

## EFFICIENCY OF LOW-INTENSITY LASER RADIATION IN ONCOLOGY EXPERIMENTAL AND CLINICAL RESEARCH

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Oncology is often placed first on a list of contradictions in studies devoted to low-level laser therapy (LLLT). This approach to oncological diseases is due to the fact that LLLT impact on malignant tumors still remains unclear. Scientists have been studying the problem since the late 1970s.

1. In vitro experiments showed that He-Ne laser irradiation of cells of Erlich's ascitic carcinoma encourages their growth (K. Moskalik et al., 1980).
2. Stimulation of growth was recorded when tumors in laboratory animals were irradiated with different types of LLLT. (Moskalik et al., 1981).
3. Stimulation of growth of Harding-Nassi's melanoma, adenocarcinoma 765 and sarcoma 37 was observed in case of their irradiation with He-Ne (633 nm wavelength) and pulse nitrogen laser (340 nm) (A. Ilyin, 1980, 1981, 1983; S. Pletnev 1980, 1985, 1987).
4. Stimulation of growth was recorded when benign mammary tumors in rats were irradiated with a He-Ne laser (N.I. Panina et al.).
5. Stimulation of growth and metastatic frequency of such tumors as Plyss's lymphosarcoma, B-16 melanoma, Erlich's ascitic carcinoma and Louis' adenocarcinoma of the lungs was recorded when they were irradiated with He-Ne laser (B. Zyrianov, 1998).
6. Stimulation of cell growth in some experiments and retardation in others were observed when cultivated malignant cells in humans (melanoma and tumors of the mammary and the colon) were irradiated with LLL radiation (480 nm and 640 nm wavelength). (T. Dasdia et al., 1988).
7. Similar results were produced when colonies of different malignant cells were irradiated with an argon laser or a dye laser pumped with the argon laser at power density of 8,5-5,- mW/cm<sup>2</sup> (Fu-Shou Yang et al., 1986).

At the same time there was proved the following:

1. Retardation of transplanted tumors' growth in case of irradiation with Cd-He laser (440 nm) at a total dose of 30 J. (A.I. Ilyina, 1982).
2. Inhibitive effect of He-Ne laser radiation on Louis's carcinoma cells is greater in case of earlier start and more duration of treatment course.
3. 37,5% reduction in tumor growth in rats with transplanted Walker's carcinoma and mice with mammary cancer (V.A. Mikhailov, 1991) as a result of semiconductor laser irradiation (890 nm) with a total dose of 0,46 J/cm<sup>2</sup>.
4. Inhibition of non-radically removed tumor growth when animals, that had been operated on for soft tissue sarcoma, are subjected to He-Ne laser irradiation.
5. Important transformations inside the original tumor, right up to total destruction of tumor's cells, were recorded in case of laser irradiation of blood. Metastases in the treated animals were of significantly smaller size as compared with control group of animals (N.F. Gamaleya, 1988).

We have cited the results of these experiments not without a purpose. What we mean to make clear is that LLLT must not be used on neoplasms in clinic. Its consequences may be unpredictable.

The principle of LLLT is as follows: as atoms of molecules absorb the power of light, they get excited with the resulting disruption of intermolecular interactions and the appearance of free ions. At the cellular level, this process manifests itself in changed activity of key enzymes responsible for cellular metabolism and in changed penetrability of cellular membranes. The reductive-oxidative enzymes are the most sensitive, followed by myeloperoxidase and by acidic and alkaline phosphatase. The transfer of electrons along the electronic transportation chain accelerates in mitochondria, the photo absorption of oxygen grows, and the "parasitogenic" breathing chains (failing to synthesize adenosine triphosphate /ATP/) are blocked. These mechanisms enable the cell to synthesize large amounts of ATP, and living processes receive better power supply.

Scientific research has described the biological effects of LLLT, which has important applications in medical practice because, unlikely high-intensity laser radiation, it causes no damage to organic tissues. In fact, LLLT has an antiinflammatory, immunocorrective and anesthetic effect. It helps healing of wounds and restoration of balance between nervous system components. The source of these diverse effects is the way of organism response to laser radiation.

Laser radiation is perceived by photoacceptors or, simply speaking, by sensitive molecules that are involved in the maintenance of balance within a cell, each human cell. Once laser radiation interacts with the sensitive molecule, energy metabolism in the cell goes up, enabling it to fully perform its functions and at a certain stage of development to divide and produce a healthy posterity.

The way in which low-intensity laser radiation is applied depends on the type and locality of the pathology. There are: 1) laser irradiation of blood. 2) external (transcutaneous) applications; 3) laser reflexotherapy (LLLT applied to acupuncture points; 4) intracavitary applications;

**Laser irradiation of the blood.** The Novosibirsk Research Institute of Blood Circulation Pathologies developed this method in the 1980s under the leadership of Academician E.N. Meshalkin and initially used it as intravascular laser irradiation of the blood (ILIB) (E.N. Meshalkin et al., 1981, I.M. Korochkin et al., 1984) The therapeutic effect of laser irradiation of blood is common for different pathologies (G.A. Gafarova et al., 1979) and is due to LLLT impact on metabolism. Laser radiation enhances the oxidation of energy materials – glucose, pyruvate and lactate, with the resulting improvement in microcirculation and utilization of oxygen in the tissues. Changes in the microcirculation system are due to vasodilatation and altered rheological properties of the blood owing to its lesser viscosity and a reduced aggregate activity of the erythrocytes. It has been recorded that with the fibrinogen level 25%-30% higher than the norm, it drops by 38%-51% following laser treatment, and when low before treatment, it rises by 100% (I.M. Korochkin et al., 1984, S.V. Moskvina et al., 2000). Laser irradiation of blood stimulates hemogenesis by way of increasing the amount of hemoglobin, erythrocytes and leukocytes (N.F. Gamaleyeva, 1981, N.F. Gamaleyeva et al., 1988). It stimulates the non-specific protection system by raising the functional and phagocytic activity of the lymphocytes. Interestingly, when blood lymphocytes are irradiated in cancer patients, T-cells are stimulated more than when such cells are irradiated in healthy persons (N.F. Gamaleyeva et al., 1986, K.I. Pagava, 1991). When the blood is treated with LLLT, T-system immunity is stimulated, with an increase in the helper and a decrease in the suppressor activity of T-lymphocytes, a normalized -lymphocyte count, a reduced cytoxin level, and a redressed immunoglobulin imbalance (E.N. Meshalkin, 1984, B.N. Zyrianov et al., 1998). The immunocorrective effect of laser irradiation of the blood is due to the increased production of the endrogenic immunomediator, interleukin-1 (IL-1), by the blood cells (E.B. Zhiburt et al., 1998). Studies at the Russian Oncological Scientific Center have confirmed these data. LLLT was applied to mononuclear cells (MNC) for 20 and 40 minutes. A subsequent analysis of MNC cytotoxicity revealed that 20-minute laser irradiation did not result in a proven increase of the killer properties of donor MNC. The donor MNC demonstrated an enhanced ability to

lyse K-562 tumor cells when exposure was extended to 40 minutes. In this case, the cytolytic MNC potential grew from an average of  $31 \pm 8\%$  to  $57 \pm 5\%$  ( $p < 0.05$ ).

**Table 1**

**Influence of laser radiation on cytotoxic activity (%) of MNC and capability of releasing the cytokins' energy (pg/ml)**

Parameter	Initial level	Exposure time	
		20 min	40 min
Cytotoxicity	31 8	38 12	57 5
Concentration			
IL-1	4,8 2,0	5,3 1,2	
6,4 2,1			
TNF	1,9 0,8	1,8 0,7	
3,8 0,2*			

\* $P < 0,05$

Laser radiation increases MNC capability to release IL-1 and TNF (tumor necrosis factor). In particular, at the exposure time of 20 min there is a tendency of increasing concentration of cytokins in MNC super-natanta in comparison with the initial level. Increase of exposition leads to more expressed capability of MNK donors to release IL-1 and PNO.

Therefore, LLLT activates the MNC of the donor blood, i.e. increases their cyto-toxic activity and makes the MNC capable of releasing the cytokins (IL-1 and TNF), which play an important role in shaping the body's immunity response (L.A. Durnov et al., 1999).

The presented research is performed with a help of the RIKTA apparatus at the frequency of 5000 Hz, exposition 5 min. The research will be continued because it is interesting to analyze the results at the frequencies of 50 Hz and 1000 Hz, exposition 2 min.

As laser equipment advanced, intravascular laser irradiation of the blood yielded its place to supravascular (transdermic) irradiation. Intravascular irradiation of the blood would be performed with low-power He-Ne lasers whose quartz-polymeric light guides would be replaced after each use. This was due to a certain technical problem – reaching out to the relatively deep-lying structures (including vessels) because laser radiation has a fairly low penetrating power. This depends on the wavelength (from 20 m in the violet part of the spectrum to 70 mm in the near infrared part), and in order to “get” deeper tissues the power of radiation has to be increased. Pulse lasers cope well with this job. In this respect, the Ga-As high-frequency pulse lasers have won the largest acclaim. With their flashes milliseconds each, they make it possible to irradiate deep-lying tissues at a power level that poses no risk to the surface structures. The state-of-the-art laser apparatus such as VITYAZ and RIKTA are fitted with special magnetic heads to maintain an optimally shaped static magnetic field (SMF). In addition to the therapeutic effect of magnetotherapy, SMF gives a certain orientation to molecular dipoles, aligning them along its power lines directed deep into the irradiated tissues. As a result, most of dipoles are spread along the light flow, thus increasing its penetration depth (V.E. Illarionov, 1989). V.A. Mostovnikov et al. (1981) attribute the high biological activity of the two physical factors to the fact that their influence on membranes and cell components involved in metabolic regulation leads to a restructuring of the special membrane structure and, as a consequence, of its regulatory functions.

Therapeutic effect of transcutaneous laser irradiation of the blood (TLIB) can be explained by the following factors:

1. Improved microcirculation: the aggregation of thrombocytes slows down, their flexibility increases, fibrinogen concentration in the plasma drops and fibronolytic activity grows, blood viscosity falls, the rheologic properties of the blood improve, and more oxygen is delivered to the tissues.

2. Ischemia of the tissues is reduced or eliminated. The cardiac discharge increases, total peripheral resistance goes down, coronary vessels dilate, and tolerance to loads increases.
3. The energy metabolism in the cells subjected to hypoxia or ischemia normalizes, and cellular homeostasis is maintained.
4. Anti-inflammatory effect is caused by the retarded discharge of histamine and other inflammatory mediators in obese cells; normalized penetrability of capillaries, and reduced edematous and pain syndromes.
5. Corrected immunity: an increased total level of T-lymphocytes and suppressor lymphocytes, an increased count of T-helpers in the absence of reduced levels of leukocytes in peripheral blood.
6. Influence on the processes of peroxide oxidation of lipids in the blood serum: reduced content of malonic dialdehyde, diene conjugants and code bases, and increased concentration of  $\alpha$ -tocopherol; and.
7. Normalized lipid exchange: increased activity of lipoproteinlipase, and a reduced level of atherogenic lipoproteins.

Experimental and clinical research has proved that the effectiveness of transcutaneous laser irradiation of the blood (TLIB) and intravascular laser irradiation of the blood (ILIB) is the same (V.N. Koshelev et al., 1995). With its simple procedure, non-invasive nature, accessibility in any conditions, and high therapeutic effects, TLIB has been widely used in cancer treatment practice.

Transdermic laser irradiation of the blood is used as an analgesic, antioxidant, desensibilizing, biostimulating, immunostimulating, immunocorrecting, detoxicating, vasodilative, antiarrhythmic, antibacterial, antihypoxic, antiedematous, and anti-inflammatory therapy (S.V. Moskvina et al., 2000).

Researchers at the Tomsk Institute of Oncology were among the first to study the effectiveness of laser irradiation of the blood in cancer patients. In refining the laser procedure, 30-minute exposure was used in one group of patients, and 60-minute exposure in another, one such exposure a day for five days. No substantial differences were found between the two groups, and no complications or side effects were recorded. The researchers registered faster healing of post-surgery wounds, and a follow-up analysis showed that the frequency and time of relapses in the patients that had had their blood irradiated with laser was authentically lower than in the control group.

Research Institute of Pediatric Oncology and Hematology at ROSC RAMS has studied the effectiveness of TLIB by analyzing changes in the cellular immunity of children that underwent chemotherapy for all kinds of malignancies. LLLT was applied to the large vessels of the carotid artery in the cubital, subclavicular and popliteal areas. The procedure involved 50 Hz LLLT for 15-20 minutes for older children (the blood was irradiated with two terminals simultaneously). In all, there were from two to three or four exposures. Patients who had received more than two exposures showed increased counts of mature T-lymphocytes, T-suppressors, and lymphocytes. There was general improvement without any complications or side effects. For younger children, LLLT dosages were calculated on a case-by-case basis.

A 50 Hz frequency is not a random choice for laser irradiation of the blood. When they studied the mechanisms of biomembrane surfaces getting rid of toxic agents, researchers I.Z. Zemtsev and V.P. Lapshin (1996) found that the depolarization of membranes (resulting from the laser irradiation of the blood) accompanied by a "washing" occurred at LLLT pulse frequencies under 100 Hz.

**External applications.** When a pathology is located on the skin or on visible mucous membranes, LLLT is applied directly. The Research Institute of Pediatric Oncology and Hematology widely uses low-intensity laser therapy to treat stomatitis, inflammations of the nasopharynx, phlebitis, intractable post-surgical wounds, and bedsores. More than 280 patients have received these treatments. Damaged mucous membranes of the mouth and of the gastrointestinal tract are a serious problem for children undergoing

chemotherapy. In case of stomatitis, the mucous membrane of the mouth cavity hurts; it develops ulcers of different sizes and depths, which makes eating impossible. In grave situations, this causes lengthy breaks in antitumoral therapy. Herbal tinctures and medicinal solutions have been used to treat stomatitis but they take a lot of time. As a rule, such treatments produce visible results on the seventh through tenth day. When LLLT was applied, we sometimes observed the same effect right after the first treatment. Full rehabilitation would occur on the third through fifth day.

Positive effects have been achieved in all cases of treating post-radiation skin reactions. A comparison of the time needed for the complete disappearance of local manifestations in children who underwent magneto-infrared-laser therapy with historical data has shown that LLLT helped to shorten recovery time by 28%.

Chief contraindications to transcutaneous laser irradiation of the blood are blood diseases with the hemorrhagic syndrome, thrombocytopenia below 60000, acute fever, states of coma, active tuberculosis, hypotonia, and decompressed states of the cardiovascular, excretory, respiratory, and endocrine systems.

In case of local treatment of such complications of chemo- or radiotherapy as stomatitis, gingivitis, radioepitheliitis, and also bedsores and slow wound processes, the above diseases and conditions are not absolute contraindications.

Absolute contraindications for local LLLT are the areas of malignant processes.

## **THE APPLICATION OF QUANTUM THERAPY IN CHILDREN'S ONCOLOGY (EXPERIMENTAL AND CLINICAL RESEARCHES)**

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The analysis of low level laser therapy (LLLT) in oncology in the Russian oncology center of science (ROCS) RAMS started in the beginning of 80-s. The high performance of LLLT was demonstrated at medical endoscopy of patients affected with pretumor diseases and swellings of the upper department of the gastrointestinal channel.

The research of LLLT, conducted in ROCS with the purpose of analysis of the influencing of laser radiation on the parameters of cell and humoral immunodefence for oncology ill, has demonstrated its high exponentiation operating. The analysis of a role of LLLT in a metabolic correlation of histic hypoxia for patients affected with malignant neoplasm before the operation and in the early postoperative time has shown that it is a high-performance measure to prevent postoperative complications and improve the results of treatment.

The absence of sufficient quantity of the scientific data about the influence of LLLT on growing organism, for the long time limited the application of low intensive lasers in pediatrics and, in particular, in children's oncology. But the large facts about the absence of toxic and cancerogenic operating of LLLT, - moreover, about its capacity to shadow an organism from the parasitic factors, for example, from ionizing radiation. In pediatrics the laser radiation has demonstrated the high clinical efficiency and safety not only in high age-group, but also in treatment of neonatal and premature children with complications in an early puerperal period with the purpose of correction of heightened nervous - reflex irritability, depressing of central nervous system, the disturbance of breathing. LLLT increases the efficiency of such pharmaceuticals as antibiotics, analgesics, abirritating and soporific drugs.

Despite to the efficiency of LLLT, the oncology diseases long time were contraindication to its usage. It is explained by poor quantity of the data about the influencing of LLLT on tumoral growth. The plenty of researches is now conducted, the results of which testify, that LLLT not only does not degrade the results of medicinal, radial and operating treatment of oncologic ill, but, in definite cases, promotes the increase of number of recovered.

One of the main properties of the swelling is the fast unchecked growth, therefore pharmaceuticals suppressing breeding of cells are applied to the treatment of malignant neoplasms. Unfortunately, these drugs have no selective effect and they strike normal structures of an organism (slimy of gastrointestinal channel, hair follicles, cells of hemopoiesis and immunodefence, genesial system), which are renovated during short period of time. Now in the research institute of children's oncology and hematology is widely applied the low intensive laser therapy in treatment of stomatites, inflammatory phenomena of a nasopharynx, phlebitides, long time not healing postoperative wounds.

The damage of mucosa of an oral cavity and gastrointestinal channel is the severe problem for children receiving chemo-therapeutic treatment. The mucosa of an oral cavity at stomatitis is painful, it has the defects of the miscellaneous sizes and depths, that limits or makes absolutely impossible eating. In heavy cases it leads to a long-time brake in antitumoral therapy. In the treatment of stomatites there were applied the gargles from decoctions of herbs, solutions of medicinal preparations, however these means demand the long spending time. As a rule, the effect from such kind of treatment is marked on 7<sup>th</sup> -10<sup>th</sup> day. On this time the antitumoral treatment ceases. At the usage of LLLT we see the

good effect already after 3-4 sessions of treatment: the pain remits, the edema decreases, the shows of the infective process lessen, the state of health of the child gets improved. As an example we want to show the clinical observation.

- The Child B., 8 months, has been entered the children's oncology center with a malignant swelling of the kidney. Pursuant to the assigned treatment the chemotherapy had started. In two weeks from the beginning of treatment the child became restless, was failed from meal, the dream was broke. At the inspection of an oral cavity on gingival and slimy surface of chicks there were detected the multiple irritations (aphthas). This very day to a child the laser therapy was started. In a few hours the child became less restless, by the evening an appetite has appeared. The laser therapy was proceeded, and in 4 days the irritations in an oral cavity have vanished. A further chemotherapy the child has transferred satisfactorily. In subsequent, at realization of chemotherapy to the child, magnet laser (quantum) therapy was assigned with the preventive purpose.

When the quantum therapy started with the preventive purpose, the slimy surface of an oral cavity is not struck absolutely or there are watched the minimum changes which are causing to the child of any non-comfort. Because the body resistance to infection contamination is sharply reduced on a background of chemotherapy, the relevant problems to our children are the inflammatory diseases of the upper respiratory paths. In these cases LLLT promotes the decreasing of an edema of slimy surfaces and the quantity of mucus separated at rhinitis, improves the outcome of sputum at bronchitis.

LLLT gets applied also when antibiotics are assigned, under indications, to a child, as the laser radiation enhances their efficiency. As well as at the treatment of stomatitis, a fast improvement is observed in the case of usage of LLLT at phlebitides after the introducing of chemical drugs, an edema and destruction of tissues at the getting of drugs under the skin. At the immediate reference there are enough 2-3 procedures completely to remove a pain, edema, local temperature rise. The large value has the possibility of using LLLT with the purpose of acceleration of healing of postoperative wounds. Practically, terms of a full recovery are reduced twice. The treatment of complications with the help of LLLT allows precisely to abide a regime of medicinal and surgical treatment, in large number of cases to avoid symptomatic assigning of anti-inflammatory medicinal preparations and analgesics, improves the quality of life of the patients during the treatment.

The large interest shows the interplay of quantum and radial therapy also used in the treatment of malignant diseases. The researches conducted concerning the interplay of quantum therapy and radial therapy, allow to consider, that:

- \* LLLT strengthens the effect of radial therapy that allows lowering the general focal dose (GFD) of irradiation

- LLLT increases the threshold of answers the tissues to radial therapy, reduces the frequency of radioepithelites,

- In case of developed of radioepithelites, the terms of their disappearing by the method of LLLT are in 2 times less, than in the control, that allows to conduct before - operational radial therapy without risks of delay of an operative measure,

- Under operating of LLLT the neogenesis flows according to restitution, with the recovery of not only the defect of tissues, but also of their function,

- LLLT does not degrade long-term results and terms of the survival rate of ill patients, received the combined treatment at the compare with the monitoring group.

One of the newest perspective directions is the usage of LLLT with the purpose of stimulation of hemopoiesis, the treatment of toxic lesions of liver during the chemotherapy, the correction of immunodefence by the method of through - dermal laser exposure of blood.

The intravascular laser exposure of blood with the help of helium-neon lasers of a red wave band already has shown the high performance in treatment of pancreatitis, peritonitis, generalized infection processes. Unfortunately, it is a labor consuming enough technique, painful for the patient. It demands the usage of one-time optical

waveguides, the activity in sterile conditions with the purpose of an avoidance of distribution of infection contamination, which increases the cost of treatment. At the same time, the deep depth of influence of LLLT with infrared band in a tissue allows to make effect on blood, setting the apparatus above the large veins, i.e. through the skin. The available data gives hope that in time this method will take the more strong place in the preventive maintenance of one of the most heavy complications of chemotherapy - the depressing of medullar hemopoiesis.

Since 1998 we use the apparatus RIKTA of the infrared band conforming to many requirements, which are presented by clinical medicine. Its design and the characteristics allow changing the power and radiated frequency, and the availability of two working terminals - reducing the time of procedures. Portative sizes and small weight allow conducting the treatment right at the bed of ill children with heavy complications. The medical effect of the apparatus RIKTA is coming from the effects of low intensive laser and broadband infrared radiation together with the constant magnetic field, due to what the maximum therapeutic efficiency gets reached.

In summary, it is necessary to note, that low intensive laser therapy is not an alternate way of treatment in an oncology. Despite of large diversification of clinical effects and the absence of absolute contraindications, LLLT is not esteemed as a method of changing the other medical measures. The problem of children's oncologists is, that using the ground of modern engineering developments and achievements of medical science to take down to a minimum collateral effects of medicinal and radial therapy, to ease to the child the strife with heavy disease. One of the best candidate solutions of this problem is the usage of low intensive laser radiation.

The analyses of LLLT in experimental and clinical conditions on the basis of ROSC RAMS are now go on. So, we study the influence of laser radiation on antitumoral (cytotoxic) activity of mononuclear cells (MNC) of the donors and the capacity of MNC to free cytokins IL - 1 and PNO. MNC were excreted from blood of the able-bodied donors by means of Ficoil-Hipaque (Sigma St. Louis, MO) technique of separation.

After allocation of MNC suspended in medium RPMI-1640 with the addition of gentamicin (50mg on 1ml), glutamine (2ml) and IL - 2 in concentration of 1000 ME in 1ml. The concentration of MNC was of 2 million in 1 ml. MNC keep separated within 3-5 day in CO<sub>2</sub> in a couveuse of the Corporation of Joun (France) at 37 degrees Celsius in atmosphere of 5 % CO<sub>2</sub>.

The cells of the target ( $1 \times 10^4$ ) in the culture of medium were saving with the different quantity of effectors. A ratio the cell - target of effectors has compounded 1 to 5 in flat-bottom 96-holes micro-trays (Nuno, Roskilde, Denmark).

Cytotoxic activity we estimated through a vital color of MNC using the earlier described technique. As the target cells we have used the tumoral line K - 562 (eritroblastula leukosis of the person).

The definition of cytokins we conducted by the method of the immune ferment analysis with the usage the test-systems by the production of 000 "Cytokin" (St. Petersburg, Russia). The measurements of the contents of IL - 1 and PNO were made in supernatanta of MNC before and in 18 hours after the irradiation on multi scanner MCC-340 (Labsistem, Finland). The calculation of the concentrations of cytokins there was conducted on the ground of standard curve obtained at testing of dilutions of the standard sample.

MNC were exposed to LLLT during 20 and 40 minutes at ultimate output of the device. As the result of the conducted activity at the research of cytotoxicity MNC there was established, that the effect of laser radiation within 20 minutes does not result in authentic increase of killer properties of MNC of the donors. Strengthening the capacity of MNC of the donors to lyse the tumor cells of K-562 line was marked at the increase of an exposition of radiation up to 40 min. In these conditions the cytolytic potential of MNC increased on the average from 31 +/- 8 % and up to 57 +/- 5 % ( $p < 0,05$ ) (see tab. 1).

**The table 1**

**The influence of quantum therapy on cytotoxic activity (%) of MNC**

### and the freeing induction of cytokin's energy (pg/ ml).

Parameter	Initial level	Exposure time	
		20 minutes	40 minutes
Cytotoxicity	31±8	38 ±12	57±5
Concentration:			
IL-1	4,8 ±2,0	5.3±1,2	6,4±2,1
TNF	1,9±0,8	1,8±0.7	3,8±0,2*

The notice: \* p < 0,05

The effect of laser exposure increases the capacity of MNC to free IL - 1 and TNF (tumor necrosis factor). In particular, during 20 minutes of exposure there was marked the tendency to increase of the concentration of studied cytokins in super-natanta MNC, comparing to the initial level. The increase of time of the effect results in more expressed induction of MNC capacity of the donors to free IL - 1 and TNF.

### Conclusions

The quantum therapy by the apparatus RIKTA results in an activation of MNC of blood of the donors, i.e. increases their functional (cytotoxic) activity and induces the capacities of MNC to free cytokins (IL - 1 and PNO), playing the relevant role in the development of the immune answer of an organism.