

Oral and Maxillofacial Effects of Chronic Cocaine Use: A Systematic Review *

Efectos orales y maxilofaciales del consumo crónico de cocaína: revisión sistemática

Efeitos orais e maxilofaciais do uso crônico de cocaína: uma revisão sistemática

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ABSTRACT

Background: Cocaine abuse produces severe oral and maxillofacial damage, yet these manifestations are often underrecognized in clinical practice. **Purpose:** To analyze and synthesize current evidence on the oral and maxillofacial abnormalities associated with cocaine use. **Methods:** This systematic review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The protocol was registered in the International Prospective Register of Systematic Reviews (CRD42024583820). A comprehensive search of articles published from 2019 to 2024 was performed in the following databases: EBSCOhost, ScienceDirect, PubMed, LiLACS, and SciELO. Extracted data included: origin and terminology of cocaine, pharmacology, general symptomatology, oral and maxillofacial effects, medical–dental management, and dental management. **Results:** A total of 10,529 records were identified, of which 17 studies met the inclusion criteria. More than 80% of the selected articles were written in English. Several uncommon oral and maxillofacial complications were identified, such as retinal artery branch occlusion and cervicocephalic arterial dissection. **Conclusions:** The evidence indicates that cocaine use is associated with a wide spectrum of oral and maxillofacial manifestations, including rare vascular complications. Continued research is needed to deepen the understanding of these alterations and to explore potential adjunctive therapies in this population.

Keywords: cocaine; dental pharmacology; dentistry; disease attributes; maxillofacial abnormalities; oral abnormalities; oral health; toxicology

RESUMEN

Antecedentes: El consumo de cocaína produce daños orales y maxilofaciales graves; sin embargo, estas manifestaciones a menudo no se reconocen adecuadamente en la práctica clínica. **Objetivo:** Analizar y sintetizar la evidencia actual sobre las

anomalías orales y maxilofaciales asociadas al consumo de cocaína. **Métodos:** Esta revisión sistemática se realizó siguiendo las directrices PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses). El protocolo se inscribió en el Registro Internacional Prospectivo de Revisiones Sistemáticas (CRD42024583820). Se realizó una búsqueda exhaustiva de artículos publicados entre 2019 y 2024 en las siguientes bases de datos: EBSCOhost, ScienceDirect, PubMed, LiLACS y SciELO. Los datos extraídos incluyeron: origen y terminología de la cocaína, farmacología, sintomatología general, efectos orales y maxilofaciales, manejo médico-dental y manejo odontológico. **Resultados:** Se identificó un total de 10.529 registros, de los cuales 17 estudios cumplieron con los criterios de inclusión. Más del 80% de los artículos seleccionados estaban escritos en inglés. Se identificaron varias complicaciones orales y maxilofaciales poco comunes, como la oclusión de la rama de la arteria retiniana y la disección arterial cervicocefálica. **Conclusiones:** La evidencia indica que el consumo de cocaína se asocia con un amplio espectro de manifestaciones orales y maxilofaciales, incluidas complicaciones vasculares raras. Se necesita investigación continua para profundizar en la comprensión de estas alteraciones y explorar posibles terapias complementarias en esta población.

Palabras clave: anomalías maxilofaciales; anomalías orales; características de la enfermedad; cocaína; farmacología dental; odontología; salud bucal; toxicología

RESUMO

Antecedentes: O abuso de cocaína causa danos orais e maxilofaciais graves, porém essas manifestações são frequentemente subestimadas na prática clínica. **Objetivo:** Analisar e sintetizar as evidências atuais sobre as anormalidades orais e maxilofaciais associadas ao uso de cocaína. **Métodos:** Esta revisão sistemática foi conduzida seguindo as diretrizes do PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses). O protocolo foi registrado no Registro Internacional Prospectivo de Revisões Sistemáticas (CRD42024583820). Uma busca abrangente de artigos publicados entre 2019 e 2024 foi realizada nas seguintes bases de dados: EBSCOhost, ScienceDirect, PubMed, LiLACS e SciELO. Os dados extraídos incluíram: origem e terminologia da cocaína, farmacologia, sintomatologia geral, efeitos orais e maxilofaciais, manejo médico-odontológico e manejo odontológico. **Resultados:** Um total de 10.529 registros foram identificados, dos quais 17 estudos atenderam aos critérios de inclusão. Mais de 80% dos artigos selecionados foram escritos em inglês. Várias complicações orais e maxilofaciais incomuns foram identificadas, como oclusão de ramo da artéria retiniana e dissecção arterial cervicocefálica. **Conclusões:** As evidências indicam que o uso de cocaína está associado a um amplo espectro de manifestações orais e maxilofaciais, incluindo complicações vasculares raras. Pesquisas adicionais são necessárias para aprofundar a compreensão dessas alterações e explorar potenciais terapias adjuvantes nessa população.

Palavras-chave: anormalidades maxilofaciais; anormalidades orais; atributos da doença; cocaína; farmacologia dentária; odontología; saúde bucal; toxicología

INTRODUCTION

Cocaine, chemically known as benzoylmethylecgonine, is a local anesthetic, an effective vasoconstrictor, and a powerful stimulant of the central nervous system. This substance is obtained from the leaves of the *Erythroxylum coca* shrub (1). It is a topic of great interest that needs to be updated, especially in relation to the oral environment. In Ecuador, the first anniversary of the elimination of the drug consumption guidelines, implemented in 2013 and repealed in 2023, is approaching. Therefore, this psychoactive substance has a significant presence in the country, as well as throughout the world (2).

The last official report on drug use in Ecuador dates back to 2016 and indicates that 30% of the university students surveyed had used illicit drugs (2). However, there was no explicit data on how many people use specific drugs. In most countries, the use of illicit drugs is penalized. However, some countries or states are considering legalization or have already decriminalized drug use. There are even states, such as Oregon in the United States, which have recriminalized drug possession, including cocaine, due to the increase in overdoses (3).

The lack of data on cocaine consumption affects evidence-based policies provided by the United Nations, which is why we must be adequately informed about this drug. Despite its limited medical uses, the most notable aspects are the devastating oral and maxillofacial consequences of its abuse, which not only diminish the quality of life of users but also impose an additional burden on the public health system (4).

The World Health Organization indicates that oral diseases are among the most common pathologies, with reliable data showing the high frequency and severity of oral and dental trauma, especially in several Latin American countries such as Ecuador, where approximately three million people have used illegal drugs, with cocaine being one of the most prevalent. This consumption produces visible manifestations, with palatal lesions being the most common. The use of this substance is influenced by a social context and economic factors, leading to public health problems due to the systemic alterations and behavioral consequences among the users. In addition, there are physical problems such as cardiac complications, respiratory depression, hepatic cirrhosis, and nephropathy. It is important to consider the oral changes that occur, such as xerostomia, changes in salivary flow, dental erosion, atypical caries, tooth loss, and gingival problems, as well as causing severe orofacial effects such as perforation of the nasal septum and palate, changes in the sense of smell, and chronic sinusitis. Therefore, it is crucial that dentists identify cocaine use as a causal factor in various oral and maxillofacial alterations, which would allow for the development and implementation of appropriate public health policies (5).

Regular cocaine use is widely associated with severe oral and maxillofacial manifestations. Intense and repeated vasoconstriction, along with direct chemical irritation, can lead to xerostomia, salivary flow disturbances, dental erosion, atypical caries, tooth loss, ulcerative gingivitis, and necrotizing periodontitis. In advanced cases, nasal septum and hard palate perforations, chronic sinusitis, olfactory dysfunction, and osteonecrosis of the maxilla have been reported. These conditions significantly impair the user's quality of life and place a considerable burden on healthcare systems (4). In Latin American countries, where cocaine use is prevalent, these lesions represent a frequent clinical challenge (6).

This study aimed to identify the most frequent oral and maxillofacial manifestations associated with cocaine use, as reported in the scientific literature. This includes harmful oral and maxillofacial effects and medical uses. Therefore, it was considered appropriate to review the scientific literature on this topic in various scientific databases in order to establish an informed basis for future research.

MATERIALS AND METHODS

This systematic review was registered with the number CRD42024583820 in the International Prospective Register of Systematic Reviews (PROSPERO) with the registration number (CRD42024583820). The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement was used to guide the reporting of the methodology and results (7). A systematic review was chosen over a scoping review because the main purpose was to identify, analyze, and critically synthesize the available evidence, with an emphasis on oral and maxillofacial manifestations associated with cocaine use that are less documented in the recent literature. A scoping review would have been appropriate for mapping the breadth of the topic; however, the article selection process was more rigorous, the evaluation of the findings was detailed, and a precise time frame was established, all of which are characteristics of a systematic review. Although previous reviews exist on the oral consequences of cocaine use, most publications do not include studies published after 2019, nor do they emphasize the atypical vascular, neurological, and maxillofacial manifestations reported in recent years. This review contributes new information by updating the available evidence and identifying emerging effects that have been previously underreported, thus providing a more contemporary and clinically relevant synthesis.

The review was limited to publications between 2019 and 2024, in English and Spanish, in order to reflect the most recent and relevant evidence on the oral and maxillofacial effects of cocaine use. This time restriction allowed for the capture of emerging manifestations and recent clinical findings, complementing previous reviews published before 2019. Potential language bias was assessed descriptively, showing that more than 80% of the included articles were in English. No meaningful differences were identified in the evidence presented in English and Spanish.

Studies published between 2019 and 2024, written in Spanish or English, which described oral or maxillofacial manifestations in humans associated with chronic or acute cocaine use, regardless of the route of administration, were included. Observational studies (case reports, case series, cross-sectional studies, cohort studies, or case-control studies) that provided relevant clinical, diagnostic, or therapeutic information related to the alterations induced by this substance were considered eligible. Studies conducted in animal models, *in vitro* research, narrative or systematic reviews, book chapters, editorials, letters to the editor without clinical data, incomplete reports, studies evaluating substances other than cocaine or in combination without being able to attribute the effects specifically to cocaine, articles whose full text was not available, and publications in languages other than Spanish or English were excluded.

Search Strategy

The search strategy included only indexed articles. Specific bibliographic databases were consulted: PubMed/MEDLINE, LILACS, SciELO, and the databases hosted within EBSCOhost (Academic Search Complete and Dentistry & Oral Sciences Source). For ScienceDirect, only its search engine was used to identify articles within Elsevier's repository, and it was not considered an independent database. No search of grey literature (theses, repositories, conference proceedings, or preprints) was conducted because the review focused exclusively on studies published in indexed journals. The authors acknowledge that excluding grey literature may introduce publication bias, but quality and traceability of the included studies were prioritized.

Only studies published in English and Spanish were included. More than 80% of the included articles were written in English. The search strategy was developed using MeSH/DeCS terms and keywords. These terms were combined using the Boolean operators OR and AND. The syntax was adapted to each database. The complete strategies applied to each source are presented below to ensure reproducibility of the process.

PubMed: ("Cocaine"[MeSH Terms] OR "Cocaine-Related Disorders"[MeSH Terms]) AND ("Mouth Diseases"[MeSH Terms] OR "Oral Manifestations"[All Fields] OR "Maxillofacial Injuries"[MeSH Terms]) AND ("2019/01/01"[Date - Publication] : "2024/07/31"[Date - Publication])

ScienceDirect: "cocaine" AND ("oral manifestations" OR "oral lesions" OR "maxillofacial lesions") AND (2019–2024)

EBSCOhost: (cocaine OR "cocaine abuse") AND ("oral cavity" OR "mouth" OR "maxillofacial region") AND ("lesions" OR "manifestations")

LILACS: (MH:cocaína OR "uso de cocaína") AND (MH:"enfermedades de la boca" OR "manifestaciones orales" OR "lesiones maxilofaciales")

SciELO: "cocaína" AND ("lesiones orales" OR "lesiones maxilofaciales" OR "manifestaciones bucales") AND (año_publicación:[2019 TO 2024])

Two researchers (G.A.M.V. and A.E.G.G.) independently screened the titles and abstracts of the identified studies. They selected those that met the eligibility criteria. They then assessed the full text of the selected studies to confirm alignment with the study purpose. Any disagreements were resolved by consensus among all authors.

In accordance with the PECO framework (Population, Exposure, Comparison, and Outcomes), the question components guided the eligibility criteria for the final inclusion of studies. The review question was: "What are the less frequently documented oral and maxillofacial manifestations in patients exposed to chronic or acute cocaine use, compared with the alterations most commonly described in the literature?"

TABLE 1
Systematization of the Articles Included in the Review

Author(s)	Study Type	Signs and Symptoms	Main Findings	Conclusions
Molina <i>et al.</i> (1)	Case-control study	Squamous cell carcinoma	Associated with the habit of chewing coca	Useful for early diagnosis, which is critical to prevent malignant transformation
Costa <i>et al.</i> , (8)	Cross-sectional descriptive	Cerebral vasospasm, increased endothelin-1	Higher risk of cerebrovascular accidents due to vasospasm and elevated endothelin-1	Allows identification of at-risk patients through diagnostic testing
Maldjian (9)	Case report	Frontoethmoidal mucocele, nasal scarring	Nasal distortion is observed due to chronic cocaine abuse	Need for urgent surgical intervention
Tonelli <i>et al.</i> , (10)	Case report	Trigeminal neuralgia, adenoid carcinoma	Palatal lesion due to chronic cocaine use	Timely diagnosis is required
Arisi <i>et al.</i> , (11)	Case report	Erosive lesions in the oral and nasal mucosa	Pemphigus vulgaris due to chronic cocaine inhalation	Severe systemic implications related to chronic use
Paradisi & Cabrero (12)	Case report	Palatal perforation due to chronic use	Severe functional perforation with aesthetic implications	Surgical interventions required
Alsarhani <i>et al.</i> , (13)	Case report	Visual alterations, blurred vision	Severe retinal artery occlusion due to cocaine use	Early evaluation is necessary to prevent complications
Pendela <i>et al.</i> , (14)	Case report	Severe ocular infection, compromised vision	Severe infectious agents associated with cocaine use	Urgent medical intervention is required to prevent vision loss
Fakin <i>et al.</i> , (15)	Case report	Bilateral necrosis, vascular alterations	Severe necrosis due to the combination of cocaine and levamisole	Need for immediate medical evaluation
Rampi <i>et al.</i> , (16)	Case report	Palatal perforation, oronasal reflux	Severe palatal damage due to vasoconstriction	Specialized surgical procedures are required
Puebla <i>et al.</i> , (17)	Case report	Ulcer on the dorsum of the tongue	Associated with chronic cocaine and marijuana use	Prevention through early differential diagnosis
Trimarchi <i>et al.</i> , (18)	Case report	Palatal carcinoma, erosive progression	Progressive lesion associated with chronic cocaine use	Constant monitoring in patients with chronic use
Berberi & Azar (19)	Case report	Palatal perforations	Severe midline complications induced by chronic cocaine use	Need for reconstruction with advanced techniques
Curvy <i>et al.</i> , (20)	Cross-sectional study	Oral lesions, crack and cocaine use	Severe lesions caused by crack and cocaine consumption	Prevention through education and timely diagnosis
Pontes <i>et al.</i> , (21)	Case report	Necrotic lesion in the palate	Severe vasoconstriction and changes in salivary flow associated with cocaine	Need for early diagnosis to enable interventions
Ferrera <i>et al.</i> , (22)	Case report	Infant intoxication	Exposure to cocaine abuse in the context of child maltreatment	Need for prevention in these vulnerable scenarios
Trevisan <i>et al.</i> , (23)	Experimental study	Changes in cortical morphology	Brain alterations related to chronic cocaine use	Implications for neurobiology research

Two reviewers independently selected the studies. To assess inter-rater agreement, a random subsample of 10% of the identified records was used for title and abstract screening, and a subsample of 20 articles was used for the full-text stage. Agreement was substantial, with a κ coefficient of 0.82 (95% CI: 0.74–0.89) for titles and abstracts, and $\kappa = 0.87$ (95% CI: 0.78–0.94) for full-text assessment. Any discrepancies between reviewers were resolved by consensus.

Ethical Considerations

This systematic review was based exclusively on published literature. Therefore, it did not pose risks to participants and did not require informed consent. All stages were conducted in accordance with the principles of scientific integrity and good practices in documentary research.

RESULTS

Seventeen studies addressing oral and maxillofacial manifestations associated with cocaine use were included. These comprised case reports, case series, case-control studies, and cross-sectional studies. Data were extracted on methodological design, population characteristics, route of use, clinical manifestations, associated complications, and duration of evolution, when reported.

Palatal Lesions and Midline Perforations

The most frequently reported manifestation in case reports and case series was palatal necrosis, often accompanied by midline perforations. These findings were consistently associated with the vasoconstrictive effect of cocaine, particularly in chronic intranasal users. The cases showed variable degrees of tissue destruction, ranging from extensive ulceration to an evident oronasal communication.

Ulcerative Lesions and Neoplastic Entities

Some case-control studies and case series described squamous cell carcinoma in chronic users. These studies linked it to repeated microtrauma, chemical irritation, and prolonged exposure to adulterant substances. Other non-malignant ulcerative lesions were also reported, but less frequently.

Cocaine-Induced Midline Destructive Lesions (CIMDL)

Several studies reported findings consistent with cocaine-induced midline destructive lesions (CIMDL). They are characterized by progressive destruction of the nasal septum, the hard palate, and adjacent tissues. Severity and anatomical extent varied across studies. However, most reports came from case series.

Vascular and Ocular Complications

Severe vascular complications were identified in individual studies, such as occlusion of a retinal arterial branch and vision loss secondary to vascular injury or, occasionally, polymicrobial infection. Although less frequent, these manifestations highlight the systemic and local effects of cocaine on highly vascularized tissues.

Mucosal Lesions and Simulated Autoimmune Diseases

Some cases described lesions resembling pemphigus vulgaris or extensive erosive mucosal disease. These findings suggest that chronic use may trigger or mimic autoimmune conditions in the buconasal region.

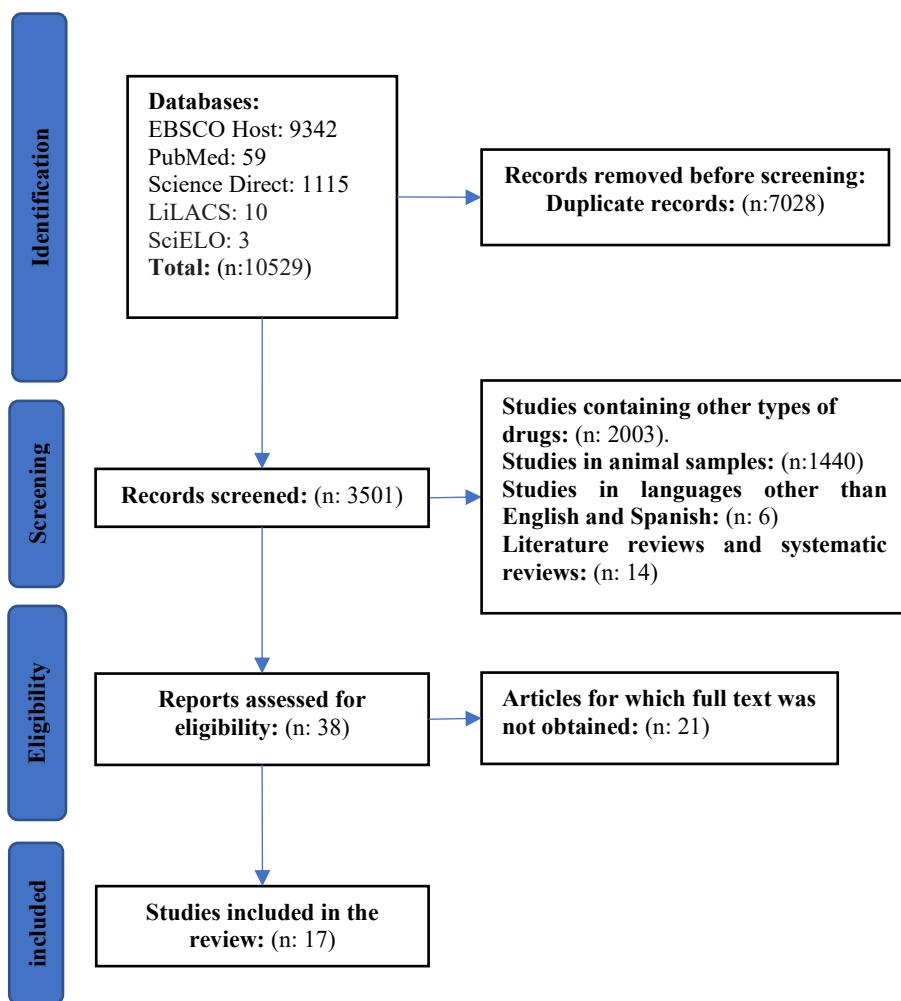


FIGURE 1

Flow diagram of study selection following the Preferred Reporting Items for Systematic Reviews (PRISMA) statement

DISCUSSION

The findings of this systematic review show that oral and maxillofacial manifestations associated with cocaine use encompass a broad spectrum of destructive, inflammatory, and vascular lesions. The available evidence is derived mainly from case reports and case series. This limits the ability to establish causal relationships and reduces the generalizability of the results. Nevertheless, these study designs provide valuable clinical information on the diversity of presentations and patterns of damage observed in chronic users.

Palatal Lesions and Midline Destruction

The most consistently documented manifestation was ischemic palatal lesions, including necrosis and midline perforations. Most of the evidence came from case series, which provides a limited level of certainty. Even so, the recurrence of this pattern across multiple reports suggests a clinical association between intranasal cocaine use and severe tissue damage. Geographic differences were minimal because cases were reported mainly in Europe and North America. This highlights a major information gap in Latin America (10,12,15,16,18, 19,21).

Ulcerative Lesions and Pseudoneoplastic Findings

Some case-control studies and case series described chronic ulcerative lesions and even squamous cell carcinoma, associated with chemical irritation and repetitive microtrauma. Given the level of evidence, these studies do not allow a causal relationship to be established. However, they underscore the need to rule out malignancy in persistent lesions among chronic users. The variety of routes of use (intranasal, smoked, chewed) may modulate lesion location and severity, but the evidence is insufficient to define comparative patterns (1).

Cocaine-Induced Midline Destructive Lesions

The literature also reports findings consistent with CIMDL. Although the included studies were exclusively case reports and case series, a reproducible clinical pattern of progressive destruction of the nasal septum, the hard palate, and adjacent structures is observed. Methodologically, these publications lack control groups. This prevents differentiation of the roles of adulterants, comorbidities, or concomitant infections (9).

Vascular and Ocular Complications

A limited set of reports described vascular complications, such as retinal arterial occlusion or infectious ocular injury. Although these manifestations were infrequent, they highlight the potential severity of chronic use. However, the lack of robust analytical studies prevents the identification of differential risk factors according to route of administration or patterns of use (8,15).

Variability in Design and Methodological Quality

Overall methodological quality was heterogeneous. The predominance of descriptive studies implies that:

- The strength of evidence is low.
- It is not possible to determine the true incidence or to quantify relative risks.
- Comparisons across routes of use or across regions are speculative.

Moreover, the lack of Latin American research limits the contextual applicability of the findings. Cultural differences, adulteration patterns, and access to health services may influence clinical presentation. Therefore, local studies with greater methodological rigor are needed.

Clinical Implications

The reviewed studies coincide that cases are often diagnosed late due to their similarity to other necrotizing or infectious conditions. This implies that clinicians should consider substance use in the differential diagnosis of rapidly progressive destructive lesions. Any specific clinical recommendation can only be derived from what the studies report. However, these studies rarely include treatment follow-up, which limits the ability to propose evidence-based protocols. Therefore, operative, restorative, or surgical measures should be framed as part of future clinical recommendations rather than as conclusions derived from this review.

Future Research Needs

The findings reveal multiple knowledge gaps:

- There is a lack of analytical studies that allow estimation of relative risk according to patterns of use.
- There is also scarce research in Latin American countries, where use and its effects may differ due to socioeconomic context.
- In addition, there is a lack of longitudinal studies to assess clinical progression and response to interventions.
- Interdisciplinary protocols and evidence-based preventive strategies need to be defined.
- Future, better-designed studies will enable more precise guidance for clinical decisions and public health policies.

Limitations

This review has several limitations that should be considered when interpreting the results. First, there is a language bias because only studies published in English and Spanish were searched. This may have excluded relevant evidence published in other languages. Likewise, time-range bias may have limited the retrieval of older reports describing important clinical manifestations associated with cocaine use.

Another limitation relates to the scope of the selected databases. Although broad platforms were used, excluding grey literature (such as theses/dissertations, institutional reports, or non-indexed communications) reduces the likelihood of identifying relevant cases, particularly in regions where formal publication is limited. In addition, the review was affected by the lack of access to some full texts, which may have restricted the inclusion of pertinent studies.

The available evidence was characterized by marked heterogeneity in study designs, with a predominance of case reports and case series and an almost complete absence of analytical or longitudinal studies. This limits the ability to establish robust associations, assess comparative risks across routes of use, and generalize findings to broader populations. In addition, variability in methodological quality, lack of uniformity in diagnostic criteria, and geographic and clinical differences among the included studies affect the consistency of the results.

Taken together, these limitations restrict the generalizability of the findings and underscore the need for studies with more robust methodologies, standardized criteria, and greater regional representativeness. This would strengthen the available evidence on oral and maxillofacial manifestations associated with cocaine use.

CONCLUSIONS

The findings of this review indicate that, in addition to the oral and maxillofacial manifestations widely described in the literature—such as xerostomia, atypical caries, periodontal disease, dental erosion, and perforations of the nasal septum or palate—there are less frequently documented but clinically relevant effects in chronic or acute cocaine users. These include atypical bone necrosis, pseudotumoral lesions, complicated chronic sinusitis, advanced oronasal communications, and findings consistent with CIMDL. These manifestations may progress rapidly and compromise orofacial function.

RECOMMENDATIONS

Based on the findings of this review, the following research lines and actions are suggested to deepen knowledge about oral and maxillofacial manifestations associated with cocaine use:

- **Population studies and longitudinal cohorts:** Evaluating the incidence and progression of oral and maxillofacial lesions in different consumer populations, considering frequency, duration, and route of consumption.
- **Diagnostic standardization:** Implementing uniform protocols for the classification and recording of clinical manifestations, allowing for comparisons between studies and greater reproducibility.
- **Characterization based on routes of administration:** Analyzing clinical differences between inhalation, ingestion, and crack use, including specific risk factors and complications.
- **Collaborative and multidisciplinary research:** Integrating dentists, maxillofacial surgeons, otolaryngologists, and other specialists to comprehensively address the observed complications.
- **Bibliometric studies:** Conducting analyses of co-authorship networks, terms, and publication trends, with the aim of identifying knowledge gaps and authors or regions with the highest scientific output in the field.

These recommendations aim to guide future research and improve the clinical, epidemiological, and preventive understanding of the impact of cocaine use on oral and maxillofacial health.

Authors' Contributions and Roles

G.A.M.V. and A.E.G.G. were responsible for idea generation, data collection, and analysis. J.A.N.I. was in charge of data interpretation. J.L.N.S. drafted the manuscript. G.A.L.T. and G.N.T.T. critically reviewed the manuscript in accordance with the PRISMA 2020 checklist. All authors approved the final version for publication and are available to address any aspect of the manuscript.

Declaration of Conflicts of Interest

The authors declare that they have no conflict of interest in relation to this scientific article.

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