

Severe acute respiratory syndrome Coronavirus disease 19 Omicron pandemic era from an oral and maxillofacial perspective – A review

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Abstract:

Due to the Coronavirus disease 2019, seen in many patients, there were also seen some oral and maxillofacial manifestations like ulcers, pigmentation, vesicles, fissured tongue and many more along with the cutaneous manifestations. ⁹ The World Health Organization (WHO) announced the spread of coronavirus disease 2019 on March 11, 2020, all across the world as an epidemic. Due to the COVID-19 in the patients, there were oral and maxillofacial manifestations like white areas, red areas, white and red mixed areas, haemorrhage, necrosis, swelling, ulcer, bulla, vesicle, pustule, pigmentation, depapillated tongue, inflammation and bleeding in the ulcers and erosion.

Keywords – oral, dental, pathology, maxillofacial, covid 19

Introduction:

Due to the Coronavirus disease 2019, seen in many patients, there were also seen some oral and maxillofacial manifestations like ulcers, pigmentation, vesicles, fissured tongue and many more along with the cutaneous manifestations. ⁹ The World Health Organization (WHO) announced the spread of coronavirus disease 2019 on March 11, 2020, all across the world as an epidemic¹. Due to the COVID-19 in the patients, there were oral and maxillofacial manifestations like white areas, red areas, white and red mixed areas, haemorrhage, necrosis, swelling, ulcer, bulla, vesicle, pustule, pigmentation, depapillated tongue, inflammation and bleeding in the ulcers and erosion. These disorders are in turn made to verify and detect the patients whether they are infected by covid-19². Mostly all the above symptoms were seen in tongue, palate and labial mucosa³. The easy and fast ⁹ spread of coronavirus disease 2019 (COVID-19) is due to Severe Acute Respiratory Syndrome Coronavirus2. Diagnostic laboratory method included ³⁷ reverse transcription polymerase chain reaction for investigating patients ³⁷ infected with sub-acute respiratory syndrome coronavirus 2⁴. And mostly the

confirmed and suspected patients who were infected with covid cases were having many manifestations like cutaneous, oral and maxillofacial manifestations^{5,6}.

Here are the types of ulcers which are caused by covid⁷.

i) Aphthous ulcer: The ulcers which are formed due to vitamin deficiency and iron in the body and are white in colour are called Aphthous ulcers⁸.

ii) Herpetiform: The ulcers that are formed on tongue and are found in bunches are called Herpetiform ulcers⁹.

iii) White lesions: When the thickness and volume increases of keratin layer due to friction or any immunological disorders on the tongue, it forms ulcers which are called white lesions as they are white in colour¹⁰.

iv) Red lesions: Red lesions are on both the tongue and the palate. The red lesions are also called Erythroplasia as they are in red colour and has a velvety texture. These are not found in clusters and are also found on the mouth floor¹¹.

v) Erythema-multiforme like lesions: Due to the excess use of antigens, the mucosa and the skin may react and may cause lesions called Erythema multiforme (EM)^{12,13,14,15}.

vi) Angina bullosa like lesions: Angina bullosa haemorrhagica (ABH) is a lesion which increase in size and burst and release the blood in the mucosa and epithelial layer and causes pain in the oral cavity¹⁶.

vii) Melkersson-rosenthal syndrome: The rare disorder that shows its effects on neurons of the upper lip and also develops a fissured tongue with the folds in it and also it causes face swelling and facial paralysis is Melkersson–Rosenthal syndrome¹⁷.

viii) Atypical sweet syndrome: The syndrome in which the lesions occur in both oral cavity and skin that causes more inflammation and also which is associated with pyrexia is Atypical sweet syndrome^{18,19}.

ix) Kawasaki like disease: In Kawasaki like disease, main pathagomonic feature includes strawberry tongue with bumpy look and fungiform papillae followed by dryness, peeling, fissuring, haemorrhagic areas, vertical cracking and diffuse changes²⁰.

x) Necrotizing periodontal disease: Oral condition of necrotic category ⁴² includes necrotizing gingivitis, acute necrotizing ulcerative periodontitis, necrotizing stomatitis and cancrum oris. In these conditions, common features are necrosis of gingiva, ulcerations seen in the interdental region, followed by osteonecrosis²¹.

xi) Vesicles: A vesicle is a small bullae which may or may not be equal to 1 cm in diameter characterised by elevation and fluid-filled lesion which in turn is covered by epithelium. This fluid accumulation can occur either outside the epithelium called intraepithelial vesicle or below the epithelium called subepithelial vesicle²².

xii) Pustules: Common sites of involvement are ⁴⁷ buccal mucosa, hard palate, vestibule, gingiva, soft palate and lateral borders of tongue in case of multiple pustule occurrence²³.

xiii) Mucositis: Most common etiology for mucositis are anthracyclines, alkalytaing agents, mTOR inhibitors, and antimetabolites which might lead to erythmatous areas in conjunction with edema and ulcerations ^{24,25,26}.

xiv) Petichiae: Hemorrhages which might occur pin-point apperances in sub-cutaneous or sub-mucosal are called petechiae²⁷.

xv) Post inflammatory pigmentation: Auto-immune diseases ⁵ such as oral lichen planus, oral lichenoid lesions, pemphigoid, pemphigus, graft versus host disease, Steven-Johnson

syndrome, and sometimes also periodontal disease might lead to Oral post-inflammatory pigmentation resulting in change in colour of the oral mucosa^{28,29,30}.



Figure: 1

Courtesy: Erbaş GS, Botsali A, Erden N, Arı C, Taşkın B, Alper S, Vural S. COVID-19-related oral mucosa lesions among confirmed SARS-CoV-2 patients: a systematic review. *Int J Dermatol.* 2022 Jan;61(1):20-32. doi: 10.1111/ijd.15889. Epub 2021 Sep 22. PMID: 34549816; PMCID: PMC8652904³¹.

What is Covid-19:

The highly spreadable and rapid transmission of the coronavirus disease 19 (COVID-19) is due to the severe acute respiratory syndrome coronavirus 2, that caused global pandemic and led to loss to human life and also economic crisis³². Coronaviruses belong to the Coronaviridae family in the Nidovirales order. The name Corona is because it looks like the crown-like structures, which are present on the outer surface of the virus. Coronaviruses size varies from 65 to 125 nm in diameter and they contain a nucleic material which is a single-stranded RNA and its size ranges from 26 to 32kbs in length. Alpha (α), Beta (β), Gamma (γ) and Delta (δ) coronaviruses are the sub-groups of coronaviruses and also some mutants were seen in coronavirus which were rapidly transmitting like omicron. Fatal cases occurs in case of pulmonary failure which are usually seen in SARS-CoV, MERS-CoV, ALI, ARDS, H1N1 2009 and H5N1 influenza A. SARS-CoV stands for Severe Acute Respiratory Syndrome

Coronavirus. MERS-CoV stands for Middle East Respiratory Syndrome Coronavirus and ALI stands for Acute Lung Injury ARDS stands for and Acute Respiratory Distress Syndrome³³.

Descending order of site of involvement includes tongue which accounts for 38%, followed by 26% of labial mucosa and finally 22% of palate. Above mentioned sites present lesions of Kawasaki-like disease, Erythema-multiforme like lesions, drug eruption, oral mucositis, atypical Sweet syndrome, angular cheilitis, Melkersson-Rosenthal syndrome, angina bullosa-like lesions, necrotizing periodontal disease, aphthous stomatitis, candidiasis, vasculitis and herpetiform lesions. Symptomatic cases accounted for 68% in relation to oral and maxillofacial lesions. The lesions were more noted in males of 51% followed by 49% of females. Severe cases of covid-19 with oral manifestations were observed in geriatric population. Risk factors included poor oral hygiene, medically compromised conditions, emotional stress, immune compromised conditions, vasculitis, and hyper-inflammatory response³⁴. The main common symptom seen in most of the patients was related to the taste disorder³⁵. And other common symptoms which are seen in coronavirus patients were alike other viral infections like myalgia, arthralgia, sore throat, cough, fever, headache, excess sputum production and dyspnoea. Oral and maxillofacial manifestations might lead to functional disorders resulting in gastrointestinal symptoms such as nausea, vomiting, tremors, anorexia and diarrhoea³⁶, followed by dermatological manifestations and neurological dysfunctions³⁷. Pre-covid symptoms included complete loss of taste, along with reduced sense of taste and alterations in the taste perception. Altered sense of taste is mentioned as Dysgeusia, diminished taste sensation is mentioned as Hypogeusia and complete absence of taste is defined as Ageusia^{38,39,40,41,42}.

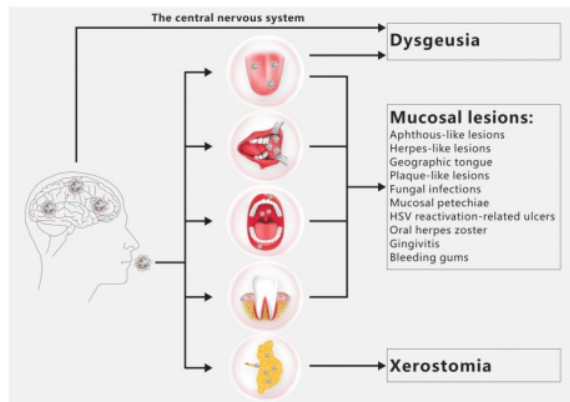


Figure: 2

Courtesy: ⁶ Amorim dos Santos, J., Normando, A. G. C., Carvalho da Silva, R. L., Acevedo, A. C., De Luca Canto, G., Sugaya, N., et al. (2021a). Oral manifestations in patients with COVID-19: A living systematic review. *J. Dent. Res.* 100, 141-154. Doi: 10.1177/0022034520957289⁴³.

Conclusion:

Due to the lack of immunity, lack of personal hygienic measures and also the less confidence in recovery, the covid 19 in effected patients was proved to be fatal⁴⁴. As there was covid 19 in many patients, the symptoms seen were bleeding in the ulcers, angular cheilitis and pressure ulcers and this ultimately raised the disease progression which also caused death to many patients⁴⁵. The most commonly observed intra-oral conditions are dry mouth, appearance of vesiculobullous lesions and alterations in taste perceptions which are being mentioned in this detailed review. As there was ⁹ increase in cases of covid 19 patients, the oral and maxillofacial manifestations were seen in mostly all the patients and thus, dentists were needed to play their roles in the early diagnosis of the infections caused by the coronavirus⁴⁶. Along with the coronavirus, it's new mutants were also found in many patients like Omicron which were changing its infrastructure and were given a shape to the highly contagious virus. So for these

kinds of mutants, we need to conduct studies more and more and find the virus and its effects⁴⁶ on the oral cavity. The patients who are infected with covid and the older patients should be first prioritized by the examiners or dental professionals so that there will be timely treatment done so that it increases the quality of the patient's life⁴⁷. The patients who have serious⁴⁰ medical conditions such as diabetes, chronic lung diseases or any heart conditions and also the patients with poor oral health are at high risk for getting infected due to covid⁴⁸. Although the recovery was seen in the patients with the poor oral conditions, but it took some time for them to recover⁴⁹. The above said oral and maxillofacial manifestations like ulcers and lesions were caused due to covid and to recover, firstly proper hygienic conditions like oral hygiene have to be followed to improve the health of the patient effected by covid⁵⁰.

References:

- ²⁶ World Health Organization. Coronavirus disease (COVID-19) pandemic. https://www.who.int/emergencies/diseases/novel-coronavirus-2019?gclid=EAIaIQobChMImpGHv7Do6QIVTLLICh2QdgaOEAAAYASAAEgKT-PD_BwE. Accessed May 28, 2020.
- ³² Ramirez, Iago & Soares, Lélío & Ramos, Marcela & Haddad, Marcela. (2021). Oral manifestations detected in COVID-19 patients: an integrative review. *Research, Society and Development*. 10. e594101422516. [10.33448/rsd-v10i14.22516](https://doi.org/10.33448/rsd-v10i14.22516).
- ³ Iranmanesh B, Khalili M, Amiri R, Zartab H, Aflatoonian M. Oral manifestations of COVID-19 disease: A review article. *Dermatol Ther*. 2021 Jan;34(1):e14578. doi: [10.1111/dth.14578](https://doi.org/10.1111/dth.14578). Epub 2020 Dec 13. PMID: 33236823; PMCID: PMC7744903.
- ⁸ Soares CD, Souza LL, de Carvalho MGF, Pontes HAR, Mosqueda-Taylor A, Hernandez-Guerrero JC, do Nascimento Medeiros SD, de Oliveira Sales A, Alves FA, Lopes Pinto CA,

de Almeida OP. Oral Manifestations of Coronavirus Disease 2019 (COVID-19): A Comprehensive Clinicopathologic and Immunohistochemical Study. *Am J Surg Pathol*. 2022 Apr 1;46(4):528-536. doi: 10.1097/PAS.0000000000001825. PMID: 34720100; PMCID: PMC8923271.

18
5. Halboub E, Al-Maweri SA, Alanazi RH, Qaid NM, Abdulrab S. Orofacial manifestations of COVID-19: a brief review of the published literature. *Brazilian oral research*. 2020 Oct 30;34:e124. <https://doi.org/10.1590/1807-3107bor-2020.vol34.0124>

15
6. La Rosa Giusy Rita Maria, Libra Massimo, De Pasquale Rocco, Ferlito Sebastiano, Pedullà Eugenio Association of Viral Infections With Oral Cavity Lesions: Role of SARS-CoV-2 Infection *Frontiers in Medicine* Volume7 2021 <https://www.frontiersin.org/articles/10.3389/fmed.2020.571214>
DOI=10.3389/fmed.2020.571214 , 2296-858X

1
7. Dalipi ZS, Dragidella F, Dragidella DK. Oral manifestations of exudative erythema multiforme in a patient with COVID-19. *Case Rep Dent*. 2021; 2021:1148945.
<https://doi.org/10.1155/2021/1148945>

20
8. Plewa MC, Chatterjee K. Aphthous Stomatitis. [Updated 2022 Aug 7]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK431059/1>

21
9. Preeti L, Magesh K, Rajkumar K, Karthik R. Recurrent aphthous stomatitis. *J Oral Maxillofac Pathol*. 2011 Sep;15(3):252-6. doi: 10.4103/0973-029X.86669. PMID: 22144824; PMCID: PMC3227248.

10. ¹⁷ Mortazavi H, Safi Y, Baharvand M, Jafari S, Anbari F, Rahmani S. Oral White Lesions: An Updated Clinical Diagnostic Decision Tree. *Dent J (Basel)*. 2019 Feb 7;7(1):15. doi: 10.3390/dj7010015. PMID: 30736423; PMCID: PMC6473409.
11. ²⁷ Scully C, Porter S. ABC of oral health. Swellings and red, white, and pigmented lesions. *BMJ*. 2000 Jul 22;321(7255):225-8. ³⁹ doi: 10.1136/bmj.321.7255.225. PMID: 10903660; PMCID: PMC1118223.
12. ² Fitzpatrick SG, Cohen DM, Clark AN. Ulcerated Lesions of the Oral Mucosa: Clinical and Histologic Review. *Head Neck Pathol*. 2019 Mar;13(1):91-102. [PMC free article] [PubMed]
13. Magri F, Chello C, Pranteda G, Pranteda G. Erythema multiforme: Differences between HSV-1 and HSV-2 and management of the disease-A case report and mini review. *Dermatol Ther*. 2019 May;32(3):e12847. [PubMed]
14. de Risi-Pugliese T, Sbidian E, Ingen-Housz-Oro S, Le Cleach L. Interventions for erythema multiforme: a systematic review. *J Eur Acad Dermatol Venereol*. 2019 May;33(5):842-849. [PubMed]
15. Paulino L, Hamblin DJ, Osondu N, Amini R. Variants of Erythema Multiforme: A Case Report and Literature Review. *Cureus*. 2018 Oct 16;10(10):e3459. [PMC free article] [PubMed].
16. ²⁴ Nayak P, Gupta S, Pathak VK, Kalra R. Angina Bullosa Haemorrhagica in COVID 19: A Diagnostic Conundrum. Case Report and Review of Literature. *Indian J Otolaryngol Head Neck Surg*. ⁸2023 Mar 2:1-7. doi: 10.1007/s12070-023-03584-w. Epub ahead of print. PMID: 37362134; PMCID: PMC9979882.

17. James, William D.; Berger, Timothy G.; et al. (2006). *Andrews' Diseases of the Skin: Clinical Dermatology*. Saunders Elsevier. ISBN 978-0-7216-2921-6.
18. El Maghraoui A, Abouzahir A, Tabache F, Bezza A, Rimani M, Ghafir D, Ohayon V, Archane MI. Manifestations systémiques du syndrome de Sweet. A propos d'un cas [Systemic manifestations of Sweet's syndrome: a case report]. *Ann Med Interne (Paris)*. 2000 Sep;151(5):413-6. French. PMID: 11033478.
19. Femiano F, Gombos F, Scully C. Sweet's syndrome: recurrent oral ulceration, pyrexia, thrombophlebitis, and cutaneous lesions. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2003 Mar;95(3):324-7. doi: 10.1067/moe.2003.4. PMID: 12627104.
20. Çakan M, Aktay Ayaz N, Keskindemirci G, Onan SH, Aköz Saydam F. A Case of Kawasaki Disease With Severe Lip and Oral Mucosa Involvement Complicated With Microstomia and Corrected With Surgery. *Arch Rheumatol*. 2017 Nov 2;33(2):238-240. doi: 10.5606/ArchRheumatol.2018.6434. PMID: 30207579; PMCID: PMC6117128.
21. Gasner NS, Schure RS. Necrotizing Periodontal Diseases. 2023 May 8. In: *StatPearls [Internet]*. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. PMID: 32491349.
22. Audrey L. Boros MSc., DDS, Diplomate, American Board of Oral and Maxillofacial pathology Division of Periodontology, Diagnostic Sciences and Dental Hygiene.
23. Rimal J, Sumanth KN, Ongole R, George T, Chatterjee S. A rare presentation of oral pemphigus vulgaris as multiple pustules. *Kathmandu Univ Med J (KUMJ)*. 2007 Oct-Dec;5(4):541-5. PMID: 18604092.
24. Bell A, Kasi A. Oral Mucositis. [Updated 2023 May 29]. In: *StatPearls [Internet]*. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK565848/>

25. ² Valer JB, Curra M, Gabriel AF, Schmidt TR, Ferreira MBC, Roesler R, Evangelista JMC, Martins MAT, Gregianin L, Martins MD. Oral mucositis in childhood cancer patients receiving high-dose methotrexate: Prevalence, relationship with other toxicities and methotrexate elimination. *Int J Paediatr Dent*. 2021 Mar;31(2):238-246. [PubMed]
26. Barasch A, Peterson DE. Risk factors for ulcerative oral mucositis in cancer patients: unanswered questions. *Oral Oncol*. 2003 Feb;39(2):91-100. [PubMed]
27. ¹⁴ Cabrera VP, Rodu B. Differential diagnosis of oral mucosal petechial hemorrhages. *Compendium*. 1991 Jun;12(6):418, 420, 422 passim. PMID: 1933990.
28. ⁵ Murti PR, Bhonsle RB, Daftary DK, Mehta FS. Oral lichen planus associated with pigmentation. *J Oral Med*. 1979;34:23-4.
29. Sakai T, Sakai H, Hashimoto N, Hirayasu R. Gingival pigmentation beneath a metallic crown: light and electron microscopic observations and energy dispersive X-ray analysis. *J Oral Pathol*. 1988;17:409-15.
30. Patsakas A, Demetriou N, Angelopoulos A. Melanin pigmentation and inflammation in human gingiva. *J Periodontol*. 1981;52:701-4.
31. ³ Erbaş GS, Botsali A, Erden N, Arı C, Taşkın B, Alper S, Vural S. COVID-19-related oral mucosa lesions among confirmed SARS-CoV-2 patients: a systematic review. *Int J Dermatol*. 2022 Jan;61(1):20-32. doi: 10.1111/ijd.15889. Epub 2021 Sep 22. PMID: 34549816; PMCID: PMC8652904.
32. ¹³ Muhammad Adnan Shereen, Suliman Khan, Abeer Kazmi, Nadia Bashir, Rabeea Siddique, COVID-19 infection: Emergence, transmission, and characteristics of human coronaviruses, *Journal of Advanced Research*, Volume 24, 2020, Pages 91-98, ISSN 2090-1232, <https://doi.org/10.1016/j.jare.2020.03.005>.

(<https://www.sciencedirect.com/science/article/pii/S2090123220300540>)

¹² 33. N. Zhong, B. Zheng, Y. Li, L. Poon, Z. Xie, K. Chan, et al. Epidemiology and cause of severe acute respiratory syndrome (SARS) in Guangdong, People's Republic of China, in February, 2003 *The Lancet*, 362 (9393) (2003), pp. 1353-1358

³ 34. Iranmanesh B, Khalili M, Amiri R, Zartab H, Aflatoonian M. Oral manifestations of COVID-19 disease: A review article. *Dermatol Ther.* 2021 Jan;34(1):e14578. doi: 10.1111/dth.14578. Epub 2020 Dec 13. PMID: 33236823; PMCID: PMC7744903.

¹¹ 35. Binmadi NO, Aljohani S, Alsharif MT, Almazrooa SA, Sindi AM. Oral Manifestations of COVID-19: A Cross-Sectional Study of Their Prevalence and Association with Disease Severity. *Journal of Clinical Medicine.* 2022; 11(15):4461. <https://doi.org/10.3390/jcm11154461>

¹ 36. Dalipi ZS, Dragidella F, Dragidella DK. Oral manifestations of exudative erythema multiforme in a patient with COVID-19. *Case Rep Dent.* 2021; 2021:1148945. <https://doi.org/10.1155/2021/1148945>

37. Halboub E, Al-Maweri SA, Alanazi RH, Qaid NM, Abdulrab S. Orofacial manifestations of COVID-19: a brief review of the published literature. *Braz Oral Res.* 2020; 34: e124. <https://doi.org/10.1590/1807-3107bor-2020.vol34.012426>

³³ 38. Mullol J, Alobid I, Sanchez FM, et al. The loss of smell and taste in the COVID-19 outbreak: a tale of many countries. *Curr Allergy Asthma Rep.* 2020; 20(10): 61. <https://doi.org/10.1007/s11882-020-00961-1>

39. Mahmoud MM, Abuhashish HM, Khairy DA, Bugshan AS, Khan AM, Moothedath MM. Pathogenesis of dysgeusia in COVID-19 patients: a scoping review. *Eur Rev Med Pharmacol Sci.* 2021; 25(2): 1114- 1134.

40. Ku H, Zhong L, Deng J, et al. High expression of ACE2 receptor of 2019-nCoV on the epithelial cells of oral mucosa. *Int J Oral Sci.* 2020; 12(1): 1- 5. <https://doi.org/10.1038/s41368-020-0074-x>

41. Lozada-Nur F, Chainani-Wu N, Fortuna G, Sroussi H. Dysgeusia in COVID-19: possible mechanisms and implications. *Oral Surg Oral Med Oral Pathol Oral Radiol.* 2020; 130(3): 344- 346. <https://doi.org/10.1016/j.oooo.2020.06.016>

42. Kaye R, Chang CWD, Kazahaya K, Brereton J, Denny JC. COVID-19 anosmia reporting tool: initial findings. *Otolaryngol Head Neck Surg.* 2020; 163(1): 132- 134. <https://doi.org/10.1177/0194599820922992>

⁶ 43. Amorim dos Santos, J., Normando, A. G. C., Carvalho da Silva, R. L., Acevedo, A. C., De Luca Canto, G., Sugaya, N., et al. (2021a). Oral manifestations in patients with COVID-19: A living systematic review. *J. Dent. Res.* 100, 141-154. Doi: 10.1177/002203452095728.

¹⁴ 44. Ganesan, A., Kumar, S., Kaur, A. et al. Oral Manifestations of COVID-19 Infection: An Analytical Cross-Sectional Study. *J. Maxillofac. Oral Surg.* 21, 1326–1335 (2022). <https://doi.org/10.1007/s12663-021-01679-x>

⁴ 45. Ferreira MD, López LZ, da Silva FP, Miléo FC, Bortoluzzi MC, Dos Santos FA. COVID-19 hospitalized patients and oral changes: a case-control study. *Clin Oral Investig.* 2023 May 16:1–11. doi: 10.1007/s00784-023-05070-7. Epub ahead of print. PMID: 37191716; PMCID: PMC10185958.

46. ¹⁹ Suhael Ahmed, Tareq Algarni, Mohammed Alshareef, Abdulrahman Alhussain, Khalid Alrashidi, Saeed Alahmari, ¹⁹ Prevalence of Oral Mucosal Lesions Among Patients Visiting Private University Dental Hospital, Riyadh, Saudi Arabia, *Annals of Dental Specialty*, 10.51847/qvnfdOmZPj, 11, 1, (83-87), (2023)
47. <https://www.hindawi.com/journals/ijd/2023/3002034.ris>
48. ⁷ Nathalie Botros, Parvati Iyer, David M. Ojcius, Is there an association between oral health and severity of COVID-19 complications?, *Biomedical Journal*, Volume 43, Issue 4, 2020, Pages 325-327, ISSN 2319-4170, <https://doi.org/10.1016/j.bj.2020.05.016>.
⁴⁹ (<https://www.sciencedirect.com/science/article/pii/S2319417020300810>)
49. ⁷ Kamel, A., Basuoni, A., Salem, Z. et al. The impact of oral health status on COVID-19 severity, recovery period and C-reactive protein values. *Br Dent J* (2021). <https://doi.org/10.1038/s41415-021-2656-1>
50. ²² Swain SK, Debta P, Sahu A, Lenka S. Oral cavity manifestations by COVID-19 infections: a review. *Int J Otorhinolaryngol Head Neck Surg* 2021;7:1391-7.
-