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The use of polychromatic polarized light (Bioptron) in physiotherapy

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As regards polychromatic polarized light with a wavelength of 400 - 2'000 nm and low intensity, it may be assumed when studying its effects on the organism that it has a variable degree of penetration into the skin, since it is a pencil of rays of different wavelenght. It is know that monochromatic laser beams of low intensity give rise to biological effects at varying depths, depending on the wavelength and the intensity.

The biological effect of laser beams with non-thermal effect and low intensity depends chiefly on the phenomenon of polarization, which is also use in "Bioptron".

The literature describes favourable therapeutic effects in relation to stimulation and regeneration in the case of torpid ulcerations and burns, as well as an analgesic effect in neuralgia and other syndromes. Positive effects have also been described in the treatment of psoriasis, acne and other skin diseases. It was experimentally confirmed that there are no negative effects on the crystalline lens or other internal organs. We wanted to compare the effects of this method of therapy with short-wave diathermy in the treatment of humeroscapular periarthritis applying subjective and objective parameters and taking laboratory findings into consideration. Initially we are also following up the therapeutic effects of polychromatic laser beams in other conditions, for which positive effects are described. We carried out a random division of a control group of subjects suffering from humersoscapular periarthitis into two sub-groups: one group treated with polychromatic polarized laser (30 patients), and a second group treated with short-wave diathermy (30 patients). All patients receive clinical treatment, with investigation of the functional state of the shoulder joint, amplitude of movement and a manual muscle test. In addition, the subjective complaints of the patients and X-ray photographs are analyzed. Changes in the blood are determined by means of laboratory studies before or after treatment. The study is still in progress and we shall therefore report only provisional results, which owing to the number of patients do not admit of final conclusions. The treatment was carried out with a Bioptron lamp, with polarized polychromatic light with an intensity of 40 W/cm^2, at a distance of 10 cm and a duration of 6 minutes.

The treatment was concluded in 13 patients, of whom 7 received polychromatic polarized light and 6 received short-wave diathermy. In 17 patients the therapy is still continuing. In the group whose periarthritis was treated with polychromatic light, 2 patients experienced cessation of pain and other subjective complaints. The movement of the shoulder joint was normalized. In 3 patients pain diminished and mobility improved; in one

patient the decrease in pain was insignificant, but mobility was normalized. One patient experienced no improvement in subjective complaints, nor did this patient's mobility improve.

In the group receiving the short-wave diathermy treatment, pain was considerably reduced in 3 patients and their mobility was normalized; in another 3 patients the diminution of pain was insignificant, but mobility improved significantly.

In patients with other diagnoses whom we treated with polychromatic polarized light (Bioptron), the following results were recorded: miofibrosis - 6 patients; in 4 patients pain was significantly reduced, with a reduction of hypertonia; in 2 patients pain was insignificantly reduced and the excessive muscle tone remainded. Trigeminal neuralgia, 3 patients; in 1 patient the pain ceased, in one it diminished and in one patient no visible improvement was recorded; he demanded a different treatment.

Neuralgia of the intercostal nerves: in 2 patients the pain decreased. Tendovaginitis antebrachi: in 1 patient the pain ceased and the crepitation disappeared, whereas in a second patient no improvement was recorded. Keloids: in one girl there was a softening of the keloid changes and an insignificant decrease, whereas in another girl we encountered neither subjective nor objective improvement. Trochanteritis: in 2 patients the pain diminished considerably. Dermatitis senilis: one patient exhibited patches of hyperkeratosis, pigmented in the frontal area, and no visible improvement occurred after the treatment.

Discussion

The biological method of operation of laser beams of low intensity is not sufficiently well known. In physiotherapy monochromatic laser has been used for a number of years, including light of low intensity, differing frequencies and hence variabel depths of penetration into the skin. It is used to stimulate acupuncture points (biologically active points) or for local stimulation. The specialist literature describes positive therapeutic results in a number of diseases, above all in the treatment of various syndromes such as bronchial asthma, as well as in the stimulation of torpid ulcerations. Our results confirm these data. There are also descriptions of the local effects on cell levels with a regard to a change in enzyme activity, in the permeability of the cell membrane and in ion concentration. There are fewer descriptions of the neurovegetative reflexes or the neurohumoral mechanism. The change in ion concentration is important to the excitation of the neurovegetative receptors, especially in the skin. It can be imagined that radiation with light stimulates the neurovegetative endings in the skin at the socalled "biological active points", or the sympathetic reflex points - "trigger points". The existence of such points is now proven. We have here a limited surface inside or outside the area of complaint or pain. Stimulation of such a point produces a local or distant feedback. The area surrounding this point is known as kurero-visceral Head's zone. The internal organs can be affected via this zone in the skin. When sensitivity is heightened the sensitivity of the skin is also heightened through the vegetative nerves, chiefly sympathetic nerves,

which accompany the area of the sympathetic nerve fibres of the segment in question. So one can say that sensitive fibres go along with the afferent vegatative fibres of the segment, which have the nature and intensity of sensitive information, and the sensitivity of the issue also grows through the vegetative nerves of the relevant segment. To the extent to which a functional disorder or disease exists in an area nervously determined by the relevant neurovegetative system, an elevated tone of the biologically active points, "trigger points", also exists. These points become sensitive spontaneously or through stimulation and a corresponding sensitivity arises. Generally the subject is unaware of the existence of these points. When he is asked to define the point of greatest pain he will seldom indicate this biologically active point. The patient will describe stimulation of this point as a flowing feeling and a radiation in the area of discomfort. These biologically active points may lie in the affected area but are far more frequently found outside this affected area. The active points and the affected area have the same nervous level through the spinal cord.

Stimulation of the vegetative neurone endings increases vegetative activity, especially in the relevant segment. Neurovegetative endings exist not only in the skin but also in the deeper soft tissues. The proreceptor and motor visceral Mackenzie zones in the sinews are well-known examples, via which it is possible to influence the circulation and breathing. There are also descriptions of the periosteal visceral Vagler-Kraus points in the periosteum, via which the function of the internal organs can be influenced.

The specialist literature describes the way in which, when the endings are stimulated, sympathetic activity is increased while the application lasts and a "post-active depression" then follows. In a distrubance of the vegetative activity or in illness, this activity is increased and when this is interrupted by stimulation, it is believed, the vicious circle of autonomous distrubance is interrupted and hence the pain is also interrupted. The tone of the vegetative nervous system is normalized, resulting in an acceleration of the metabolism, an improvement in circulation and the disappearance of the pain, or its alleviation.

In the case of stimulation by low energy laser beams, the local temperature is not greatly increased; nor are any morphological changes as well as a change in the reactivity of the organism. It is reported in many scientific studies that after irradiation with monochromatic laser, an increase in the permeability of the cell membrane and an ion exchange of ions Na^+, $Mg2^+$ and others has occurred. The concentration of adrenosin-triphosphate changes, as does the osmotic resistance of the erythrocytes and the general chemodynamics: the microcirculation improves in the form of an acceleration and a decrease in the erythrocyte aggregation. The increased muscle tone diminishes, as does the chronic neurogenic pain. I believe that it is highly probable that the same changes occur through polychromatic light. In the area of ulcerated damage in a torpid ulceration there is stimulation of the formation of granulations and epithelization.

The biological effects of laser radiation depend on the wavelength or the physical parameters of the source, or the intensity. The frequency and depth of penetration determine which cells absorb the laser energy or at which neurovegetative level the

changes arise in the area of the membrane of the nerve endings, and which neurone will conduct the information to the central nervous system.

The depth of penetration of these beams most probably goes up to 3 mm and the biological effects on deeper structures can be explained only by an activation of the neuroreflexive mechanisms through the neurovegetative endings in the skin and lymph ducts. The concentration of N^{+}, Mg^{++} and adenosin triphosphate changes on the membranes of these endings, which sets the neurovegetative or neurohumoral mechanisms in motion.

Apparatus for the vervous stimulation of the lymph ducts. Adrenergic innervation of the lymphatic postcapillary (KL = capillary valve). Falk Hillarpa method x 300. (Prepared and recorded by F.B. Hajsman.)

Near the blood vessels the lymph capillaries are also rich in neurovegetative engings.