

**Osteomyelitis (ICD-10 code: M86)** is an inflammatory infectious process in bones. The basis of the disease is necrosis of bone areas with various thickness followed by suppuration, formation of fistula and slow sequestration.

Laser therapy is first of all aimed at stimulating the immune processes, and at eliminating the inflammatory and septic phenomena in the affected area.

The tactics of osteomyelitis therapy is determined by the level at which medical assistance is provided. In clinical conditions, direct exposure of the suppurative focus to intraosseous transcutaneous irradiation using infrared LLLT is allowed, or, in presence of a fistulous tract, to intrafistular irradiation using a KIVL-01 disposable nozzle. In this case, an AT-ILBI-P emitter is used. For correct introduction of the distal end of KIVL, a catheter of adequate diameter is used. Direct laser irradiation of the osteomyelitis focus requires "mitigation" with antibacterial drugs.

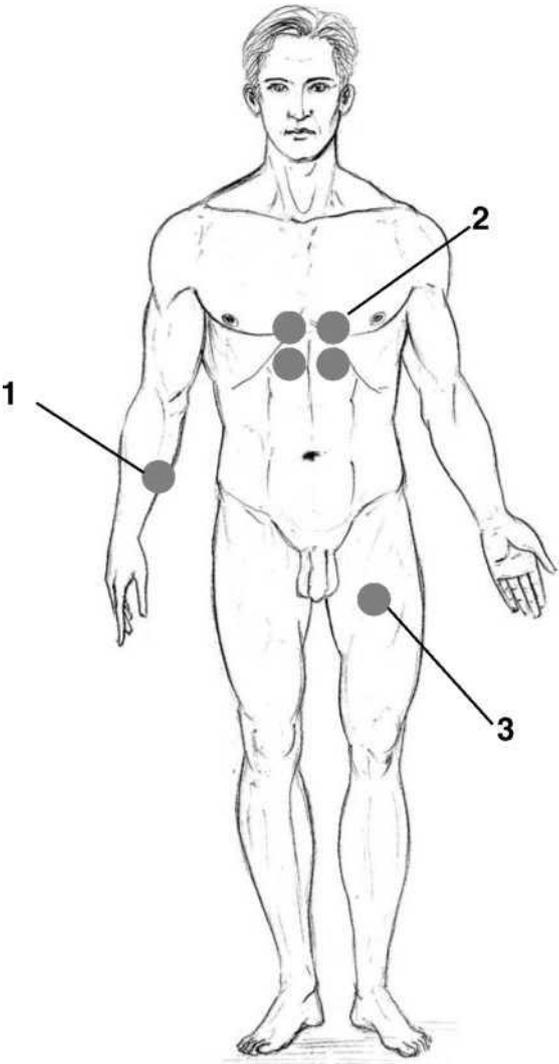
In the outpatient conditions, the focus of the degenerative disk disease is not exposed to irradiation directly, and treatment is aimed at increasing the immune activity through ILBI (intravenous laser blood irradiation) or TLBI (transcutaneous laser blood irradiation) in the projection of ulnar vessels, influencing the neurovascular fascicles corresponding to the affected area, and at irradiating the area of thymus. The laser therapy procedures are recommended to be performed under the supervision of the "Dialaz" hardware and software system in order to accurately determine the dose rates that have direct influence on the quality of the immunomodulatory reactions.

Table 18

**Modes of irradiating the areas of therapy in treatment of osteomyelitis**

Irradiation area	Terminal	Frequency, Hz	LEDs Power, mW (laser, mW)	Nozzle	Exposition, min
Suppurative focus, percutaneous irradiation	DT3	5,000	0	No. 7	3—6
Ulnar vessels TLBI	KT1	1,500	20	No. 7	2—4
Neurovascular fascicle	OT1	150	20	No. 7/MN	2—4
Thymus projection	OT1-2	80—150	0—20	No. 7/MN	2—4
Intrafistular irradiation	AT-ILBI-P	—	15	KIVL-01	4—8
ILBI	AT-ILBI-P	—	5	KIVL-01	10—15

The overall duration of protracted treatment should not exceed 14-16 procedures. Repeated laser therapy is required after 3-5 weeks. Repeated treatment is also required according to individual schedules.



**Fig. 36**

**Projection areas for osteomyelitis treatment**

Legend: pos. "1" — ulnar neurovascular fascicles, pos. "2" — thymus projection area, pos. "3" — projection of the femoral neurovascular fascicle.

**Traumatic injury of ligaments (ICD-10 code: M66.4)** is a ligaments trauma resulting from excessive hyperextension with excessive axial or angled load.

Laser therapy is required for accelerating the regenerative processes, eliminating inflammatory and microcirculatory disorders in the affected area.

Especially relevant is the use of LLLT factors in ligaments treatment, due to the anatomically determined deficiency in their blood supply, resulting in significantly reduced regeneration of damaged ligaments, as compared to similar indicators in other tissues with better blood supply.

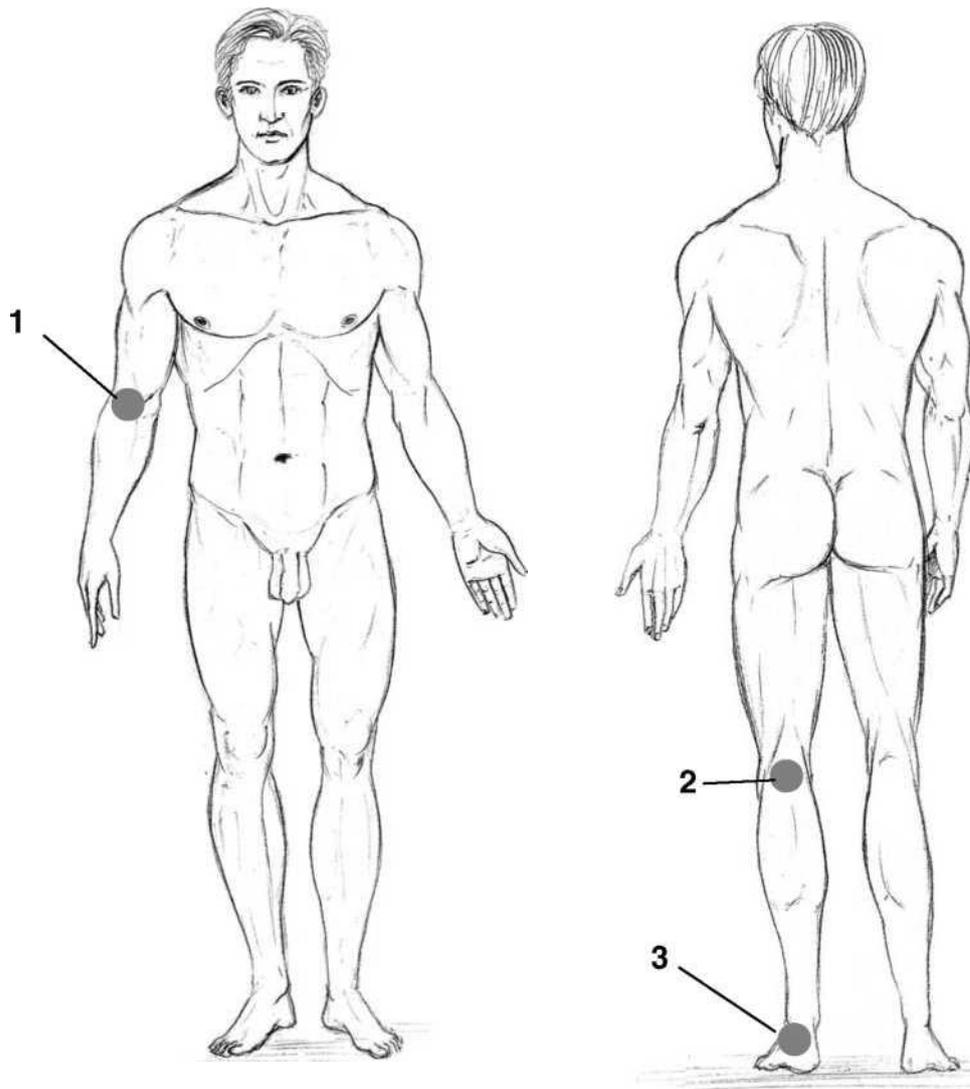
The therapy is performed by regular irradiation of the damaged area. For the purpose of potentiating the effects in the area of direct laser irradiation of the affected area, the neurovascular fascicles corresponding to the affected area are irradiated, as well as transcutaneous blood irradiation in the projection of the chelidon for improving overall energy rating of the organism.

Table 58

**The modes of irradiation of the treated areas in case of traumatic ligaments damage**

Irradiation area	Terminal	Frequency, Hz	LEDs power, mW	Nozzle	Exposition, min
The damaged ligament area	OT1-2	1,500—5,000	20	No. 7/MN	3—9
Neurovascular fascicle	OT1	300—600	20	No. 7	2
Ulnar vessels TLBI	KT1	1,500	30	No. 7	4—6

Duration of the laser therapy course is up to 14 procedures. Repeated treatment course of the same duration is allowed after 2-3 weeks.



**Fig. 69**

**An example of selecting the exposure areas in case of ligament injury**

Legend: pos. "1" — ulnar vessels projection, pos. "2" — projection of the popliteal neurovascular fascicle, pos. "3" — projection of the trauma area.

**Fracture (ICD-10 code: T02)** is a disruption of bone anatomical integrity due to a traumatic injury.

The tasks of laser therapy include elimination of inflammation, swelling and pain in the trauma area, speeding up the reparative processes and, in the final stages of treatment, optimization of fracture consolidation.

The main area of influence is the area of the fracture. In this case, irradiation should be performed through a window specially made in the plaster cast. The fracture area may be irradiated through the plaster cast with the use of lasers emitting in the infrared spectrum. In this case, the maximum power should be used.

Table 60

**The fracture area radiation modes**

Irradiation area	Terminal	Frequency, Hz	Power of LEDs,	Nozzle	Exposition, min
The fracture area through the window in the plaster cast	OT2-4	150	50	Nos. 5, 7, 12	7—12
The fracture area through the plaster cast	OT4	5,000	50	MN	7—12

During the recovery period, after the plaster cast is removed, the area of the fracture may be exposed to irradiation in order to re-consolidate the callus (in case of a massive callus).

In the absence of deviations in the area of consolidated the fracture, it is recommended to perform a short (5-7 sessions) treatment course for the muscle groups of the affected limb in order to speed up its restitution.

Table 61

**Radiation modes in rehabilitation period**

Irradiation area	Terminal	Frequency, Hz	LEDs power, mW	Nozzle	Exposition, min
Callus in the fracture area	OT2-4	150	50	No. 7/MN	4—10
Muscles of the affected limb	OT1-2	300	30	No. 7/MN	4—8

**Degenerative disc disease of the spine (ICD-10 code: M42)** is a disease characterized by the reduction in the size and density of the intervertebral disc due to degenerative processes. Degenerative disc disease results in development of osteoarthritis in zygapophysial joints of the spine, and in the risk of developing hernias in the disk.

Laser therapy is performed in order to improve local blood circulation, activate anti-inflammatory, antiedematous and analgesic action (in case of a moderate pain syndrome).

The degenerative disc disease is treated in two main ways: the method of anti-inflammatory laser therapy during the acute phase of the disease, and the method of intervertebral disc structure restitution during the period outside exacerbation of the basic process.

Anti-inflammatory laser therapy is most effective when pulsed infrared lasers are used, and it is performed by irradiating the problem areas with covering healthy tissues within the upper and lower segment with the use of available terminal according to the following pattern: frequency 600-1,500 Hz, exposure 0.5—3 minutes on the same area. The LED radiation power is 30 mW.

In the initial period, higher values of laser irradiation parameters are used; with reduction of inflammation, swelling of soft tissues and appearance of the pain syndrome, the power and frequency are reduced. The duration of a therapy course is 6 to 14 procedures.

The method of intervertebral disc structure restitution is to be performed in the non-acute period by the method of pharmaceutical and laser therapy, which consists in performing laser phoresis of chondroprotective preparations in the area of affected disks.

Chondroprotective preparations may be preparations based on ointments (chondroxede, chondroitinakos, chonda) or water (aphlutop, chondrolon).

The chondroprotective preparations used in clinical conditions have poor effectiveness due to several reasons: on the one hand, there is a poor blood flow to the gristle, and on the other hand, the high-molecular-weight chondroitin sulphate hinders reaching the therapeutic concentration of the medication in the pathologically modified area of the intervertebral gristle.

The listed above disadvantages of medical treatment are compensated for in case of pharmaco-laser therapy due to restoring microcirculatory hemodynamics in the area of the cartilage and due to improving the transportation of macromolecular chondroitin sulfate through the skin barrier due to laser phoresis of chondroprotective drugs. Besides, the increasing of the energy rating of tissues (and of the entire organism) is also aimed at ensuring metabolic effects of chondroitin sulphate pharmacokinetics in the area of the affected disc.

Disks rehabilitation therapy is to be performed according to the following procedure: immediately before the procedure, a thin layer of the medication is applied at the level of the affected disks, followed by irradiation with the use of any IR terminal as follows: frequency 150-600 Hz, exposure of each area - 0.5 to 4 minutes. The power of LED radiation is to be up to 50-80 mW (depending on the section of the spine); the power of the laser source is to be not less than 6 to 8 W. There is no conceptual difference in choosing a terminal. Preference is only given to the infrared laser sources due to good penetration capacity of the wavelengths of this spectral range.

The duration of the laser therapy course is up to 12 procedures. Laser restitution of intervertebral discs should be performed regularly; course therapy is to be performed at least quarterly. Efficiency of complex treatment should be monitored on the basis of general x-ray examinations of the spine.

The final x-ray examination of the spine is performed upon completion of the second therapy course.

### **Increasing physical working capacity in athletes**

Sporting achievements in various sports are primarily due to physical ability of an athlete, which is, in turn, primarily determined by the aerobic capacity of the organism's cellular systems. As is well known, every functional activity of the organism, including work of the muscles, is related to consuming energy resources. The level of the energy available for the organism in this case plays the role of a functional activity regulator for various physiological processes, including muscular activity. In the moment of intense physical activity, the organism is able to "deactivate" less important organs (those of reproductive and digestive systems), however, together with muscular work, several other physiological processes are ongoing that are aimed at ensuring the vital functions of the organism. Therefore, good energy supply to the organism is the determining factor for reaching high results in various sports that require power and motor efforts from the athlete. The use of LLLT methods for increasing physical (and athletic) ability is based on increasing the intensity of energy metabolism at the cellular level with a consequent increase in the functional abilities of organs and systems, and in improving the microcirculatory hemodynamics in biological tissues and hemorheological parameters.

The schedule of tactical activities includes influencing the region of the parasympathetic ganglia, cervical vertebrae, collar area, and intravenous or extravascular irradiation of blood vessels in the chelidon area. The latter area is the basic one, since the principle of the maximum energizing of the organism is implemented when it is irradiated directly.

The positive effect is guaranteed if the optimal LLLT dose is received by the organism of the athlete. The best way of receiving the optimum radiation dose is the use of photoplethysmographic monitoring (based on the "Dialaz" hardware and software complex).

For achieving the conditions that contribute to better workability of the organism, the basic option with moderate reactivation of ergothropic activity is chosen during the last two procedures of laser therapy.

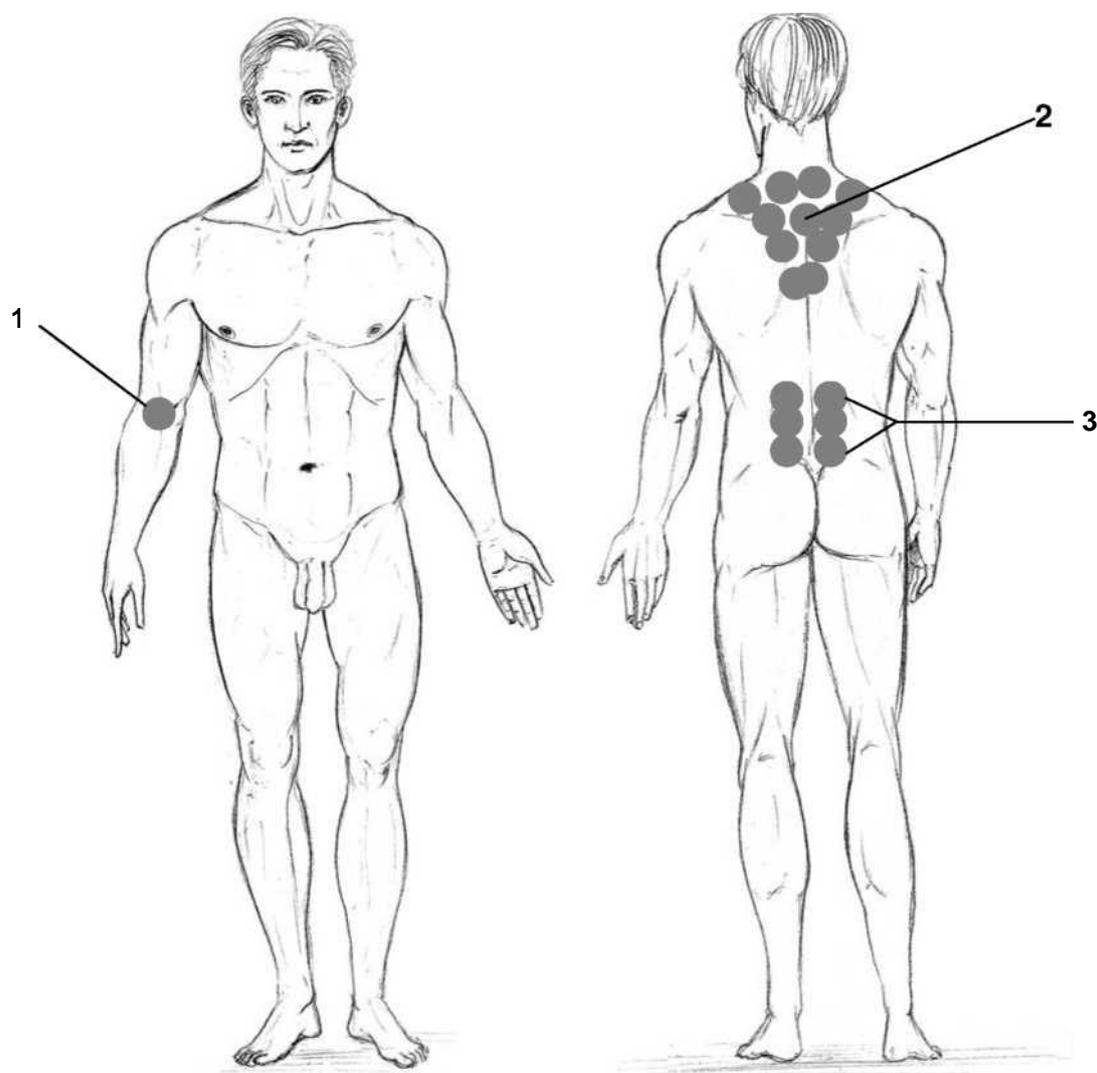
Table 64.

**The modes of irradiating areas for increasing workability in athletes**

Irradiation area	Terminal	Frequency, Hz	LEDs power, mW	Nozzle	Exposition, min
Ulnar vessels TLBI	KT1	1,500	30	No. 7	4—6
Spine, L1—L5	MT	300—600	40—50 (50—60)	BN	3—4
Collar area	MT	150	30—40 (30)	BN	4—6

Rehabilitation after sports-related and psychoemotional sports-related loads is performed according to the same criteria, in accordance with the adaptive state defined by the diagnostic parameters of the monitoring photoplethysmography with the use of the "Dialaz" software and hardware complex.

The duration of the procedure and the treatment course is generally determined by the parameters of the photoplethysmographic research.



**Fig. 71**

**The areas of influence for the purpose of improving athletic workability in athletes**

Legend: pos. "1" — ulnar vessels, pos. "2" — collar area, pos. "3" — projection L1 to L5.



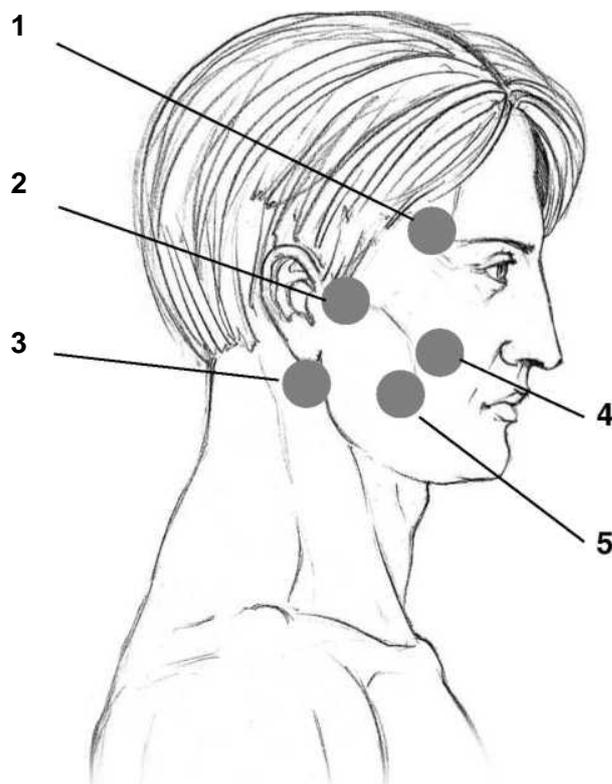
**Neuralgia** is a pronounced syndrome of inflammation and swelling in a peripheral nerve. The pain is clinically manifested along the nerve; the pain is paroxysmal, of sharp, aching, burning or dull nature. The reason for this suffering can be both inflammation of the nerve or nerve plexus, and spinal diseases, or pathological changes in the tissues around the nerve trunk. In this case, neurological symptoms are determined by development of the repetitive stress injury.

Laser therapy for this group of diseases is aimed at relieving swelling and inflammation of the affected nerve, or at eliminating the causes that determine the repetitive stress injury.

**Trifacial neuralgia (ICD-10 code: G50.0)** is manifested by the paroxysmal pain syndrome along its branches and in the areas of innervation: in the cheeks, the upper or the lower jaw and in the temporal region.

Therapeutic measures include irradiating the nerve exit areas on the affected side, influencing the areas of the highest pain sensitivity, and irradiation of the projection area of the upper sympathetic ganglia (Fig. 169).

The mode of irradiating the trifacial nerve exit area is determined by the nature of the pain syndrome: in case of expressed pain syndrome, the frequency is 600-1500 Hz, if pain severity is lower, the frequency is in the range between 50 and 150 Hz.



**Fig. 169**

**The specific effect areas in treating trifacial neuralgia**

Legend: pos. "1" — projection of the first branch of the trifacial nerve, pos. "2" — pretragal area, pos. "3" — projection of the top sympathetic ganglion, pos. "4" — projection of the 2-nd branch, pos. "5" — projection of the third branch of the trifacial nerve.

**The modes of radiating the influence areas in treating the trifacial neuralgia**

293Irradiation area	Terminal	Frequency, Hz	LEDs Power, mW (lasers, W)	Nozzle	Exposition, min
Trifacial nerve exit areas, acute period	KT1	600—1,500	50	No. 7/MN	2—12
Trifacial nerve exit areas, subacute period and residual effects	KT1	50—150	30	No. 7/MN	2—12
The upper sympathetic ganglion	KT1	150—300	40	No. 7/MN	4
Receptor area	MT	150—300	40 (30)	BN	4

Further, with pain management, the procedure includes irradiation of the receptor zone positioned on the outer side of the forearm.

The duration of a course of laser therapy is 10 to 12 procedures.

**Facial nerve neuritis (ICD-10 code: 051)**

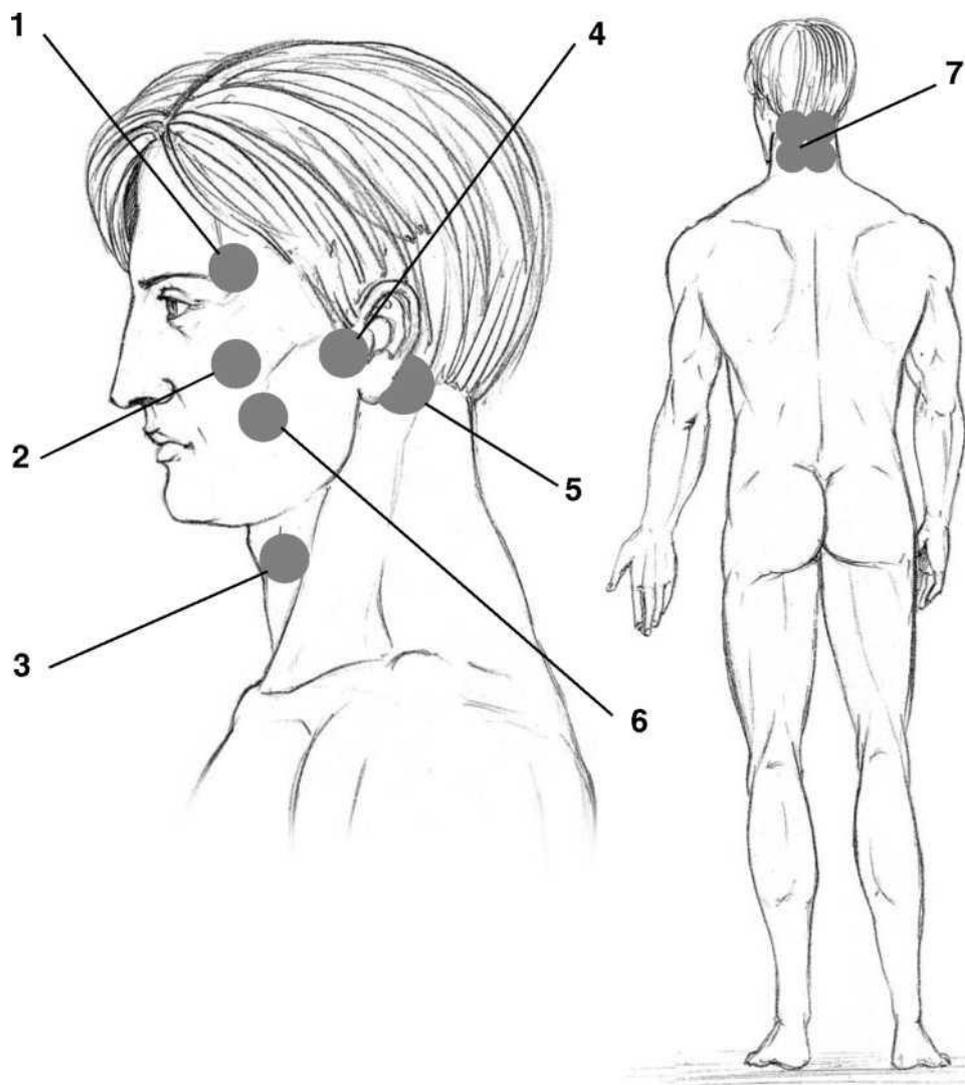
The plan of therapeutic activities includes transcutaneous irradiation of the area of facial nerve exit from the skull, affecting the area of the pterygopalatine fossa and the projection areas of nerve branching on the face, affecting the cervical and stellate sympathetic ganglia on the healthy and diseased sides, in the projection of the area of carotid artery on the affected side.

Extravasal irradiation of blood vessels is performed in the projection of the chelidon, the carotid artery on the affected side, and the area of the sympathetic ganglia at the level of the cervical vertebrae.

Table 190

**The modes of radiating the influence areas in treating the facial nerve neuritis**

Irradiation area	Terminal	Frequency, Hz	LEDs Power, mW (lasers, W)	Nozzle	Exposition, min
Facial nerve exit area	KT1-2	50—150	50	No. 7/MN	2—8
Projection of the pterygopalatine ganglion	KT1-2	50—150	50	No. 7/MN	2—4
Palsy muscles	OT1-2	150—300	50	No. 7/MN	4—6
The carotid artery on the affected side	KT1	1,500	30	No. 7	4
Cervical vertebrae	MT	150—300	40 (20—25)	BN	2—4



**Fig. 171**

**Irradiation areas in treating the facial nerve neuritis**

Legend: pos. "1" is the upper branch of the facial nerve, pos. "2" is the middle branch, pos. "3" is the projection of the carotid artery, pos. "4" is the area of facial nerve exit to the skull, pos. "5" is the projection of the pterygopalatine ganglion, pos. "6" is the lower branch of the facial nerve, and pos. "7" is the projection of the cervical sympathetic ganglia.

The overall duration of protracted therapy is 7 to 10 procedures. Repeated courses of therapy are performed after 3 to 6 weeks.

Neuritis of the sciatic nerve (ICD-10 code: G57.0)

The main influence area is positioned along the affected nerve. The area is irradiated with the use of scanning method along the rear and lateral surfaces of the thighbone and the shinbone.

Additionally, the following is performed: affecting the receptor area of the sciatic nerve along the front surface of the shin-bone and the rear side of the thighbone with the covering of the popliteal space, irradiation of the femoral and popliteal neurovascular fascicles, and affecting the area of segmental innervation of the nerve at level L1—L5.

Table 195

**The modes of irradiating the therapeutic areas in treating the sciatic nerve neuritis**

Irradiation area	Terminal	Frequency, Hz	LEDs Power, mW (lasers, W)	Nozzle	Exposition, min
Spine, L1—L5	MT	300—600	40 (60)	BN	4—8
Projection of the sciatic nerve	OT3-4	600—5,000	50	No. 7/MN	6
Neurovascular fascicles	KT1	50—150	50	No. 7/MN	4—8
Receptor areas	MT	50—150	40 (30)	BN	4—6

The duration of protracted therapy is 12 to 14 procedures. Repeated therapy is mandatory after 3-4 weeks.

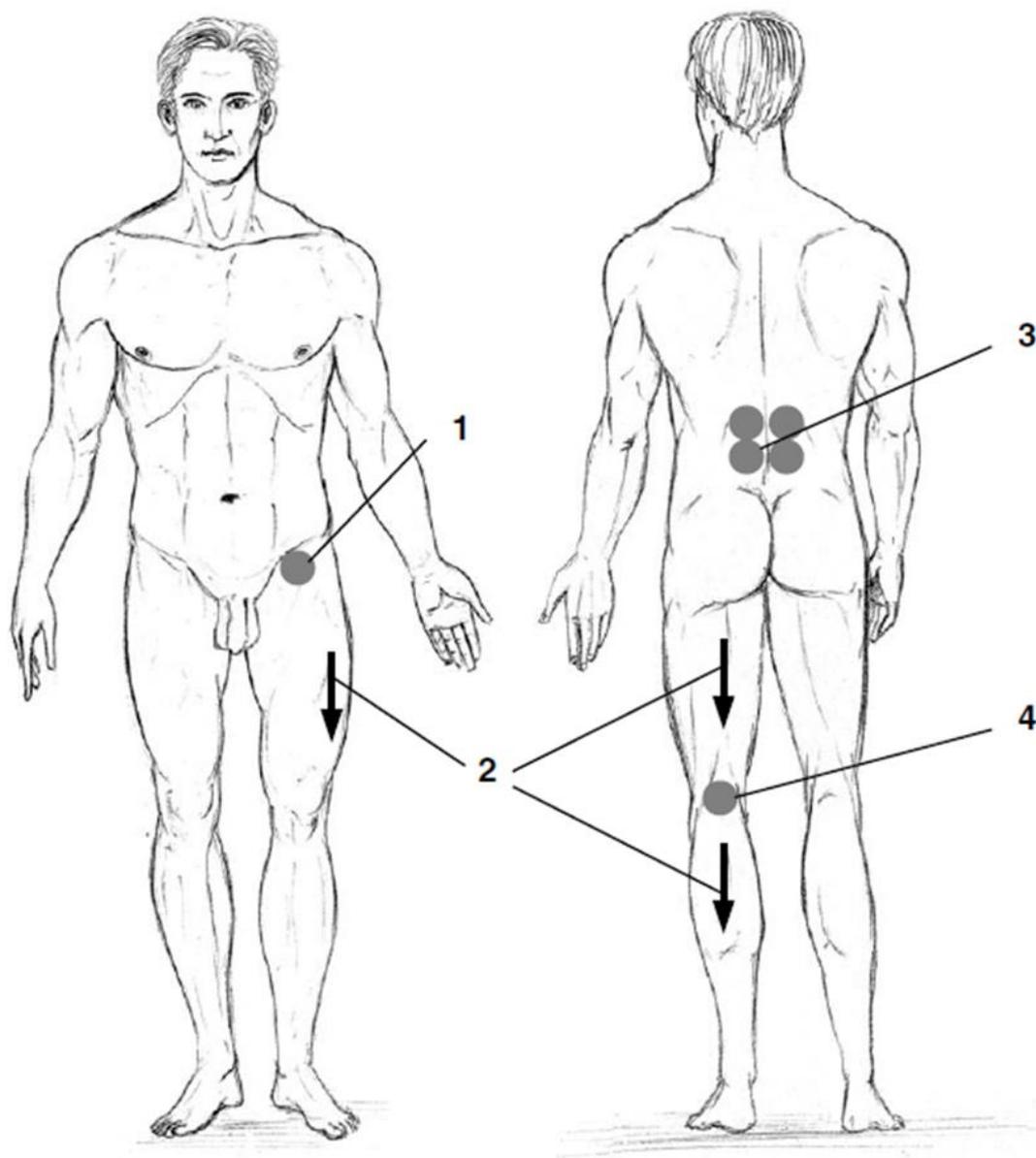


Fig. 176

**Positioning of the areas exposed to laser therapy of the sciatic nerve neuritis**

Legend: pos. "1" is the projection of the femoral neurovascular fascicle, pos. "2" is the position and the direction of nerve scanning, pos. "3" is the area of segmental innervation of the sciatic nerve, and pos. "4" is the popliteal neurovascular fascicle