

SYSTEMIC EFFECTS OF BIOPTRON LIGHT THERAPY

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18 YEARS OF INTENSIVE STUDY INTO BIOPTRON

THE experience of our laboratory investigation in the field of Photobiology and Photomedicine exceeds 50 years, while the period of intensive studies on BIOPTRON therapy is as long as 18 years. Our great interest to this phototherapeutic modality is based on the unique properties of BIOPTRON light that simulates dominant components of the terrestrial solar radiation – polychromatic visible and infrared radiation with power density, characteristic of a summer day's in Europe. These 2 parts of solar spectrum occupy about 97% of the solar radiation on the Earth's surface. Hence, we deal with a very important environmental factor, which allows us to consider reactions to the light of human and animal organisms as an adoptive response to the light exposures that was developed during a long period of evolution.

For the last several years, we studied the effect of BIOPTRON light on the blood properties that are important for regenerative and metabolic processes. Because the blood movement rate in circulation is determined by red blood cells, we investigated their rheological properties. It was shown that in 0.5-24 hrs after a single irradiation of volunteers with deformability, red blood cells increased, while their viscosity fell. Simultaneously the transport function, (in particular, oxygen transport) enhanced, which resulted to increase of partial oxygen pressure in blood.

In parallel, disaggregation of platelets and increase of anti-coagulation activity of plasma

components were observed, which seems to determine the development of anti-thrombotic effect of BIOPTRON-light: irradiation of the rat femoral arteries completely blocked (prevented) development in these vessels of the experimentally induced irreversible thrombosis.

An important role in trophic function of blood belongs to its circulation rate in micro-vessels. According to our observation, as soon as 2 minutes after irradiation of a small body area the rate of microcirculation in volunteers and patients with Type II diabetes mellitus increased both locally and in remote tissues (i.e. at the systemic level). The optimum increase of microcirculation rate was observed at 30 minutes, (up to 47%).

The evidence was obtained in our study that in both cases the increase of microcirculation rate resulted from activation of synthesis of nitric oxide (NO) – the most important vasodilator that is secreted by vascular endothelial cells and platelets.

Apart from the improvement of microcirculation and enhancement of the transport function of blood, the correction of some indices of metabolic processes was recorded: after exposure to BIOPTRON light in volunteers' blood the level of glucose and atherogenic lipids (triglycerides, cholesterol, β -lipoproteins) fell, while the content of anti-atherogenic lipids, (α -lipoproteins) increased.

Wound healing effects of BIOPTRON light therapy is undoubtedly associated with improvement of blood microcirculation, enhancement of the trophic function of blood, but also with increase of concentration in blood serum of growth factors and some cytokines.

We had also demonstrated, that addition to culture media of 2.5% of serum, isolated from blood of volunteers or patients with Breast Cancer I-II stages after 7-10 daily post-surgery exposures to BIOPTRON light, significantly stimulated proliferation of keratinocytes, endotheliocytes and fibroblasts – basic participants of wound healing process, but inhibited proliferation of several lines of human tumor cells.

In experiments with laboratory animals, it was shown that exposure to BIOPTRON light decelerates the growth of malignant tumors (murine hepatoma) both after light treatment of mice with tumors, and after direct exposure to light of tumor cells themselves with their subsequent transplantation to syngeneic mice.

The mechanism of anti-tumor effect of BIOPTRON light was not associated with cytotoxic or cytostatic action of light on cells, but was a consequence of structural changes of tumor cell surface which enhanced their recognition by natural killer cells – main effectors of the innate anti-tumor immunity.

As a consequence, cytolytic activity of natural killer cells increased which resulted in the death of the light-irradiated tumor cells. Mechanism of anti-tumor effect of BIOPTRON light in case of photoirradiation of tumor-bearing mice needs to be studied in the future. However, in our opinion the oncological safety of BIOPTRON light therapy has been already proved.

All the above data was published in main international journals on Photomedicine and Photobiology (Photomedicine and Laser Surgery, Photochemical and Photobiological Sciences, Photochemistry and Photobiology, Laser Therapy, Photodiagnosis and Photodynamic therapy, Lasers in Medical Sciences etc).

SHORT INFORMATION:

For 18 years of intensive studies of BIOPTRON light effects in human we could elucidate mechanisms of main systemic effects – anti-inflammatory, immunomodulatory, wound healing, anti-tumor and normalization of metabolic processes. These effects are developing due to

transcutaneous photomodification of blood in the upper skin vasculature. It is noteworthy, that irradiation of small area of the body surface leads to changes in the entire circulating blood volume. It is undoubtedly associated with unique physical peculiarities of BIOPTRON light: its polychromatic visible and infrared components simulates spectral and power density parameters of two dominant kinds of the terrestrial Solar radiation - the main environmental factor. During evolution they could promote the development in living organisms the adoptive beneficial mechanisms of light utilization.

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