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Review

COVID-19 PANDEMIC – A REVIEW WITH A DENTAL PERSPECTIVE

ABSTRACT

Novel betacoronavirus is a recent threat to the global health. It has been identified as the cause of the outbreak of respiratory illness that originated in the city of Wuhan, China and has spread rapidly to several other countries within a short span of time. Transmission occurs through respiratory droplets or contaminated surfaces from an infected person, saliva of infected persons has also shown shedding of live virus. Clinical manifestations of COVID-19 can range from mild to severe and can even progress to ARDS and septic shock leading to death. All health care professionals including dental surgeons are at a high risk of acquiring the infection. Dental clinics and hospitals carry a high risk of cross-infection. Aggressive preventive and personal protective measures help in preventing exposure to the infection. Dental professionals should adopt various specific preventive methods and treatment strategies to prevent the spread of the infection in a dental setup.

Keywords: Coronavirus, dental practice management, infection control, pandemic, pneumonia.

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INTRODUCTION

Coronavirus is the recent pandemic that has affected the world and is rapidly spreading. Coronaviruses can infect a wide range of mammals and birds, affecting many organ systems causing a range of infections. They are also known to cause respiratory tract infections in humans, such as Severe acute respiratory syndrome (SARS) and the Middle East respiratory syndrome (MERS).[1] Recently, a novel coronavirus has been identified as the cause of an outbreak of respiratory illness that originated in the city of Wuhan, in China, which has spread to several other countries around the world within a short span of time. This has put the world on high alert for transcontinental transmission of the virus.

History

In1965, Tyrrell and Bynoe[2] discovered the B814 virus, from the human embryonic tracheal organ cultures of adults with common cold. During the same period, Hamre and Procknow[3] isolated a similar type of virus with atypical features. The characteristics of B814 and Hamre's virus were different from any known myxo-or paramyxoviruses and they were collectively called as 229E. Later, Tyrrell along with a group of virologists in the late 1960s found some human and animal strains to be morphologically similar under electron microscopy.[4,5] They were grouped and named as coronaviruses.[6]

In 2002–2003, there was an epidemic of SARS, due to a coronavirus that originated in southern China, initially affecting the Asia–Pacific region, which spread worldwide later. The virus grew easily in tissue cultures. The genomic sequence of which differed from other known coronaviruses.[7] But showed similarity with a virus cultured from Himalayan palm civets. They were collectively called severe acute respiratory syndrome coronavirus (SARS-CoV).[8]

In 2012, a novel beta coronavirus induced respiratory illness leading to morbidity and mortality was reported in Arabian countries.[9] It was found to be spread from dromedary camels to human beings, transmitted by either direct or indirect contact.[10] The virus that caused the infection was initially called as human coronavirus-EMC, but has been later renamed as the Middle East respiratory syndrome coronavirus (MERS-CoV).[11]

On December 8, 2019, many cases of pneumonia due to unknown etiology were reported in the city of Wuhan, Hubei province of China, with manifestations similar to that of a viral etiology. Samples from the lower respiratory tracts of the affected individuals were studied for viral genomic analysis that indicated a novel coronavirus which was subsequently named as 2019 novel coronavirus (2019-nCoV) by the World Health Organisation (WHO).[12] It was reported to cause Severe Acute Respiratory infection (SARI).[13]

Virology

Coronaviruses include a large family of single-stranded enveloped RNA viruses. They belong to the order of Nidovirales, family of Coronaviridae and subfamily of Coronavirinae. They are categorized into four genera as α, β, γ, δ. The remarkable feature of these viruses are the spiky projections on their outer surface giving them the distinctive solar corona or crown appearance, hence called as Coronaviruses. They have unique helically symmetrical nucleocapsids. Specific glycoproteins that are present in the virus include the spike (S), membrane (M), envelope (E), and nucleocapsid (N) proteins.[14] The 2019-nCoV belongs to the β -genus and it comprises of enveloped virions of size 50–200nm in diameter with a single positive RNA genome.[15]

The nucleotide identity of 2019-nCoV exhibits similarity to that of SARS-CoV, hence it was officially named as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).[16] Studies on structural analysis of SARS-CoV-2 have predicted that these viruses use angiotensin-converting enzyme 2 (ACE2) as its host receptor similar to the SARS-CoV. The binding ability of the virus to ACE2 is known to be an important factor determining the infecting and transmitting capability of the virus among humans.[17]

Epidemiology and Transmission

The first case of SARS-CoV-2 induced febrile respiratory illness detected in the city of Wuhan,

in China is continuing to spread to many nations across the world. The virus was thought to be originated from the Huanan Seafood and animal wholesale market after which it was shut from public use on January 1, 2020.[18] Though the origin of SARS-CoV-2 needs further investigation. Few studies have suggested that SARS-CoV-2 was closely related to BatCoV RaTG13 detected in bats of Yunnan Province of China.[19] Transmission can occur both by direct and contact spread to people among close contacts of the affected individuals. The main route of transmission is by respiratory droplets, but surfaces contaminated by an infected person also poses a higher risk.[20]

According to WHO, the total number of confirmed cases reported globally as on April 19th 2020, was about 2,241,359. The maximum number of cases being reported in the United States of America (695,353Cases), The number of cases in Turkey is 82,329. In India, 15,712 cases have been confirmed. SARS-CoV-2 has caused about 152,551deaths globally.[21] Though cases are being recovered, the scientific evidence about the chance of reinfection is still being studied extensively.

Pathogenesis

Though the pathogenesis of SARS-CoV-2 infection is still under extensive research, the mechanism is found to be similar to that of SARS-CoV and MERS-CoV. The S protein of SARS-CoV-2 has a higher binding affinity to the ACE 2 receptors, than SARS-CoV.[15] Once the virus enters the human body the S protein of SARS-CoV aids the virus in entering the host cells. It binds to the ACE2 receptor by establishing fusion of the virus directly to the plasma membrane,[22] clathrin-dependent and independent endocytosis also helps the virus to enter into the host cells.[23] Once the virus enters the host cell translation of the RNA genome occurs and the viral genome starts replication. The viral antigen will be presented to the antigen presenting cells (APC). Antigen presentation will stimulate the humoral and cellular immunity (virus specific B and T cells) of the body. This leads to a severe systemic inflammatory response due to the release of excessive pro-inflammatory cytokines and chemokines by the immune effector cells.[24,25] This cytokine storm will cause an aggressive immunological reaction leading to ARDS, multiple organ failure and even death in severe cases.[26] (Figure 1)

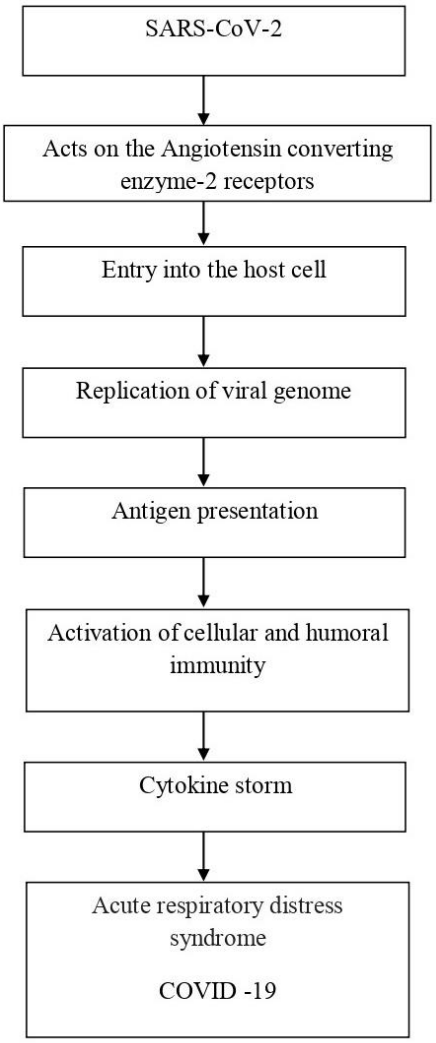

Figure 1: Schematic representation of Pathogenesis of SARS-CoV-2

Clinical manifestations

The signs and symptoms may occur between 2 – 14 days after a SARS-CoV-2 infection[27], but the incubation period ranges from 5-14 days.[21] The clinical manifestations of SARS-CoV-2 infection were reported to be similar to that of previous beta coronavirus infections (i.e SARS-CoV and MERS-CoV) to some extent. Fever, dry cough, dyspnoea were the most common symptoms. Signs like rhinorrhoea, sneezing, or sore throat may denote the location of target cells in the lower airway. The infection may range from mild to severe and can progress to ARDS and septic shock leading to death. Old age, obesity, and the

presence of other comorbid conditions may lead to increased mortality. Computed Tomographic investigation of the chest may reveal ground-glass opacities in the lungs and multiple lobar and sub segmental areas of consolidation.[28] On February 11, 2020, WHO has given an official name for the disease as COVID-19, which means Coronavirus disease- 2019.[29]

Diagnostic methods and Management

Specific RT-PCR tests have enabled the detection of SARS-CoV-2.[30] Specimen required for the diagnosis include upper respiratory tract (URT) specimens like nasopharyngeal and oropharyngeal swabs and lower specimen tract (LRT) specimens like expectorated sputum, endotracheal aspirate, or bronchoalveolar lavage. URT specimen collection should be done using sterile viral swabs made of dacron or rayon and transported in viral media.[13,31] Studies have shown viral cultures of the saliva of confirmed cases to be positive indicating live viral shedding in saliva contributing to transmission of the infection. Hence Saliva can also serve as a promising noninvasive specimen for diagnosis, monitoring, and infection control in patients with SARS-CoV-2 infection.[32]

Management of COVID-19 includes isolation of the patient, early supportive care and constant monitoring. Oxygen supplementation therapy for patients with SARI, hypoxemia or shock, conservative fluid management, appropriate empirical antimicrobials including neuraminidase inhibitors are recommended.[13] Remdesivir, Chloroquine and Hydroxychloroquine has shown in-vitro activity against SARS-CoV-2 (Table 1).[33,34]

Table 1: Recommendations for the use of Remdesivir, Chloroquine and Hydroxychloroquine in the management of COVID-19

Drug	Guidelines
Remdesivir	**Recommended** in hospitalized patients with severe COVID-19 disease, i.e $SpO_2 \leq 94\%$ on ambient air (at sea level), requiring supplemental oxygen, mechanical ventilation, or extracorporeal membrane oxygenation. **Not recommended** for the treatment of mild or moderate COVID-19 outside the setting of a clinical trial. **Not recommended** to use outside a hospital setting / clinical trial.
Chloroquine	**Not recommended** to use high dose of chloroquine for the treatment of COVID-19 disease, because a high dose carries a higher risk of toxicities than a lower dose.
Hydroxychloroquine	**Not recommended** to use outside a hospital setting / clinical trial.

Recent studies have proved the broad spectrum antiviral efficacy of Chloroquine, which is commonly used as an anti-malarial drug.[35] Chloroquine increases the endosomal pH and also interferes with the glycosylation of ACE receptors thereby inhibiting the viral fusion to the host cell. Remdesivir is an adenosine analogue that causes premature termination of the chain leading to inhibition of the viral RNA replication.[33] As of now, there is no approved vaccine for the disease but vaccines for SARS-CoV-2 are under clinical trials.

Dental perspective

As for other health professionals, dental surgeons also have a high risk of acquiring the infection from the patients. In a dental setup, early identification of patients with SARS-CoV-2 is difficult because of nonspecific symptoms and presentation.[36] Hence dental surgeons should follow standard personal protective measures and precautions with all the patients during the period of the pandemic. There are chances that dental surgeons may encounter patients with a travel history from high-risk areas of SARS-CoV-2, hence the dental surgeons should be highly vigilant and have a proper knowledge in suspecting a case of SARS-CoV-2. According to the WHO criteria for suspecting a case,[37]

A. Patient having SARI of no other possible etiology explaining the clinical presentation and a recent travel history or residence in China or other

high-risk countries, in the past 14 days before the onset of symptoms,

B. Patient having any acute respiratory illness and any one of the following in the past 14 days before the onset of symptoms:

1. History of contact with a COVID-19 positive case/probable case of SARS-CoV-2 infection (or) 2. A health care worker working in a setup where COVID-19 positive case/probable cases of SARS-CoV-2 infection were being treated.[37]

If a dental surgeon encounters a suspected/ confirmed case, the patient should be referred to and reported to the public health authority for testing and management of COVID-19.

Preventive measures in dental practice

Health care workers should follow aggressive personal protective methods by using N95 masks, goggles, face shield, protective gowns, etc.[38]Evaluation of the dental patients must be carried out by taking a proper history of the patient, including recent travel history and history of contact with suspected or confirmed cases, Screening patients for signs and symptoms of the infection, Routine temperature assessment of all patients before performing any procedure[39], using mouth rinses of 1% Hydrogen peroxide or 0.2% Povidone in patients before the procedure can reduce the microbial load of saliva including potential SARS-CoV-2 carriage.[40] Use of 0.2% chlorhexidine gluconate as a pre procedural mouthwash has shown significant reduction in the aerosolized microflora generated during ultrasonic scaling.[41]

In a dental setup droplet and aerosol transmission are unavoidable because devices like airotors, ultrasonic scalers work in the patient's oral cavity generating loads of aerosol mixed with saliva and even blood during the procedure. In addition to that cough or saliva of the patient can also contaminate the devices and surfaces.[39] Hence rubber dam isolation, use of high volume saliva ejectors, four-handed technique, anti-retraction handpieces, autoclaving of handpieces after every patient and following strict disinfection protocol may help in reducing the risk of transmission. During the pandemic of COVID-19 use of ultrasonic scalers and procedures that are likely to induce coughing should be avoided.[40] Postponement of elective procedures and providing emergency dental services is recommended.[42] (Table 2)

Table 2: List of emergency, urgent and non-urgent dental needs

Emergency Dental Care	Urgent Dental Care	Non-Urgent / Treatment that can be postponed
• Uncontrolled bleeding • Cellulitis/Space infections • Intra Oral/Extra oral swellings compromising the airway • Trauma involving facial bones	• Severe dental pain/Pulpitis • Pericoronitis • Surgical post-operative osteitis • Dry socket dressing changes • Abscess, or localized bacterial infection resulting in localized pain and swelling • Fracture of Tooth / Orofacial soft tissue trauma • Dental treatment required prior to critical medical procedures. • Final crown/bridge cementation if the temporary restoration is lost, broken or causing gingival irritation • Biopsy of abnormal tissue	• Routine oral examinations and recall visits • Oral prophylaxis • Orthodontic procedures other than those to address acute issues (e.g. pain, infection, trauma) • Extraction of asymptomatic teeth • Restorative dentistry including treatment of asymptomatic carious lesions • Aesthetic dental procedures

Providing emergency dental care

Dental emergencies that need immediate treatment has to be addressed after following the standard precautions. In case of irreversible pulpitis, chemico mechanical carious removal under rubber dam isolation and local anesthesia followed by exposure and devitalization the pulp is recommended to reduce the pain of the patient. Combination of NSAIDs with acetaminophen may also be prescribed for the management of dental pain. Patients who require treatment procedures involving hand pieces should be treated in an

isolated, well-ventilated room.[43] In Patients with intra oral swellings as a result of bacterial abscess, that has a potential risk to develop into a space infection, extractions of the tooth with the pathogenic cause should be preferred rather than a restorative management.[44] If in case extraction of a tooth is needed, absorbable sutures so as to eliminate the need for suture removal are preferred. Management of severe cases of space infections or maxillofacial injuries is recommended to be performed only in a hospital set up so as to screen and test for suspicion of SARS-CoV-2, if required. Emergency treatment in patients who are suspected cases of the infection should be preferably carried out in negative pressure rooms.[43]

Dental imaging during the pandemic

Radiographs are advised only when it is strictly indicated. Intraoral radiographic techniques are not advised because of their ability to induce gag reflex and cough in patients. The intraoral film packet that is placed inside the patient's mouth has a high risk of carriage as it contacts the oral tissues and may possess a serious risk of transmission. Panoramic radiography may be used to evaluate the dental and associated structures instead of intra oral radiographs.[45] Other extra oral radiographic techniques and Cone-beam computed tomography are also recommended in indicated cases.[46]

Telescreening and Patient education

Dental patients should be encouraged to contact the dental clinic/hospital to inform the nature of their dental need prior to their visit. This enables the dental team to telescreen[46] the patient regarding the medical history, travel history, signs and symptoms of the patient and decides whether it is an emergency/urgent/non-urgent dental need. If the dental need of the patient is not an emergency, then the patient can be educated regarding the management and advised for postponement of the dental procedure. In case of an urgent dental need an appropriate appointment schedule can be given, so as to reduce the waiting time of the patient in the dental clinic. This helps the patient by reducing the risk of acquiring any nosocomial infection due to an unwanted visit to a dental setup and also allows the dental surgeon to take care of those patients who need immediate dental care.

CONCLUSIONS

The COVID-19 outbreak has emerged as a reminder of the continuing threat of zoonotic viral diseases to global public health. It is necessary for the dental surgeons and the dental team to be vigilant and protective in providing dental care and also in preventing the SARS-CoV-2 transmission. Though many features of the virus and the disease are still under research, strict surveillance and standard precautions may help in the early identification of the diseased and prevent the further spread of the disease.

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CONFLICT OF INTEREST STATEMENT

None

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