Review Article

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Corona Virus, A Breaching Pathogen: Dentist's Eye

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ABSTRACT

Background: An epic β-coronavirus (2019-nCoV) caused severe, and even fatal pneumonia explored in a sea-food marketplace (wet market) of Wuhan city, Hubei province of China, and swiftly spread to further provinces of China and additional countries. The 2019-nCoV was unusual from SARS-CoV but shared the same host receptor, the human angiotensin-converting enzyme 2 (ACE2). The innate host of 2019-nCoV may be the bat *Rhinolophus affinis.* The present article gives an overview of COVID-19 and protocol of infection control in a dental clinic while performing essential procedures.

Keywords: COVID-19, coronavirus, human angiotensin-converting enzyme 2, Rhinolophus affinis.

INTRODUCTION

The mysterious Coronavirus disease 2019 (COVID-19) or 2019-nCoV was initially identified when the first case of pneumonia of an unknown origin was reported in Wuhan, the capital city of Hubei province, China in December 2019.[1,2]WHO named the novel viral pneumonia as "Corona Virus Disease (COVID-19) on 12th February 2020," while after exploration done by International Committee on Taxonomy of Viruses (ICTV) recommended this novel coronavirus name as "SARS CoV-2" due to the phylogenetic and taxonomic of this novel coronavirus.[3,4] As being extremely contagious in nature, by the end of January 2020, coronavirus disease 2019 (COVID-19) outburst had intensified into a solemn tragic level for public health as a result of which it was found to be spread by human to human transmission among close contacts, particularly in the medical field.[5,6] To the present current situation, the most frequent mode of transmission are found to be respiratory droplet mode and contact.[7,8] Recent reports state that the incubation period so far is 1–14 days.

Hospitals are the places where infection can be easily transmitted. Precisely, dental departments are at higher risk of disease transmission by direct or indirect means. Chinese Stomatological Association issued, *'A Letter to Patients Suffering Oral Diseases During Prevention and Control of Covid-19'*, which suggested that patients should be cautious when visiting the dentist, and also informed dental workers to protect themselves comprehensively.[9,10]

Risk Factors

Risk 1 - Formation of aerosols formed by water mist generated by the air-driven high-speed handpiece blend with the saliva and blood of patients, air polisher and its diffusion.

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Risk 2 - Prolonged operation times resulting in the survival of aerosols within the clinical office offering spreading of the disease.

Risk 3 - No protection to the patients during the treatment process.

Risk 4 - Screening of susceptible patient.

Risk 5 - Contamination of dental equipment with saliva, blood, and mixed water droplets.

It, therefore, becomes obligatory for the dental professional to follow the universal precautions and treat every patient as being potentially infectious. Hence, the present article gives an overview of COVID-19 and protocol of infection control in a dental clinic while performing essential procedures.

TAXONOMY

Coronaviruses fit into the family of Coronaviridae, of the order *Nidovirales*, comprising large, single, plus-stranded RNA as their genome.[11,12] Presently, there are four genera of coronaviruses: α-CoV, β-CoV, γ-CoV, and δ-CoV.[13,14] Primarily α-CoVand β-CoV include infections of the respiratory, gastrointestinal and central nervous system of humans and mammals while γ-CoV and δ-CoV infect birds. In 2002–2003 and 2012, fatal severe respiratory diseases were caused by SARS-CoV and the Middle East respiratory syndrome coronavirus (MERS-CoV) respectively and now in 2019-2010 by novel coronavirus (COVID-19) 20–22. On comparing the literature and recent reports, SARS CoV and MERS CoV belong to same group β-CoV23,24. and their nucleotide sequence resemblance between 2019-nCoV and SARS-CoV (about 79%) or MERS-CoV (about 50%), 2019-nCoV can cause fatal infection and spread at a higher rate than the other two coronaviruses.[15,16]

STRUCTURE & PATHOGENESIS

The term coronavirus (2019-nCoV) has been derived from the word "corona" means "crown" due to its structure which is present in "spike protein" in the membrane envelope. Its genome encodes four major structural proteins: the spike (S) protein, nucleocapsid (N) protein, membrane (M) protein, and the envelope (E) protein.

The S protein from coronavirus is capable of binding to the receptors of the host to enable viral entry into target cells and bind to the human angiotensin-converting enzyme 2 (ACE2), the same host receptor for SARS CoV. Even though there are four amino acid variations of S protein between 2019-nCoV and SARS CoV, the high empathy between ACE2 and 2019-nCoV S protein too proposed that susceptibility to 2019-nCoV is directly proportional to the expression of ACE2.[17,18]ACE2+ cells were found to be profusely present all through the respiratory tract, along with the cells morphologically compatible with salivary gland duct epithelium in the human mouth. Henceforth, dental patients and professionals are considered to be unprotected to pathogenic microorganisms, including viruses and bacteria that infect the oral cavity; therefore, respiratory tract.

TRANSMISSION ROUTES OF 2019-nCOV:[19]

There are two communal transmission routes of novel coronavirus comprising of (table 1):

a) Direct transmission: Through cough, sneeze, and droplet inhalation transmission.

b) Indirect transmission: Through contact with oral, nasal, and eye mucous membranes contact, or through coarse or small droplets, body fluids such as blood, saliva.

Table 1: Routes of transmission

	ROUTE	TRANSMISSION
1.	Aerosol and splatter	Evidently, an aerosol is noticeable during dental procedures like tooth preparation using a rotary instrument during the use of the air-water syringe, ultrasonic scaler, and air polishing. Particles (0.5 to 10 μm in diameter)- Greatest potential to penetrate and accumulate in the smaller passages of the lungs. Particles (<50 μm in diameter) - stay airborne for a prolonged period of time on environmental surfaces or enter the respiratory tract.

2.	Contact spread	DIRECT CONTACT: with the body fluid of a contaminated patient. INDIRECT CONTACT: aerosols present in environmental, dental instruments, patient materials contaminated by infected patients through conjunctival, nasal, or oral mucosa by coughing and talking without a mask.
3.	Contaminated surfaces spread	It can persist on surfaces like metal, glass, or plastic from 2h up to 9 days and the humid surrounding may increase its spread.

Table 2: Modes of transmission in a dental clinic set up.

	SOURCE	TRANSMISSION
1	Handpieces	Stuck of patient materials remain in the lumens, crevices of handpieces and internal mechanisms of their attachments.
2	Saliva ejector	Formation of a lip seal by the sudden closing of the mouth may lead to a backflow of previously suctioned fluids from another person such as saliva or blood components.
3	Casts and its relevance	Casts poured from impressions can port infectious microorganisms which may be distributed throughout the laboratory when the castings or dies are trimmed.
4	Bone drills and Saws	Immediate reuse of re-sterilized instrument used on one patient to another.
5	Modern dental and medical equipment	Contain small lumens which may lodge body fluid of another infected patient.
6	Tooth preparation with an air-turbine handpiece	Contamination can be nullified by the use of high vacuum evacuator under rubber dam isolation and pre-procedural rinse with antiseptic mouthwashes such as chlorhexidine.

Table 3: Clinical Manifestations.

DAYS	CLINICAL FEATURES
DAY 1-3	Run a fever
DAY 4	Sore throat, hoarse voice, increased body temperature, diarrhoea, headache
DAY 5	Fatigue, muscle pain, dry cough
DAY 6	Productive cough, difficulty in breathing, diarrhoea, vomiting
DAY 7	High fever, cough more sputum, body ache and pains, diarrhoea, vomiting
DAY 8-9	Symptoms get a worse, messy fever; cough gets worse, difficulty breathing

NOTE: Clinical features may be resisted by individual immunity.

Table 4: Differential Diagnosis [8,20]

DISEASES	**RESPIRATORY SYMPTOMS**	**CONSTITUTIONAL SYMPTOMS**
Common cold	Stuffy nose, sneeze	No obvious discomfort
Influenza	Stuffy nose, runny noses, sore throat and dry cough	High fever, body ache, malaise
SARS	Cough, dyspnea	Fever, chill, malaise, headache, diarrhoea
MERS	Sore throat, dry cough, dyspnea	Fever, chill, rigour
Mild COVID-19	Cough or not, sore throat	Fever
Severe COVID-19	Breathless, respiratory failure	Fever, muscle ache, confusion, headache

PROTOCOL FOR TREATMENT OF CONFIRMED COVID-19 INFECTION

1. **Treatment of COVID-19 Upper Respiratory Tract Infection (Fever, Running Nose, Cough without Lung Infiltrate + PCR)**

Chloroquine phosphate-500mg BID 5 days

Oseltamivir-150mg BID for 5 days

2. **Treatment of COVID-19 Pneumonia**

Chloroquine phosphate-500mg BID 10 days

Darunavir/cobicistat-Darunavir 800 mg/cobicistat 150 mg OD for 2 weeks

Atazanavir-400 mg OD with food for 2 weeks

Oseltamivir- 150 mg BID

Corticosteroids-Methylprednisolone 40 mg 12h for 5 days

SPECIMEN COLLECTION:

1. Combined nasopharyngeal/oropharyngeal swab.
2. If definite repeat every 3 days till negative.
3. If negative repeat second test after 24 hours.
4. If 2 consecutive harmful isolation can be discontinued

- The lower respiratory specimen is preferred
- Airborne and contact isolation is recommended [21]

COMPREHENSIVE INFECTION CONTROL PROTOCOL

PATIENT EVALUATION:

1. Measurement and record the temperature of every staff and patient as a routine procedure. Questions to be asked on a patient's health status and contact or travel.

2. Provide patients and their accompanying person's medical masks and temperature measurement once they enter the hospital.

3. If the patient is suffering from fever, refer that patient to the designated hospitals and reschedule further his/her appointment.

4. If a patient has been to outbreak regions within the past 14 days, quarantine for at least 14 days.

5. Use handwash after each case and followed by the use of hand sanitisers by the doctor and assistant.

6. Hand sanitisers, preferable chlorhexidine with alcohol-based or alcohol-based (hand-rub solution).

7. Environmental surface disinfection: preferably accelerated hydrogen peroxide(0.5%), benzalkonium chloride (0.05%), ethyl alcohol (70%), isopropanol (50%), sodium hypochlorite (0.05-0.5%) is very effective against corona viruses.

ORAL EXAMINATION:

Make sure personal protective measures should be used before any examination (face shield, goggles, mouth masks, gown).

1. Preoperative antimicrobial mouth rinse (1% hydrogen peroxide) could reduce the number of microbes in the oral cavity.

2. Avoidance of procedures that are likely to cause cough.

3. Usage of 3- way syringe should be minimized.

4. Intraoral X-ray examination can stimulate saliva secretion and coughing. Therefore, extraoral dental radiographs such as panoramic radiography, cone beam CT are the alternatives for the same.

5. Dental personnel should use N95 respirators that provide a higher level of protection instead of mask specially while performing aerosol-generating procedures.

TREATMENT OF EMERGENCY CASES:

1. Usage to rubber dams and high volume saliva ejectors can help in minimizing aerosol.

2. Usage of face shields and goggles are essential while performing procedures with high or low-speed drilling with water spray.

3. If a carious tooth is diagnosed with indicative irreversible pulpitis, pulp exposure could be made with chemical-mechanical caries removal under rubber dam isolation and a high volume saliva ejector subsequent to local anaesthesia, then pulp devitalization can be performed to reduce the pain.

4. After treatment, environmental cleaning and disinfection procedures were followed.

5. If a tooth is indicated for extraction, the absorbable suture is preferred.

6. For patients with facial soft tissue contusion, debridement and suturing should be performed.

WASTE DISPOSAL:

1. Ensure safe waste management.
2. Treat waste contaminated with blood, body fluids, secretions in accordance with local regulations.

CONCLUSION

COVID-19 owns prevailing pathogenicity and transmissibility, which has drawn the attention of every individual of almost around the whole world. It can be even transmitted by asymptomatic patients. Henceforth, on keeping in mind regarding the clinical features, dentists should take specific precautionary measures for controlling this outburst disease.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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