

Can Dentists Prevent Black Fungus in Post-COVID-19 Patients?

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ABSTRACT

In the southeast India, post-COVID-19 black fungus is increasingly being reported in medically compromised individuals. Diabetes and systemic steroids in COVID-19 patients constitute the double-edged sword that results in post-COVID-19 fungal infections. Black fungus is a part of normal flora that thrives in an immunocompromised state, resulting in rhino-orbital-cerebral mucormycosis. Majority of patients, suffering from black fungus, have uncontrolled diabetes and have undergone steroid therapy. Intra-oral signs are the earliest warning signs in black fungus and dentists should be on the lookout for these, so as to prevent the development of deadly infection. Comprehensive intra-oral signs are enlisted in this review for dentists that include tooth mobility and periodontal clinical attachment loss amongst others. Evidence-based preventive approaches are highlighted in this review to reduce morbidity and mortality, associated with black fungus. Regular dental check-ups are vital to prevent and diagnose early the secondary fungal infections in post-COVID-19 patients, reducing morbidity significantly.

Key Words: *Black fungus, Mucormycosis, COVID-19, Diabetes, Steroids.*

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In the southeast India, post-COVID-19 black fungus is increasingly being reported in medically compromised individuals; and those, who have taken high doses of steroids during COVID-19 treatment.¹ Black fungus (mucormycosis) is a rare opportunistic fungal infection that has now become the most common notifiable post-COVID-19 infection in susceptible Indian population with a high mortality rate.² Following evidence-based recommendations for dentists have been developed on the basis of global guidelines of the European Confederation of Medical Mycology and experience of treating patients suffering from black fungus with diabetes in renal transplant and dialysis patients at a tertiary care hospital.³ Dentists can easily diagnose and prevent black fungus in post-COVID-19 patients, based on these recommendations, and they should be an integral component of multi-disciplinary team managing black fungus.

This fungus is ubiquitously found in soil, manure, and vegetables and can be cultured from the oral cavity and nasal passages of healthy patients without clinical signs of infections. Infection results from either inhalation or ingestion of fungal spores and through contamination of traumatised tissue.

An ulcerative lesion or an extraction socket can become the portal of entry of these fungi into the head and neck region in immunocompromised individuals.⁴

More than half of the patient population, suffering from black fungus, have uncontrolled diabetes resulting in hyperglycaemia and acidosis.^{5,6} Cell-mediated immunity in these patients is significantly reduced as acidosis has a negative effect on the phagocytic ability of granulocytes. Acidosis favours an acidic environment, resulting in increased levels of free ferric ions thereby supporting the growth of black fungus.⁷ Furthermore, these fungi secrete ketoreductase, which easily breaks down ketone bodies in diabetic patients.¹ These fungi can directly penetrate the endothelial lining of blood vessels, resulting in angioinvasion, necrosis, and thrombosis.⁸

Although speculations abound as to the reasons for the sudden aggressive and fulminant nature of black fungus amongst COVID-19 patients; diabetes, industrial oxygen cylinders, and inappropriate use of a high dose of steroids for more than two weeks are implicated in their spread. Risk factors for the spread of black fungus include non-sterile products such as bandages and wooden tongue depressors, medical devices such as catheters, insulin pumps, and medical procedures such as surgeries and tooth extractions. In addition, environmental risk factors are contaminated oxygen supplies, inadequate sanitation, defective ventilation systems, and water leakage. There are many clinical variants of mucormycosis; however, the most common is rhino-orbital-cerebral mucormycosis.⁹ It affects the nasal and oral cavity, the paranasal sinuses, and spreads to the eyes, ears, and brain.^{10,11}

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The earliest signs of black fungus are evident in the oral cavity. Although generalised gingivitis is seen in COVID-19 patients, black fungus presents with generalised periodontitis, bleeding upon probing, clinical attachment loss, halitosis, and bad taste. Discoloration of the tongue and hard palate is seen commonly in these patients; and is one of the first signs of black fungus in the oral cavity. Unilateral numbness of cheek or teeth or a sudden weakness of the muscles of mastication are other early signs that indicate fungal infection.^{12,13}

Tooth mobility is also associated with this disease, coupled with ulceration and localised intra-oral abscesses. Dry socket is common, if teeth are extracted in these patients. Fungal infection in the maxillary sinus often results in pain that radiates to the maxillary teeth. Therefore, dental orthopantomograms (OPGs) or full mouth intra-oral X-rays should be used for screening such patients. Some black fungus cases present as acute necrotising ulcerative gingivitis (ANUG) with pain in gums and teeth. The gums between the teeth appear punched out and ulcerate with a covering of grey layer of necrotic tissue. The gums bleed easily and mastication and talking become painful.^{6,12}

Dentists can easily identify these symptoms by examining the oral cavity and performing the basic periodontal examination. Black fungus in post-COVID-19 patients can be prevented and diagnosed at an early stage; thus, reducing morbidity and even mortality. Along with oral care, strict diabetic control is necessary to prevent this fungus from spreading to the kidney, liver, and other organs.^{5,14}

Oral check-ups should be made mandatory for patients who have recovered from COVID-19 to check these warnings signs.³ Mucormycosis can develop weeks or even months after patients have recovered from COVID-19; so regular dental check-ups at three-month intervals should be performed for these patients.¹⁵ An inappropriate management of mucormycosis can lead to systemic spread to the lungs and brain. The systemic spread requires a multidisciplinary approach, which may involve ophthalmologists, ENT specialists, general surgeons, dentists, neurosurgeons, and maxillofacial surgeons. The drug of choice is injectable amphotericin B for six to twelve weeks along with surgical debridement until healthy tissue is evident; and oral care that includes deep scaling, debridement, and prophylaxis.

Good glycaemic control during the post-COVID-19 phase in diabetic patients prevents a surge of black fungus.^{6,14,16} The use of systemic steroids should be limited to two weeks to prevent the infection with this fungus. Patients on oxygen therapy should use sterile, distilled, or de-ionised water for humidifiers. Mineral water and tap water should not be used in humidifiers; and water should be changed on daily basis as these harbour fungi. Wearing gloves while handling soil, manure or moss can also prevent this disease. Steam inhalation is recommended to keep the paranasal sinuses clear. Nasal irrigation with betadine can also help prevent the fungal infection. Good oral hygiene should be maintained in vulnerable patients with mouth rinses

of chlorhexidine or two percent povidone-iodine solution, if any of the intra-oral signs appear. Mouthwashes should be discontinued after the resolution of symptoms.¹⁵ Patients with signs of fungal infection should take a high protein, low carb, and low sugar diet, and multivitamin complexes that include Vitamin D, A, E, and B-Complex.³

Patients should be informed to contact their physician or dentist, if any of the warning signs of black fungus become evident.

In conclusion, screening of post-COVID-19 patients combined with regular dental check-ups are vital to prevent and diagnose early the secondary fungal infections in these patients, thereby reducing morbidity significantly.

CONFLICT OF INTEREST:

The authors declared no conflict of interest.

AUTHORS' CONTRIBUTION:

SJAZ: Conception, design and critically revision of the manuscript.

SM: Proofreading, literature review and critically revision of the manuscript.

Both the authors gave final approval and agreed to be accountable for all aspects of the work.

REFERENCES

1. Gandra S, Ram S, Levitz SM. The "Black fungus" in India: The emerging syndemic of COVID-19-associated mucormycosis. *Ann Intern Med* 2021; M21-2354. doi: 10.7326/M21-2354.
2. Dyer O. Covid-19: India sees record deaths as "black fungus" spreads fear. *BMJ* 2021; **373**:n1238. doi: 10.1136/bmj.n1238.
3. Cornely OA, Alastruey-Izquierdo A, Arenz D, Chen SC, Dannaoui E, Hochhegger B, et al. Global guideline for the diagnosis and management of mucormycosis: An initiative of the european confederation of medical mycology in cooperation with the mycoses study group education and research consortium. *Lancet Infect Dis* 2019; **19**(12):e405-e21. doi: 10.1016/S1473-3099(19)30312-3.
4. Shastri SP, Murthy PS, Jyotsna T, Kumar NN. Cone beam computed tomography: A diagnostic aid in rhinomaxillary mucormycosis following tooth extraction in patient with diabetes mellitus. *J Indian Acad Oral Med Radiol* 2020; **32**(1):60. doi: 10.4103/jiaomr.jiaomr_12_20.
5. Moorthy A, Gaikwad R, Krishna S, Hegde R, Tripathi KK, Kale PG, et al. SARS-CoV-2, Uncontrolled diabetes and corticosteroids-an unholy trinity in invasive fungal infections of the maxillofacial region? A retrospective, multi-centric analysis. *J Maxillofac Oral Surg* 2021; **20**(3):1-8. doi: 10.1007/s12663-021-01532-1.
6. Moona AA, Islam MR. Mucormycosis or black fungus is a new fright in India during covid-19 pandemic: Associated risk factors and actionable items. *Public Health Prac (Oxford, England)* 2021; **2**:100153. doi: 10.1016/j.puhp.2021.100153.
7. John TM, Jacob CN, Kontoyiannis DP. When uncontrolled

- diabetes mellitus and severe COVID-19 converge: The perfect storm for mucormycosis. *J Fungi (Basel)* 2021; **7(4)**:298. doi: 10.3390/jof7040298.
8. Jain M, Tyagi R, Tyagi R, Jain G. Post-COVID-19 gastrointestinal invasive mucormycosis. *Indian J Surg* 2021; 1-3. doi: 10.1007/s12262-021-03007-6.
 9. Bayram N, Ozsaygılı C, Sav H, Tekin Y, Gundogan M, Pangal E, et al. Susceptibility of severe COVID-19 patients to rhino-orbital mucormycosis fungal infection in different clinical manifestations. *Jpn J Ophthalmol* 2021; **65(4)**:515-25. doi: 10.1007/s10384-021-00845-5.
 10. Mehta S, Pandey A. Rhino-orbital mucormycosis associated with COVID-19. *Cureus* 2020; **12(9)**:e10726. doi: 10.7759/cureus.10726.
 11. Gupta S, Goyal R, Kaore NM. Rhino-orbital-cerebral mucormycosis: Battle with the deadly enemy. *Indian J Otolaryngol Head & Neck Surg* 2020; **72(1)**:104-11. doi: 10.1007/s12070-019-01774-z.
 12. Pérez-Alfonzo R, Alencar-Marques S, Giansante E, Guzmán-Fawcett A. Oral signs of tropical, fungal, and parasitic diseases. *Oral Signs Systemic Disease: Springer* 2019; 193-225. doi: 10.1007/978-3-030-10863-2_10.
 13. Garg D, Muthu V, Sehgal IS, Ramachandran R, Kaur H, Bhalla A, et al. Coronavirus disease (Covid-19) associated mucormycosis (CAM): case report and systematic review of literature. *Mycopathologia* 2021; **186(2)**:289-98. doi: 10.1007/s11046-021-00528-2.
 14. Rawlani SS, Siddiqui A, Reza M, Chelkar S, Rani T, Roy TR, Bhatia HK. Black fungus mucormycosis, epidemiology, etiopathogenesis, clinical diagnosis, histopathology and its management-a review. *Int J Med Dent Res* 2021; **1(2)**:1-8.
 15. Sadasivam S. Oral mucormycosis: A new threat to COVID patients. *A Guide to Oral Health J Dental Health Oral Res* 2021; **2(2)**:1-7.
 16. Ahmadikia K, Hashemi SJ, Khodavaisy S, Getso MI, Alijani N, Badali H, et al. The double-edged sword of systemic corticosteroid therapy in viral pneumonia: A case report and comparative review of influenza-associated mucormycosis versus COVID-19 associated mucormycosis. *Mycoses* 2021; **64(8)**:798-808. doi: 10.1111/myc.13256.

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