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### RESEARCH ARTICLE

#### COVID 19- AN EXPEDITIOUSLY TRANSMITTING VIRAL PANDEMIC: AN OVERVIEW

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#### Abstract

COVID 19 is a rapidly transmitting airborne viral infection caused by severe acute respiratory syndrome corona virus 2(SARS- CoV-2). Disease was first reported in Hubei province of Wuhan city, China in December 2019, which spread globally within a short span of around 3months. This manuscript briefs on epidemiology, transmission modes, clinical aspects, diagnostic approach and preventive measures and focuses on precautions to be taken by dental and medical professionals.

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#### Introduction:-

Coronavirus disease 2019 is possibly a serious respiratory acute infection caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). COVID 19 was identified in late December 2019 as the pathogen responsible for emergent potentially fatal pneumonia in city of Wuhan, china<sup>1</sup>. COVID 19 has rapidly spread from Wuhan to most other provinces affecting about 6,799,713 humans and over 397,388 lost their life (as on 7<sup>th</sup> June 2020). World Health Organization declared a public health emergency of international concern over this global pneumonia outbreak on 30th January 2020. Clinical manifestations were similar to airway infection and presentation varied from mild common cold to severe viral pneumonia progressing to acute respiratory distress syndrome that could be lethal. The emblematic clinical expression of the patients who suffered from the novel viral pneumonia was fever, cough, myalgia and abnormal chest CT, and subtle symptoms were sputum production, headache, haemoptysis, and diarrhoea<sup>2-4</sup>.

Clinical presentation of COVID 19 were disparate from the severe acute respiratory syndrome (SARS) caused by SARS coronavirus (SARS-CoV) that popped up in 2002–2003, indicating that a new person-to-person transmission infectious agent has caused this emergent viral pneumonia outbreak<sup>5-6</sup>. Virus from the patients with viral pneumonia was isolated by Chinese researchers and sequenced its genome (29,903 nucleotides) and identified it as novel coronavirus (2019-nCoV), which is the seventh member of the family of corona viruses that infect humans<sup>11</sup>. On 11th February 2020, World health organisation (WHO) named the novel viral pneumonia as “Corona Virus Disease (COVID19)”, while “SARSCoV-2” was suggested by the international Committee on Taxonomy of Viruses (ICTV) because of its genetic similarity to the SARS-CoV<sup>7-9</sup>.

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**Epidemiology**

On 31<sup>st</sup> December 2019, WHO was informed about few pneumonia cases of obscure aetiology in Wuhan city, China. Affected individuals had a link with live seafood and animal market in south china. Samples were collected from the affected individuals and WHO declared novel corona virus was the causative agent. In a very short span, the disease spread to other provinces and now affected almost 210 countries. On which the worst affected are USA, Spain, China, Italy and Iran. More than 82,692 cases and 4,632 deaths have been reported in China (as of 16 April 2020)<sup>10-12</sup>.

**Mode of COVID 19 transmission**

Chan, J. F.-W. et al., from their research suggested that he COVID-19 commenced with a single animal-to-human transmission and then pursued by sustained human-to-human spread<sup>5</sup>. Now the researchers are of the opinion that interpersonal transmission occurs through respiratory droplets and contact<sup>13</sup>. Faecal-oral transmission was also suggested by researchers as they have isolated COVID19 from the stool of affected individuals in China and United states<sup>14</sup>. Other mode of transmission like aerosols and mother to new born are yet to be confirmed

**Proposed Sources of Transmission.**

Researches on COVID 19 are ongoing worldwide so are the contemporary data. Direct transmission and contact transmission are the two common modes. Direct transmission route is by cough, sneeze and droplet inhalation and contact transmission by contact with oral, nasal, and eye mucous membranes. Initially the researchers believed that the potential source of transmission is symptomatic patients with COVID 19. Recent researches suggested that asymptomatic patients and patient on the incubation period could also transmit the disease, which is now one of the main concerns at it is tough task to identify these patients and quarantine them. Other concern is whether the patients in their recovering stage could transmit the disease<sup>5,13,15-17</sup>.

Incubation Period: Isolation or quarantine of a suspected or exposed COVID 19 person is 14 days since the incubation period of COVID 19 could be as long as 2 weeks. But it has been estimated that the incubation period of COVID 19 is around 5 to 6 days<sup>17,18</sup>.

**Who could be at high risk?**

Prevailing data suggest that COVID19 can affect any age group or gender. High risk category includes health care providers, patients hospitalized for other reasons, and people who are in close contact with symptomatic or asymptomatic COVID 19 patients<sup>16</sup>.

**COVID 19 transmission in dental clinics**

Dentist and dental hygienist frequently are exposed to pathogens affecting oral cavity and respiratory tract as the treatment procedures are carried in a close proximity with the patients. Figure 1 shows the different occupational group who face greatest corona virus risk<sup>19</sup>. Dental practitioners are among the high-risk category of getting COVID 19 because of the face to face communication with dental patients and frequent exposure to blood and oral fluids and usage of sharp equipment's<sup>15</sup>.

Pathogens can easily spread in a dental setting since aerosols produced during treatment procedure remain suspended in air for long time which could be inhaled by patients, dentists and other hospital staff<sup>19</sup>. In addition to that direct contact with blood, oral fluids, contact of oral, nasal, or conjunctival mucosa with aerosols or even droplets contaminated with micro-organisms generated from a COVID19 infected individual could lead to spread of disease. Researchers also suggest that it may also be transmitted through contact from fomites like clothes or furniture<sup>15</sup>.

Furthermore, it has been identified by the researchers that 2019-nCov enters the cell through the ACE2 cell receptor which are in abundant in respiratory tract and salivary duct epithelium which contribute to human-to-human transmission<sup>15,20-21</sup>.

Spread of COVID 19 in dental setting could by airborne and droplet spread, contact spread and spread through contaminated surface. Most of the dental related treatments produce aerosols and droplets, which is one of the main areas of worry in a dental setting. The droplets produced could be a mixture of water, saliva and patient's blood, which carry greatest risk of infection. Contact spread in dental professional scan occur by direct or indirect contact with contaminated dental instruments, patient materials, human fluids and making it a possible source to the virus

spread. Thus, high chance of spreading COVID 19 through airborne and contact spread from infected individuals to dentists and hospitals staff<sup>22</sup>. Droplets produced during treatment procedures in infected persons could contaminate the treatment areas which could also be a source of transmission as the virus can persist on surfaces like metal, glass, or plastic for up to a couple of days. Coronavirus remain to be infectious in room temperature from 2hrs to even nine days. Adequate infection control protocols should be followed to prevent the spread of 2019-nCoV<sup>23</sup>.

### **Clinical Manifestations**

The major category of COVID 19 affected patients in china had only mild symptoms. Common symptoms were fever and dry cough. Other patients had symptoms like dyspnoea, fatigue. Atypical symptoms of COVID 19 include anorexia, sputum production, sore throat, myalgia, confusion, rhinorrhea, chest pain, haemoptysis, abdominal pain, headache, diarrhoea, and vomiting<sup>3,24</sup>. Bilateral pneumonia, with ground-glass opacity and bilateral patchy shadows being the most common patterns observed in chest CT of affected patients<sup>3</sup>.

About 90% of patients with COVID19 presented with more than one symptom, and approximately 15% of patients presented with fever, cough, and dyspnoea. In some cases, fever and breathing difficulty occurred one to two days after episodes of diarrhoea and nausea<sup>4,24</sup>. Acute respiratory distress syndrome, shock and arrhythmia were some of the complications seen in hospitalized patients in Wuhan city<sup>24</sup>. Although complications of COVID 19 can happen in patients of any age, it mainly occur in medically compromised patients with cardiovascular and respiratory diseases and diabetic patients<sup>25</sup>.

According to current data, the fatality rate (cumulative deaths divided by cumulative cases) of COVID-19 is 0.39% to 4.05% which is less compared to previous corona outbreaks such as SARS (severe acute respiratory syndrome;  $\approx 10\%$ ) and MERS (Middle East respiratory syndrome;  $\approx 34\%$  but higher than that of seasonal influenza (0.01% to 0.17%) as per literature review<sup>16,26</sup>.

### **Diagnostic approach**

Initial step is by conducting a physical examination since the affected patient may be febrile and may have dyspnoea and cough. Auscultation may yield other positive findings such as inspiratory crackles and bronchial breathing in case of patient with pneumonia. All check for tachypnoea, tachycardia and cyanosis in patients with respiratory distress

### **Investigations:**

The viral nucleic acid detection test or RT-PCR (Reverse Transcription Polymerase Chain Reaction) of respiratory tract specimens is currently accepted as the gold standard diagnostic method<sup>27</sup>. But the interpretation of this test should be made cautiously since it is influenced by different factors like sampling operations, sampling timing (period of disease development), specimens source (upper or lower respiratory tract) and performance of detection kits. Recent evidences show the diagnostic accuracy of RT-PCR might be lower than optimal ( $<100\%$ ) because it might show negative results in patients with SARS-CoV-2 infection during the initial days of the disease development. Nucleic acid tests also show false negative results in patients who are asymptomatic or mildly symptomatic. Therefore the suspected patients should be monitored for 14-16 days (symptom duration) and should show atleast 3 negative tests to confirm that the patient is disease free.<sup>28</sup>

Chest CT imaging is another diagnostic approach which when compared to RT-PCR is more practical, and a rapid method to diagnose and assess COVID-19, especially in hyper endemic areas and in countries which are not able to provide sufficient RT-PCR detection kits<sup>29</sup>. With RT-PCR results, the sensitivity, specificity, accuracy of chest CT in indicating COVID-19 infection were 97%, 25% and 68%, respectively.<sup>28</sup>

Other investigations used are Pulse oximetry, Arterial blood gas (ABG), Complete blood count, Comprehensive metabolic panel, Coagulation screen, Inflammatory markers (serum procalcitonin and C-reactive protein), Serum troponin, Serum lactate dehydrogenase, Serum creatine kinase. The most common laboratory findings in patients hospitalised with pneumonia include leukocytosis, leukopenia, lymphopenia and elevated liver transaminases. Other abnormalities include neutrophilia, thrombocytopenia, decreased haemoglobin, decreased albumin, and renal impairment<sup>4,24</sup>.

**Diagnostic criteria World Health Organization: case definitions for surveillance<sup>30</sup>.**

A. Patients with acute respiratory illness (i.e., fever and at least one sign/symptom of respiratory disease such as cough or shortness of breath) AND with no other aetiology that fully explains the clinical presentation AND a history of travel to or residence in a country/area or territory reporting local transmission of COVID-19 disease during the 14 days prior to symptom onset.

B. Patients with any acute respiratory illness AND having been in contact with a confirmed or probable COVID-19 case in the last 14 days prior to onset of symptoms.

C. Patients with severe acute respiratory infection (i.e., fever and at least one sign/symptom of respiratory disease such as cough or shortness of breath) AND requiring hospitalisation AND with no other aetiology that fully explains the clinical presentation.

Probable case: A suspected case for which testing is inconclusive.

Confirmed case: A symptomatic / asymptomatic case with laboratory confirmation.

**Management**

Clinical trials are going to evaluate the efficacy of certain drugs like Lopinavir and Remdesivir<sup>31</sup>. As of now the treatment is mainly supportive. More than the management part, the health care sector currently focuses on aspects like prevention, lower the transmission rate, early diagnosis, isolation of suspected and infected persons, supportive care to relieve the symptoms and organ support for severely affected patients<sup>4</sup>.

**Preventive measures**

The best way to prevent the infection is by avoiding exposure to the virus. People should be advised to wash hands often with soap and water or by using alcohol-based hand sanitiser and avoid touching the eyes, nose, and mouth with unwashed hands. Avoid close contact with people and maintain social distancing (i.e., maintain a distance of at least 3 feet), particularly those who have a fever, cough or sneeze. Hygiene measures like covering mouth and nose when coughing or sneezing are also recommended. Patients with fever, cough, breathing difficulty should seek medical attention at the earliest. Patient who recently visited COVID19 affected countries should contact the health care provider and advised home quarantine for a minimum of 14 days. Consumption of raw or undercooked animal products, handling raw meat, milk, or animal organs should also be avoided<sup>30</sup>.

**Infection control in dental setting**

For an effective control and prevention of COVID 19, foremost thing is that dental practitioners should be familiar with transmission routes of 2019-nCoV, identify COVID 19 infected patients, and a thorough knowledge about the preventive measures to be taken while doing treatment procedures.

An infected patient with symptoms in acute febrile phase should not visit the dental clinic. Symptomatic patients should not be treated in a dental clinic, those cases should be reported to the Government corona care centre and should be quarantined. With a contact free forehead thermometer, patients body temperature should be measured. Patient should be given a questionnaire in order to screen those with potential infection of 2019-nCoV before taking a history and performing dental examination.

Following queries should be included in the questionnaire,

- a) History of fever with in 14days.
- b) History of respiratory problems, such as cough/ dyspnoea within 14 days
- c) Recent travel history to COVID affected places
- d) History of contact with COVID 19 affected or suspected persons within the past 14 days
- e) History of participation in any gathering, meetings, or close contact with unacquainted people

If the patients had no positive history and his/her body temperature is below 37.6<sup>0</sup>C, the dentist can perform emergency dental treatment with adequate infection control measures. If the patients give any positive history and his/her body temperature is below 37.6<sup>0</sup>C, the dentist should postpone the dental treatment and advice the patient to self-quarantine at home for 14 days and contact the health department if he/she develops any symptoms. And if the patients give any positive history and his/her body temperature is above 37.6<sup>0</sup>C, he/ she should be immediately quarantined and the dentist should report the case to health department or government corona care unit.

Unconditional maintenance of good hand hygiene is of the utmost importance in dental practice since fecal-oral transmission of COVID 19 has been reported. Infection control department of the West China Hospital of Stomatology, Sichuan University has put forward a two-before and-three-after hand hygiene guideline to reinforce the compliance of hand washing. Specifically, the oral professionals should wash their hands before patient examination, after touching the patient, before dental procedures, after touching the surroundings and equipment without disinfection, and after touching the oral mucosa. Besides that, dental professionals must avoid touching their own eyes, mouth, and nose<sup>31</sup>.

As of now, there are no specific guidelines for the protection of dental professionals from COVID 19 infection. Barrier-protection equipment, including protective eyewear, specified masks, gloves, caps, face shields, and protective outdoor, is strongly recommended for dental professionals and all healthcare providers since COVID 19 transmission mainly airborne<sup>15,16</sup>.

Based on the possibility of the spread of COVID 19, three-level protective measures of the dental professionals are recommended<sup>15</sup>.

- (1) Primary protection (standard protection for staff in all clinical settings). Wear disposable working cap, disposable surgical mask, and working clothes (white coat), using protective goggles or face shield, and disposable latex gloves or nitrile gloves if necessary.
- (2) Secondary protection (advanced protection for dental professionals). Wear disposable doctor cap, disposable surgical mask, protective goggles, face shield, and working clothes (white coat) with disposable isolation clothing or surgical clothes outside, and disposable latex gloves.
- (3) Tertiary protection (strengthened protection when treating an asymptomatic or suspected or confirmed 2019-nCoV infected person).

Special protective outdoor is needed. If protective outdoor is not available, wear working clothes (white coat) with extra disposable protective clothing outside. Also wear disposable doctor cap, protective goggles, face shield, disposable surgical mask, disposable latex gloves, and impermeable shoe cover.

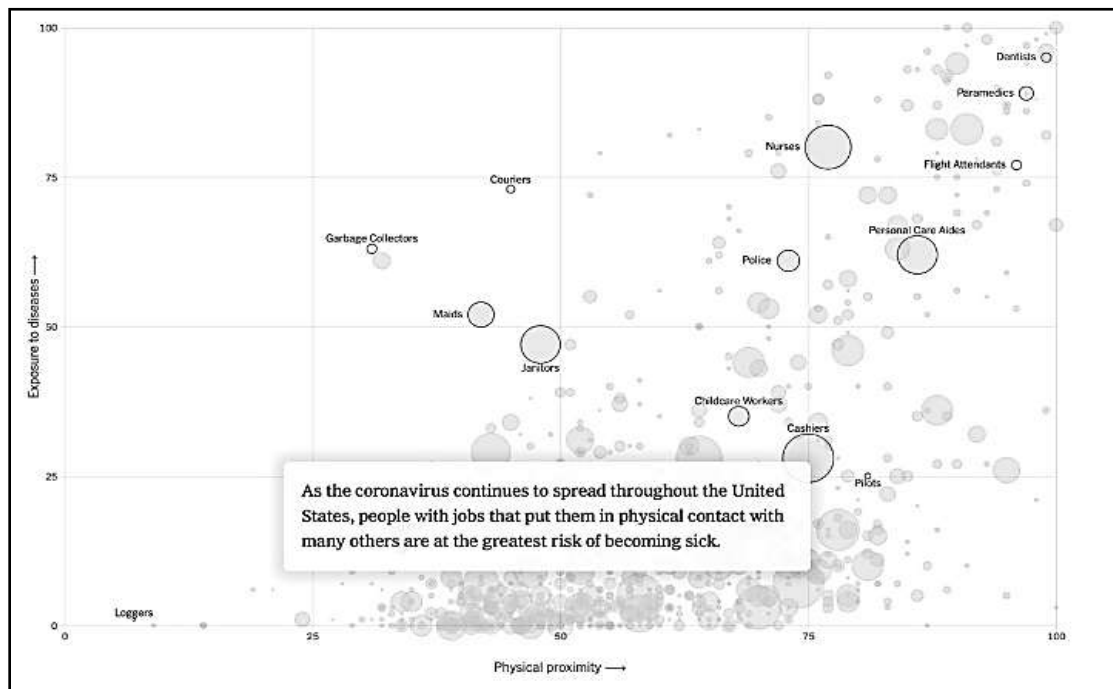
While performing oral examination it is always better to use a preoperative antimicrobial mouth rinse as it can reduce the microbial load in the oral cavity<sup>32</sup>. Chlorhexidine, which is commonly used as mouth rinse in dental practice, may not be effective against 2019-nCoV since it is vulnerable to oxidation, so it is recommended to use mouth rinse containing oxidative agents such as 1% hydrogen peroxide or 0.2% povidone. Procedures which may induce cough should better be avoided. Usage of aerosol and droplet generating procedures, such as ultrasonic scaling, cavity and crown preparations using high speed handpieces, the use of 3-way syringe, should be avoided or minimized as much as possible. Intraoral radiography can induce saliva secretion and cough; hence it should be ordered judiciously and instead rely on extraoral dental radiographs and cone beam CT, in case of emergency during the outbreak of COVID-19<sup>15,16</sup>.

Rubber dam isolation can markedly reduce the production of saliva and blood contaminated aerosol or spatter while using high-speed handpieces and dental ultrasonic devices. Rubber dam along with high speed suction will be more effective in reducing risk which requires four handed dentistry, which is beneficial for infection control. Usage of manual techniques like hand scaling and chemo mechanical aids like Carisolv can be used to remove caries if rubber dam isolation is not possible, which helps in minimizing aerosol production as much as possible<sup>33</sup>. Another way of infection control is by using Anti-retraction handpiece since dental handpiece without anti-retraction valves may aspirate and expel the debris and fluids during the dental procedures and also the microbes may further contaminate the air and water tubes within the dental unit leading to cross-infection<sup>15</sup>.

The medical waste should be transported to the temporary storage area which includes the used disposable protective equipment. Reusable instrument must be properly cleaned, pre-treated, sterilized, and stored UV chamber or sterile pouches. The medical and domestic waste generated from the treatment of COVID 19 suspected or infected patients should be regarded as infectious medical waste. Double-layer yellow colour medical waste package bags and "gooseneck" ligation should be used<sup>16</sup>. And finally, the clinic setting as well as the public area should be frequently disinfected. Public areas which are usually ignored including furniture, door handles, hand rails, elevators etc should also be disinfected regularly.

**Table 1:-** Investigations and expected results in COVID 19 positive cases<sup>32</sup>

SL No	Investigations	Expected results in COVID 19 patients
1	Pulse oximetry <ul style="list-style-type: none"> <li>Order in patients with severe illness such as respiratory distress and cyanosis.</li> </ul>	Low oxygen saturation (SpO <sub>2</sub> <90%)
2	Arterial Blood Gas <ul style="list-style-type: none"> <li>To detect hypercarbia or acidosis.</li> <li>In patients with respiratory distress and cyanosis who have low oxygen saturation (SpO<sub>2</sub> &lt;90%).</li> </ul>	Low partial oxygen pressure
3	Complete blood count <ul style="list-style-type: none"> <li>In patients with severe illness.</li> </ul>	Leukopenia, lymphopenia, and leukocytosis
4	Comprehensive metabolic panel	elevated liver transaminases, decreased albumin, renal impairment
5	Serum procalcitonin	May be elevated in patient with secondary bacterial infection
6	Serum C-reactive protein	May be elevated in patient with secondary bacterial infection
7	Serum troponin level	May be elevated in patient with cardiac injury
8	Blood and sputum cultures negative for bacterial infection	Negative for bacterial infection
9	Real-time reverse transcription polymerase chain reaction (RT-PCR) <ul style="list-style-type: none"> <li>Upper and lower respiratory tract and nasopharyngeal specimens are used</li> </ul>	To confirm the diagnosis Positive for severe acute respiratory syndrome coronavirus 2 (SARSCoV-2) viral RNA; negative for influenza A and B viruses and other respiratory pathogens
10	Chest x-ray	Unilateral or bilateral lung infiltrates
11	Computed tomography (CT) chest	Bilateral ground-glass opacity or consolidation



**Figure 1:-** Shows the various occupational group who face greatest corona virus risk<sup>19</sup>.

**Conclusion:-**

COVID 19 is spreading worldwide at an alarming rate. The most vulnerable group being elderly people with underlying systemic conditions and those who are immune compromised. The community should cooperate with the government of all the countries and health care workers to quarantine themselves at home until this infectious disease can be brought under control.

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