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## Review Article

# Dental practice during the era of COVID-19

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### ABSTRACT

**Background:** Since the emergence of COVID-19, dentists all over the world have been put into the high risk zone for the possibility of cross-infection. All the dental clinics were initially instructed to treat only emergency cases which resulted into the negligence of dental health. In order to restore the dental health status and dental practices, it is necessary for dentists and dental staff to follow utmost precautions and new treatment protocol to reduce the chances of infection and contamination of dental operatory.

**Objective:** This review article focuses on the current scenario of dentistry based on the outbreak of pandemic in year 2020 and how dentists can modify the treatment protocol in order to deliver safe and efficient treatment to the patients.

**Research Method:** Literature for the review was searched using the online database – Pubmed. Around 70 studies were being referred to understand the disease and its impact on dentistry.

**Review Results:** Changes should be made in the designing of the clinic along with adoption of the new working protocol. Appointments should be scheduled in a way such that social distancing is followed. All the patients and dental staff shall be made familiar with the concept of hand hygiene, personal protective wear, use of masks and other hygiene etiquettes and protocols.

**Clinical Significance:** Dental staff should be trained prior to opening of the clinic. They all must be trained to maintain a sterile environment and record a thorough case history. All the working members must also be made aware about the oral manifestations of COVID-19 and should be looked for before initiating the treatment.

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## 1. Origin of COVID-19

COVID-19 was first found in the city of Wuhan, China on 31 December, 2019.<sup>1</sup> The outbreak originated from Hunan seafood market in Wuhan. Coronavirus originally belongs to Coronaviridae family of *Nidovirales* order and the particular strain isolated from the patients in China belonged to the  $\beta$  group of Coronaviridae family.<sup>2</sup> It consists of a positive-sense single stranded RNA genome with approximately 30 kilo base<sup>3</sup> and has a spherical structure consisting of RNA matrix shelled by an envelope made up of proteins. Several glycoprotein projections are attached to this envelope.<sup>4</sup> This particular structure of the virus as observed under electron microscope resembles a

“crown” and hence the virus is known as coronavirus. Its diameter ranges from 150 nm to 160 nm.<sup>5</sup> Coronavirus has a unique Nucleoprotein (N) which is bounded to the RNA in a helical structure, making it less prone to degradation.<sup>6</sup>

On January 30, 2020 WHO officially announced the outbreak as a global health emergency and a pandemic.<sup>7</sup> Novel coronavirus was officially named as COVID-19 on the basis of its nomenclature by WHO on February 11, 2020.<sup>8</sup> As on 12 September, 2020, total number of recorded cases worldwide are 28,761,906 out of which 921,596 people have lost their lives. The first fatal case was reported on 11 January, 2020.<sup>9</sup>

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## 2. Clinical Manifestation of COVID-19

COVID-19 shares 79% similarity with the genome of SARS-CoV suggesting that there might be a similarity in their pathogenesis also.<sup>10,11</sup> Both of them use ACE2 receptors to enter the host cell which are plentiful on alveolar type II cells and ciliated cells of alveolar epithelium of lungs.<sup>12</sup> For the same particular reason, COVID-19 and SARS-CoV share identical clinical symptoms as well.<sup>13</sup>

Incubation period of the infection ranges from 1 to 14 days.<sup>14,15</sup> COVID-19 can have a wide range of symptoms from mild to severe. Typical symptoms of coronavirus infection include dry cough, fever, bodyache and headache, shortness of breath, muscular pain and weakness. Some additional symptoms have also been observed in certain patients like diarrhea, rhinorrhea, vomiting and loss of sense of smell and taste. Dominant symptom out of all is fever (98%) and that is why temperature check is being considered in daily screening of the infection.<sup>16</sup>

It has been observed that coronavirus in mild cases is usually self limiting and patients mostly recover within 1-2 weeks.<sup>8</sup> Majority of the fatal cases had underlying illness like pre-existing cardiovascular disease, diabetes mellitus, neurological disease; etc.<sup>17</sup> ARDS (Acute Respiratory Distress Syndrome) and multiple organ failure so far have been the most common cause of death among coronavirus infected people.<sup>18,19</sup>

### 2.1. Cytokine storm

Studies have showed that severely ill coronavirus infected patients had abnormally large amount of release of pro-inflammatory cytokine in their body which could be the key reason for development of ARDS and multiple organ failure.<sup>20</sup> This increased release of cytokine in such patients has been termed as “cytokine storm”.

Release of cytokine into the blood circulation is an important innate immune response of the body against all the viral infections and if this release gets exaggerated, it could result into organ and tissue damage. Similar thing is observed in COVID-19 infection. Abnormal increased release of cytokines like IL-6, IL-1, TNF- $\alpha$ , and interferon result into accelerated influx of macrophages, neutrophils and T cells at the site of the infection.<sup>21</sup> This influx of cells causes damage to the lungs and other organs resulting into the death of an individual.

## 3. Transmission of COVID-19

Potential recognized routes of transmission of the infection as per recent reports are<sup>22,23</sup>

1. Respiratory Droplets
2. Contact with contaminated surfaces
3. Aerosol transmission/Air borne transmission
4. Human to human contact

It has been seen that infected small droplets (5 to 10  $\mu\text{m}$ ) or droplet nuclei (<5  $\mu\text{m}$ ) can remain suspended in air for a considerable amount of time, capable of infecting a person coming in close contact with them.<sup>24</sup> Van Doremalen et al.,<sup>25</sup> in their study, reveal that viral particles can remain viable in aerosols for up to 3 hours. It has also been observed in recent studies that COVID-19 cannot penetrate the intact skin due to the presence of keratin in it but is capable of leaking down into the body system through contact with mucosal layer such as that of eyes, nose and mouth.<sup>26</sup> Due to the same reason it is advised not to touch the face with contaminated hands.

Asymptomatic cases have also been reported which were capable of spreading the infection<sup>27</sup> as viral load in asymptomatic patients is no less than those with the symptoms.

## 4. Diagnosis of COVID-19

Samples for diagnosis are collected using nasopharyngeal and oropharyngeal swabs from upper respiratory tract. The collected samples are then analyzed using RT-PCR test.<sup>28</sup> The sensitivity of RT-PCR is very high and hence it is being used commonly. Bronchoscopy can also be used in incubated patients to observe the change in lungs but it is avoided in regular screening due to the risk of generation of aerosols.<sup>28</sup> RNA of COVID-19 has also been detected in stool and blood samples.<sup>29</sup> False positive test are very common among asymptomatic patients due to the contamination of the swabs.

Few studies have suggested that saliva could also be a potential diagnostic tool as it has been observed that the virus can be isolated from the saliva of the patients for up to 29 days even after the infection.<sup>30</sup>

One major threat posed by coronavirus is appearance of continuous positive RT-PCR test even in samples of patients recovered from the infection.<sup>8</sup> This characteristic has never been displayed in the entire human history before.<sup>8</sup> A potential challenge faced by the world due to the same is difficulty in controlling the spread of the infection. Asymptomatic carriers have added to this burden because of trouble in tracing of such cases.

## 5. Research Method

Literature for the review was searched using the online database- Pubmed. Over 70 studies published from January, 2020 to August, 2020 were referred to understand the disease and its impact on dentistry. No language barrier was taken into consideration. All the nonscientific discussion papers, short communications and web data were excluded.

## 6. Occupational Hazard for Dentists

Soon after the announcement of COVID-19 as pandemic by WHO, most of the dental clinics were shut down all over the

world and were bound to attend only emergency situations in order to prevent cross contamination to the patients and to the doctors. Both, WHO and Health Ministry of India has put dentists in high risk category for COVID infection because of the very obvious interaction with contaminated aerosols and close contact with oropharyngeal region of the patient while performing the operations.<sup>31</sup> Dentists are required to follow strict regulatory protocols while performing the treatment procedures in order to prevent such transmission of disease. There are many oro-facial manifestations of COVID-19 as well which dentists must be able to recognize to avoid any unnecessary contamination of the operatory and persons.<sup>32</sup>

### 7. Oral Manifestions of COVID-19

Dentists can look out for oro-facial manifestations of COVID-19 as the warning sign before initiating the treatment. According to recent studies, signs noted in the oral cavity include appearance of vesiculobullous lesions in the oral cavity like ulcers,<sup>33,34</sup> desquamative gingivitis, loss of taste sensation, dysgeusia,<sup>35</sup> geographic tongue<sup>36</sup> and oral candidiasis.<sup>36</sup>

Patients with any of the above mentioned or any other abnormal oral finding should be asked to get COVID-19 test done in order to confirm the existence of infection. Also, dentists should be asked to visit the patients already infected with COVID-19 and admitted in hospitals to confirm the presence of such lesions and provide required, adequate treatment.

### 8. Routine Dental Care Treatment during the Era of COVID-19

Outbreak of this pandemic has affected the dental practices all over the world. This review focuses on the new norms that must be followed by dental professionals in order to restore their practices and status of dental health among their patients. The Dental Council of India (DCI) and many other dental regulatory bodies all over the world including American Dental Association (ADA) and UK General Dental Council (GDC) have released a set of instructions to be followed by the dentists to avoid cross-contamination.

#### 8.1. Initial screening of the patients

Dental professionals, before initiating the treatment must be able to identify and sort patients with high risk of infection.<sup>37</sup> The first interaction with the patient must be on the phone in the form of tele-consultation. On the basis of the telephonic triage, it should be decided if the condition is an emergency or not. If the condition isn't an emergency then the desired medicinal prescription must be given to avoid any unnecessary visit to the dental clinic. (Chart 1)

An elaborated clinical history is a must to confirm the presence of any suspected signs and symptoms of the

infection. Patient should be provided with a questionnaire asking about his/her recent body temperature, history of presence of cough, difficulty in breathing, travel history or if they have met any person with such symptoms in past two weeks.<sup>37,38</sup> Patient shall also be asked about the appearance of such symptoms in any of the family member. (Table 1).

**Table 1:** Questionnaire to be filled by the patients upon their arrival in the clinic

S.No.	Questions	Yes	No.
1.	Do you have any travel history (abroad or within the country) in past 15 days?		
2.	Did you experience any symptoms of Covid-19 like fever, cough or bodyache in past 15 day?		
3.	Did you recently meet any person with such symptoms?		
4.	Did any of your family member/person you live		

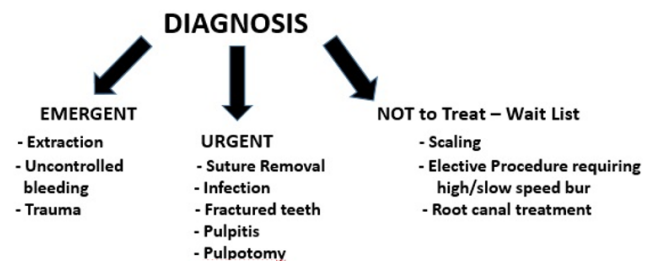


Chart 1: Categorization of dental procedures under emergent, urgent and not to treat categories

#### 8.2. Scheduling of appointments

Dental appointments should be planned in such a way that there is no crowding at the clinic. Estimated treatment time should exceed by 30 minutes deliberately to organize and disinfect the operatory for next patient. All the immune-compromised patients, elderly and those with any underlying co-morbidity should be asked to visit during the morning time as they are at a higher risk of capturing the infection. At least 2 meter of distance between patients and their accompanying care givers or relatives in the waiting area should be observed.<sup>39</sup>

All the patients visiting the clinic should be strictly advised to wear face masks and shoe covers upon their entry to the clinic. Upon the arrival of the patients in the dental setup, an initial temperature check should be done. Treatment of any patient having temperature higher than 37.5 degrees Celsius should be deferred.<sup>40</sup> Sanitization of hands upon entry to the clinic should be a must. A separate disposable plastic bag can be given by the assistant to the patient to keep all the accessories and personal items.

Thereafter, patient must be instructed to wait in the waiting area till the operatory and the doctor are ready to initiate the treatment.<sup>41</sup> For adult patients, accompanying relatives should be asked to wait outside the clinic. For caregivers and nannies; protocol, similar to the one followed with the patient must be applied.

### 8.3. *Hand hygiene*

WHO states that washing hands properly with soap and water can effectively eradicate the virus from skin of hands and prevent transmission of infection.<sup>42</sup> They also state that if the hands aren't visibly soiled then cleaning the hands with 60-70% alcohol based hand rub can be equally effective.<sup>42</sup>

Thus, it is suggested that upon entry of the patient in the clinic, they should be instructed to sanitize their hands using an alcohol based hand rub. It is highly recommended for the professional as well to thoroughly wash their hands for at least 20 seconds before gloving up, after the completion of the procedure and after touching any contaminated surrounding of the patient. Same instructions are supposed to be followed by all the other staff members of the clinic.

### 8.4. *Personal protective equipment*

Due to the close proximity of face of the patient and the dentist while performing dental treatment procedures, there is high chance of transmission of infection. Dental professional are hence advised to wear full PPE kit while performing the procedure.

**Face Mask:** While performing aerosol generating procedure, N 95 (National Institute for Occupational Safety and Health-certified) respirator should be worn.<sup>42,43</sup> For treating dental emergency of COVID-19 suspected or positive patients EU FFP3 respirators (European Standard Filtering Face Piece) or an equivalent respirator are supposed to be worn.<sup>26,42</sup> If N95 respirator is not available readily, then a surgical mask can be worn but only in case of non aerosol generating procedure of a COVID-19 negative person at distance of up to 1 cm.<sup>43</sup>

It is suggested that before entering the operatory for the treatment, patients should also wear PPE and be in it till the end of the treatment.

### 8.5. *Pre-procedural mouth rinse*

No studies so far have proven the efficacy of chlorhexidine mouthwash against COVID-19. Though, it has been seen that the virus can be destroyed by oxidation process, indicating the use of oxidizing agents such as 1% hydrogen peroxide or 0.2% povidone for pre-procedural mouth rinse to reduce the viral load in oral cavity.<sup>44</sup>

### 8.6. *Use of rubber dam*

Rubber dam is capable of reducing the aerosol generation by 70% and thereby reducing the chance of viral transmission.<sup>45</sup> Any aerosol generating procedure, thus, shall be guided by the use of a rubber dam. If it isn't available, then it is suggested to avoid the procedure or use an alternative, no aerosol generating procedure like use of hand scalers instead of an ultrasonic scaler for periodontal scaling.

### 8.7. *Reduction of aerosols in dental operatory*

Possible source of generation of aerosols in a dental operatory can be air driven hand pieces, ultrasonic devices, abrasion devices and air polishers.<sup>46</sup> Aerosols aren't just a threat in spread of coronavirus infection but can also cause spread of various other infectious disease including influenza, tuberculosis; etc. Air filters can be installed, along with the use of rubber dam to reduce the amount of contaminated air in the operatory. Two most easily available and cheapest options for air filtration are: high-volume evacuator (HVE) and high-efficiency particulate arrester (HEPA) filters.<sup>47</sup>

#### 8.7.1. *High-volume evacuator (HVE)*

This suction device can help in removing the air at a rate of up to 2.83 meter cube per minute. They effectively reduce contamination caused by the operating site by 90%.<sup>48</sup> For proper filtration the device should be held at a proper distance (approximately 6–15 mm) from the active ultrasonic tip.<sup>47</sup> Its one limitation is that it requires an assistant to hold and aim the vacuum to eliminate the water spray produced during dental procedures.

#### 8.8. *High-efficiency particulate arrester (HEPA) filters*

This device can remove 99.97% of the particles. It is able to catch any viral particle in the air before it is able to attach to any surface. One big disadvantage associated with HEPA filter is that it is expensive in compare to HVE filter and difficult to clean.<sup>49</sup>

### 8.9. *Disinfection of the operatory and contaminated surfaces*

Viral particles diffused in air can settle on surfaces, making them contaminated. Different studies suggest that COVID-19 can remain active on hard surfaces for from 2 hours to 9 days.<sup>50</sup> It has also been seen that virus can survive for longer at a temperature less than 30 degrees Celsius<sup>51</sup> and its rate of presence is better at relative humidity of 50% in compare to that of 30%.<sup>51</sup> Due to such prolonged survival of virus on hard surfaces under these mentioned conditions, it is essential to disinfect these surfaces.

All the hard surfaces can be efficiently cleaned using 62–71% ethanol/ 0.5% hydrogen peroxide/ 0.1% sodium hypochlorite for 1 minute.<sup>50</sup>

### 8.9.1. Far-UVC light

Far- UVC light (207–222 nm) can efficiently kill the virus and bacteria in environment without causing any harm to human skin and eyes.<sup>52</sup> It gets absorbed by the genetic material of the microbes, causing its structural damage via photodimerization process and hence, ceasing their replication process.<sup>53</sup> UVC is able to deactivate virus at adose of 2 mJ/cm<sup>2</sup>.<sup>52,54</sup> The disinfection process is usually carried out for 20 to 30 minutes.<sup>55</sup>

Surfaces of the clinic in the dark region, where UVC is unable to penetrate can always remain infected. So, it is advised to supplement Far-UVC light disinfection with surface disinfection with chemicals as described above.<sup>55</sup> Along with all this, proper ventilation of the clinic should be maintained accompanied with regular maintenance of air conditioning systems.

Chemical defogging for disinfection of the operatory is being employed in some of the clinics, but it should be avoided as the wet surfaces obtained after the process of chemical defogging can promote the proliferation of the virus. Virus has a better chance of survival under moist conditions as mentioned above, resulting into the failure of disinfection using chemical defogging.

## 9. Organization of the clinic

Minimalism is the key to avoid any cross infection. Dental clinics should be divided into two areas: treatment and non treatment zones.<sup>56</sup> Treatment zone includes the dental operatory and non treatment zones involve the waiting area, consultation room, radiograph room and other non operating office rooms.

All the unnecessary furniture items like decorative wall hangings, informative posters, magazines for entertainment, fish tanks should be removed from the clinic. Only Chairs must be kept in the waiting area at a distance of 2 meter. It is recommended to separate the reception and billing desk with a glass to protect the staff.<sup>41</sup>

Treatment room shall be spacious and free of any unwanted furniture with well maintained ventilation. Only the clinician, dental assistant and the patient should be allowed inside the treatment room with fully protected PPE kits. Ideally, there should be two dental teams made: one for the initial screening, case history recording and shooting of radiographs in the non treatment area and one for performing the dental procedure. Both the teams should work in their zones respectively for efficient patient handling.

### 9.1. After the completion of the treatment

After the treatment is completed, PPE of the patient, doctor and other staff is supposed to be collected by the assistant and disposed off according to the guidelines of government under the category of biomedical waste. Used instruments should be cleaned using alcohol based solution and then sent for autoclave. Operatory should be disinfected properly after all the treatments are done, so that there is no contamination left for early morning appointments. Entire working staff and doctors are advised to sanitize and wash their hands thoroughly before leaving the clinic. Clothes worn during the clinical session should be washed separately to protect the family members and upon arrival to the house, dental staff and doctor should take bath.

## 10. Conclusion

All the dental clinics must absorb the new norms. Adequate training should be provided to the dental staff and doctors to maintain a sterile environment and to guide the patients through the new working protocol. To avoid the chance of cross infection, re-designing of the clinic should be taken into consideration.

## 11. Source of Funding

None.

## 12. Conflict of Interest

None.

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### Author biography

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