Clinical Practice Guideline: **Thermography**

Date of Implementation: **February 9, 2006**

Effective Date: **May 21, 2026**

Product: **Specialty**

GUIDELINES

The use of all forms of thermography is considered unproven and not medically necessary.

DESCRIPTION/BACKGROUND

Thermography is a diagnostic procedure that measures surface temperature in various parts of the body. Thermography is used in various fields of medicine to help identify temperature abnormalities. There are four major types of thermography: liquid crystal; magnetic resonance (MR); thermocouple; and infrared thermography.

Liquid crystal thermography involves the use of thermochromic liquid crystals that change their reflected color as a function of temperature. The simplest medical use of these is the forehead thermometer that is laid on the forehead to detect fever. They have also been used in the past to study skin diseases and lesions. This is an older technology which is no longer frequently used in medicine. Currently the most common use of liquid crystal thermography is in the electronics and technical arena.

Magnetic resonance thermography uses the same technology as other magnetic resonance imaging (MRI) but incorporates the variable of temperature into the evaluation. The benefit of MR thermography is that it is very sensitive and can detect very small temperature changes, which are necessary for some uses.

Thermocouples are temperature sensors that measure the change in voltage generated when any conductor is subjected to a thermal gradient (Seebeck effect). This voltage change is then transformed into a temperature reading. These devices are most commonly used in electronics and industrial contexts. In 1924, a chiropractor developed the neurocalometer – a handheld device with two thermocouples placed along the spine to measure temperature differences. The inventor theorized this device could detect chiropractic subluxations through temperature differentials. The current version of the neurocalometer is the Nervoscope, a tool currently used by some chiropractors. Proponents believe viewing a patient’s skin thermal patterns provides valuable information on the normal and abnormal functioning of the underlying neurophysiology.

Infrared thermography uses equipment sensitive only to infrared frequencies which convert the infrared radiation emitted from the skin surface into electrical impulses that may be visualized. The majority of these devices are large pieces of equipment, which need to be used in a special climate-controlled room under controlled conditions. This type may be used for certain conditions including complex regional pain syndromes, carpal tunnel syndrome, disc herniation, and radiculopathy. There are also handheld infrared tools for which there is no reliable evidence of accuracy.

EVIDENCE REVIEW

The literature review focused on the use of thermography for musculoskeletal and related disorders. As such MRI thermography, which is used primarily for non-neuromusculoskeletal (NMS) conditions, was not considered in this evaluation. No randomized clinical trials for thermography in the peer review literature were found. Most studies of thermography have been performed comparing it with other diagnostic tests, the most common being clinical exam, computed tomography (CT), electromyography (EMG) and myelography. The bulk of the evidence regarding thermography is from methodological studies which provide little insight into the actual performance or utility of the instruments under investigation.

Gulevich et al. (1997) found that infrared thermography was useful in the diagnosis of complex regional pain syndrome with a predictive validity of 90%. Herrick and Herrick (1987) and Ming et al. (2005) found that infrared thermography might be useful in diagnosing carpal tunnel syndrome and associated neuropathies. Ping and You (1993) and Zhang et al. (1999) found that infrared thermography may have utility as a diagnostic tool for patients with lumbar and cervical disc herniations respectively. Takahashi et al. (1994) concluded that thermography may be clinically useful in diagnosing radiculopathy based on the finding that the thermograms agreed with the findings of the clinical exam; however, they do not mention what type of thermography was utilized.

Leclaire et al. (1996) found that thermography was not a useful diagnostic tool for low back pain but do not mention the type of thermography used; in addition, their paper had significant methodological flaws. So et al. (1989) found that thermographic findings were of little diagnostic value in the evaluation of lumbosacral radiculopathy, but they do not mention what type of thermography was used.

Plaugher (1992) performed a systematic review of the literature on thermography for NMS abnormalities of the spine, evaluating many different types of thermography. Plaugher concluded that full scan (non-handheld) infrared thermography was a sensitive diagnostic procedure for detecting spinal abnormalities such as disc protrusion. The review found that the evidence for liquid crystal thermography is weak and inconclusive and as such should not be recommended. For thermocouple and other handheld devices, the review found that there was no evidence supporting the use of these tools.

A literature review and meta-analysis by Hoffman et al. (1991) to determine the role of thermography for diagnosing lumbar radiculopathy produced no clear-cut results. The role of thermography remains unclear. Rigorous clinical research is required to establish its diagnostic accuracy and clinical utility. Thermography cannot be recommended currently for routine clinical use in evaluating low-back pain.

DiBenedetto et al. (2002) reported that thermograms of injured feet show areas of increased heat, but excessive weight-bearing pressure on feet, new shoes, or boots also cause increased infrared emission even without discomfort. Differentiation remains difficult; thermography may detect early injury; however, it does not reveal exact diagnoses.

To evaluate the perceived status of thermography in the diagnosis of musculoskeletal disorders, Awerbuch (1991) used the following data sources: medical and legal journals published from 1956 onward; report of the United States Office of Health Technology Assessment and personal communication with the author of that report. The selection of studies was confined to the application of thermography to musculoskeletal and neurological medicine. Awerbuch concluded that little evidence exists of any application of thermography in which it is unequivocally superior to conventional diagnostic imaging methods.

Meeker and Gahlinger (1986) provide a review and summary of research and a comparison with myelography, computerized tomography, electromyography, and clinical and surgical findings in cases of presumed musculoskeletal pain syndromes. The importance of diagnostic sensitivity, specificity, positive and negative predictive value, and accuracy (validity) are discussed. In general, the literature reports high sensitivity and negative predictive value, but lower specificity and positive predictive value. They examine the implications of these findings in regard to clinical case management, with emphasis on potential usefulness to chiropractors. There remain a number of questions about the scientific validity of this research.

A systematic review by Triano et al. (2013) found that there was good evidence for the reliability of thermography in identifying lower limb sciatica. However, the review concluded that there was no good evidence to support the use of thermography to measure paraspinal temperatures for the purpose of localizing the site of care. Sanchis- Sánchez et al. (2014) completed a systematic review and meta-analysis on infrared thermal imaging in the diagnosis of musculoskeletal injuries. The authors concluded there is a lack of support for the usefulness of infrared thermal imaging in musculoskeletal injury diagnosis. Dibai-Filho and Guirro (2015) did a critical review of the literature on the evaluation of myofascial trigger points using infrared thermography. The authors concluded that currently, there are few studies evaluating the accuracy and reliability of infrared thermography for the diagnosis and assessment of myofascial trigger points.

Schiavon et al. (2021) aimed at assessing infrared thermography potential and limitations in these pathologies in a systematic review. Out of 718 articles that were reviewed, 32 met the inclusion criteria, encompassing a total of 2,094 patients. Nine studies reported the application to osteoarthritis, 21 to rheumatic diseases, 2 on both. The publication trend showed an increasing interest in the last decade. Seven studies investigated the correlation of temperature changes with osteoarthritis, 16 with rheumatic diseases, and 2 with both, whereas 2 focused on the pre-post evaluation to investigate treatment results in patients with osteoarthritis and 5 in patients with rheumatic diseases. A correlation was shown between thermal findings and disease presence and stage, as well as the clinical assessment of disease activity and response to treatment, supporting infrared thermography role in the study and management of rheumatic diseases and osteoarthritis. Authors concluded that this systematic review showed an increasing interest in thermography, with several applications in different joints affected by inflammatory and degenerative pathologies. Infrared thermography proved to be a simple, accurate, noninvasive, and radiation-free method, which could complement current screening, diagnosis, monitoring of disease progression, and response to medical treatment.

Albuquerque et al. (2021) evaluated the role of infrared thermography as a helpful outcome measure tool in subjects with back and neck syndromes in a systematic review. While 16 studies were in line with the aim of this review, only 7 precisely fulfilled the inclusion and exclusion criteria and were ultimately included in the review. Thermography seems to give an objective notion of change in inflammatory activity, which can corroborate the usefulness of treatment or the improvement/worsening of the patient's symptoms. The overall quality of research was uneven in the study design, endpoint measures, and sample characteristics. Authors concluded that the number of high-quality studies of the role of infrared thermography in patients with back and neck syndromes remains limited. More than a diagnostic tool, thermography can be an objective tool for monitoring the effectiveness of treatment by identifying deviations from a healthy state.

Park et al. (2021) investigated the thermographic findings of carpal tunnel syndrome (CTS). They enrolled 304 hands with electrodiagnostically identified CTS and 88 control hands. CTS hands were assigned to duration groups (D1, < 3 months; D2, 3–6 months; D3, 6–12 months; D4, ≥ 12 months) and severity groups (S1, very mild; S2, mild; S3, moderate; S4, severe). The temperature difference between the median and ulnar nerve territories (ΔM-U territories) decreased as CTS duration and severity increased. Significant differences in ΔM-U territories between the D1 and D3, D1 and D4, D2 and D4, and S1 and S4 groups were observed. Thermal anisometry increased as CTS duration and severity increased. Significant differences in thermal anisometry between the D1 and D4 as well as the D2 and D4 groups were noted. Thermal anisometry was higher in the S4 group than in the S1, S2, and S3 groups. As CTS progresses, skin temperature tends to decrease, and thermal variation tends to increase in the median nerve-innervated area. Thermographic findings reflect the physiological changes of the entrapped median nerve.

Dias de Lacerda et al. (2022) systematically reviewed the literature on the diagnosis of tendinopathy using infrared thermography (IT). Seven studies were included in the meta-analyses, which showed that IT has an overall sensitivity of 72% and specificity of 95%. IT showed adequate accuracy to detect tendon injuries, with high specificity in the evaluation of lateral epicondylitis and shoulder tendinopathy.

Liu et al. (2025) analyzed and summarized the application of infrared thermography (IRT) in clinical practice. A total of 51 articles were ultimately included in the study. The application of infrared thermography has been used in oncology, painful diseases, inflammation, rheumatism, and vascular-related diseases. Even though IRT is presently employed in a number of clinical scenarios, it has not been integrated into diagnostic guidelines as of yet. It also has not been acknowledged as a stand-alone medical technology. Also, utilization of IRT is in the initial stages of development for many situations. Other limitations include lack of standard protocols, influence of subject factors, lower precision and specificity for IRT to detect small or precisely located abnormalities, which may result in misdiagnosis. Authors conclude that despite the extensive utilization of infrared thermography in clinical settings, addressing its current limitations may optimize its benefits.

Podlasek et al. (2025) explored the clinical utility of thermography in diagnosing and monitoring stroke, with an emphasis on its clinical applications. A total of 20 studies were included after screening 277 records. Thermography emerged as a promising tool for stroke patients in both the acute and chronic phases. In the acute phase, it demonstrated potential in detecting early signs of carotid occlusive disease by identifying temperature differences in the forehead or neck regions. Additionally, thermography contributed to the differential diagnosis of Wallenberg syndrome. In the chronic phase, it exhibited clinical utility in monitoring rehabilitation progress. Authors concluded that thermography shows promise as a non-invasive tool for stroke assessment and monitoring. While preliminary studies suggest physiological relevance, its clinical utility remains investigational and requires further validation.

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