

# Guidelines For Neuromusculoskeletal Thermography

Practice Guidelines Committee of the American Academy of Thermology  
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## GENERAL STATEMENT

This guideline was prepared by members of the American Academy Of Thermology (AAT) as a guide to aid the neuro-muscular thermologist and other interested parties. It implies a consensus of those substantially concerned with its scope and provisions. The AAT guideline may be revised or withdrawn at any time. The procedures of the AAT require that action be taken to reaffirm, revise or withdraw this guideline no later than three years from the date of publication. Suggestions for improvement of this guideline are welcome and should be sent to the executive director of the American Academy of Thermology. No part of this guideline may be reproduced in any form, in an electronic retrieval system or otherwise, without the prior written permission of the publisher.

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## Extremity and Spine Infrared Thermographic Evaluation

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### Purpose:

Infrared thermography of the extremities and spine is performed to provide an overview of the location, extent and severity of vasomotor abnormality. The thermographic evaluation can be performed from the cranium to the base of the spine (inclusive of all segments) and torso to the extremities, extended to the fingers and toes.

### Common Indications

Some of the common indications for performance of extremity and spine infrared thermographic imaging include (1-10):

- Evaluation or follow-up of patients with known or suspected vasomotor instability.
- Assessment of patients with known Chronic Regional Pain Syndrome (CRPS) types I and II, Thoracic Outlet Syndrome, Vaso-motor Headache and Barre'-Leiou Syndrome.
- Pre-procedure assessment for planning of intervention.
- Follow-up to determine technical adequacy of surgical intervention, i.e., sympathetic block, sympathectomy and/or spinal cord stimulator placement.
- Follow-up to detect improvement, progression or spread of disease, which may reflect change in condition.
- Evaluation of vasospastic disorders, rheumatic inflammation and unexpected post operative or post fracture pain.
- Evaluation of trauma, shoulder hand syndrome or other disorders associated with autonomic dysfunction.
- Mapping of the extent of vasomotor instability to guide sympathetic response generator identification.
- Mapping of the location of vasomotor instability for impairment rating purposes.
- Confirmation of diagnostic inclusion criteria for clinical diagnostic purposes.

### Contraindications and Limitations

Contraindications for extremity and spinal infrared thermographic imaging include the following:

- Presence of casts, bandages or other technical factors that preclude the ability to expose skin to a temperature equilibration environment
- An uncooperative patient.

## Guideline 1: Patient Communication and Preparation

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- 1.1 The examining physician explains why the extremity and spinal Infrared Thermographic examination is being performed to the patient, taking care to ensure that the patient understands the necessity for each aspect of the evaluation.
- 1.2 Responds to questions and concerns about any aspect of the examination.
- 1.3 Advises the patient about risk factors and symptoms of vasomotor instability or C Fiber (sympathetic) pain, and the benefits of movement in the presence of sympathetic pain or vasomotor instability.
- 1.4 Refers specific diagnostic, treatment or prognosis questions to the patient's physician.
- 1.5 Patient should not have contact with any object if that body part is being imaged. Cotton garments may be worn to cover breast or genital areas when they are not under study.
- 1.6 Shower or bathe the morning of the test to ensure that the skin is as clean as possible; however, avoid hot water exposure to the skin for at least two hours prior to the test.
- 1.7 Avoid placing any material of any kind on the skin, such as any skin lotions, deodorants, preparations, moisturizers, liniments, topical analgesics, etc. Avoid make-up if the face is to be examined
- 1.8 Wear loose clothing to the test; avoid anything binding against the skin; avoid support undergarments or pantyhose. Do not wear jewelry, including rings if the hands are to be examined.
- 1.9 Avoid skeletal manipulation, acupuncture, physical therapy, the use of TNS units, or electrodiagnostic testing for 12 hours prior to the test. Exceptions should be noted in the record.
- 1.10 Whenever possible steroids, sympathetic blockers, vasoactive medications, opiates and transdermal patches should be avoided for 24 hours prior to testing (8-16 hours minimum). Exceptions should always be recorded in the record.
- 1.11 When Stress examinations are being performed, medications that are not medically necessary and that alter sympathetic function should be avoided for at least 24 hours prior to testing.
- 1.12 In the absence of extenuating circumstances, for original diagnostic studies sympathetic and neurolytic blocks should be avoided for 3 days prior to testing (5,11,12,13)

## Guideline 2: Patient Assessment

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Patient assessment should be performed before infrared thermographic imaging. This includes assessment of the patient's ability to tolerate the procedure and an evaluation of any contra-indications to the procedure (4,14).

- 2.1 Obtain a complete, pertinent history by interview and/or review of the patient's medical record.  
A pertinent history includes:
  - a. Current medical status, especially regarding pain and vasomotor instability.
  - b. Presence of any signs or symptoms of allodynia or hyperalgesia in association with sudomotor, vasomotor or other autonomic dysfunction.
  - c. Relevant risk factors for vasomotor instability: prior history of RSD or CRPS, trauma, fracture, repetitive use, vibration syndrome, peripheral neuropathy, spinal pathology, radiculopathy, vasomotor headache, rheumatic illness, cardiovascular disease, hypertension, diabetes, peripheral vascular disease, coagulopathy, birth control pill use, hypothyroidism or infection.
  - d. Pathology/Laboratory investigation values.
  - e. Current medication or therapies
  - f. Results of other thermographic or vascular studies
  - g. Results of prior autonomic, sympathetic or vascular interventions
- 2.2 Complete a limited, focused, detailed or extensive physical examination, which includes assessment of all structures under study. Trophic changes, vasomotor or sudomotor changes and possible pain generators should be documented.

## Guideline 3: Examination Guidelines

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- 3.1 Infrared thermography both measures and maps the degree and distribution of skin temperature changes. Skin temperature is largely under the control of the autonomic nervous system and bilateral symmetry is expected through out

the body. Asymmetric patterns of 1 degree centigrade or greater (that are not due to local traumatic, inflammatory or vascular disease) occur when sympathetic pathology exists.

Thermography is not a test of structure, but rather physiology and therefore when structural injury is suspected other radiographic imaging or diagnostic studies should be performed. This is important as treating other previously undiagnosed conditions can often result in resolution of symptoms.

Due to the complex nature and etiology of painful conditions associated with skin temperature asymmetry patterns, only those doctors trained in the proper techniques required to perform and interpret thermographic studies should do so. When present, the pattern of asymmetry discovered by infrared thermographic examination should guide the treating physician in determining the source or generator of the abnormality. Both response to treatment and additional testing may still be required to complete this task (15-19).

3.2 All studies should utilize infrared technology with sensitivity of at least 0.1 degree centigrade (100 units nominal expansion thermal drift; NETD) and a minimum of 100 micro-radians spatial resolution.

3.3 All studies should be performed in a laboratory where ambient temperature is controlled, free from drafts and where there is no exposure to ultraviolet rays that may result in heating. The imaging room should be comfortably cool to allow for pull-off of superficial heat from the skin (20-25 degrees centigrade is commonly used). Unless a stress exam is intentionally being done no extraneous thermal stresses should exist.

3.4 Ventilation systems should be designed to avoid direct airflow onto the patient. Carpeted flooring is preferred. Exposing the patient's feet may assist with equilibration, even with upper extremity examinations. Standard fluorescent lights are appropriate.

3.5 While a single set of images can be adequate in cases where obvious thermal asymmetry exists, repetition at specified time intervals (usually fifteen minutes, but not to exceed twenty minutes) allows for assessment of reproducibility and progressive change with increased exposure to the ambient temperature. No equilibration period is required for post block or stress test examinations.

3.6 A standard exam protocol for each segment evaluated should be used. This will frequently require multiple infrared thermographic windows with different points of focus (arm, forearm, wrist, hand, thigh, leg, foot, cervical, thoracic and lumbosacral spine). Each point of focus should include anterior, posterior, medial, lateral or oblique views. Contralateral and AP views should be equidistant and fill the image screen.

3.7 The patient's physical and mental status is assessed and monitored during the examination, with modifications made to the procedure plan according to changes in the patient's clinical status during the procedure. Also, findings are analyzed throughout the course of the examination to assure that sufficient data is provided to the physician to direct patient management and render a final diagnosis.

3.8 Appropriate infrared thermographic instrumentation, which includes real time display, electronic static image capture, storage, post capture annotation or hard copy documentation capabilities.

3.9 Evaluate the patient's physical and mental status prior to discharge (20-25).

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#### Guideline 4: Review of The Infrared Thermography Examination

4.1 The data acquired during the extremity and spinal infrared thermographic examination should be reviewed to ensure that a complete and comprehensive evaluation has been performed and documented. Any exceptions to the routine examination protocol (i.e., study omissions or revisions) should be noted and reasons given.

4.3 Record all technical findings required to complete the final interpretation so that the measurements can be classified according to the laboratory diagnostic criteria (these criteria may be based on either published or internally generated data, but must be internally validated regardless of the source). (see Appendix)

4.4 Complete required laboratory documentation of the study.

4.5 Alert medical director or other responsible physician when immediate medical attention is indicated, based on the infrared thermographic examination findings.

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#### Guideline 5: Presentation Of Exam Findings

5.1 Provide preliminary results as provided for by internal policy based on examination findings.

5.2 Present the record of diagnostic images and when applicable, explanations for sub-optimal examination findings to the interpreting physician for use in diagnosis and archival purposes.

- 5.3 Alert laboratory medical director or appropriate health care provider when immediate medical attention is indicated.

### Guideline 6: Exam Time Recommendations

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High quality and accurate results are fundamental elements of the infrared thermographic examination. A combination of direct and indirect exam components is the foundation for maximizing exam quality and accuracy.

- 6.1 Indirect exam components include pre-exam procedures:
- a) obtaining previous exam data, completing pre-exam paperwork,
  - b) exam room and equipment preparation and
  - c) patient assessment, history, and positioning (Guideline 1 & 2).
- 6.2 Post exam procedures include:
- a) clean up consisting of compiling, processing, and reviewing data for preliminary and/or formal interpretation (Guidelines 3 and 4),
  - b) patient communication (Guideline 2),
  - c) examination charge and billing activities where appropriate. Recommended time: 30-40 minutes.
- 6.3 Direct exam components include equipment optimization, patient positioning throughout the exam, and the actual hands-on examination process. (Guideline 3) Recommended time: 60 minutes.

### Guideline 7: Continuing Professional Education

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Certification is considered the standard of practice for infrared thermographic technology. It indicates an individual's competence to perform medical thermographic technology at the entry level. After achieving certification, all Registered Infrared Thermographic Technologists are expected to keep current with:

- 7.1 Advances in diagnosis and treatment of sympathetic pain syndromes with and without vasomotor instability.
- 7.2 Changes in infrared thermographic examination protocols or published laboratory diagnostic criteria.
- 7.3 Advances in thermographic technology used for the extremity and spine examinations.
- 7.4 Advances in other technology used for extremity and spinal thermographic examination.

### Needs Assessment

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Pre-existing vasomotor tone and vasomotor capacitance plays a significant role in thermoregulation, clinical symptomatology and manifestations of systemic illness.

Thermography is the only non-invasive technology available to image and map microcirculatory arterial-venous shunting (vasomotor instability) associated with these disorders. It can play an important role in clinical diagnosis and in distinguishing between central and peripheral etiologies of thermal change. Medical Thermography can also be used to document drug induced symptoms and paradoxical responses to blocks (8,15,21,25).

Other technologies like PET scan, MRI, Spectroscopy, Electrodiagnostics or EEG do not provide the same information offered by Medical Thermal imaging (17). The clinical application of Thermography can help physicians both understand the patho-physiology associated with these changes and improve patient outcomes (6,24,26,27).

The mission and bylaws of the American Academy of Thermology support the incorporation of thermal imaging into clinical medicine. The AAT recognizes a current and ongoing need to promulgate CME in the science and methods of thermal imaging and the clinical application of heat asymmetry patterns obtained from thermal imaging among both physicians and thermal technologists.

### Appendix

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It is recommended that published or internally generated diagnostic criteria should be validated for each thermography system used. When validating infrared thermographic diagnostic criteria, it is important to realize that equipment, operator and interpretation variability is inherent to this process.

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