**Post Covid Dental Complications: Mucormycosis or Black Fungus**

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**Abstract**

A complex interplay of corona virus infection, immunosuppressive treatments and uncontrolled blood sugar levels have evolved in current surge of Mucormycosis / fungal infections in recovered covid patients. We describe a rare case of probable mucormycosis in a 32-year-old man with diabetes, and COVID-19 antibodies with no history of hospitalisation or fever and negative RT-PCR test for covid 2 months back. We also performed a systematic review of our cases encountered in last 1 year and identified five peculiar cases of COVID-19 associated oromaxillofacial complications/mucormycosis. Of the six cases included in our review, diabetes mellitus and use of immunocompromised drugs were the most common risk factors. This article provides potential information about post COVID-19 dental complications, and highlights on the suggested treatment policies for oral health practitioners.

**Keywords:** Covid-19; Dental complications; Mucormycosis; Diabetes

**Introduction**

In this devastating 2nd wave of COVID-19, a new challenge in the form of Mucormycosis colloquially called as’ Black Fungus’ maiming people with COVID-19. A lot of rumours have also been doing rounds around this fungal infection. Here, we aim to bring scientific facts ONLY to help you understand pathophysiology in post covid dental complications to some extent.

COVID-19 is comparatively a new disease, with foreground being known on an impulsive basis about the natural history of the disease, particularly in terms of post-recovery events. After acute COVID-19 illness, recovered patients may continue to report broad categories of signs and symptoms including fatigue, cough, sore throat, difficulty in breathing, loss of taste etc. because of multiple organ involvement. For follow up care and well-being of all post-COVID recovering patients, comprehensive approaches are the need of time [1].

There are numerous plausible mechanisms for the development of MRONJ like impaired bone repair, osteoclast activity suppression, tissue inflammation and infections, and impaired angiogenesis or vascular repair. This case series describes the role of interplay between diabetes mellitus, covid-19 and pharmacotherapy which may have increased the risk of osteonecrosis and manifested jaw necrosis in various forms in patients suffered from COVID-19 and diabetes received aggressive immunosuppressive drugs for its management.

Here we are presenting 6 cases of dental complications suspected to be linked with Covid 19. A case of osteomyelitis in covid 19 recovered patient suspected to be Mucormycosis, diagnosis of thromboembolic event with Pilot study in covid -19 /suspected cases in our 3 cases, Covid-19 affected individual suspected with MRONJ in one case followed by 6th case, presenting with osteomyelitis of maxilla with fungal infection i.e., mucormycosis along with extensive tissue necrosis in an uncontrolled diabetic individual, thus analysing the consequences of covid-19 in musculoskeletal system.
Discussion

Mucormycosis is an infection caused by fungi belonging to the order Mucorales [2]. *Rhizopus oryzae* is the most common organism isolated from patients with mucormycosis and is responsible for about 70% of all cases of mucormycosis [3-5]. The major risk factors for mucormycosis include uncontrolled diabetes mellitus in ketoadiposis, other forms of metabolic acidosis, treatment with corticosteroids, neutropenia, malignant hematologic disorders, and derforexamine therapy in patients receiving hemaodlysis [4,6,7]. Because of the increasing prevalence of diabetes mellitus, increased hospitalisation and use of immunosuppressive drugs due to high number of covid cases the number of patients at risk for this deadly infection is dramatically increasing [8]. Unfortunately, despite mutilated surgical debridement and adjunct antifungal therapy, the overall mortality rate for mucormycosis remains >50%, and it approaches 100% among patients with disseminated disease or those with persistent neutropenia [4,9]. Clearly new strategies to prevent and treat mucormycosis are urgently needed, and such strategies can be facilitated by clear understanding of the pathogenesis of the disease. Disease transmitted mainly via inhalation of spores from environmental sources [10].

Tissue necrosis is the hallmark of mucormycosis, occurs due to angioinvasion & subsequent vascular thrombosis. [10,11] Oromaxillofacial manifestations of mucormycosis usually include bone exposure and necrosis, which demands histopathological examination to confirm the diagnosis because of its nonspecific features and possible similarities to bacterial osteomyelitis, iatrogenic infections and trauma [11].

In our clinic we reported a case of 35 year old male diabetic patient as a regular dental infection which later on was co-related with covid-19 complication based upon systemic and radiographic findings presenting extra pulmonary manifestations of covid-19 depicting necrosis of maxilla due to some underlining systemic condition which may be a covid-19 post infection complication.

As many post covid complications are reported with involvement of arteries leading to thromboembolic events so here we planned for a pilot study based on 3 similar cases in our clinic to detect presence of thrombus formation in maxillary artery. We decided to go with CT study of face angiography and D-dimer test values to look for presence of any thromboembolic movement.

In 60yr old male patient and 52yr old male patient cases before it was thought to be a case of thrombolytic event but looking upon laboratomy and radiological findings with no such co relating pathologic results were found, later it was considered to be a cases of avascular necrosis of maxilla. But on the other hand our other case a 38yr old male diabetic patient who was previously infected with covid-19 and presented with atypical facial pain along with multiple discharging sinuses in maxillary arch so to clear up the dilemma we went further to go for d-dimer values and angiography of face which gave clear picture that it is not the case of thromboembolic event because there were no such laboratory or radiological findings proving it to be a thromboembolic event after covid-19 infection.

This is the first pilot study till now to our knowledge to go for CT study of face angiography to confirm any thromboembolic event involving maxillary artery and its branches. As limited data is present on thromboembolic events associated with oral conditions, still dental surgeons should consider thromboembolic events and be aware of its signs and symptoms while treating patients. This is unfortunate that no such cases are reported in medical literature till yet. Several studies reported for thromboembolic events especially in ICU patients who were previously affected by covid-19 severely [12,13].

Few of the studies reported showed cases of mild covid-19 affected individuals to complicate with thromboembolic events during the active phase of the disease [14,15].

In one case to diagnose a patient of MRONJ two criteria needs to be fulfilled i.e history of ongoing medication with antiangiogenic or antiresorptive such as Bisphosphonates and denosumab other is non healing bone that can be easily probed through fistula in maxillofacial region with no history of radiation of head and neck region or underlying malignancy [16-20] our case is found to be previously infected with covid-19, for supportive care must have undergone medications. Biopsy report also did not reveal any kind of malignancy and patient was presenting with draining pus from multiple sinuses.

The symptoms clinically manifested as toothache from non-odontogenic cause, radiating pain, unexplained pain along with altered sensation. Radiographically, it may be an unexplained bone loss attributed to periodontal inflammation thus making changes in trabecular bone pattern [18] Our patient in present case also presented with pain in affected area.

For providing detailed examination, digital imaging such as CT or CBCT provide much higher quality of tomographic images in order to reveal MRONJ lesions [21,22]. In our case to make the diagnosis we preferred for digital imaging CECT which showed mucosal hypertrophy with multiple lymph nodes. Treatment management of MRONJ is very challenging and also controversial [22], [23,24] though treatment protocol is case specific and based on staging and symptoms in ONJ [18].

In subject case, we discussed a dental complication after covid-19 infection, mucormycosis in an uncontrolled diabetic patient whole maxilla is being affected but covid antibody reports was positive but patient had no history of fever, cough or hospitalisation. In this case, Biopsy report was suggestive of mucormycosis and we planned for the treatment through surgical approach by doing extraction of teeth in affected area along with debridement and curettage of tissue with as much conservation possible.

In our pursuit to further acknowledge the etiopathogenesis of such disease which is linked with post covid-19 complication, after
going through our previous cases we eliminated the probability of osteonecrosis, thromboembolic event and MRONJ/CRONJ through our various findings such as D-dimer, CT angiography of face and other relative haematological, histopathological and radiological tests. As suggestive by our biopsy and haematological findings which is suggestive of mucormycosis in this case we stated that comorbid condition can be one of the accountable element familiar to this fungal condition as uncontrolled diabetes may cause immune suppression thus inviting such fungal invasions.

Conclusion
In summary, dental surgeons caring for recovered COVID-19 patients must be aware of serious infections that can complicate the course of COVID-19. A high degree of clinical suspicion is required to diagnose mucormycosis. Early diagnosis and timely management are necessary to improve outcomes in mucormycosis and post covid oral maxillofacial complications. The clinical presentation of Mucormycosis may vary depending on the pathogen. Oral Mucormycosis must be suspected when the above-mentioned clinical presentations are found in immunocompromised patients/uncontrolled diabetic or post covid cases or patients with immunosuppressive drugs.

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