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Skin surface temperature and pain tolerance threshold in young and elderly individuals

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Skin surface temperature and pain tolerance threshold in young and elderly individuals

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SUMMARY

BACKGROUND: Studies involving the thermography and algometry have been shown effective for the evaluation and diagnosis of painful processes, bringing relevant information about the physiology of aging. This study aimed at comparing skin surface temperature and pressure pain threshold (PPT) in young and elderly individuals, as well as to investigate associations between body temperature and PPT in these groups.

MATERIALS AND METHODS: This is an observational cross-sectional study in which 53 healthy volunteers participated. They were subjected to thermography (thigh and lumbar spine) and PPT evaluations (vastus medialis, vastus lateralis, and lumbar spine). Data were analyzed with descriptive statistics and correlation coefficients in SPSS v.26.

RESULTS: Young individuals exhibited higher values of body temperature in the left thigh (30.0°C vs. 26.8°C), right thigh (29.9°C vs. 26.8°C) and lumbar spine (32.0°C vs. 31.9°C) when compared to the elderly. PPT did not differ between groups. No associations were observed between surface temperature and PPT.

CONCLUSION: Young individuals presented higher temperature values, but no differences were found in pain tolerance. Surface temperature was not associated to PPT in either group.

KEYWORDS: pain; aging; pressure pain threshold; thermography.

HAUTOBERFLÄCHENTEMPERATUR UND SCHMERZTOLERANZSCHWELLE BEI JUNGEN UND ÄLTEREN MENSCHEN

HINTERGRUND: Studien mit Thermografie und Algometrie haben sich als wirksam für die Beurteilung und Diagnose von schmerzhaften Prozessen erwiesen und liefern relevante Informationen über die Physiologie des Alterns. Diese Studie zielte darauf ab, die Hautoberflächentemperatur und die Druckschmerzschwelle (PPT) bei jungen und älteren Menschen zu vergleichen und Zusammenhänge zwischen Körpertemperatur und PPT in diesen Gruppen zu untersuchen

MATERIALIEN UND METHODEN: Dies ist eine beobachtende Querschnittsstudie, an der 53 gesunde Freiwillige teilgenommen haben. Sie wurden einer Thermografie (Oberschenkel und Lendenwirbelsäule) und PPT-Auswertungen (Vastus medialis, Vastus lateralis und Lendenwirbelsäule) unterzogen. Die Daten wurden mit deskriptiver Statistik und Korrelationskoeffizienten in SPSS v.26 analysiert.

ERGEBNISSE: Junge Personen wiesen im Vergleich zu älteren Menschen höhere Werte der Körpertemperatur am linken Oberschenkel (30,0°C vs. 26,8 °C), am rechten Oberschenkel (29,9 °C vs. 26,8 °C) und an der Lendenwirbelsäule (32,0 °C vs. 31,9 °C) auf. PPT unterschied sich nicht zwischen den Gruppen. Es wurden keine Zusammenhänge zwischen Oberflächentemperatur und PPT beobachtet.

SCHLUSSFOLGERUNG: Junge Probanden wiesen höhere Temperaturwerte auf, aber es wurden keine Unterschiede in der Schmerztoleranz gefunden. Die Oberflächentemperatur war in keiner der beiden Gruppen mit PPT assoziiert.

SCHLÜSSELWÖRTER: Schmerz; Altern; Druckschmerzschwelle; Thermographie.

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Introduction

Age-related physiological changes directly impact thermal sensation in the elderly [1]. Scientific literature points out that elderly individuals may present lower temperature When compared to the younger ones [2]. One way to assess skin surface temperature is through the employment of infrared thermography, an efficient method to study body temperature distribution, and also a valuable aid in the study of pain [3,4,5,6,7]. This contributes to the etiological identification and follow-up of pain, especially in tissue diseases and chronic symptoms [3,4,5,6,7]. Thermography is a non-invasive, painless, and quick assessment method, without contraindications or side effects, and it is also a good predictor of physiological dysfunctions, since body temperature is an indicator of health condition [8,9].

In the study of pain, studies validate the combined use of algometry and thermography as a means of screening and improving diagnostic accuracy in clinical practice [3,4,5].

Pressure algometry evaluates the sensitivity to pain caused by a minimum pressure that causes pain or discomfort in a certain region of the body, called pressure pain threshold (PPT) [10,11]. Studies have shown association between PPT and skin surface temperature, suggesting that the higher the temperature, the lower the PPT [4,11, 12, 13,14]. Most of these investigations evaluated young and adult populations [14, 15,16]. However, an investigation about skin temperature and PPT in the trapezius muscle of health subjects [17] did not find significant associations between these variables, even when analyzing groups with low and high PPT values.

Other studies have been conducted with people living with some painful pathology, such as low back pain [11], osteoarthritis [18], myofascial pain [3] or fibromyalgia [19]. In some clinical studies, thermography was employed as an evaluation tool, but among them, only few have good methodological quality [10].

Although the investigation and understanding about the changes resulting from the aging process and its physiology are growing concerns in the scientific community, the associations between temperature and pain have been little explored in healthy elderly individuals up to now.

The investigation on the association between these variables may unveil relevant information about the ageing process in healthy individuals, therefore, the aim of this study was to compare skin surface temperature and PPT in young and elderly individuals, as well as to investigate associations between temperature and PPT in these groups.

Materials and methods

This is a cross-sectional observational study, conducted in a university clinic in the south zone of the city of Sao Paulo (Brazil). The project was approved by the local ethics committee, and all volunteers gave written informed consent prior to participation.

The sample of this study consisted of 53 healthy individuals of both genders, divided into two groups: healthy young people aged 18 to 30 years (n=30), and healthy elderly individuals from 60 to 75 years old (n=23). Recruitment of participants was carried out via direct approach to university students, personal contacts of participants and researchers, and contact with groups of elderly people.

Participants should be sedentary, have preserved cognitive capacity, and ability to walk independently without prostheses or orthoses. Those with complaint of chronic pain or recent injuries, neurological pathologies such as stroke sequel, the ones with metabolic diseases such as diabetes, presence of musculoskeletal diseases that caused pain in any joint, presence of injuries in lower limbs that could affect locomotion, who had undergone any orthopedic surgery, and the ones who presented fever due to viral or bacterial infection in the last 24 hours were excluded from the study.

PPT was assessed using the PainTest™ FPX 25 Algometer (Wagner Instruments, Greenwich). Skin surface temperature assessment was performed with a FLIR ONE PRO thermographic camera for iOS, coupled to a smartphone, with 3°C or ±5% measurement uncertainty of the overall reading, sensor array size of 160x120, thermal sensor with pixel size of 12 µm, spectral range of 8 to 14 µm, visual resolution of 1440x1080 and thermal sensitivity [MRDT] of 150 mK. The considered emissivity was 98%. The sensor was previously connected to data collection in order to generate stabilization. It should be noted that for taking the images, the camera was perpendicularly positioned in relation to the participant.vided detailed and clear information about the study pro-

For data collection, participants were assigned to a reserved room and wore clothes that allowed exposure of the regions of interest. Before the assessments, researchers pro tocol.

The infrared thermography examination was conducted under standardized conditions, following measures recommended by previous studies [7,20, 21]. The room had a controlled temperature of 22°C and relative humidity of around 50%, with windows and curtains closed, to prevent any type of external light from entering the environment. Assessments were carried out in the afternoon. Before the exam (about 2 hours), participants were instructed not to have taken hot baths or showers, used creams, powders or performed vigorous exercises. They should also have fasted for up to two hours, not have ingested any stimulants, substances with caffeine or nasal decongestants, drinks containing alcohol, and not having smoked cigarettes.

Before image collection (in the afternoon), each volunteer remained for 20 minutes in the climate-controlled room so that the skin reached thermal equilibrium with the temperature of the examination room. According to the appropriate technique for the thermographic examination, the patient was initially standing, and thermographic images were collected in anterior and posterior incidences. Temperature was registered in degrees Celsius. To evaluate the regions of interest (ROI) scattered throughout the body, the volunteer should be at a distance of 2 meters from the infrared camera, with rectangles being determined as anatomical landmarks, as follows: lower back - between the iliac crest and the first true rib (Figure 1); thighs - 5cm above the superior edge of the patella up to the inguinal line (vastus medialis and vastus lateralis) (Figure 2). These ROIs have already been described by previous studies [7,20,21]. Thermal images were analyzed by the Flir Tools software. All procedures adopted in acquisition and treatment of thermal images are in accordance with the consensus statement on the measurement of skin temperature (TISEM consensus) [22].

Immediately after the thermography assessment, pressure pain threshold was evaluated. Participants were asked to place themselves in prone, supine and sitting positions. Then, using the algometer, pressure was applied at a

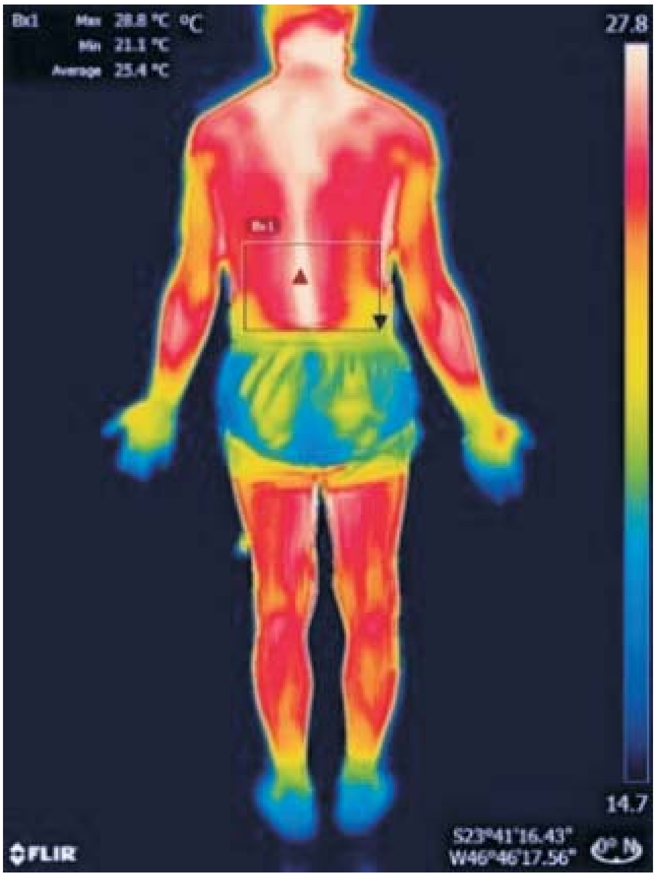


Figure 1
Thermographic assessment image of the lumbar spine ROI.

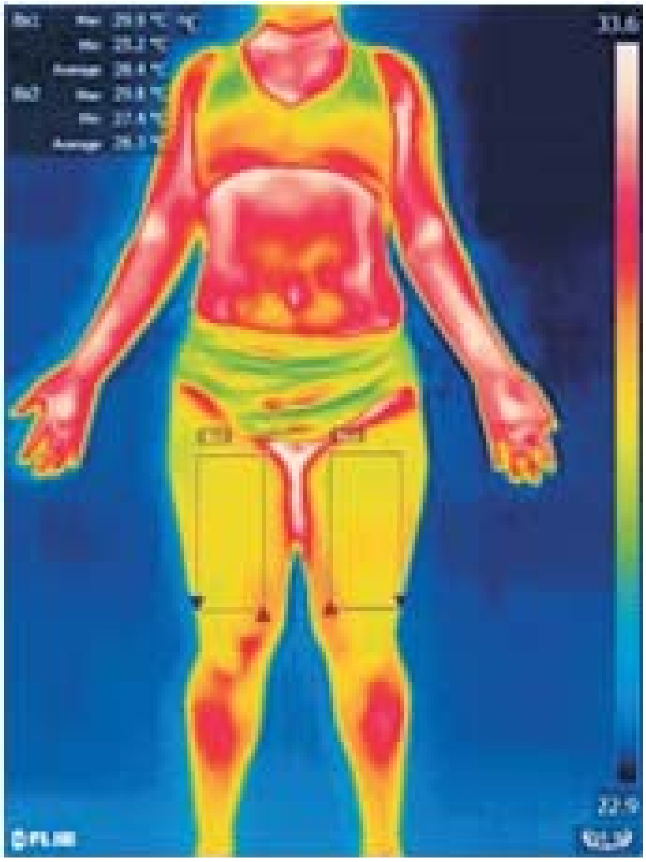
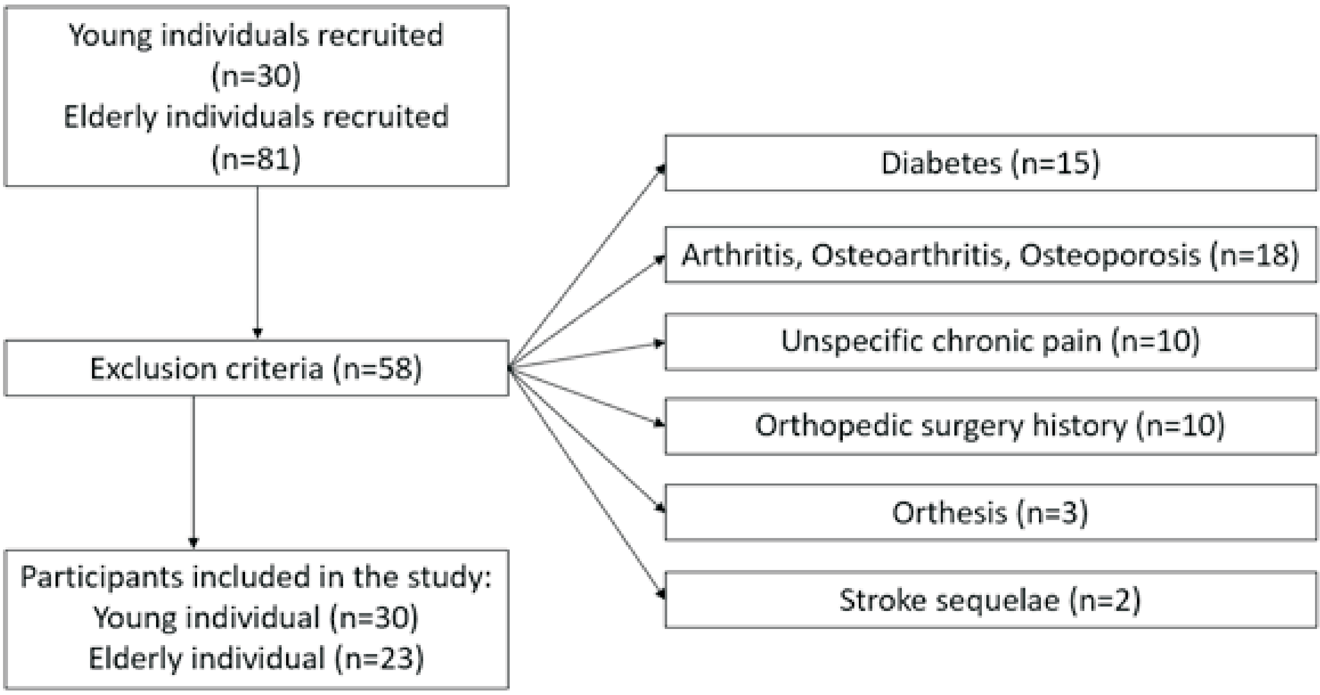


Figure 2
Thermographic assessment image of the right and left thigh ROIs.

constant speed of 1kg/s up to the level at which the volunteer reported discomfort or pain. The subject was instructed to say "stop" as soon as this sensation appeared. The final amount of pressure applied was recorded. The

Figure 3
Study flowchart



areas assessed were paraspinal muscles (at the level of L4, 2 and 4cm from the medial line) [23]; vastus medialis and vastus lateralis regions of the quadriceps [24]. All of the assessments were conducted by one trained evaluator.

Data were analyzed using SPSS v.26 for Windows, and results were expressed as means ± standard deviations. Normality of the data was assessed by Shapiro-Wilk test. Comparison of data between groups was performed using Mann-Whitney U test. Pearson or Spearman's correlation coefficients were calculated and classified as follows: $0.0 < r < 0.2$: very weak association, $0.2 < r < 0.4$: weak association, $0.4 < r < 0.6$: moderate association, $0.6 < r < 0.8$: strong association, $0.8 < r \leq 1.0$: very strong association. In all cases, the descriptive level α was established in 5% ($\alpha < 0.05$) [25]. Post-hoc analysis of sample size to determine statistical power was performed in G*Power v. 3.1.9.2 for Windows.

RESULTS

A sample of 111 volunteers was recruited between August 2021 and June 2022. Volunteers were divided into 2 groups, young (n=30) and elderly individuals (n=81). Out of them, all the 30 young and only 23 elderly persons met inclusion criteria. The post hoc test for this sample size revealed a statistical power of 73% for an α=0.05.

Demographic data of both groups are shown in Table 1.

Table 1
General characteristics of the study sample.

	Young (n=30)	Elderly (n=23)
Age (years)	21.2 ± 2.6	65.7 ± 3.9
Weight (kg)	69.66 ± 14.22	70.60 ± 13.48
Height (m)	1.69 ± 0.08	1.61 ± 0.08
BMI (kg/m)	24.13 ± 4.10	27.16 ± 5.14
Gender		
Male	18 (60)	6 (26.1)
Female	12 (40)	17 (73.9)

kg: kilogram, m: meters, BMI: body mass index, m^2: square meters.
Data are expressed as means ± standard deviations or n (%)

In the comparison of skin surface temperature values in young and elderly groups, higher values were observed in young individuals, as shown in table 2.

Table 2 Thermographic assessment, °C: degrees Celsius.
Data are expressed as means ± standard deviations.

	Young (n=30)	Elderly (n=23)	p
Left thigh (°C)	30.0 ± 2.5	26.8 ± 2.6	<0.001
Right thigh (°C)	29.9 ± 2.6	26.8 ± 2.6	<0.001
Lumbar spine (°C)	32.0 ± 2.1	30.0 ± 1.7	<0.001

Table 3 presents the comparison of PPT in vastus lateralis, vastus medialis and paraspinal regions, between groups. No significant differences were observed regarding algometry.

Table 3
Pain tolerance in young and elderly individual

	Young (n=30)	Elderly (n=23)	p
Vastus lateralis (kg/cm)	6.26 ± 2.18	5.77 ± 3.12	0.159
Vastus medialis (kg/cm)	6.09 ± 2.15	5.53 ± 2.92	0.216
Paraspinal (kg/cm)	8.64 ± 2.91	8.01 ± 3.36	0.451

Data are expressed as means ± standard deviations.

No associations were found between pressure pain tolerance and skin surface temperature among young and elderly individuals, as shown in Table 4.

Table 4
Associations between pressure pain tolerance thresholds and skin surface temperature among young and elderly.

	Young (n=30)		Elderly (n=23)	
	r	p	r	p
PPT VL (kg/cm^2) *vs.* T left thigh (°C)	0.020	0.917	0.251	0.248
PPT VL (kg/cm^2) *vs.* T right thigh (°C)	0.011	0.954	530.2	0,245
PPT VM (kg/cm^2) *vs.* T left thigh (°C)	0.036	0.849	0.129	0.557
PPT VM (kg/cm^2) *vs.* T right thigh (°C)	0.034	0.857	0.126	0.567
PPT PS (kg/cm^2) *vs.* T lumbar spine (°C)	0.051	0.788	-0.061	0.783

PPT: pressure pain threshold, T: skin surface temperature, VL: vastus lateralis, VM: vastus medialis, PS: paraspinal.

Discussion

This study aimed at comparing surface temperature and pressure pain tolerance thresholds among young and elderly individuals, as well as to verify associations between these variables.

Significant differences were found in the thermographic evaluation of the thighs and lumbar spine between groups, with young individuals presenting higher temperature values when compared to the elderly. This result corroborates literature reports of a universal trend of lower body temperature in the aging process, regardless of the evaluated site [1,2]. Elderly people tend to have lower body temperatures than young adults, but in practice, it is difficult to define precisely what is the variation in basal temperature resulting from the aging process [1,2,3]. Results of the present study corroborate findings of a previous review showing that temperature is slightly lower in elderly subjects [26], and one of the probable explanations for the temperature decrease with age is that it may be related to a lower metabolic rate, and to a decrease in heat dissipation ability [27].

Interestingly, no significant differences were observed in pain tolerance among young and elderly volunteers. Pain perception tends to reduce with age, due to the lower functionality of pain receptors in nerve endings, as well as the electrical activity of these neurons [28], which tends to deteriorate with advancing age [28]. Pressure pain threshold is lower in patients with chronic pain [29], but the sample of this study was composed only by healthy individuals. El Tumi et al. [30] state that there is tentative evidence that old adults may be more sensitive to mechanical pain but not to heat-evoked pain when compared to young adults, however, authors admit that there is still a need for further studies on age-related changes in pain perception.

In the present study, surface temperature was not associated with pressure pain tolerance. Previous studies that observed indirect association between body temperature and pain tolerance (i.e. higher temperature with lower pain tolerance threshold) have also been conducted with people living with some painful pathology [11,12,18,19,20].

Alfieri et al. [11] demonstrated that the greater the pain complaint in individuals with chronic low back pain, the greater the surface temperature and the lower the pain tolerance threshold. Similarly, Casas-Barragán et al. [19] found an important association between temperature and low pain tolerance thresholds in women with fibromyalgia. Herbele et al. [31] sought to identify scientific evidence of alterations in the puerperal breast based on clinical examination, using pressure algometry and thermography, also associating lower temperatures with greater pain tolerance. Haddad et al.[12], in a study involving myofascial trigger points in masticatory muscles, observed moderate and significant associations between pain tolerance thresholds and the registered temperature values.

However, even in inflammatory diseases, thermal changes may not be associated with pain tolerance threshold, possibly due to central sensitization [16]. Dibai-Filho et al.[16] did not observe association between temperature and PPT in patients with neck pain. Vargas e Silva et al.[32] sought to examine the associations between radiographic evidence of knee osteoarthritis, self-reported pain, PPT and surface temperature of the knee. Authors also found that temperature and PPT were not associated.

This study has some limitations. Despite the reasonable statistical power, sample size was not large enough to allow a wide generalization of results herein. Our sample of healthy individuals, without chronic pain or metabolic disfunctions such as diabetes, impacted the sample size of the elderly group. However, the adoption of such criteria is justified by the fact that results referring to thermographic evaluation and pain thresholds could present altered values in the presence of pain [11] and in individuals with diabetes mellitus [33], as previously reported. Diabetes mellitus can cause hyperesthesia (exaggerated responses to tactile stimuli) or hyperalgesia (exaggerated sensitivity to painful stimuli) from diabetic neuropathy [33]. On the other hand, the fact that the assessments were carried out by the same evaluator, under the same conditions, is a positive highlight of this study, thus avoiding risk of bias. Another limiting factor is that body composition has not been assessed, so body fat percentage was not evaluated. Hence, future studies including this assessment may bring novel information on this issue.

It is suggested that further studies seek to evaluate the association between PPT and surface temperature by comparing both young and elderly individuals with chronic pain. The semi-quantitative assessment of pain intensity at tender points and its association with local skin surface temperature may lead to a greater diagnostic efficacy, contributing to the quality of results in investigations of painful processes.

Conclusion

Young individuals presented higher temperature values than the elderly, but no differences were found between groups with respect to pain tolerance. Skin surface temperature and pressure pain thresholds were not associated in healthy individuals.

References

1.Blatteis CM. Age-Dependent Changes in Temperature Regulation - A Mini Review. Gerontology 2012;58:289-295.

2.Gomolin IH, Aung MM, Wolf-Klein G, Auerbach C. Older is colder: temperature range and variation in older people. J Am Geriatr Soc. 2005; 53(12):2170-2172.

3.Rangon FB, Ferreira VTK, Rezende MS, Apolinario A, Ferro AP, Guirro ECO. Ischemic compression and kinesiotherapy on chronic myofascial pain in breast cancer survivors. J Body Work Mov Therapies.2018; 22(1):69-75.

4.Rodrigues-Sanz D, Becerro-de-Bengoa-Vallejo R, Losa- Iglesias ME, Martinez-Jimenez EM, Munoz-Garcia D, Perez- Boal E, Calvo-Lobo C, López-López D. Effects of Compressive Stockings and Standard Stockings in Skin Temperature and Pressure Pain Threshold in Runners with Functional Ankle Equinus Condition. J Clin Med. 2018; 7(11):454-462.

5.Girasol CE, Dibai-Filho AV, Oliveira AK, Guerra RRJ. Correlation Between Skin Temperature Over Myofascial Trigger Points in the Upper Trapezius Muscle and Range of Motion, Electro- myographic Activity, and Pain in Chronic Neck Pain Patients. J Manip Physiol Ther. 2018; 41(4):350-357.

6.Alfieri FM, Battistela LR. Body temperature of healthy men evaluated by thermography: A study of reproducibility. Technol Health Care. 2018; 26(3):559-563.

7.Dias CS, Alfieri FM, Santos ACA, Battistella LR. Whole-body thermographic assessment of patients with stroke sequelae who report temperature differences between the sides. Therm Int. 2022; 32(1):14-19.

8.Lima RP, Brioschi ML, Teixeira MJ, Neves EB. Análise termográfica de corpo inteiro: indicações para investigação de dores crônicas e diagnóstico complementar de disfunções secundárias. Pan Am J Med Therm. 2015; 2(2)70-7.

9.Alfieri FM, Santos ACA, Battistella LR. Uso da termografia como método de avaliação na medicina física e de reabilitação. Acta Fisiatr. 2018; 24 (3):147-150.

10.Park G, Kim CW, Park SB, Kim MJ, Jang SH. Reliability and usefulness of the pressure pain threshold measurement in patients with myofascial pain. Ann Rehabil Med. 2011; 35(3): 412-417.

11.Alfieri FM, Lima ARS, Battistella LR, Silva NC de OVE. Superficial temperature and pain tolerance in patients with chronic low back pain. J Body Work Mov Therapies. 2019; 23(3): 583-587.

12.Haddad DS, Brioschi ML, Arita ES. Thermographic and clinical correlation of myofascial trigger points in the masticatory muscles. Dentomaxillofacial Radiol. 2012; 41(8):621-629.

13.Benito-de-Pedro M, Becerro-de-Bengoa-Vallejo R, Losa- Iglesias ME, Rodrigues-Sanz D, López-lópez D, Cosin-matamoros J, Martínez-Jiménez EM, Calvo-Lobo C. Effectiveness between Dry Needling and Ischemic Compression in the Triceps Surae Latent Myofascial Trigger Points of Triathletes on Pressure Pain Threshold and Thermography: A Single Blinded Randomized Clinical Trial. J Clin Med. 2019; 8(10):1632.

14.Zhang Y, Ge H-Y, Yue S-W, Kimura Y, Arendt-Nielsen L. Attenuated skin blood flow response to nociceptive stimulation of latent myofascial trigger points. Arch Phys Med and Rehabil. 2009; 90(2):325-332.

15.Kimura Y, Ge HY, Zhang Y, Sukimura H, Arendt-Nielsen L. Evaluation of sympathetic vasoconstrictor response following nociceptive stimulation of latent myofascial trigger points in humans. Acta Physiol. 2009; 196(4):411-417.

16.Dibai-Filho AV, Barros MA, Oliveira AK, Guirro RRJ. Electrical impedance of the torso is associated with the pressure pain threshold on myofascial trigger points in patients with chronic neck pain: A cross-sectional study. J Back Muscoskelet Rehabil. 2018; 31(2):275-284.

17.Seixas A, Soares M, Rodrigues S. Exploring the association between pressure pain threshold and skin temperature in the upper trapezius of healthy subjects.Thermology international 2019; 29(3):103-107.

18.Alfieri FM, Vargas E Silva NCO, Dos Santos ACA, Battistella LR. Cutaneous temperature and pressure pain threshold in individuals with knee osteoarthritis. Rev Bras Reumatol. 2020; 58(5): 272-276.

19. Casas-Barragán A, Molina F, Tapia-Haro RM, García-Ríos MC, Correa-Rodríguez M, Aguilar-Ferrándiz ME. Association of core body temperature and peripheral blood flow of the hands with pain intensity, pressure pain hypersensitivity, central sensitization, and fibromyalgia symptoms. Ther Adv Chronic Dis. 2021 5(12):2040622321997253.

20. Ring EF, Ammer K. Infrared thermal imaging in medicine. Physiol Meas.2012; 33(3):33-46.

21. Marins JCB, Fernandes AA, Cano SP, Moreira DG, Silva FS, Costa CMA, Fernandez-Cuevas I, Sillero-Quintana M. Thermal body patterns for healthy Brazilian adults (male and female). J Therm Biol. 2014; 42:1-8.

22. Moreira DG, Costello JT, Brito CJ, Adamczyk JG, Ammer K, Bach AJE, Costa CMA, Eglin C, Fernandes AA, Fernández-Cuevas I, Ferreira JJA, Formenti D, Fournet D, Havenith G, Howell K, Jung A, Kenny GP, Kolosovas-Machuca ES, Maley MJ, Merla A, Pascoe DD, Priego Quesada JI, Schwartz RG, Seixas ARD, Selfe J, Vainer BG, Sillero-Quintana M. Thermographic imaging in sports and exercise medicine: A Delphi study and consensus statement on the measurement of human skin temperature. J Therm Biol. 2017; 69:155-162.

23. Fischer AA. Pressure threshold measurements for diagnosis of myofascial pain and evaluation of treatment results. Clin J Pain.1987; 207 (2): 207-214.

24. Imamura M, Imamura ST, Kaziyama HH, Targino RA, Hsing WT, De Souza LP, Cutait MM, Fregni F, Camanho GL. Impact of nervous system hyperalgesia on pain, disability, and quality of life in patients with knee osteoarthritis: a controlled analysis. Arthritis Rheum. 2008; 59 (10) 1424-1431.

25. Campbell MJ. Statistics at Square Two. 2nd Ed. Blackwell: BMJ Books, 2006.

26. Fernández-Cuevas I, Bouzas Marins JC, Arnáiz Lastras J, Gómez Carmona, PM, Piñonosa Cano S, García-Concepción MÁ & Sillero-Quintana M. Classification of factors influencing the use of infrared thermography in humans: A review. Infrared Physics & Technology 2015;71(0):28-55.

27. Petrofsky JS, Lohman E 3rd, Suh HJ, Garcia J, Anders A, Sutterfield C, Khandge C. The effect of aging on conductive heat exchange in the skin at two environmental temperatures. Med Sci Monit. 2006 ;12(10):CR400-408.

28. Sobrinho ACS, Almeida ML, Rodrigues GS, Junior CRB. Associação de dor crônica com força, níveis de estresse, sono e qualidade de vida em mulheres acima de 50 anos. Fisioter Pesqui. 2019; 26 (2): 170-177.

29.Imamura M, Chen J, Matsubayashi SR, Targino RA, Alfieri FM, Bueno DK, Hsing WT. Pressure pain thresholds in patients with chronic nonspecific low back pain. J Back Muscoskelet Rehabil. 2013; 29(2):327-336.

30. El Tumi H, Johnson MI, Dantas PBF, Maynard MJ, Tashani OA. Age-related changes in pain sensitivity in healthy humans: A systematic review with meta-analysis. Eur J Pain. 2017; 21(6): 955-964.

31.Herbele ABS, Ichisato SMT, Nohama P. Avaliação da mama na lactação por termografia e presença de dor. Acta Paul de Enferm. 2015; 28(3):256-263.

32.Vargas e Silva NCO, Dos Anjos RL, Santana MMC, Battistela LR, Alfieri FM. Discordance between radiographic findings, pain, and superficial temperature in knee osteoarthritis. Rev Bras Reumatol 2020:58 (6):375-380

33.Nascimento OJM, Pupe CCB, Cavalcanti EBU. Diabetic neuropathy. Rev Dor. São Paulo, 2016;17(Suppl 1):S46-S51.

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XXV Meeting of the Polish Society of Thermovision Diagnostics in Medicine combined with Polish Association of Medical Physics

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The Polish Society for Thermal Imaging Diagnostics in Medicine has been in existence or almost 25 years. It was founded by the team of the thermal imaging laboratory by Professor Anna Jung. It brings together scientists and practitioners, including physicians as well as physicists and engineers who use thermal imaging cameras in their research and professional work.

The main goals that the PTDTM sets for itself include:

1. to disseminate knowledge about the possibilities of using thermal imaging diagnostics in me- dicine

2. conducting research in the use of thermal imaging in various fields of science

3. exchange of experience and diagnostic possibilities of the technique, its drawbacks and limitations

4. cooperation with foreign centers and formation of research consortia whose task is to develop appropriate procedures for thermographic imaging in various fields of medicine.

For more than 20 years, the International Conferences entitled. "Meeting of the Polish Society of Thermovision Diagnostics in Medicine" were "traditionally" held in Zakopane. Now, after a quarter of a century of PTDM, the XXV International Conference entitled "Meeting of the Polish Society of Thermovision Diagnostics in Medicine. "XXV Meeting of the Polish Society of Thermovision Diagnostics in Medicine" will be held for the first time in Wisla and for the first time in conjunction with the 19th Silesian Seminar of Medical Physics, a National Conference.

The conference will present topics related to the use of thermography in medical diagnostics in the broadest sense, as well as in the control of the results of applied treatment, such as in radiotherapy. One of the sessions will be devoted to the use of thermovision in sports medicine. Preliminary results of research on the use of body cooling in the early diagnosis of breast oncological diseases will also be presented. Presentation topics will also include topics indicating new trends in the use of thermography in medicine and technology.

The topics of each session along with the presenters are listed below.

SESSION 1

THERMAL IMAGING IN THERAPY AND DIAGNOSIS

Session chair: Prof. Anna Jung and Dr Kevin Howell

1) Dr inz. Lukasz Kapek

Maria Sklodowska-Curie National Research Institute of Oncology, Gliwice Branch

Physical parameters in thermal imaging of basal cell cancer patients treated with high-dose-rate brachytherapy

2) Mgr inz. Dominika Plaza

Maria Sklodowska-Curie National Research Institute of Oncology Gliwice Branch

Could thermovision be a useful method in assessing body` s thermal reaction to the dose received during radiotherapy?

3) Mgr inz Katarzyna Kokoszka/Prof Armand Cholewka

Faculty of Science and Technology, University of Silesia; GLCenter Sp. Z o. o.

Use of preliminary cooling in thermal imaging of breast diseases

4) Dr inz Beata Englisz

Faculty of Science and Technology, University of Silesia

Thermal imaging evaluation of hard-to-heal wounds treated by hyperbaric oxygen therapy

SESSION 2

THERMAL IMAGING IN SPORT

Session chair: Dr Jozef Gabrhel (Slovakia) and Prof. Joanna Chwiej (Akademia Górniczo- Hutnicza, Kraków)

1) Victor Franco

Universidad Politécnica de Madrid

Skin temperature variations and performance during a long term endurance running

2) Dr inz Teresa Kasprzyk- Kucewicz

Faculty of Science and Technology, University of Silesia

Thermal imaging as a tool in sportsman efficiency evaluation

3) Prof Dr hab Jakub Adamczyk

Academy of Physical Education, Warsaw

Application of thermal imaging in evaluation of self-myofacial release technique

4) Prof Dr hab Andrzej Swinarew

Faculty of Science and Technology, University of Silesia

Thermography application in extreme sport

5) Prof Joanna Chwiej

AGH University of Science and Technology Krakow

Infrared imaging - not only the thermography

SESSION 3

CURRENT RESEARCH AND APPLIED INNOVATIONS ABOUT THERMAL IMAGING

Session chair: Prof Manuel Silliero (Universidad Politécnica de Madrid) and Prof Jakub Adamczyk (Akademia Wychowania Fizycznego Warszawa)

1) Inz. Aleksandra Mrowiec

Faculty of Science and Technology, University of Silesia

Is Thermal Imaging a Helpful Tool in Diagnosis of Asymptomatic Odontogenic Infection Foci- A Pilot Study

2) Dr Jozef Gabrhel

Private Clinic, Trencín, Slovakia

Sonograhic and thermographic findings of the joints of the upper and lower limbs

3) Dr Bartlomiej Michalak, Dr Robert Gajda

Academy of Physical Education, Warsaw

Relation between skin temperature and muscle stiffness in Masters Athletes: effect of age and event

4) Mgr inz. Pawel Rutkowski

SPONSORED LECTURE - Innovations in thermal imaging cameras used in medicine

All those interested in the topic of the use of thermal imaging in medicine and our conferences are encouraged to keep up to date with news and announcements of upcoming seminars at www.ptfm-slask.pl and to contact us directly by email: armand.cholewka@gmail.com.

Abstracts

COULD THERMOVISION BE A USEFUL METHOD IN ASSESSING BODY` S THERMAL REACTION TO THE DOSE RECEIVED DURING RADIOTHERAPY?

Dominika Plaza[1], Agnieszka Baic[2], Barbara Lange[3], Lukasz Kapek[4] , Krzysztof Slosarek[1], Agata Stanek[5], Armand Cholewka[2]

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PURPOSE OF THE STUDY: The main objective of the study was to assess the usefulness of the infrared thermography method in assessing the body's thermal reaction depending on the dose administered during radiotherapy treatment of breast cancer.

MATERIAL AND METHODS: The research group consisted of patients after breast-conserving surgery or mastectomy who were qualified for breast cancer treatment with radiotherapy. Treatment plans prepared individually for each patient were correlated with thermographic images. The tests were performed before treatment and after each week of treatment, which allowed the observation of changes in the temperature of the irradiated surface during treatment. The control group consisted of healthy women. It was analyzed whether there is a temperature difference between the breast areas. Care was taken to properly prepare the room, strict criteria for qualification and exclusion for the study were prepared.

RESULTS: During treatment, a qualitatively similar increase in mean temperature was observed, both in patients after partial breast surgery and after mastectomy, even due to the lower thermal resistance of the layer of tissue after removal of the entire breast. The reaction to the radiation dose received during radiotherapy treatment in the form of a change in skin surface temperature is similar in both groups. The highest increase in temperature was noted in the third week of treatment (the appearance of a radiation reaction was also observed at that time). These values are consistent with literature data. A high positive correlation was obtained between isodoses and isotherms. It was found that in healthy women there is no visible thermal asymmetry between the breasts. The difference in mean temperatures between the breasts is 0.2 °C and these differences are not statistically significant.

CONCLUSIONS: The study confirmed that infrared thermography can be used in clinical practice in patients with breast cancer during radiotherapy treatment. However, further studies on a larger group of patients are needed.

PHYSICAL PARAMETERS IN THERMAL IMAGING OF BASAL CELL CANCER PATIENTS TREATED WITH HIGHDOSE-RATE BRACHYTHERAPY

Lukasz Kapek[1,2], Agnieszka Cholewka[3], Agnieszka Szurko[2], Agata Stanek[4], Dominika Plaza[3], Marta Szlag[3], Krzysztof Slosarek[3], Piotr Wojcieszek[5], Armand Cholewka[2]

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4 School of Medicine with the Division of Dentistry in Zabrze, Department and Clinic of Internal Diseases, Angiology and Physical Medicine in Bytom, Medical University of Silesia, Batorego Street 15, 41-902 Bytom, Poland;

5 Maria Sklodowska - Curie National Research Institute of Oncology, Wybrzeze Armii Krajowej 15 Gliwice Branch, Poland; Brachytherapy Department.

PURPOSE: One of the methods of treatment of basal cell carcinoma (BCC) is a High Dose Rate (HDR) brachytherapy. The only viable option in diagnosis of BCC is histopathology examination with require taking skin sample. While this may not be a problem during pre-treatment diagnosis, checking the effectiveness of the treatment with the subsequent sampling can cause visible scars (specially in face area). This is important in particular in HDR treatment which leaves more sensitive and thinner. this study suggests the use of thermography as a noninvasive method for bringing information about treatment during and after treatment.

MATERIALS AND METHODS: Thirty-three patients of Maria Sklodowska - Curie National Research Institute of Oncology, Gliwice Branch, Poland, suffering from basal cell carcinoma were monitored with thermovision before and after the treatment with HDR brachytherapy. All were confirmed with histopathology examination.al

RESULTS: Anysis of the data revealed two groups among all patients with different gradient temperature of the treatment area and its surrounding. The first group was characterized with higher temperature of lesion, the second one with lower lesion temperature. Observed changes is temperature in regions of interest before and after therapy could provide additional information, which could be useful in planning the next steps in treatment process

INFLUENCE OF CENTRAL NERVOUS SYSTEM ACTIVATION ON THE RESPONSE OF SKIN TEMPERATURE TO THE RESISTANCE TRAINING

Manuel Sillero-Quintana [1], Jacob Jones-Rando [1], João Carlos Bouzas Marins [2] and Adérito Seixas [3]

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PURPOSE OF THE STUDY: Infrared thermography (IRT) has many applications in the sports area [1], such as the detection of

biomechanical imbalances, injury prevention, and quantification of training load. Direct current potential (DC potential) has been used to measure brain function and is a great indicator of the functional state of the Central Nervous System (CNS) and the level of subject functionality [2]. The aim of this work was to relate the activation of the sympathetic and parasympathetic nervous systems with the skin temperature (Tsk) of the lower limbs after a resistance training exercise.

MATERIAL AND METHODS: Under controlled conditions, the average Tsk in the areas of the anterior and posterior thighs, knees, and legs was obtained with a thermal imager and parasympathetic and sympathetic activation was registered with an Omegawave® device in 20 healthy and trained male volunteers (25.39 ± 8.21 years) before exercise, immediately after standard resistance training (3 exercises (2 quadriceps + 1 hamstrings) × 4 sets × 10 repetitions (70% 1RM), 90 seconds recovery) and after 20 min of recovery.

RESULTS: The results showed a significant effect of exercise and recovery on Tsk in all regions of interest (ROIs) considered ($p < 0.05$) and strong inverse relationships between sympathetic and parasympathetic activation values. Significant results were found for the total variation of Tsk ($p < 0.05$) with highly positive values for subjects with lower sympathetic activation and almost null or even negative values for those with higher sympathetic activation. Sympathetic activity was a significant predictor of total Tsk variation in the anterior thigh, posterior thigh and anterior knee, but not in the posterior knee, anterior leg, and posterior leg. Baseline Tsk was a significant predictor of total Tsk variation in all ROIs except in the posterior knee.

CONCLUSIONS: Tsk measured by thermography could be used to estimate the level of participation of muscle areas in exercise. Registering the level of sympathetic activation before exercise could be interesting in predicting the physiological Tsk response to strength training.

REFERENCES

1.Marins, J.C.B.; Fernández-Cuevas, I.; Arnaiz-Lastras, J.; Fernandes, A.A.; Sillero-Quintana, M. Applications of infrared thermo-m graphy in sports. A review. Rev. Int. Med. Cienc. Act. Fis. Dep. 2015, 15, 805-824.

2.Peake, J.M.; Kerr, G.; Sullivan, J.P. A critical review of consumer wearables, mobile applications, and equipment for providing biofeedback, monitoring stress, and sleep in physically active populations. Front. Physiol. 2018, 9, 743.

SKIN TEMPERATURE VARIATIONS AND PERFORMANCE DURING A LONG TERM ENDURANCE RUNNING

Victor Hugo Pereira Franco [1,2], Jorge Roberto Perrout de Lima [2], Ciro José Brito [2],Manuel Sillero-Quintana [3]

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PURPOSE OF THE STUDY: The use of Infrared Thermography (IRT) during competitions and training in hot conditions help prevent hyperthermia, helping to control body cooling procedures [1,2]. Previous research has concluded that Skin Temperature (Tsk) during low-intensity aerobic exercise tends to fall, but quickly rises back to normal values after exercise [3]. However, no study has analyzed skin temperature during long term endurance exercise such as the ultramarathon. For this, it is necessary to verify that in long term endurance running (6 hours) the behavior of the skin temperature is the same as in short term endurance running.

Therefore, the aim of this work was to analyze the skin temperature variations during a long term endurance running.

MATERIAL AND METHODS: Thirty-nine volunteers male elite soldiers highly trained (27.6 ± 6.3 yrs; 77.0 ± 8.5 kg; 5.8 ± 4.5 hours/week; 39.2 ± 20.6 km/week) ran 6h on a official 400-meters athletics track. The race was divided into 3 series with 15-min intervals between series for the data colection. The participants were free to determine their pace during the run. The average Tsk in the anterior and posterior areas of the thighs, knees and legs was obtained with a thermographic camera at different times during the running (pre-running; after ran 2h; after ran 4h; after ran 6h; after 1 hour of rest).

RESULTS: After 6 hours of running, the participants ran 41.25 ± 8.17 km, showing a positive pacing strategy when athlete's speed gradually declines throughout the duration of the event. The participants ran 17.75 ± 4.38 km in the first serie, 13.17 ± 3.15 km in the second and 10.33 ± 2.26 km the third.

Regarding the skin temperature during the long term running, the lowest temperatures in 4 ROIs were found after the participants ran the first 2h, except in posterior leg an thigh where the lowest temperature was measured before starting the race (pre-race). The highest temperatures were found 1h after the end of the race, except for the posterior leg whose highest temperature was reached at the end of the 6h of running.

Conclusions: These data suggest that there is an inversely proportional relationship between performance and skin temperature, that is, the faster the athlete runs, the lower his temperature and the opposite, the slower he runs, the higher his skin temperature.

REFERENCES.

1.Fernandes AA., Amorim PR, Brito CJ, Sillero-Quintana M, Bouzas Marins JC. Regional skin temperature response to moderate aerobic exercise measured by infrared thermography. Asian Journal of Sports Medicine 2016, 7(1), e29243.

2.Racinais S, Ihsan M, Taylor L, Cardinale M, Adami PE, Alonso JM, Bouscaren N, Buitrago S, Esh CJ, Gomez-Ezeiza J, Garrandes F, Havenith G, Labidi M, Lange G, Lloyd A, Moussay S, Mtibaa K, Townsend N, Wilson MG, Bermon S. Hydration and cooling in elite athletes: relationship with performance, body mass loss and body temperatures during the Doha 2019 IAAF World Athletics Championships. British Journal of Sports Medicine, 2021, 55(23), 1335-1341.

3.Fernández-Cuevas I, Torres G, Sillero-Quintana M, Navandar A. Thermographic assessment of skin response to strength training in young participants. Journal of Thermal Analysis and Calorimetry, 2023, 1-9.

SONOGRAPHIC AND THERMOGRAPHIC FINDINGS OF THE JOINTS OF THE UPPER AND LOWER LIMBS

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3.University of St. Cyril and Methodius in Trnava,
4.Veterinary Outpatient clinic Soprec, Czech Republic,

INTRODUCTION:A sonographic image is created by the reflection of ultrasound waves in the place of impedance changes. It can determine the structure that is the source of the pain (1). Thermography is an imaging method that detects and analyzes infrared radiation from the body's surface. It is a pathophysiological method (2). We use recorded deviations from the normal temperature pattern and changes in absolute temperature parameters to determine the pain phenotype, stratify patients into specific subgroups, and select appropriate treatment.

METHOD: Our study is a retrospective study in which, from the total number of patients who were admitted to our private clinic in the last 10-12 years for pain in the shoulders, elbows, wrists and hands, hips, knees and in two years in ankles and feet, we selected only those who were examined sonographically and at the same time thermographically. All patients also underwent a myoskeletal examination. In some cases, examinations were completed with other imaging methods such as X-ray, MRI, CT...

The number of patients meeting these criteria was 332 for the shoulders (208 men, 141 women), 153 for the elbows (107 men, 46 women), 110 for the wrists and hands (57 women, 53 men), 232 patients for the hip joints (99 women, 133 men), knees 727 (321 women, 406 men), ankle joints and feet 57 (23 women, 34 men).

RESULTS: In the shoulders, pathological sonographic findings were recorded in the following representation: usuration (21%), calcifications (21%), bursae, articular recesses (16%), AC joint disorders (12%), rotator cuff ruptures (12%), disorders in sulcus bicipitalis (8%), osteoproductions, intramuscular, intradermal findings, fractures, growth plates (10%). Thermographically, 45% of findings were of increased thermal activity, 15% of hypothermic findings, and 40% of normal temperature patterns were recorded.

For elbows, 79% of sonographic findings were positive, 21% of findings were negative. Percentage of pathological sonographic findings: lateral epicondylitis 37%, medial epicondylitis 20%.rac Osteophytes, calcifications, corpora libera, arthrosis, cysts, bursae, tendon and muscle ruptures, nerve compression, ftures 43%. Thermographically, hyperthermic findings were recorded in 85%, hypothermic findings in 8%, normal temperature pattern in 7%.

In the area of the wrists, we recorded the following sonographic findings: bursae, cysts, joint filling, vagina tendinis filling (41%), osteophytes, calcifications (33%), usuration (14%), injuries (9%), nerves (7%). Thermographically, 22% of findings were hyperthermic, 11% hypothermic, 67% with a normal temperature pattern. Sonographic findings of the hands included: osteophytes, calcifications (53%), cysts, bursae, filling of the vagina tendinis, gangliomas (35%), trauma (8%), usuration (4%). Thermograms were hyperthermic in 32%, hypothermic in 7%, and normal in 61%.

In the case of hip joints, according to their nature, sonographic findings were divided into: lymphadenopathy, lipomas, fibromas, fibrotization (7%), bursae, cysts (12%), calcifications, osteophytes (49%), bone and muscle trauma in various locations (5%), 19% of patients with coxarthrosis were examined, 2% of patients were examined for complications after TEP, the number of pathological structural findings in the thigh area was 6%. 59% of thermograms showed abnormality. Of these, 42% had hyperthermia, 17% had hypothermia, and 41% had a normal temperature finding. In 84% of patients with coxarthrosis III.-IV.st. hypothermia in the gluteal region was detected.

The knee had the following sonographic findings: bursae, cysts (47%), calcifications, ossifications, mucoids, tophi, corpora libera (38%), ostephytes (32%), hydrops, haemarthrosis (30%), FP arthrosis (27%), FT arthrosis (26%), meniscopathies (20%), gangliomas (18.5%), tendon, muscle, ligament ruptures, total or partial (14%), synovial hypertrophy and fat pad (7%), fractures, abruptions (5.4%), tendinopathies (5%), bone surface ossification (3%), TEP complications (2.8%), plicas (1.5%), growing pains (1.5%), chondrocalcinosis (1%), aseptic osteonecrosis (1%), tumors (0.3%), nerves (0.3%), foreleg, calf (2.2%). 67% of thermographic findings were hyperthermic, 5% hypothermic and 28% had normal temperature findings.

In the case of findings on the ankle joints and feet, in 47% of cases, these were findings in the area of the calcaneus, in 16% of the Achilles tendon, in 27% of other findings (calcifications, bursa subachilea, prominence of the rear talus and calcaneus edges, plantar fascia tendinopathy, ganglioma plantar aponeurosis, hydrops ATC, cyst, osteophytes, chondral degeneration, peroneal tendinopathy, fibulotalar ligament rupture, periostosis tub. osis navicularis). Thermographically, we found hyper- thermia in 74% of cases, hypothermia in 19% and normal temperature findings in 7%.

CONCLUSION: The results of our retrospective studies of selected areas of the musculoskeletal system over the last decade show that more than half of the sonographic findings of pain syndromes of the musculoskeletal system are of extra-articular origin. The ratio of hyperthermic, hypothermic and normal temperature findings is different in individual anatomical locations. Sonographic and thermographic examination of musculoskeletal structures allows both to detect the affected structure and to determine the type of pain, and based on this information to choose targeted treatment and tailored treatment.

References

1.Bradley M, O´Donnell P. Atlas of musculoskeletal ultrasound anatomy. Cambridge. Cambridge university press. 2010

2.Bianchi S, Martinoli C. Ultrasound of the Musculoskeletal System. Berlin. Springer-Verlag Heidelberg, 2007

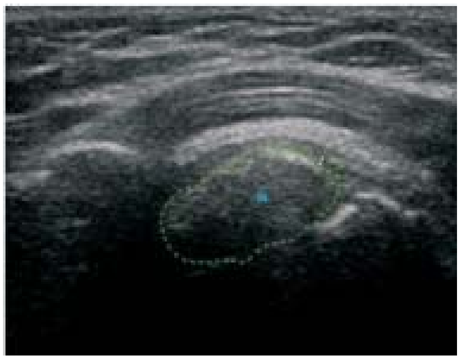
3.Ammer K, Ring EFJ. The thermal human body. Singapore. Jenny Stanford publishing. 2019.

4.Gabrhel J. Sonographic and thermographic findings of the shoulder, clinical practice cases. Litomyšl.H.R.G. spol. s.r.o. 2021

5.Gabrhel J. Sonographic et thermographic findings of the elbow, clinical practice cases. Litomyšl.H.R.G. spol. s.r.o. 2021

6.Gabrhel J. Sonographic et thermographic findings of the wrist and hand, clinical practice cases. Litomyšl.H.R.G. spol. s.r.o. 2023

7.Gabrhel J. Sonografické a termografické nálezy bedrového klbu, prípady z praxe. Litomyšl H.R.G. spol.s.r.o. 2023



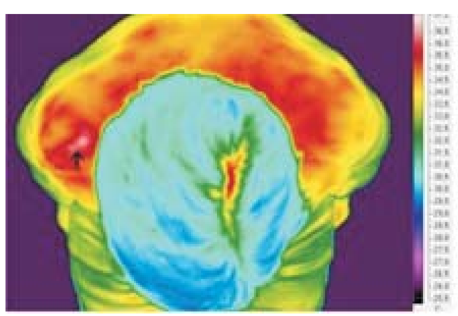


Fig.1a. Sono Fig.1b, X.ray Fig.1c.TMV

Calcification deposit on the right side. increased temperature activity on the right side.

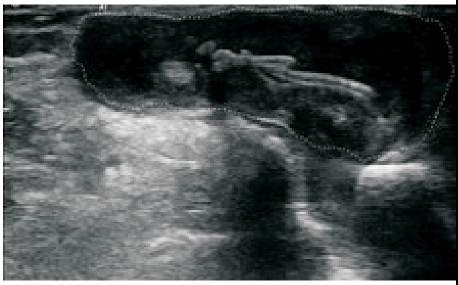


Fig.2a. sono -
hypoechogic filling bursae olecrani.

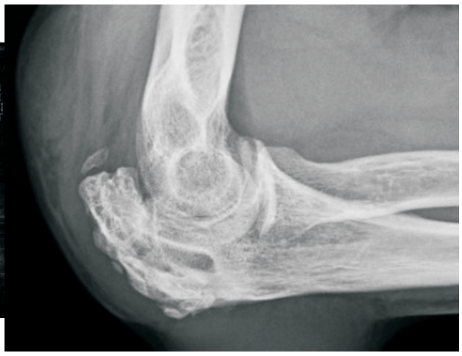


Fig.2b. Xray -
osteophyt olecrani, bony metaplasia of

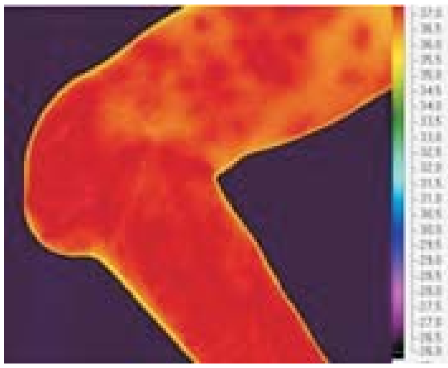


Fig.2c .TMV -
increased temperature activity.

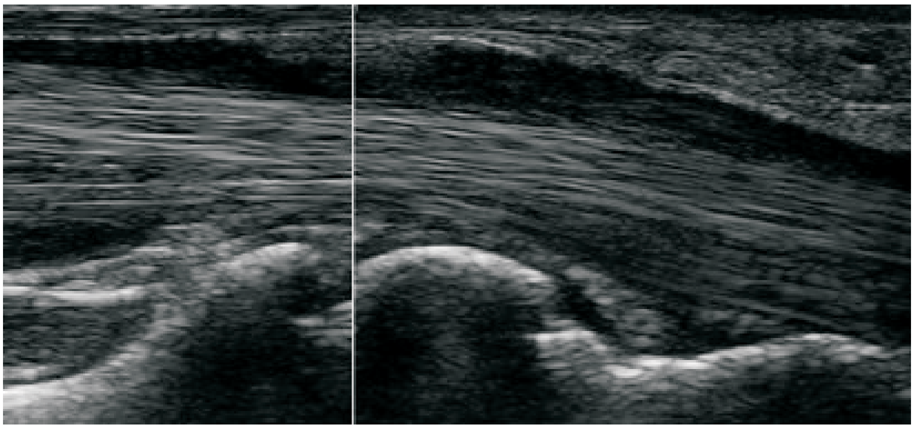


Fig.3a .sono
thickend n.medianus on the left side

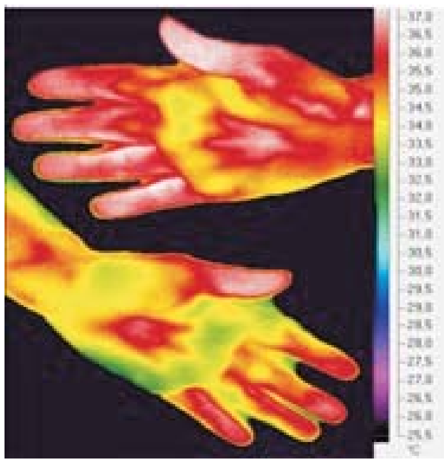


Fig.3b. TMV
hypothermia of the 2^{nd},3^{rd} and 4^{th} finger of the left hand.

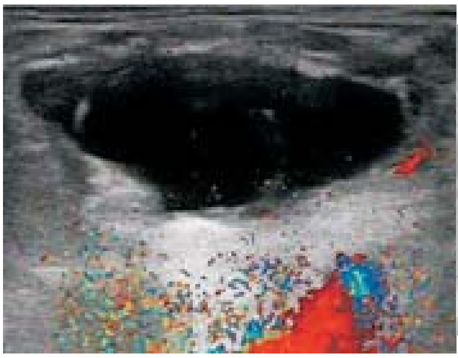


Fig.4a. Sono
cyst on the right side.

Fig.4b. Xray.

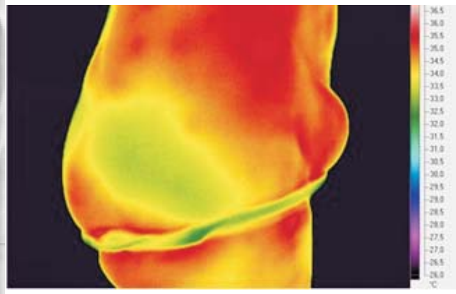


Fig.4c. TMV
decreased temperature activity.

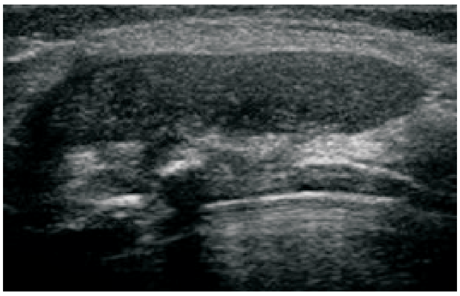


Fig.5a.sono
calcification deposits and ganglion over TEP

Fig.5b. Xray
TEP

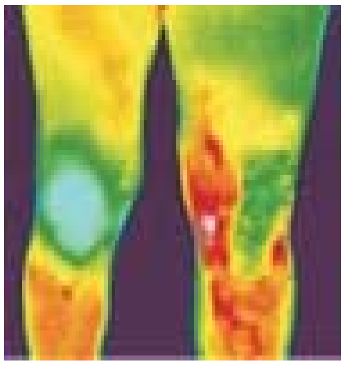


Fig.5c.TMV
increased temperature on the left side.

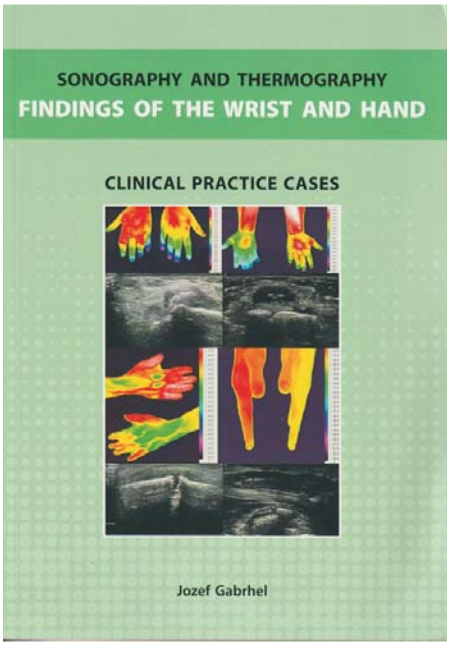
Fig.6a. Sono
usuration tali.

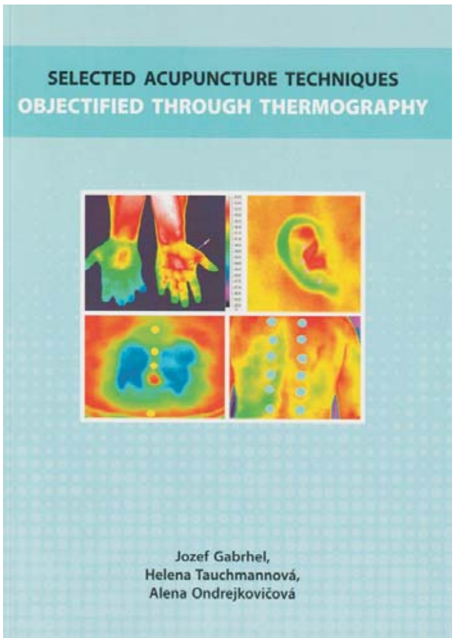
Fig.6b.Xray
osteonecrosis tali.

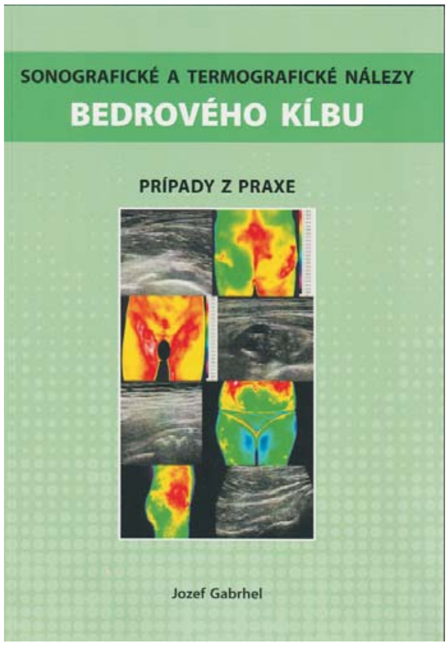
Fig.6c. TMV
increased temperature on the left side.

News in Thermology

New Books







Jozef Gabrhel published 3 more volumes of his case book Equin series. The English versions of "Sonography and Thermo- graphy Findings of the Wrist and Hand" and of "Selected Acupuncture Techniques Objectified Through Thermo- graphy" are now available. A voluminous book in Slovak language reports on 289 pages sonographic and thermo- graphic findings in the hip region.

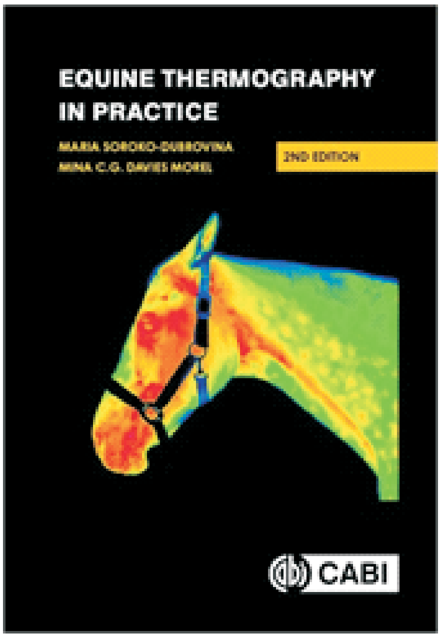
Both the wrist- and the hip-book are organised in sections on anatomy, normal sonographic and normal thermographic findings followed by parts on various bone, cartilage, and soft tissue pathologies. Ultrasound findings predominate in number. The thermal images are classified as normo-, hypo- or hyperthermic. Hypothermia was defined as the affected side being cooler by 0.5°C or more than the contralateral side Hyperthermia describes a side-difference in temperature of +0.5°C or more. Unfortunately, detailed information on the level of hypo-or hyperthermia are missing.

Such temperature details are plenty available in the acupuncture-volume. Examples of traditional acupuncture, electroacupuncture, ear acupuncture are provided. The effect of abdominal acupuncture is demonstrated by temperature changes. Finally, a case series after cupping is presented. In conclusion, there are vasomotor changes after application of traditional and recent forms of acupuncture. These changes can be visualised through thermal imaging.

Thermography in Practice

By Maria Soroko-Dubrovina & Mina C G Davies Morel

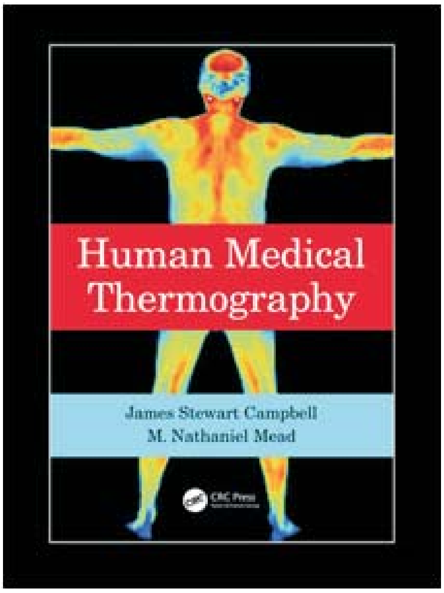
- 2nd Edition
- 176 pages, Hardcover
- Expected publication May 30, 2023



Evidence-based and yet very practical, **Equine Thermography in Practice** discusses how to use the tool in the diagnosis of equine musculoskeletal injuries. It covers what the user can expect to see in normal versus injured horses, giving guidelines for best practice. The book builds on the basics covering the principles of thermography, then reviews its applications in equine veterinary medicine and the role of the technique regarding equestrian athletes and rehabilitation.

Fully updated throughout with new references and additional illustrative case studies, this new edition:

- Covers advances made in thermography applications for rehabilitation, such as the assessing the effectiveness of physical devices like lasers, magnetic therapy, shock wave therapy and cryotherapy with additional updated references.
- Includes new cases and thermographic images to illustrate improvementsin the thechnology.
- Updates knowledge on thermographic imaging technology
- Extensively illustrated and thorougly referenced this book is indispensable for both novice and experienced practitioners using the technique, including equine veterinarians, equine physiotherapists and body work practitioners.



Human Medical Thermography
By James Stewart Campbell, M. Nathaniel Mead

Edition: 1st Edition

First Published 2022

eBook Published: 5 August 2022

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eBook ISBN 9781003281764

Subjects: Engineering & Technology, Medicine, Dentistry, Nursing & Allied Health

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2023

14th- 18th August 2023
Cape Town, South Africa

International Heat Transfer Conference IHTC17

Venue: Cape Town International Convention Centre, Cape Town, South Africa

Submissiion for papers closed on 30th October 2022

Website: https://ihtc17.org/

21st - 22nd October 2023
Virtual AAT 2023 Annual Scientific Session

Website: https://annualmeeting.aathermology.org

About The Event

The 2023 Annual Scientific Session will be a Virtual Meeting consisting of both recorded presentations and live sessions. Those who register for the full meeting with next year's membership will be given 60 days post-meeting access to the recorded presentations.

Separate registration is required for the Pre-Meeting Physician's Thermography Interpretation and the Getting Started Courses. The Interpretation course is on line, at your own pace, followed by a Virtual Live question and answer session conducted between 9:00am and 12:00pm (Eastern Time) on Friday, October 20th, 2023.

The getting Started course is Virtual Live format only.

It runs from 2:00pm to 5:00pm, on Friday, October 20th, 2023

The 2023 Program is pending.

30th October-November 3rd Abu Dhabi, UAE
QIRT Asia Conference

The conference, 4th QIRT Asia 2023 will be held in Abu Dhabi, United Arab Emirates

Website: https//qirt-asia-2033.org

FIRST ANNOUNCEMENT

WROCŁAW UNIVERSITY
OF ENVIRONMENTAL
AND LIFE SCIENCES

XVI Congress of the European Association of Thermology

6th – 8th September 2024

Faculty of Biology and Animal Science

Wrocław University of Environmental and Life Sciences

Wrocław, Poland

XVI Congress of the European
Association of Thermology

Wrocław POLAND 2024

www.eurothermology.org

The EAT and Wrocław University of Environmental and Life Sciences are delighted to invite you to participate in the XV EAT Congress in Wrocław, Poland from 6th to 8th September 2024.

The European Association of Thermology exists to promote, support and disseminate research in thermometry and thermal imaging in the fields of human and veterinary medicine and biology. We do this through our peer-reviewed journal Thermology International, regional seminars around Europe, and our flagship Congress, which takes place every three years.

Following on from the most recent meetings in Porto (2012), Madrid (2015), London (2018) and online (2021) the Congress heads to eastern Europe for 2024 to Wrocław in Poland.

The Organising Committee looks forward to welcoming you to Wrocław University of Environmental and Life Sciences in the summer of 2024.

Dr. Kevin Howell
EAT President

VENUE.

Wroclaw lies on the banks of the River Oder in western Poland, and is the capital of the Lower Silesian Vovoideship. It was the European Capital of Culture in 2016, and won the "European Best Destination" title in 2018.

Our venue will be the Faculty of Biology and Animal Science at the prestigious University of Environmental and Life Sciences on Chelmonskiego Street in the eastern suburbs of Wrocław. The Faculty building boasts excellent conference facilities including a large lecture theatre, ample lobby space for networking and poster presentations, and a spacious restaurant for lunch breaks. This is the perfect environment for delegates to present their thermological research at Europe's flagship biomedical temperature congress.




ORGANISING COMMITTEE	INTERNATIONAL SCIENTIFIC COMMITTEE
Maria Soroko-Dubrovina (POL), Chair	**Kurt Ammer (AUT), Chair**
Kurt Ammer (AUT)	John Allen (GBR)
Kevin Howell (GBR)	Danilo Gomes Moreira (BRA)
Anna Jung (POL)	George Havenith (GBR)
Adam Roman (POL)	Kevin Howell (GBR)
Adérito Seixas (POR)	Anna Jung (POL)
Manuel Sillero-Quintana (ESP)	James Mercer (NOR)
Karolina Śniegucka (POL)	Adérito Seixas (POR)
Ricardo Vardasca (POR)	Manuel Sillero-Quintana (ESP)
Anna Zielak-Steciwko (POL)	Maria Soroko-Dubrovina (POL)
Paulina Zielińska (POL)	Hisashi Usuki (JPN)
	Ricardo Vardasca (POR)

KEY DATES.

Abstract submission will open online on 4th September 2023, and authors will be notified of acceptance for oral or poster presentation by 4th March 2024.

May 2023. Publication of the First Announcement.
31st July 2023. Publication of the “Call for Abstracts” document.
4th September 2023. Opening of abstract submission and registration.
31st December 2023. Abstract submission deadline.
4th March 2024. Acceptance notification to authors.
6th May 2024. End of Early Registration and deadline for registration of presenting authors.

REGISTRATION FEES (*)

	Early Registration (Until 06 MAY 2024)	Late Registration (After 06 MAY 2024)
EAT MEMBER	€360	€410
Non-Member	€440	€490
One-day registration	€200	€250
Student	€200	€250
Accompanying person	€120	€120

(*) Further information about the registration process will be provided in the "Call for abstracts" document. Registration includes access to all congress sessions, congress lunch and coffee breaks, the Gala Dinner, and other congress social programme events.

ACCOMMODATION

Recommended hotels:

1. **Hotel ZOO**

Address: ul. Wroblewskiego 7, 51-627 Wroclaw

website: http://zoo-hotel.pl/

2. **Radisson Blu Hotel Wroclaw*****

Address: ul. Purkyniego 10, 50-156 Wroclaw

website: https://www.radissonblu.com/pl/hotel-wroclaw

3. **Grape Hotel & Restaurant*****

Address: Parkowa 8, 51-616 Wroclaw

website: https://www.grapehotel.pl

4. **PURO Wroclaw Old Town*****

Address: Pawła Włodkowica 6, 50-072 Wroclaw

website: https://purohotel.pl/pl/wroclaw

5. **HOTEL EUROPEUM *****

Address: ul. Kazimierza Wielkiego 27A, 50-077 Wroclaw

website: https://europeum.pl

6. **Hotel Mercure Wroclaw Centrum******

Address: pl. Dominikański 1, 50-159, Wroclaw

website: https://www.accorhotels.com/pl/hotel-3374-hotel-mercure-wroclaw-centrum/index.shtml

ACCOMPANYING PERSONS

All accompanying persons will be invited to join the Congress Gala Dinner and full social programme upon payment of the appropriate €120 fee.