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Przebieg zachorowania na COVID-19 w odniesieniu do zmysłu węchu, smaku i wzroku

The SARS-CoV-2 virus contributes to disorders of the sense of smell, taste and vision by attacking many important structures in human body

Znaczenie systematycznej rehabilitacji na przestrzeni 45 lat pacjentki z rozwojową dysplazją stawu biodrowego

The importance of systematic rehabilitation over 45 yrs of a patient with developmental dysplasia of the hip joint

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BIOMAGNETOTERAPIA W WYROBACH MEDYCZNYCH „ORT BUTTERFLY”

- BEZ BÓLU, STRESU I BEZ TABLETEK!
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Ogromny potencjał Natury w zwalczaniu smogu energetycznego i autooksydacji, będącej główną przyczyną wszystkich chorób cywilizacyjnych! **Najstarsza Terapia Świata** wspomagająca każdą formę leczenia! Uważa się do dziś, że bez niej nie da się wyleczyć żadnej choroby do końca! **Naturalna Terapia Magnetyczna** Twoje Zdrowie, Twoja Uroda, Odporność i Sprawność do późnej starości! **Wypróbuj** – gdy zawiodły już inne terapie!

Biomagnetoterapia inicjuje ożywienie komórkowe, oczyszcza i „odmładza” krew, podnosząc witalność całego organizmu, który uruchamia intuicyjne procesy obronne, znosząc dyskomfort powodowany bólem, urazem lub stresem, bez konieczności ostrej dawki leków chemicznych...

DLACZEGO CHORUJEMY?
Natężenie sztucznych pól elektromagnetycznych zwiększyło się 100 tys. razy! Naturalne pole magnetyczne Ziemi zmniejszyło się swą moc o połowę!

ZŁOTE LOGO
Międzynarodowych Targów
Rehabilitacja
Łódź IX/2007

Jestem osobistym królikiem doświadczalnym! I żyję – realizując 25 lat wciąż nowe i śmielsze pomysły w wykorzystaniu tej **boskiej energii** naturalnych magnesów! Dzięki nim pokonuję dziś niezliczone przeszkody i przeciwności losu z nieznaną mi przedtem energią i determinacją! To moja pasja! I przeznaczenie!

Najnowsza opinia klienta:

Komentarz ten jest moim osobistym świadectwem zadowolenia z produktów biomagnetycznych „Ort Butterfly”, których używam od 20. lat! Zastanawiam się, zwłaszcza nad fenomenem poduszki (określenie nie jest przypadkowe) zwyczajnie; nie wyobrażam sobie snu i wypoczynku bez magnetycznej „Ort Butterfly” – pod głową! Jej ergonomiczny, przyjazny dla głowy i szyi kształt sprawia, że wysypiam się „po królewsku”. Zabieram ją również ze sobą w bliższe i dalsze podróże! Czyż gdyby była to zwyczajna poduszka, fundowałbym sobie dodatkowy bagaż? Wychwalam więc ją od zarania, polecam i rekomenduję, bo jest tego warta! Bez niej nie wyobrażam sobie prawdziwie relaksacyjnego snu i błogiego, kojącego wyczpoczynku! Dziękuję, że ją Pani stworzyła!

J. Szw. Działdowo (maj 2020)

PS *Poduszki „Ort Butterfly” to prawdziwe arcydziełka robione z wyczuciem i sercem... jak rzeźby Michała Anioła... Polecam wszystkim!*

Zapraszamy do zapoznania się z opiniami użytkowników i ekspertów jakie pojawiły się na przestrzeni ostatnich 10 lat: www.butterfly-mag.com → opinie klientów

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XVII JESIENNE DNI FIZJOTERAPII

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Temperature measurements on facial skin surface as evaluated by infrared thermal camera and pyrometer following physiotherapeutic light treatments

Pomiary temperatury na powierzchni skóry części twarzowej czaszki w ocenie kamerą termowizyjną na podczerwień oraz pirometrem po zastosowaniu fizykoterapeutycznych aplikacji świetlnych

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Abstract
Any clinical procedure in dentistry, especially one that involves a breach of tissue integrity, carries the risk of complications, which can occur in any speciality. These include: postoperative wound pain, tissue swelling, bleeding, redness, elevated temperature, trismus, decreased sensation as a result of nerve damage. Postoperative patient care aims to minimise the risk of complications and to treat those which have developed. To this end, we can resort to physical therapy, one of the modalities of which is light therapy, using electromagnetic wave ranges of red, infrared, yellow and ultraviolet light. Yet, it remains unclear which wavelength should be used to treat any specific disease entity and which form of therapeutic light should be used in the rehabilitation of a specific complication following dental procedures? In this study, we used the Cason CA380 infrared digital pyrometer with a laser pointer and the Fluke Ti 400 thermal imaging camera. On the basis of the tests and statistical analysis, it can be concluded that the application of light significantly increases the temperature of the irradiated facial skin surface. Irrespective of the type of light used, each was associated with an increase in temperature. A more pronounced increase in temperature on the facial skin surface after a given ap-plication suggests that the effect of light therapy is shallow, which is relevant to the choice of a specific light wavelength to be applied in a particular disease entity or dental complication.

Key words:
temperature measurement, light therapy, pyrometer, thermal imaging

Streszczenie
Każdy zabieg kliniczny postępowania stomatologicznego, a zwłaszcza przebiegający z naruszeniem ciągłości tkanek, niesie za sobą ryzyko powstania powikłań, które zdarzają się w każdej specjalności. Do nich należą: ból rany pooperacyjnej, obrzęk tkanek, krwawienie, zaczerwienienie, podwyższona temperatura, szczękościsk, zaburzenia czucia, będące następstwem uszkodzenia nerwu. Pozabiegowa opieka nad pacjentem ma na celu zminimalizowanie ryzyka wystąpienia powikłań oraz terapię już istniejących. W tym zakresie posiłkujemy się m. in. medycyną fizykalną pod postacią światłolecznictwa w zakresie fali elektromagnetycznej czerwonej, podczerwonej, żółtej i ultrafioletowej. Pozostaje jednak niewiadomą, którą długość światła wykorzystać w celu leczenia określonej jednostki chorobowej i jakie światło terapeutyczne należy zastosować do rehabilitacji konkretnego powikłania po zabiegach stomatologicznych. Do badań wykorzystano pirometr na podczerwień ze wskaźnikiem laserowym CA380 i kamerę termowizyjną Fluke Ti 400. Na podstawie przeprowadzonych badań i analizy statystycznej można wnioskować, iż użycie czynnika świetlnego ma istotny wpływ na wzrost temperatury naświetlanej okolicy skóry części twarzowej czaszki. Niezależnie od rodzaju użytego czynnika świetlnego, każdy z nich doprowadził do wzrostu temperatury. Najwyższy wzrost temperatury na powierzchni skóry części twarzowej czaszki po zastosowaniu danej aplikacji wskazuje na płytkie oddziaływanie fizykoterapii świetlnej, co ma znaczenie w zastosowaniu konkretnej długości światła w danej jednostce chorobowej lub powikłaniu stomatologicznym.

Słowa kluczowe:
badanie temperatury, światłoterapia, pirometr, termowizja

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Introduction

Any clinical procedure in dentistry, especially one that involves a breach of tissue integrity, carries the risk of complications. These can occur in any speciality and for various reasons: negligence or discontinuation of treatment by the patient, as well as due to iatrogenic factors. Some complications: postoperative wound pain, tissue swelling, bleeding, redness, elevated temperature, trismus, are to be expected, especially in dental surgery, while others may occur unexpectedly intraoperatively or immediately after surgery [1, 2]. Anaesthesia, which is obligatory for surgery, can by itself result in complications, such as blocked nerve conduction or nerve damage in the region supplied by the anaesthetised branch, causing sensory impairment to persist beyond the intended duration of anaesthesia. Post-anaesthesia complications, mainly following regional anaesthesia, are also encountered in the course of conservative, endodontic or periodontal treatment [3, 4]. Across all dental specialities, the most prevalent complications are related to pain which may occur during treatment, if the patient has not been anaesthetised, or after the procedure. Acute pain can often become chronic, which is equally discomforting and which cannot be managed in ways other than through the use of pain medications [5, 6]. The common procedure of caries excavation is associated with considerable pain during cavity preparation with a bur, even with a high-speed air turbine handpiece. In the field of conservative dentistry, there is also a concept of post-preparation pain, associated with a breach in the integrity of hard tissue, known as a ‘tissue insult’. Other complications include periapical osteolysis, which requires endodontic treatment. Dental bone loss at the root apex is another complication of the untreated carious process that is challenging to treat. A rapid resolution of the osteolytic lesion with the possibility of periapical tissue regeneration is an important part of the conservative treatment of the tooth and allows it to be used for further procedures such as prosthetics [7].

Postoperative patient care aims to minimise the risk of complications and to treat those which have developed. To this end, we can resort to physical therapy, which is not intended as an alternative to primary or pharmacological treatment. However, by taking advantage of its effects, we can support the primary treatment, help maintain the therapeutic effect, prevent the progression of the disease, counteract complications, as well as increase the body’s immunity by restoring its homeostasis [8, 9]. One form of physical therapy is light therapy, also known as phototherapy. Light is an electromagnetic wave which has an energy and can be described in terms of several parameters (length, amplitude, frequency, etc.). From the point of view of physics, it is a transverse wave, resulting from the propagation in space of coupled electric and magnetic fields. The wave causes the so-called photooxidation, a process that activates molecules in the body. Its effect on cells is mainly manifested through enhancing the production of ATP – adenosine triphosphate.

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Phototherapy can be administered using various light sources, including filtered continuous light from quartz, helium, fluorescent lamps, laser or LED [10, 11]. In the broad spectrum of electromagnetic waves (visible as well as invisible radiation), we can distinguish two key categories with therapeutic properties:
• Ultraviolet light – with a wavelength of 350–450 nm.
• Red light – near the invisible infrared spectrum – 600–830 nm.

Electromagnetic light waves can be used for both diagnostic and therapeutic purposes. In the course of the diagnostic procedures prior to the scheduled surgery, the patient undergoes physical diagnostic tests. These include measurements of temperature and sensation on the facial skin surface, which may be altered following dental intervention.
Thermography, also known as thermal imaging, is an automatic and non-contact method for evaluating body surface temperature distribution. It is used to visualise infrared radiation, which is invisible to the human eye, and thus acquire information about physiological and pathological processes in the human body, reflected in local and global temperature changes [12, 13, 14].
In physical therapy, considerable success has been achieved with magnetic field LED therapy, which is the combined application of a slowly changing electromagnetic field of extremely low frequency (Extremely Low Frequency-Magnetic Field, ELF-MF) and light from high-energy LEDs (Light Emitting Diodes) in the wavelength range corresponding to red (R), infrared (IR), mixed light (RIR) and ultraviolet (UV) radiation. Red light is emitted at 630 nm, infrared at 855 nm, and ultraviolet at 430 nm wavelengths. The magnetic field induction in the JPS System is 15 μT, with a magnetic field frequency in the range of 180–195 Hz [15, 16, 17]. Yet, it remains unclear which wavelength should be used to treat any specific disease entity and which form of therapeutic light should be used in the rehabilitation of a specific complication following dental procedures? This question inspired our study on the effect of specific wavelengths of light on the degree of facial skin warming, which is a clear reflexion of the depth of penetration.

Aim
The aim of this study was to measure the temperature on the facial skin surface using a py-rometer and a thermal imaging camera following treatments of magnetic field LED therapy and polarised light therapy.

Material and methods
In this study, we used combination therapy, combining two therapeutic physical agents – electromagnetic field and electromagnetic wave of red, infrared and ultraviolet light spectrum in the form of magnetic field LED therapy generated by the Viofor JPS device (Med&Life, Poland). Polarised yellow light with a wavelength of approximately 570 nm, within the visible light spectrum, was generated by the Solaris device (Medicolux, Poland).

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The study included 180 patients who were assigned by simple randomisation to one of five experimental groups and one control group. In groups of 30, the researchers applied electromagnetic radiation in combination with light: red (R), infrared (IR), mixed (RIR – red, infrared), ultraviolet (UV) and polarised light (PL). Patients in the control group were exposed to a slowly changing electromagnetic field without the light agent – ELF-MF (Tab.1).

Tab.1. Configuration of studied groups

CG	I	II	III	IV	V
ELF-MF	ELF-MF+IR	ELF-MF+R	ELF-MF+RIR	ELF-MF+PL	ELF-MF+UV

CG – control group; I, II, III, IV, V – experimental groups

The study was approved by the Bioethics Committee of the Pomeranian Medical University in Szczecin (KB – 0012/36/15). It complied with ethical standards, and all participants signed a written informed consent and were informed about the methodology and protocol of the study. There was no financial incentive to participate and patients were free to withdraw from the study at any time. All patients were in general good health and were not on regular medication. The exclusion criteria were regular pharmacological treatment, mental illness, coag-ulopathy, diabetes and chronic infections. The participants were not addicted to nicotine, alcohol or drugs.

Before and after the application of the relevant physical agent, the temperature at the application sites was measured using the Cason CA380 pyrometer and the Fluke Ti 400 infrared thermal imaging camera.

Temperature measurements were taken at the same, strictly defined locations on the facial skin. The test began with three measurements of the temperature on the facial skin surface prepared for application. The mean temperature score was recorded in the test sheet. Electro-magnetic field was then applied with an elliptical applicator in the control group and light therapy in groups I, II, III, IV, V (R, IR, RIR, PL, UV) (Fig. 1).

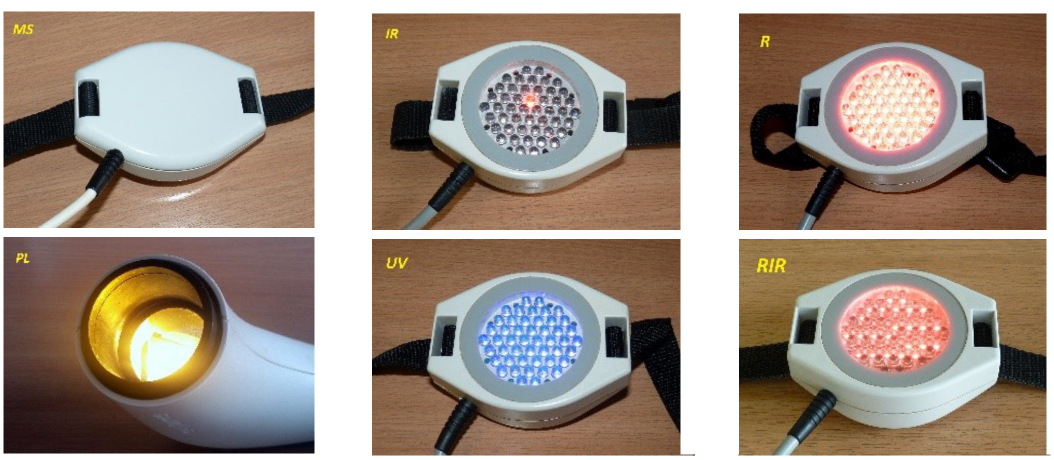

Fig. 1. The elliptical applicator and magnetic-field+light applicators used in this study

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Each application lasted 10 min. In the case of Viofor JPS, the M1, P3 programme was used, while for the Solaris lamp, a fivepulse application was used, corresponding with the intended duration of the physiotherapy treatment. After the application, the temperature was again measured three times with the pyrometer and the thermal imaging camera and the mean score was recorded (Fig. 2).

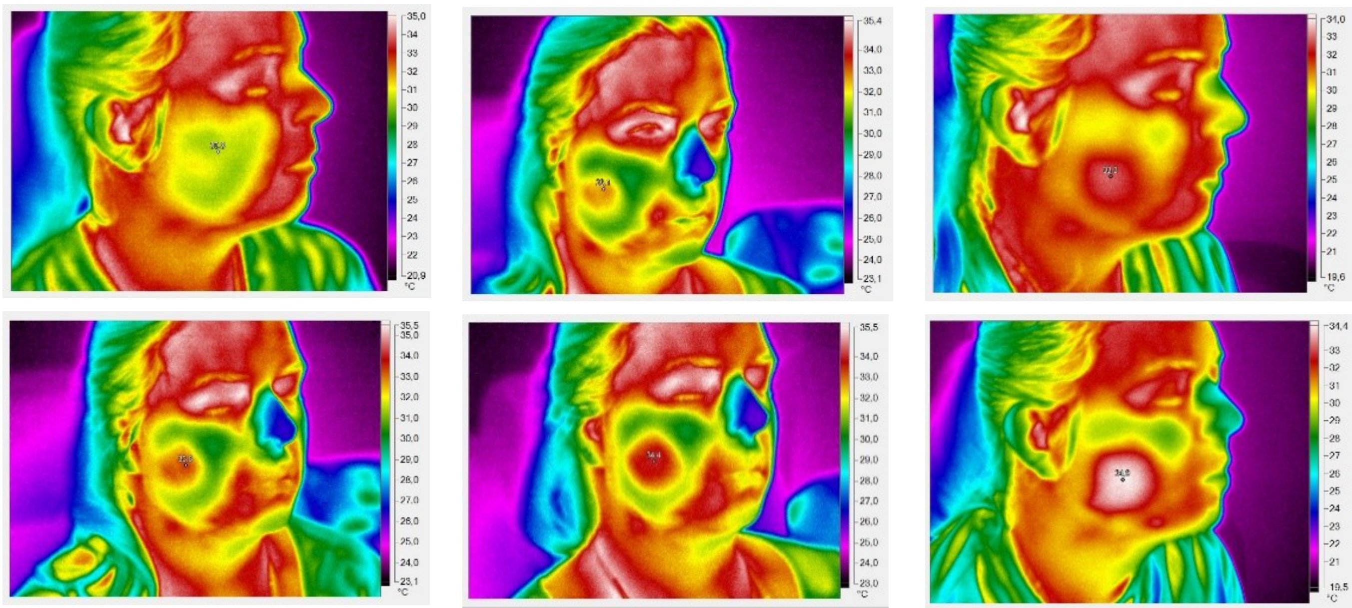

Fig. 2. Examples of follow-up images after light therapy, taken with the Fluke Ti 400 thermal imaging camera

Results

Once the tests were completed, the results were analysed statistically using Student's t-test and Student's t-distribution, as well as the ANOVA with Tukey's post hoc test. Results were considered significant at $p < 0.05$. The R statistical package ver. 4.2.2 was used for the calculations.

Statistical analysis showed that the difference between the initial and final temperature, i.e. the temperature before and after the application of light therapy, in each group, was statistically significant, irrespective of whether it was measured with a pyrometer (Tab. 2) or a thermal imaging camera (Tab. 3).

Tab. 2. Descriptive statistics of temperature before and after light therapy, measured with the CA380 pyrometer, and the significance of the difference

Source of light		Temp. before			Temp. after			p
		Mean	SD	Range	Mean	SD	Range	
CG	ELF-MF	32.16	1.423	29.1–34.8	33.96	1.45	31.1–36.2	< 0.001
I	ELF-MF IR	31.84	1.696	29.3–34.8	34.05	1.888	30.8–37.5	< 0.001
II	ELF-MF R	32.14	2.318	23.4–34.8	34.44	1.976	28.0–37.9	< 0.001
III	ELF-MF RIR	32.40	1.625	27.9–35.4	35.41	2.227	30.7–40.7	< 0.001
IV	ELF-MF PL	32.76	2.298	24.6–35.7	36.94	1.781	32.3–40.0	< 0.001
V	ELF-MF UV	32.76	1.906	27.8–36.7	37.76	1.411	34.1–40.2	< 0.001

doi.org/10.56984/8ZG0DF529

Tab. 3. Descriptive statistics of temperature before and after light therapy, measured with the Fluke Ti 400 thermal imaging camera, and the significance of the difference

Source of light		Temp. before (n = 180)			Temp. after (n = 180)			p
		Mean	SD	Range	Mean	SD	Range	
CG	ELF-MF	30.71	0.732	29.8–32.7	31.21	0.770	30.0–33.3	0.014
I	ELF-MF IR	30.68	0.478	30.0–31.7	33.28	0.795	31.7–34.7	< 0.001
II	ELF-MF R	30.50	0.802	29.3–32.3	33.20	1.107	31.1–35.7	< 0.001
III	ELF-MF RIR	31.14	0.583	30.0–32.1	33.74	0.907	32.2–35.5	< 0.001
IV	ELF-MF PL	30.41	0.608	29.7–31.8	35.12	1.026	33.0–37.0	< 0.001
V	ELF-MF UV	31.30	0.756	30.0–33.0	34.80	0.994	32.7–37.0	< 0.001

Analysis of differences between groups.
The ANOVA showed that the difference in initial temperatures between the groups was not statistically significant. The treatment in the control group, using only electromagnetic field (ELF-MF) (without light), caused the smallest temperature increase. The mean temperature increment was: 1.8°C when tested with a pyrometer, and 0.5°C using a thermal imaging camera. In the experimental groups that received electromagnetic stimulation in combination with infrared, red, mixed, yellow and ultraviolet light, the difference between the temperatures before and after treatment was greater (Tab.4).

Tab.4. Temperature differences before and after treatment

Source of light		Pyrometer CA380 °C	FlukeTi400 camera °C
CG	ELF-MF	1.80	0.49
I	ELF-MF IR	2.21	2.60
II	ELF-MF R	2.30	2.70
III	ELF-MF RIR	3.01	2.60
IV	ELF-MF PL	4.18	4.71
V	ELF-MF UV	5.01	3.50

The researchers investigated intergroup differences in temperature increase as a result of the therapy, to obtain a picture of the effect of the type of light on the heating of the soft tissues in the craniofacial region.
a) Cason CA380 pyrometer
The distribution of temperature increments in patient groups is shown in Fig. 3.
Seeing as temperature increments significantly deviated from a normal distribution, ANOVA was applied to log(1+increment), showing no significant deviation (Shapiro-Wilk test, $p = 0.284$). Significant intergroup differences were found ($p < 0.001$).
Tukey's post hoc test revealed significant differences in several pairs of groups (Tab. 5).

doi.org/10.56984/8ZG0DF529

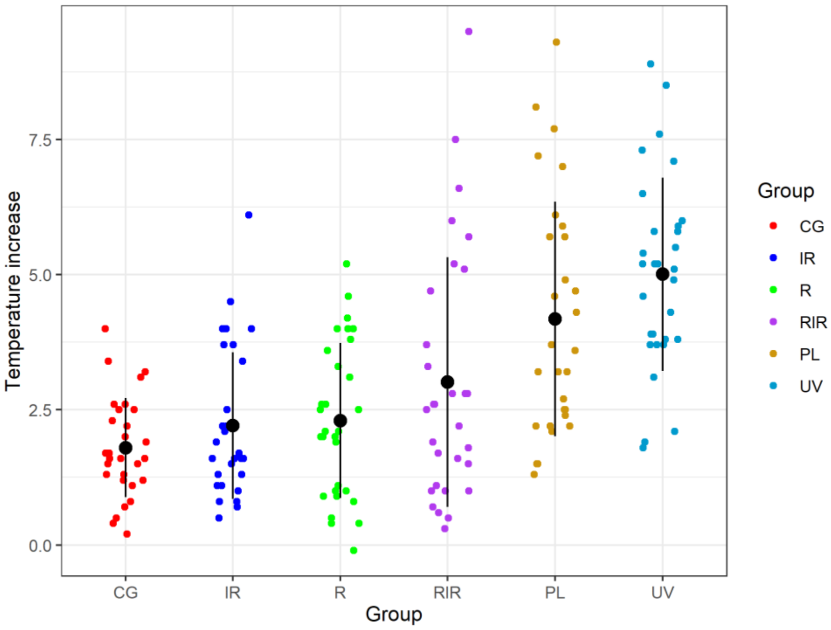

Fig. 3. Distribution of temperature increase as measured by pyrometer in patient groups. The mean value and the area of variability (mean ± SD)

Tab. 5. The results of Tukey's HSD test for pyrometer measurements

Group pairs	diff in logs	diff	p adj.
IR-CG	0.111	0.41	0.911
R-CG	0.091	0.50	0,963
RIR-CG	0,264	1.21	0.158
PL-CG	0.565	2.38	**< 0.001**
UV-CG	0.752	3.21	**< 0.001**
R-IR	−0.02	0.09	> 0.999
RIR-IR	0.152	0.80	0.731
PL-IR	0.454	1.97	**0.001**
UV-IR	0.641	2.80	**< 0.001**
RIR-R	0.173	0.71	0.622
PL-R	0.474	1.88	**< 0.001**
UV-R	0.661	2.71	**< 0.001**
PL-RIR	0.301	1.17	0.074
UV-RIR	0.489	2.00	**< 0.001**
UV-PL	0.187	0.206	0.544

diff in logs – pairwise difference of log-transformed temperature increment,
diff – pairwise difference of temperature increment,
p adj. – significance level including multiple comparisons, significant differences shown in bold.

Pairs with significant differences are also shown in Tab. 6. Three groups (CG, IR, R) show a low temperature increment, two (PL, UV) – high, with a moderate increase in the RIR group.

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Tab. 6. Significant differences in mean temperature increase as measured by pyrometer

	CG	IR	R	RIR	PL	UV
CG	–				*	*
IR		–			*	*
R			–		*	*
RIR				–		*
PL	*	*	*		–	
UV	*	*	*	*		–

b) Fluke Ti 400 infrared thermal imaging camera.
The distribution of temperature increments in patient groups is shown in Fig.4.
Significant intergroup differences were found ($p < 0.001$). Tukey's post hoc test revealed significant differences in several pairs of groups (Tab.7).

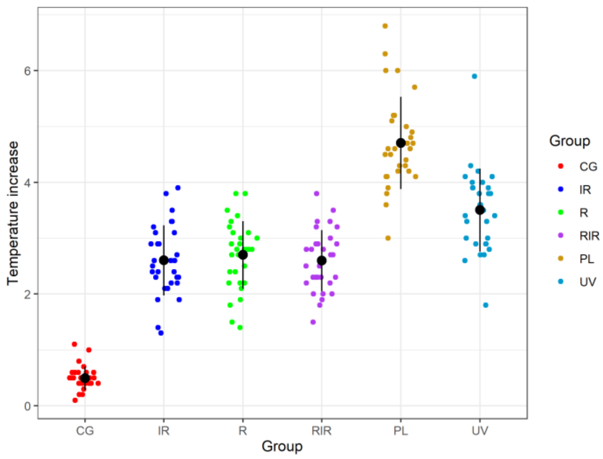

Fig.4. Distribution of temperature increase as measured by TI camera in patient groups. The mean value and the area of variability (mean ± SD) are shown

Tab. 7. The results of Tukey's HSD test for TI camera measurements

Group pairs	diff in logs	diff	p adj.
IR-CG	0.874	2.11	**< 0.001**
R-CG	0.902	2.21	**< 0.001**
RIR-CG	0.876	2.10	**< 0.001**
PL-CG	1.339	4.21	**< 0.001**
UV-CG	1.099	3.01	**< 0.001**
R-IR	0.027	0.10	0.984
RIR-IR	0.001	−0.01	**> 0.999**
PL-IR	0.465	2.10	**< 0.001**
UV-IR	0.225	0.90	**< 0.001**
RIR-R	−0.02	−0.10	0.988
PL-R	0.437	2.01	**< 0.001**
UV-R	0.197	0.80	**< 0.001**
PL-RIR	0.463	2.11	**< 0.001**
UV-RIR	0.223	0.91	**< 0.001**
UV-PL	−0.24	−1.20	**< 0.001**

diff in logs – pairwise difference of log-transformed temperature increment,
diff – pairwise difference of temperature increment,
p adj. – significance level including multiple comparisons, significant differences shown in bold.

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Pairs with significant differences are also shown in Tab.8. Statistically significant differences were not found only between the R, IR, RIR groups.

Tab. 8. Pairs with significant differences in mean temperature increase as measured by TI camera

	CG	IR	R	RIR	PL	UV
CG	–	*	*	*	*	*
IR	*	–			*	*
R	*		–		*	*
RIR	*			–	*	*
PL	*	*	*	*	–	*
UV	*	*	*	*	*	–

The use of each type of light had a significant effect on the temperature of the irradiated area of the body, but different light agents caused different degrees of tissue warming. Each type of light applicator resulted in an increase in temperature.
The application of the electromagnetic field alone resulted in the lowest degree of warming. The use of ultraviolet light resulted in the highest pyrometer-measured increase in temperature of the irradiated area compared to other applicators. In measurements with a thermal imaging camera, the highest temperature increase was recorded after the application of polarised yel-low light.

Discussion

Light therapy, due to its increasing applicability in diagnostics, clinical therapy and rehabilitation, is currently a spectacularly growing branch of physical therapy. Over the past decade, magnetic field LED therapy has been used with great success as an adjunctive treatment in conditions and ailments of an aesthetic nature [9]. The use of the appropriate wavelength of light during physical therapy has a significant impact on the depth of penetration of the electromagnetic wave into tissue structures. This is probably related to the synergistic effect of the electromagnetic field and light, which is caused by the similar mechanism of action of both agents at the cellular level. Taking into account earlier reports and putting them together with the present findings, it can be confirmed that UV light with a wavelength of 430 nm and polarised light with a wavelength of 570 nm, which are associated with the highest degree of heating of the dermal layers, have the most superficial effect, confined to the epidermis only. Red, infrared and mixed light achieve a much greater depth of penetration, with a relatively low heating effect on the skin surface [10]. Information regarding the depth of penetration of the electromagnetic wave makes it possible to select the right therapy depending on the specific condition and its location, which is particularly important in dental treatment and subsequent rehabilitation. This knowledge will have a bearing on the efficacy of treatment of degenerative lesions of the marginal and apical periodontium, as well as the regeneration of bone osteolysis and injury to the inferior alveolar nerve and lingual nerves. In these cases, the effect of the physical agent helps accelerate regeneration, but it requires that the light beam together with an electromagnetic field penetrate into the nerve endings located in the dermis. In the literature, one can find reports on the effect of slowly changing electromagnetic

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fields combined with light therapy in the treatment of conditions related to neuralgia of the trigeminal nerve and facial nerve, inflammation of the paranasal sinuses, and TMD, which likewise entails the need for deep penetration of the physical agent [18, 19, 20]. The penetration of light energy together with an electromagnetic field into the area surrounding the root apex has been used therapeutically to aid the regeneration of osteolytic foci of periapical tissues in the course of chronic inflammation [7]. The use of laser therapy, LED therapy, polarised light therapy has been proven in the treatment of neuralgia and postoperative complications – post-extraction or following intraoral anaesthesia [18]. Electromagnetic fields combined with light are also used to great effect to accelerate bone regeneration in the course of orthodontic treatment and following surgical procedures such as apicoectomy, haemisection or tooth replantation. Both magnetic field LED therapy and polarised light therapy result in the warming up of soft tissues, improving local blood supply, which in turn induces cellular metabolism, supports the treatment of orofacial pain conditions and reduces muscle tension [21]. In practice, this means that each type of light causes a different increase in temperature, thus achieving a stronger or weaker therapeutic effect.

Conclusions

1. On the basis of the tests and statistical analysis, it can be concluded that the application of light significantly increases the temperature of the irradiated facial skin surface.
2. Each type of light agent leads to an increase in temperature on the skin surface.
3. A more pronounced increase in temperature on the facial skin surface after a given application suggests that the effect of light therapy is shallow, which is relevant to the choice of a specific light wavelength to be applied in a particular disease entity or dental complication.

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