

RARE INFECTION IN TIMES OF PANDEMIC: A CASE OF ORAL MUCORMYCOSIS ASSOCIATED WITH COVID-19 AND ITS OUTCOME AFTER YEARS

INFECÇÃO RARA EM TEMPOS DE PANDEMIA: UM CASO DE MUCORMICOSE ORAL ASSOCIADO À COVID-19 E SEU DESFECHO APÓS ANOS

INFECCIÓN RARA EN TIEMPOS DE PANDEMIA: UN CASO DE MUCORMICOSIS ORAL ASOCIADA A LA COVID-19 Y SU EVOLUCIÓN TRAS AÑOS

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ABSTRACT

Mucormycosis is an opportunistic, invasive, and highly lethal fungal infection caused by fungi of the order Mucorales. During the COVID-19 pandemic, a significant increase in its incidence has been observed. The recommended intervention is the removal of affected tissues through surgical debridement and antifungal therapy. Treatment should continue until the signs indicated in the

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imaging exam resolve and the patient's immune system is restored. This article reports the case of a 59-year-old male patient with mucormycosis after infection with SARS-CoV-2. The clinical picture included pain in the maxillary region for three months, with previous antibacterial therapy without satisfactory results. The diagnosis was made through imaging tests and histopathological analysis, which showed areas of necrosis and angioinvasive fungal infection of the genus *Mucor*. Treatment involved a maxillectomy along with antifungal therapy with isavuconazole. The objective is to establish the correlation between infection with the new coronavirus and increased susceptibility to mucormycosis, also highlighting other systemic factors, as well as the efficacy of isavuconazole as an adjunct medication in the treatment of mucormycosis. It is concluded that patients affected by COVID-19 are more susceptible to mucormycosis due to conditions such as diabetes mellitus, immunosuppression, and prolonged use of corticosteroids. Furthermore, it is established that isavuconazole emerges as an alternative comparable to amphotericin B, and in cases of infiltrative lesions refractory to drug treatment, maxillectomy followed by prosthetic rehabilitation can provide functional and aesthetic recovery.

Keywords: Black Fungus. COVID-19. Mucormycosis. Maxillectomy. Oral Cavity. SARS-COV-2.

RESUMO

A mucormicose é uma infecção fúngica oportunista, invasiva e de altamente letal, causada por fungos da ordem Mucorales. Durante a pandemia da COVID-19, observou-se um aumento significativo de sua incidência. A intervenção indicada é a remoção dos tecidos afetados sendo desbridados cirurgicamente e a terapia antifúngica. O tratamento deve continuar até a resolução dos sinais indicativos no exame de imagem e a reconstituição do sistema imunológico do paciente. O presente artigo relata o caso de um paciente masculino, 59 anos com mucormicose após infecção pelo SARS-CoV-2. O quadro clínico incluiu dor na região maxilar durante 03 meses sendo realizado terapia antibacteriana prévia sem resultado satisfatório, o diagnóstico foi realizado por meio de exames de imagem e análise histopatológica que demonstrou áreas de necrose e infecção fúngica angioinvasivo do gênero *Mucor*. O tratamento envolveu uma maxilectomia juntamente a terapia antifúngica com isavuconazol. Objetiva-se estabelecer a correlação entre a infecção pelo novo coronavírus e a maior suscetibilidade à mucormicose, evidenciando também outros fatores sistêmicos, assim como a eficácia do isavuconazol como medicação coadjuvante no tratamento da mucormicose. Conclui-se que pacientes acometidos pela COVID-19 apresentam maior suscetibilidade à mucormicose devido a condições como diabetes melitus, imunossupressão e uso prolongado de corticoides. Ainda, se estabelece que isavuconazol surge como alternativa comparável com a anfotericina B, e, em casos de lesões infiltrativas e refratárias ao tratamento medicamentoso, a maxilectomia seguida de reabilitação protética pode proporcionar recuperação funcional e estética.

Palavras-chave: Fungo Negro. COVID-19. Mucormicose. Maxilectomia. Cavidade Oral. SARS-COV-2.

RESUMEN

La mucormicosis es una infección fúngica oportunista, invasiva y de alta letalidad, causada por hongos del orden Mucorales. Durante la pandemia de COVID-19 se observó un aumento significativo de su incidencia. La intervención indicada consiste en la remoción quirúrgica

(desbridamiento) de los tejidos afectados, asociada a terapia antifúngica. El tratamiento debe mantenerse hasta la resolución de los signos evidenciados en los estudios de imagen y la reconstitución del sistema inmunológico del paciente. El presente artículo reporta el caso de un paciente masculino de 59 años con mucormicosis posterior a infección por SARS-CoV-2. El cuadro clínico incluyó dolor en la región maxilar durante tres meses, habiéndose realizado previamente tratamiento antibacteriano sin resultados satisfactorios. El diagnóstico se estableció mediante exámenes de imagen y análisis histopatológico, que evidenciaron áreas de necrosis e infección fúngica angioinvasiva del género *Mucor*. El tratamiento incluyó maxilectomía asociada a terapia antifúngica con isavuconazol. El objetivo es establecer la correlación entre la infección por el nuevo coronavirus y la mayor susceptibilidad a la mucormicosis, destacando además otros factores sistémicos, así como la eficacia del isavuconazol como medicación coadyuvante en el tratamiento de esta enfermedad. Se concluye que los pacientes afectados por COVID-19 presentan mayor susceptibilidad a la mucormicosis debido a condiciones como diabetes mellitus, inmunosupresión y uso prolongado de corticoides. Asimismo, se establece que el isavuconazol surge como una alternativa comparable a la anfotericina B, y que, en casos de lesiones infiltrativas y refractarias al tratamiento farmacológico, la maxilectomía seguida de rehabilitación protética puede proporcionar recuperación funcional y estética.

Palabras clave: Hongo Negro. COVID-19. Mucormicosis. Maxilectomía. Cavidad Oral. SARS-CoV-2.



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INTRODUCTION

The outbreak of the coronavirus disease, SARS-CoV-2, also known as COVID-19, has changed the landscape of medicine in many ways, including a significant increase in fungal infections, which have become a growing threat to infected patients. Several hypotheses have been proposed about how COVID causes immune system dysregulation, such as molecular mimicry and lymphocyte activation. Opportunistic fungal diseases have also been correlated, such as mucormycosis, a disease that has gained prominence due to its severity, especially in the rhino-cerebral, orbital, and maxillofacial areas (Verma & Bali, 2021).

Mucormycosis, also known as black fungus, is a potentially devastating, rare, non-septate filamentous fungal infection that, in cases not diagnosed early, can aggressively progress to fatal consequences such as spread to the brain and adjacent structures. It is caused by the Mucoraceae family in the genera *Rhizopus*, *Mucor*, *Rhizomucor*, *Cunninghamella*, *Lichtheimia*, and *Apophysomyces*, first described by Paultauf in 1885. There are six clinical forms of mucormycosis, the most common being the rhino-cerebral-orbital form (44–48%), followed by

the cutaneous form (10–19%), pulmonary form (10–11%), disseminated form (6–10%), and finally, the gastrointestinal form (2–11%) (Aswal *et al.*, 2022), (Datarkar *et al.*, 2024), (Jain & Taneja, 2022), (Janjua *et al.*, 2022).

In general, the manifestations of mucormycosis depend on two factors: 1 - the route of entry of fungal spores into the human body, mainly by inhalation, followed by ingestion or direct inoculation into the skin; 2- predisposing diseases of the infected patient. The clinical manifestation of mucormycosis is variable, as the infection progresses rapidly through the body and can affect the paranasal sinuses, orbits, lungs, kidneys, central nervous system, gastrointestinal tract, and skin (Raid *et al.*, 2021). Mucormycotic osteomyelitis is a rare oral condition, and its oral manifestations are often evident in the palate and may include initially subtle symptoms such as toothache, tooth mobility, halitosis, edema, ulceration, formation of necrotic bone/sequestra in the palate and maxillary alveolus, and the formation of oroantral or oronasal communications/fistulas (Paavai *et al.*, 2023).

The diagnosis of mucormycosis is challenging, with laboratory tests and radiographic imaging being important auxiliary resources. The diagnosis of mucormycosis can be made by identifying the fungus in the affected tissue through biopsy and subsequent histopathology. A valid fungal culture in microbiology is also important. Diagnostic imaging techniques, mainly computed tomography (CT) scans of the paranasal sinuses and lungs. Another option that is often performed is molecular testing and direct identification of the fungus in bodily secretions, such as blood, plasma/serum, pleural fluid, and urine, which are equally significant (Benerjee *et al.*, 2023), (Deenadayalan *et al.*, 2024), (Janjua *et al.*, 2022).

Histopathological examination may reveal neutrophilic/granulomatous cells, and invasive lesions are differentiated by angioinvasion and large areas of closure. Perineural invasion is visible in cases where nerve structures are involved. Necrotic tissue with inflammatory constituents is found, such as neutrophils, lymphocytes, macrophages, and giant cells. Inflamed granulation tissue, hemorrhagic elements, and extravasated RBCs are also observed. The necrotic tissue presents broad, non-septate hyphae (Benerjee *et al.*, 2023).

Once the diagnosis has been made, the intervention indicates the removal of the affected tissues by surgical debridement and the administration of antifungal therapy. Treatment should continue until the indicative signs in the imaging exam have resolved and the patient's immune system has been restored. Due to the need for surgical debridement, patients often suffer mutilation, which affects aesthetics, masticatory function, quality of life, and social acceptance

(Benerjee *et al.*, 2023), (Chopra *et al.*, 2023), (Chouksey *et al.*, 2024), (Deenadayalan *et al.*, 2024), highlighting the importance of early diagnosis in order to enable success with conservative therapies.

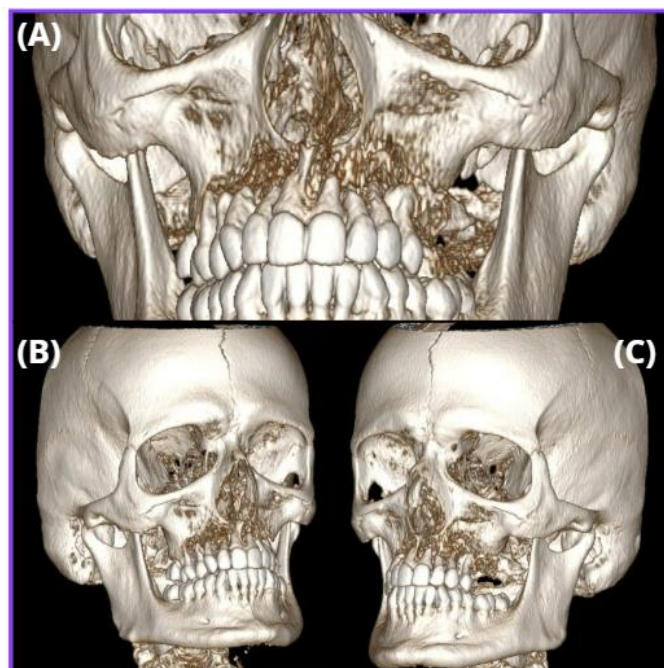
This article aims to address a clinical case of mucormycosis in the oral cavity and its association with COVID-19, highlighting its clinical, surgical, and rehabilitative management, as well as its treatment alternatives.

CASE REPORT

A 38-year-old male patient sought emergency care at a private hospital in Recife, Pernambuco, complaining of persistent pain in the maxillary region for approximately three months. The patient in question had a history of hospitalization for SARS-CoV-2 infection. Computed tomography revealed extensive bone fenestration of the maxilla, associated with bilateral opacification of the maxillary sinuses, with radiographic features suggestive of an osteomyelitic infectious process (Figure 1).

Figure 1

(A) Three-dimensional reconstruction of the computed tomography scan in the frontal plane showing an area of necrosis in the anterior region of the maxilla. (B) and (C) Three-dimensional reconstruction of the computed tomography scan in the right and left 3/4 planes.

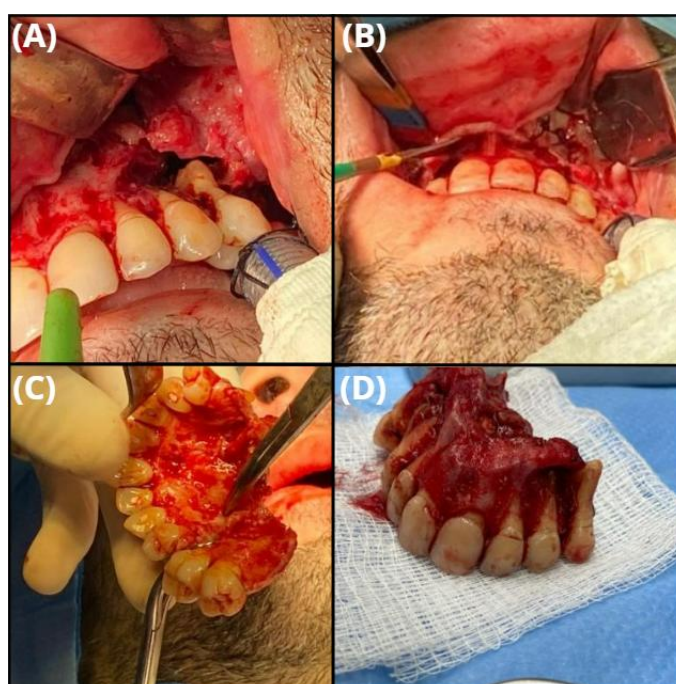


The patient underwent an incisional biopsy for etiological investigation. Microbiological examination identified the presence of *Klebsiella* bacteria, and antimicrobial treatment with Teicoplanin was initiated and maintained for a period of three months. However, despite continuous use of the medication, the clinical picture progressed without signs of significant improvement.

Given the refractoriness to drug treatment and the worsening of the patient's bone changes and symptoms, a more radical surgical intervention was chosen, and a total maxillectomy was indicated and performed (Figure 2). The surgical material was sent for further histopathological analysis, which revealed the presence of angioinvasive fungus of the genus *Mucor*, confirming the diagnosis of rhinofacial mucormycosis.

Figure 2

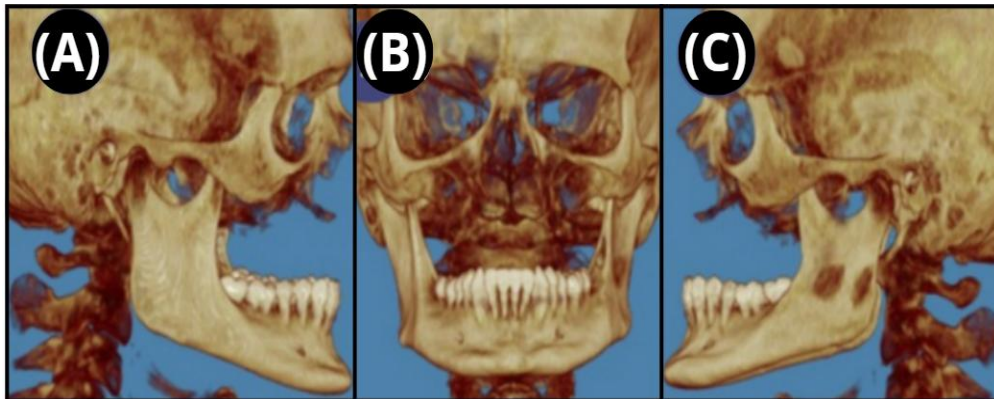
(A) and (B) initial appearance of the lesion during surgery, (C) and (D) surgical specimen from the maxilla after total maxillectomy.



From that moment on, a new therapeutic protocol was initiated, this time with systemic antifungal medication. Isavuconazole 200 mg, in injectable form, was chosen. The medication was initially administered every 8 hours, and after three months of continuous use, the dosage was adjusted to a single daily dose to maintain control of the infection.

Figure 3

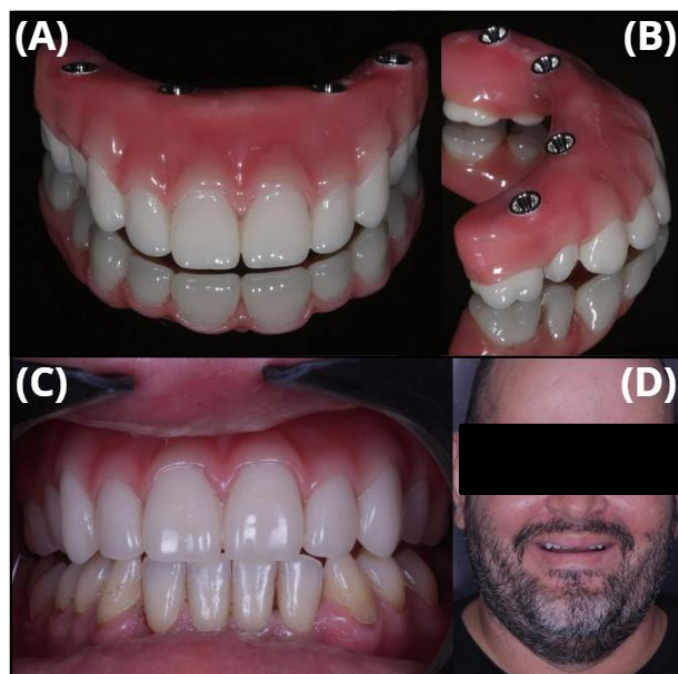
3D reconstruction of the postoperative period.



After six months, the patient underwent prosthetic rehabilitation, managing to recover his aesthetics, masticatory function, and quality of life. Currently, he remains in the postoperative period of two years in outpatient follow-up with no signs of recurrence.

Figure 4

(A) and (B) details of the implant-supported prosthesis. (C) patient with prosthesis installed in mouth and (D) extraoral appearance with prosthesis in use.



DISCUSSION

Delays in treating mucormycosis can double the mortality rate, raising it from 35% to 66%. The association between COVID-19 and craniofacial mucormycosis is still considered controversial, especially due to the presence of confounding factors such as diabetes and steroid use, making it difficult to establish a causal relationship Abdullah *et al.* (2025), Chopra *et al.* (2023), Hasheminasab *et al.* (2022), Jain and Taneja (2021), Verma and Bali (2021) contribute to reporting the increased incidence of mucormycosis with many cases of patients with COVID-19, making it one of the most serious complications of this infection (Abdullah *et al.*, 2025), (Chopra *et al.*, 2023), (Chouksey *et al.*, 2024), (Hasheminasab *et al.*, 2022), (Jain & Taneja, 2021), (Verma & Bali, 2021).

Abdullah *et al.* (2025) state that although mucormycosis has been predominantly found in immunocompromised patients, transplant recipients, diabetics, and patients using steroids, the underlying conditions promoted by COVID-19 also seem to stimulate fungal infection of mucormycosis as they favor the germination of fungal spores, increasing the risk of fungal co-infections. Sepsis, which is also associated with COVID-19, can compromise mucosal barriers and allow the fungus to translocate into the blood, which can be fatal when it affects the maxillofacial region. However, among these conditions, immunosuppression is probably the most important contributing factor (Chopra *et al.*, 2023).

Requiring accurate diagnosis and early intervention, given its infiltrative and disseminated nature, other authors also argue that mucormycosis affects more patients with some type of immunocompromise, such as Aswal *et al.* (2022), Paavai *et al.* (2023), Riad *et al.* (2021), who mostly say that diabetes mellitus is the most common predisposing disease in cases of mucormycosis, but that others like COVID-19, malignant neoplasms, organ transplant patients, and those using corticosteroids and immunosuppressive therapies are also risk factors for mucormycosis (Paavai *et al.*, 2023), (Raid *et al.*, 2021).

According to Benerjee *et al.* (2023), the prognosis of the disease depends on its extent, spread, and aggressiveness. Chopra *et al.* (2023) and Deenadayalan *et al.* (2024) argue that effective treatment of this condition involves a combination of surgical debridement of the affected area, whenever possible, and antifungal drug therapy. Chopra *et al.* (2023) also report that the drug of choice is liposomal amphotericin B (5-10 mg/kg/day by intravenous infusion), although they offer alternatives such as posaconazole, especially for patients with renal failure or

when amphotericin B is not tolerated. In cases of extensive disease or rapid progression, the combined use of isavuconazole or posaconazole may be considered as a drug treatment option. The three authors agree that early diagnosis and rapid intervention are crucial to reduce mortality associated with infection (Benerjee *et al.*, 2023), (Chopra *et al.*, 2023), (Deenadayalan *et al.*, 2024).

Among these options for amphotericin B, authors Janjua *et al.* (2022) highlight the use of isavuconazole, a second-generation triazole antifungal agent that is broad-spectrum and water-soluble, which has shown promising results in various fungal infections, as it acts by interrupting the synthesis of ergosterol, an essential component of the fungal cell membrane. This medication is available in 100 and 200 mg tablets and IV formulation. Another benefit is that, unlike voriconazole, isavuconazole does not require cyclodextrin for solubility, which eliminates the associated renal toxicity, making it a safer alternative. In the US and the European Union, isavuconazole is approved for the treatment of invasive mucormycosis and has demonstrated efficacy comparable to that of amphotericin B, which is currently considered the gold standard (Janjua *et al.*, 2022).

In the clinical case discussed in this article, isavuconazole was used, which proved to be effective, as reported by other authors for the treatment of mucormycosis. However, it is emphasized that treatment should continue until the indicative signs in the imaging exam are resolved and the patient's immune system is restored. As for the surgical approach, invasive treatments were chosen since the patient was resistant to drug treatment. Due to the presence of erosion, perforation, and tissue necrosis, maxillectomy was recommended concomitantly with drug treatment. It was considered that although this treatment causes aesthetic and masticatory function changes due to mutilation, the patient could recover his quality of life and achieve psychological improvement through oral rehabilitation. In these situations, an obturator made of thermopolymerized acrylic resin is a viable option to overcome this perspective.

Dahihandekar *et al.* (2022) also emphasize that as part of the multidisciplinary team, they should monitor the surgical site for early detection of reinfection and avoid the high risks of surgical reconstruction in patients with comorbidities, allowing rehabilitation without many changes in the overall context (Chouksey *et al.*, 2024), (Dahihandekar *et al.*, 2022).

CONCLUSION

It was concluded that patients who were affected by COVID-19 due to associated systemic conditions or opportunistic immunosuppressive windows are more susceptible to concomitant contamination by mucormycosis. It also showed that isavuconazole is a viable therapeutic option with efficacy comparable to amphotericin B, which is the gold standard for the treatment of fungal lesions, and that lesions that follow the infiltrative pattern and are resistant to drug therapies can be treated with maxillectomy with subsequent functional and aesthetic improvement through prosthetic rehabilitation.

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REGULATORY STATEMENT

This study was conducted in accordance with all provisions of the appropriate guidelines and policies. As it is based on a case report, the participant's free and informed written consent was obtained prior to their inclusion in the study and presentation of the case, ensuring that they were fully aware of the nature, objectives, procedures, risks, and benefits involved. This was also mediated through the signing of the hospital's terms of risks and benefits of surgery.

REFERENCES

- Abdullah, B., Museedi, O., Allawi, N., Ismael, F. J., Warnakulasuriya, S. (2025). *Impact of COVID-19 on the prevalence of oral and maxillofacial disorders: A retrospective cohort study*. *Sci Prog*, 108(1).
- Aswal, G. S., Rawat, R., Dwivedi, D., Prabhakar, N., Kumar, K. V. R. (2022). *Diagnosis and management of mucormycosis in the dental clinic: A guide for oral health professionals in India*. *J Family Med Prim Care*, 11, 4293–8.
- Banerjee, A., Das, M., Verma, P., Chatterjee, A., Ramalingam, K., Srivastava, K. C. (2023). *COVID-19 and Mucormycosis of Orofacial Region: A Scoping Review*. *Cureus*, 15(4), e37984.

- Chopra, S., Satiya, S., Wanknis, P. P., Kale, L., Tidke, S. (2023). *Various Treatment Modalities in COVID-19 Associated Facial Mucormycosis and the Need for its Surgical Management: A Systematic Review. J Maxillofac Oral Surg.*
- Chouksey, G., Gupta, V., Choure, R., Pakhare, A. P., Dev, A., Kumar, B. (2024). *Quality of life after prosthodontic rehabilitation in patients with bilateral total maxillectomy due to COVID-19-associated mucormycosis of the maxilla. Arch Craniofac Surg, 25(6), 285–291.*
- Dahihandekar, C. A., Pisulkar, S. K., Patra, M., Bansod, A. V. (2022). *Orbital rehabilitation of a COVID-19-induced mucormycotic defect – a case report. J Family Med Prim Care, 11(11), Nov, 7419–24.*
- Datarkar, A., Bhawlikar, A., Shah, V., Mankear, V., Gadve, V., Daware, S. et al. (2024). *Osteomyelitis of the jaw due to mucormycosis after coronavirus disease 2019 infection – A prospective study. Ann Maxillofac Surg, 14, 40–6.*
- Deenadayalan, N., Pandyan, P. D. A., Satheesh, C., Aparnaa, M., Samyo, G. S. (2024). *Unravelling the complexity of mucormycosis-a rare case report. Ann Maxillofac Surg, 14, 96-8.*
- Hasheminasab, M., Salehi, Karizmeh, M., Sharifi, R., Beshkar, M., Matloubi, N., Asadi, A. A. et al. (2022). *COVID-19-associated mucormycosis involving the maxilla. Clin Case Rep, 10(5), e06165.*
- Jain, A., Taneja, S. (2022). *Post-COVID fungal infections of maxillofacial region: a systematic review. Oral Maxillofac Surg, 26(3), Sep, 357–63.*
- Janjua, O. S., Shaikh, M. S., Fareed, M. A., Qureshi, S. M., Khan, M. I., Hashem, D. et al. (2022). *Dental and oral manifestations of COVID-19 related mucormycosis: Diagnoses, management strategies and outcomes. J Fungi, 8(1), 44.*
- Paavai, T. T., Vasanthi, V., Rameshkumar, A., Rajkumar, K., Krishnakumar, Raja, V. B., Muthusubramanian, V. (2023). *Maxillary mucormycotic osteonecrosis as a manifestation of post-COVID-19 infection in non-diabetic patients: report of two cases. J Microsc Ultrastruct, 12(2), Nov, 99–103.*
- Riad, A., Gomaa, E., Hockova, B., Klugar, M. (2021). *Oral candidiasis of COVID-19 patients: case report and review of evidence. J Cosmet Dermatol, 20(6), Jun, 1580–4.*
- Verma, D. K., Bali, R. K. (2021). *COVID-19 and mucormycosis of the craniofacial skeleton: Causal, contributory or coincidental?. J Maxillofac Oral Surg, 20(2), Apr–Jun, 165–166.*