



Systematic Review

Clinical implications of Novel COVID-19 on dental practice — An overview

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ARTICLE INFO

Article history:

Received 22.10.2020

Accepted 27.01.2021

Published 24.02.2021

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[https://doi.org/](https://doi.org/10.38138/JMDR/v6i2.12)

10.38138/JMDR/v6i2.12

ABSTRACT

The Corona Virus Disease 2019 (COVID-19) caused by a zoonotic virus is considered to be highly contagious and transmissible from human to human. COVID-19 pandemic has posed a significant challenge for dentists. Dentists and auxiliary staff are at high risk due to the possibility of disease transmission through the aerosols generated during dental treatment. This article focuses on understanding the general characteristics of COVID-19, routes of transmission among dental professionals and outlines safe dental practice measures to be adopted during clinical practice amidst the pandemic. This paper discusses the clinical implications of COVID-19 on general dental practice.

Keywords: COVID 19; dental care; aerosol; transmission; guidelines; corona virus

1 BACKGROUND

A Severe Acute Respiratory Syndrome (SARS) like respiratory infection with symptoms of pneumonia emerged for the first time in December 2019, in Wuhan City, China. It attained pandemic proportion within few months of its first report. It was thought to be caused by corona group of virus, a zoonotic infection of unknown origin.⁽¹⁾ The corona virus demonstrates a community spread pattern of infection which has gripped the entire humanity and triggered extensive community health crisis. Despite, the international efforts to cease the spread, the outbreak is still escalating.⁽²⁾ Initially when the novel disease was reported immediate recognition of its consequences was delayed which lead to this perilous status quo around the world.⁽³⁾ The International Committee on Taxonomy of Viruses has scientifically termed it as SARS-CoV-2, however, it is commonly known as the COVID-19 virus. The scientific name Severe Acute Respiratory Syndrome –Corona Virus 2 (SARS-CoV-2) was given as it has close similarity in its genome pattern with that of Severe Acute Respiratory Syndrome –Corona Virus (SARS-CoV) and Middle East Respiratory Syndrome-Corona Virus (MERS-CoV). When

COVID-19 infects a human body, the presence of the virus has been recorded copiously in the nasopharyngeal and salivary secretions, and its spread is largely considered through exposure to respiratory or salivary droplets of the affected patients.⁽²⁾ This is a grave concern for dentists as they are at high risk due to the exposure to aerosol.

COVID-19

World Pandemic Crisis was declared by World Health Organization in the month of January 2020 due to the uncontrollable spread of the COVID-19. Researchers have identified the early transmission properties of SARS-CoV-2 after conducting rigorous research on the novel virus that originated in China and later spread throughout the world. Epidemiological characteristics of this deadly virus which includes, the mode of transmission, clinical properties, clinical manifestations, diagnosis, and treatment are described below;

Mode of Transmission

The spread of the virus can take place in two modes – direct and indirect. Direct- coughing, sneezing, inhalation

of droplets, saliva, oro-fecal route and person to person. Indirect – oral mucosa, nasal mucosa, ocular conjunctiva, fomites, and saliva.^(1,4) Recent data has also mentioned that Transmission from asymptomatic patients and patients in the incubation period is also plausible.⁽⁵⁾

Characteristics of COVID-19

1. The SARS-CoV-2 measures around only 120 nm (0.12 μ m).⁽³⁾
2. The virus can exist in saliva for 29 days, which can also be applicable for SARS-CoV.⁽⁶⁾
3. Although the estimated incubation period of SARS-CoV-2 is 5-6 days, data shows it can be as long as 14 days.
4. The prevalence of COVID-19 is seen high in elderly males with comorbidities and close contacts to COVID-19 patients.⁽⁷⁾
5. The fatality rate (cumulative deaths divided by cumulative cases) of COVID-19 is 0.39% to 4.05%.^(5,6)

Clinical Manifestations of COVID-19

Typical clinical symptoms of COVID-19 are fever, dry cough, myalgia, fatigue, and dyspnea. On further investigations like, chest tomography (CT) was presented with bilateral frosted glass appearance showing bilateral pneumonia of the lungs.

Whereas the atypical clinical symptoms are indicative of COVID-19 are production of sputum, headaches, hemoptysis, diarrhea, dizziness, abdominal pain, nausea, vomiting, confusion, sore throat, and loss of smell and taste.^(1,6)

In severe conditions acute respiratory distress syndrome, arrhythmia, and shock were seen in patients, likewise, poorer prognosis was observed in older individuals and patients with underlying comorbidities.⁽⁵⁾

Diagnosis

Various epidemiologic information like asking for history for any clinical symptoms, along with a travel history 14 days before the onset of symptoms, contact with symptomatic persons are vital in deciding to go forward with the diagnostic test. If there is a contributing history then sample collection for SARS-CoV-2 should be accurate and specific as it may directly affect the diagnosis of the tests done. If the patients are asymptomatic nasopharyngeal (NP) and oropharyngeal (OP) swabs, nasopharyngeal wash/aspirate or nasal aspirate (NA), throat swab, and throat washing specimens are collected from the upper respiratory tract, however if the patients are symptomatic sputum, a lower respiratory tract aspirate and broncho-alveolar lavage specimens are collected from lower respiratory tract. Identification of the novel virus can be carried out various techniques like i) the conventional methods of cell culture and electron microscopy, ii) nucleic amplification tests like Real Time

Reverse-Transcription Polymerase Chain Reaction (rRT-PCR) and reverse transcription loop-mediated isothermal amplification (RT-LAMP), iii) Immunoassay method to detect SARS-CoV-2 antibodies or antigens in fluids of the patients, and iv) radiographic assessment of lungs with Computed tomography (CT) scan.

Treatment

Even though there is no specific universal protocol or guidelines that have been recommended for treating suspected or confirmed cases of COVID-19, it is of crucial significance that early identification and timely symptomatic treatment should be carried out to avoid fatality.

The present line of treatment for COVID-19 is i) symptomatic treatment to control the source of infection; ii) use infection prevention and control measures to lower the risk of transmission like movement control, quarantine, social distancing and creating public awareness; iii) provide early diagnosis, isolation, and supportive care for affected patients and iv) medications have been used across the world to reduce the death rate in patients.⁽⁵⁻⁹⁾

- Antiviral drugs – Remdesivir is the only drug that has been approved by Food and Drug administration for treatment of COVID-19.
- Vaccines have been developed across the world to control the spread of COVID-19 and vaccination have also begun in many parts of the world.
- Chloroquine and hydroxychloroquine
- Corticosteroids
- Convalescent plasma transfusion
- Antibodies

Impact on Dentistry

Dentists are very much aware regarding occupational health concerns in dentistry, due to infectious diseases like hepatitis, tuberculosis, etc., and its risk assessment, whereas other professions do not have to consider such issues, this puts dentists in the high-risk category during this COVID-19 pandemic.⁽³⁾ Initially, the impact of COVID-19 pandemic on dentistry remained unclear leaving the regulatory and advisory bodies silenced and leaving them no choice but advise the dentist all over the world to regulate their routine dental care to only emergency treatments, although in few countries the dental clinics were instructed to be closed during the lockdown period to prevent the transmission through dental clinics.⁽⁶⁾

Most of the dental schools have suspended clinical activities to prevent nosocomial infections and adapted virtual teaching in various online platforms. Nevertheless, they face a great challenge identifying an alternate way of training the students for direct patient treatment, as it is a crucial part of the curriculum.^(5,10)

Why dental procedure are high risk during this covid-19 pandemic?

Previous studies have shown the large amount of microorganism are present in 1ml of saliva. According to a study conducted on the microbiomes in the oral cavity it revealed a presence of 600 million various types of microorganism present in the oral cavity and about 100 million bacteria present in 1ml of saliva.⁽¹¹⁾ Another study conducted to examine the presence of Hepatitis C virus showed results of approximately 2000 hepatitis C virus in 1ml of saliva.⁽¹²⁾ In a study done recently after the onset of the pandemic, it showed a presence of approximately 158,000 SARS-CoV-2 virus in 1ml of saliva confirming the high rate of transmission of COVID-19 through saliva.⁽¹³⁾

Saliva and blood from the infected patient present in the aerosol is considered to be the chief source for transmission in a dental clinic (Figure 1). There are 3 different possible routes through which SARS-CoV-2 can be present in saliva.

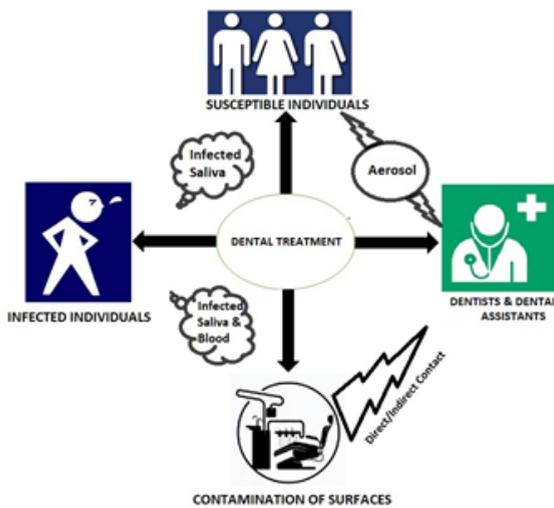


Fig. 1: Various routes of transmission of COVID-19 in dental clinic

First route is as the liquid droplets entering the oral cavity from the lower and upper respiratory tract. Second route is the Presence of SARS-CoV-2 in blood and entry to the oral cavity through Gingival Crevicular Fluid. Third, through saliva secreted from the infected major and minor salivary gland.⁽⁴⁾ It is known that SARS-CoV-2 can bind to human Angiotensin-Converting Enzyme 2 (ACE-2) receptors, which are highly concentrated in salivary glands; this may be a possible explanation for the presence of SARS-CoV-2 in secretory saliva.⁽²⁾

In dentistry use of high speed rotary instruments, ultrasonic scalers, air-water syringes, drills etc. are unavoidable, moreover, these instruments due to its high speed it generates large amount of heat which is injurious to the hard/soft tissues and pulpal nerves in the oral cavity. To

control the temperature water spray is used along with all these instruments which leads to the formation of aerosols mixed with saliva and blood which are reservoirs of bacteria, fungi and viruses. Besides liquid aerosols, solid particles like tooth substance, plaque, calculus abrasive powder etc. are also emitted into the surroundings during the procedures. In a study done to assess the quantitative risk assessment of microbial aerosol during dental procedures, the results showed that aerosol production was at its peak during scaling and significantly less when compared to extractions and drilling procedures. (Figure 2) Although, there was no significant difference in aerosol production amongst ultrasonic and sonic scalers.⁽¹⁴⁾

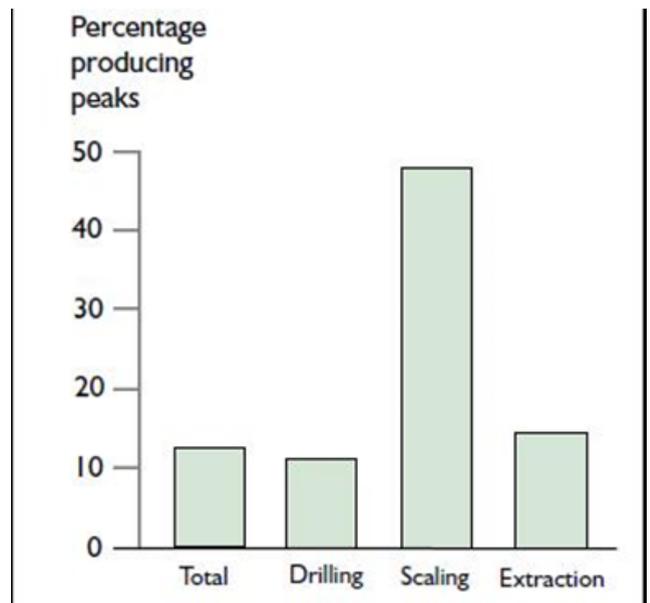


Fig. 2: Peak Percentage of Aerosol Production during various Dental Procedures

Bennett AM, Fulford MR, Walker JT, Bradshaw DJ, Martin MV, Marsh PD. Microbial aerosols in general dental practice. British dental journal. 2000 Dec;189(12):664-7.

A previous study done on blood-containing aerosols generated by powered dental instruments showed that aerosols produced during dental procedures can transmit 100,000 microbes per cubic foot up to six feet, and, microbes can stay in air from 35 minutes to 17 hours if there is insufficient air flow current or ventilation system.⁽¹⁵⁾ These blood-containing aerosols from infected persons can settle down and contaminate the entire surface in a dental clinic. Furthermore, it is found that the Human Corona virus with active infectivity can stay in air from 2 hours to 9 days and survive better at higher relative humidity.⁽¹⁶⁾

Recently an in-vitro study was done to compare the effect of povidone iodine and hydrogen peroxide on SARS-CoV-2 as a pre-procedural rinse. The result study showed that povidone iodine with a concentration of 0.5% and 1.5%

for 15 seconds can be considered over hydrogen peroxide as a pre-procedural rinse, since the SARS-CoV-2 virus is completely inactivated after the rinse. Another clinical study has also shown significant reduction in the microbial levels in aerosol while using 0.2% of chlorhexidine for 60 seconds as pre-procedural rinse. Therefore, these pre-procedural rinses along with use of high volume suction and saliva ejector, constant disinfection of surfaces and maintaining a clean and dry dental environment acts as an adjunct in reduction of the viral load in the aerosol generated, also, can significantly reduce the presence of Human Corona virus in the dental clinic. (15–19)

However, considering the factors like the mode of transmission, increased level of transmissibility, the severity of the infection, high risks of fatality due to novel COVID-19 and the viral load in the saliva, added precautionary protocols has to be followed to treat patients in a dental setup to ensure minimal aerosol generation during the procedures. Aerosols and splatter can be controlled by following these steps:

Guidelines For Treating Patients During COVID-19 Pandemic (3,5,6,15–19)

- Careful screening questions to be asked to all patients pre-appointment over the telephone. Questions to be asked are for i) travel history before 14 days, ii) ask for clinical symptoms (rise in body temperature, cough, difficulty in breathing, respiratory infection, flu like symptoms etc.) in the past 14 days, iii) any close contact with known people/family members showing the clinical symptoms or who have recent travel history, iv) have you attended any large gathering or get together with unknown people v) have you visited any COVID-19 containment zones in your locality and finally based on the information collected categorizing the treatment for the patients (Figure 3).
- Dentists can defer treatment based on the screening symptoms, body temperature and follow proper referral protocol to quarantine centers. (Table 1)
- Considering every patient as a potential asymptomatic COVID-19 carrier.
- Proper Hand hygiene – wash hands with soap or use alcohol-based disinfectants before patient examination, before dental procedures, after touching the patient, after touching the surroundings, equipment without disinfection and after touching oral mucosa, saliva and blood. Disinfect all surfaces within the dental clinic.
- Use of Personal protective equipment (PPE) – gloves, N-95 mouth masks, goggles, face shield, and body protective wear for Dentist and Dental assistants. Before and after the procedure PPE must be carefully worn and removed respectively, by following the correct sequence and technique.

- Precaution should be taken by the dental professionals to avoid touching their own eyes, mouth, nose or skin while or immediately after treating patients without proper hand wash.
- In unavoidable cases of emergency dental care (tooth pain and/or swelling) for suspected or confirmed cases of COVID-19 conditions, pharmacologic management in the form of antibiotics and/or analgesics is an alternative. This approach may offer symptomatic relief and will provide dentists sufficient time to either refer the patient to a specialist or deliver dental care with all appropriate measures in place to prevent the spread of infection
- Unfortunately, if postponing treatment is not possible then perform treatment in airborne infection isolation rooms (AIIRs) or negative pressure rooms ideally at a hospital setting.
- For radiographic investigations consider extra-oral radiographs over intra-oral radiograph, as salivation and gag reflex is very minimal.
- Provide 15 ml of 0.2% chlorhexidine mouthwash for 60 seconds or 0.5-1.5% of povidone iodine for a pre-procedural rinse for 15 seconds to minimize the SARS-CoV-2 viral load in the patient's saliva has been recommended.
- Prevent cross-infection risk by using Disposable and single-use instruments and devices.
- Avoid using aerosol-generating instruments (airotors, scalers, high-speed hand-piece, etc.) utmost and perform all the procedures minimally invasive.
- Use of high volume saliva ejector, high volume suction and rubber dam to curtail aerosol and splatter during the procedures.
- Post-treatment, environmental cleaning, ample ventilation, and disinfection procedures should be followed.
- In emergency Life-threatening cases, immediate admission to the hospital followed by a chest CT to rule out suspected SARS-CoV-2 infection, as RT-PCR is time-consuming.

2 CONCLUSION

This novel COVID-19 pandemic cannot be taken lightly or carelessly as it has taken millions of lives around the globe. Moreover, until now the complete understanding of the virus is still not clear, which makes it even more dangerous, as a standardized treatment protocol for its prevention is unavailable. Referring to the mechanism of how this virus works dentists are also at high risk for contracting the infection. This asks for adopting improved and safer guidelines during dental treatments which require in-depth research regarding the virus to establish a standardized protocol.

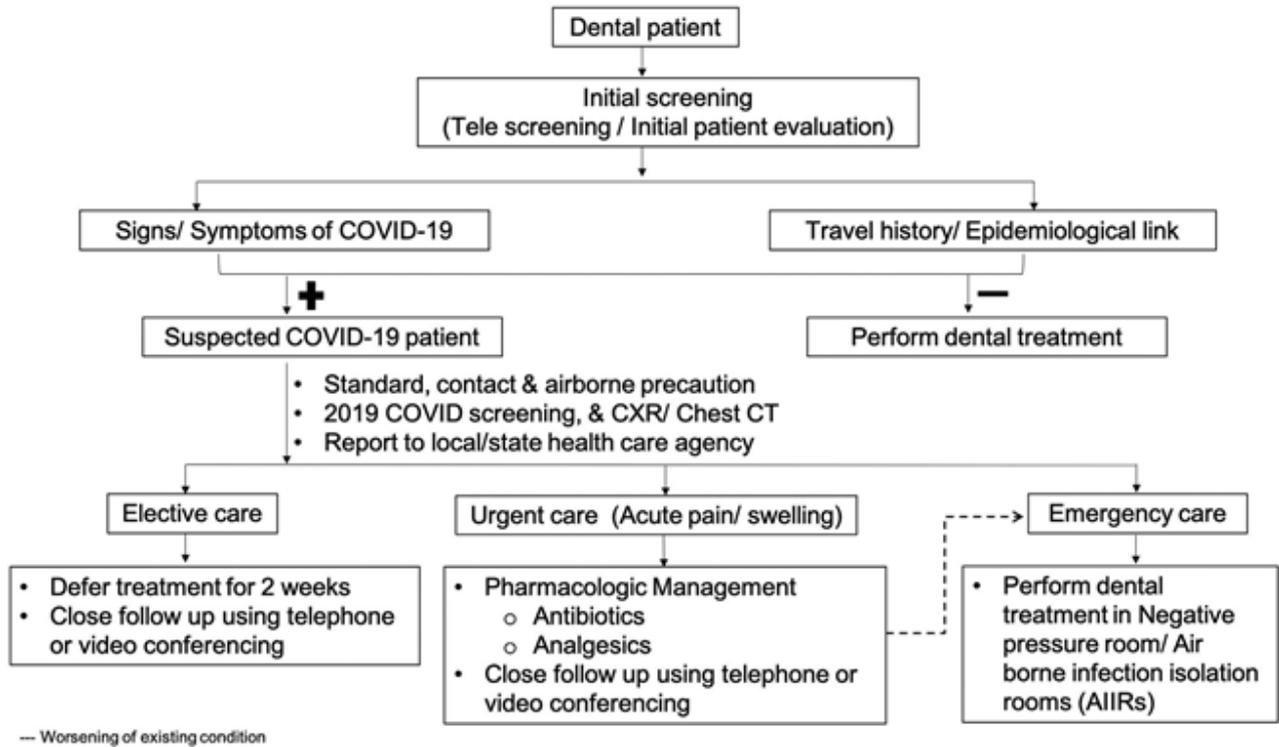


Fig. 3: Management of patients during COVID-19 pandemic in Dental Clinic. A Ather, B Patel, NB Ruparel, A Diogenes. Coronavirus Disease 19 (COVID-19): Implications for Clinical Dental Care. J Endod. 2020;46(5):584–95.

Table 1: Decision-making in Deferring Patients from Dental Treatment during COVID- 19 Pandemic.

SCREENING SYMPTOMS	TEMPERATURE	DECISION MAKING IN TREATMENT	STANDARDIZED OPERATING PROTOCOL
Present	< 37.30 C	Defer treatment	Home quarantine and assessing the flu- like symptoms and temperature for 14 days, if present, report to Local Health Authorities. If absent report back for dental treatment.
Present	>37.30 C	Defer treatment	Immediate institutionalized quarantine and dentist should report to Infection Control Department or Local Health Authorities
Absent	< 37.30 C	Treat with extra personal protection, disinfection protocols and avoid aerosol generating procedures	---
Absent	>37.30 C	Defer treatment	Refer the patient to a COVID-19 center for a Confirmatory COVID-19 test. If, tested negative can continue with dental treatment and tested positive should be quarantined.

REFERENCES

- 1) Coelho MG. Impacto del COVID-19 (SARS-CoV-2) a Nivel Mundial, Implicancias y Medidas Preventivas en la Práctica Dental y sus Consecuencias Psicológicas en los Pacientes. *Int j odontostomatol.* 2020;14(3):271–278.
- 2) Ather A, Patel B, Ruparel NB, Diogenes A. Coronavirus Disease 19 (COVID-19): Implications for Clinical Dental Care. *J Endod.* 2020;46(5):584–595.
- 3) Coulthard P. Dentistry and coronavirus (COVID-19) - moral decision-making. *British Dental Journal.* 2020;228(7):503–505. Available from: <https://dx.doi.org/10.1038/s41415-020-1482-1>.
- 4) Sabino-Silva R, Jardim ACG, Siqueira WL. Coronavirus COVID-19 impacts to dentistry and potential salivary diagnosis. *Clinical Oral Investigations.* 2020;24(4):1619–1621. Available from: <https://dx.doi.org/10.1007/s00784-020-03248-x>.
- 5) Meng L, Hua F, Bian Z. Coronavirus Disease 2019 (COVID-19): Emerging and Future Challenges for Dental and Oral Medicine. *Journal of Dental Research.* 2020;99(5):481–487. Available from: <https://dx.doi.org/10.1177/0022034520914246>.

- 6) Alharbi A, Alharbi S, Alqaidi S. Guidelines for dental care provision during the COVID-19 pandemic. *The Saudi Dental Journal.* 2020;32(4):181–186. Available from: <https://dx.doi.org/10.1016/j.sdentj.2020.04.001>.
- 7) Chen N, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet.* 2020;395:507–513.
- 8) Zhai P, et al. The epidemiology, diagnosis and treatment of COVID-19. *Int J Antimicrob Agents.* 2020;55(5).
- 9) Wu SY, Yau HS, Yu MY, et al. The diagnostic methods in the COVID-19 pandemic, today and in the future. *Expert Review of Molecular Diagnostics;*20(9):985–993.
- 10) Iyer P, et al. Impact of COVID-19 on dental education in the United States. *J Dent Educ.* 2020;84(6):718–722.
- 11) Nasidze I, Li J, Quinque D, Tang K, Stoneking M. Global diversity in the human salivary microbiome. *Genome Research.* 2009;19(4):636–643. Available from: <https://dx.doi.org/10.1101/gr.084616.108>.
- 12) Santos RL, Deus DMD, Lopes EPDA, Coêlho MR, Castro JFD. Evaluation of viral load in saliva from patients with chronic hepatitis C infection. *Clin Oral Investig.* 2020;24(4):1619–1621.
- 13) To KKW, Tsang OTY, Leung WS, et al. Temporal profiles of viral load in posterior oropharyngeal saliva samples and serum antibody responses during infection by SARS-CoV-2: an observational cohort study. *Lancet Infect Dis.* 2020;20(5):565–574.
- 14) Bennett AM, Fulford MR, Walker JT, Bradshaw DJ, Martin MV, Marsh PD. Occupational health: Microbial aerosols in general dental practice. *Br Dent J.* 2000;189(12):664–667.
- 15) Miller RL. Characteristics of blood-containing aerosols generated by common powered dental instruments. *Am Ind Hyg Assoc J.* 1995;56(7):670–676.
- 16) Peng X, Xu X, Li Y, Cheng L, Zhou X, Ren B. Transmission routes of 2019-nCoV and controls in dental practice. *Int J Oral Sci.* 2020;12(1):1–6.
- 17) Bidra AS, Pelletier JS, Westover JB, Frank S, Brown SM, Tessema B. Comparison of In Vitro Inactivation of SARS CoV-2 with Hydrogen Peroxide and Povidone-Iodine Oral Antiseptic Rinses. *Journal of Prosthodontics.* 2020;29(7):599–603. Available from: <https://dx.doi.org/10.1111/jopr.13220>.
- 18) Eggers M, Koburger-Janssen T, Eickmann M, Zorn J. In Vitro Bactericidal and Virucidal Efficacy of Povidone-Iodine Gargle/Mouthwash Against Respiratory and Oral Tract Pathogens. *Infectious Diseases and Therapy.* 2018;7(2):249–259. Available from: <https://dx.doi.org/10.1007/s40121-018-0200-7>.
- 19) Sawhney A, Venugopal S, Babu GR, et al. Aerosols how dangerous they are in clinical practice. *J Clin Diag Res.* 2015;9(4):52–57.