# Guidelines For Dental-Oral And Systemic Health Infrared Thermography

**General Statement:**

This guideline was prepared by members of the American Academy Of Thermology (AAT) as a guide to aid the performance of Dental-Oral and Systemic Health infrared imaging in evaluating patients with Dental-Oral and Systemic Health related complaints. 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 The AAT guideline may be revised or withdrawn at any time.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. 

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## Statement of Need

Thermography is a non-invasive technology available to image and map microcirculatory shunting associated with circulatory changes in the skin. It can play an important adjunctive role in assessing Dental-Oral and certain Systemic Health related illnesses and diseases, and confirming clinical diagnosis. When performed and interpreted within the scope of this Guideline, Dental/Systemic Health Thermography can also play a useful role in monitoring treatment effects of dental-oral and specified systemic health conditions.

Other structural imaging technologies such as X-Ray, Ultrasound, CT, and MRI do not provide the physiologic information offered by Dental/Systemic Health Thermal Imaging. The clinical application of Thermography can help physicians both understand pathophysiology and improve patient outcomes.

The American Academy of Thermology supports incorporating infrared thermal imaging into clinical medicine and its specific utility in monitoring dental-oral and applicable systemic health conditions. The AAT recognizes a current and ongoing need to promulgate continuing dental/systemic health education in the science and methods of thermal imaging and the practical clinical application of variant heat patterns obtained from thermal imaging.

**Purpose:**

Medical Infrared imaging (thermography) is a physiologic study that can provide an accurate and reproducible high-resolution image of skin temperature. This image can be analyzed both qualitatively for thermovascular mapping and quantitatively for minute changes in skin heat emission. As with most physiologic studies, anatomic findings may not correlate and may not even be present.

The Guidelines contained herein will focus solely upon infrared imaging for Dental – Oral and Systemic Health studies.

**Common Indications:**
Some of the common indications for performance of Dental-Oral and Systemic Health studies include:

- Evaluation or follow-up of patients with known or suspected temporal mandibular joint (TMJ) disease and/or dysfunction and other occlusive disorders.

- Evaluation or follow-up of patients with known or suspected oral-facial pain and myofascial conditions of the head and neck.

- Evaluation or follow-up of Inflammatory and infectious conditions related to the teeth, gingiva, and mouth.

- Evaluation or follow-up of physiologic changes associated with caries and decay.

- Detection and follow-up of maxillary or mandibular nerve damage.

- Assessment of those systemic or organ-specific disorders, or otherwise unclassified indications, that have generally accepted skin surface thermal findings or signatures include:

    - cerebral vascular disease in the distribution of the ophthalmic artery
    - Orbital inflammation
    - Glaucoma
    - thyroid disease
    - hepatic overload or portal congestion
    - gastroesophageal reflux
    - abdominal skin temperature and necrotizing enterocolitis
    - peripheral arterial disease
    - superficial venous disorders
    - venous malformation

    - hemangioma regression documentation
    - inflammatory and obstructive lymphatic disorders
    - pressure ulcers
    - arterial perforator and vascularization assessment
    - reperfusion of post-surgical defects
    - monitoring of ductus arteriosus closure in newborns
    - alterations in central and peripheral temperature differential as an indicator for abnormal clinical states
    - brown adipose tissue (BAT) metabolism reduction in the presence of obesity, hypothyroidism, or diabetes
    - finger temperature rebound assessment for coronary artery disease risk
    - varicocele
    - dermatologic and immunologic conditions, including superficial skin vascular responses to allergy testing
    - psychological manifestations that may impact skin surface temperature
    - community health fever screening
    - forensic evaluations

- Pre-procedure assessment for the planning of interventional therapeutics.

- Follow-up to determine the technical result of medical or surgical interventions, such as corrective dental measures, anesthetic injection, vascularization, environmental and liver detoxification, restoration of neuro-endocrine-immune imbalance, and emotional restructuring.

- Follow-up to detect improvement, progression, or spread of disease.

- Mapping of vasomotor instability.

- Mapping of the location of thermologic abnormalities for impairment rating purposes.

- Confirmation of diagnostic inclusion criteria for clinical diagnostic purposes.

- Confirmation of diagnostic inclusion criteria for research purposes.

**Contraindications and Limitations:**

Contraindications Dental/Systemic Health Thermal Imaging include:

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

- The presence of a beard or long hair can disturb the facial examination. The interpreting physician must take into account facial hair or skin irritations that may interfere with thermal evaluation of the region of interest.

- An uncooperative patient (if performing static images or when video processing cannot overcome the limitation).

**Guideline 1: Patient Communication and Preparation:**

Communication:

1.1 The laboratory's medical director should ensure that the patient is explained the necessity for performing Dental-Oral and Systemic Health Infrared Dental/Systemic Health Imaging and the associated procedure.

1.2 The laboratory's medical director should ensure that any patient questions and concerns about any aspect of the examination are addressed..

1.3 The laboratory's medical director should ensure that the patient is advised about risk factors and symptoms of vasomotor instability and associated pathophysiology and obtain informed consent either written or orally from the patient to proceed with Dental-Oral and Systemic Health Infrared Dental/Systemic Health Imaging.

1.4 The laboratory's medical director should ensure that specific diagnostic, treatment, or prognosis questions are referred to the patient's physician.

Preparation (exceptions should be noted in the record):

1.5 Patient should not have contact with any object if that body part is being imaged. Eyeware, clothing or garments should be not worn over any region under study.

1.6 The patient should shower or bathe the morning of the test to ensure that the skin is clean, however the patient should avoid hot water exposure to the skin and the use of a hair dryer for at least two hours prior to the test.

1.7 The patient should avoid using skin lotions, sunscreens, deodorants, preparations, moisturizers, liniments, makeup, hair spray, hair cream, topical analgesics, etc. the day of the exam.

1.8 The patient should discontinue Nicotine and caffeine products 4 hours prior to imaging. For evaluations of the face and neck, mouthwashes and breath mints should be discontinued 2 hours prior to imaging.

1.9 For intraoral assessments, the patient should remove dentures or other devices that may preclude direct visualization of the buccal cavity, and avoid drinking liquids other than room temperature water, for 1 hour prior to imaging.

1.10 The patient should wear loose clothing to the test and avoid anything binding against the skin, including support undergarments or pantyhose. They should not wear jewelry, preferably including rings if the hands are to be examined (exceptions are made for rings that cannot be removed or jewelry that the patient chooses not to remove for personal reasons). Hearing aids or eyeglasses should not be worn during facial examinations.

1.11 To the extent possible, discontinue the use of appliances such as braces, neoprene wraps, Ace bandages, hair bands, etc., on the day of testing.

1.12 When the regions of interest include the face or hands, prolonged contact with a cell phone should be avoided by the patient for at least 2 hours prior to testing.

1.13 When the region of interest includes the face, the patient should avoid chewing for at least 2 hours prior to the test.

1.14 The patient should avoid massage, skeletal manipulation, acupuncture, restorative therapy, dry needling, moxibustion, saunas, extended sun exposure, TENS or electric muscle stimulation, laser therapy, or ozone therapy 24 hours prior to imaging. Electrodiagnostic testing should be avoided for 24 hours prior to imaging.

1.15 Whenever possible, steroids, sympathetic blockers, vasoactive medications, opiates nd transdermal patches should be avoided for 24 hours prior to testing (12-16 hours minimum). Exceptions should be recorded in the record.

1.16 When Cold 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.

1.17 In the absence of extenuating circumstances, for original diagnostic studies sympathetic and neurolytic blocks should be avoided for 3 days prior to testing.

1.18 Peripheral nerve implants and spinal cord/dorsal column stimulators should be turned off 4 hours prior to testing.

**Guideline 2: Patient Assessment**

Patient assessment should be performed before Dental-Oral and Systemic Health Infrared Imaging. This includes assessing the patient's ability to tolerate the procedure and an evaluation of any contra-indications to the procedure.

2.1 Obtain a complete, pertinent history by interview and/or review of the patient's dental/medical record. A pertinent history includes:

a. Current dental/medical status, including dental history when applicable, pain, and vasomotor instability.

b. Presence of any signs or symptoms of inflammation, allodynia, or hyperalgesia in association with sudomotor, vasomotor, or other autonomic dysfunction. A symptom diagram should be completed (i.e.:pain, numbness, tingling, etc.).
c. Relevant risk factors for inflammation or vasomotor instability: prior history of odontalgia, recent surgery, RSD or CRPS, trauma, fracture, repetitive use, vibration syndrome, peripheral neuropathy, spinal pathology, radiculopathy, vasomotor headache, rheumatic or autoimmune 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 recent therapies.
f. Results of other imaging, thermographic or vascular studies.
g. Results of prior dental, systemic health related, autonomic, sympathetic, or vascular interventions.
h. Results of other relevant anatomic or physiologic studies (such as X-ray, CT, MRI, Diagnostic Ultrasound, and electromyography).

2.2 Complete a limited, focused, detailed, or extensive physical examination, which includes an assessment of the structures under study. Dental-Oral, organ-specific, or system-related regions of interest. Erythema, trophic changes, vasomotor or sudomotor changes, neurological symptoms, and possible pain generators should be documented.

**Guideline 3: Examination Guidelines**

3.1 Dental-Oral and Systemic Health Infrared Imaging measures and maps the degree and distribution of IR thermal emission. When studies are performed ,according to guidelines, asymmetric or localized IR emission variations of 1°C or greater may indicate pathology in a properly cooled subject.

Dental-Oral and Systemic Health Infrared Imaging does not test structure but rather correlate alterations in physiology. Therefore, additional radiographic imaging, or diagnostic studies may be indicated to better define the diagnosis when a structural injury is suspected.

Due to the complex nature and etiology of conditions associated with skin temperature asymmetry patterns, specialized training in the proper techniques to perform and interpret Infrared imaging is required. When present, the pattern of asymmetry or localized variance should guide the treating physician in determining the source or generator of the abnormality. Both responses to treatment and additional testing may be required to complete this task. Oral –Systemic Studies are not Health Risk Assessments. They are properly represented to be Thermographic evaluations.

3.2 The following minimum specifications should guide the selection and use of infrared hardware and software systems. These specifications apply to modern infrared imagers.

They are not intended to reflect on systems used in the past. While recognizing that individual circumstances will vary, for the purposes of this document, the typical imager Field of View (FOV) is 25 degrees, patient to imager distance 3-8 feet (as needed to allow the region of interest to fill approximately 75% of the image) and optical quality is satisfactory to the vast majority of observers.

Emissivity is a fractional representation of the amount of energy radiated from a material versus the energy that would come from a true black body at the same temperature. Passive IR imaging (thermology) measures and maps the pattern of skin thermal radiance (the degree and distribution of skin temperature changes). If needed for the examination being performed, medical grade imagers should be calibrated against two black bodies having emissivity of 0.98, and spanning the physiologic temperature range.

Imager emissivity set to 0.98 (human skin). The emissivity is a fractional representation of the amount of energy radiated from a material versus the energy that would come from a black body at the same temperature.

- Imager detector spectral bandwidth: typically, 8 to 14 microns (micrometers).
- Preferred absolute detector resolution of $\geq$ 640 X 480 coupled with a suitable microbolometer and lens. Today, most medical imaging systems utilize uncooled focal plane array detectors found in the 320 X 240 sensor range or higher. When systems with 320 X 240 sensor arrays are coupled with a high-quality microbolometer, lens, and compensatory software or firmware innovations, they can approach the image quality, spatial resolution, and spot measurement requirements found in 640 X 480 systems.
- Min. measurable spot size is 2.1x2.0 mm (3x3 or 9 pixels) at 40 cm distance.
- Spatial resolution quality at 8 feet (2.4 meters) equivalent to $\leq$ 2.6 mRad IFOV (Instantaneous Field of View) at 40 cm minimum focus.
- Thermal sensitivity of $\leq$ 50 mK NETD (Noise Equivalent Temperature Difference) @ 30 $^0$C.
- Ability to perform accurate quantitative differential temperature analysis with a precision of $\leq \pm$ 0.05 $^0$C (50mK).
- Repeatability and precision of $\leq \pm$0.05 $^0$C (50mK) detection of temperature difference.
- Thermal drift (caused by internal heating of equipment during normal operation or by changes in external ambient temperature) to be strictly controlled by calibration to a known temperature standard if necessary for the study under consideration.
- Maintenance of detector uniformity and correction via calibration to a known temperature standard.
- Ability to render images in hi-resolution color and grayscale.
- High-resolution image visual display for interpretation.

- If video mode is used, it may incorporate real-time image focus and capture capability. While 10Hz, 20Hz, and 30Hz frame rates are capable of real-time imaging, having faster capability is preferred (i.e., 50Hz). For temperature analysis, radiometric video files are preferred.
- Precision Autofocus is recommended.
- Imager temperature range set to cover temperatures within the range of human emissions (20-45 $^{0}$C).
- Ability to archive images for future reference and image comparison at the same patient positioning and distance from the imager.
- Software manipulation of the images should be maintained within strict parameters to ensure that the original qualities of the images are not compromised.
- Imaging software capable of identifying areas of temperature calculations and locations for reporting

Appropriate infrared instrumentation, including real-time display, electronic static image capture, storage, post-capture annotation, or hard copy documentation capabilities, should be utilized.

3.3 All studies should be performed in a laboratory where the ambient temperature is controlled, free from drafts, and there are no sources of infrared rays (such as sunlight or incandescent lights) that may result in heating. The imaging room should be comfortably cool to allow for pull-off of superficial heat, which may produce artifact from the skin used. The IR imaging suite should maintain a steady-state 20° to 25° (± 1°C) throughout testing. 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. The patient's feet should be insulated from a cold floor by carpeting or a foam mat. Exposing the patient's feet may assist with equilibration, even with upper extremity examinations. Standard fluorescent or LED lights are appropriate.

3.5 Since reproducibility of images obtained is important, most studies should consist of more than one set of images taken under the same conditions. Infrared studies should be performed in a steady-state 20° C (± 1°C) environment and the patient should be allowed to equilibrate for 15-20 minutes prior to imaging. If Infrared studies are performed in an environment where the ambient image suite temperature is greater than 21° C, or if the thermologist desires to assess either sympathetic skin response or reproducibility and progressive change with increased exposure to the ambient temperature, then repeating the study two times at fifteen-minute intervals should be performed.

3.6 A standard exam protocol for each region of interest should be used. This will frequently require multiple infrared images (including differing views) with different points of focus **(example templates are available for Members in the Knowledge Center within the AAT Member Portal).**

A typical set of images should include anterior, posterior, medial, lateral, and inferior views for the head and neck. When the region of interest includes the torso,oblique views should be included. Depending upon the body part being studied, lateral views may be omitted (for example, oblique views have greater utility than lateral views in thyroid studies, and neither may have relevance in intra-buccal studies).

Oral-facial studies should preferably not be confined to the head and neck only. An example Oral-Facial protocol might include the following views (at a distance of 2.5-4.0 feet): 1- frontal face (anterior), 2- lateral face (both sides), 3- eyes open close up (anterior), 4- frontal face and neck (anterior), 5- lateral face and neck (both sides), 6- posterior head and neck (only if the patient does not have hair in the head region), 7- neck close up (anterior), 8- neck close up (posterior), 9- oblique face (both sides), 10- oblique neck (both sides), 11-oblique submandibular (both sides) and 12- intra-buccal.

Contralateral and AP views should be equidistant and fill about 75 per cent of the image screen. It is recommended that the contralateral images be captured with the same image orientation. Additional images may be required for patients with specific, unique circumstances.

The technician should note and mark any skin lesions/blemishes (pimples, bug bites, skin cancer removal sites etc.) for later interpretation of the thermographic images. If necessary, a traditional visual digital image should accompany the thermographic image to aid the interpretation.

Whole Body studies done with the purpose of imaging the entire surface of the skin with minimal views that do not provide evidence of reproducibility, or that do not follow the breadth and scope of this guidelineare not supported by this Guideline.

3.7 While Dental-Oral studies have employed stepped palettes of no less than ten steps typically formatted at 1°C per step, many laboratories now use a full-spectrum graded color palette. Organ specific and Systemic Health studies may employ graded color, grey scale or reverse grey scale palettes during study acquisition. Further, in order to aid maximum detection of thermal values by the human eye, palette span can be adjusted in this instance to just cover the temperatures found over the region of interest (Full-Span technique). *Isothermal* spans (images having identical span ranges) can be provided during interpretation processing, facilitating thermal symmetry evaluation.

3.8 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. Also, findings are analyzed throughout the examination to assure that sufficient data is provided to the physician to direct patient management and render a thermograhic impression.

3.9 Evaluate the patient’s physical and mental status prior to discharge. Additional discharge instructions may include a recommendation to schedule a follow-up

appointment with the attending physician and resume all medication or dental/medical treatment that may have been discontinued prior to the Dental/Systemic Health infrared study.

**Guideline 4: Review of the Infrared Thermography Examination**

4.1 The data acquired during Dental/Systemic health medical infrared 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 with the reasons given.

4.2 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). It is recommended that published or internally generated diagnostic criteria be validated. When validating dental/systemic health infrared diagnostic criteria, it is essential to realize that equipment, operator and interpretation variability are inherent in this process.

4.3 Complete required laboratory documentation of the study.

4.4 Alert Dental/Medical Director or another responsible physician when immediate dental/medical attention is indicated, based on the infrared examination findings.

**Guideline 5: Presentation of Exam Findings**

5.1 Provide preliminary results as provided 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 Dental/Medical Director or appropriate health care provider when immediate dental/medical attention is indicated.

**Guideline 6: Preparation and Storage of Exam Findings**

6.1 Images should be presented to the interpreting physician for use in analysis and archival purposes. Radiometric images in either radiometric image format or non-radiometric formats such as lossless JPEG, PNG, or DICOM are acceptable. A color-to-temperature Thermal Scale must accompany each image.

6.2 The imaging clinic should adhere to all established federal and state regulations. Archiving of image data and the analysis/report are to be maintained for no less than seven years.

**Guideline 7: Exam Time Recommendations**

High quality and accurate results are fundamental elements of the Infrared Dental-Oral/Systemic study. A combination of direct and indirect exam components is the foundation for maximizing exam quality and accuracy. Recommended time: 30-60 minutes.

7.1 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).

7.2 Post exam procedures include:

a) initial report preparation 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.

7.3 Direct exam components include equipment optimization, patient positioning throughout the exam, and the actual hands-on examination process. (Guideline 3).

**Guideline 8: Reporting**

8.1 A Medical Director's report should be prepared within 24 hours of the study. As part of their protocol, imaging facilities should consider sending each patient a summary report within 15 days of the thermographic examination.

8.2 Report layout: The body of the Infrared Dental/Oral–Systemic Health Thermographic report should clearly state that laboratory procedures that follow a peer-reviewed, internationally accepted Guideline were utilized. The set of images obtained for the study should be documented. If a standard protocol for reading images is used, then this should be stated as well.

8.3 Thermographic Findings should be documented, and any abnormalities noted. Thermographic Impressions include classification according to an accepted naming system or summarization of the Thermographic Findings. When recognized, patterns (thermal signatures) are seen due to the clustering of findings. Thermographic Impressions may include the description of that pattern (for example, a sympathetic skin

response asymmetry pattern is seen in the distribution of a branch of the trigeminal nerve or hyperthermia over the maxillary sinus). However, care should be taken not to make any statements about clinical diagnosis in this section of the report.

8.4 Clinical Impressions are not to be included in the Thermographic Findings paragraph but rather in a separately identifiable paragraph that speaks to the generator or etiology of those findings. Any clinically relevant discussion should be reserved for this paragraph.

8.5 Dental/Oral findings should be reported as asymmetric skin response when done as a cold stress sympathetic skin response study. With the exception of intra-oral evaluations, highly significant findings include asymmetry of $\geq$ 1 degree Centigrade in $\geq$ 25% of the surface area of any individual region or constellation of regions and isolated localized hot or cold spots over specific anatomical areas. For intra-oral evaluations, asymmetry of $\geq$ 0.6 °C may be considered to be significant at a moderate level. Intra-oral temperature measurements must be timed to the respiratory cycle, imaged during breath holding, or averaged over many respirations as the oral mucosa is cooler on inspiration and warmer during expiration.

8.6 Systemic Health-related findings that should be read are protocol dependent. The following list includes established thermal signatures that correlate with Systemic Health conditions.

- Cerebral vascular disease: reduced skin temperature (>2$^{o}$C) or thermal asymmetry in the forehead supplied by branches of the ophthalmic artery or in the vascular distribution of the orbital interior angle and medial superciliary areas of the eye. This specifically does not include the carotid artery.
- Orbital Inflamation: Conjunctivitis causes diffuse warmth of the eye and lids. Hordeolum (stye) creates marked warmth in the effected lid.
- Glaucoma: Occult glaucoma should be suspected if one cornea is cooler than contralateral. Caution: unilateral contact lens wear can mimic this finding.
- Thyroid disease: hot or cold spots over the thyroid gland; lobe thermal asymmetry; thyroid thermal gradient ($\geq$1$^{o}$C) vs. surrounding tissue. In the case of Graves Disease: serial study analysis to monitor treatment response (decreasing medial canthus temperature expected).
- Hepatic overload and portal congestion: diffuse “forked tongue” perforators on grey scale or diffuse spray brush dots on grey scale.
- Necrotizing Enterocolitis: presence of mean chest and abdominal wall temperature differentials (mean abdominal wall temperature falls).
- Gastroesophageal Reflux: hypothermia in the anterior chest wall from acid challenge to the esophagus.
- Peripheral arterial disease: thermal gradient line consistent with the peripheral artery (usually coldness) may be seen in a vasotomal or distal distribution. Exercise challenge testing can enhance findings.

- Superficial venous disorders: tortuosity; increased skin temperature (2-$4^0$C). Examination must be performed with the patient in the upright position.
- Venous Malformation: skin temperature may be hot or cold depending upon the degree of arterial shunting and or venous reflux.
- Inflammatory and obstructive lymphatic disorders: hot spots over inflamed lymph nodes, hyperthermia over lymphatic chains, or a characteristic "glow area"over areas with lymphatic edema.
- Pressure ulcers: localized hyperthermia for those not yet visible (as staging progresses, findings change).
- Arterial perforator and vascularization assessment: vessel visualization on color or grey scale, at rest and under cold stress to assess for greatest thermal capacity; maintenance of perfusion post graft; assessment of hypothermia in failing grafts and of hyperthermia in fistulas.
- Patent Ductus Arteriosus: reversal of cooler core then peripheral temperature upon closure (based upon case report findings only).
- Brown Adipose Tissue: reduced activation after cold stress
- Reduced finger temperature rebound after systolic BP occlusion in the presence of coronary artery disease
- Varicocele: increased temperature in a hemiscrotum.
- Dermatologic and immunologic conditions: hyperthermia over sites of infection, trauma, immune response (allergy), insect bites, radiation, burns, or frostbite; thermal aberrations (primarily hyperthermia) that may be present with various skin cancers, psoriatic disorders, and vasculititis; hypothermic spots with leprosy. Superficial skin vascular responses to environmental impacts such as mold or other allergens: hypervascularity with or without closed loops on grey scale or hyperthermia on the color palette have been reported.
- Psychological manifestations that may impact skin surface temperature include hyperventilation, anxiety, panic, depression, and drug addiction: systemic hypothermia with slow recovery to following rewarming; acute (stage fright, lie detector testing, etc.) and chronic stress-related conditions: extremity vasoconstriction or torso patchy hyperthermia on grey scale (as might be induced by a peripheral nitrous oxide or vaso-vagal manifestations such as blushing or perspiration).
- Community health fever screening: mean ear temperature >37.7 $^o$C, or medial canthus temperature readings > 38 $^o$C. A black-body temperature standard to frequently calibrate the thermal imager or other methods to calibrate the absolute detected temperature, are essential for fever detection due to the inherent drift of standard thermal imagers and environmental changes over time. Since numerous factors can impact temperature detection for fever screening, AAT online temperature detection for fever detection course recommendations should be followed.
- Forensic Evaluations: fingerprint detection after applying steam to blood-stained cloth, domestic violence applications including contusion, trauma detection, and strangulation.

8.7 Findings not yet sufficiently recognized due to lack of consensus or as a result of having no basis in the medical literature include those related to visceral disease not already specified, paraspinal changes for immune system disease, external carotid findings for cerebral vascular or carotid artery disease, non-vascular cardiac disease (such a mitral valve disease), metabolic diseases such as diabetes, and laboratory abnormalities. Any reference to medical conditions on a thermal image that may be misleading or construed as having been diagnosed as a result of a shown thermal signature should be avoided.

If the interpreting thermologist feels that a finding may have relevance, and at the same time construes that it may fall within the scope of section 8.7, then he/she may report the finding as long as the following verbiage is included in the report. 1) it is clearly stated in the description of the finding that it is being correlated to viscera for localization and positioning purposes only, and 2) it is clearly stated that thermal imaging for this application has not been substantiated and can only serve in an adjunctive capacity.

**Guideline 9: Continuing Professional Education**

Certification is considered the standard of practice for Infrared Dental/Systemic Health technology. It indicates an individual's competence to perform Dental/Systemic Health studies at the entry level. After achieving certification, all registered infrared technologists are expected to keep current with:

9.1 Advances in diagnosis and treatment of Dental-Oral and Systemic disorders as defined in this guideline or that may have relevance to conditions under study.

9.2 Changes in infrared Dental-Oral and Systemic examination protocols or published laboratory diagnostic criteria.

9.3 Advances in infrared Dental-Oral and Systemic technology used for related examinations.

9.4 Advances in other technology used for Dental-Oral and Systemic infrared examination.

**Guideline 10: Emerging Technologies**

10.1 Technology is constantly being introduced that at times can challenge existing guidelines or that do not necessarily conform to currently accepted practices. These technologies can span the entire spectrum of sophistication and therefore require different adaptive responses. On one end of the spectrum, there are innovations based upon a generally accepted medical, scientific methodology that shas gained regulatory acceptance, and on the other end, there are technologies that are intended for personal use

only or that have applications in non-medical fields but have not been accepted as suitable for medical practice.

10.2 General industrial or personal use thermal imaging detectors that do not meet the specification guidelines contained herein are not intended for use in Medical Thermology. “Add-on” thermal imagers that plug into a cellular phone are, at present, not adequate for medical thermology imaging.

10.3

Point of Care Thermography (POCT) and associated software, are rapidly evolving as an essential clinical modality in many clinical settings. However, any equipment used must have appropriately obtained and continually maintain FDA Class I Medical Device status**.**

10.3 Technologies not otherwise covered in these Guidelines that employ methodologies, hardware, or protocols that have gained Federal Regulatory listing for Medical Thermology may become available over time. In cases where these technologies are employed the body of the report should document which device(s) were used and why. Other components of the Guideline should still be followed.

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