







Diagnosis of fibromyalgia: diagnostic feasibility and accuracy of thermography

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ABSTRACT

Introduction: Studies have suggested using thermography as a resource to diagnose fibromyalgia, although there has been no evidence confirming this hypothesis so far. **Objective:** To evaluate the sensitivity and specificity of computerized infrared thermography as an auxiliary method for diagnosing fibromyalgia. **Methods:** It is a diagnostic accuracy study with cross-sectional design. One hundred and three individuals were evaluated for global pain using the Visual Analogue Scale. The measurement of pain at tender points was assessed by algometry, and skin temperature was assessed by thermography. To evaluate sensitivity and specificity, the analysis was performed using the Receiver Operating Characteristic Curve, measured by the area under the curve with their respective confidence intervals. **Results:** Thermography has not been very sensitive or specific for pain (tender points) and diagnosis of fibromyalgia, according to the evaluation of the Receiver Operating Characteristic Curve, with an area under the curve equal to or lower than 0.75. **Conclusion:** In this study the thermography was not sensitive and specific as a tool for diagnosing the fibromyalgia syndrome. This study highlights important clinical implications concerning the current methods for diagnosing it, which, despite all efforts, are still subjective and poorly reproducible.

Keywords: Fibromyalgia; thermography; sensitivity and specificity.

INTRODUCTION

Fibromyalgia syndrome (FMS) is a chronic neurobiological disorder of musculoskeletal and connective tissue disorder, common at any age and sex. It has undefined complex multifactorial etiopathogenesis with gradual acceptance of its validity still questioned. It is difficult to be diagnosed and it is clinically underestimated, constituting a scientific and clinical challenge as an enigmatic puzzle^{1,2}. Although people of all ages and both sexes may develop it, women are more likely to have it, and almost 50% of them are aged between 35 and 44. Scientific literature shows FMS prevalence values in the general population between 0.2 and 0.6%, and 2.4 and 6.8% in women¹⁻⁸.

FMS is characterized by concomitant symptoms, whose cardinal sign is generalized (pain in four, out of the five regions of the body), persistent musculoskeletal pain (non-inflammatory), associated with fatigue (physical exhaustion), sleep disorders and cognitive problems, with frequent occurrence of additional somatic and psychological symptoms, resulting in widespread damage to quality of life^{1,3,4}. High levels of disability

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are self-reported by patients⁵. Genetic factors, psychosocial variables and environmental stressors also seem to have an influence on FMS⁶⁻⁸.

Generally, FMS is classified as follows: soft-tissue rheumatism (STR)⁹ and it may be primary (when it appears alone) or secondary to other rheumatic diseases¹⁰; belonging to chronic overlapping pain conditions (COPCs)¹¹; disorder between the affective spectrum disorders (ASD)¹²; one of the chronic syndromes with unclear etiology¹³; among functional somatic syndromes (FSS) and medically unexplained symptoms (MUS)¹⁴. Professionals in rheumatology, psychosomatic and analgesic medicine classify FMS as central sensitization, a psychosomatic disorder or a neuropathic pain⁸.

People with FMS also present some abnormalities in the neuroendocrine and autonomic nervous system, neurochemical changes, neuro-immune interactions, with potential involvement in focal neuroinflammatory processes in parts of the diencephalon, contributing to a neurosensitizing action^{11,12}.

Although the cause, pathophysiology and mechanisms of FMS are not yet fully understood and are even controversial, the finding of hypersensitivity in multiple stimulation modalities, particularly for unpleasant stimuli in fibromyalgia, suggests that the sensitivity to pain evoked by FMS may be related to an altered hedonic appreciation for sensory stimuli, rather than to peripheral tissue changes². This characterizes FMS as a disorder of pain regulation and central sensitization³. This hypothesis is corroborated by brain imaging studies using functional magnetic resonance imaging, in which various disorders of pain processing and regulation (increasing or decreasing pain inhibition) were observed in people with FMS³.

Individuals with no identifiable nociceptive input (primary FMS) usually develop regional pain syndrome and, over time, it generalizes. Fibromyalgia syndrome, however, is much more common in individuals with chronic pain attributable to peripheral pain generators, that is, with identifiable nociceptive input (secondary FMS) and, therefore, the peripheral and central aspects of pain should be differentiated⁸.

Diagnostic confounding factors are added, due to the similarity of FMS to other musculoskeletal, neurological, endocrine-metabolic, psychiatric, psychological, and drug-related conditions and symptoms¹⁵. For example, small fiber neuropathy (the most common neurological disease) underlies 49% of the diseases labeled as fibromyalgia¹⁶. Hauser et al.¹ suggest a clinical diagnosis of chronic pain based on a differential assessment in order to provide a more appropriate opinion in relation to FMS.

An accurate diagnosis would be the first decisive step towards more effective care and better treatment results¹⁷. When patients are recognized based on diagnostic confirmation, both the physician and the patient eliminate a major obstacle to the effective management of the disease. Once the diagnosis has been made,

patients report better health satisfaction, less long-term symptoms, and reduced health care use and costs¹⁸.

In this scenario, using cutaneous Infrared Thermography has contributed to the neuromuscular evaluation of individuals with chronic pain, providing some relevant support in the study of pain. The infrared thermography methodology is non-invasive and the heat offers bidimensional, real-time images without harmful radiation effects. Studies have proposed the use of thermography as a diagnostic resource for fibromyalgia, however, no evidence has been able to confirm this hypothesis so far¹⁹⁻²³.

As FMS is a polysymptomatic condition, delayed diagnosis is rather common, in addition to excessive testing and inadequate treatment, leading to high costs, such as the ones of some chronic diseases, for instance, diabetes and hypertension. It presents direct costs per patient and indirect ones²⁴.

Therefore, our aim was to assess the sensitivity and specificity of thermography as an auxiliary method for diagnosing fibromyalgia.

METHODS

It as diagnostic accuracy study with cross-sectional design. Measurement instruments are constant objects of investigations for information validity (measurement)²⁵. In this sense, investigations of diagnostic accuracy (precision) may contribute to the assumption of explicit evidence of validation that relate to the potential discriminative and predictive ability of a test. Sensitivity and specificity are two key characteristics of measures of diagnostic accuracy²⁶.

Accuracy measures are commonly used in diagnostic instruments, and it is suggested that evaluations of an instrument's discriminating capacity can be enlightening, and they can be obtained by analyzing the Receiver Operating Characteristic Curve (ROC)²⁶.

The research was submitted to the Ethics Committee on Research with Human Beings, affiliated to the Brazilian Health Council for Research on Human Beings (CONEP), under number CAAE 36614214.6.0000.5547.

Study location and sample

Patients were recruited from the patient registry of a rehabilitation reference center (target population of other studies)^{26,27} located in the south of the city of São Paulo, patients with a medical diagnosis of fibromyalgia in the age group of 25 to 60 years and patients without a diagnosis of fibromyalgia matched for age and sex. The sample was initially composed of 103 female individuals, randomized into two groups: Fibromyalgia Syndrome Group, with skeletal muscle pain (n=80), whose individuals had FMS, and Control Group, no history of skeletal muscle pain (n=23), whose individuals were healthy.

Patients answered a questionnaire to check if they met all the inclusion criteria of this study and signed the Informed Consent Form. Age-matched female subjects with a history of generalized musculoskeletal pain for at least 3 consecutive months and pain in at least 11 or more of the 18 tender points and with a clinical diagnosis of fibromyalgia were included in the Fibromyalgia Syndrome Group. In this study, 18 tender points were evaluated, according to the criteria of the American College of Rheumatology.

The study did not include individuals diagnosed with infectious or contagious neurological disease, whose clinical condition evolved into loss of urinary sphincter control; with previous cancer diagnosis; in severe neurological conditions; with acute orthopedic injuries or illnesses; unable to walk; who had undergone previous surgery 2 months before the start of data collection and who had suffered previous acute myocardial infarction 6 months before the start of data collection.

All assessments were carried out at the Exercise Physiology Laboratory at the Polyclinic of the Brazil Adventist University (UNASP). The global pain assessment was performed using the Visual Analogue Scale (VAS)²⁸, pain quantification at tender points was assessed using algometry (Pain Test™ FPX Compact Digital Algometer Pain Diagnostic Gage 20Lb x. 25Lb; 10kg X 100Gr, Italy) according to the parameters recommended in literature²⁹, and the skin temperature was assessed through thermography.

Procedure and data collection

The collection was carried out in two moments. In the first one, fibromyalgia patients had a clinical consultation to assess the stability and monitoring of the disease, using a fibromyalgia diagnostic instrument based on the modified criteria of the American College of Rheumatology of 2010/2016, which contains three important items: widespread pain index and symptom severity scale if symptoms were present and similar in the last three months, and the patient could not have another disease that would explain the pain³⁰.

In the second moment, all participants were submitted to pain assessment using the Visual Analogue Scale (VAS). All participants were submitted to assessment of pain perception thresholds through algometry. To perform the algometry, the researcher used a 90° approximation angle (formed between the stimulation surface and the stimulated point).

Algometry was always performed by a single evaluator, who received training before data collection. For evaluation, the participant was instructed to say “stop” as soon as the feeling of pressure changed from uncomfortable to painful. Right after it, the stimulus was interrupted, and the values were recorded in kgf/cm². On the stimulation surface, we find the stimulation point with a diameter of 0.5 cm. Pressure was applied to the tender points on each side of the body.

Fibromyalgia patients who had VAS greater than five points and/or algometry lower than 3kg/cm² in 11 of the 18 tender points underwent thermography. If these parameters were not met, a new evaluation was scheduled, at a time when the patient was having a fibromyalgia crisis, which increased the probability of meeting the previous requirements. After dolorimetry in 30 to 40 minutes (including stabilization of body temperature) thermography and algometry were performed in all participants and with the fibromyalgia patient in painful crisis, to better specify the sensitivity of the exam.

In thermography, the device consisted of a radiometer that captured the infrared waves emitted by the body, without any contact or ionic radiation. The temperature increased when the energy emitted per unit of time increased, being able to measure the temperature from the energy emitted by the skin surface in a totally safe way, without contraindication. The device used was T-Series Ultimate, ultimate & sensitivity resolution. The native resolution was up to 640 x 480, the thermal resolution was up to 1.2 MP with UltraMax™ - a 4x improvement. Enhancement MSX® on live video, stored images and UltraMax images Class-leading sensitivity up to <0.02°C for excellent image quality. Temperature calibrations up to 2,000°C. FLIR T640 cameras, 76,800 pixels, thermal resolution, UltraMax image enhancement, advanced interchangeable lenses to adjust the vision and spot size. T640 display does research in the brightest environments.

The protocol was carried out through strict control of the environmental conditions of the room, mainly for reproducibility of the results, as in any thermodynamic test. For this purpose, the infrared thermography exam took place in a room with a stable temperature and with normalized temperature readings for any location on the body surface, regardless of the environment and the individual's body temperature. The volunteers were instructed not to palpate, press, rub or scratch the skin at any time, until they had completed the entire thermographic examination.

During the examination, all volunteers were only wearing their underwear. It was performed in a standing position, at muscle rest, in an adaptation room with controlled temperature and humidity, to minimize interference in the studied variables. A document was explained and elaborated, which was given to the volunteers in the first assessment so that they could follow some procedures in order to be prepared for the exam. The volunteer would inform the evaluator if, at the time, he/she was having a crisis and whether he/she had failed to comply with any of these guidelines.

The thermographic examination was performed with the participants standing on a rubber base, in four image acquisitions, one in the anterior view, one in the posterior view, with the thermographic camera fixed vertically on the tripod and, when necessary, the image operator moved the tripod and/or camera for height and distance adjustment, which in these cases were 4m.

For the stabilization of body temperature, the participants were instructed to remain in standing position with underwear and barefoot during the acquisition of images, for a period of 18 minutes. The volunteers tied their hair and put on a disposable hat.

To obtain the images, the positioning was standardized: for anterior and posterior images, the participant was in standing position, with abducted arms and legs, and in the right and left lateral positions, with slight abduction of the lower limbs in 70° lateral rotation (with legs apart) and the upper limbs with their arms in front of each other. Positions were aided by reference lines. Thermography images were always taken by a single evaluator, who received training before image collection.

In order to avoid thermal variation, the examination room was kept free of air current and exposure to ultraviolet rays, without temperature variations. The room was air-conditioned at a temperature of 23°C±0.5°C and illuminated with cold-light by means of fluorescent lamps, with humidity of 45% and air speed <0.2m/s and, preferably, laminar flow³¹.

The infrared thermography protocol adopted in this research was guided by the guidelines of the American Academy of Thermology (AAT) Neuro Musculoskeletal Thermography, considering the preparation of the participants, the conditions of the examination room and the process of capturing and recording images³². The images and results were transformed into a PDF file, filed in a folder for each participant to perform the results spreadsheet. The interpretation of the thermograms was processed and analyzed by a specific software, using the Rainbow colorimetric scale, with a temperature range of 23° to 35°C and an emissivity standard of 0.98.

Data analysis

To assess sensitivity and specificity, the analysis was performed using the ROC curve, indicating the area under the curve (AUC) with its respective confidence intervals (95%). Among the precision indices to summarize the ROC curves, AUC is the most commonly used. The area under the curve summarizes the “global” location of the entire ROC curve and can be interpreted as the probability that an affected individual chosen at random will be classified as more likely to be affected than an unaffected individual chosen at random. It refers to the average sensitivity value for all possible specificity values, being especially useful in a comparative study of two diagnostic instruments²⁶.

Data analysis was performed using descriptive statistical techniques with absolute and relative distributions or in mean and standard deviation, as appropriate. Data symmetry was analyzed using the Shapiro-Wilk test. Comparison between groups was performed using the “t” or Mann-Whitney test according to the distribution of variables with quantitative outcome. Pearson or Spearman correlation tests were applied, according to the normality of data. Statistical analyzes of data were performed using the Statistical Package of Social Science (SPSS) version 22. All tests were analyzed with a significance level of 5% (p<0.05).

RESULTS

The sample initially consisted of 103 individuals, 23 healthy ones without fibromyalgia (Control Group) and 80 with fibromyalgia (Table 1).

Pressure sensitivity and specificity obtained from 18 tender points were analyzed using algometry. For the sensitivity and specificity of the exam to be considered good, the AUC should be greater than 0.75. Table 2 shows that the pressure obtained at the trapezius, epicondyle, trochanter, gluteus medius and medial surface of the knee had AUC greater than 0.75. The most sensitive and specific tender point was the gluteus medius, with AUC of 0.87 and 95% CI (0.79-0.94).

Table 3 shows that the pressure obtained at the occipital, epicondyle and medial surface of the knee tender points showed AUC greater than 0.75. The medial surface of the knee and the epicondyle presented similar AUC=0.81.

In the Fibromyalgia Syndrome Group, there was a weak but significant association between thermography and algometry in four of the 18 tender points, namely, left trapezius (r=-0.25; p=0.002), right greater trochanter (r=-0.23, p=0.003), left greater trochanter (r=-0.19, p=0.03) and right gluteus medius (r=-0.22, p=0.02).

The sensitivity and specificity of the temperature obtained from the 18 tender points were analyzed using thermography. For the sensitivity and specificity of the exam to be considered good, the AUC should be greater than 0.75. Table 4 shows the temperature obtained at the anatomical points analyzed, it was not possible to obtain an AUC equal to 0.75, with the trapezius being the tender point with the highest AUC (0.66), with a confidence interval of 95 % (95% CI) 0.51-0.81. The trochanter had the lowest AUC (0.48 (95% CI 0.31-0.64).

Table 5 shows the temperature obtained at the anatomical points analyzed, it was not possible to obtain an AUC equal to 0.75. The trapezius was the tender points with the highest AUC 0.68, with 95% CI (0.51-0.85). The epicondyle had a lower AUC (0.51), with 95% CI 0.32-0.69.

DISCUSSION

The aim of this study was to analyze the sensitivity and specificity of thermography for auxiliary use as a diagnostic method for fibromyalgia. The main result of this study showed that the thermography was not very sensitive or specific for the diagnosis

Table 1: Sample characteristics

Variables	Control Group (n=23)	Fibromyalgia Syndrome Group (n=80)	p-Value
Age, years	51.4±10.8	54.8±8.7	0.89
BMI, kg/m ²	29±5	29.4±4.5	0.91
VAS, cm	3.6±1.8	8.24±1.2	<0.0001

BMI: body mass index; VAS: Visual Analog Scale.

Table 2: Area under the pressure curve obtained at tender points with the diagnosis of fibromyalgia as the variable of analysis

Test result variable	Area under curve	Standard error	p-Value*	95%CI	
				Inferior limit	Superior limit
Occipital	0.645	0.070	0.055	0.509	0.782
Supraspinatus	0.713	0.072	0.005	0.572	0.854
Trapezius	0.774	0.063	0.000	0.652	0.897
Epicondyle	0.836	0.047	0.000	0.744	0.928
Cervical	0.738	0.068	0.002	0.605	0.870
Pectoral	0.742	0.062	0.001	0.620	0.863
Trochanter	0.787	0.062	0.000	0.666	0.907
Gluteus	0.872	0.038	0.000	0.797	0.946
Knee	0.815	0.049	0.000	0.718	0.911

*significant at p<0.05

Table 3: Area under the pressure curve obtained at the tender points, with the pain manifested by the patient with fibromyalgia

Test result variable	Area under curve	Standard error	p-Value*	95% CI	
				Inferior limit	Superior limit
Occipital	0.791	0.074	0.002	0.646	0.937
Supraspinatus	0.664	0.084	0.080	0.500	0.828
Trapezius	0.688	0.107	0.045	0.478	0.898
Epicondyle	0.816	0.062	0.001	0.695	0.938
Cervical	0.634	0.088	0.154	0.462	0.805
Pectoral	0.737	0.079	0.012	0.583	0.892
Trochanter	0.663	0.103	0.084	0.460	0.865
Gluteus	0.739	0.071	0.011	0.600	0.878
Knee	0.818	0.054	0.001	0.713	0.923

*significant at p<0.05

Table 4: Area under the curve for body surface temperatures obtained from tender points with the diagnosis of fibromyalgia as the variable of analysis

Test result variable	Area under curve	Standard error	p-Value*	95% CI	
				Inferior limit	Superior limit
Occipital	0.491	0.077	0.905	0.341	0.641
Trapezius	0.663	0.076	0.035	0.514	0.812
Epicondyle	0.489	0.080	0.892	0.333	0.646
Cervical	0.556	0.081	0.472	0.396	0.715
Pectoral	0.596	0.079	0.214	0.442	0.750
Trochanter	0.481	0.083	0.810	0.319	0.644
Gluteus	0.548	0.079	0.531	0.393	0.703
Knee	0.496	0.086	0.961	0.327	0.665
Supraspinatus	0.505	0.081	0.948	0.346	0.664

*significant at p<0.05

Table 5: Area under the curve for body surface temperatures obtained from tender points with pain manifested by the patient as the variable of analysis.

Test result variable	Area under curve	Standard error	p-value*	95% CI%	
				Inferior limit	Superior limit
Supraspinatus	0.522	0.100	0.817	0.325	0.719
Trapezius	0.686	0.085	0.048	0.519	0.852
Epicondyle	0.510	0.093	0.916	0.328	0.692
Cervical	0.551	0.087	0.587	0.381	0.721
Pectoral	0.620	0.092	0.201	0.440	0.801
Trochanter	0.516	0.109	0.863	0.303	0.729
Gluteus	0.611	0.101	0.238	0.413	0.809
Knee	0.588	0.099	0.350	0.394	0.782
Occipital	0.596	0.084	0.307	0.432	0.760

*significant at p<0.05

of fibromyalgia. For the sensitivity and specificity of the test to be considered good, the area under the curve should be greater than 0.75, but it was not possible to obtain an area under the curve equal to 0.75. The trapezius being the anatomical point (trigger point) presented the highest AUC=0.66 95% CI (0.51 to 0.81).

It's noteworthy that each patient reports his/her symptoms subjectively, and the etiology of the problem is not always identified in the clinical evaluation. Since the cause of pain is not fully recognized, numerous erroneous diagnoses and therapeutic failures are possible, as well as chronic painful symptoms, loss of productivity and consequent biopsychosocial incapacity. Such patients are labelled as misleading, hypochondriacs, neurotics and sometimes have psychosomatic abnormalities or psychic disorders³².

Brioschi et al.³³ claim that 87% of patients with chronic pain do not have an anatomical substrate demonstrable by routine imaging exams to explain their pain, which corresponds, in most cases, to dysfunctions of the neuro-musculoskeletal system, justifying the use of other diagnostic and imaging resources in the study of the patient's pain and in their clinical and therapeutic direction, such as infrared imaging.

Making the diagnosis of fibromyalgia has been shown to be still much discussed. In 1990, the ACR approved the criteria for fibromyalgia, as well as for its classification³⁴. In 1990 and 2010, the ACR approved and updated criteria for fibromyalgia as well as for its classification³⁴. The set of criteria has been quantitatively validated using patient data but has not yet undergone validation based on a set of external data, so these criteria are subject to updates. It is noteworthy that in 2015, the ACR started to provide approval only for classification criteria, no longer considering the financing or approval of diagnostic criteria³⁰.

An extensive investigation on the topic has been carried out since then, showing the need for updating. In 2016, based on information prior to 2010/2011 and new research, a new update was proposed³⁵. On the one hand, this update showed that the diagnosis of fibromyalgia in adults can be seen as a syndrome of moderate to severe symptoms and can be recognized by plotting the Polysymptomatic Distress Scale (PSD)¹⁵. The patient can be diagnosed when the level of symptoms is high enough (widespread pain in more than 11 tender points from the 1990 criteria or high levels of widespread pain index -WPI), which indicate the number of active pain sites, but do not include its distribution.

On the other hand, there were changes in criterion 1 of the Widespread Pain Index (WPI) and the Symptom Severity Score (SSS), as well as adding a generalized pain criterion (criterion 2), which is different from the generalized definition of pain of 1990. The definition is: pain in at least four, out of five regions. Other changes were related to standardization that makes the 2010 and 2011 criteria (criterion 3) the same: "Symptoms are usually present for at least three months"; the diagnostic validity of fibromyalgia regardless of other diagnoses, concomitant

with the presence of other relevant clinical diseases; adding the Fibromyalgia Symptom Scale as a complete component of the Fibromyalgia criteria; and replacing the medical estimate of the burden of symptoms by checking the presence of headaches or pain in the lower abdomen, as well as depression in the last six months³⁵.

A study carried out by Wolfe et al.³⁵ with the objective of observing the agreement and disagreement between the diagnoses based on the 2010/2011 and the 2016 criteria, evaluated 4,731 patients (27.9%) who met the 2011 criteria, and 4,077 (24.0%) who met the 2016 review. The authors concluded that the 2016 fibromyalgia criteria further refined and increased the usefulness of the symptom-based diagnosis of fibromyalgia, even though there are explicit limitations regarding reliability and validity linked to aspects associated with the criteria.

In this study, a difference in skin temperature was found between control subjects and those with fibromyalgia in most tender points. The biggest AUC was for the trapezius. However, for the diagnosis of manifested pain, AUC was more expressive.

Thermography has already been shown to be sensitive to expose skin temperature variation and can be an important method in detecting temperature variations in tender points of patients with fibromyalgia. This is because in these anatomical points, temperature variation can occur both for increase and decrease, since, if an inflammation due to muscle tension occurs, it can result in an increase in temperature, or, if there is a reduction in blood flow due to muscle spasm, this may cause a reduction in temperature³⁶.

Lima et al.³⁷ carried out a study with 50 female patients, between 20 and 83 years old, with reports of chronic pain, having the whole body exam done, which brought important secondary information for the approach of the patient with complaints of chronic pain, as myofascial dysfunctions not related to the main complaint and which, if left untreated, can lead to the onset of injury and the appearance or worsening and the perpetuation of the clinical picture of pain and disability. This global assessment made it possible to diagnose mainly myofascial disorders, osteoarthropathies, tendinopathies, postural changes correlated or not to the main complaint of chronic pain, but, above all, to identify other secondary changes, such as cardiovascular disorders and the sleep pattern, and central and peripheral neurological disorders.

Another study evaluating the back temperature of patients with unilateral muscle spasm using thermography showed that there is a significant temperature difference between individuals who experience pain in one hemisphere of the back in relation to control subjects and the contralateral hemisphere. The authors attribute this temperature difference to the vasomotor condition³⁸.

In this sense, evaluating the temperature sensitivity of patients with fibromyalgia compared to controls, patients immersed the forearm in cold water at 1°C, with a significant

difference in relation to core body temperature in relation to peripheral temperature of the forearm. The temperature among patients with fibromyalgia was significantly lower and had a shorter tolerability time. There was a correlation between the previous pain and the temperature after the procedure²³. Gomes et al.³⁸ claim that thermography has high specificity, and the important thing is a high sensitivity to identify chronic pain. The IR image does not demonstrate the presence of pain, but the vasomotor changes in the same projection areas. For this reason, it must be preserved as part of information to always be integrated with other clinical data.

Apparently, although some studies have shown this difference in skin temperature between fibromyalgia patients and control subjects, in this study, thermography has not proved to be a fully viable method to be applied in the auxiliary diagnosis of fibromyalgia.

The clinical limitations of this study refer to the fact that only an assessment of skin temperature was performed. It is possible that, if more evaluations were carried out, the results could be different. On the other hand, the present study has important clinical applications, mainly for the current diagnostic methods of fibromyalgia, which are still subjective and not very reproducible, when checking other technologies for diagnostic aid.

Conclusion

In this study, no statistically significant differences were found between the control groups and those with fibromyalgia syndrome, with no consistent information supporting the use of thermography as a diagnostic tool for fibromyalgia syndrome. It helps to explain a still important technological gap for a more objective diagnosis of fibromyalgia.

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