REVIEW ARTICLE

ORAL MANIFESTATIONS ASSOCIATED WITH COVID-19

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| Received May 06, 2022 | | Accepted June 18, 2023 | | Published June 21, 2023 | | ID Article | Sofia-Ref9-6-16ajiras060623 |

Abstract

Introduction: Coronavirus infection is a viral disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). In addition to general symptoms, various degrees of oral manifestations have been reported, including loss of taste, aphthous lesions, recurrent herpes virus infections, and ulcerations. **Objective**: This study aims to provide an overview of the different oral manifestations of COVID-19 described in the literature, along with their prevalences. **Materials and Methods:** A comprehensive literature search was conducted using five search engines (PubMed, Cochrane Library, Ebsco, Science Direct, and Google Scholar), following predefined inclusion and exclusion criteria. The retrieved articles were meticulously screened by reading the titles, abstracts, and full texts. **Results**: Our review included 11 publications out of a total of 1634 articles selected through the electronic search. The findings indicate that altered taste, xerostomia, and ulcers were the most common oral manifestations among COVID-19 patients. The tongue, palate, buccal mucosa, and lips were the most frequently affected locations for lesions caused by coronavirus infection. **Conclusion**: Patients with COVID-19 frequently experience oral manifestations such as taste impairment, xerostomia, and oral ulcers. However, it is important to note that these manifestations are not specific to COVID-19, as they can also be caused by other factors such as stress, reduced immunity, medication use, poor oral hygiene, and more. High-quality studies are required to confirm the potentially controversial association between oral lesions and COVID-19.
***Keywords**: Oral manifestations, COVID-19, SARS-CoV-2.*

1. INTRODUCTION

The coronavirus disease 2019 (COVID-19), caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [1], originated in Wuhan, China in December 2019. Since then, it has become a global health crisis with significant social and economic consequences, resulting in 668.7 million confirmed cases and 6.7 million deaths worldwide as of January 23, 2023 [1]. In Morocco, there have been 1.27 million confirmed cases and over 16,300 deaths in the same period [2].

The primary transmission of this disease is believed to occur from bats, which serve as a potential intermediate host for the virus, allowing for mutations that enable its infection in humans. Despite the development of various vaccines to target the viral attachment to host receptors, the number of infected individuals continues to rise due to the lack of effective treatments, inadequate vaccine production and distribution, and the emergence of mutant strains that can diminish the efficacy of existing vaccines [3].

Patients diagnosed with COVID-19 commonly experience symptoms ranging from mild to severe, including fever, cough, and fatigue. In severe cases, the virus can obstruct the pulmonary airways, leading to pneumonia, cytokine storm, and acute respiratory distress syndrome [1-4–6].

Apart from the general symptoms, various oral manifestations have been reported in COVID-19 cases. These manifestations include loss of taste, aphthous ulcers, recurrent herpes virus infections, ulcerations, necrotizing gingivitis, erythematous lesions, and salivary gland infections [4]. The disappearance of these oral manifestations corresponds with the recovery from COVID-19, suggesting a potential association between viral infection and oral clinical manifestations [4].

The objective of this study is to provide a comprehensive overview of the different oral manifestations of COVID-19 described in the existing literature, along with their respective prevalences.

2. MATERIALS AND METHODS

2.1 Search strategy

The literature search process to identify relevant articles for this comprehensive review involved several meticulous steps. Initially, an electronic search was conducted using five prominent search engines, namely PubMed, Cochrane Library, Ebsco, Science Direct, and Google Scholar. The search strategy employed a combination of specific keywords derived from the Medical Subject Headings (MeSH) terms. The keywords used for the search included "Oral Manifestations," "COVID-19," and "SARS-CoV-2."

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By utilizing this comprehensive approach, we aimed to ensure a thorough exploration of the available literature pertaining to the oral manifestations of COVID-19. The selected search engines were chosen for their extensive coverage of scientific publications, encompassing a wide range of medical and dental research.

This systematic search strategy helped to identify relevant articles from various sources, including peer-reviewed journals, conference proceedings, and other scholarly publications. The use of MeSH terms in the search helped to refine the results and ensure the inclusion of articles specifically related to the oral manifestations of COVID-19.

The electronic search was carried out with careful consideration of predefined inclusion and exclusion criteria, which helped to maintain the relevance and scientific rigor of the articles included in the review. The screening process involved reading the titles, abstracts, and full texts of the retrieved articles, ensuring that only those meeting the specific criteria were selected for further analysis.

By employing this rigorous literature search methodology, we aimed to compile a comprehensive and scientifically robust overview of the various oral manifestations of COVID-19 reported in the existing literature. This approach ensures the inclusion of high-quality studies and provides a reliable foundation for the findings and conclusions of this review.

2.2 Inclusion criteria

This comprehensive review encompassed publications from 2019 to 2022, ensuring a comprehensive analysis of the relevant literature. The review included publications in both English and French languages to capture a broader range of studies and enhance the inclusiveness of the analysis.

The search process encompassed various study designs, including randomized controlled clinical trials and non-randomized studies. This approach aimed to incorporate a diverse range of research methodologies to provide a well-rounded assessment of the topic. Furthermore, systematic reviews and meta-analyses were included to examine the existing evidence comprehensively and synthesize findings from multiple studies.

Observational studies, such as cohort studies and case-control studies, were also incorporated into the review. These types of studies provide valuable insights into real-world scenarios and help identify potential associations between oral manifestations and COVID-19. By including observational studies, the review aimed to consider a wide range of study designs and their respective contributions to the overall understanding of the topic.

Importantly, this review focused on studies involving human subjects. By emphasizing research conducted on humans, we aimed to provide insights and recommendations relevant to clinical practice and patient care. This focus ensures that the findings of this review can directly inform healthcare professionals and contribute to evidence-based decision-making.

By incorporating studies from various years, languages, study designs, and focusing on human subjects, this comprehensive review aims to provide a thorough and well-rounded analysis of the different oral manifestations of COVID-19 reported in the existing literature.

2.3 Exclusion criteria

In this review, specific criteria were applied to select relevant studies for inclusion while excluding studies that did not meet certain criteria. Studies where COVID-19 positivity was not confirmed were excluded to ensure the focus remained on the oral manifestations specifically related to COVID-19. This criterion aimed to maintain the relevance and accuracy of the findings.

Furthermore, publications that were not available in full text were also excluded from the review. Access to full-text articles is crucial for a comprehensive analysis and understanding of the research conducted. By excluding publications without full text, we aimed to ensure the integrity and quality of the included studies.

Additionally, the review considered only publications that directly addressed the objectives of our work. This criterion ensured that the included studies aligned with the specific aims and research questions of the review. By focusing on studies that directly addressed the objectives, we aimed to enhance the coherence and relevance of the findings.

2.4 Article selection:

Following the removal of duplicate articles, each remaining article was independently reviewed by two reviewers. The screening process involved assessing the titles, abstracts, and full-text publications against pre-established inclusion and exclusion criteria. This systematic approach ensured that only relevant articles aligned with the objectives of the review were considered for further analysis.

To augment the search process, the reference lists of the selected articles were meticulously examined to identify additional studies that met the criteria for inclusion. This step aimed to ensure a comprehensive assessment of the available literature and minimize the possibility of overlooking relevant studies.

3. RESULTS

The literature search yielded a total of 1634 articles, out of which 1499 remained after removing duplicates. The titles of these articles were screened, resulting in the exclusion of 1334 articles. Following the initial screening, 165 articles were retained for further evaluation based on their abstracts. After reading the abstracts, only 60 articles met the inclusion criteria. Subsequently, the full texts of these 60 articles were carefully reviewed, leading to a further reduction to 29 articles. Finally, a critical evaluation of the quality and relevance of these articles was conducted, resulting in the inclusion of 11 articles in our review (Figure 1).

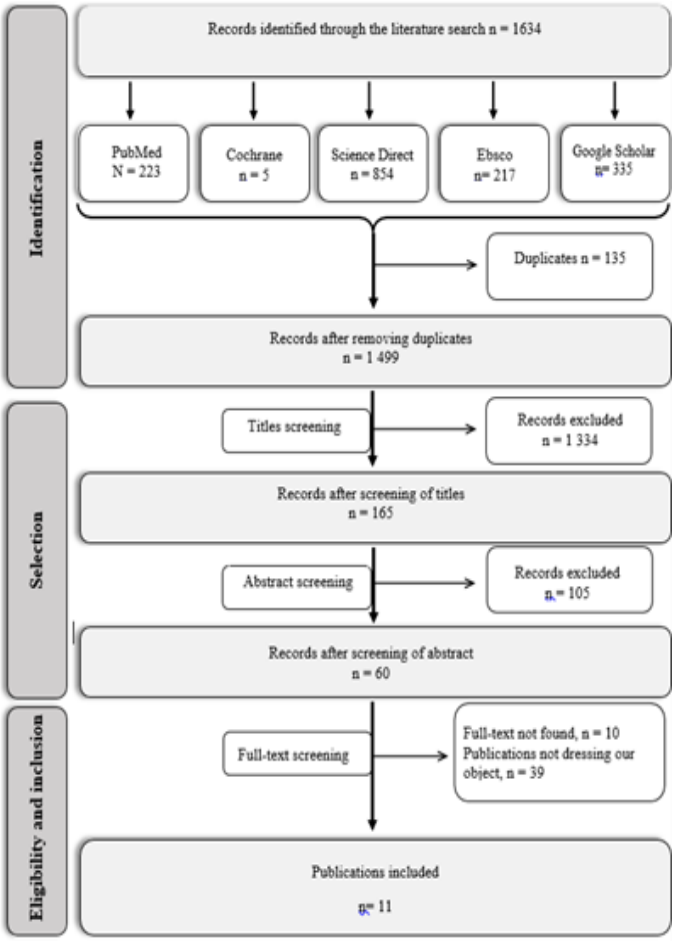

Figure 1: Literature review Flowchart.

The review included a diverse range of studies, consisting of 3 retrospective studies, 4 case series, 2 observational studies, 1 case report, and 1 cohort study. These studies were conducted in different countries across Asia, Europe, and America, involving participant groups ranging from 8 to 1256 individuals.

The selected studies examined various aspects of oral manifestations associated with COVID-19, encompassing a wide range of conditions such as periodontal diseases, xerostomia, altered taste, vascular lesions, vesiculobullous lesions, temporomandibular disorders, bruxism, dental lesions, and candidiasis. Among COVID-19 patients, altered taste, xerostomia, and ulcers were identified as the most common oral manifestations (refer to Table 1). Notably, the tongue, palate, buccal mucosa, and lips were frequently affected locations of lesions caused by coronavirus infection (refer to Table 2).

The studies revealed that older individuals with pre-existing health conditions and severe SARS-CoV-2 infection exhibited more extensive and severe oral cavity lesions that persisted beyond the acute phase of the infection. Additionally, gender differences were observed in the oral manifestations of COVID-19, as highlighted by the findings from these studies. Overall, the collection of studies included in the review provides valuable insights into the diverse oral manifestations associated with COVID-19, shedding light on the prevalence, location, and severity of these manifestations in different populations and contexts.

Table 1: The reported oral manifestations and their respective prevalence's.

The study	The reported oral manifestations	The prevalence (%)
Biadsee et al. [7]	Taste impairment	52
	Xerostomia and dysgeusia	More than 50
	Masticatory muscle pain	11
Sinjari et al. [1]	Xerostomia	30
	Impaired taste	25
	Burning sensation	15
	Difficulty in swallowing	20
Fantozi et al. [8]	Dysgeusia	59.5
	Xerostomia	49.5
Fidan et al. [9]	Aphthous-like ulcer	46.6
	Erythema	38.8
	Lichen planus	20.6
Subramanian et al.[6]	Ulcers mucositis	-
	Herpes Erythema Angulas cheilitis	-
	Geographic tongue	-
	Burning sensation	-
	Papillary atrophy	-
Amorim dos Santoset al. [10]	Gustatory disfucntion	-
	Hypogeusia	-
	Candidiasis	-
	Geographic tongue	-
Gherlone et al. [11]	Salivary gland extasia	38
	Dry mouth	30
	Masticatory muscle weekness	19
	Dysgeusia	17
	Anosmia	14
	Temporomandibular joint abnormalities	7
	Trigeminal neuralgia	2
Brandao et al. [12]	Dysgeusia	-
	Aphthous-like ulcers	-
	Hemorrhagic ulcerations	-
	Hepes	-
	Petechia	-
	Hyposmia	-
Rafalowicz et al. [13]	Discolorations,ulcerations and hemorrhagic changes	32
	Mycosis	29.69
	Aphthous-like lesions	25.79
	Cheilitis	12.5
	Salivary secretory disorders	60
Soares et al. [5]	Dysgeusia	-
	Anosmia	-
	Ecchymosis/petechia	-
	Vesiculobullous lesions	-
	Ulces	-
Bardellini et al. [14]	Hyperemic pharynx	37
	Taste alteration	11.1
	Pseudomembranous candidiasis	7.4
	Coated tongue	7.4
	Geographic tongue	307

Table 2: The oral sites most affected.

The studies	The oral sites	The Prevalence (%)
Fidan et al. [9]	Tongue	39.7
	Buccal mucosa	34.5
	Gengiva	18.9
	Palate	6.9
Rafalowicz et al. [13]	Buccal mucosa	32
	Tongue	29.69
	Palate	25.76
	Lip	12.5
Subramanian et al.[6]	Buccal mucosa	-
	Tongue	-
	Lip	-
	Palate	-
Amorim dos Santoset al. [10]	Tongue	-
	Palate	-
Brandao et al. [12]	Tongue	-
	Lip	-
	Palate	-
Soares et al. [5]	Only palate	57.1
	Tongue	28.6
	Lip/Palate	14.3
	Buccal mucosa	-
Bardellini et al. [14]	Pharynx	37%
	Tongue	-

4. DISCUSSION

4.1 The pathogenesis of oral lesions in patients withSARS-coV

The pathogenesis of oral lesions in patients with SARS-CoV-2 infection remains uncertain and unclear, but several hypotheses have been proposed to explain their development.

SARS-CoV-2 has a preference for nasal, ocular, and oral tissues [15]. Multiple studies have detected the presence of the SARS-CoV-2 viral spike protein in salivary glands, endothelial cells, and oral epithelium, suggesting a connection between COVID-19 and oral lesions [5-16]. This association may be attributed to the high expression of ACE2, the primary receptor for severe acute respiratory syndrome, in oral tissues [1-17]. The interaction between SARS-CoV-2 and ACE2 can potentially impair the function of keratinocytes and disrupt the epithelial lining of the oral mucosa, leading to increased susceptibility to foreign pathogens, ulcers, and necrosis [5-12]. The thrombotic processes observed in various organs during COVID-19 may also contribute to the development of certain oral manifestations through thrombotic disease [5].

In a study by Soares et al., (2019) thrombi of different morphologies and stages were observed in oral tissues, including fibrin thrombi, recanalized thrombi, and vessels exhibiting fibrinoid necrosis. These findings align with immunohistochemistry results showing positive apoptotic markers in endothelial cells, suggesting their involvement in the pathogenesis and onset of vascular, vesiculobullous, and chronic ulcer lesions [5]. However, it has not been firmly established whether SARS-CoV-2 infection directly causes oral lesions or acts as a predisposing factor for their development [18].

Martín Carreras-Presas et al. propose that the systemic deterioration of health status, resulting from either the direct effects of the virus or appropriate therapies, may be responsible for pathological changes in the oral cavity [19]. This theory is supported by Fidan et al., (2021) who highlight various contributing factors such as stress and inadequate oral hygiene in the appearance of oral lesions [9].

According to Doceda et al., (2022) these manifestations may be associated with underlying comorbidities or concurrent and subsequent lesions caused by local irritants [20]. In addition to the factors mentioned earlier, the cytopathic effects of the virus, hyperinflammation, and medication side effects should also be considered in the pathogenesis of oral lesions [5].

Amorim Dos Santos et al. suggest that the appearance of secondary aphthae in the oral cavity may be linked to an immune response similar to that observed in other viral infections [10]. It is proposed that SARS-CoV-2 triggers an inflammatory immune response, leading to a cytokine storm and immune exhaustion, which could contribute to the early onset of oral lesions [18-21].

These hypotheses and observations provide valuable insights into the potential mechanisms underlying the development of oral lesions in individuals with SARS-CoV-2 infection. However, further research is needed to fully elucidate the complex pathogenesis of these manifestations and their relationship with the viral infection and associated factors.

4.2 The oral manifestations of COVID-19

4.2.1 Gustatory impairment: The primary features of the disease, which can manifest even before a confirmed COVID-19 diagnosis, include dysgeusia (distorted taste), hypogeusia (reduced taste sensation), and ageusia (complete loss of taste) [22–24]. Studies have shown that angiotensin-converting enzyme 2 (ACE2) receptors, which are cellular receptors for SARS-CoV-2, are abundant in the oral mucosa, particularly on the dorsal surface of the tongue [17-25]. This high affinity of the virus for these receptors contributes to its impact on taste perception [25-28].

The SARS-CoV-2 virus triggers the release of cytokines that lead to the death of taste cells and their abnormal regeneration, resulting in taste alterations among COVID-19 patients. Moreover, the virus directly affects peripheral taste neurons by causing damage to ACE-2-expressing cells. Furthermore, research suggests that zinc imbalance in these patients may contribute to taste bud infection and inflammation [29].

Anosmia, or loss of smell, is frequently observed alongside taste disorders in COVID-19 patients. It has been reported that 95% of taste disorders are secondary to olfactory dysfunction [25]. Therefore, it remains unclear whether taste disturbance is primarily caused by olfactory dysfunction or if it can be considered an initial manifestation of SARS-CoV-2 infection [22-26].

In a study conducted by Biadsee et al., more than half (52%) of COVID-19 patients reported alterations in their sense of taste. The changes in taste perception primarily affected sweet (47%), salty (42%), sour (41%), and spicy (40%) tastes. The study also found that these alterations were more prevalent in women [7].

Amorim Dos Santos conducted a systematic review of 40 studies, which showed that taste impairment is the most common oral manifestation of COVID-19, with a prevalence estimated at 45% (95% CI). Dysgeusia was found to have a prevalence of 38%, hypogeusia 35%, and ageusia 24%. The results indicated that these taste disturbances were associated with mild to moderate COVID-19 infections and were more frequently reported by women.

In Italy, a 2021 study by Fantozzi (2020) revealed that taste dysfunction was the most commonly reported symptom, followed by xerostomia and olfactory dysfunction [8]. Similarly, a survey conducted in Israel in 2021 demonstrated that taste and olfactory disorders were persistent symptoms, persisting even after 6 months [30]. Consistent with these findings, the majority of prevalence studies included in our review have shown that taste dysfunction and xerostomia are among the first reported symptoms preceding other manifestations of COVID-19.

4.2.2 Oral mucosal lesions: According to a study by Fidan et al., (2021) aphthous ulcers were found to be the most prevalent oral mucosal lesion, with a prevalence of 46.6%. The etiology of these ulcers is often multifactorial. On the other hand, erythema is predominantly observed in boys, with a prevalence of 32.8%. Lichen planus, a T-cell-mediated immune response, primarily affects middle-aged women and can manifest in the oral mucosa, tongue, lips, and gingiva, with an estimated prevalence ranging from 0.22% to 5% [9].

A study by Soares et al., (2022) revealed that the ulcers observed in COVID-19 patients exhibit distinct characteristics, including ischemic borders and a central area with a fibrinous pseudomembrane. These ulcers typically follow a course of approximately 21 to 28 days. It is important to differentiate these lesions from conventional traumatic ulcers, which typically display an erythematous halo and heal within 7 to 14 days [5].

Villaroel Dorrego et al., in their study, confirmed that ulcers were the most commonly observed oral manifestation in patients with COVID-19. These ulcers can manifest as either hemorrhagic or aphthous types. Patients with mucosal lesions often experienced dysgeusia, oral pain, or a burning sensation [29].

A case series involving eight patients showed that the observed lesions exhibited two distinct profiles: one resembling aphthous ulcers in young patients with mild cases of COVID-19, while the other presented a more extensive profile resembling necrotic ulcers caused by herpes simplex virus type 1, typically seen in older and immunocompromised individuals [12].

In Rafalowicz's study involving 1256 patients, 32% of patients exhibited discoloration, ulceration, and hemorrhagic changes on the oral mucosa. Additionally, 25.79% had aphthous-type lesions on the hard palate, and 12.5% presented with atrophic cheilitis. In an extreme case, an aphthous-type lesion persisted on the hard palate for 6 months [13].

According to a systematic review conducted by Erbas et al., (2022) which analyzed 39 articles, 39.3% of patients presented with oral ulcers [31]. Among these ulcers, the majority (58.3%) were aphthous ulcers, characterized by a lesion surrounded by an erythematous halo caused by dilated blood vessels, with the ulcer bed covered by a yellowish pseudomembrane. Necrotizing or ischemic ulcers were observed in 12.5% of patients, while shallow ulcers with irregular borders were seen in 16.6% of patients. All patients who presented with ulcers reported experiencing pain.

The tongue was the most common location for these ulcers (54.1%), followed by the lips, oral mucosa, and palate [31].

4.2.3 Candidiasis: According to a study by Salehi et al., (2020) individuals with COVID-19 are at an elevated risk of developing mucosal candidiasis [32]. A retrospective study conducted in Italy focusing on 27 children who tested positive for COVID-19 revealed that oral pseudo-membranous candidiasis was the predominant oral manifestation, followed by geographic tongue and taste alteration [14]. These opportunistic fungal infections appeared to arise from factors such as immunosuppression resulting from acute infection, extensive medication usage, or inadequate oral hygiene [25].

The findings suggest that the immune system's compromised state, either due to the acute COVID-19 infection itself or the medications used for treatment, creates a favorable environment for the overgrowth of Candida fungus in the oral cavity. Additionally, poor oral hygiene practices can contribute to the development of candidiasis.

Understanding the association between COVID-19 and candidiasis is crucial for healthcare providers to effectively diagnose and manage oral manifestations in COVID-19 patients. Implementing preventive measures, such as maintaining good oral hygiene and monitoring the oral health status of individuals infected with COVID-19, can aid in the early detection and timely treatment of mucosal candidiasis and other related oral complications.

4.2.4 Temporomandibular disorders and bruxism: To examine the impact of COVID-19 on temporomandibular disorders (TMD) and bruxism, two simultaneous online cross-sectional surveys were carried out. These surveys, conducted in Israel and Poland, aimed to assess the prevalence and exacerbation of TMD and bruxism [33]. The findings from both surveys indicated that the negative psycho-affective consequences induced by the pandemic, such as anxiety, depression, and personal concerns, significantly heightened the likelihood of developing and intensifying temporomandibular disorders and bruxism [33].

Furthermore, a retrospective cohort study was conducted to investigate the influence of COVID-19 lockdown measures on Italian patients with TMD. The study revealed that the distress caused by COVID-19 had an adverse impact on the levels of anxiety and depression among individuals with chronic TMD. Consequently, this increased the severity of facial pain experienced by the patients [34].

These studies collectively highlight the interconnectedness between the psychological distress stemming from the COVID-19 pandemic and the occurrence and exacerbation of temporomandibular disorders and bruxism. Understanding this association is crucial in addressing the oral health implications of the pandemic and implementing effective management strategies for patients experiencing TMD and bruxism symptoms.

4.2.5 kawasaki disease or mucocutaneous lymph nodesyndrome: In individuals diagnosed with Covid-19, there have been reports of a multisystem inflammatory disorder reminiscent of Kawasaki disease, which is characterized by symptoms affecting the mucous membranes. Among the documented cases, approximately 62.1% involved men. Various dermatological manifestations were reported, encompassing conditions such as cracked lips, cheilitis (inflammation of the lips), dry and chapped lips, dry red swollen lips, the presence of a strawberry tongue (exhibiting a distinctive appearance resembling a strawberry), and the occurrence of hemorrhagic crusts on the tongue [31].

4.2.6 Salivary gland disorder: Salivary gland disorders have been identified as a significant aspect of COVID-19 infection due to the high expression of ACE-2 receptors in minor salivary glands [17-35, 36]. Extensive research has confirmed the presence of ACE2 and TMPRSS2 receptors in oral tissues, including salivary glands, suggesting that the oral cavity, particularly the salivary glands, could potentially serve as reservoirs for the virus [1-16-27-37, 38].

Studies have detected the virus in vacuolated cells of the surface epithelium and salivary glands, indicating that saliva could be a primary mode of transmission [5-39]. Previous research on other coronaviruses has also identified the presence of the virus in saliva and salivary glands, highlighting the potential of saliva as a non-invasive sample for diagnosis, surveillance, and infection control in COVID-19 patients [5].

Soares et al., (2022) conducted a study that confirmed the presence of the viral spike protein in salivary glands, supporting the notion that these glands may act as natural reservoirs for the virus, as observed in other viral infections [5]. These findings are consistent with the research conducted by Sabino-Silva et al., (2020) and Sinjari et al., (2020) [1-39].

In Italy, a study involving 122 patients identified salivary gland ectasia and dry mouth as common oral symptoms associated with COVID-19 [11]. Another survey of 58 COVID-19 patients reported xerostomia (dry mouth) and taste dysfunction as the most prevalent symptoms, further highlighting the prominence of salivary gland-related symptoms and disorders in individuals with COVID-19 [40].

These findings emphasize the significance of understanding and monitoring salivary gland involvement in COVID-19, as it could have implications for transmission, diagnosis, and management of the disease.

4.3 The evolution of oral manifestations related to COVID-19 and treatment: Patients who have been infected with SARS-CoV-2 should undergo a comprehensive oral examination and be closely monitored for a minimum of 6 months. The treatment approach for oral cavity changes will depend on the individual's clinical condition, ranging from simple observation to specialized interventions. In cases where pain is present, laser biostimulation has been recommended as an effective solution. For patients presenting with complex pathological changes in the oral cavity, referral to specialists for tailored treatment is advisable [13].

According to the study conducted by Soares et al., (2022) most patients with chronic ulcers were treated with topical corticosteroids, resulting in resolution of the lesions within 1 to 2 weeks. Patients who exhibited only vascular lesions did not require any treatment, and these lesions completely resolved within 2 weeks following the initial consultation [5].

In a case series conducted by Rafalowicz et al., (2022) aphthous lesions and small ulcers that underwent laser therapy showed healing after four to five sessions. Fungal lesions disappeared after 10 days of using the antifungal medication Nystatin. Patients with altered salivary secretion were prescribed stimulating medications for a period of 14 days, leading to improved salivary secretion. However, approximately 36% of patients did not accept the proposed treatment and instead received recommendations for oral hygiene products and underwent weekly check-ups. Interestingly, in this group of patients, most pathological changes spontaneously disappeared after 3 weeks [13].

These findings highlight the importance of personalized treatment approaches based on the specific oral manifestations and clinical condition of patients infected with SARS-CoV-2. Regular follow-up and individualized interventions can contribute to the effective management and resolution of oral lesions associated with COVID-19.

5. CONCLUSION

In conclusion, oral manifestations commonly observed in patients with COVID-19 include taste impairment, xerostomia, and oral ulcers. However, it is important to note that these manifestations are not specific to COVID-19 and can also be attributed to various other factors such as stress, decreased immunity, medication use, and poor oral hygiene.

Recognizing these symptoms, identifying associated risk factors, and conducting comprehensive oral examinations can aid in the early detection of asymptomatic carriers, leading to prompt diagnosis and effective disease containment.

Nevertheless, further high-quality studies with large sample sizes and regular follow-up are necessary to establish a definitive association between oral lesions and COVID-19, as well as to investigate their correlation with the oral viral load and clinical status of individuals infected with COVID-19.

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Cite this article: Haitami Sofia, Fahim Oumaima, Achfennar Imane and Benyahya Ihsane. ORAL MANIFESTATIONS RELATED TO COVID-19. *Am. J. innov. res. appl. sci.* 2023; 16(6): 373-381.