



LITERATURE REVIEW:

Ultrasonography in Oral and Maxillofacial Infections: A Scoping Review

Ecografía en infecciones orales y maxilofaciales: una revisión de alcance

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ABSTRACT: Maxillofacial infections are complex clinical conditions that can progress rapidly and extend into deep fascial spaces. Although computed tomography remains the reference imaging modality, ultrasonography has emerged as a promising alternative due to its accessibility, low cost, and lack of ionizing radiation. The aim of this review was to analyze and synthesize the available scientific evidence on the diagnostic and therapeutic role of ultrasonography in maxillofacial infections. A scoping review was conducted following the PRISMA-ScR guidelines and the methodological frameworks of Arksey and O'Malley and the Joanna Briggs Institute. A systematic search was conducted in PubMed, Scopus, and Web of Science for studies published between 2000 and May 9, 2026. The PubMed search strategy was: ("Ultrasonography"[Mesh]) AND (((("Focal Infection, Dental"[Mesh]) OR (maxillofacial infection)) OR (facial space infection)). Primary studies evaluating the diagnostic and/or therapeutic use of ultrasonography in maxillofacial infections were included. Eighteen studies involving a total of 787 participants were included. Most studies assessed odontogenic infections and superficial facial space infections. Ultrasonography was useful for differentiating cellulitis from abscesses, assessing lesion extent, and guiding minimally invasive drainage procedures. However, limitations were reported in the assessment of deep fascial spaces due to interference from bone and air. The use of Point-of-Care Ultrasound (POCUS) demonstrated effectiveness in hospital and emergency care settings. Ultrasonography appears to be a valuable complementary tool in the management of maxillofacial infections, particularly for superficial infections and minimally invasive procedures. However, methodological heterogeneity and operator dependency limit definitive conclusions about its diagnostic and therapeutic accuracy.



KEYWORDS: Ultrasonography; Maxillofacial infections; Odontogenic infection; Point-of-care ultrasound; Diagnosis; Drainage.

RESUMEN: Las infecciones bucomaxilofaciales son una condición clínica compleja que puede progresar rápidamente y comprometer espacios fasciales profundos. Aunque la tomografía computarizada continúa siendo el método de referencia, la ecografía ha emergido como una alternativa prometedora debido a su accesibilidad, bajo costo y ausencia de radiación ionizante. El objetivo de esta revisión fue analizar y sintetizar la evidencia científica disponible sobre el rol de la ecografía en el diagnóstico y tratamiento de las infecciones bucomaxilofaciales. Se realizó una revisión de alcance siguiendo las directrices PRISMA-ScR y el marco metodológico de Arksey y O'Malley y del Joanna Briggs Institute. Se efectuó una búsqueda sistemática en PubMed, Scopus y Web of Science desde el 2000 hasta el 09 de mayo de 2026. La estrategia en PubMed fue: ("Ultrasonography"[Mesh]) AND (((("Focal Infection, Dental"[Mesh]) OR (maxillofacial infection)) OR (facial space infection))). Se incluyeron estudios primarios que evaluaran el uso diagnóstico y/o terapéutico de la ecografía en infecciones bucomaxilofaciales. Se incluyeron 18 estudios, con un total de 787 participantes. La mayoría de los estudios evaluaron infecciones odontogénicas y de espacios faciales superficiales. La ecografía demostró utilidad para diferenciar celulitis de abscesos, evaluar la extensión de las lesiones y guiar procedimientos de drenaje mínimamente invasivos. Sin embargo, se reportaron limitaciones en la evaluación de espacios profundos debido a la interferencia de hueso y del aire. El uso de ecografía a pie de cama (POCUS, del inglés Point-of-Care Ultrasound) mostró efectividad en contextos hospitalarios y de urgencia. La ecografía parece ser una herramienta complementaria relevante en el manejo de las infecciones bucomaxilofaciales, especialmente en infecciones superficiales y procedimientos mínimamente invasivos. No obstante, la variabilidad metodológica y la dependencia del operador limitan conclusiones definitivas respecto a su rendimiento diagnóstico y terapéutico.

PALABRAS CLAVE: Ultrasonografía; Infecciones maxilofaciales; Infección odontogénica; Ecografía a pie de cama; Diagnóstico; Drenaje.

INTRODUCTION

Oromaxillofacial infections (OMFI) represent a complex clinical problem in dental and medical-surgical practice, as they involve an anatomical region characterized by multiple fascial planes and structures (1). These infections most commonly originate from odontogenic sources (2). Furthermore, they may rapidly spread to the deep neck spaces, compromising patients' general health status (3).

Early diagnosis of OMFI is essential, as inadequate management may lead to severe complications requiring hospitalization and surgical intervention (4-6). Despite advances in antibio-

tic therapy and preventive strategies, several studies have reported an increase in the incidence and complexity of these infections over the past decade (7). This increase is particularly observed in patients with systemic diseases, limited dental follow-up, or incomplete initial treatments (8).

Traditionally, the diagnostic evaluation of OMFI is based on clinical examination, supplemented by imaging methods. Among these, computed tomography (CT) is considered the reference standard for detecting deep abscesses and determining their extent (9). However, CT has important limitations, such as exposure to ionizing radiation, the use of intravenous contrast agents, and limited availability in certain healthcare settings (10,11).

These limitations have encouraged the search for alternative diagnostic methods.

In this context, ultrasonography has emerged as a promising diagnostic and therapeutic tool in the management of OMFI (12,13). It is a non-invasive, relatively accessible, and low-cost modality (14) that enables real-time evaluation of soft tissues, facial edema, and glandular or vascular involvement. Additionally, ultrasonography facilitates differentiation between cellulitis and abscesses (15-17). Its use as guidance for minimally invasive procedures, such as aspiration or percutaneous drainage, may reduce the need for surgical approaches and the use of general anesthesia (18).

Nevertheless, the available evidence remains heterogeneous in terms of methodological design, study populations, indications, and outcomes (13,19). Moreover, uncertainties persist regarding its diagnostic performance and therapeutic impact (17,20). To date, there is no structured synthesis that systematically integrates the role of ultrasonography in the management of OMFI. Therefore, the aim of this review was to analyze and synthesize the available scientific evidence regarding the role of ultrasonography in the diagnosis and treatment of oromaxillofacial infections.

MATERIALS AND METHODS

STUDY DESIGN

This scoping review followed a systematic approach to the search, selection, and synthesis of existing knowledge, using the PRISMA ScR Extension Fillable Checklist (21). The methodological framework proposed by Arksey and O'Malley (22) and the Joanna Briggs Institute (JBI) Manual for Evidence Synthesis (23) was adopted.

RESEARCH QUESTION

The research question was: What is the available scientific evidence on the use of ultrasonography in the diagnosis and management of maxillofacial infections? The PCC (Population, Concept, Context) framework was used. The population included patients with maxillofacial infections. The concept was the use of ultrasonography as a diagnostic and/or therapeutic tool. The context included dental and medical-surgical clinical settings.

ELIGIBILITY CRITERIA

Primary studies (cross-sectional, retrospective, and prospective) and case series with ≥ 3 patients were included. Studies had to evaluate the use of ultrasonography in OMFI in adult and/or pediatric populations, for diagnostic and/or therapeutic purposes. Studies published between 2000 and 2026 were considered, with no language restrictions. Single case reports, narrative reviews, editorials, letters to the editor, animal studies, and articles without full-text access were excluded.

INFORMATION SOURCES AND SEARCH STRATEGY

A systematic search was conducted in PubMed, Scopus, and Web of Science from 2000 to May 9, 2026. The strategy combined MeSH terms and free-text terms related to ultrasonography and maxillofacial infections, using Boolean operators AND and OR. The PubMed search strategy was: ("Ultrasonography"[Mesh]) AND (((("Focal Infection, Dental"[Mesh]) OR (maxillofacial infection)) OR (facial space infection)).

This strategy was adapted for the other databases. Additionally, a manual complementary

search was performed in the reference lists of the included studies, applying the same eligibility criteria.

SELECTION OF SOURCES OF EVIDENCE

Articles retrieved from the databases were imported into Rayyan (Qatar Computing Research Institute, Doha, Qatar), where duplicate records were identified and removed. Two reviewers (IB and CA) independently screened titles and abstracts to assess eligibility according to the inclusion criteria. In cases of disagreement regarding inclusion or exclusion, the study advanced to full-text evaluation.

Subsequently, the same reviewers independently assessed the full texts to confirm eligibility. Discrepancies in the final study selection were resolved through discussion and consensus. When agreement could not be reached, a third reviewer (AH) made the final decision.

DATA CHARTING PROCESS AND DATA SYNTHESIS

Data extraction was independently performed by two reviewers (IB and CA) using a Microsoft Excel spreadsheet (Microsoft Corporation, Redmond, WA, USA). The following data were collected: author, year of publication, country, study design, sample size, population characteristics, type of infection, type of ultrasound device, transducer, clinical indication, role of ultrasonography (diagnostic and/or therapeutic), comparator diagnostic methods, and main findings. Data were organized into tables, and a narrative synthesis of the results was conducted.

RESULTS

A total of 291 articles were identified through Medline, Scopus, and Web of Science databases. After the selection process, 18 studies were included (Figure 1).

CHARACTERISTICS OF THE INCLUDED STUDIES

A total of 18 studies published between 2002 and 2026 were included, comprising 787 participants overall. The studies were geographically distributed across Asia (n=9), Europe (n=3), Africa (n=3), and The Americas (n=3). Sex distribution was reported in 13 out of the 18 studies. The participants' age range included both pediatric and adult populations, with mean age reported in 11 studies.

Regarding methodological design, 12 studies were prospective, two were clinical trials, one was retrospective, two were case series, and one was a survey. In terms of infection type, 13 studies included infections of odontogenic origin, two studies focused on non-odontogenic infections, and three studies included mixed infections (Table 1).

CLINICAL INDICATIONS FOR THE USE OF ULTRASONOGRAPHY

All 18 studies reported the use of ultrasonography in maxillofacial infections across emergency, hospital, and outpatient clinical settings. Regarding the type of application, 11 studies used ultrasonography exclusively for diagnostic purposes, three for exclusively therapeutic purposes, and four for combined diagnostic and therapeutic purposes. All studies used linear transducers, with frequencies ranging from 4 to 15 MHz (Table 2).

COMPARATOR DIAGNOSTIC METHODS, RESULTS, AND LIMITATIONS OF ULTRASONOGRAPHY

Regarding the comparator methods used, nine studies employed clinical examination, six used surgical incision and drainage (I&D), two compared findings with magnetic resonance imaging (MRI), and only one study used computed tomography (CT) as the reference standard (Table 3).

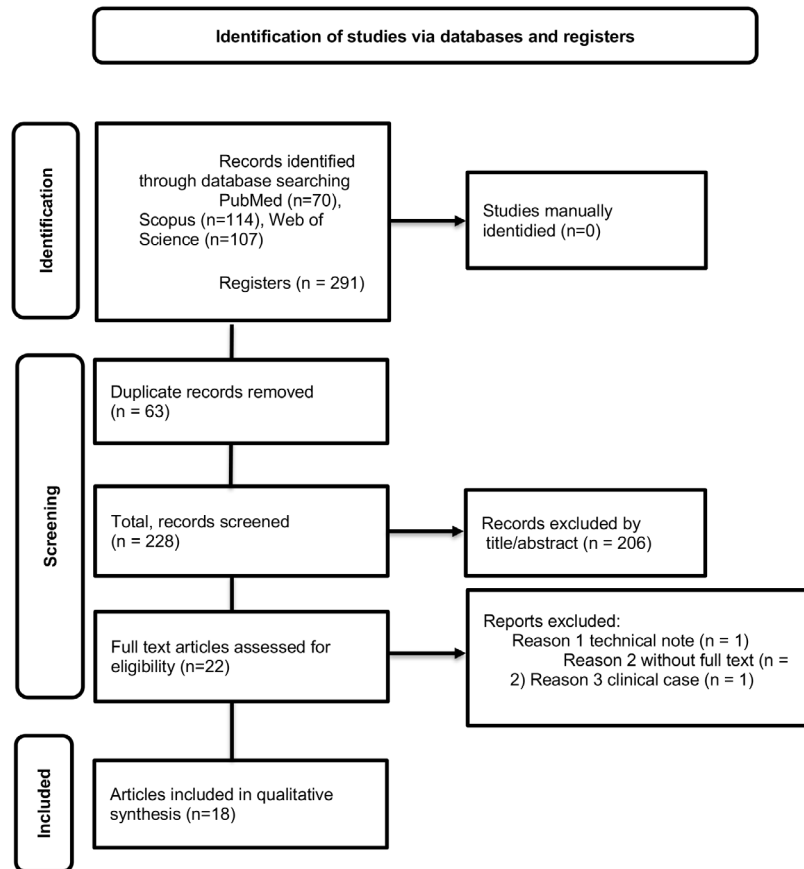


Figure 1. PRISMA flow diagram describing the different stages of the information processing.

Table 1. General and methodological characteristics of the included studies.

Article	Design	n (M/F)	Mean Age (years)	Type of infection	Conclusions
Ghali (2021) India (17)	P	20 (NR)	NR	Odontogenic	Enables prediction of the stage and localization of infection in superficial spaces.
Srinivas (2009) India (24)	P	25 (13/12)	32	Odontogenic	High diagnostic accuracy in orofacial inflammatory conditions.
Bassiony (2009) USA (16)	P	16 (NR)	31.5	Odontogenic	Useful in superficial infections, with limited applicability in deep spaces.
Mukhi & Mahindra (2012) (25)	P	26 (8/18)	30	Odontogenic	A cost-effective, non-invasive technique that complements clinical examination.
Shah (2021) India (26)	P	40 (22/18)	NR	Odontogenic	A cost-effective tool for timely diagnosis and management.
Macedo Costa (2023) Brazil (18)	P	20 (13/7)	NR	Odontogenic	Useful for airway management and drainage in critically ill patients.
Saifi (2024) India (27)	P	40 (14/26)	40.1 ± 11.5	Odontogenic	Superior to clinical examination for localizing abscesses and guiding surgical approach.
Frid (2025) Israel (12)	P	90 (52/38)	7.8 ± 3.7 (pediatric)	Odontogenic	Moderate diagnostic accuracy of POCUS among non-specialists after training.
Gross I (2026) Israel (28)	P	36 NR	0-18	Odontogenic	Ultrasonography is a valuable diagnostic tool for frontline emergency physicians.
Poweski (2014) USA(29)	P	82 (46/36)	37.2 ± 13.6	Odontogenic	Does not significantly improve diagnostic accuracy compared to clinical examination.
Pallagatti (2012) India (30)	P	45 (25/20)	38	Mixed	Allows assessment of lesion extent, nature, and vascular relationships.
Adamu (2022) Nigeria (31)	P	36 (21/15)	35.0	Mixed	Improves diagnostic accuracy when combined with clinical and histopathological evaluation.
Mallorie (2012) United Kingdom (32)	R	43 (NR)	37	Mixed	High reliability for detecting superficial fluid collections.
Al-Belasy (2005) Egypt (33)	CT	11 (7/4)	25	Odontogenic	Ultrasound-guided drainage is a feasible alternative in cases with trismus.
Lindeboom (2007) Netherlands (34)	CT	100 (50/50)	NR	Non-odontogenic	Allows objective assessment of treatment response.
Yusa (2002) Japan (35)	CS	8 (4/4)	NR	Odontogenic	Doppler ultrasound enables safe and precise drainage, reducing tissue trauma.
Abbiramy (2023) India (36)	CS	6 (3/3)	30	Odontogenic	Reduces tissue trauma and avoids unnecessary incisions through guided drainage.
Ryba & George (2017) United Kingdom (37)	S	140 surgeons (NR)	NR	Non-odontogenic	POCUS should be incorporated as a core competency in maxillo-facial surgery.

The abbreviations used in this table include: US (ultrasound/ultrasonography); NR (not reported); M (male); F (female); n (sample size); % (percentage); ± (standard deviation); P (prospective study); R (retrospective study); CS (case series); CT (clinical trial); S (survey); and POCUS (point-of-care ultrasound).

The term “mixed” refers to infections of both odontogenic and non-odontogenic origin. Odontogenic infections are those originating from dental structures or associated tissues. Non-odontogenic infections include those arising from glandular, lymphatic, or other cervical structures. The term “deep spaces” refers to infections involving anatomical regions such as the sublingual, masticator, parapharyngeal, or deep cervical spaces. The abbreviation “vs” indicates a comparison between diagnostic methods or clinical approaches.

Table 2. Clinical indications for the use of ultrasonography in maxillofacial infections.

Author (year)	Type of application	Linear transducer frequency	Clinical indication	Role of ultrasonography
Lindeboom (2007) (34)	Diagnostic	Linear 7.5–15 MHz	Cervicofacial lymphadenitis in children	Diagnostic evaluation and therapeutic follow-up
Bassiony (2009) (16)	Diagnostic	Linear 7.5 MHz with color Doppler	Superficial fascial space infections	Alternative to MRI in superficial infections
Srinivas (2009) (24)	Diagnostic	Linear 8 MHz	Acute odontogenic facial swelling	Anatomical study of vascular structures
Pallagatti (2012) (30)	Diagnostic	Linear 8–12 MHz with color Doppler	Acute odontogenic facial swelling	Evaluation of extension and relationship with vital structures
Mallorie (2012) (32)	Diagnostic	Linear 9–12 MHz	Suspected purulent collections	Confirmation of pus presence, avoiding surgery
Poweski (2014) (29)	Diagnostic	Linear 4.8–12 MHz	Acute odontogenic facial swelling	Comparison with clinical examination
Ryba & George (2017) (37)	Diagnostic	Linear 7–12 MHz	Cranio-cervical infections	POCUS as an adjunct in maxillofacial surgery
Shah (2021) (26)	Diagnostic	Linear 8–12 MHz with color Doppler	Superficial space infections	Diagnosis and therapeutic guidance
Ghali (2021) (17)	Diagnostic	Linear 9 MHz	Suspected fascial space infection	Alternative to MRI for diagnosis and staging
Adamu (2022) (31)	Diagnostic	Linear 7.5–15 MHz	Orofacial swellings	Lesion characterization (cystic, solid, infectious)
Frid <i>et al.</i> (2025) (12)	Diagnostic	Linear 4–12 MHz	Pediatric odontogenic infections	Diagnostic support by non-specialists (POCUS)
Al-Belasy (2005) (33)	Therapeutic	Linear 7.5 MHz	Submasseteric abscesses with trismus	Ultrasound-guided drainage avoiding general anesthesia
Abbiramy (2023) (36)	Therapeutic	Linear 5–7 MHz with Doppler color	Infections requiring rapid intervention	Guidance for needle drainage
Yusa <i>et al.</i> (2002) (35)	Therapeutic	Linear 7.5 - 10 MHz	Deep abscesses difficult to localize	Guidance for drainage and prevention of vascular injury
Mukhi & Mahindra (2012) (25)	Diagnostic–therapeutic	Linear 9 MHz	Superficial space infections	Diagnosis and guidance for percutaneous drainage
Macedo Costa <i>et al.</i> (2023) (18)	Diagnostic–therapeutic	Linear 6–13 MHz	Deep cervical infections	Airway assessment, diagnosis, and follow-up
Saifi (2024) (27)	Diagnostic–therapeutic	Linear 7–12 MHz	Cellulitis vs abscess differentiation	Diagnosis and real-time guided drainage
Gross I (2026) (28)	Diagnostic–therapeutic	Linear 6–14 MHz	Superficial space infections	Diagnosis and guidance for percutaneous drainage

The abbreviations used in this table include: MRI, magnetic resonance imaging; POCUS (point-of-care ultrasound), ultrasound performed at the bedside for clinical evaluation; MHz (megahertz), a unit of measurement for ultrasound frequency, where higher values are associated with greater resolution in superficial structures and lower penetration in deeper tissues; and color Doppler, an ultrasound modality that allows real-time assessment of blood flow through color-coded visualization. The term “linear transducer” refers to an ultrasound probe that emits parallel waves and provides high-resolution images, particularly useful for the evaluation of superficial soft tissues.

Table 3. Ultrasonography findings compared with clinical and imaging methods in odontogenic infections.

Author (year)	Comparator	Main findings	Limitations
Yusa (2002) (35)	Clinical examination	Accurate localization of abscesses; use of Doppler in procedures	Limited needle visualization
Lindeboom (2007) (34)	Clinical examination	Assessment of therapeutic response	Non-blinded study design
Abbiramy (2023) (36)	Clinical examination	Effective ultrasound-guided drainage	Inaccessibility of deep spaces
Shah (2021) (26)	Clinical examination	Higher abscess detection compared to clinical evaluation	Limited performance in deep spaces
Ryba & George (2017) (37)	Clinical examination	86% of surgeons reported the need for POCUS training	Cost, availability, and learning curve
Gross I (2026) (28)	Clinical examination	26 of 33 patients were considered to have significant pus by pediatric emergency physicians	Selection bias; partially trained operators; lack of expert review
Saifi (2024) (27)	Clinical and radiographic examination	Detection of clinically unrecognized abscesses; enabled guided drainage	Small sample size; poor bone penetration
Pallagatti (2012) (30)	Clinical, histopathological, and radiographic examination	Diagnostic accuracy: 90%	Limitations in small lesions or when cortical bone is intact
Adamu (2022) (31)	Clinical, histopathological, and radiographic examination	Diagnostic accuracy: 86.1%; 100% detection of osteomyelitis and abscesses	Operator dependency; transducer variability
Al-Belasy (2005) (33)	I&D	73% success rate for guided drainage	Small sample size
Srinivas (2009) (24)	I&D	High sensitivity and specificity	Limited frequency; absence of Doppler
Mukhi & Mahindra (2012) (25)	I&D	Specificity: 100%	Limited performance in deep spaces
Poweski (2014) (29)	I&D	No significant differences in diagnosis	Difficulty in fluid characterization; cost
Frid (2025) (12)	I&D	Reduction in hospitalizations	Verification bias; non-expert operators
Mallorie (2012) (32)	I&D	Diagnostic agreement: 92%	Operator dependency
Bassiony (2009) (16)	MRI	100% agreement in superficial infections	Limited assessment of deep spaces
Ghali (2021)(17)	MRI	100% sensitivity in superficial infections; lower performance in deep spaces	Limited evaluation of deep spaces
Macedo Costa (2023) (18)	CT	Prediction of hospitalization; successful drainage rate: 45%	Operator dependency; interference from bone/air

The abbreviations used in this table include: MRI, magnetic resonance imaging; CT, computed tomography; I&D (incision and drainage), surgical incision and drainage; POCUS (point-of-care ultrasound), ultrasound performed at the bedside for immediate evaluation; MHz (megahertz), a unit of ultrasound frequency associated with image resolution and tissue penetration; and Doppler, an ultrasound modality used to assess blood flow. The term "histopathology" refers to the microscopic analysis of tissues used as a diagnostic gold standard. The expression "clinical examination" corresponds to an assessment based on signs and symptoms without advanced imaging support. The abbreviation "vs" is used to indicate comparison between diagnostic or therapeutic methods.

DISCUSSION

This scoping review assessed the available scientific evidence regarding the use of ultrasonography in oromaxillofacial infections (OMFI) and its diagnostic and therapeutic applications. No recent reviews addressing this topic were identified. The findings indicate that ultrasonography represents a relevant tool in the management of maxillofacial infections, with both diagnostic and therapeutic applications across various clinical settings. Its use is primarily concentrated in the evaluation of infections of odontogenic origin and superficial anatomical spaces, where it supports clinical decision-making and the planning of minimally invasive interventions. Additionally, its implementation in acute care settings, including the use of point-of-care ultrasound (POCUS), reflects a growing trend toward its integration into the initial assessment of patients with infectious involvement. However, the clinical utility of ultrasonography is influenced by inherent technical limitations and the relatively limited number of available studies, which restricts the ability to draw definitive conclusions regarding its comparative performance and its impact on clinical outcomes in patients with maxillofacial infections.

Regarding its diagnostic role, ultrasonography has been described as a useful tool for differentiating cellulitis from abscesses (38), as well as for assessing the extent of soft tissue infections (29). This diagnostic capability is explained by its high resolution in superficial structures and its ability to provide real-time imaging (39), allowing for the identification of purulent collections, inflammatory changes, and relevant anatomical relationships. However, the diagnostic performance of ultrasonography varies depending on the type of infection and anatomical location (17), being more consistent and reliable in superficial infections than in those involving deep spaces (40). This limitation in the evaluation of deep spaces is mainly associated with interference from bony structures, such

as the mandible, and the presence of air, which restrict ultrasound wave penetration and hinder visualization of deeper anatomical planes (41).

From a therapeutic perspective, ultrasonography has demonstrated utility as a guidance tool in minimally invasive procedures, particularly in the percutaneous drainage of abscesses (15). Its use enables more precise localization of purulent collections, optimizing procedural planning and reducing the risk of injury to vascular or neural structures (42). Furthermore, real-time imaging facilitates better procedural control and reduced invasiveness (43), which may contribute to decreasing the need for more extensive surgical interventions and the use of general anesthesia in selected cases (32).

When compared with other imaging modalities, such as computed tomography (CT) and magnetic resonance imaging (MRI), the main advantages of ultrasonography are its accessibility, low cost, and absence of ionizing radiation (16,18). These characteristics make it an attractive alternative in resource-limited settings or in clinical scenarios requiring rapid assessment (28). However, unlike CT, which remains the reference standard for the evaluation of deep infections and their extent (44), ultrasonography has limitations in providing a comprehensive characterization of the affected anatomy (45), restricting its use as a standalone modality in complex cases. In this context, ultrasonography appears to have a complementary rather than substitutive role, particularly in the assessment of deep or cervically extended infections.

Although this review did not identify evidence regarding the use of cone-beam computed tomography (CBCT) in maxillofacial infections, its application in dental practice remains relevant, particularly for the evaluation of dentomaxillofacial structures (46). However, its utility is limited in the characterization of soft tissues and in the

assessment of deep head and neck spaces (47), thereby restricting its use in severe infections. In contrast, computed tomography (CT) provides a comprehensive evaluation of the extent of infectious processes, including the involvement of deep anatomical spaces and potential airway compromise (44,45), establishing it as the imaging modality of choice for severe maxillofacial infections. In this context, these imaging modalities should not be regarded as mutually exclusive but rather as complementary components of a stepwise imaging approach. CBCT is primarily intended for the evaluation of dentomaxillofacial and osseous structures; ultrasonography provides real-time dynamic assessment of superficial soft tissues and facilitates image-guided minimally invasive procedures; whereas CT is reserved for the comprehensive evaluation of extensive infections with potential deep fascial space and cervical involvement.

An additional relevant finding of this review is the increasing use of POCUS, especially in emergency settings and in patients with systemic involvement (37). This modality enables rapid and dynamic assessment, facilitating real-time clinical decision-making (36-37). However, its implementation largely depends on the operator's level of training, introducing an important source of variability in imaging results. Operator dependency has been consistently reported as a limitation (37), highlighting the need for standardized training programs and the incorporation of specific ultrasonography competencies into clinical practice in maxillofacial surgery (37).

From a clinical perspective, ultrasonography should be considered a first-line tool in patients with suspected superficial infections, particularly when there is uncertainty in differentiating cellulitis from abscess or when image-guided drainage procedures are being planned. Its availability, absence of ionizing radiation, and ability to

provide immediate assessment make it a particularly useful alternative in emergency departments and resource-limited settings. However, computed tomography remains indispensable when deep fascial space involvement, cervical extension, airway compromise, or the need for a comprehensive anatomical assessment for surgical planning is suspected. Consequently, ultrasonography and computed tomography should not be regarded as mutually exclusive techniques, but rather as complementary imaging modalities whose use should be individualized according to the location of the infection, the clinical severity of the patient, and the diagnostic information required.

The variability among the studies included in the present review constitutes one of the main limitations for building robust evidence, with differences observed in methodological designs, sample sizes, studied populations, clinical indications, ultrasonographic protocols, and evaluated parameters. In addition, the diversity of comparator methods and the absence of standardized diagnostic criteria and outcome measures hinder comparisons across studies and limit the reproducibility of the findings. Most of the available investigations were single-center studies with a limited number of participants, highlighting the need for prospective multicenter studies to validate the diagnostic and therapeutic performance of ultrasonography across different clinical scenarios. Likewise, the available evidence regarding operator training and certification remains limited, despite operator dependency being one of the most frequently reported limitations. Finally, no studies were identified that evaluated the cost-effectiveness of ultrasonography compared with other imaging modalities, an aspect that may be critical for its implementation at different levels of healthcare. In this context, ultrasonography should be considered a complementary tool within the diagnostic and therapeutic process of maxillofacial infections, while future research should focus on the development of

standardized ultrasonographic protocols, operator training programs, and multicenter studies aimed at establishing more precisely its clinical utility and its impact on patient outcomes.

In conclusion, ultrasonography represents a relevant clinical tool in the management of maxillofacial infections, with consistently reported diagnostic and therapeutic applications in the literature. Its use allows for the evaluation of soft tissue infections, differentiation between cellulitis and abscesses, and guidance of minimally invasive procedures, with greater utility observed in superficial infections and acute care settings. However, variability among the included studies in terms of design, populations, diagnostic criteria, technical parameters, and outcomes limits the ability to establish robust comparisons or accurately define its performance relative to reference methods. Furthermore, its lower performance in deep space infections and its operator dependency represent significant limitations for clinical application. In this context, ultrasonography is best positioned as a complementary tool within the diagnostic and therapeutic process. Its integration into clinical practice may optimize decision-making and reduce the need for more invasive interventions in selected scenarios. Nevertheless, its clinical value and impact on patient outcomes should be confirmed through well-designed clinical studies with standardized methodologies.

DECLARATIONS

AUTHOR CONTRIBUTION STATEMENT: Conceptualization and study design, C.L.A.A. and A.H.R.; literature review, C.L.A.A. and I.B.O.; formal analysis, C.L.A.A. and A.H.R.; investigation and data collection, C.L.A.A. and I.B.O.; data analysis and interpretation, C.L.A.A., I.B.O., and A.H.R.; drafting of the original manuscript, C.L.A.A., I.B.O., and A.H.R.; review and editing, C.L.A.A., I.B.O., R.M.C., and A.H.R.; supervision, A.H.R.

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