INFRARED TEMPERATURE CONTROL DURING MAGNET THERAPY

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Abstract

In this paper we have considered a practical research of skin surface temperature change during physiotherapy with low frequency magnetic field. In order to measure the temperature, we have used a thermo graphic camera. The research has been conducted during magneto therapy of a hand in clinical conditions.

1. INTRODUCTION

Optical technologies, and those with infrared light in particular, are becoming more and more commonplace in our lives. As well as in the commonly used optical fibers for transmitting information, the infrared light is also used for indirect temperature measurement. Of essential interest is the compiling and processing of information for temperature fields in the human body [1-9].

The infrared rays which emit from a surface form an image defined a thermograph. Localized increases in the temperature of tissue can be caused by abnormalities which can resemble hot spots or inhomogeneous areas in the thermogpraph. This image has been applied in the investigation of various clinical problems and its reliability and convenience have been proven. Thus, it includes changes of temperature in the regions affected by physiotherapy, and the measurements of temperature may be applicable as an adjunctive physiologic test when the patients' response to treatment is assessed and documented.

Special video cameras which do not have the option of being affixed to a segment of the body, are at the basis of infra red systems. This study aims to assess the applicability of infra red thermography for the evaluation of local physiologic responses in the cases of patients undergoing magneto therapy.

As a safe physiatrist method applied in the treatment of various diseases (articular, intraabdominal, intracranial), magneto therapy has a long history.

This type of therapy, being an alternative physical therapy agent, provides beneficial effects because it has the ability of penetrating deeply in the tissue during the repair process.

The action's mechanism depends on the flow of electrical charges which cause a net flow of ionic current necessary for activities related to the restoration of basic cells and this is believed to result in reproducible healing effects by cell cytoprotection and growth factor synthesis stimulation.

Due to modern devices, it is possible to generate various frequencies, modulations, impulse shapes and duration of exposure.

The frequencies applied are between 1 and 100 Hz, while the magnetic flux density is up to 20 mT. The established physical mechanisms for the interaction of pulsed magnetic fields with living matter are three: magnetic induction, magnetomechanical effects and electronic interactions which is

believed to be responsible for the vasodilatation, analgesie, anti-inflammatory, anti-edematous and spasmolytic activity, as well as for the acceleration of healing.

2. EXPERIMENT

The experiment was conducted within the physiotherapy department of Diagnostic-Consultative Centre 5 – Sofia. Thirty infrared pictures were produced during therapy with two toroidal magnets, of the hand of a sixty-five-year-old volunteer patient (fig. 1 - fig. 3). The pictures were produced at thirty-second intervals. The adjustments of the magneto therapy procedure are the following: magnetic induction 20 mT, square pulses with frequency 10Hz and duty cycle 0,4. The thermography was obtained using infrared thermography device FLIR E40.

All examinations were performed in a sitting position in a quiet room at a constant room temperature following an acclimatization period of 20 min keep-

ing the hands free of any contact to the rest of the body or other objects. All temperature images were archived using internal SD memory card. For the final analysis, the temperature values were determined and given in degrees Celsius (°C). The temperature and perfusion measurements were processed electronically using the device related software from FLIR.

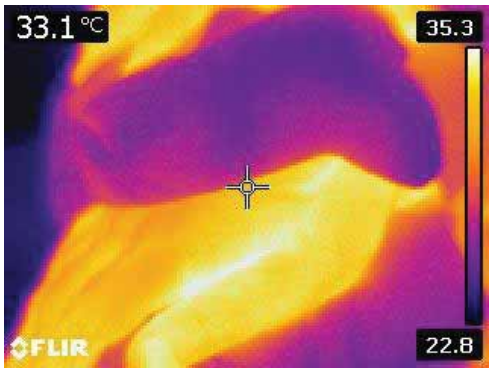

Fig.1. Infrared image with measurement of the region of interest

Fig. 2. The same image as the one in fig. 1 but in visible light

Fig. 3. Infrared image with the measurement of coil temperature

For the emissivity of human skin is taken a constant value 0.98 for the wavelength range of 2–14 um. Recordings were made with a rate of one image per 30 s for a period of 15 minutes. The temperature drift due to the heating of the IR detector was corrected by periodic self-calibration.

3. RESULTS

The results are presented in the following table

No	1	2	3	4
T, °C	33.1	33.2	33.1	33.2

5	6	7	8	9
33.3	33.8	33.2	33.7	33.4

10	11	12	13	14
33.3	33.5	33.3	32.9	33.4

15	16	17	18	19
32.7	33.3	33.4	33.1	32.7

20	21	22	23	24
32.7	33.2	33.2	32.9	32.9

25	26	27	28	29
32.8	32.6	33,2	33,1	32,7

30	31
33,5	33,3

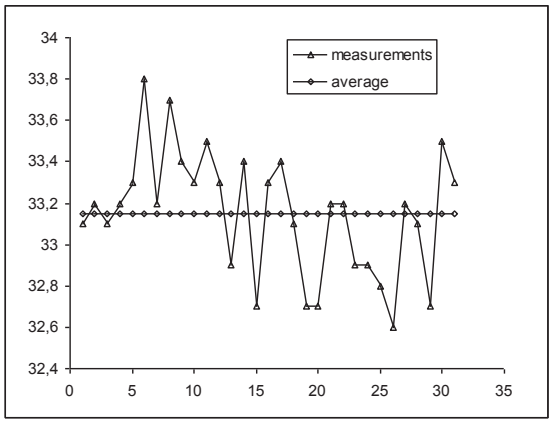

Fig. 4. Graphical representation of results (x-axis – number of measurement, y-axis – temperature in Celsius)

The average and variation are respectively 33,15 and 0,09.

4. CONCLUSIONS

No tendency of temperature change in the selected region has been detected. Fluctuations have been observed in both increasing and decreasing directions. It can be stated that they are due to involuntary twitching of the patient and measurement method error. As a next step is envisioned the broad-

ening of the research to a greater number of patients and wider regions of interest.

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