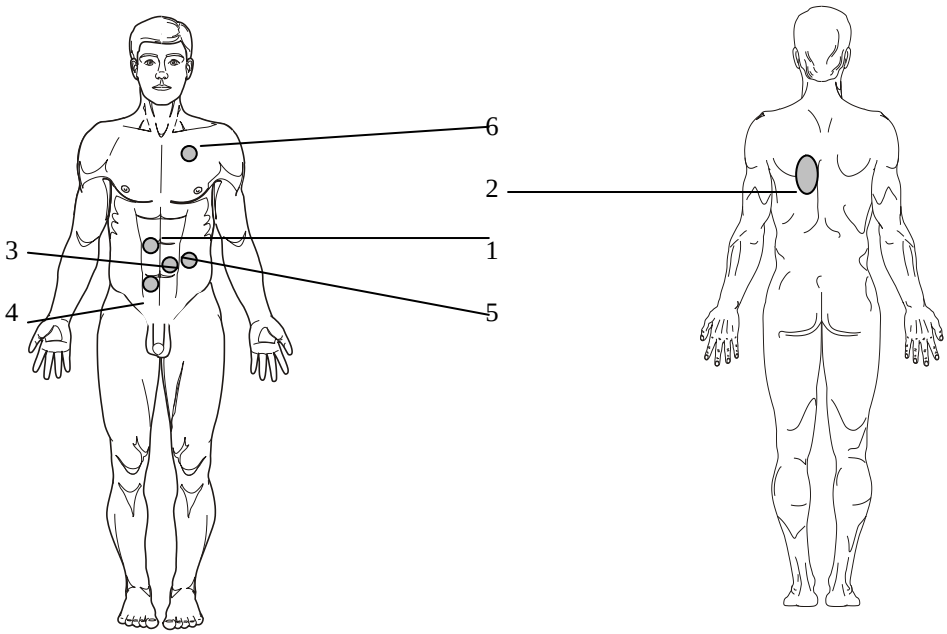


Fig. 20. Zones for MIL-irradiation in treating chronic pancreatitis

7.8. **Cardio-vascular diseases**

Having specific favourable effects to the organism MIL-therapy is indicated in cardio-vascular pathology as a part of a curative complex. Due to its analgesic, anti-ischemic and anti-arrhythmic effects MIL-therapy stabilizes hemodynamic indexes, cardiac function, elevates electric myocardial stability and tolerance to physical loading in 88% of patients on average. MIL-therapy gradually may lead to the reduction of prescribed medicine doses till their complete cancellation.

During MIL-procedure a patient lays down on his back or sits. The terminal (LILR frequency 5 Hz, LED radiation power 50 mWt) is put subcutaneously on the breast to the following zones (Fig.21):

1 - the projection of apical bunt (exposure 2 min);

2 - the second intercostal space to the right of the sternum (2 min);

3 - the second intercostal space to the left of the sternum (2 min);

4 - paravertebrally to the right and to the left (level ThIII-IV) (1 min on each zone);

5 - the middle third of the sternum (1 min);

6 - paravertebrally at the level of lower angle of the left scapula (1 min);

7 - the area of the left carotid (1 min);

8 - to the right and to the left of the 3rd neck vertebrae (0,5 min)

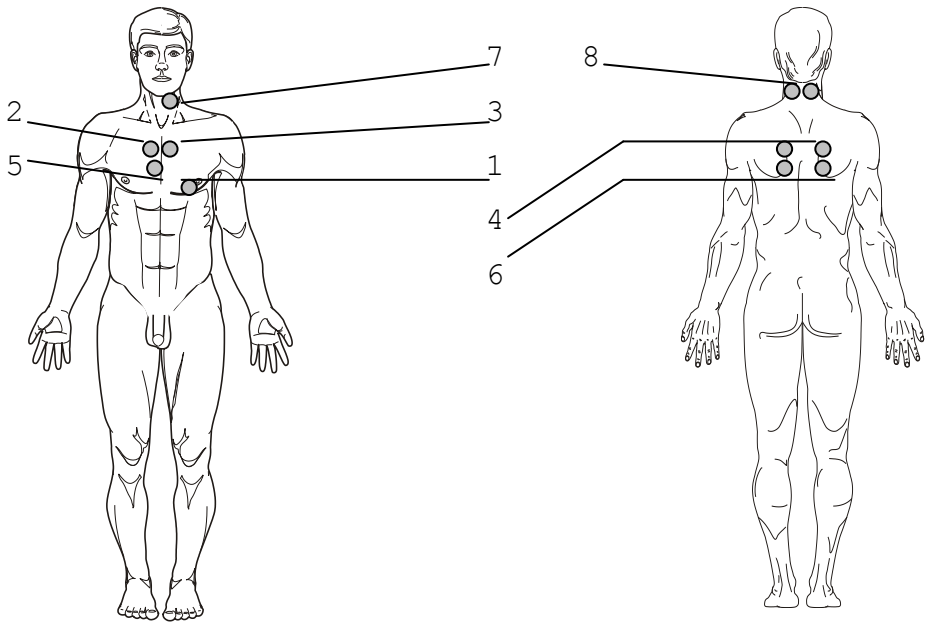


Fig.21. Zones for MIL-irradiation in treating cardio-vascular diseases

Rhythm disturbances. Hypertension

For rhythm disturbances a combination of zones 1, 2, 3, 6 and 7 is recommended (Fig.21). The course consists of 10 daily procedures.

For treating initial stages of hypertension and symptomatic arterial hypertension MIL-irradiation is done to zones 2, 3, 4, 5, 6 and at the level of the 3rd neck vertebrae paravertebrally on both sides (zones 8) for 0,5 min.

Stable angina on exertion (I-IV functional class), angina at rest (first attack, progressive angina), extrasystolic arrhythmia

The terminal is put alternatively (Fig. 21) to zones 1, 3, 6 with exposure 2 min on each zone, impulse frequency 5 Hz, LED radiation power 90 mWt. The course consists of 12 procedures performed every other day.

7.9. **Inflammatory diseases in the bronchi and lungs**

MIL-therapy is indicated to patients with chronic bronchitis at the exacerbation period in combination with conventional medicamentous therapy and for the prophylactics of possible exacerbation. MIL-therapy increases effectiveness of the complex treatment in chronic bronchitis considerably activating positive processes in the bronchial tree, improving cell content in the broncho-alveolar lavage liquid (namely, increasing a number of alveolar macrophages and their vitality). There is a tendency: the longer is the disease duration and the more pronounced are its complications (emphysema, pneumosclerosis), the more resistant are obstructive processes to the treatment.

For achieving a positive clinical effect the individual biophotometric control of MIL-therapy is necessary. A gradual elevation of the reflection coefficient indexes in the diagnostically important points is thought to be a positive sign. For details see Article 8.

Chronic obstructive bronchitis in the exacerbation phase

MIL-therapy (6-7 daily procedures) is performed in combination with conventional medicamentous therapy. Impulse frequency is 50 Hz, LED radiation power is 80 mWt, exposure on one zone is 2 min. Irradiation is applied contactly to 4 zones with a slight compression of soft tissues (Fig. 22): the projection of main bronchi at Th3-Th6 level (zones 1) and over shoulders area (Krenigue fields, zones 2). The day after that (additionally to these zones) MIL-irradiation is done to the cubital vascular bundle (zones 3) for 2 min on each point (3-4 irradiations for the course).

After the 3rd procedure practically all patients have positive dynamics of subjective parameters. By the end of the treatment one can see normalization of temperature, improvement of bronchial patency, reduction of cough and amount of the discharged sputum, reduction of inflammatory process of the bronchi. After the 7th procedure some patients reveal signs of catarrhal inflammation in the

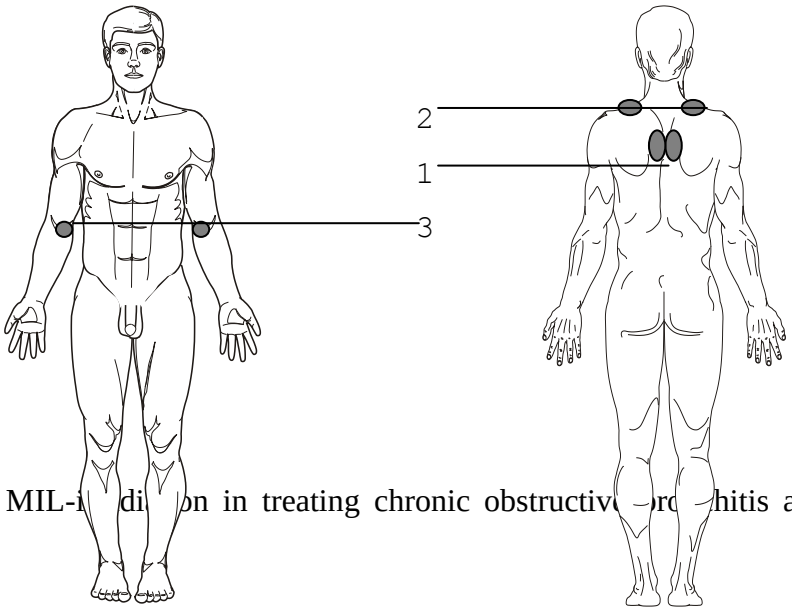


Fig. 22. Zones for MIL-irradiation in treating chronic obstructive bronchitis at its exacerbation phase

upper respiratory tract. By the 7th procedure the induced NST-test reveals the reduction of microbicidic activity of neutrophils especially, in patients with the initial elevated metabolic indexes. These data may indicate some possible connections between the secondary infection in the organism and loss of potential capability of neutrophils to respond with respiratory explosion to an additional irritator. Studies of oxygen exchange with spontaneous and inducted NST-testing during the treatment may be recommended as a criterion for prognosing LT coure duration and for defining a risk group for secondary infection.

Acute and chronic bronchitis

The terminal is on the skin (Fig. 23) on the thymus projection (zone 1), exposure 1 min. Then the irradiation is transferred parasternally at the level of III-IV intercostal space (zone 2) and paravertebrally to the right and to the left at ThIII-ThV level (zones 3) with exposure time 2 min on each zone. Frequency is 80 Hz, LED radiation power is 80 mWt. The course consists of 10-12 daily procedures.

MIL-therapy results in the improvement of respiratory tract patency at the level of media and large bronchi because of the increased bronchi adrenoreceptors

sensitivity to sympatomimetics, improved blood oxygenation, less coughing and easier sputum discharge.

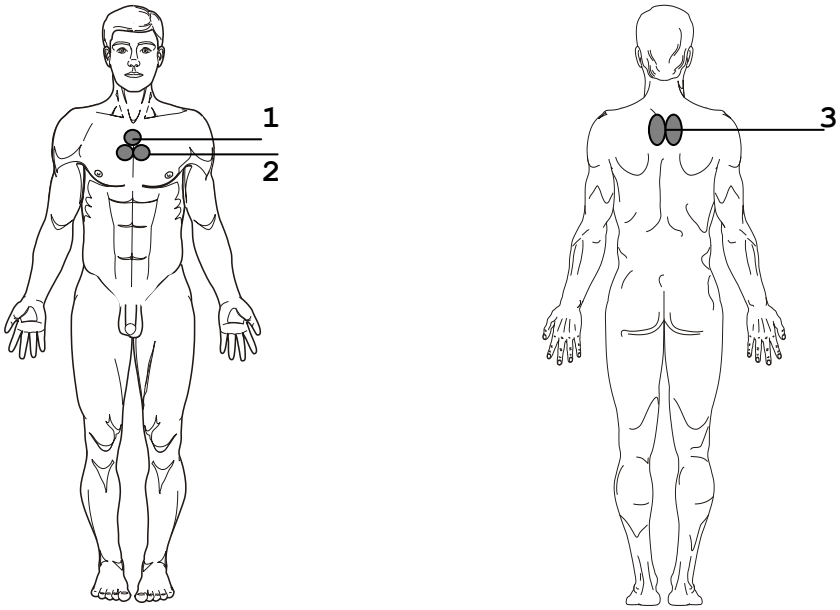


Fig. 23. Zones for MIL-irradiation in treating acute and chronic bronchitis

Asthma

In the bronchial walls of a patient with asthma there exists a chronic inflammatory process which, in the course of time, leads to irreversible sclerotic processes in the respiratory tract. Walls of the bronchi and bronchioles are sensibilized to allergic factors. Preservation of residual sensibilization after the treatment defines remission periods in patients. Presence of long lasting infective allergic process, application of corticosteroid drugs lead to the decrease of phagocytic activity. Unadequate MIL-stimulation of the immune system may cause the emaciation of cellular functional activities and, in a number of cases, disease exacerbation.

Athmatic patients are divided into 3 groups depending of the severity of the disease: with a mild course (I), with a moderate course (II) and with a severe course (III).

Patients from the first group take inhalations with ß2- sympatomimetics of short duration; from the second group - inhalations with ß2- sympatomimetics and/or corticosteroids; from the third group - inhalations with corticosteroids, oral ß2- sympatomimetics, teophillin of prolonged action and/or corticosteroids. Additionally, patients from the third group may be prescribed stabilizers of mast cell membranes, bronchospasmolitics and mucolitic expectorants.

Combined treatment is the most effective in the first and second groups: hemosorption + MIL-therapy (phagocytosis activity gets significantly increased, endotoxicosis level gets decreased, patients' sensitivity to medicamentous therapy gets better). MIL-therapy is done after hemosorption (hemosorption is performed with 3-day interval) (Fig. 24) on the area of left subclavicular (zone 8) and inguinal (zones 6) vascular bundles (for 2 min on each zone at LED radiation power 60 mWt in a day three times a week); MILtherapy course consists of 6 - 8 procedures and hemosoprbtion course has 3 procedures.

In the third group transcutaneous MIL-irradiation (Fig. 24) is performed paravertebrally at the level of upper angles of scapulas (zones 2)along the medial axillary lines (zone 4), supraclavicular areas (zones 1), at the I and II intercostal spaces along the medclavicular lines (zone 10 on both sides) with 0,5 min exposure on each zone; on the areas of fossa jugular (zone 7) and thymus (zone 9) - for 1 min. Every other day the irradiation is applied to the area of cubital fossa (zones 5) for 2 minutes and to the projection of adrenal glands (zone 3) - for 1 min. One course includes 8 - 15 procedures every other day with respect to the hemoglobin content in patients' blood. MIL-therapy has been noted to bring general improvement in patient's state, larger amount of the discharged sputum , decreaseing of symptoms which require ß2- sympatomimetics and corticosteroids inhalations.

The best clinical effect is achieved in patients with a mild course of disease who have never used corticosteroids preparations.

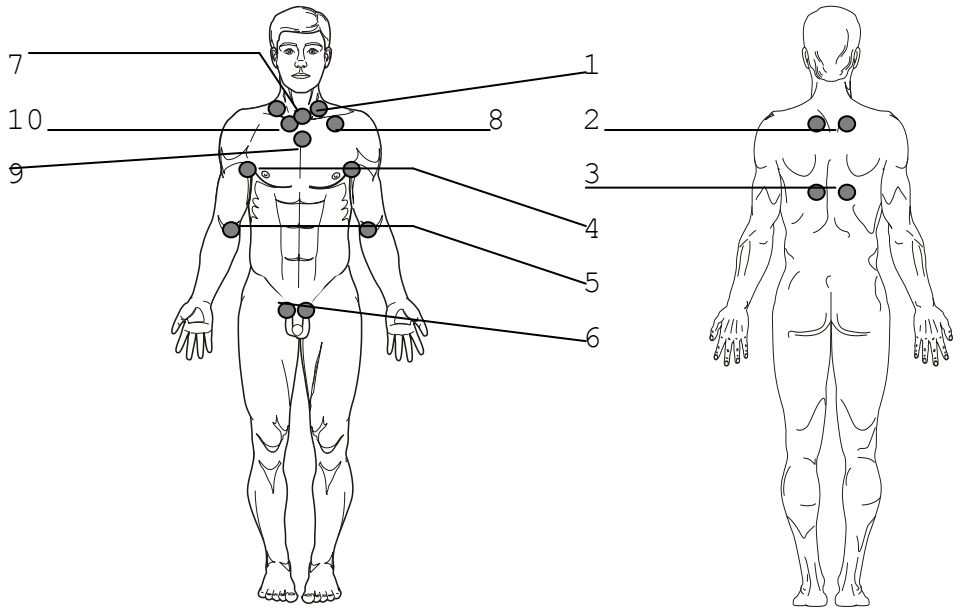


Fig. 24. Zones for MIL-irradiation in treating asthma

Acute and chronic pneumonia

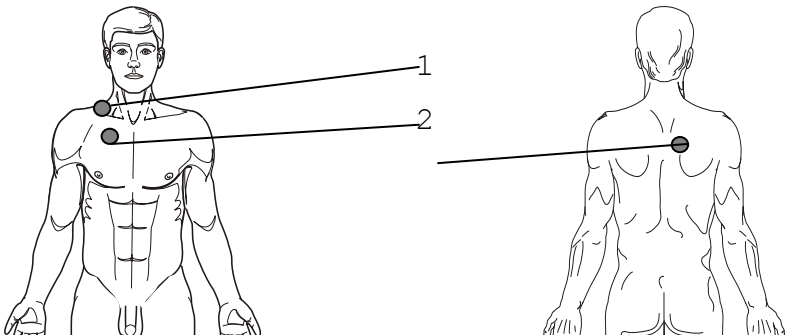
The terminal is put onto the skin in the areas corresponding to the projection of the diseased lung lobe (revealed by X-ray and auscultation) and to the projection of main bronchi (frequency 80 Hz, LED radiation power 80 mWt). The illustrated example demonstrates MIL-therapy application in patients with the lesion in the upper lobe of the right lung.

RIGHT LUNG (Fig. 25) When upper lobe is injured: 1. – the IIIrd intercostal space along the medclavicular line (zone 2), exposure 2 min. 2. - the IVth intercostal space along the medial axillary line (zone 4), exposure 2 min. 3. - the IVth intercostal space along the paravertebral line (zone 3), exposure 2 min. 4. Krenigue field (zone 1), 1 min. When the medial lobe is injured: 1. - the Vth intercostal space along the medclavicular line (exposure 1 min). 2. - the Vth intercostal space along the back axillary line (exposure 1 min). 3. - the Vth intercostal space along the paravertebral line (exposure 1 min). When the lower lobe is injured: 1. - the VIth intercostal space along the front axillary line (exposure 1 min). 2. - the VIth intercostal space along the back axillary line (exposure 2 min). 3. - the VIth intercostal space along the paravertebral line (exposure 1 min).

LEFT LUNG. When the lesion is in the upper lobe: 1. – the IInd intercostal space along the medclavicular line (exposure 1 min). 2. - the IIIrd intercostal space along the medial axillary line (exposure 1 min). 3. - the IIIrd intercostal space along the paravertebral line (exposure 1 min). When the lesion is in the lower lobe: 1. -the VIIth intercostal space along the front axillary line (exposure 1 min). 2. - the VIth intercostal space along the back axillary line (exposure 2 min). 3. - the VIth intercostal space along the paravertebral line (exposure 2 min).

The terminal is put on the thorax on the area of lung infiltrate projection. The course of treatment has 7-8 sessions. In case of necessity it may be repeated in two weeks (by the same scheme).

MIL-therapy in the complex treatment has been found out to reduce the duration of the disease by 5-7 days.



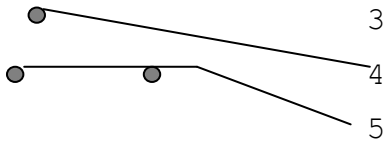


Fig. 25. Zones for MIL-irradation in treating acute and chronic pneumonia (with the lesion in the upper lobe of the right lung)

Acute pneumonias in children

Acute pathology of the lungs and pleura in children (aged 1-12 years) is accompanied by a constant and rapidly progressive acute respiratory insufficiency. Basic values of the external respiration function and gas exchange in children suffering of the complicated forms of acute pneumonia (a pre-destruction phase) - lobitis, pleuropneumonia, infiltrative form- demonstrate some tension in the compensatory mechanisms with the reduction of lung diffuse capability . It indicates a marked deterioration in the alveolar-capillary membrane. Impairments in the ventilation and diffusion are accompanied by changes in blood gas content (1st-2nd stages of the respiratory insufficiency).

MIL-therapy is performed on the 3 day after the beginning of antibioticotherapy (Fig. 26). The application is done in the contact way: along the medioclavicular (zone 2), medial axillary (zone 3) and medial scapular (zone 4) lines on the area of inflammatory infiltration, paravertebrally and symmetrically in the area of ThII-VI (zones 5, 6). After that the thymus projection (zone 1) is irradiated. Impulse frequency is 50 Hz, LED radiation power is 30 mWt, exposure is 0,5 min on each zone. The course of treatment consists of 7-8 procedures every other day.

After MIL-therapy session in addition to the reduction of blood oxygen capacity indexes and anaemia one can see a statistically significant elevation of blood saturation and common oxygen concentration with stable values of

hemoglobin content. Common clinical, X-ray and biochemical indexes improve more rapidly (3-4 days on the average).

In case of acute destructive pneumonia in children MIL-therapy increases compensatory processes of distributive-diffuse and ventilation mechanisms in respiratory insufficiency due to the elevation of respiration space-efficiency, balanced oxygen consumption, improved alveolar-capillary membrane function and oxygen-transport function of blood. Average day-time is reduced by 15-20% on the average, the incidence of destructive complications decreases up to 20-25%.

If infiltrative forms of the acute destructive pneumonia are transferred into different variants of lung and lung-pleural destruction, MIL-therapy sessions are to be cancelled before the acute phase of the disease is over.

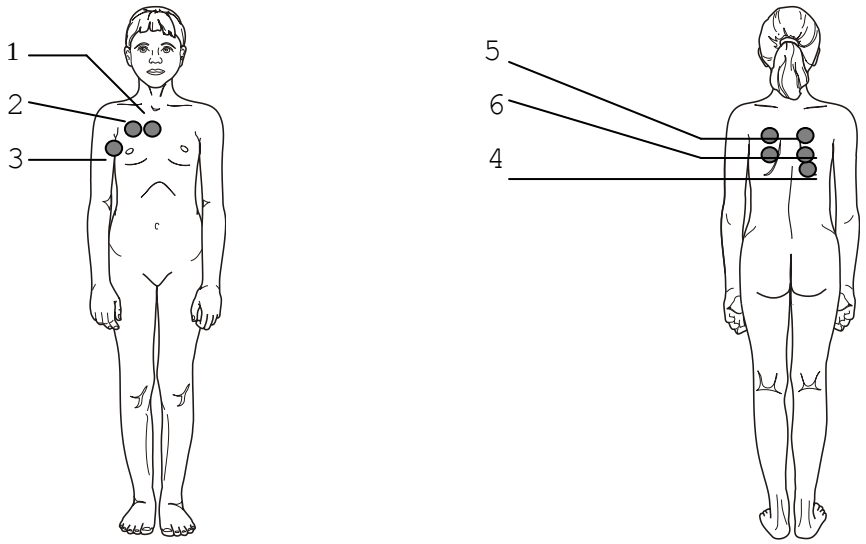


Fig. 26. Zones of MIL-irradiation for treating acute pneumonias in children

7.10. **Gynaecologic disorders**

It has been shown that MIL-therapy increases the organism hormone saturation with estrogens and progesterone due to its stimulative effect on the ovaries. This is especially important in case of infertility. MIL-therapy also improves blood circulation in the pelvis and removes the irritation of vegetative nervous system

caused by an inflammatory process thus, facilitating the functionability of the organs located in the pelvis.

Post-operative infiltrates, pericultitis at the late post-operative period, incomplete epithelization of pseudo erosion in the uterine neck after diathermoelectrocoagulation, salpyngitis, oophoritis, chronic salpyngoophoritis with a pain syndrome, adhesions in the pelvis, uterine infantility, sterility caused by the tube inpatency, algodysmenorrhea, vulva itching and kraurosis.

MIL-therapy is applied as an independent method or as a part of complex therapy in subacute and chronic inflammatory disorders in the female genitalia and in functional impairments.

The terminal is put (Fig. 27) on the abdominal wall in the area of ovaries projection (zones 7), uterine projection (zone 8), tube projection, on the sacrum (zones 6) or on the vulva (zone 9) depending on the nosology and the method applied. To perform the irradiation from the inside a special lightguide is attached to the apparatus. First, the lateral arches (zones 2) or the uterine neck (total time is about 2-5 min) are irradiated, after that the terminal (without an attachment) is put on 1-2 painful zones in the area of Mikhaelis rhombus (zones 6) for 2 min on one zone.

If a woman is planning to have a baby or if she is treated for infertility the adnex projection on the front abdominal wall is not irradiated. The terminal is recommended to be put on the liver (zone 4), pancreas (zone 5), on the zones of Mikhaelis rhombus angles (zones 6). Impulse frequency is 80 Hz, LED radiation power is 40 mWt. 8-10 procedures for the course of treatment. MIL-therapy course may be repeated in 2-3 weeks.

Inflammatory process and pain syndrome decrease after 2-4 procedures. MIL-therapy effectiveness is controlled with biophotometry in the zones of uterine adnex projection (zones 7) on the abdominal wall before and right after the procedure (subcutaneous or intracavital). See Article 8 for details.

Postnatal endometritis

MIL-therapy is indicated on the second day after the uterine wall scraping to get antiinflammatory, analgesic and spasmolitic effects (in combination with adequate antibacterial therapy). MIL-therapy session are performed daily (Fig. 27) intravaginally with a special attachment 2-3 times a day with an interval for 2,5-3

hours during 2-3 days (frequency 80 Hz, LED radiation power 50 mWt, exposure 2 min). Afterwards the irradiation is done transcutaneously: the terminal is put on the pubis (zone 1, 8 - uterine projection) with a moderate compression of soft tissues, on the painful zones 6 (defined with palpation by a physician) on the sacrum (exposure 2 min on one zone); impulse frequency is 50 Hz, LED radiation power is 70 mWt. Procedures are performed daily once a day during 3-4 days.

The decrease of pain, body hyperthermia, bloody discharges from the uterine are seen 5-7 days earlier comparing to conventional therapy.

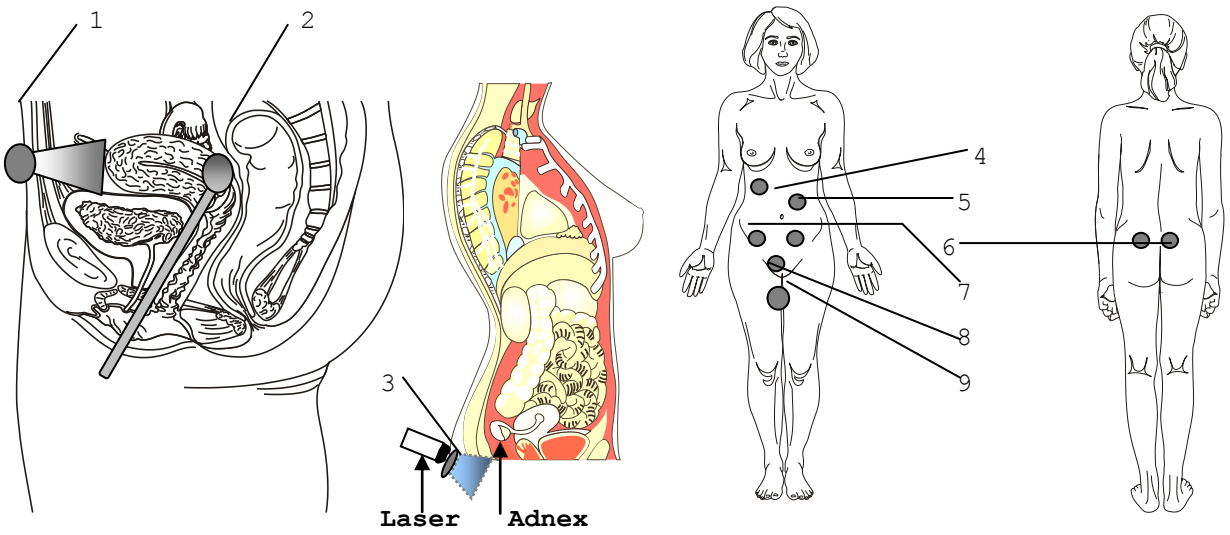


Fig. 27. Zones of MIL-irradiation for treating gynecologic disorders

Endometrium hyperplasia

Hormone therapy of hyperplastic endometrium disorders is a basis of modern therapy directed towards the decrease of a proliferative potential of the organism. However, specific intolerance to hormonal preparations in combination with a wide range of contraindications limit their application in a great number of patients.

It has been found out that the level of different phosphoinozitides in the blood of patients with glandular endometrium hyperplasia and atypical endometrium hyperplasia is 1,3 and 1,6 times lower than in healthy women; and, in tissues affected by hyperplastic process it is 1,4 times higher on the average than in the intact endometrium. Normalizing phosphoinozitide content in the blood and endometrium tissue reduces a proliferative profile in the organism, thus preventing endometrium cells malignization as well.

MIL-irradiation is done (Fig. 28) on the iliac zones (zones 4), subpubic area (zone 5) , on the thymus projection (zone 2) and on the left subclavicular area (zone 1);); impulse frequency is 50 Hz, LED radiation capacity power is 60 mWt, exposure time at one zone is 2 min. At first, 5 daily procedures are performed and then after a 7-day break the course is repeated.Two months later MIL-therapy course (10-12 procedures) is performed under the same scheme with additional irradiation of the zones on the plantar surfaces of feet (zones 3 and 6) for 0,5 min at one zone.

MIL-therapy in combination with phosphoinozitide preparations (phopholipid preparations containing phosphoinozitides in different combinations at positions D-3 and D-4 in the inozitol circlet) restores impaired phosphoinozitide exchange in patients with regulated and non-regulated proliferative disorders. Adding hormonal preparation Nonavlon to this therapeutical complex facilitates the restoration of a hormone profile in patients. Such complex therapy provides a stable therapeutic effect.

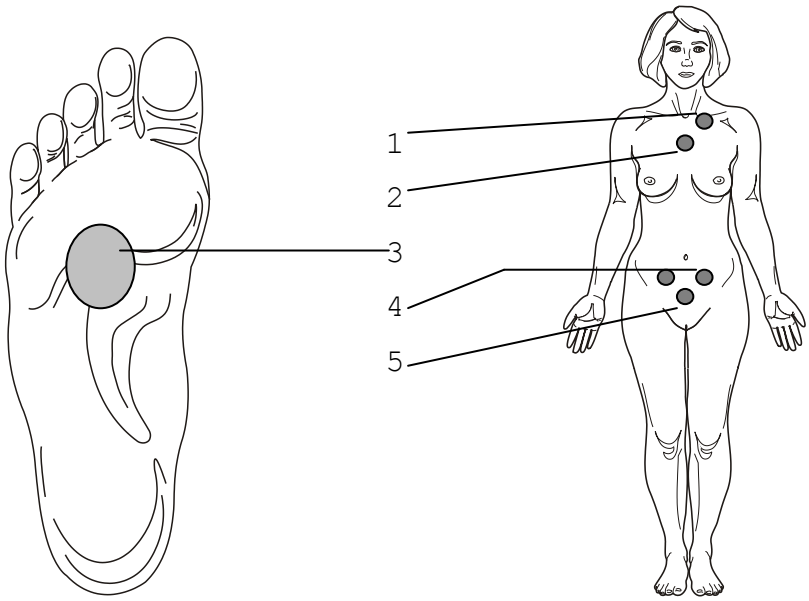


Fig. 28. Zones of MIL-irradiation for treating endometrium hyperplasia

7.11. Urology

Postoperative sutures

MIL-therapy is very effective for treating patients in post-operative period, after reconstructive-restorative surgeries on the ureter, after surgeries for urethric and cystic-vaginal fistulas, plastic surgeries for urine incontinence. Irradiation is applied to postoperative sutures in several zones (for 2 min on each zone) with frequency 80 Hz, LED radiation power 50 mWt daily (6-8 procedures). The course is repeated in 4-5 days.

Chronic cystitis and the infiltrate in the pelvis

MIL-therapy is indicated in the complex treatment of patients with chronic cystitis and infiltrate in the pelvis to prepare them for reconstructive-restorative surgeries at distal parts of the ureter. The terminal is applied in a contact stable way (Fig. 28) on the supra pubic zone (zone 5) and on the iliac region (zones 4) for 2 min on each zone. Impulse frequency is 80 Hz, LED radiation power is 80 mWt. The course of treatment consists of 10-12 daily procedures.

Urolithiasis

MIL-therapy is indicated in pre-operative period. The terminal is applied (Fig. 29) parasternally (zones 2) at the 2nd intercostal space. Impulse frequency is 5 Hz, LED radiation power is 40 mWt, exposure is 2 min on one zone. Afterwards, the irradiation is done posteriorly to the stone projection (zone 5) for 2 min with frequency 5 Hz, for 2 min with frequency 150 Hz and for 2 min with frequency 5000 Hz. The terminal slowly moves 12-15 cm. down. In 4-6 hours MIL-irradiation is applied to the inguinal vascular bundles (zones 6) with frequency 5 Hz, LED radiation power 90 mWt during 5 min on each side. Then the irradiation is applied to feet surfaces; the terminals are slowly moved from zone 1 to zone 2 (only in this direction) for several times during 1 min (frequency 10 Hz, LED radiation power 100 mWt).

The course of treatment (combined with medicamentous therapy) lasts for 5-7 days with daily MIL-sessions. In many cases MIL-therapy applied under this scheme together with drinking much liquids and medicamentous therapy (spasmolitics,

analgetics, etc.) facilitates stone excretion thus, leading to the cancellation of the planned surgery. After the stone excretion is completed (or in a postoperative period) MIL-therapy is performed daily during 5-7 days 1-2 times a day. Irradiation is applied to the area of affected kidney (zone 5) and on the inguinal vascular bundles (zones 6). IR LILR impulse frequency is 600 Hz, LED radiation power is 90 mWt, exposure on each zone is 2 min.

Traumatic ureter fistulas

At the site of ureter implantation after plastic surgeries at the lower third of the ureter one can infrequently see a secondary stenosis: inflammation at the anastomosis and in the adjacent tissues leads to a long lasting anastomositis caused by a club-shaped edema and postoperative trauma.

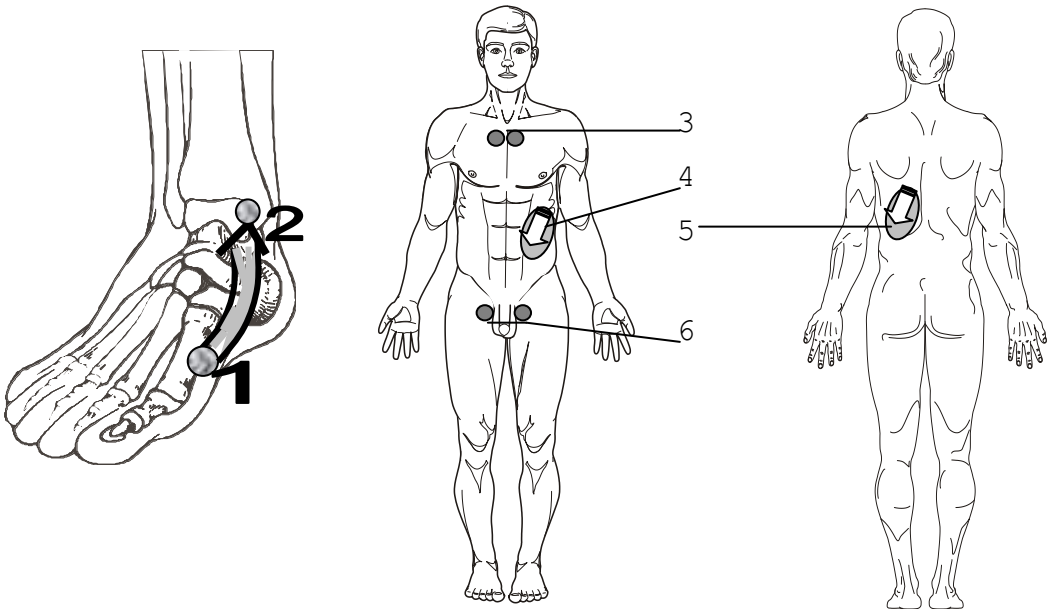


Fig. 29. Zones of MIL-irradiation in treating urolithiasis

In patients survived plastic surgeries at the distal parts of the ureters, especially in case of indirect plastics with the bladder wall (flap-type surgeries by Boari, Demel, Lopatkin) the syndrome of so-called irritated bladder is formed . Dysuria gets more pronounced because of long-staying urethral and ureter drainage tubes used in the postoperative period. The picture of bullous edema develops in some places due to

the augmentation of inflammatory changes around the anastomosis; at the site of implantation of the ureter into the bladder the mucous becomes folded. Complex treatment with the application of MIL-therapy improves results of surgical treatment in such patients: signs of anastomositis are reduces by 75%.

MIL-therapy is prescribed on the first postoperative day with 7-8 daily sessions. The terminal is consecutively put on two zones at the anastomosis projection, after that - on the projection of the inguinal vascular bundle (Fig. 29, zones 6). Exposure is 2 min on each zone, impulse frequency is 50 Hz during first three procedures, after that - 80 Hz; LED radiation power is 50 mWt.

Cystitis (catarrhal, ulcerative, ulcerative-fibrinotic, granular chronic)

Signs of the inflammation in bladder mucous are accompanied by the signs of local and generalized hypoxia which is revealed during endoscopic and angioscopic investigations. Microcirculatory impairments of spastic or spastic-atonic type are revealed in all patients. Number of microvessels is decreased in a half of patients.

MIL-therapy is performed daily (7-8 procedures for the course). The terminal is subcunateously applied on the bladder (zone 4) (Fig. 30), then on the barbate process LV (zone 3): exposure is 2 min, frequency is 50 Hz, LED radiation power is 70 mWt. After that the thymus projection (zone 2) and the left subclavicular vascular bundle (zone 1) are irradiated for 2 min. each . Impulse frequency is 80 Hz, LED radiation power is 50 mWt. In case of necessity the course is repeated in 2 weeks.

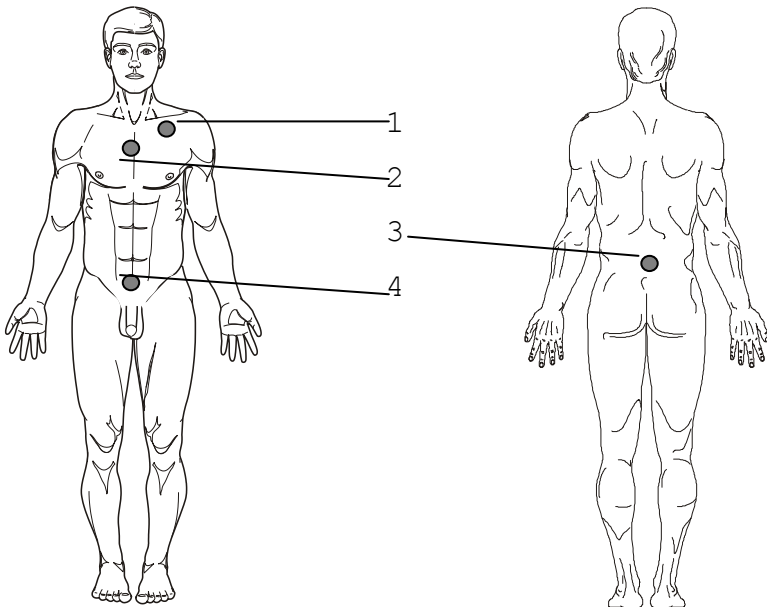


Fig. 30. Zones of MIL-irradiation in treating cystitis (catarrhal, ulcerative, ulcerative-fibrinotic, granular chronic)

Reduction of the conjunctive indicator, significant improvement of microcirculation are seen after 2-3 MIL-sessions in 82% of patients on the average with further progress by the end of the treatment (by the 8-10th session). A comparative analysis of MIL-therapy effectiveness and intravenous injections with reologically active preparations has shown quite obvious advantages of MIL-therapy because microcirculation improvement under MIL-irradiation was more prolonged.

Prostatitis

MIL-therapy is combined with medicamentous treatment and gland massage (MIL-therapy preceeds the massage). The terminal is put (Fig. 31) on the perineum with moderate compression of soft tissues (before the anus) and above the pubis bone (zone 1), exposure for 2 min on each zone. After that the inguinal vascular bundles (zones 3) are irradiated for 2 min and 1-2 painful zones in the sacrum area (zones 2) defined by a physician on palpation are irradiated too (for 2 min). Impulse frequency is 80 Hz, LED radiation power is 50 mWt. 8-10 daily sessions.

Totally, MIL-therapy is performed within 2-3 courses with two- week breaks in-between. The treatment may be repeated in 6 months, in case of necessity.

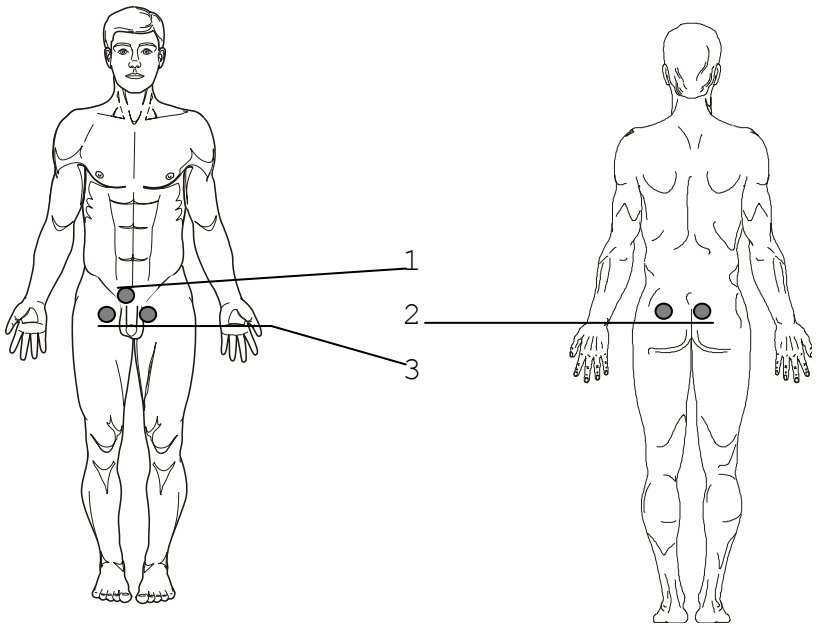


Fig. 31. Zones of MIL-irradiation in treating prostatitis

7.12. **Endocrine disorders**

MIL-therapy is effective in the treatment of Diabetes mellitus type II, hypothyreosis of various genesis and other endocrine disorders. It may be applied as an independent method as well as in the combination with traditional medicamentous therapy. MIL-therapy for endocinological diseases should be conducted only by an endocrinologist trained in laser therapy and after thorough patient's examination. Constant biochemical control (blood and urine glucose levels, their daily fluctuations, C-peptide, immune reactive insulin, T3, T4, TTG, cortizol) and clinical control are performed during MIL-therapy course .

Diabetes mellitus

The main task of modern medicine is to arrest progressing both the disease itself and its complications (for instance, distal diabetic polyneuropathy is seen in 10-80% of patients). It has been shown that laser therapy (especially without drugs - as a monotherapy) is very effective for improving the state and conductivity of injured nervous fibres, microcirculation in tissues and organs, hormonal balance , CNS functions, immunity.

The terminal is put (Fig. 32) onto the skin of the front abdominal wall at the pancreas projection (zone 5) (irradiation through the lumbar area is not recommended due to a possible stimulation of adrenal cortex and contrainsular corticosteroid effect) and on the lower ribs to the right (zone 4). Exposure is 2 min on each area with a gradual increase up to 5 min. by the 4-5th session. After that the thymus projection (zone 3) and the left subclavicular vascular bundle (zone 2) are irradiated for 2 min at each zone. Impulse frequency is 50 Hz, LED radiation power is 70 mWt. The course consists of 10 -12 procedures every other day.

Slight elevation of blood sugar level is seen in practically all patients immediately after the first procedure. After 3-4 sessions it goes down both in blood and urine. It has been noted that definite changes of reflection coefficient in tissues revealed at biophotometry during the treatment correlate with daily fluctuations of sugar level in blood. This indicator helps to individualise the course of treatment. Blood sugar level in type II diabetes (both under the administration of antidiabetic drugs and without it) decreases by 1,5-2 times; it also depends on the patient's compensatory mechanism. Reduction of the amplitude of daily blood sugar level under MIL-therapy

is a favourable prognostic sign. The course of MIL-therapy may be repeated in 3-4 months.

Diabetic angiopathy of the lower extremities (trophic ulcers)

A thorough diabetes compensation (medicamentous, laser) is provided preliminary to MIL-therapy. Hemotripsin, Solcoseril ointment , Actovegin ointment are appplied topically . After that the left subclavicular area (zone 2) and the inguinal vascular bundles (zones 6) are irradiated for 2 min. each, the thymus projection (zones 3) is irradiated for 1 min. (Fig. 32) (frequency 50 Hz, LED IR radiation power 60 mWt) . Procedures are performed every other day, 10-12 procedures for the course.

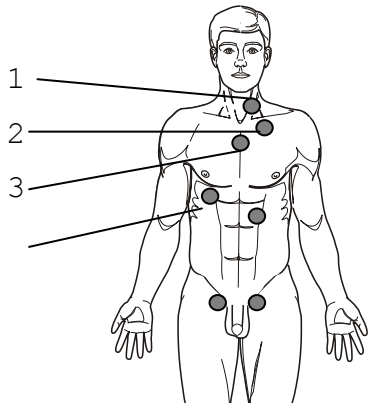
A clinical effect (ulcer epithelization, elimination of painful sensations) is maximally evident by the 8-10th procedure. Reduction of antiaggregant medicine is possible by the 5-6th procedure. Heparin dosage is gradually decreased and by the 3-4th procedure it may be cancelled. Topical drugs (except drying substances) are cancelled at the beginning of epithelization process . No side effects have been registered. The basic effect is the inhibition of free radical processes (more than by 2 times) which is correlated with patient's state and may be a criterion of treatment adequacy.

Diabetic retinopathy

Fluorescent lymphoangioscopy reveals a significant damage of lymph circulation in patients with this pathology (moderate filling the level of which depends on the duration of the diabetes mellitus and the extension of destructive changes in the retina and choroidal membranes). MIL-therapy effects lymph circulation in the bulbar conjunctiva in patients with pre-proliferative diabetic retinopathy (type II diabetes mellitus): indexes of lymphatic drainage in the eye are improved.

The terminal is put (Fig.32) on the left subclavicular vascular bundle projection (zone 2), on the left carotid projection (zone 1). Impulse frequency is 150 Hz, LED radiation power is 70 mWt, exposure is 2 min on each zone. Then the sympathetic nodes on the neck are irradiated bilaterally for 1 min. Procedures are performed every other day (7-8 for the course). MIL-therapy course may be repeated in 1-3 months.

Upper neck sympathetic node



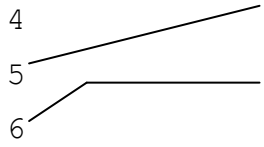


Fig. 32. Zones of MIL-irradiation for treating diabetes mellitus

Hypothyreosis (after the autoimmune thyroiditis, after a partial resection of the thyroid gland, etc.)

MIL-therapy combined with pharmacotherapy is extremely effective in such diseases, especially at their initial stages as well as at the neurologic syndrome: after few first sessions patients note "clarity in the head", reduction of fatigability, better physical and psychological state. By the end of MIL-therapy course there appears a significant decrease in the emotional liability and mood fluctuations, a marked improvement of psychic and motional activity. However, a tendency for recurrences is still preserved. That is why curative-prophylactic, antirecurrent courses of MIL-therapy are recommended every 2-3 months (3-4 courses). MIL-therapy is performed as an independent method or in combination with L-thyroxin substitution therapy.

The first variant: the terminal is put (Fig. 33) on the thyroid gland area (zones 1) consecutively on both lobes with the exposure 1 min. Then zones to the right and to the left from the 7th neck vertebrae (zones 6) are irradiated for one minute. After that the liver (zone 7) and the pancreas (zone 8) are irradiated for 2 min on each zone. Impulse frequency is 50 Hz, LED radiation power is 75-80 mWt. Procedures are performed every other day, 10-12 procedures for the course.

During MIL-therapy one can observe normalization of clinical signs (hypodynamics, bradycardia). Reflexometric data are improved too. Cortizol level in blood goes up right after the first session (blood sampling is done 30-40 min. after MIL-therapy session). Further a thorough selection of doses and irradiation repetitions eradicate this reaction. After 4-5 sessions there appears the increase of threeiodthyronin (T3) content with a simultaneous decrease of tetraiodthyronin (T4) content in blood. The patients who are prescribed L-thyroxin (in a constant dosage) and MIL-therapy have

less pronounced fluctuations in T3 and T4 levels than patients who have only MIL-therapy. However, at the same time one can observe a significant reduction in the hypophysis thyrotropic hormone (TTG) level; this fact demonstrates an effective stimulation of the hormone in glandular tissue.

If the first course of MIL-therapy is effective, the repeated course is recommended in 3-4 months under the control of patient's endocrine status.

The second variant: MIL-sessions are performed every other day. The area of the left subclavicular vascular bundle (zone 4) (Fig.33) is irradiated with the impulse frequency 10 Hz, LED radiation power 60 mWt; exposure 10 min. After that the 7th neck vertebrae (zone 6), the front temporal areas (zones 2, 3) and both thyroid lobes (zone 1) are irradiated alternatively, for 15 sec. Impulse frequency is 80 Hz, LED radiation power is 60 mWt. 10 - 20 procedures for the course. This variant is more preferable in patients with evident nervous and psychic disturbances.

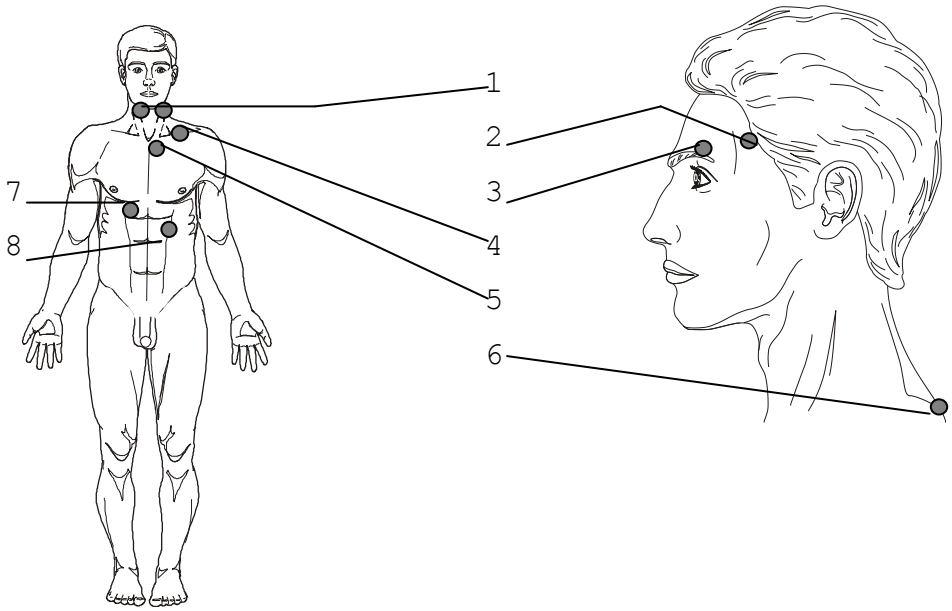


Fig. 33. Zones of MIL-irradiation for treating thyroid gland pathologies

Climacteric syndrome

Gynecologists-endocrinologists consider the climacteric syndrome to be a natural physiological process characterized by the extinction of gonadotropic

function of the front hypophysis lobe and by the impairments in coordination with the ovarial-adrenal system.

MIL-therapy normalizes blood hormonal level, central regulation of the endocrine system. It also significantly increases psycho-emotional status and improves the quality of life.

The curative terminal is put (Fig. 34) on the area of apical stroke (zone 2) and on the left subclavicular vascular bundle projection (zone 1). Impulse frequency is 5 Hz, LED radiation power is 30 mWt, exposure is 5 min on one zone. Then the liver (zone 3) and the pancreas (zone 5) are irradiated with frequency 80 Hz and LED radiation power 40 mWt, exposure 2 min. This irradiation is done paravertebrally at LIII-LIV (zones 4) level for 30 sec. (frequency 600 Hz, LED radiation power 40 mWt). 8-10 daily procedures for the course. The course is repeated under the same scheme one month later.

With climax advancing in men and women there appear manifestations of a number of different diseases including cardio-vascular, urologic, gynecologic, metabolic, psycho-neurologic ones. So, in 6 months after these two MIL-therapy courses a patient may require a new MIL-therapy course for treating the revealed accompanying pathology. Such treatment is performed according to the schemes described in the present Instructions (see the corresponding articles).

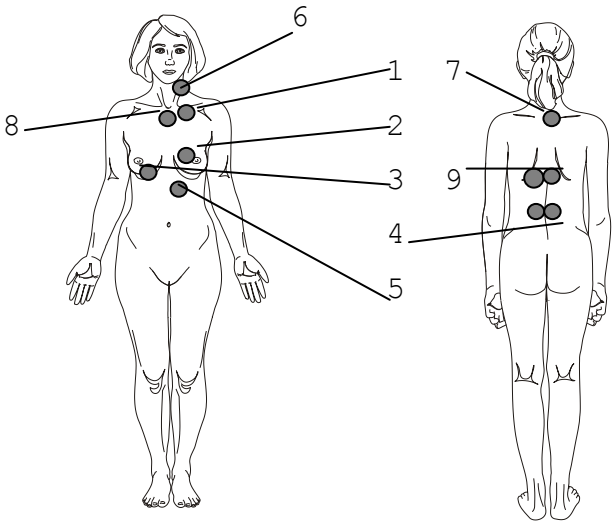


Fig. 34. Zones of MIL-irradiation for treating climacteric syndrome and hormonal disturbances

Laser therapy and hormonal therapy

Lately, hormones of the hypophysis, adrenal cortex and others have been widely used for treating asthma, ulcerative colitis, rheumatism and other pathologic processes in men. However, the longer lasts the endocrine dysfunction caused by this therapy, the more expressed are psychic disturbances even up to the development of so-called “steroid psychosis”. Sensation of energy, constant euphoria may quickly transform to depression, prostration and other negative states.

Curative-adaptive mechanisms of LILR irradiation are used to protect human organism of hormonal therapy side-effects (in combination with medicamentous preparations but with gradual reduction of their doses).

MIL-therapy is performed every other day (Fig. 34). The left subclavicular area (zone 1) is irradiated with 10 min. exposure (impulse frequency 10 Hz, LED radiation power 60 mWt). Zones of the carotid projection (zone 6 on each side), of the thymus projection (zone 8) are irradiated simultaneously, 1 min on one zone (zone 1 is irradiated every other day). Then MIL-irradiation is done to the sites of somatic injury (gastritis, colitis, asthma, etc.) and to the liver projection (zone 3) for 2 min on each zone; then the 7th neck vertebrae (zone 7), the adrenal glands projection (zones 9) with exposure 15-30 sec., impulse frequency 80 Hz, LED radiation power 40 mWt. Total time for one procedure is not more than 10 min. The course of treatment consists of 5-10 such procedures.

MIL-therapy in this pathology has the aim to reduce the dosage of hormonal medicamentous preparations, to control symptoms of endocrine dysfunctions. One month later a new course of MIL-therapy may be started to treat a basic disease using the developed, tested scheme.

7.13. **Chronic anemias**

MIL-therapy included into the complex treatment of chronic anemias significantly improves the results of such treatment (by the stimulation of blood formation). The terminal is applied (Fig. 35) on the thymus area (zone 1), on the projection of spleen to lower ribs (zone 2) between the front and middle axillary lines on the left. Impulse frequency is 80 Hz, LED radiation power is 70-80 mWt, exposure time is 2 min on one area. Then the area of inguinal vascular bundles (zones 4) is irradiated with frequency 1500 Hz, LED radiation power 100 mWt, exposure 1 min. Five daily

procedures are performed this way; then the irradiation is done only on the area of inguinal vascular bundles (zones 4) every other day using the above mentioned parameters but with 2 min. exposure on each zone (2 procedures). After that the next three procedures are done with 5 min. exposure on each zone. MIL-therapy course may be repeated 3 months later. Control of blood indexes is performed throughout all the treatment.

7.14. Dermatologic disorders

It is recommended to treat infectious skin disorders with supravenous laser radiation of blood (SLRB) (Fig. 35). This irradiation is done to projections of the left subclavicular vascular bundle (zone 5) and thymus (zone 1) for 2 min on each zone with frequency 150 Hz every other day and LED radiation power 90 mWt (in addition to the techniques described below). Duration of the procedure should not exceed 10 min.

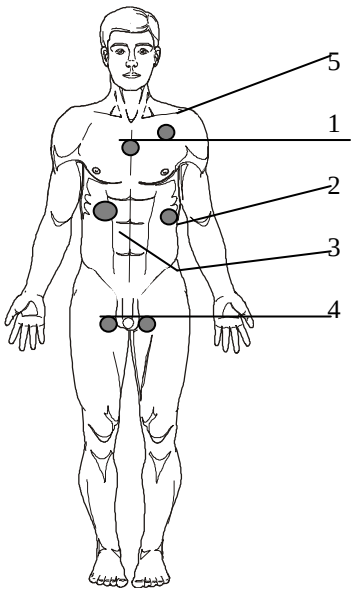


Fig. 35. Zones of MIL-irradiation for treating chronic anemias

Pyodermitis

MIL-irradiation is combined with local drug therapy. The terminal is put on lesions (through bandage or equiv.). Impulse frequency is 50 Hz for the first three procedures, then 80 Hz (LED radiation power 60 mWt). Depending on the lesion

dimensions 1-3 zones are irradiated for 1-2 min on each zone as well as the regional lymphatic nodes (Fig.36, zones 1-6) along the lymph flow from the pathologic focus (2 min): zone 6 (above the clavicle at the place of oblique neck muscle attachment on the front), zone 1 (axillary area), zone 2 (the sternum at the nipples level), zone 3 (the xiphoid process), zone 4 (to the left of the umbilicus), zones 5 (inguinal lymphatic nodes). 10-12 daily procedures are done for the course.

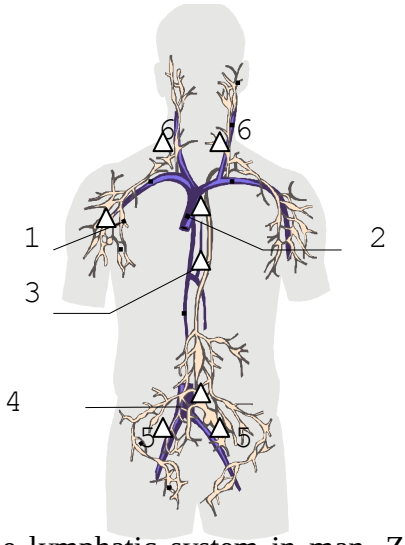


Fig. 36. The lymphatic system in man. Zones for MIL-irradiation in treating skin diseases

Virus dermatosis

MIL-irradiation effects an injury through the bandage (right after the application of drugs on the skin). In case of the girdle MIL-therapy is added to the conventional medicamentous therapy: methylen blue, brilliant green, fucortsine (topical), vitamins of group B and ascorbic acid, antiviral preparations (Aciclovir, Zovirax, Valtrex, Virazol, Virolex, Gevizosh), immune modulators (Licopid, Cycloferone).

Post- girdle neuralgias are treated with antidepressants and small doses of neuroleptics. MIL-irradiation is applied along the injured nerve at its most painful points. Impulse frequency is 50 Hz, LED radiation power is 50 mWt; total time for the procedure has to be not more than 10 min. In 2 weeks the course (7 procedures every other day) is repeated (impulse frequency 80 Hz, LED radiation power 30 mWt).

MIL-therapy applied at the early stages arrests the girdle development and, in severe cases facilitates the backward development of the disease.

Focal sclerodermia

MIL-therapy is the most effective at the stage of edema and tissue induration when applied in combination with resorptive drugs (lidaze, ronidaze, aloe, dimexide). Procedures are performed every other day (10-15 for the course) with impulse frequency 50 Hz, LED radiation power 80 mWt and exposure on one zone 2 min. Total duration of MIL-therapy procedure is not more than 10-15 min.

Eczema. Neurodermitis

MIL-therapy improves the sensitivity of injured skin to steroid and anti-histamine preparations. Impulse frequency is 5 Hz, LED radiation power is 70 mWt; summarized exposure time on the injured skin and on the left carotid artery at one procedure should no exceed 10 min. The course of treatment consists of 7-8 procedures every other day.

In chronic forms of the disease 2-3 courses of MIL-therapy with 2-3 months break are required.

Allergic dermatosis

Allergic dermatosis is a widely spread pathology in pediatrics characterized with the congenital allergically changed reactivity. In 80% of cases allergic disorders is a hereditary burden. In allergic dermatosis there is a tendency to dermal pathology progression; digestive organs are prone to various pathological processes (gastritis, duodenitis, dysbacteriosis with malabsorption); one can see the damage of the immune profile in 100% of patients, diturbances in CNS and vegetative nervous system, residual signs of survived encephalopathy. One can frequently meet disseminated forms of the allergic process easily complicated by secondary skin infectioning, constant recurrences, high resistance to the prescribed drug therapy, intolerance to a number of drugs. Moreover, in children (aged 6 months - 15 years) physicians not infrequently diagnose severe forms of acute allergic dermatosis with eczema-like course and toxico-allergic skin lesions - erythrodermia (a long lasting and persistent course of neurodermitis despite of its treatment).

Children aged up to one year are prescribed mineral water, breast milk, milk soya mixtures and fasting diet pauses during the day.

Children aged 3 years and more may be treated with MIL-therapy (Fig. 37) and enterosorbents, rise diet, fasting diet, starving- fasting diet with mineral water.

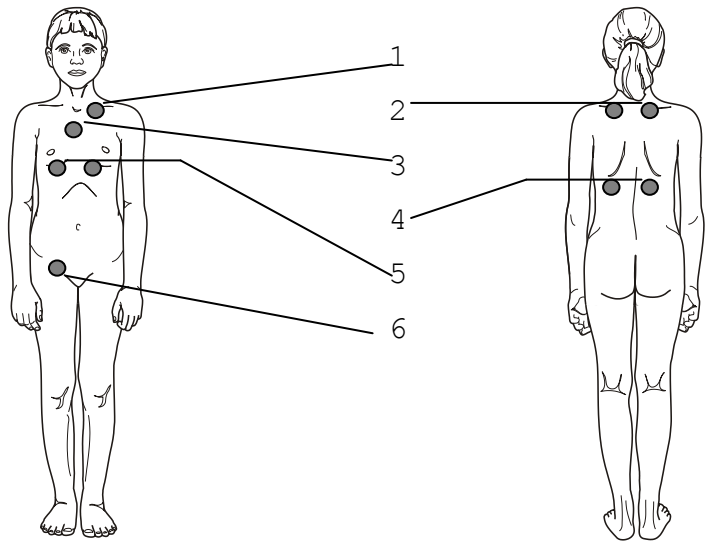


Fig. 37. Zones of MIL-irradiation in treating allergic dermatosis

MIL-irradiation (impulse frequency 10 Hz, LED radiation power 60 mWt) is performed on the thymus projection (zone 3) with exposure 0,5 min on each point, paravertebrally (zones 2) at CVII level for 15 seconds on each side. After that the area of left subclavicular vascular bundle (zone 1) and the area of the right inguinal femoral bundle (zone 6) are irradiated for 1 min; the projection of adrenal glands (zone 4) is irradiated for 0,5 min. Procedures are performed daily (6-7 for the course). In 2 weeks skin lesions are irradiated (2-4 zones for one procedure with exposure of 10-12 seconds on each zone). After a two- week break one more MIL-therapy course is performed.

Preliminary enterosorption therapy to eliminate endogenous intoxication (Polyphepan for external and internal treatment) makes MIL-therapy maximally effective.

7.15. **Otorhynolaryngological (ENT) pathology**

Rehabilitation after rhinosurgical interventions

Rhinosurgeries are quite frequently complicated with long lasting edema of the nasal mucous and dystrophic rhinitis with the formation of crusts, dryness in the nose.

MIL-therapy is performed intranasally via attachnments No.4 or No.5 (Fig. A Annex 1) daily (5-7 procedures). A lightguide is inserted into the nasal passage 2-5

mm deep; irradiation is stable, impulse frequency is 50 Hz, LED radiation power is 90 mWt, exposure into every nostril is 2 min.

In the majority of patients after the 3rd procedure there is a reduction of nasal cavity mucous edema, pain syndrome; nasal respiratory function and olfaction are restored. Complete epithelization of the injured tissues develops by the 5-7 day; mucous membrane have normal humidity and colour. Duration of treatment is reduced by 2-3 days on the average comparing to traditional treatment.

Maxillary sinusitis (sinusitis)

MIL-therapy is performed only if there is a passage for secretion discharge from the cavity (natural or postoperative). To form a natural discharge vasoconstrictive drops, anemization with 0,1% adrenaline hydrochloride solution and others are prescribed. In 95% of cases the developed acute process may be controlled without puncturing the maxillary sinus.

The terminal is applied (Fig. 38) on the mastoid processes (zones 2) with 2 min. exposure, on the projection of Highmore cavity (zones 8) - 1-2 min, on the barbate process of the 3rd neck vertebrae (zone 5)- 1 min, on the thymus projection (zone 11) - 1 min. Impulse frequency is 50 Hz, LED radiation power is 80 mWt. 7-8 daily procedures for the course; the course may be repeated in 2 weeks (7-8 procedures but every other day).

Duration of treatment is reduced by almost one third in comparison to the conventional therapy.

Tonsillitis, laryngotracheitis, pharyngotracheitis

MIL-therapy is added to basic curative manipulations (lavement, mucous ointment). The terminal is applied (Fig. 38) on the submandibular zones (4) under the angles of lower jaw (exposure 1-2 min on each zone), on the area of fossa jugularis (zone 10) with exposure of 1 min, on the vocal chords projection (zone 6) (1 min), on the thymus projection (zone 11) (exposure for 1 min), on the barbate process of the third neck vertebrae (zone 5) - 1 min, bilaterally on the barbate process of the seventh neck vertebrae (zone 7) for 1 min on one zone.

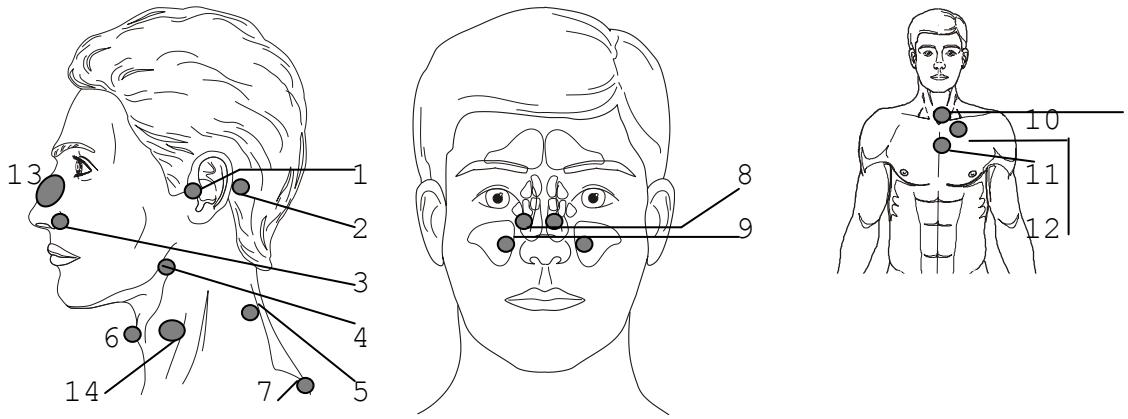


Fig. 38. Zones for MIL-irradiation in treating otolarhynlaryngological (ENT) disorders

Impulse frequency is changed every day in the following order: 50 Hz, 150 Hz, 600 Hz, 150Hz, during the last two procedures - 80 Hz. MIL-therapy course consists of 7-8 daily procedures. Duration of treatment is reduced by 20-30%. In six months a new MIL-therapy course is recommended to prevent recurrences.

Rhinitis (catarrhal, purulent, vasomotor, exacerbation of chronic atrophic rhinitis)

The terminal is put (Fig. 38) on the bridge of the nose (zone 13) (exposure 1 min.), on the submandibular zones (zones 4) below the lower jaw angle (exposure for 1-2 min on one zone), on the thymus projection (zone 11) (exposure 1 min.), on the barbate process of the third neck vertebrae (zone 5), (exposure 1 min.), bilaterally on the points of barbate process at the seventh neck vertebrae (zone 7)(exposure 1 min.). Impulse frequency is 50 Hz during the first three procedures, later - 80 Hz; LED radiation power is 70 mWt. MIL-therapy course consists of 8-10 daily procedures. Drugs are not applied in many cases.

Attachments No.4,5,6 are used for the direct irradiation of nasal mucous (Fig. A, Annex 1) .

Symptoms of acute rhinitis are controlled after the 3th-4th procedure. In 20% of patients their local status remains unchanged during MIL-treatment, but subjectively all patients note a marked improvement. Thus, therapeutical effectiveness of this method goes up to 80%.

Adenoid vegetations, stages II-III

MIL-therapy is performed daily (the course consists of 7-8 procedures). Irradiation is done intranasally (for 1 min on each half of the nose), endoorally close to the front teeth, without the attachement (for 1 min), under the lower jaw anteriorly to the jaw angle (Fig. 38, zone 4) - bilaterally for 1 min each side and on the thymus projection (zone 11) during 0,5 min. Frequency is 80 Hz, LED radiation power is 40 mWt.

The second MIL-therapy course is repeated in 2-3 months, the 3rd course is performed in 6 months. Adenoid vegetations become reduced up to the dimensions of the first stage; nasal respiration is restored practically in all patients. In the majority of cases no recurrences are observed.

Chronic purulent middle otitis

The terminal is applied (Fig. 38) on the area of external acoustic canal (zone 1), on the mastoid process (zone 2), under the angle of lower jaw (zone 4) located at the same side with the diseased ear, exposure 1-2 min on each zone. After that the area of barbate process of the third neck vertebrae (zone 5) is irradiated during 1 min. Impulse frequency is 50 Hz, LED radiation power is 70 mWt. To deliver IR radiation from the terminal directly to the lesion one can use the reflexotherapeutical attachment (No.6) inserted (very carefully) into to the ear through the auricle.

The course of treatment consists of 7-8 daily procedures. After 2-4 procedures pain and itching disappear, otorrhea significantly decreases, a persistent remission develops. In 3 weeks a repeated course of MIL-therapy is recommended (7-8 procedures every other day under the same scheme).

Menier disorder, neurosensor hearing disorder

In the majority of patients the activation of POL processes and depression of antioxidant blood system activity because of the presence of accompanying pathologies in the heart, lungs, kidneys and other organs are revealed.

MIL-irradiation is performed (Fig. 38) on the left subclavicular vascular bundle (zone 12) with exposure 2 min., frequency 5000 Hz, LED radiation power 60 mWt; then both inguinal vascular bundles (Fig.37, zone 6) are irradiated with frequency 1500 Hz and LED radiation power 90 mWt for 2 min on every bundle. 7-8 procedures for the course. MIL-therapy may be repeated in 6 months, if indicated.

Chronic cochleoneuritis

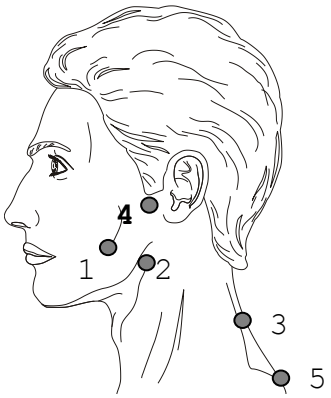
In cochleoneuritis (Fig. 38) the terminal is applied contactly on the mastoid process (zone 2). After that the area of external acoustic canal (zone 1) is irradiated for 2 min on each ear. Impulse frequency is changed every day (the course consists of 10 daily procedures) in the following order: 5, 10, 50, 150, 600, 1500, 5000, 600, 150 Hz; LED radiation power is constant during the whole course - 50-55 mWt. In 3 weeks the course is repeated under the same scheme. After 6 -month break MIL-therapy may be repeated, if indicated by the audiogram data.

While treating otorhynolaryngological (ENT) diseases the magnetic field and laser light interact with numerous types of tissues which have different density (bones, fascias, muscles, mucous, etc.) and consequently, highly different optophysical features. That is why biophotometrical control in treating ENT pathology is very important for correcting MIL-therapy approach and dosage (see Article 8).

7.16. **Stomatology**

Parodontitis, periostitis, stomatitis, enamel hyperstesia, postoperative and traumatic tissues injuries in the oral cavity

The terminal is applied (Fig. 39) on the cheek on the pathological focus projection (zone 1) and under the angle of lower jaw on the same side (zone 2); exposure 2 min on one point. Then the barbate process of the third neck vertebrae (zone 3) is irradiated for 1 min. After placing the terminal close to the front teeth (the patient's mouth is opened) the oral cavity is irradiated through one-layer sterile gauze during 1 min. Impulse frequency is 50 Hz, LED radiation power is 90 mWt. The course of treatment consists of 7-8 daily procedures. After a two-week break the course of MIL-therapy is repeated (7-8 procedures every other day).



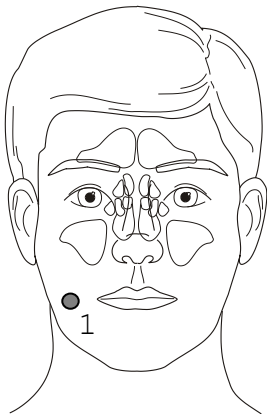


Fig. 39. Zones for MIL-irradiation in stomatology

Arthrosis of the temporo-mandibular joint

The terminal is applied (Fig. 39) on the joint (zone 4) and under the angle of lower jaw (zone 2) for 2 min on each zone. Then the barbate process of the third (zone 3) and seventh (zone 5) neck vertebra are irradiated transcutaneously for 1 min on each zone . Impulse frequency is 50 Hz, LED radiation power is 30 mWt. The course of treatment consists of 7-8 daily procedures. After a two-week break the course of MIL-therapy is repeated under the same scheme (7-8 procedures every other day).

8. BIOPHOTOMETRY USED FOR MEDICAL DIAGNOSTICS AND FOR DOSAGE VARIFICATION IN MIL-THERAPY

Application of LILR in clinical practice supposes an individual biophotometric control which allows to reach the most optimal dose in every patient as well as to objectively control laser therapy process, its effectiveness and duration. The absorbed dose defines laser therapeutic effect. That is why a reflection coefficient (absorption) at a fixed wavelength, in particular in the infrared range, may serve as an individual criterion to follow the dynamics of the pathological process resorption in MIL-therapy.

Transmission of LILR through biological tissues depends on their structure and functional state. Some part of LILR which effects biological tissues is reflected from its surface. LILR energy which enters tissues is dissipated many times and is absorbed by different biological structures. The amount of the energy absorbed by biotissues (Dabs) is equal to the difference between the incident light energy (Dinc) and the reflected one (Dref).

$$Dabs = Dinc - Dref = Dinc \cdot (1 - C\,ref)$$

where Cref - a coefficient of light reflection from the surface of skin and its deeper structures. This coefficient for human skin varies from 0,3 up to 0,6 on the average. That is why it has to be taken into consideration individually for every patient who is prescribed MIL-therapy. The performed investigations have shown that the reflection

of IR radiation in patients aged above 30 is 10-15% less, than in patients over 50. The coefficient of reflection depends on the intensity of skin pigmentation.

A special apparatus has been designed for defining C ref - biophotometer. It allows to estimate the amount of light reflected from the surface of a bioobject. IR-radiation photoreceptors are in-built in the body of the terminal in "MILTA-F" apparatus (see *Passport* with technical description). An inner cylindrical camera in the terminal where laser, LEDs and photodiodes are placed plays the role of integrating sphere. Thus, the in-built photoregistor serves as a mini-biophotometer with digital indication of the reflected amount of continuous IR radiation. The bottom of a special well for the terminal on the panel of the remote control in the apparatus "MILTA-F" type plays a role of the supporting ("standard") diffuse reflector. The IR-laser and LED radiation reflected from the supporting reflector or a bioobject is trapped by photo-diodes, increased and processed; then its values are shown on the display of the front panel as "REFLECTION LEVEL". "00" indicates the absence of radiation.

The described device may be used to measure the reflection coefficient in biological tissues, bandages, skin, surface of ulcers, burns and other lesions on biological tissues. Values of "REFLECTION LEVEL" on the display allow to constantly control the presence of invisible (for human eyes) IR light at any moment during MIL- procedure. Photoregistor output data does not practically depend on curved and longitudinal-transverse movements of the terminal.

Before reading photoregistor data with curative and diagnostic purposes it is recommended to perform a seria of consecutive biophotometrical measurements to find out the differences (variation) in digital indicator data while performing some likewise measurements (for instance, to press the terminal to tissues with different degree of compression, etc.). It is recommended to fix, to collect and to systemise all the data received during these measurements in a special form. The presence of this or that pathology is defined both by standard diagnostic methods and by the results of photometric measurements. Deviations from normal biophotometrical data exceeding the variation indicator data by two times and more indicate the presence of a pathology in the investigated region. Normal photoregistor data are those data which are obtained during the irradiation of patient's skin on the contralateral area. If the difference in the photoregistor data obtained after measuring a diseased focus is 6-7

units more that those in the symmetrical (healthy) area, a physician may be sure that there is a focus of pathological process there.

It has been found out that during MIL-therapy changes of optical parameters in treated tissues take place from one procedure to the next one; so, if a physician is quite experience, he may evaluate the course of pathological process, predict possible complications and control the effectiveness of the performed treatment as well as to correct exposure time and the number of procedures. Clinical and experimental investigations have shown that IR radiation reflection level at different conditions and diseases lies within the range from 40 relative units (RU) up to 70 RU. (Table 3). On the average this value is equal to 5 RU. In the average this value is $m_{av/bo}$= 55 RU.

Table 3

Characteristics of the irradiated object	**Photoregistor data**
Standard surface (white paper)	95
Healthy skin (normal)	60-70
Penetrating skin-muscular, postoperative wounds	40-50
Burnt surface	45-60
Hyperemia skin	50-60
Marked edema of soft tissues, edema of joints with bursitis	45-55
Trophic ulcers and unhealing wounds	30-40
Ischemia of tissues in vascular disorders of the extremities	50-55
Cicatricial tissue after wounds and operations	40-60
Mucous	25-35
Heary surfaces	25-35

Calculations for photodiodes placed inside the camera (apparatus "MILTA-F") are given in the first edition of Instructions and in authors' works (see List of Literature).

Some modifications of "Milta-F-8-01" have widened diagnostical possibilities (in comparison to "Milta-F") due to the placement of additional photo diodes outside the irradiation camera in the magnet apertures (this intervention is protected by

Russian patent). IR-signals basically reflected from the inner deep layers of biological objects reach these photodiodes. In congested hyperemia or edema tissue reflection decreases (because more IR radiation is absorbed); in case of ischemia of deep structures, spasms of the vessels - visa versa. A very valuable diagnostic information may be received while comparing photoregistor data obtained from the external photodiodes with the data obtained from the photodiodes placed inside the terminal camera (a button on the terminal allows to change the regime of measurements - either only internal or only external photodiodes). Currently, investigations are being conducted to interpret these comparative photoregistor data more precisely.

Accuracy and reproducibility of digital indications are quite sufficient parameters to have a qualitative evaluation of irradiation doses and doses for comparison. The univocacy of the correlation between the in-built photoregistor data and the power of the reflected IR radiation (mWt but not RU) makes it possible to use this photoregistor as an indicator which gives the information qualitatively and, to some extent, quantitatively about tissue reaction to the combined MIL-irradiation just during the curative procedure.

Example. Biophotometry in chronic bronchitis (the inner photodiodes are used).

Values of reflection coefficient Cref (CR) were determined above the registration fields (Fig.40) I and II (projections of the main bronchi - paravertebral zones of the interscapula area at ThIII- ThVI level) and III, IV (supra shoulders - Krenigue fields). An arithmetic mean index for the values of two symmetrical fields is written as CR-1 (fields I and II) and as CR-2 (fields III and IV). These values were taken from healthy individuals (norms) and in patients with chronic bronchitis during MIL-therapy (daily). Changes in CR show the dynamics of lung tissue pathology in patients.

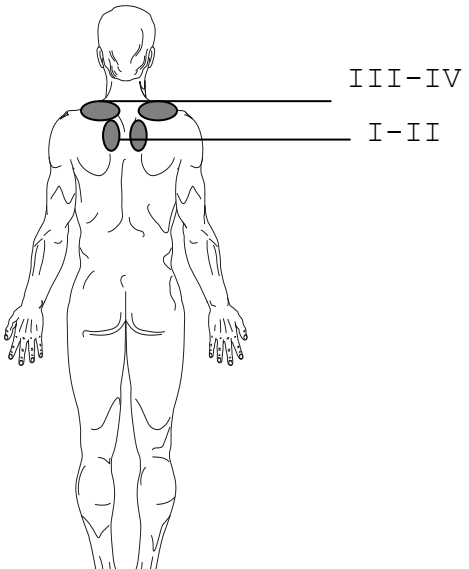


Fig. 40. Fields of CR values registration.

It is shown that CR-1 predominatingly reflects an inflammatory process and, to less extent, bronchial obstruction. CR-2, visa versa, reflects bronchial obstruction and its severity rather than inflammation (Table 4, 5).

As it has been shown in studies CR values gradually increase by the 6-7th procedure and after that remain unchanged. It leads to a conclusion that MIL-therapy course in chronic bronchitis should not exceed 7-8 procedures in order to avoid side-effects.

Table 4

Dynamics of photoregistor data in patients with chronic non-obstructive bronchitis treated with MIL-therapy

Coefficient of reflection	Basic group (n=31)		Comparative group (n=8)		Norm
	Before treatment	After treatment	Before treatment	After treatment	
CR-1	51,99+-2,68	61,28+-2,38s	51,63+-3,96*	55,18+-4,19	62,35+-4,28
CR-2	57,72+-3,24	61,38+-3,47	56,91+-4,01	59,03+-4,12	63,35+-3,88

Table 5

Dynamics of photoregistor data in patients with chronic obstructive bronchitis treated with MIL-therapy

Coefficient of reflection	Basic group (n=45)		Comparative group (n=14)		Norm
	Before treatment	After treatment	Before treatment	After treatment	
CR-1	45,07+-2,17*	52,02+-2,21*s	44,18+-3,22*	49,21+-3,18*	62,35+-4,28
CR-2	48,56+-	56,78+-2,59s	49,28+-	52,34+-	63,35+-

	3,06*		3,37	3,61*	3,88

* - deviation from normal values is statistically significant

s - dynamics is statistically significant

Controls -patients treated with conventional therapy.

A simplified calculation of the energy absorbed by a patient during MIL-procedure with "MILTA-F-8-01"

A summarized energy (impulsed and continuous IR radiation) absorbed by a patient during MIL-procedure (an individual dose) is:

$Da = [1-(mbo/mab]\cdot[Pp+(Pip\cdot\tau i\cdot F)]\cdot te$

where,

Da -absorbed energy in J

mbo and mab - values on a photoregistor in "Milta-F-8-01" when the terminal is applied on a bioobject or put into the apparatus well. Before the procedure mab is tuned to 100 units (mWt).

Pp - LED radiation power (for "Milta-F-8-01" Pp= 100 mWt).

Pip -impulse power of laser radiation equal to about 4 Wt.

τi - is equal to about $150\cdot10^{-9}$ sec - duration of LILR impulse.

F (in Hz) - frequency of laser radiation impulse (5, 10, 50, 80, 150, 600, 1500, 5000 Hz).

te (in seconds, s) - summarized time of exposure for one procedure.

The following simplified formula to determine the absorbed energy may be recommended for practical application:

$$Da=(1-mbo/100)\cdot(0,1+0,6\cdot10^{-6}\cdot F)\cdot te=(1-mbo/100)\cdot D_{+},\ [J]$$

If the attachments are used, the irradiated energy is approximately:

$Da=(1-a)\cdot(1- m_{\tau h}/m_{ab})\cdot D_{+},\ [J]$, where *a* approximately equals 0,35 -a total coefficient of losses for attachments, $m_{\tau h}$ - photoregistor values for the inserted attachment, m_{ab} =100 - photoregistor data when the terminal is placed into the apparatus well, D_{+} - a summarized energy of irradiation [J] during MIL- procedure.

CONCLUSION

MIL-therapy is an optimal curative method determined by three preformed physical factors parameters and combinations of which are scientifically grounded and proved by a large number of experimental and clinical investigations. Apparatus “MILTA-F” is safe both for a patient and for a physician, as it has been proven by long term investigations of domestic and foreign scientists.

Due to the subcellular and cellular effects MIL-therapy is practically universal for the majority of diseases and, plays a fundamental role in their complex therapy. It allows to significantly reduce expenditures for medicines (sensitivity of the organism to which is significantly increased with MIL-therapy), to improve the effectiveness of sanogenetic processes in the organism and to reduce the terms of treatment. The efficiency of complex treatment with MIL-therapy reaches 83-92% in some cases. With biophotometor of a new type apparatus “MILTA-F-8-01” has raised to such curative and diagnostic level which meets all the requirements of modern practical healthcare service. But, at the same time, a physician is expected to widen his knowledge and to have a creative approach to work.

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CONTENTS

INTRODUCTION
1.MECHANISMS OF BIOLOGIC AND THERAPEUTIC EFFECTS OF INFRARED RADIATION FROM LASERS AND LEDS
2. MECHANISMS OF BIOLOGIC AND CURATIVE EFFECTS OF THE CONSTANT MAGNETIC FIELD. MAGNETIC-LASER THERAPY.
3. MAIN AREAS FOR THE APPLICATION OF IRRADIATION FROM APPARATUSES OF "MILTA-F" TYPE
4.TECHNICAL PARAMETERS OF THE APPARATUSES OF "MILTA-F" TYPE
5. SAFETY MEASURES
6. WORK GUIDELINES
7. COMMON PRINCIPLES OF THERAPEUTIC METHODS FOR MIL-THERAPY.
7.1.Surgical disorders
7.2.Acute thrombophlebitis of the extremities
7.3.Traumatic injuries of long tubular bones, tendons, muscles
7.4 Disorders of bones and joints of metabolic and inflammatory etiology
7.5.Disorders of the nervous system. Psychoneurology.
7.6 Atherosclerotic injuries of arteries in the lower extremities
7.7 Diseases of the gastro-intestinal tract
7.8.Cardio-vascular pathology
7.9 Inflammatory diseases in the bronchi and lungs
7.10.Gynecologic disorders
7.11.Urology
7.12.Endocrine disorders
7.13.Chronic anemias
7.14.Dermatological disorders
7.15 Otorhynolaryngological (ENT) pathology
7.16.Stomatology
8. BIOPHOTOMETRY USED FOR MEDICAL DIAGNOSTICS AND FOR DOSAGE VARIFICATION IN MIL-THERAPY
9. CONCLUSION
Recommended literature
CONTENTS

Annex 1

Attachment 1 for treating diseases of the uterine cervix

Attachment 2 for treating the vagina

Attachment 3 for treating the vagina and rectum

Attachment 4 with a rubber bush for otorhynolaryngology

Attachment 5 for the application in stomatology

Attachment 6 for laser reflexotherapy

A. **Lightguide attachments for the apparatus "MILTA-F" type.**

B. **A bracket with the terminal holder**

Annex 2

Distribution of values of magnetic induction B vector under the magnet radius r (1) and in case of its ranging from the magnet platitude along its axis l (2).

Annex 3

SIGN OF LASER SAFETY
(GOST 12.4.026-76, “SBBT. Signal colours and safety signs”)

Yellow
Black
Yellow
CARE! LASER RADIATION!