INFRARED INVESTIGATION ON THE THERMAL FIELD IN THE CASE OF INFLUENCE OF ULTRA HIGH FREQUENCY SIGNALS ON THE HUMAN BODY

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Abstract

In this paper the subject of infrared thermal imaging cameras and their potential for medical applications are investigated. Two different medical physiotherapeutic appliances are reviewed in terms of heat eminence during a standard therapy session..

1. INTRODUCTION

Through the development of technics and technology, every day we are facing new perspectives in health care – both diagnostically and therapeutically. What is observed in the last few years is an increasingly more significant implementation of infrared thermal-imaging-based medical apparatus, generally in the diagnostic sphere. However the potential of this technology in contemporary medicine is still to be explored in further detail. The current paper is an attempt to broaden the view and deepen the understanding of some of the existing therapies (ultrasound and UHF) through the analysis of data provided by a thermal camera.

2. CURRENT STATE OF THE PROBLEM

Another broadly accepted for its soothing, anti-inflammatory, desensitizing, trophic, anti-hypertensive and stimulating effect of regenerative processes in damaged tissues is the UHF pulse therapy. Given the fact, that the spectrum of this therapy (40.86MHz) is known to hold certain risks in special cases (such as patients with neoplasms, cardiac insufficiency with signs of decompensation, pronounced atherosclerosis, hyperthyroidism, a tendency to bleeding, pregnancy, pulmonary tuberculosis in advanced lesions and risk cause haemoptysis), it is beneficial to be able to analyse thoroughly the coverage of greater influence of the appliance. This can be achieved with a great amount of accuracy through the analysis of the thermal field, changed throughout the therapeutic session under the emission of the UHF apparatus.

3. EXPERIMENTS

For the experiments the same thermal camera is used for data collection – FLIR E40, with thermal sensitivity of < 0.07°C, accuracy of ±2°C or ±2% of reading and temperature range of -4°F to 1,202°F (-20°C to 650°C) [3], [4]. For maximum accuracy, the camera is fixed on a stand and movement of the object is avoided.

With UHF therapy the setting includes two objects of interest – one is the patient and another one for testing the amount of thermal radiation emitted outside of the direct field of application, shown in Fig. 1:

Fig. 1. UHF therapy – sinusitis treatment

4. RESULTS

For the UHF therapy images there are 3 points of analysis used in all 19 thermal images taken – SP1, which is where directly next to the point of application of the plates, SP2, which is a control point on the head of the patient and SP3, which is on another person in the room, but far from the plates (Fig. 2):

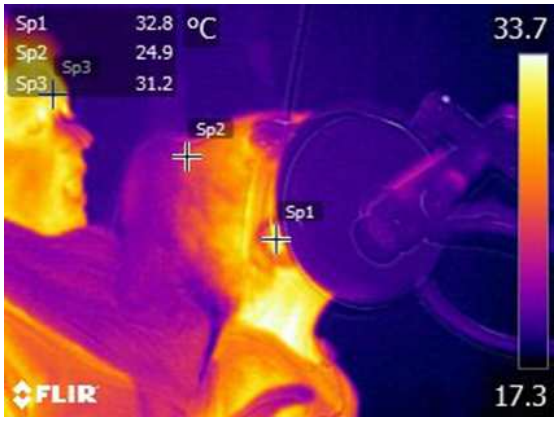

Fig. 2 Thermal image of UHF therapy – points used for analysis

It is important to note that for each image the emissivity of human skin is considered through the coefficient ε=0.98.

The data collected from the UHF session shows a steady temperature rise as for all examined points (Fig. 3).

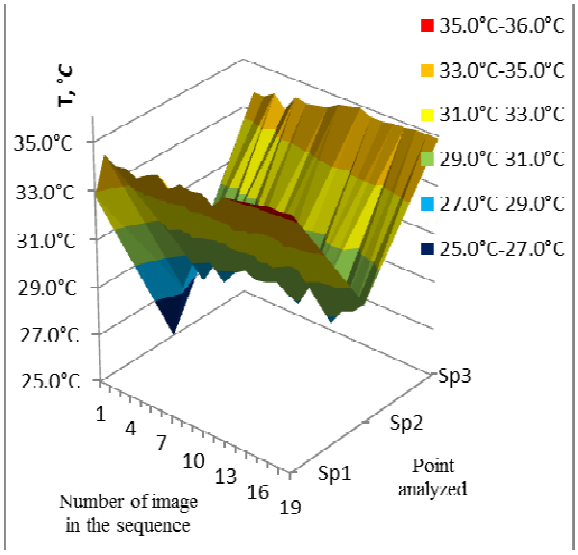

Fig. 3. UHF Therapy – thermal changes in the analyzed points

What is observed in a more dynamic temperature increase at the beginning of the session for all points of analysis (with about 3-4 °C) and then a more gradual, but still noticeable increase until the end. It should be emphasized that there is a major temperature rise for SP3 (3,7°C), which is chosen to be in a subject different from the one to whom the treatment is directly applied. This means there is significant emission outside of the plates' focal point, which could make it dangerous for anyone in the near proximity. That is why it is of great importance to use a shielded room (Faradey cage) for UHF treatment sessions.

5. CONCLUSION

The analyzed data gives one more perspective of the countless applications of thermal imaging cameras for medical purposes. Such analysis can be very useful in providing a new understanding of widely-used technology in terms of safety and effectiveness. Since IR imaging is non-invasive and does not bear and risks, it can be implemented wherever it is useful and possible. It carries a great potential also for diagnostic medicine – early tumor/cancer detection, diagnosing neuropathies, all kinds of inflammation, scanning large groups of people for high body temperature, veterinary purposes and many others. In the near future IR thermography might become a valid single diagnostic method for many diseases that involve intricate changes in temperature field.

6. APPENDIX AND ACKNOWLEDGMENTS

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