

Brazilian Current Studies of Medical Thermology

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Abstract – Thermology is flourishing in Brazil and its use is very recent compared to other countries. The steady growth of this medical specialty is encouraged by a climate of collegial harmony between physicians, thermologists and engineers. In Brazil, there is multispecialty interest in the use of thermography in the prevention, diagnosis, and treatment of disorders particularly influenced by pain, vascular, breast, ophthalmologic and sport medicine's researches. The author discloses the main recent investigations at Brazil.

Keywords: Chronical pain, vascular, breast, sport medicine, ophthalmology, thermography; diagnoses

Resumo – A termologia está florescendo no Brasil e é de uso muito recentemente comparado a outros países. O crescimento constante dessa especialidade médica é incentivado por um clima de harmonia acadêmica entre médicos, termologistas e engenheiros. No Brasil, há um interesse de várias especialidades no uso da termografia na prevenção, diagnóstico e tratamento de doenças, particularmente influenciados pelas pesquisas na área de dor, angiologia, mastologia, oftalmologia e medicina do esporte. O autor divulga as principais e mais recentes investigações no Brasil.

Palavras-chave: Doenças crônicas, vascular, mamas, medicina do esporte, oftalmologia, termografia, diagnóstico.

1. PAIN APPLICATIONS

In Brazil, there is multispecialty interest in the use of thermography in the prevention, diagnosis, and treatment of disorders – particularly related to the nerves, muscles, bones and brain – that may produce temporary or permanent impairment. Many physicians, including neurologists, neurosurgeons, anesthesiologists, orthopedists, sport medicine physicians, physiotherapist and dentists are using thermography on a routine basis for the evaluation of chronic pain. Infrared imaging measurements can provide a useful, non-invasive and nonionizing examination for diagnosis of myofascial trigger points (MTPs) in muscles

when compared with ultrasonography. Haddad et al from Department of Oral Radiology, School of Dentistry (FMUSP) are identifying and correlating MTPs in the masticatory muscles, using thermography and algometry (1). The face has trusted and fixed thermo-anatomical points, which can be assessed as reference for thermography analysis. Assignment of anatomical reference is a key step in diagnosis of facial diseases and also MTPs. Although thermography can assess physiological and functional aspects of the face such as microcirculation and autonomous nervous system function. It may determine a fixed hot landmark as the inner canthus of the eyes, which are related to the site of superficial supra-orbital vessels

projections. Dr Haddad identified, mapped and quantified facial thermo-anatomical points in healthy adult population that can be used as a reference craniometric landmark for thermography studies (2).

It has also been stimulated the use of thermography to evaluate neuropathic pain. We are conducting thermographic studies for distal diabetic neuropathy identification by tests that induce thermoregulatory responses as the rewarming index after cold stress testing (3). We are also conducting studies of thermographic identification of traumatic neuromas post-amputation and comparing with ultrasound images. Thermography can guide injection of botulinum toxin for local treatment with good clinical response. Vascular cold patch is a useful prognostic index to follow up by thermography migraine patients and is a neurogenic inflammatory response that can also be inhibited with botulinum toxin. We are conducting and evaluating this neurological response.

Also are being conducted experimental studies in animals. Laser therapy technique is a noninvasive method which has shown to be clinically effective in reducing the sensitivity to pain and therefore in improving the quality of life of patients with neuropathic pain, pain that is characterized by various changes and metabolic chemical mediators. Dr Oliveira from Laboratory of Functional Neuroanatomy of Pain Department of Anatomy Institute of Biomedical Science (FMUSP) is examining the effects of application of Laser on soreness induced by chronic constriction (CCI) of the sciatic nerve of Wistar rats, to evaluate the involvement of substance P and TRPV1 and analyze tissue perfusion by thermography technique after laser therapy. Our preliminary results indicate an improvement in the group treated with laser compared with CCI group (no treatment) in behavioral tests for allodynia, thermal and mechanical hyperalgesia. Thus, we suggest that laser therapy improves neuropathic pain induced by CCI, but there are still studies demonstrating the involvement of this technique in maintaining this painful syndrome and its possible mechanism of action as a therapeutic intervention.

Professor of Physiology José Cipolla-Neto, M.D, Ph.D. from the Department of Physiology and Biophysics, Neurobiology Lab, Institute of Biomedical Sciences, FMUSP is conducting research on the influence of melatonin on thermoregulation and obesity. To this approach is

being used thermography to monitor response of brown adipose tissue (BAT) before and after melatonin administration and also in pinealectomized patients. The results are being compared with positron emission tomography-computed tomography (PET-CT) scan using 2-[18F]-fluoro-2-deoxy-D-glucose (18F-FDG) to measure glucose utilization associated with BAT mitochondrial respiration and also magnetic resonance imaging (MRI). Infrared thermography may record the activation of BAT, Dr Brioschi post-doctoral at FMUSP identified in the fibromyalgia pain syndrome (FMS) a characteristic “mantle signal” related to BAT dysfunction. Hands or feet immersion in water at 20°C provocative test evaluates the aforementioned activation. Although not a definitive diagnosis, the phenomenon of the mantle and peripheral vasoconstriction may support the clinical diagnosis, having an important role in monitoring patients with FMS, as markers of autonomic dysfunction, present in this disease (4).

Oriental medical practitioners are beginning to use thermography as a graphic display of treatment effect. Recently Dr Freire, one of our recent experts in thermology, reported on thermographic hands vasomotor inhibition characteristics of LI-4 acupuncture point.

2. VASCULAR APPLICATIONS

There is growing interest in the use of thermography in the prevention of cerebrovascular disease and heart attacks. Dr Edmar Santos of Albert Einstein Israelite Hospital recently reported on his work in cerebrovascular applications. The fingertip temperature rebound by infrared thermography monitoring after brachial artery compression showed good correlation with the Framingham score for stroke (FRSS) in 10 years. Recently, the measurement of endothelial function by thermography through the microcirculation in patients emerged as a useful tool to evaluate the presence of atherosclerotic plaque in different vascular beds. From these results we concluded that the study of endothelial function by thermography can be used as a surrogate marker to improve stratification of cardiovascular risk and might also be useful for the evaluation of therapeutic strategies (5,6).

3. BREAST APPLICATIONS

Although breast thermography is being performed in some Brazilian centers most is being done in the research field by universities, most of whom are improving diagnostic criteria based upon biopsied cancer cases. The biologist Keli Morais of the Center for Research and Self-Sustaining Energy Development, Parana Federal University, recently defended his PhD who presented the results of the work entitled: An infrared image based methodology for breast lesions screening. The new methodology applied obtained lesion detection efficiency with 96% accuracy rate in the study group of 47 women with malignant breast tumors. In this study the control group without lesions contained 101 women which ensured reliability in sample representation. The advisors were Prof. José Viriato Vargas (PhD) and Dr. Marcos Brioschi. These results contributed to the development of a robust methodology, inexpensive and universal access to the population that will contribute to the prevention of deaths of women due to breast cancer. The results demonstrate that the method has potential for utilization as a noninvasive screening exam for individuals with breast complaints, indicating whether the patient should be submitted to a biopsy or not (7).

The other research carried out at the same center analyzed the thermal behavior of the breasts during the cycle temperatures. The average temperature of the breast in healthy women had a direct relationship with the central and ambient temperature and can be estimated mathematically. It is suggested that an equation could be used in clinical practice for estimating the normal breast reference temperature in young women, regardless of the day of the cycle, and thus assist in evaluation of anatomical studies (8).

4. OPHTHALMOLOGICAL APPLICATIONS

Obstructions in the lacrimal pathways quite often require accurate and reliable image scanning for confirmation and documentation. Infrared thermal imaging is a resource that complements diagnosis; it does not require touching the patient or applying contrast materials and has been used in various medical procedures for decades. However, there have been few studies in the literature about its use in ophthalmology. Dr. Machado from Department of

Ophthalmology and Visual Sciences, Paulista School of Medicine (EPM), Federal University of São Paulo (UNIFESP) has developed a close-up magnification thermography for ophthalmologic applications. Recently we published a case of dacryocystitis where the obstruction of the lacrimal punctum was so acute that conventional dacryocystography could not be used. The authors have successfully reported the use of thermography as a complementary propaedeutic and will discuss the method they used (9).

5. SPORT MEDICINE

Prof Neves and his group have recently published essential findings for the field of thermography studies in sport medicine. Their first work involved soccer players (10) and the second, rugby players (11).

Neves and his collaborators published some methodological findings that impact directly the way to analyze thermal images acquired in sports science (12). They demonstrated that subjects with lower subcutaneous fat layer have a higher skin temperature variation rate during exercise than those with higher subcutaneous fat layer (13). In another study they showed that although ultrasound images have high sensibility for muscle physiological changes on the first 24 hours after exercise, on the other hand, thermography had higher sensibility for muscle physiological changes than ultrasound images from 24 to 96 hours after training (14). And thermography seems to be an efficient, trustworthy and secure method in order to monitor skin temperature during cryotherapy application. Evidence supports the use of thermography in detriment of contact methods (15).

Because of these multicenter researches and applications, the Brazilian thermographic exams have a whole body characteristic examination at the main medical centers (16). They are focused on the full evaluation of the patients, not only specific areas, evaluating a series of possibilities after exposing the patients' thermoregulatory response at a well-controlled lab. This characteristic has increased the reputation and the value of thermography as a significant and useful diagnostic method in the Medicine practice in our country. Thermology is flourishing in Brazil and its use is very recently compared to other countries. The steady growth of this medical specialty is encouraged by harmony between

physicians, thermologists and engineering. With the encouragement and support of the Brazilian National Council for Scientific and Technological Development, Brazilian Thermology Association and the universities, patients in Brazil are reaping increasing benefits from the science of thermology.

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