The Intravenous Laser Blood Irradiation in Chronic Pain and Fibromyalgia

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Abstract:
Intravenous laser blood irradiation was first introduced into therapy by the Soviet scientists EN.Meschalkin and VS.Sergiewski in 1981. Originally this method was developed for the treatment of cardiovascular diseases. Improvement of rheologic properties of the blood as well as improvement of microcirculation and reduction of the area of infarction has been proved. Further, reduction of dysrhythmia and sudden cardiac death was achieved. At first, only the Helium-Neon laser (632.8 nm) was used in this therapy. For that, a power of 1-3mW and a period of exposure of 20-60 minutes were applied. The treatments were carried out once or twice a day up to ten appointments in all1. In the years after, many, and for the most part Russian studies showed that helium-neon laser had various effects on many organs and on the hematologic and immunologic system. The studies were published mainly in Russian which were little known in the West because of decades of political separation, and were regarded with disapproval. Besides clinical research and application for patients, the cell biological basis was developed by the Estonian cell biologist Tiina Karu at the same time. An abstract is to be found in her work “The Science of Low-Power Laser-Therapy”

Keywords: laser; pain; irradiation

Effects and mode of operation of intravenous Low-Level-Laser-Therapy of the blood

1. Under laser blood irradiation, anti-inflammatory effects were observed that improved the immunologic activity of the blood1.

2. A fundamental finding was the positive influence on rheological properties of the blood which is of greatest interest to surgery, angiology and cardiology in particular2. A diminishing tendency of aggregation of thrombocytes and an improved deformability of erythrocytes result in an improved oxygen supply and with that to a decrease of partial carbon dioxide pressure, which is particularly relevant to wound healing3. Furthermore, the activation of phagocytic activity of macrophages was proved in conjunction with structural modifications. A positive effect on the proliferation of lymphocytes and B- and T-cell-subpopulations could be verified too4.

3. The hypoxia of the tissue is improved which leads to a normalization of the tissue metabolism. In addition the fibrinolysis will be activated. Apart from the elimination of hypoxia and the normalization of tissue metabolism an increase of ATP-synthesis occurs with a normalization of cell membrane potential. Additional vasodilatation is leading to de-blocking of capillaries and collateral vessels in connection with the described improved rheological properties of the blood together.
with an improved trophicity of tissues and normalization
of neurosensory stimulation. The increased release of
NO from monocytes obviously is of critical importance.
Because of the described effects the intravascular blood-
irradiation is used in Russian surgical university-clinics
preoperatively to avoid thromboembolic complications,
and improve postoperative wound healing.

In addition there are laser specific analgesic,
spasmolytic and sedative effects.

There are reports on patients with chronic
glomerulonephritis who had significant improvement
of tolerability of medication (glucocorticoids,cytostatic
drugs, diuretics) and of kidney function. In the same
way an improvement of inflammation parameters in
acute pyelonephritis could be shown. In necrotising
pancreatitis, an improvement of blood lab values and
of the immunological parameters has been proved too5.

4. Intravenous blood irradiation was widely used in
obstetrics and gynecology to stimulate utero-placental
blood exchange and as prophylaxis and therapy of
inflammations of the interior genitals.

5. Furthermore it was observed that mitochondria
changed to so called “giant mitochondria” after
laser-irradiation with activation of various metabolic
pathways and increased production of ATP. The electron
microscopy of “giant mitochondria” revealed intracellular
annular structures. These mitochondrial changes cannot
be compared with pathological giant mitochondria as
they appear in certain clinical syndromes. In these
syndromes we can observe pathological swelling of the
organelles and deposit of pathological paracrystalline
albumins leading to specific myopathies. The structure of
mitochondria may vary strongly according to the type of
cell. They can impress as sausage shaped organelles, but
may also appear as a highly branched intercommunicating
tubular network. Observations of fluorescence marked
mitochondria in living cells have shown that they are
dynamic and may vary their shape strongly. Above
all it is important that mitochondria may merge with
each other, or divide themselves. Probably, the balance
between fusion and division is decisive for the shape and
form of a mitochondrion. It was shown in histological
researches on helium-neon laser irradiated lymphocytes
that by development of so called giant forms the number
of mitochondria was diminishing simultaneously, but
the total volume was unchanged. It was detected that
the cause of the development of “giant mitochondria”
was a fusion of smaller mitochondria6. Manteifel and
Karu proved big branched forms of mitochondria in
germinating yeast cells, but after laser-irradiation an
expansion of the tubular network developed without
damaging the organelles3. These mitochondria are marked
by a relative enlargement of surface of the mitochondrial
cristae due to activation of the respiratory chain and ATP-
synthesis. It has to be mentioned that the description of
the development of mitochondria to giant mitochondria
is discussed controversially.

Heine is pointing out that there is no evidence that
such pathological forms of mitochondria will lead to an
activation of varied metabolic pathways ways leading
to an increase of ATP-production. Heine described the
way of reproduction of mitochondria in 1979: Whenever
there is a need of additional ATP they will divide, but
not fuse with each other7.

Obviously there seems to be generalized effects
of the intravenous blood-irradiation on almost every
organ system so that this therapy may be employed in
the treatment of various diseases causally or additively.
Gasparian described4 the improvement of microcirculation
especially in central nervous structures. In particular, this
is most important in the hypothalamus which has a highly
developed vascular micro system. He assumes that the
intravenous blood-irradiation is stimulating the functional
activity of the hypothalamus and limbic system leading
to an activation of hormonal, metabolic, immunological
and vegetative processes with mobilization of adaptive
reserves.

Intravenous laser blood irradiation is carried out with
low power of 1-3 mW and an exposure time of 20-60
minutes. A series of 10 treatments will be carried out
either every day or three times a week with a weekend
break.

For intravenous laser blood irradiation first of all
you have to feed in a cannula into a suitable vein of
the elbow or the forearm. The vein should have a wide
lumen to catch a great volume of blood in the period of
time. In the Russian studies a simple steel-cannula was
inserted, in which a disposal laser plastic-catheter was
fed in and was connected to a laser diode. This procedure
was modified by the author by feeding in a blue plastic
cannula for children (Braun Medical, Melsungen)6 into
a suitable vein and then a newly developed disposable
laser-catheter made of biological compatible plastic
material is inserted into the vein. With veins that are
difficult to puncture or if there is lack of practice, the
setting of the cannula may cause problems, but recently
a suitable little butterfly was developed which permits
an easy application of the above described catheter. The
advantage of this therapy is that it can be learned by an
assistant or a nurse, so the doctor has not to be right
next to the patient all the time.

Up to now it was believed that especially irradiation in the red range was particularly effective due to the absorption spectrum of cytochrome-C-oxidase in the respiratory chain with a stimulation of the ATP-synthesis. The originally Russian studies were all carried out with red light laser of the wavelength 632, 8 nm of the helium-neon-laser because in the beginning there was no laser in the shorter wave range (green or blue) available. Because the red light is not absorbed by the erythrocytes, when red laser light is conducted into the bloodstream, the vein lights up in bright red. So actually it should make sense to use complementary green laser light for laser blood irradiation as well. When green laser light is conducted into a vein you practically will not see any green shining through the skin since the “red” erythrocytes are absorbing green light virtually completely. This therapy was introduced by the author for the first time to laser blood irradiation and many of the patients treated with red laser light were treated with green laser once more, and the results were compared with red light laser. On that occasion it turned out that the green laser causes corresponding stimulations too and obviously reacts on various parameters in a different way or better than the red light laser. In a third cycle some of the patients were treated then with a combination of red and green laser - with the idea to stimulate the leucocytes initially with the red laser and to load energy on the erythrocytes with the green laser. Then it turned out that the combination of both types of laser obviously reveal the best possible effect. These results represent however just first impressions and they have to be investigated further intensively to obtain valid data. Reviewing the latest literature, it comes out that the green laser was also tested extensively to obtain valid data. In another work from Vinck and colleagues of the department anatomy, embryology and histology of the University of Ghent, Belgium, it could be shown in April 2005 that under green light irradiation it comes to an increase of fibroblast proliferation with an improved effect on glucose metabolism. It must be emphasized here again that the described works on green laser so far were exclusively in-vitro-experiments. The first human investigations with green light laser blood irradiation were made by the author himself and have been described in this presented work here for the first time.

**Conclusion**

The current procedures to treat chronic pain and fibromyalgia primarily consist of medication, physiotherapeutic and psychological therapeutic forms, which cannot always achieve a significant reduction of the symptoms; however, from experience, they mostly prevent aggravation. According to the classical Chinese model, the needle acupuncture treatment represents another option to limit the individual symptoms. By observing the individual patient groups, however, a slightly limited tolerability of the pain stimuli associated with the application was often produced. According to references as well as the very needle treatment experiments, even better results are achieved in a comparative manner and to a certain extent by using laser needle acupuncture treatment. The intravenous blood irradiation using red light and green lasers has also been capable of accomplishing a significant improvement in the symptoms of the condition affecting the patients. This is especially demonstrated in the general well-being, which improved by approximately a factor of 3. An energetic concentration of the cell lines present in blood and the accompanying improvement and acceleration of ADP conversion to ATP seems to have considerable effects both in the muscular system as well as in other different factors. The observations presented in this work
do not fulfil the prerequisites for a controlled application observation or for a treatment study. However, they show a significantly positive trend for a clinical record that is only otherwise difficult to treat. Therefore, the contents of further studies are required for the processing of a stringently prospective representation in the treatment process of fibromyalgia using controlled methods.

References