



Impact of COVID-19 on Oral Health

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

In December 2019 an outbreak of COVID19 occurred which is a severe acute respiratory disorder. Many succumbed to this global pandemic and many are still fighting the after effect of it. The virus directly affects the immune system especially of lungs. Therefore, the people who already have compromised immunity are at the very risk. The first symptoms to appear in COVID19 patients are ageusia and anosmia while treating the COVID19 patient's certain practices are followed which aid in rapid oral health deterioration like oxygen mask, ventilators, heavy dose of medicines. Certain medicines used in treatment also precipitate poor oral health like bleeding gums, oral ulceration and dry mouth are the most common oral health problems faced after COVID19 recovery. COVID directly affects the immune system thereby making way for opportunistic infections like mucormycosis. Mucormycosis offers a severe burden on oral and general health affecting the standard of living and cause death in severe cases. Sinusitis, Periodontitis, black staining across the bridge of nose and sinus, localized discomfort and unbearable diplopia and refractive errors along with embolism and necrosis are seen in mucormycosis patients. Treatment of mucormycosis consists of surgery and replacement of lost structures Patients with compromised immunity need to take proper precautions during and after COVID.

Keywords: Covid-19; Oral Health; severe acute respiratory disorder; Mucormycosis patients.

1. INTRODUCTION

In December 2019 an outbreak occurred in Wuhan, China called COVID-19 which was severe acute respiratory disorder. Eventually the outbreak had blowout to numerous countries and upstretched as pandemic. The mortality rate differs in different countries depending on medical facilities [1]. On 11th of march 2020 it was pronounced as the global pandemic by World Health Organization [2]. So far, COVID-19 has infected over 54 million individuals worldwide, resulting in 1,324,249 deaths by 17 November 2020.

Till date, researchers have identified a number of risk factors linked to a serious COVID-19 disease course and outcome.

No symptoms are seen in people who already encountered the virus. The virus should be treated as soon as possible if it causes symptoms including an extreme temperature, body aching, dry cough, nausea, chills, headache, sore throat, anorexia, ageusia, anosmia and shortness of breath, which are all common.

According to a new study, in 14 percent of population extreme covid leads to insufficient interferon response. Certain people encounter this because their autoantibodies fight and counterpart their interferons. Some have a hereditary abnormality that stops their bodies from manufacturing sufficient quantity of a certain type of interferon. Without a doubt, this coronavirus strain, which has lately been nicknamed the hit and run virus, alters the immune system, causing marked alteration in responses that turns in antagonism to the host, following in autoimmune damage, markedly to the connective tissue of the lungs [3].

The researchers believe, a connection exists between bacterial burden and SARS-COV-2 infection. They focus to see if conditions like pneumonia, sepsis and RDS connected to poor COVID-19 outcomes is sequel of pinnacle of bacteria or infection/superinfection.

While some infected people recover without difficulties, others may require hospitalization, oxygen therapy, or even ventilator [3].

Oral health has been reported to decline in critically ill hospitalized patients, particularly

those in intensive care units. Hyposalivation, like aspiration pneumonia, can cause very rapid oral health deterioration and it's sequel, as well as damaging the lower respiratory tract. Medical treatment, intubation, tracheostomy, external ventilation, as well as mouth breathing and decreased salivation leads to oral health deterioration and its outcomes, simultaneously affecting the lower respiratory track [4].

Some recovered patients can have other symptoms.

Dental hygiene is crucial aspect of general health and well-being. Eating, speaking, laughing, and living a good life all require the use of the mouth. periodontal diseases and Dental caries are commonest oral disorders, and they are largely preventable [5]

2. CO-RELATION BETWEEN POOR DENTAL HYGIENE AND SEVERITY OF COVID-19

According to British researchers, poor oral hygiene has been associated to the seriousness of COVID-19 disease induced because of the SARS-CoV-2 infection.

Bleeding gums, dry mouth, and ageusia are the most seen post-Covid dental problems. Dentists estimate that 30-40% of recovered patients present for consultation with bleeding gums and ulcerations.

2.1 Bleeding Gums

Gums normally bleed due to Covid virus-induced elevated levels of cytokines like IL6. Gum disease may raise cytokine levels in the bloodstream.

The cytokine storm, or the enhanced release of cytokines from host cells, has been associated to illness development in individuals with coronavirus disease, according to recent research (COVID-19).

Immune system then assaults the body's own tissues, which can be harmful. An overzealous inflammatory response caused by a cytokine storm can harm the blood, lungs, kidneys, vessels, and liver, as well as throughout the body increased creation of blood clots. The cytokine

storm may, in the end, be more dangerous than the coronavirus. Without a doubt, this coronavirus strain, which has lately been termed the hit and run virus, modifies the immune system, creating significant alterations in responses that turns in opposition to the host, resulting in autoimmune damage, especially to the connective tissue of the lungs [3].

2.2 Dry Mouth

The most common cause of dry mouth is breathing through one's mouth due to the use of a mask. Mouth breathing can dehydrate oral tissue, particularly if you don't drink enough water. Another biological mechanism is viral entry into the salivary glands, which are abundant in the ACE2 receptor. [6].

Owing to excess amount of ACE2 (angiotensin converting enzyme) receptor in oral tissue, studies specify that the oral cavity may be the easily affected region to this virus [7].

The ACE2 receptor has long been known to be the SARS-CoV-2 virus's target receptor and portal of admission into the human cell [7].

According to a new preprint report, salivary glands, mouth, tonsils contain the greatest RNA sub to proteins that the SARS-CoV-2 virus desires to infect cells. [8] Two of them are the ACE2 receptor and the TMPRSS enzyme, which allow the virus to combine its membrane with the host cell's and slide inside [8].

Covid-19 infection of the salivary glands can affect both the quantity and quality of saliva produced. Meanwhile, a new terminology, "Covid Tongue," has been coined in a dermatology, where raised bumps on the tongue were observed in 25-30% of post-Covid patients who were examined, followed by bursitis [3]. So far, no cases of Covid tongue have been identified in this region. [3] However, any symptoms that arise after Covid's recovery should be monitored and treated, according to a health official.

2.3 Oral Ulcerations

Many patients have oral ulcers as a result of extreme inflammation. COVID-19 has been linked to vascularity abnormalities caused by viral blood vessel disruption. The virus enters the endothelial cells that line blood vessels through the ACE2 receptor and destroys them, resulting in oxygen deprivation. Tissue necrosis, such as

oral ulcers, may be caused by vessel damage. Increased inflammation and upregulation of inflammatory markers bring about by the SARS-CoV-2 virus can worsen ulceration and tissue harm [9].

In the literature, case reports have been cited that indicate confirmed COVID-19–positive patients with oral ulcers thought to be brought about by the SARS-CoV-2 virus [10].

People having poor oral hygiene will have more severe inflammation. Individuals with these symptoms should contact their dentist as soon as possible and should not ignore the warning signs [3].

3. EFFECT OF MEDICATIONS OF COVID-19 ON ORAL HEALTH

Medicines used in the treatment of COVID19 patients, both routinely and experimentally, can have adverse effects, but the benefits outweigh the risks. Even after fully recovering from COVID19, some patients may experience oral problems related to saliva production, neurologically based oral sensations, soft tissues, and so on as a result of intensive medication [11,12]. experimental antiviral medication lopinavir and ritonavir, which are protease inhibitor combinations commonly prescribed in HIV cases, can lower viral load, severity, and bad clinical outcomes, and death rates are reduced in SARS patients [13]. These antiviral medications may cause side effects (2%), such as stomatitis, in the oral cavity and other regions of the gastrointestinal tract.

Furthermore, because topical and systemic steroids are contraindicated for COVID19 infection, [14] Long span immune-related oral medical conditions may worsen in SARSCoV2 positive patients who have been recommended to stop taking them. In theory, patients having oral problems and other coexisting comorbidities who are taking anti-inflammatory medications for rheumatoid arthritis, for example, may benefit from these treatments, shielding them from severe COVID19 consequences [15]. Adverse oral health outcomes like opportunistic fungal infections, xerostomia which are related to decreased salivation, gingivitis and ulcerations are mostly precipitated by default immune system and vulnerable oral mucosa also severe COVID-19 infection and other therapeutic measures [16].

4. OPPORTUNISTIC FUNGAL INFECTIONS CAUSED BY COVID-19 (MUCORMYCOSIS)

In some states mucormycosis which is a rare but serious fungal infection, also named as black fungus, is being identified most commonly seen in Covid-19 patients. The disease affects mostly lungs and brain but, in some instance, skin is also affected. Although it is rare, but it's a fatal infection. It is bringing about by a cluster of moulds known as mucormycetes, contemporary seen in our surroundings. Generally, people having compromised immunity due to certain medications are affected, say experts from the Covid-19 task force. After the patients inhale the spores enters the sinuses or lungs. Patients having diabetes mellitus, haematological malignancy and chemotherapy, hematopoietic stem cells, and solid-organ transplant recipients on immunosuppressive therapy, with iron overload, on peritoneal dialysis, extensive skin injury, human immunodeficiency virus (HIV) infection, and voriconazole therapy are at increased jeopardy of acquiring mucormycosis. Among citizens hospitalized or recovering from Covid 19, a marked increment in mucormycosis is noted with few requiring immediate surgery. The pathogens associated with mucormycosis varies considerably between India and developed countries [17]. Globally, *Rhizopus arrhizus* is the commonest cause of mucormycosis. The *Apophysomyces* species ranks second in India compared to the *Lichtheimia* species in developed countries. Infections due to *Rhizopus microsporus* and *Rhizopus homothallicus* are rising in India.

5. CLINICAL PRESENTATION OF MUCORMYCOSIS

Mucoromycetes does not usually offer a significant hazard to people who have a healthy immune system. According to the recommendation, mucoromycetes infection should be considered if presence of

- * Sinusitis;
- * Localized discomfort on cheekbone, one-sided facial pain, numbness or swelling;
- * Black staining across bridge of nose/palate;
- * Periodontitis, jaw involvement;
- * Unbearable diplopia and refractive errors;
- * Embolism, necrosis, dermatological problems;
- * Chest discomfort, pleural effusion, and a deterioration of respiratory symptoms are seen.

*Survivors of COVID-19 who have had the disease for weeks to months—termed long haulers—describe oral problems they're encountering such as teeth falling out, sensitive gums, teeth turning grey, and teeth cracking [18].

5.1 Teeth Cracking

An article published in September 2020 in the *New York Times* discussed the phenomena of dentists seeing a tremendous increase in patients presenting to their practices with fractured teeth during the coronavirus pandemic [16]. The article cited an increase in bruxism (teeth grinding and clenching) as the mostly likely culprit [16].

The article specifically examined three COVID-19 pandemic-related factors that could cause an increase in tooth fracture from bruxism [16]. First, psychological stress from the pandemic could have a major role in stress-related tooth fracture. Second, poor orthopedic posture from makeshift at-home workstations could lead to bruxism. Finally, sleep deprivation and/or obstructive sleep apnea could result in bruxism and cracked teeth [16].

5.2 Loss of Taste and Smell

High chances of OGDs (Oral and Gustatory dysfunction) are seen in COVID. [19] A sudden onset ageusia and anosmia are two symptoms that can be the earliest indicators of COVID19. An average of 47% (up to 80%) of individuals who test positive for COVID-19 can have subjective complaints of taste and smell loss, particularly in cases of asymptomatic or mild disease.[17] The mechanism behind this loss is suspected to be viral disruption of cranial nerves 1, 7, 9, and 10, as well as the supporting cells of neural transmission [20]. In addition, because the tongue has an abundance of ACE2 receptors, direct viral entry into tongue cells is possible.

6. TREATMENT OF MUCORMYCOSIS

Mucormycosis may require surgery in the future, even if it is treated with antifungals. Controlling diabetes, decreasing steroid use, and quitting immunomodulating medicines are all critical, according to doctors. The treatment consists of normal saline IV infusion, followed by an infusion of amphotericin B and antifungal medication given minimum for 4-6 weeks to maintain appropriate systemic hydration.

Experts on the task group emphasized the importance of monitoring blood sugar levels after Covid-19 treatment, as well as in diabetics. Steroids should be used with caution – the right time, dose, and duration are crucial. A team effort is required while treating mucormycosis. patient has to adjust with deprivation of function due to lost jaw—difficult mastication, deglutition, aesthetics and loss of self-esteem, doctors say. Once the patient recovers after surgery prosthetic replacement of lost structures is possible. Though it's an infrequent condition. However certain range of population is worse affected. A new technology came into existence called as ozone water. The wide level of advantages of ozone can be utilized in the management of many dental treatment procedures in the benefit of patients. Ozone influences the humoral and cellular immune system to generate synthesis of biologically active substances for the reduction of inflammation and promote better wound healing Ozonated water has become an undisputed disinfection agent in the management of periodontitis and has become good alternative for antiseptics. [21]

7. CONCLUSION

There is a significant bearing of oral-health on general-health. Preliminary signs of COVID19 are generally seen in oral cavity and it shouldn't be disregarded. Medical practitioners should be known to all the conditions related with COVID19. Recovered patients should take proper care and follow the guidelines and should visit the dental professional accordingly.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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