

ACCURACY AND RELIABILITY OF INFRARED THERMOGRAPHY IN THE DIAGNOSIS OF ARTHRALGIA IN WOMEN WITH TEMPOROMANDIBULAR DISORDER

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ABSTRACT

Objective: The purpose of this study was to determine the accuracy and reliability of infrared thermography in the diagnosis of arthralgia in women with temporomandibular disorder.

Methods: Thirty women aged between 18 and 40 years were recruited for the study. The Research Diagnostic Criteria for Temporomandibular Disorders was used to allocate the volunteers to the control group ($n = 15$) and arthralgia group ($n = 15$). Both groups were submitted to infrared thermography of the temporomandibular joint (TMJ), followed by a punctual analysis of the images. The Mann-Whitney U test was used for the comparison of skin surface temperature between groups. The intraclass correlation coefficient was calculated to determine the reliability of the infrared image analysis. The receiver operating characteristic curve was used to determine the accuracy of the diagnosis.

Results: Skin temperature was significantly greater over the left ($P = .004$) and right ($P = .012$) TMJ in the arthralgia group. The intraclass correlation coefficient ranged from 0.841 to 0.874. The area under the receiver operating characteristic curve ranged from 0.598 to 0.675.

Conclusion: Excellent intrarater and interrater reliability was found in the analysis of the infrared images of the TMJ. However, infrared thermography demonstrated a low accuracy in the diagnosis of arthralgia in women with temporomandibular disorder. (*J Manipulative Physiol Ther* 2013;36:253-258)

Key Indexing Terms: *Temporomandibular Joint Disorder; Skin Temperature; Thermography*

Temporomandibular disorder (TMD) is a problem with a complex diagnosis¹⁻³ and etiology that affects several structures of the stomatognathic system, such as the masticatory muscles, temporomandibular joint (TMJ), and/or joint disk.⁴⁻⁷

A recent study reports that pain is the most prevalent symptom in TMD of either a muscle or joint origin.⁷ A number of authors consider the identification of arthralgia based on the presence of pain upon palpation of the lateral and/or posterior region of the TMJ together with the patient's report of pain during movements of the mandible.⁷⁻⁹ However, Emshoff and Rudisch¹⁰ state that individuals with TMJ pain do not constitute a homogeneous

group and examinations that complement the clinical evaluation are important for a precise diagnosis.

Regarding the studies that evaluated subjects with joint changes, Roh et al¹¹ used magnetic resonance for the identification of the association between disk displacement, degenerative alterations, and joint effusion in individuals with joint conditions. Moreover, a recent systematic review stresses the need for studies assessing the actual benefits of nuclear magnetic resonance and computed tomography in the evaluation of individuals with TMJ changes and advises caution in the request for imaging examinations, especially in cases of financial restriction.¹² Li et al¹³ investigated the efficacy of ultrasound for the diagnosis of disk displacement,

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reporting that this examination is acceptable for ruling out some clinical suspicions but should be complemented with magnetic resonance. Another study stresses the need for standardization in the ultrasound examination for the evaluation of the TMJ.¹⁴

Among the clinical evaluations used for the identification of TMJ pain, Look et al⁹ report that the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) is commonly used for the identification of arthralgia. However, the correct use of this measure requires the rater to undergo a training and calibration exercise.⁸

An individual assessed by the RDC/TMD can be diagnosed with myofascial pain (Ia or Ib), disk displacement (IIa, IIb, or IIc), and/or joint changes (IIIa, IIIb, or IIIc). Thus, with regard to reliability, the literature⁹ reports good reliability intrasite and intersite for myofascial pain without limited opening (Ia), myofascial pain with limited opening (Ib), disk displacement with reduction (IIa), and arthralgia (IIIa). However, for the diagnoses of disk displacement without reduction (IIb), disk displacement without reduction without limited opening (IIc), osteoarthritis (IIIb), and osteoarthritis (IIIc), the values of intrasite and intersite reliability were poor.

With regard to accuracy of RDC/TMD, the literature⁹ shows the following values: Ia (65% of sensitivity and 92% of specificity), Ib (79% of sensitivity and 92% of specificity), IIIa (53% of sensitivity and 86% of specificity). For other intra-articular diagnoses, the accuracy was poor. In this context, even with the accuracy values below the desirable level, the RDC/TMD is the instrument better accepted by the scientific community for the diagnosis of TMD.

Infrared thermography is another possible diagnostic tool for TMJ conditions.^{15,16} This method is used to determine skin surface temperature based on the emission of infrared radiation from bodies with a temperature above absolute zero. Thermal imaging is also noninvasive method that offers no patient discomfort.¹⁷⁻¹⁹

Studies have shown that the temperature of the TMJ is higher and thermal asymmetry is greater in individuals with TMD in comparison with a control group.²⁰⁻²² However, few studies have been carried out to assess the diagnostic accuracy of infrared thermography. The investigations conducted to date report that this equipment is accurate for the diagnosis of TMD.^{15,16} Based on this sentence, the hypothesis tested herein is that infrared thermography is accurate for the diagnosis of arthralgia. Therefore, the aim of the present study was to determine the accuracy and reliability of infrared thermography in the diagnosis of arthralgia in women with TMD.

METHODS

Study Design

A cross-sectional study was carried out following approval from the Human Research Ethics Committee of

the Methodist University of Piracicaba (São Paulo, Brazil) under protocol number 15/11. All volunteers agreed to participate by signing a statement of informed consent.

Population

Seventy-seven women were recruited from the university community of the cities of Piracicaba and Americana, São Paulo, Brazil. The RDC/TMD⁸ was used for the inclusion of volunteers with and without TMD. In the former group, women mandatorily diagnosed with arthralgia (IIIa) were included.

The physiotherapist who applied the RDC/TMD was trained and calibrated according to the standards of the International RDC/TMD Consortium.

The following were the exclusion criteria: younger than 18 years and older than 40 years; body mass index (BMI) greater than 25 kg/m²; current orthodontic or physiotherapeutic treatment; current use of medications, such as analgesics, anti-inflammatory drugs, muscle relaxants, or vasoactive agents; systemic disease; history of facial trauma or TMJ surgery; head or neck radiation; and a diagnosis of osteoarthritis (IIIb) or osteoarthritis (IIIc) on the RDC/TMD.

Forty-seven volunteers were excluded following the application of the eligibility criteria: 37 did not have a diagnosis of IIIa on the RDC/TMD, 8 had a BMI over the established cutoff point, 1 was undergoing orthodontic treatment, and 1 was older than 40 years. Thus, the final sample was composed of 30 women, who were divided into 2 groups: control group, 15 volunteers without TMD, mean age of 20.73 ± 2.18 years, mean BMI of 21.30 ± 1.97 kg/m²; and arthralgia group, 15 volunteers with TMD (IIIa), mean age of 24.46 ± 5.69 years, mean BMI of 21.73 ± 1.91 kg/m².

As TMD can affect different structures of the stomatognathic system simultaneously (muscles, joint disk, and/or TMJ), volunteers with diagnoses concomitant to arthralgia were included, as performed in a study carried out by Manfredini et al.²³ Thus, among the 15 volunteers with arthralgia, 10 also had a diagnosis of myofascial pain (Ia), 5 had a diagnosis of myofascial pain with limited mouth opening (Ib), 2 had a diagnosis of joint displacement with reduction (IIa), and 1 had a diagnosis of joint displacement without reduction and without limited range of motion (IIc).

Infrared Thermography

For the examination, the volunteers remained in a room for 20 minutes with a controlled temperature (22°C ± 1°C) lit with fluorescent bulbs without the presence of heat-generating electrical equipment or the incidence of direct air or sunlight.¹⁹ The participants were instructed to avoid a hot bath or shower; the use of topical agents, creams, and

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