REGULATION THERMOGRAPHY AND SYMMETRY

BASIC PRINCIPLES, SOURCES OF ERROR, POINTS OF EMPHASIS AND LIMITATIONS TO THE METHOD

(a) Pain in internal organs is often sensed on the surface of the body, a sensation known as referred pain.

(b) One theory of referred pain says that nociceptors from several locations converge on a single ascending tract in the spinal cord. Pain signals from the skin are more common than pain from internal organs, and the brain associates activation of the pathway with pain in the skin. Adapted from H.L. Fields, Pain (McGraw Hill, 1987).

Skin (usual stimulus)

Primary sensory neurons

Secondary sensory neuron

Ascending sensory path to somatosensory cortex of brain

Liver and gall bladder

Heart

Appendix

Stomach

Small Intestine

Colon

Ureters

Kidney (uncommon stimulus)
What is thermography? What "methods" are available? Where are the "priorities" and its "limitations"? What possible "sources of error" do we have to look out for?

Humans are homoiothermic beings (warm-blooded animals). Homoeothermic state is dependent on metabolism. However, all metabolic events generate heat. In order to keep temperature constant it is essential that the heat produced inside the body is transferred into the surrounding environment by radiation as soon as the temperature in the core of the body exceeds a certain degree (H. HENSEL).

Thermography is based on the physiology of heat in humans. Generation and dissipation of heat are governed by cybernetic rules. In addition to knowledge of heat physiology knowledge of the control sequences of the organism is a requirement for understanding of thermography.

Heat being predominantly generated in the core of the body is first of all lead to the skin by means of convection through the blood vessels. It is then transferred in the avascular uppermost skin layers to the surface of the skin by conduction and from there radiated off into the environment. The result is two different ways to quantifying heat:

1. Measuring of surface temperature by infrared thermography.
   a. with quick acting electronic thermometers (*infrared thermography*)
   b. with micro-encapsulated liquid crystals (cholesterol crystals) which change color according to skin temperature (*liquid crystal thermography*)

2. Measuring of radiated heat, infrared radiation, with out skin contact
   a. with a thermovision camera (*infrared thermography*)
   b. with non-contact thermometers (bolometers, pyrometers, etc.) (*non contact thermography*)

Liquid crystals and infrared thermography provide a colored picture of heat distribution. The different colors must then be converted info centigrade. A documentation is done with a polaroid type instant picture camera.

"Thermolytics" infrared thermometers measure skin temperature in centigrade. A computer is used for documentation and analysis of the measurement.

A non-contact thermometer records the infrared radiation originating from the skin. With reference to the spectrum of radiation if looks as if human skin acts like a black source of radiation.
The two different approaches therefore incorporate two different parameters - measuring of temperature and measuring of heat radiation. Therefore the resulting thermograms have to be interpreted differently. This has not been and is not done frequently. Therefore results are often unsatisfactory and misunderstanding leading to confusion which acts as a disservice to thermography. Each of the different approaches can be justified and there are specific indications for each one. Infrared thermography is preferred in rheumatology (J. M. ENGEL). The colored picture on the screen reproduces the affected area of the joint. Examiners looking for a focal area affecting the joint prefer the contact thermography.

**Fig. 1: Physiological ideal thermogram**

![Physiological ideal thermogram](image)

**Fig. 2: Organ disease with throughout satisfactory regulation for the rest**

Liquid crystal thermography is reserved for local areas (diagnosis of breast lesions, certain neurological problems). The practitioner who wants to get an overall impression of his patient and who is looking for the cause of chronic disorders amongst other things, uses the “thermolytics” infrared thermography – my publication of results are only valid for this approach.

The general conditions for thermal measuring and for observance of possibile distorting factors as to the patient as well as to the measuring itself have already been published in several papers (J. M. ENGEL, H. P. KÜMMERLE, A. ROST, E. SCHWAMM, G. STÜTTGEN).
Further error and misunderstanding are due to the different approaches of different groups in research. These differences must and should lead to different results. Without taking this into consideration there is no comparison or exchange which could be dangerous.

Temperatures at the surface of the skin are not only subject to vascular influences but are also influenced by viscero-cutaneous reflexes. In this way a specific temperature pattern which is characteristic to the individual can be reproduced like a signature.

Fig. 3: Hyporegulating thermogram

Fig. 4: Hyperregulating thermogram

Fig. 5: Chaotic thermogram

The approach of the clinicians therefore is identical with our second measurement. In contrast we do not add another one but we simply put one in front. This very first one has to be obtained from an unstressed system, i.e. from the not yet cooled system. Our organism is only able to react once to a physiological stimulus and our thermal stimulus is a physiological one and it makes use of the full range of its regulatory capability, the regulatory range. A further stimulus in the physiological range provokes no more, no further reaction. That means: After a cooling stress such as the temperature of the room there will be no more, no further reaction to an additional stimulation such as wetting the hands with cold water.
Thermal regulation testing using several measuring points of the body is only possible because the cooling stimulus by the considerably lower room temperatures does not immediately lead to a drop of skin temperature. It works in our favor that any regulator also in biological systems has a so called "dead period". In technology this is the period of latency between stimulation and triggered effect. This "dead period" during which skin temperature is kept up at its original value lasts for about one minute and a half as we found out in our own studies. During this one and a half minute all anticipated measuring has to be completed.

To a cooling stimulus there are the following forms of regulatory response:

1. Normal regulation. On thorax and abdomen we record a lower temperature by 0.5-1.0 centigrade.
2. The regulatory range is reduced (0.3 - 0.4 centigrade).
3. There is no regulation in the corresponding reflex zone, i.e. first and second reading are equal.
4. After cooling stimulus we find increased temperature, a paradoxical reaction.
5. Temperature drops excessively in several areas (beyond 1.0 centigrade).
6. The temperature image is generally chaotic: zero and excessive reactions simultaneously and in dose succession.

It is of special importance that disturbances of heat management - applying to disturbances of heat pattern as well as temperature regulation - precede organ damage by years. Preceding even functional disorders. On the one hand there is the disadvantage that we occasionally cannot (yet) verify our pathological finding clinically. On the other hand by regulation thermography we own a method representing true preventive medicine. Considering this being a completely harmless, non-invasive method, in no way bothering the patient, working with a physiological stimulus - something man is always exposed to -, it is incomprehensible that this approach did not get any wider acceptance in medicine. Perhaps this is due to the necessity to change our thinking to evaluate thermal findings: It is recorded not only "what has happened" but also "what is about to happen". It is impossible to present all the diagnostic capabilities of regulation thermography within a short paper. Only a few important features can be mentioned.

On principle regulation thermography is not and cannot be a supplementary method supporting other diagnostic procedures. It is rather a preexamination, as a basic one, supporting further clinical diagnosis.
Being such as basic investigation it may:

- Spare the patient unnecessary and unpleasant invasive diagnostic methods,
- save the physician a lot of time and
- help lowering costs of the health insurance resp. of the patient itself for diagnosis considerably.

The patient's temperature pattern provides us with reliable information's as to function triggered by the autonomous nervous system of individual organs and of the whole organism. Assessment of the regulatory capability informs us how far the system is under stress, how much more stress it can take, how much can be compensated. It shows us if we deal with purely functional disorder, with organ disease, with a chronic disorder, or on top of it with malignant tendencies. We get informed about the selection of therapy, can control our therapy and are able to document our therapeutic success. We can find out if disease is caused by a field of disturbance, are able to verify it and can check the success of focal therapy. Impending coronary infarct or stroke (CVA) can be read from documented values. In case of psychic disorders we can distinguish psychosomatic from somatopsychic ones. This limited information should suffice.

Every method has its limitations. This is also true with thermography. Knowing and observing its limitations protects us from committing diagnostic errors and protects the method from coming into disrepute or being rejected. As with every newly developed method of the last decades there has been a temptation as to thermography being able to "prove cancer". Very soon thermography has been found not being more efficient than other methods. Its sole advantage is being absolutely harmless. Because it has not been living up to these expectations it has been put aside again. Even recent attempts to develop a computerized version into a "cancer-diagnosing tool" did not satisfy. Meaning to expect too much of it. You cannot simply decide with regulation thermography if there is badly damaged tissue or already existing tumor. It is however more important to say that regulation thermography represents a tool for "tip-off-diagnosis". We must make use of this opportunity since thermal changes are the first signs of beginning processes and since no other method recognizes them at such an early stage.

Whoever understands and uses regulation thermography in the aforementioned manner has a method at hand providing an early and comprehensive insight into the physical shape of his patient. He will do justice to his patient by not -as is often the case - dismissing problems being difficult to define as "psychosomatic". And he will be able to monitor his therapy.
Thermography in conjunction with thermoregulation testing offers an abundance of diagnostic conclusions. The reliability of this method is due to its physiological basis: Generation and irradiation of heat in humans. There are two different approaches: Measuring of skin temperature on one hand and registration of irradiation of heat on the other. Results of both procedures are not equivalent. They have to be interpreted in different ways.

**Literature**

- KÜMMERLE, H. P.: Klinische Carlorimetrie und Thermometrie, Thieme-Verlag, Stuttgart 1958

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Prof. Dr. A. Rost 1996