Chapter 5

Whole-Body Cryotherapy as a Tool to Improving of Infrared Thermography Diagnostics

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ABSTRACT

The use of low temperature on the whole human body switched on beneficial physiological reactions. Whole-body cryotherapy is used as a part of rehabilitation. There were reported studies of thermal imaging performed due to whole body cooling in case of patients suffering from different diseases that showed a significant enhancement of the skin temperature gradient observed after cryotherapy. That explains that such therapeutic technique like whole-body cryotherapy can be used as a part of infrared thermography diagnostic procedure.

INTRODUCTION

Skin Temperature as the Physical Parameter

Body temperature is used as an indicator of diseases processes. It is usually measured by contact thermometers which must be stick to the skin or put inside the body orifices i.e. mouth, ear or rectum. It is very important factor describing our health state. But what about the skin temperature? Does it give us some important information about our health state too? Nowadays, we can say that it is very important to measure not only internal organism temperature, but also, in many cases, body surface temperature which might be sensitive indicator of metabolism changes beneath the skin what might be related to health state. This was proved by Hipocrates. However, his experiments were performed with poor precision and had only qualitative character. Can we measure it very precisely? Can we use such parameter

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like body surface temperature to evaluate or even diagnose some diseases? Maybe it is possible to use thermal maps of the body to differentiate diseases?

However, first we should take into consideration that body surface temperature can give us very important information about tissue’s health state – especially soft tissues just beneath the skin. Hippocrates was the first one who proved and showed how important skin temperature is. He did it using wet soil which was put on patient’s skin in vicinity of abdomen. Wet soil while drying changing its color and Hippocrates was able to see in a sense the temperature gradient. Now it is obvious that skin temperature gradient is also a very important physical parameter that can be used in medical diagnosis. There is no doubt that the skin temperature and its variation can also be a symptom of disease in living organism. It is very important that the skin temperature change can be easily detected by infrared imaging. Temperature gradient is a very good diseases indicator because local blood flow and metabolism changes cause temperature change of the skin Therefore, infrared thermography imaging which is completely non-invasive diagnostic technique can be widely and easily used in medical diagnosis (Ring, Jung, Kalicki, Zuber, Rustecka, & Vardasca, 2013; Cholewka & Drzazga, 2006).

Maybe it will be possible to combine body cooling with thermal imaging and use it as a diagnostics method. However, before we present the achieves and possibilities of use the infrared thermography as a tool of diagnosis in whole body cryotherapy, we should first explain a little what the whole – body cryotherapy is and how it is used in medicine.

Whole Body Cooling in Sport and Medicine

In last few decades, very popular modern forms of wellness in sport has become using the whole body cooling as a part not only the rehabilitation but also as a part of normal training program as well as in recovering after injuries. Properly dosed and applied treatments renewing athletes, give a chance to reduce the negative effects of overloads and prepare the sportsman for the next train. The aim of wellness in sportsmen is to speed up the healing process and rise the efficiency level of the body (Vardasca, Ring, Plassmann, & Jones, 2012). Cryotherapy may cause circulatory and metabolic better exercise tolerance and delay the accumulation of tiredness while working muscle. In addition, the subjective feelings of the athletes after using a series of sessions in the cryochamber show a faster regeneration after training, and higher motivation to re-repetition training (Ring & Ammer, 2012). Cryotherapy has been also considered as an excellent treatment method in many fields of sports. Many clinical studies have reported that the use of cryotherapy has a beneficial effect on pain reduction and recovery of various injuries. Additionally, results of various studies are coherent on the effects on pain and neuromuscular processes (Ring, Jung, Kalicki, Zuber, Rustecka, & Vardasca, 2013). Whole-body cryotherapy, as well as the local one, are methods used for the treatment of acute soft tissue injuries. As part of the therapy can be used various methods such as ice towels, ice packs, ice massage, refrigerant gases, gel packs and inflatable splints. The chosen method of cooling the tissue directly influences the obtained therapeutic effect (Ring & Ammer, 2012).

It is known the biochemical and physiological processes in the human body are highly sensitive due to temperature change. The internal temperature of the body is constant and is kept at 37 °C with primary typical daily changes approximately 0.7 °C. But the surface temperature of the body changes in a wide range because of changes in ambient temperature. With all energy generated by the tissues mentioned, only 15-25% is converted into kinetic energy. The rest of the energy is converted into heat and distributed