

Diagnostic procedures in infrared thermography for the human face: a scoping review protocol

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ABSTRACT

Purpose: to present the scoping review protocol that will describe the diagnostic procedures used in infrared thermography to evaluate the human face.

Methods: based on the Joanna Briggs Institute and PRISMA-ScR checklist, with the mnemonic: population (P) - human face, concept (C) - infrared thermography, and context (C) - diagnostic procedures in infrared thermography for the human face. The methodological structure will have six stages. The PubMed, LILACS, SciELO, BBO, Web of Science, EMBASE, Scopus, Cochrane Library, and Grey Literature Report databases will be searched, with no restriction on time or language. The review will include qualitative and quantitative studies. Two reviewers will independently select studies and extract data. Results will be analyzed using a variable approach.

Conclusion: this scoping review protocol followed the methodological precepts and is apt to be carried out. It will serve as the basis for other scoping reviews. Conducting a scoping review is important and the prior publication of the scoping review protocol is essential to make the review process transparent.

Keywords: Review; Methods; Thermography; Face



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INTRODUCTION

Infrared thermography (IRT) is a noninvasive, painless, quick technique with no contraindications or side effects used to diagnose physiological dysfunctions. It makes it possible to assess and quantify temperature variations and follow up on rehabilitation, encompassing the craniofacial area¹⁻⁴. The technique's specificity, sensitivity, and image resolution have evolved, especially for the face, but there is still a lack of studies with good methodological quality for diagnosis and/or rehabilitation^{1,4}.

IRT use for face images began with dental studies, which is a field correlated with the speech-language-hearing sciences, particularly regarding oral-motor control. This technology helps assess and follow up on orofacial aspects, more specifically temporomandibular disorders (TMDs) and their consequences to mastication^{2,3,5-8}.

A literature review on dental studies points out that the technique helps diagnose and plan treatment of orofacial changes, postoperative follow-up, and TMDs¹. These data are corroborated by a systematic review that reports thermal oscillations in studies on TMD and masticatory muscle impairments⁴. An integrative review with the same purpose was recently published⁹, citing IRT as a complement to laboratory and TMD diagnosis and treatment examinations. A bibliometric review¹⁰ presents the main recommendations regarding orofacial pain (myogenous and arthrogenous TMD and neuropathies), endodontics (inflammatory toothache), dental implant (osseointegration), and postoperative care.

In the speech-language-hearing sciences, especially regarding structural and functional aspects of the stomatognathic system, recent national publications analyzed orofacial muscles associating them with IRT analysis^{11,12}. A study in the field of voice showed post-treatment changes in the skin temperature in the region of the larynx¹³.

Concerning the face, an important national study identified, mapped, and quantified 28 anatomical thermal points in healthy adults, including muscles, commissures, and temporomandibular joints in frontal and lateral planes³. The members of the American Academy of Thermology and the Brazilian Thermology Association recently developed and published a guideline to help perform IRT imaging to assess patients with oral and systemic health complaints¹⁴.

No scoping review has been published so far on IRT diagnostic procedures for the human face. A search was conducted in the Cochrane Database

of Systematic Reviews, Joanna Briggs Institute (JBI) Evidence Synthesis, and MEDLINE/PubMed in May 2022. Previous reviews highlight procedures for the human body but do not refer to the head and neck area. A scoping review in this area is essential to understand the characteristics of the diagnostic procedures that have been used in IRT assessment of the face, considering the specificities of this region. Surveying the procedures will help guide clinical application and scientific research. Before developing a scoping review, its protocol should be first created to ensure a transparent process¹⁵⁻¹⁷.

Given the references approached above and the need to understand the procedures that have been used, this study aimed to present the protocol of a scoping review to identify IRT diagnostic procedures to assess the human face.

METHODS

This study is a scoping review protocol, without any direct involvement of participants and with a secondary analysis of previously published literature. Hence, it was exempted from approval of the originating institution's research ethics committee. Since health review registers do not allow for scoping reviews, the instruction is to publish the protocol in a scientific journal or register it on another platform¹⁶. The protocol of this review was registered in the Open Science Framework on May 9, 2022 (osf.io/dq8bt). Scoping reviews are characteristically interactive and constructed throughout the process. Therefore, there may be changes in the methodological process described in this protocol; such changes will be reported in the scoping review, as instructed.

The methods developed for this scoping review protocol will follow the guidelines described by the Joanna Briggs Institute (JBI)^{15,16} and those published by Arksey and O'Malley¹⁸. The recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis: Extension for Scoping Reviews (PRISMA-ScR)¹⁹ will also be used throughout the scoping review process.

JBI instructs the use of the PCC mnemonic: Population (P) – who makes up the sample and what are the characteristics of the research population; Concept (C) – what is the central issue to be examined; and Context (C) – which specific details are related to the population. Items approached in the PCC will define the scoping review title, objective, question, and inclusion/exclusion criteria. This study used PCC as described in Chart 1.

Chart 1. Mnemonic: Population, Concept, and Context

Mnemonic	Description
Population (P)	human face
Concept (C)	infrared thermography
Context (C)	diagnostic procedures in infrared thermography for the region of the human face

Source: the authors (2022)

The methodological structure of the scoping review will have the following six stages^{18,20}:

Stage 1: Identifying the review question.

Based on the authors' survey and PCC strategy, the review question will be as follows: "What IRT diagnostic procedures are used to assess the human face?".

Stage 2: Identifying relevant studies.

Search strategy

The search strategy will use key scoping review inclusion and exclusion criteria based on JBI^{15,16}, according to the PCC strategy. The keywords that will be used were listed upon the review team's decision (EG, MC, EASS, GTBD, HKAS), based on the following

MeSH terms for MEDLINE/PubMed: 'thermography', 'temperature', 'body temperature', 'diagnostic imaging', 'thermal', 'infrared', 'imaging' and 'head', 'stomatognathic system', 'facial muscle', 'dentistry', 'mimetic muscles', 'facial', 'oral' – with adaptations according to each database's specific requirements.

The search will be conducted in the following databases: National Library of Medicine at the National Institutes of Health (PubMed); Latin American and Caribbean Health Sciences Literature (LILACS) via the Virtual Health Library Regional Portal (VHL); Scientific Electronic Library Online (SciELO) via SciELO Citation; Brazilian Dental Library (BBO), via VHL Regional Portal; Web of Science – Core Collection (Clarivate Analytics); EMBASE; Scopus; Cochrane Library, and Grey Literature Report. The search strategy is described in Chart 2.

Chart 2. Search strategy

Database	Strategy
PubMed	(((((((((thermography[MeSH Terms]) OR (thermography[Text Word])) OR (temperature[MeSH Terms])) OR (body temperature[MeSH Terms])) OR (diagnostic imaging[MeSH Terms]) OR (thermal)) AND (infrared)) AND (imaging))) AND ((((((((((head[MeSH Terms]) OR (stomatognathic system[MeSH Terms])) OR (facial muscle[MeSH Terms])) OR (dentistry[MeSH Terms])) OR (mimetic muscles[MeSH Terms])) OR (facial)) OR (oral))))))
LILACS	('thermography' OR 'body temperature') AND ('head' OR 'face' OR 'face muscle') AND (db:("LILACS"))
SciELO	((thermography) OR (microcirculation) OR (body temperature)) AND ((head) OR (face) OR (face muscle) OR (facial muscle) OR (stomatognathic system) OR (mimetic muscles))
BBO	('thermography' OR 'body temperature') AND ('head' OR 'face' OR 'face muscle') AND (db:("BBO"))
Web of Science	TS=(thermography) AND TS=(face OR face muscle)
EMBASE	('thermography'/exp OR 'microcirculation'/exp OR 'body temperature'/exp) AND ('head'/exp OR 'face'/exp OR 'face muscle'/exp) AND [embase]/lim NOT ([embase]/lim AND [medline]/lim)
Scopus	(TITLE-ABS-KEY ('thermography' OR 'microcirculation' OR 'body AND temperature') AND TITLE-ABS-KEY ('head' OR 'face' OR 'face AND muscle'))
Cochrane Library	(thermography) OR (microcirculation) OR (body temperature) in Title Abstract Keyword AND (face) OR (face muscle) OR (facial muscle) OR (stomatognathic system) in Title Abstract Keyword - (Word variations have been searched)
Grey Literature Report	thermography OR microcirculation OR body temperature OR face OR face muscle OR facial muscle OR stomatognathic system

Source: the authors (2022)

Eligibility criteria

Studies will be included following PCC and the search strategy described in Chart 2, with no limits on participants' ages or restrictions on time or language of publication. The review will include qualitative and quantitative studies, presented as original research articles (clinical trials, observational studies, or any other design), any types of reviews, theses, dissertations, and monographs, whose abstracts and full texts are available.

The grey literature will be also consulted in the Grey Literature Report database. If another study is found in the study references, it will also be included.

Studies whose full texts are unavailable, books, and book chapters will be excluded.

Stage 3: Study selection

Studies selected through the search strategies

will be exported to EndNote reference management software (Clarivate Analytics, PA, USA), and duplicates will be removed.

Studies will be selected in two stages: 1) two independent blind reviewers (EASS, GTBD) will assess titles and abstracts and select for the next stage those that meet the eligibility criteria; 2) the authors (EASS, GTBD) will retrieve the full texts of studies selected in the previous stage and review them independently. The two reviewers (EASS, GTBD) will first discuss any divergence they may have in any of the stages. A third author (EG) will be consulted in case of discrepancies.

The study selection stages will be documented in a scoping review flowchart¹⁵. It will present the search results, removed duplicates, study selection, and retrieval, studies added from a third search, and the number of final studies (Figure 1).

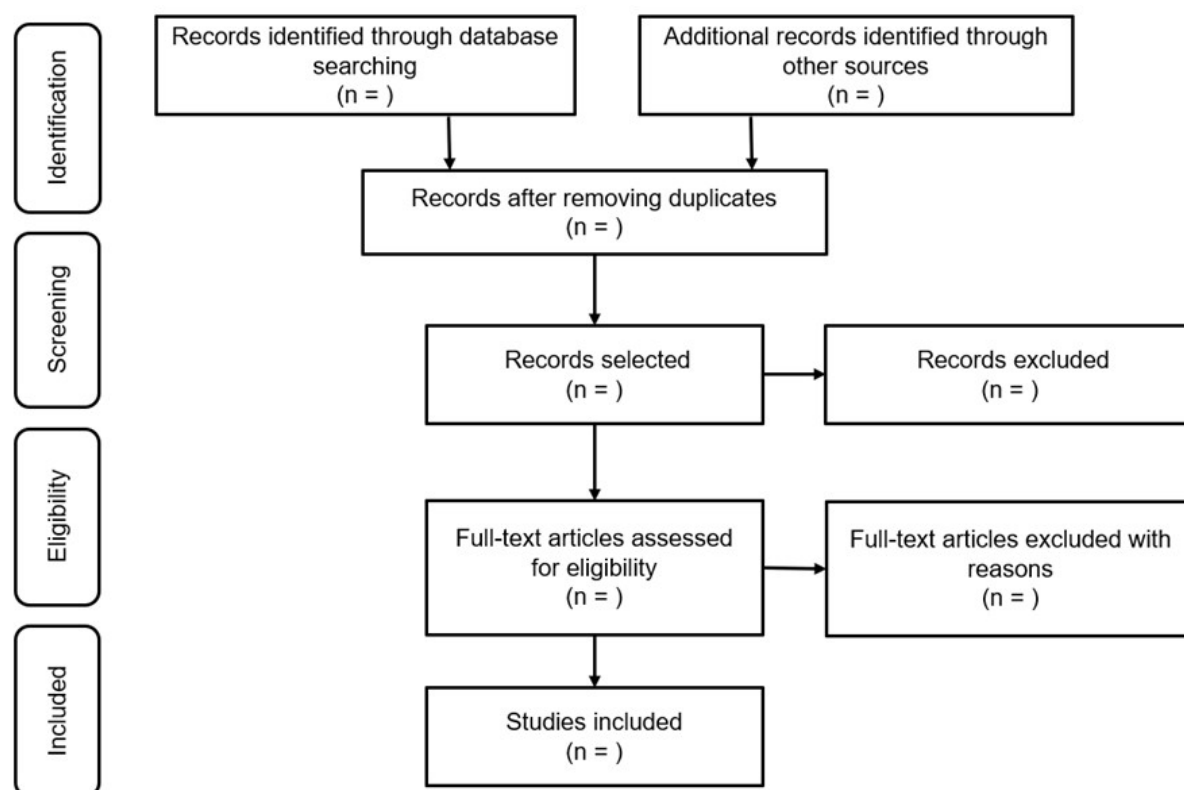


Figure 1. PRISMA flowchart for scoping reviews¹⁵

Stage 4: Data mapping.

Two independent reviewers (EASS, GTBD) will extract data from the selected articles, filling out a table previously organized in Google Forms in a continuous updating process, as needed. The main information of the selected studies will be presented in a result chart with the author(s), year of publication, country of origin, study design, study objective(s)/purpose, sample (size, age, sex), region of the human face analyzed, camera used, setting/pick-up method (acclimation period [min], distance [m], room temperature [°C], and relative humidity [%]), image analysis method, inter-rater reliability, and conclusions.

Stage 5: Collection, summary, and report of results

Qualitative, quantitative, and mixed studies will be analyzed with a variable approach. Quantitative data will be extracted, tabulated, and presented through descriptive statistics (e.g., frequencies and means), and qualitative ones will be processed with thematic analysis. Results that answer the review question will be extracted and organized, describing which IRT methodologies are used to assess the human face. A flowchart will be developed as indicated for scoping reviews. Also, as it will be a scoping review, the methodological quality of the studies will not be assessed.

The scoping review will point out the implications of its results to social, political, clinical, and research aspects. It may also identify gaps in the studies, which will be analyzed to generate a more in-depth study for future research. Studies will be discussed based on the current literature and, especially, the guidelines on the topic.

Stage 6: Consultation (optional)

This is an optional but important stage to share knowledge, according to JBI. The product of this scoping review may be used as a methodological guide to other studies. The findings of this scoping review protocol will be publicized to the scientific community through a scoping review article.

DISCUSSION

The aim of scoping reviews also referred to as scoping studies, is to broadly map the evidence that sustains an area of research, surveying the sources available and all types of evidence^{18,21-23}. They are useful because they examine recent areas, clarify concepts,

and identify gaps²¹. In the theoretical-methodological field, they also map the theories and methodologies that will ground future research²³.

The number of scoping reviews in the literature has increased in the last years, with essential improvements in the procedures and reports^{20,23,24}. Given the inconsistent methods and unreliable results, JBI^{15,16} issued a manual with guidelines to develop and carry out scoping reviews, keeping company to the PRISMA-ScR checklist¹⁹ and articles with the same purpose^{17,18,22,25-28}. It is greatly important to follow adequate scoping review methodology, aligned with epistemological and theoretical assumptions²³.

The JBI manual^{15,16} requires that a scoping review protocol be developed before carrying out the scoping review itself, as the protocol details the objectives and methods to carry out and publicize the review, ensuring a transparent process¹⁷. Both JBI and PRISMA-ScR checklist instructs registering the protocol to ensure transparency (in tools such as the Open Science Framework). Moreover, they also consider making the protocol available to the scientific community in a publication^{16,17}.

The JBI manual^{15,16} points out some instructions. Reviews must have at least two reviewers to minimize bias. They suggest using the PCC mnemonic to define the title, objective, and methods to be approached. The title must clearly indicate it is a scoping review. The objective must clearly state the research question, identifying the PCC-based inclusion criteria.

In the Introduction, the authors cite theoretical aspects of the research question, including whether reviews are available approaching the topic, and justify the production of the scoping review. There must also be a preliminary search to ascertain that no scoping reviews or other types of reviews with the same purpose are found, indicating which databases were researched. If there is a review available, the new one must be justified^{15,16}.

The scoping review structure presented in the JBI manual¹⁵ is the one by Arksey and O'Malley¹⁸, which is widely used in publications and has been improved²⁵. It has six stages: (1) identifying the research question – it clarifies the research question and relates it to the objective; (2) identifying relevant studies – amplitude and coverage of the scoping review process; (3) selecting studies – an iterative approach to select studies and extract data; (4) mapping data – quantitative and qualitative summary; (5) collecting, summarizing, and reporting results – identifying the implications

of the study to social/political, clinical, and research aspects; and (6) consulting (optional) – using consultation as a necessary component of the scoping review methodology.

The search strategy for the scoping review must be comprehensive to identify published and unpublished primary studies as well as any types of review. The reviewers must indicate language and time limits, if any. They recommend including a librarian or experienced reviewer in the group that will carry out the study. The JBI manual¹⁵ recommends a search strategy in three stages: 1) a limited initial search in at least two databases relevant to the topic, followed by a title and abstract analysis; 2) a full search with all keywords in all databases; 3) search for additional studies. They suggest informing that the authors may be contacted, if necessary.

Concerning results, the data extraction is named a chart of results, which aims to provide readers with a logical descriptive summary of the results, based on the objective and scoping review question. Along with data extraction, the authors must furnish a plan to present the results, which may be refined throughout the review. Results may be presented in a description and/or table – in this last case, a narrative summary must accompany the table. Qualitative data require descriptive analysis and presentation, and reviewers must not perform a thematic analysis/synthesis. As for quantitative data, the occurrence of concepts, characteristics, and so forth is presented¹⁶.

The table must be outlined during the protocol development, with information such as author, year, and relevant results to the scoping review. Moreover, the JBI manual¹⁵ suggests other important information reviewers may use: a) author(s), b) year of publication, c) origin/country of origin (where the study was published or carried out), d) objectives/purpose, e) study population and sample size (if applicable), f) methodology/methods, g) type of intervention, comparator, and their details (e.g., intervention duration) (if applicable), h) intervention duration (if applicable), i) results and details (if applicable), j) main findings related to the scoping review question(s).

CONCLUSION

This scoping review protocol was developed according to the methodological guidelines and is apt to be carried out. This article will also strengthen the methodological components of future studies that aim to review this topic and develop and validate protocols,

including those related to the structures and functions of the stomatognathic system. It also contributes to practices based on scientific evidence.

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Authors' contributions:

EG: study conceptualization and design, data acquisition, analysis and interpretation, article writing, final approval;

EASS, GTBD: data acquisition, data analysis and interpretation;

HKAS, MGS, ANSA: study conceptualization and design;

MC: study conceptualization and design, data analysis and interpretation, final approval;

HJS: study conceptualization and design, final approval.