

COVID-19: A dental update on the risk factors, prevention and management protocol

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Abstract

The emergence of Coronavirus disease (COVID-19) outbreak has led to a global pandemic. The COVID-19 caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) originated in bats and was transmitted to humans through an intermediate host. COVID-19 is transmitted by inhalation or contact with infected droplets and average incubation period is 5.2 days. The COVID-19 epidemiological and clinical characteristics are being

collated but symptoms in children seem to be milder than those that adults experience. By virtue of the nature of dental practice, close proximity of dentists and patients during treatment; the dental health team are considered as a high risk health professional group for acquiring or transmitting SARS-CoV-2. Until an effective treatment or vaccine is developed, care must be taken to minimise the risk of infection to, from, or between dental care professionals and patients. Therefore, this review focuses

on risk factors, and aims to provide preventive measures to limit risk of transmission and management protocol to be followed in dental clinic set up.

Keywords: COVID-19, SARS-CoV-2, Disease transmission, Triage.

Introduction

By the end of December 2019, Wuhan the capital city of Hubei province in People's Republic of China witnessed an outbreak of pneumonia with unknown aetiology. What followed later shook the whole world with the outbreak affecting more than 187 countries and a public health emergency of international concern was declared by World Health Organisation (WHO) on 30th January 2020. Originally, the identified pathogen was named as 2019 novel coronavirus (2019-nCoV) by WHO on 11th February 2020. The International Committee on Taxonomy of Viruses later renamed this novel coronavirus as severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2).^[1] The disease was named COVID-19; corona virus disease 2019.^[2]

With exponential growth of infected individuals and alarming level of transmission, COVID-19 was declared by WHO as pandemic on 11th March 2020.^[3]

The disease seems to be less severe in children as compared to adults, still they should be considered as potential carriers of SARS-CoV-2 unless proven otherwise.^[4] This is a concern for the dental personnel as it puts them at a high risk of transmission of the infection should need for treatment in such children arises. The common transmission routes of SARS-CoV-2 are mainly by respiratory droplet inhalation and contact transmission.^[5]

Hence, this review focuses on the risk factors, provides insights into preventive measures and management protocol to be undertaken by the dental personnel during COVID-19.

Risk Factors

There is strong evidence to suggest the origin of SARS-CoV-2 from specific species of bat, *Rhinolophus affinis*, also known as the horseshoe bats although the intermediate host is still undetermined. It is also confirmed that 2019-nCoV enters the cell in the same way as SARS virus contributing to human to human transmission.^[6]

The primary symptoms in humans appear to be fever, cough, dyspnoea, myalgia or fatigue, dysgeusia (loss of taste sensation), anosmia (loss of smell sensation). The two main routes of transmission include,

- Direct transmission: through coughing, sneezing and inhalation of droplets.
- Contact transmission: through contact with nasal, oral and ocular mucosa.^[5]

This puts health care workers, especially dentists, dental hygienists, dental staff at higher risk. In March 2020, Occupational Safety and Health Administration (OSHA) classified dentists/dental providers in the very high-risk group for COVID-19.

Although patients with symptomatic COVID-19 have been the main source of transmission, recent studies have shown that asymptomatic patients or those who have mild pneumonia can be carriers of SARS-CoV-2.^[7] Vertical transmission of SARS-CoV-2 has not yet been confirmed.^[8]

Due to close contact with patients, dental personnel are at a risk for exposure to COVID-19. This virus can be transmitted in dental settings through three major routes: 1) inhalation of suspended airborne viral particles, 2) direct exposure to respiratory secretions containing droplets, blood, saliva, 3) indirect contact with contaminated surfaces or instruments.^[9]

High speed dental handpieces utilising air or water spray, surgical extractions, ultrasonic scalers can all lead to the

generation of considerable amount of droplets and aerosols mixed with patient's saliva and/or blood leading to high risk of transmission.^[10] Also, research has shown that the coronavirus can remain on the surfaces such as metal, glass or plastic and maintain their virulence for several days. Hence, the most important concern is the transmission of the virus through the above mentioned routes from patients to clinic staff or other patients posing a high risk to the dental personnel as well as the general public.

Preventive Measures and Management Protocol

At this time, with no approved treatment for COVID-19 and the potential risks of its transmission looming around, prevention becomes crucial in the dental setup. The standard protective measures carried out in our daily clinical work are not effective enough to prevent the spread of SARS-CoV-2. Currently, the approach towards COVID-19 is to control the transmission by strict implementation of preventive measures, provide early diagnosis and supportive care for patients.

Telephone

Though the American Dental Association (ADA) recommended to address only dental emergencies and to postpone all elective dental procedures, still there will be patients who will need our urgent attention.^[11] In order to address the issues of the patients, it becomes essential that a member of the dental personnel preferably the dental assistant undertakes the telephonic triage procedure to inquire about the cause and the severity of the dental problem. The dental assistant should also be trained to ask about the general wellbeing of the patient, whether he or she had experienced any flu-like symptoms, episodes of sore throat, any recent contact with patient suspected of COVID-19. This is essential as a concern to safety of the dental practitioner and his team.

Patient screening / evaluation

It should be emphasized that all appointed patients should be considered as potential asymptomatic SARS-CoV-2 carriers. Hence they should be screened by first taking the body temperature using a contact-free forehead infrared thermometer maintaining a distance of 3 to 15 centimetres away from the patient.^[12] The patient should be observed for the prodromal phase symptoms of the SARS-CoV-2 infection which is history of fever, cough, difficulty in breathing, diarrhoea, nausea, body ache, loss of taste or smell in the past 14 days. If the patient gives positive symptoms, he or she should be reported to the state or local surveillance officers as per the directive of the Ministry of Health and Family Welfare. Note that symptoms of fever and fatigue could be caused by acute dental infection also; therefore, the aetiology should be confirmed.

Waiting area

COVID-19 awareness signage should be displayed in waiting area. Discourage footwear within clinic interiors or provide foot cover to the patients. Seating arrangement should be such that the physical distance between patients is maintained at minimum 3 feet. It should also be ensured that patients are placed in an adequately ventilated waiting area. Fomite bearing objects such as books, magazine and toys should be removed. Only one person should be present at reception area and should have a projecting desk of width at least 3 to 4 feet. Reception area staff should use triple layer mask, gloves and should practice hand hygiene. Ensure that all patients cover their nose and mouth with a tissue or their elbow when coughing or sneezing; instruct them to dispose used tissues into a waste bin controlled by foot immediately after use and ensure hand hygiene.

Hand hygiene

During the outburst of SARS, epidemiological studies suggested that handwashing with soap and 70%–90% alcohol-based hand rubs (ABHR) was effective in curbing virus transmission.^[13] The WHO stated that hand hygiene which includes either cleansing hands with an ABHR or with soap and water for 20 seconds; are equally effective. ABHR are preferred if the hands are not visibly soiled with blood or saliva, otherwise water and soap should be used.^[14] Hand hygiene should be performed by dental personnel before touching a patient, before any cleaning or aseptic procedure is performed, if there is an exposure to body fluid or if there is an accidental touching of patient's surroundings.^[15]

Personal protective measures for dental personnel

Personal protective equipment (PPE) can form an effective barrier against most hazards of aerosols generated from the operative site. Components of PPE are Protective eyewear and face shields, face mask, gloves, gowns (with or without aprons), head cover and shoe cover.

- Protective eyewear and face shields: COVID-19 may also be transmitted through contact with the mucous membranes of eyes, as infectious droplets could easily contaminate the human conjunctival epithelium. To protect the eyes from aerosols during dental procedure, protective eyewear and face shield should be worn throughout the treatment and disinfected in between patients.
- Face masks: When performing aerosol generating procedures, a particulate respirator that is National Institute for Occupational Safety and Health (NIOSH)-certified N95 (3M ESPE, USA) or European Standard Filtering Face Piece 2 (EU FFP2), should be used. N99 is the recent version of N95 which filters 99% of particles. When performing emergency dental treatment with suspected or confirmed COVID-19, a

higher level of respiratory protection such as EU FFP3 respirators conforming to European Standard 149 (EN149) should be considered.^[16]

Because of increased demand and shortage of N95 respirators, the concept of decontamination and reuse of N95 respirators comes into play. Centres of Disease Control and Prevention (CDC) has given guidelines regarding the use of N95 respirators. The N95 respirators need to be discarded following any aerosol producing procedures or any contamination with blood or other body fluids. A cleanable face shield is advised over the N95 respirator whenever feasible to prevent contamination of the mask. However, CDC has also recommended a wait and reuse method where the used masks can be kept in a clean breathable paper bag and hung to dry out to be reused after a gap of minimum 5 days.^[17] Many procedures have been mentioned for the sterilisation of N95 masks such as using ultraviolet C radiation, decontamination using a Bioquell (Horsham, Pennsylvania) Z-2 device that uses hydrogen peroxide vapor for sterilization, autoclaving, baking the masks at 75 degrees for 30 minutes.^[18,19,20] Despite these measures the manufacturer insists that none of the above mentioned methods meet the disinfection criteria such as affecting the fit and filtration of the respirator, hence the author is of the opinion that such sterilization methods should be used with caution.

- Gloves: Nitrile gloves are preferred over latex gloves because they resist chemicals such as chlorine.
- Gowns: It is the second most used piece of PPE. They are designed to provide 360 degree protection from exposure to virus. It act as a barrier to eliminate contact and droplet exposure.
- Shoe covers: It should be made up of impermeable fabric to facilitate personal protection and disinfection.

- Use of head covers is recommended.

Pre-procedural mouth rinses

Pre-procedural use of mouth rinses can significantly reduce the salivary load of microbes. Pre-procedural mouth rinse containing oxidative agents such as 1% hydrogen peroxide or 0.2% povidone-iodine is recommended because SARS-CoV-2 is vulnerable to oxidation. 0.12% and 0.2% concentration of Chlorhexidine gluconate mouthwash shown to be effective against SARS-CoV-2.^[21]

Rubber dam isolation

According to Harrel and Molinari (2010), if the rubber dam is correctly placed, the only source of contamination would be the tooth which is undergoing treatment. Use of rubber dam could significantly reduce airborne particles in approximately 3-feet diameter of the operational field by 70%.^[22] When rubber dam is applied, extra high-volume suction for aerosol and spatter should be used during the procedures along with regular suction. In this case, the implementation of four-handed dentistry is necessary.

Anti-retraction handpiece

The highspeed handpiece without anti-retraction valves may aspirate and expel the debris and fluids during the dental procedures. Dental handpieces with specially designed anti-retractive valves or anti-reflux designs are recommended as an extra preventive measure for cross infection.^[23] These handpieces can significantly reduce the backflow of oral microorganism, oral fluid and debris into the tubes of the handpiece and dental unit, hence use of any other handpieces should be prohibited.

Disposable devices: Disposable devices such as mouth mirror, syringes should be used to prevent cross contamination.

Intraoral radiographs: Intraoral radiography is the most common technique used in dental practice; however it can stimulate salivary secretion, gagging and coughing.

Therefore, extraoral radiography such as panoramic radiography and cone beam computed tomography should be used as alternatives during COVID-19 outbreak.

Removal or filtration of contaminated air

The two most commonly used devices to remove or filter contaminated air in treatment areas are the high volume evacuator (HVE) and the high- efficiency particulate arrestor (HEPA) filters. HVE filter is a suction which helps to remove air at a rate of up to 2.83 m³ per minute. It is an efficient way to remove generated dental aerosols and could effectively reduce contamination caused by the operating site by 90%. This device should be held at a distance of approximately 6–15 mm from the active ultrasonic tip or highspeed handpiece. HEPA filter is an air filtration device, that can remove 99.97% of the particles measuring upto 0.3 μm in diameter.^[24] Air filtration with HEPA 13 or HEPA 14 filters is considered ideal.

VacStation Extra-oral Dental Suction system can be used to reduce risk associated with airborne particulates and pathogens present in aerosol spray which is an inherent part of dental care. It purifies air using multi-level filtration system which traps viruses, microbes greater than 0.3 μm in diameter.

Disinfection of the clinic set up

SARS-CoV-2 can persist on inanimate surfaces for up to 9 days. They can be efficiently inactivated by surface disinfectants such as 62%–71% ethanol, 0.5% hydrogen peroxide (or) different concentrations of sodium hypochlorite. Disinfection of instruments can be carried out by using 1% sodium hypochlorite after each treatment of patient. Surfaces in proximity to the operating areas should be disinfected using 0.1 % sodium hypochlorite after each patient visit. The waiting room or clinic including the handles and door knobs, handles of chairs, reception table as well as dental chairs should be wiped

several times in a day with alcohol based disinfectant. Flushing of suction and disinfection of waterlines with 0.01% sodium hypochlorite, mopping of floor with 0.1% sodium hypochlorite should be done to reduce the risk of cross-infection in the dental clinic setup.^[25]

Management of medical waste

All biomedical waste pertaining to patient care should be carefully disposed in accordance with the Biomedical Waste Management and Handling Rules through an authorised biomedical disposal agency. Dental waste collected should be considered medically infectious waste that should be strictly disposed using double-layer yellow medical waste package bags and gooseneck ligation.^[26]

Vaccination

Many researchers and scientists, over the world are working on potential drugs and vaccines to manage SARS-CoV-2 infection. There are recent, promising reports of patients showing improvement when they are administered hyperimmune sera (containing antibodies to SARS-CoV-2) from recovered COVID-19.^[27]

“Solidarity trials” for development of specific drugs and vaccines were initiated by WHO in 10 countries on March 2020. Currently phase1/2 trials of Oxford vaccines ChAdOx1 are being conducted.

This implies that vaccination is a promising approach to prevent the spread of COVID-19 in near future.

Management Protocol

During these difficult times of COVID-19 the dental health team are in a dilemma towards the treatment needs of patients especially children. As per the directive of ADA only emergency treatments should be undertaken whereas all elective treatments should be deferred. Hence It becomes imperative for the dental practitioner to explain the same to the patients or their parents with a sensible

pragmatic approach and provide treatment approaches that can be undertaken without elective procedures.

Conditions where dental treatment can be performed under strict infection control measures^[11]

- Cellulitis or a diffuse soft tissue bacterial infection with intra-oral or extra-oral swelling that can potentially compromise the patient’s airway.
- Severe dental pain from pulpal inflammation.
- Tooth fracture resulting in pain or causing soft tissue trauma.
- Dental trauma with avulsion/luxation.
- Open carious lesions which is causing pain due to food impaction.
- Pain or discomfort due to orthodontic appliances or ongoing orthodontic treatment.

General guidelines towards treatment approach in dental clinic^[4, 28]

- Using telephonic triage, analgesics and antimicrobials should be advised as the first line of treatment.
- Avoid the use of high speed handpiece, ultrasonic scalers and the three way syringe unless absolutely necessary.
- Try and accomplish restorative procedures or emergency access openings using the micromotor and a contra angle handpiece. Water coolant can be used intermittently through a 5 ml disposable syringe. Excess water should be suctioned out using high vacuum suction. Use of a spittoon should be avoided.
- Chemo mechanical removal of caries should be encouraged followed by excavation of caries using sharp spoon excavators.
- Use of Atraumatic restorative treatment should be encouraged.
- Use of Interim Therapeutic Restorations (ITR).

- Avoid pulpectomies in primary teeth with questionable prognosis. Opt for extractions instead, followed by space maintainers.
- Disinfect alginate impressions by immersing in 0.5% sodium hypochlorite solution for 15 seconds.
- Use Hall technique of crown especially in proximal carious lesions where pain is due to food impaction.
- Use SDF (Silver Diamine Fluoride) and SMART (Silver Modified Atraumatic Restorative Treatment) techniques.
- Apply glass ionomer restorations instead of composite resin restorations for primary or permanent teeth.
- Resin reinforced glass-ionomer cement can be used as an alternative to etch and rinse adhesives or composite resins, for splinting traumatized teeth or rebonding orthodontic brackets.

Conclusion

The emergence of COVID-19 has brought new challenges and responsibilities for dental professionals. With no treatment for this disease at present, there is a need to find alternative methods to control the spread of disease.

Dental personnel are at a higher risk of exposure to infectious diseases. A better understanding of transmission of SARS-CoV-2 and its implications in dentistry can help us identify and curb the spread of infection. Though children present with mild symptoms, it is the responsibility of dental personnel towards implementation of special precautions which could prevent disease transmission. Contemporary minimally invasive procedure that minimise or eliminate aerosol generation should be employed instead where intervention is indicated, until the practice restrictions ease in the future.

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