

GUIDELINES FOR DENTAL-ORAL AND SYSTEMIC HEALTH INFRARED THERMOGRAPHY - 2019 EDITION

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Resumo: Esta diretriz foi preparada por membros da Academia Americana de Termologia (AAT) e Associação Brasileira de Termologia (ABRATERM) como um guia para auxiliar a realização de imagens infravermelhas na avaliação de pacientes com queixas relacionadas à saúde bucal e sistêmica. Implica um consenso dos que estão substancialmente preocupados com o seu âmbito e disposições legais. A diretriz AAT/ABRATERM pode ser revisada e modificada a qualquer momento. Os procedimentos da AAT/ABRATERM exigem que sejam tomadas medidas para reafirmar, rever ou atualizar esta diretriz, no prazo máximo de três anos a partir da data de publicação. Sugestões para melhoria desta diretriz são bem-vindas e devem ser enviadas a Americana de Termologia (AAT) e a Associação Brasileira de Termologia (ABRATERM).

Palavras-chave: termografia; saúde; face; raios infravermelhos

General Statement: This guideline was prepared by members of the American Academy Of Thermology (AAT) and Brazilian Thermology Association (ABRATERM) as a guide to aid the performance of Dental/ 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 legal provisions. The AAT/ABRATERM guideline may be revised or changed at any time. The procedures of the AAT/ABRATERM require that action be taken to reaffirm, revise or upgrade 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 American Academy of Thermology and Brazilian Thermology Association (ABRATERM).

Keywords: guideline; thermography; health; face; infrared rays

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 the assessment of Dental-Oral and certain Systemic Health related illnesses, diseases, and in their 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 information offered by Dental/Systemic Health Thermal Imaging. The clinical application of Thermography can help physicians both understand patho-physiology and improve patient outcomes.

The American Academy of Thermology supports the incorporation of infrared thermal imaging into clinical medicine and its specific utility in the monitoring of 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 in 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 caries and decay.
- 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
 - thyroid disease
 - hepatic overload or portal congestion
 - abdominal skin temperature and necrotizing enterocolitis
 - peripheral arterial disease
 - deep and superficial venous disorders
 - hemangioma regression documentation

- inflammatory and obstructive lymphatic disorders
- pressure ulcers
- 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
- varicocele
- dermatologic and immunologic conditions, including superficial skin vascular responses to environmental impacts such as mold or other allergens
- psychological manifestations that may impact skin surface temperature
- community health fever screening
- forensic evaluations
- Pre-procedure assessment for planning of interventional therapeutics.
- Follow-up to determine 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, which may reflect change in condition.
- Mapping of the extent of vasomotor instability to guide generator identification.
- Mapping of the location of vasomotor instability for impairment rating purposes.
- Confirmation of diagnostic inclusion criteria for clinical diagnostic purposes.
- Confirmation of diagnostic inclusion criteria for research purposes.

COMMON INDICATIONS

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 can disturb the facial examination. The interpreting physician must quality control the study so that facial hair, or skin irritations from shaving, does not interfere with 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.
- 1.2. The laboratory’s medical director should ensure that any patient questions and concerns about any aspect of the examination are responded to.
- 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. No clothing or garments should be worn over any region that is under study.
- 1.6. The patient should shower or bathe the morning of the test to ensure that the skin is as clean as possible. 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 placing any material of any kind on the skin, such as any skin lotions, sun screens, deodorants, preparations, moisturizers, liniments, makeup, hair spray, hair cream, topical analgesics, etc. the day of the exam.
- 1.8. Nicotine and caffeine products should be discontinued by the patient 4 hours prior to imaging. For Evaluations of the face and neck mouth washes and breath mints should be discontinued for 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; avoid anything binding against the skin; avoid support undergarments or pantyhose. They should not wear jewelry, preferably including rings if the hands are to be examined (exceptions are made for rings which cannot be removed or jewelry which 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 and transdermal patches should be avoided for 24 hours prior to testing (12-16 hours minimum). Exceptions should always 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 assessment of 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 (ie: 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 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 Xray, CT, MRI, Diagnostic Ultrasound, and electromyography).
- 2.2. Complete a limited, focused, detailed or extensive physical examination, which includes assessment of all 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 in accordance with guidelines asymmetric or localized IR



emission variations of 1°C or greater can be indicative of pathology in a properly cooled subject.

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

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 Dental-Oral and Systemic Health 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 response to treatment and additional testing may still 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 be incorporated into the design of infrared hardware and software systems. These specifications are intended to speak to the design of modern infrared imaging equipment that is considered commonplace today. They are not intended in any way reflect on systems used in the past. While recognizing that individual circumstances will vary for the purposes of this document, lens FOV is 25 degrees, patient to camera distance 3-8 feet (as needed to allow the region of interest to fill approximately 75% of the image) and lens quality is satisfactory to the vast majority of observers. Camera temperature offset should be calibrated against the emissivity of a black body at 1.0 if needed for the exam being per-

formed.

- 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.
- Camera detector spectral bandwidth: 8 to 14 microns (micrometers).
- Preferred Absolute detector resolution of > 640X480 coupled with a suitable microbolometer and lens. Most modern medical imaging systems today utilize uncooled focal plane array detectors found in the 320X240 sensor range or higher. When systems with 320X240 sensors 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 640X480 systems.
- Min. measurable spot size is 2.1x2.0mm (3x3 or 9 pixels) at 40cm distance.
- Spatial resolution quality at 8 feet (2.4 meters) equivalent to ≤ 2.6 mRad IFOV (Instantaneous Field of View) at 40cm minimum focus.
- Thermal sensitivity of < 50mK NETD (Noise Equivalent Temperature Difference) at 30°C.
- Ability to perform accurate quantitative differential temperature analysis with a precision of ≤ ±0.05°C (50mK).
- Repeatability and precision of

$\leq \pm 0.05^\circ\text{C}$ (50mK) detection of temperature difference. The repeatability of a differential measurement must be in the presence of ± 3 NETD (6 sigma - 99.9% defect free mfg. standard).

- 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 realtime image focus and capture capability. While 10Hz, 20Hz, and 30Hz frame rates are capable of realtime imaging, faster capability is preferred (i.e.: 50Hz). For temperature analysis, radiometric video files are preferred.
- Precision Autofocus is recommended.
- Temperature range set to cover temperatures within the range of human emissions (20-45°C).
- Ability to archive images for future reference and image comparison at same patient positioning and distance from the camera.
- 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 sympathetic skin response instrumentation, which includes 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 ambient temperature is controlled, free from drafts and where 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° ($\pm 1^\circ\text{C}$) 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 should be standing on a carpeted floor. 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

($\pm 1^\circ\text{C}$) 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 image windows (including differing views) with different points of focus. 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 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 the image screen. It is recommended that the contralateral images should be captured with the same image orientation. Additional image obtainment 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.) on thermographic images. If it deemed helpful to provide more information regarding the same then a traditional visual digital image should accompany the thermographic image.

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 Guideline are not supported by this Guideline.

- 3.7. Dental-Oral studies typically employ color palettes of no less than ten colors and are typically formatted at 1°C per color. Many laboratories have found it beneficial to use palettes different than ten colors however when vasomotor mapping is desired the 1°C per color format should be retained. Organ specific and Systemic Health studies may alternatively employ color, grey scale or reverse grey scale palettes that are formatted for eight colors during study acquisition. Unless a single specific region of interest is being studied each palette type is still typically calibrated across a range of 10°C however. Post-image processing may then be performed in varying palettes as deemed necessary by the interpreting thermologist.

- 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 course of the examination to assure that sufficient data is provided to the physician to direct patient management and render a diagnostic impression.

- 3.9. Evaluate the patient's physical and mental status prior to discharge. Additional discharge instructions may include recommendation to schedule follow up appointment with the attending physician, and to 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 INFRA-RED THERMOGRAPH 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 and 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 should be validated for each thermography system used. When validating dental/systemic health infrared diagnostic criteria it is important to realize that equi-

ipment, operator and interpretation variability is inherent to this process.

- 4.3. Complete required laboratory documentation of the study.
- 4.4. Alert Dental/Medical Director or other 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 for by internal policy based on examination findings.
- 5.2. Present the record of diagnostic images and when applicable, explanations for suboptimal 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 radiometric image convertible format such as JPEG 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.

amination.

- 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 was utilized. The set of images obtained for 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 discussion that is clinically relevant 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 > 1 degree centigrade in > 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 $> 0.6^{\circ}\text{C}$ may be considered to be significant at a moderate level.

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 ($>2^{\circ}\text{C}$) 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.
- Thyroid disease: hot or cold spots over the thyroid gland; lobe thermal asymmetry; thyroid thermal gradient ($>1^{\circ}\text{C}$) vs. surrounding tissue.
- 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).
- Peripheral arterial disease: thermal gradient line consistent with peripheral artery (usually coldness) such as may be seen in a vasotomal or distal distribution.
- Deep and superficial venous disorders: tortuosity, cold or warm limbs.
- Inflammatory and obstructive lymphatic disorders: hot spots over inflamed lymph nodes, hyperthermia over lymphatic chains or in a characteristic “glow area”.
- Pressure ulcers: localized hyperthermia for those not yet visible (as staging progresses findings change).
- 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.
- 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, and vasculitic disorders; 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 color palette.
- Psychological manifestations that may impact skin surface

temperature including hyper-ventilation, anxiety, panic, depression, and drug addiction: systemic hypothermia with slow recovery to following re-warming; 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 peripheral nitrous oxide or vasovagal manifestations such as blushing or perspiration).

- Community health fever screening: mean ear temperature $>37.7^{\circ}\text{C}$, or medial canthus temperature readings $> 38^{\circ}\text{C}$. A blackbody temperature standard to frequently calibrate the thermal camera is essential for fever detection due to the inherent drift of standard thermal imagers.
- Forensic Evaluations: finger print 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, carotid, and coronary 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 however also 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

REFERENCES

- 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 generally accepted medical scientific methodology that have 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 thermal imaging cameras that do not meet the specification guidelines contained herein are not intended for use in Medical Thermology.
- 10.3. Technologies not otherwise covered in these Guidelines that employ methodologies, hardware, or protocols that have gained Federal Regulatory approval for Medical Thermology may become available over time. In cases where these technologies are employed the body of the report should document which deviations occurred and why, and other components of the Guideline should still be followed.

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