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Diagnostyka laserowa temperatury na powierzchni skóry części twarzowej czaszki po zabiegach fizykoterapeutycznych

Laser diagnostics of temperature on the surface of the skin of the facial part of the skull after treatment physiotherapy

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Streszczenie:

Fizykoterapia w postaci czynnika świetlnego znajduje coraz szersze zastosowanie również w stomatologii. Wykorzystywane jest w celach analgetycznych i przeciwzapalnych, a także w regeneracji układu stomatognatycznego. W przeprowadzonym badaniu ocenie poddano zmianę temperatury na powłokach skóry części twarzowej czaszki i szyi po zabiegach magnetoledoterapii i pileroterapii, z wykorzystaniem termometru laserowego CASON CA 380. Badanie przeprowadzono u 150 pacjentów w przedziale wiekowym 20-40 lat, którzy zostali podzieleni na 4 grupy badawcze i grupę kontrolną. W grupie badanej zastosowano synergizm pola elektromagnetycznego i energii świetlnej diod LED, aplikatorami R, IR, RIR oraz światło spolaryzowane. Pacjenci grupy kontrolnej poddani zostali działaniu pola elektromagnetycznego przy użyciu aplikatora eliptycznego, bez jakiegokolwiek czynnika świetlnego. Stwierdzono, że zastosowanie czynnika świetlnego skutkuje istotnym statystycznie przyrostem temperatury na powierzchni skóry części twarzowej czaszki i szyi.

Słowa kluczowe:

fizykoterapia w stomatologii, magnetoledoterapia, światło spolaryzowane, zmiana temperatury

Abstract

Physiotherapy in the form factor of the light is also becoming more widely used in dentistry. It is used for the purpose of analgesic and anti-inflammatory as well as in the regeneration of the mandible. In the conducted study assessed the change in temperature on the skin coatings facial part of the skull and neck as a result of the application LED therapy and polarized light using laser thermometer CASON CA 380. The study was conducted in 150 patients aged 20-40 years, who were divided into four test groups and a control group. In the study group used the synergism of the electromagnetic field and light energy LED applicators R, IR, RIR and polarized light. Patients in the control were subjected to an electromagnetic field with an applicator elliptical, without any factor of the light. It has been found that the application of the light results in a statistically significant increase of skin temperature on the surface of the facial skull and neck.

Key words:

physical therapy in dentistry, LED therapy, polarized light, temperature change

Introduction

Scientific research confirms that light induces the so-called photo biological effects. The precursor of light therapy was American John Nash Ott. It was he who discovered, on the basis of research, the effect of light on living organisms and found that only the full spectrum of natural light is one of the conditions for the complete health of plants, animals and humans. He also explained that mental health affects so "temperature" color or "intonation" of color. Its study has shown that even small variations in lighting, have an impact on the ability of single cells to normal growth. He was also the author of the theory that the effect of light on the health of psychosomatic takes place at the unconscious level. This observation was used later in the treatment of colors – that is chromo therapy and the diagnosis of the state of human health based on the appearance of the aura.

Light is an electromagnetic wave endowed with energy and having a number of parameters (length, amplitude, frequency, etc.). From a physical point of view, the light is a transverse wave being the result of the transverse wave propagation in space changes coupled electric and magnetic fields. In fact, the electric component and magnetic diverge in a chaotic manner, not structured, but they always extend vectors relative to each other at right angles. That wave engenders of so-called photo oxidation, or oxidation under the influence of light, which is a process of activating the molecules of the body. Its action on the cell manifests itself mainly influenced by the production of ATP – adenosine triphosphate. It has been proven that energy production in the mitochondrion of the cell can be supported by light acting on certain groups of enzymes. This effect of light induces an increase in the production of energy carriers, such as an increase in the synthesis of ATP. Because ATP is the basic energy of the working cells, this way you can positively affect the essential functions of the body, especially in repair features. Research related to this issue, among others, led Harry Whelan, a neurologist at the Medical College of Wisconsin (USA). He showed that mitochondrion absorb a significant part of the radiation energy, resulting in the stimulation of cell division. It accelerates in this way the regeneration of damaged tissues and organs. Of course, the action of the light wave will depend largely on the degree of its absorption by the body, and the physicochemical properties of the body. However, the ability of activation of the light wave depends primarily on its parameters. The efficiency depends on the health of the body of a single cell, which is dependent on the proper health of cellular membrane. Surface density of cargo – electrostasis depends on the light, or photons, or quanta of electromagnetic radiation cell division. It accelerates thus the regeneration of damaged tissues and organs. Of course, the action of the light wave will depend largely on the degree of its absorption by the body, and the physicochemical properties of the body. However, the ability of activation of the light wave depends primarily on its parameters.

The use of phototherapy is possible using various techniques. Are backed by some light is primarily specially tuned in terms

of frequency and intensity. The radiation source can thus be filtered continuous light with quartz lamps, helium, fluorescent, laser or luminescent diode LED. The invention of these diodes caused lower production costs and design of therapeutic devices, lower their weight, longer lifetime, easier maintenance and a reduction in requirements associated with maintaining the safety and operation [1,2]. In spite of using the same maximum wavelength therapeutic effects achieved by using super bright LED may differ significantly from the effects of laser systems. This became the reason for the extended, so far unresolved, scientific discussion. Among the wide band of electromagnetic waves (visible in plain light and invisible radiation) can be divided into two basic groups having therapeutic qualities:

- ultraviolet light – having a wavelength of 350-450 nm,
- red light – close to the invisible infrared – 600-830 nm.

Both ranges exhibit a similar actions at the photoreceptors of the body, wherein the red light has a higher depth of penetration (because of the higher energy already mentioned).
The optimum wavelength of light when it comes to the impact of the therapeutic range is from 660 to 690 nm. These waves are endowed with considerable energy compared with the shorter waves, by which it is possible to penetrate deeper into the body.

Purpose of job

The interest in the influence of light on a physical medium soft and hard tissues has committed to conduct research, for which the aim was measurement of skin temperature coatings of facial part of the skull and neck after applying treatments LED therapy and polarized light, using the previously mentioned devices Viofor JPS and Solaris.

Materials and methods

For testing has qualified 150 patients, in general good health, who were free of chronic disease and who were not taking any medication. Research group consisted of 120 people, which have been further divided into four sub-population of 30 patients, while the control group contained 30 people. In the study group were excreted particular subgroups, depending on the type of therapeutic treatment. In the three subgroups magnetic field – MF (ELF – extremeely low frequency) mated with a different kind of light conditions: infrared (IR), red (R) and mixed (RIR). However, in one a electromagnetic field was applied in combination with polarized light (Table 1).

Tab. 1. The division into control group and test groups

GROUP	CONTROL GROUP	TEST GROUP			
SUBGROUP	Magneto-stimulation	Magneto-stimulation + LED IR	Magneto-stimulation + LED R	Magneto-stimulation + LED RIR	Electromagnetic field + polarised light

Temperature measurements were made in a strictly predetermined locations. These included coating the skin around the paranasal sinuses, mandible, temporomandibular joint and neck.

Magnetic field and led therapy by Viofor JPS system required the use of two types of applicators. Subjecting the control group only electromagnetic stimulation require the use only the elliptical applicator (Fig. 1). However, in the study group was the applicator provided with a high-energy LEDs, with the ability to emit different kinds of light (Fig. 2). During the

Fig. 1. Applicator electromagnetic field

Fig. 2. Lighting system of VIOFOR JPS

correlation the magnetic field with red light all 48 diodes that were embedded in the applicator, glowed red. Magnetic field and led therapy Viofor JPS system required the use of two types of applicators. Subjecting the control group only require the use of magnetic stimulation of the elliptical applicator. However, in the study group was the applicator provided with a high-energy LEDs, with the ability to emit different kinds of light (Fig. 3). During the correlation the magnetic field with red light diodes 48 all that were embedded in the applicator, glowed red. Due to the fact that the length of the light is 640 nm and in the range of visible to the human eye, so you can easily see the effect of light emission associated with this type of radiation. In the case of mixed light in which are connected to the red and infrared light in the applicator can only be observed twenty four LEDs emitting in red, as the other LEDs

Fig. 3. Applicator to LED therapy - RED and INFRARED

Fig. 4. Laser thermometer with an electronic display used in the study

emit infrared light not visible to the human eye. The light emitting IR (infrared) in the applicator is shown the red dot, which is a red LED light conditions, placed in order to control the emission of infrared light that is not visible to the eye.
The examination procedure was started with the temperature measurement three times selected applications area using a thermometer with laser pointer CASON CA 380 (Fig. 4).
After calculating the average value was saved in the card test. Then were chosen surrounding skin facial or neck pain patient physical stimulation factor selected by 10 minutes. Devices were set fixed programs for Viofor JPS was a program M1 P3 while in Lamp Solaris used a five-pulsation. After finishing the application re-examined three times the temperature and extended with the average value was recorded in the card.

Results

After examining all of the collected results were statistically analyzed, which showed significant changes between the initial and final temperatures depending on the applied light stimulator (table 2). In the case of led therapy highest temperature after application occurred in the case of the correlation of light mixed (RIR). However, throughout this study the electromagnetic field coupled with polarized light resulted in the highest degree heat the skins.

Tab. 2 Average temperatures analysis (T°C)

	MF - ELF	MF + IR	MF+ R	MF + RIR	MF + Polarised light
the highest temperature before application	34,80	34,80	34,80	35,40	35,7
the highest temperature after applications	36,20	37,50	37,90	40,70	40,00
Δ T	1,80	2,21	2,30	3,01	4,18

In the case of the initial temperature difference between them has not been statically significant view of the fact that their volume was similar. Significantly different terminal values of temperatures between groups, which may reflect the influence of the type of light to warm the soft tissue facial part of the skull and neck.

Used in the control group applicator emitting an electromagnetic field caused only a minimal increase in temperature. The average value of the changes was 1.8°C. In the case of a the research which uses a magnetic stimulation in combination with infrared light, an increase in the temperature difference between before and after the test. On average, the increase amounted to 2.21°C. The red light correlated with magnetic stimulation resulted in a similar small increase in temperature, as in the case of infrared light. On average, the increase amounted to 2.30°C. A much higher temperature increase observed in the case of the combined mixed light stimulation and magneto-polarized light. The average temperature rise amounted to 3.01°C and 4.18°C (Fig. 5).

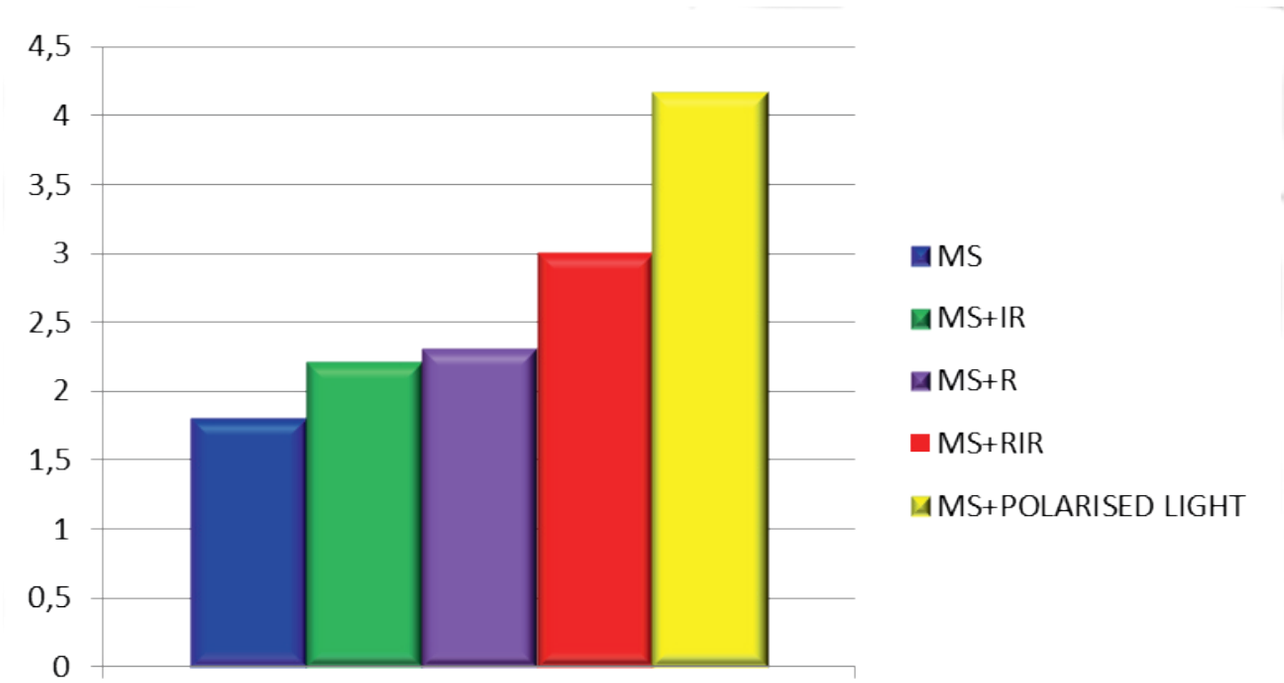

Fig. 5. Average temperature difference

Discussion

The use of physical therapy in the form factor of the light is becoming widely destiny in dentistry. It is used for the purpose of analgesic and anti-inflammatory as well as in the regeneration of the mandible [3]. In the conducted study assessed the change in temperature on the skin coatings facial part of the skull and neck as a result of the application LED therapy and polarized light using the device Viofor JPS and Solaris. Each of factors led to a rise in temperature. However, audit and subsequent analysis shows significant differences in warming the tissues depend on the used type of stimulation. The same electromagnetic field induces a very slight warming of tissues while light mixed, especially polarized light will lead to a noticeable increase in temperature in the perception of

patient and measurement methods. Taking into account the differences obtained can reflect on degree of effectiveness of the fluid and the effect of therapeutic light [4,5]. It is claimed that the red light acts on the mitochondrion of infrared light while affect the cell membrane. The combination of these two types of lamps will light in a two-level stimulation, both at the mitochondrial and the membrane. Light energy and the magnetic field at the biological level are similar to the correlation and therefore will trigger a synergistic effect. Research confirms that particularly intense on the body operates red light. It is believed that the reasons lie the resonant frequencies of light and the body. Treatments are the most effective when the length of the electromagnetic wave is in the range of 600-700 nm, which is in the range of visible light. Infra-red radiation is also used as a treatment of many diseases. For use in the treatment of dermatological disorders, neurological, musculoskeletal, skeletal, killing of tumor cells, the treatment of eczema, infection, in order to accelerate wound healing (especially after surgery), the regeneration of cells and tissues [6,7].

Conclusions

1. Both the application magnetoledoterapii and in polarized light, comes to the warm soft tissues as a result of which will improve blood circulation, which will accelerate the transformation of cells. This will also assist the treatment of pain disorders craniofacial and neck, and will be a reduction in muscle tension.
2. In practice this means that each different type of light makes the temperature rise and thus will cause a stronger or weaker therapeutic effect.
3. In the case of led therapy highest temperature after application occurred in the case of the correlation of light mixed (RIR). However, throughout this study the electromagnetic field coupled with polarized light resulted in the highest degree heat the skins.

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Piśmiennictwo

1. Sharrard W.J.: A Double-blind trial of pulsed electromagnetic fields for delayed union of tibial fractures. British Edit. and Bone Joint Surg. 1990; 72: 347-355
2. Mooney V.: Randomized Double-Blind Prospective Study of the Efficacy of Pulsed Electromagnetic Fields for Interbody Lumbar Fusions. Spine, 1990, 15, 7, 708-712
3. Opalko K., Dojs A., Deka W.: Zastosowanie wolnozmiennych pól magnetycznych w praktyce stomatologicznej. Stomat. i Prot., 2003; 1: 9-16
4. Sieroń A., Krawczyk-Krupka A.: Komórkowe efekty oddziaływania wolnozmiennych pól magnetycznych. Acta Bio-Opt. Inform. Med., 1998, 4, 79-83
5. Lietz-Kijak D., Kijak E., Opalko K.: Diagnostyka rentgenowska w przebiegu regeneracji struktur kostnych z zastosowaniem programu Corel Draw Graphic, Mag. Stomat., 2012, 5, 94-99.