



RESEARCH ARTICLE

CORONA VIRUS AND DENTISTRY: AN OVERVIEW

Dr. Aushili Mahule¹, Dr. Jay Kumar Gade² and Dr. Vandana Gade³

1. Post Graduate Student, Department of Prosthodontics, Crown and Bridge and Oral Implantology, Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, Maharashtra, India.
2. MDS, HOD & Professor, Department of Prosthodontics, Crown and Bridge and Oral Implantology, Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, Maharashtra, India.
3. MDS, Professor, Department of Conservative Dentistry and Endodontics, Swargiya Dadasaheb Kalmegh Smruti College and Hospital, Nagpur, Maharashtra, India.

Manuscript Info

Manuscript History

Received: 07 January 2020

Final Accepted: 10 February 2020

Published: March 2020

Key words:-

Corona Virus, SARS, MERS, Dentistry, Aerosols, Saliva

Abstract

The recent emergence of Corona virus (COVS) outbreak appeared as a bolt from the blue for the whole world. Patients infected with COVS may be present in the outpatient dental department. The main source of transmission of the COVS is by droplet, thus healthcare professionals that perform aerosol-generating procedures such as dentists need to be updated about the nature of the disease. The patient and the dentist often share a close contact while an ongoing dental treatment and the saliva being regarded as a potential source of the virus, a knowledge about the disease and necessary preventive measures is required. This article aims to highlight the basic about the Corona virus infection and its possible relation with dentistry.

Copy Right, IJAR, 2020,. All rights reserved.

Introduction:-

The World Health Organization (WHO) has declared a “public health emergency of international concern” due to the worldwide spread of COV on 30th January 2020. Corona virus had a rapid epidemic spread from Wuhan, China. Globally 95,333 confirmed cases of COVS have been reported out of which 80,565 confirmed cases are from China while 14,768 confirmed outside of China. Approximately 3015 deaths were reported from China and 267 deaths from other countries (WHO, situation report 45).

COVS are a group of highly diverse, single-stranded, enveloped, RNA viruses that interact with the components of host cells for their replication and proliferation. The virus belongs to the order Nidovirales, family Coronaviridae and subfamily Coronavirinae. There are 4 genera of COVS: alpha COVS, beta COVS, gamma COVS, and delta COVS. COVS can cause respiratory, gastrointestinal, hepatic, and neurologic diseases in humans. There are 2 COVS that can cause severe disease: severe acute respiratory syndrome (SARS)-COVS and Middle East respiratory syndrome (MERS)-COVS. Both the viruses are zoonotic in origin and linked to human consumption of palm civet cats. Bats and camels are also the suspected sources of MERS virus (Adalja, 2018; Hui, 2017; Tok, 2017; Burell, 2016).

Brief history:

SARS, was first reported in the southern part of China (Guangdong) in 2003 and had later spread to Canada, Singapore, Vietnam and worldwide by travellers through Hong Kong in February 2003 and March 2003. Certain individuals infected a disproportionate number of others leading to super spreading of the viral disease.

Corresponding Author:- Dr. Aushili Mahule

Address:- Department of Prosthodontics, Crown and Bridge and Oral Implantology, Swargiya Dadasaheb Kalmegh Smruti Dental College and Hospital, Nagpur, Maharashtra, India.

Approximately 8000 cases were reported, with 10% of cases being fatal. The epidemic was however exterminated as the infection control measures were instituted in health care settings and with cessation of the palm civet cat's consumption (Hui, 2017).

On the other hand, MERS emerged in September 2012 from the Arabian Peninsula. In Saudi Arabia (2012) the first case of MERS-COV was reported when a male patient who had died of severe pneumonia and multiorgan failure. All cases of MERS had a super spreading via South Korea. Since its discovery, MERS-COV infection has spread to almost 27 countries. The WHO has been informed of 1769 laboratory-confirmed cases of infection with MERS-COV, with at least 630 deaths (Adalja, 2018; Hui, 2017).

Pathogenesis of SARS in brief:

Coronaviruses consists of five structural proteins in the genome namely: the Spike protein (S), Membrane protein (M), Envelope (E) glycoproteins, Hemagglutinin Esterase (HE) and Nucleocapsid protein (N) (Figure 1). The nucleocapsid protein and the spike protein of SARS-COV plays an imperative role in the pathogenesis of human COVS-induced diseases and is a major determinant of virulence (Hui, 2017; Tok, 2017).

The disease progression occur due to activation of cell mediated immunity and hyperinnate inflammatory response as shown by marked increases in the levels of the inflammatory cytokines like interleukin IL-1, IL-6, and IL-12 and in chemokines like T_H1 IFN- γ -inducible protein 10 (IP-10), neutrophil chemokine IL-8, and monocyte chemo attractant protein-1 (MCP-1) (Hui, 2017).

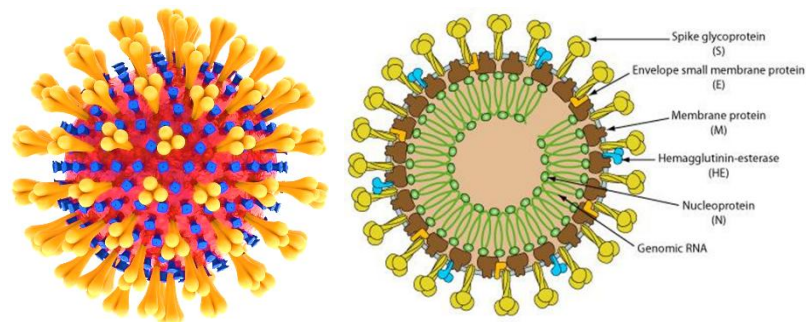


Figure 1:- Structure of Corona Virus

Clinical features:

The estimated mean incubation period of SARS is 4.6 days whereas the mean time from symptom onset to hospitalization can vary between 2 days and 8 days. Table 1 describes the clinical features of SARS (Hui, 2017).

Laboratory Findings in SARS:

1. Lymphopenia (early fall of CD4 & CD8 lymphocytes)
2. Disseminated intravascular coagulation,
3. Elevated lactate dehydrogenase, and
4. Elevated creatinine kinase

Pathogenesis of MERS:

MERS-COV causes a rapid dysregulation of cellular transcription pathways causing apoptosis of bystander cells by evading the host innate immune response. The dipeptidyl peptidase 4 (DPP4), also known as CD26, acts as the functional cellular receptor for MERS-COV. DPP4 homologues that permits MERS-COV infection are present in a variety of cell lines like alveolar cells, ciliated bronchial epithelium, unciliated cuboid cells of bronchioles, endothelial cells of pulmonary vessels, pneumocytes, epithelial syncytial cells and rarely in alveolar macrophages. This receptor is involved in the regulation of cytokine responses as well as glucose metabolism. However, antibodies against the S binding domain of MERS-COV helps to neutralize infectivity (Hui, 2017; Burell, 2016).

Clinical Features:

The incubation period of MERS is estimated to be more than 5 days but could be as long as 2 weeks. Table 2 describes the major clinical features of MERS (Hui, 2017).

Laboratory features:

Laboratory features are quite similar to that of SARS and common laboratory findings of MERS include leukopenia particularly lymphopenia.

Radiologic Features of MERS (Hui, 2017):

1. The most common CT finding in hospitalized patients with MERS-COVs infection is that of bilateral predominantly sub pleural and basilar airspace changes, with more extensive ground glass opacities than consolidation.
2. Abnormalities in sub pleural and peribronchovascular areas suggestive of an organizing pneumonia pattern.
3. Unilateral or bilateral patchy densities or infiltrates, segmented or lobar opacities, ground-glass opacities, and small pleural effusions in some cases.
4. Lower lobes are affected more than upper lobes early in the course of illness with more rapid radiographic progression than SARS.

Routes of transmission of COVS:

The main routes of virus spread are airborne and droplet transmission related to human respiratory activities such as talking, coughing, sneezing etc. Aerosols generated during dental procedures from a patient infected with COVS can also lead to spread of the disease. Transmission can also take place via direct contact and indirect contact (fomite) transmission (Hui, 2017; Samaranayake, 2004).

COVS and dentistry:

The oral cavity and the respiratory tract of humans consists of vivid microbial flora and these microbes act as potential sources of cross-infection in dentistry. Most of the dental procedures are aerosol producing and the COVS infection spreads mainly through droplet infection; thus the inter-relation between dentistry and COVS cannot be overlooked. However, till date there is no documented cases of SARS transmitted in a dental setting. But, as health care providers, dentists should be wary of the disease and should have knowledge about the nature and course of the disease, should be able to identify patients affected with SARS and should know how to prevent dental transmission of the disease.

Identification of patients with SARS:

Identification of a suspected case of SARS can be done following the CDC's diagnostic criteria for SARS. Although it is unlikely for the SAR patient to visit a dentist in the acute febrile stage of the disease. If at all this happens, the dentist should not treat the patient. Instead the suspected cases should be referred to a health care facility for diagnosis and care. Dentists should also report the case to state or local health departments (Samaranayake, 2004).

Patient evaluation:

As a routine procedure, dentists should take a thorough medical history of every patient. The questionnaire used for screening SAR patients should be modified to incorporate targeted questions regarding SARS and should include the following:

1. Any recent history of fever?
2. Any experienced of a recent onset of a respiratory problem, such as a cough or difficulty breathing?
3. Have you, within the last 10 days (that is, the incubation period for SARS), travelled internationally or visited an area where documented or suspected community transmission of SARS is occurring?
4. Have you come into contact with a patient with SARS in the past 10 days?

If a positive response is received from the patient for any of the above mentioned questions, the dentist should refer the patient to medical facility as patients with SARS require ground emergency medical services. Clinicians should delay treating recuperating patients for at least one month after they are released from the hospital. Such patients should be instructed to remain at home for a week after discharge from the hospital, and during this period they should be instructed to stay indoor and keep minimum contact with others.

The cases where the patient recently has recently returned from a geographic region suspected or documented for community transmission of SARS, the dentist can adjourn treatment until the incubation period is over. However, emergency dental treatment limited to infection and pain control can be provided using barrier precautions and avoiding spatter or aerosol-generating procedures. The proper use of standard precautions is adequate to prevent the nosocomial spread of SARS in the absence of aerosol-producing procedures (Seto, 2003).

Pre-procedural mouth rinsing:

Use of pre-procedural antimicrobial rinses (with 0.12 to 0.2 percent chlorhexidine gluconate or povidone iodine) is recommended to reduce the disseminated microbial load into the dental operatory environment. These pre-procedural rinses are specifically useful in cases where rubber dam isolation is not feasible and the dental procedure is associated with an increased release of microbes, eg ultrasonic scaling (Samaranayake, 2004; Kohn, 2003).

Hand hygiene:

One of the most important method of preventing transmission of any infectious agent, including the SARS, is hand washing and appropriate hand care. A dramatic reduction in the prevalence of health care associated infections has been shown when regimented hand hygiene measures were introduced (Larson, 2000). Superficial as well as deeper cell layer of the skin consists of various microbial flora that are mainly acquired through environmental routes. This superficial flora can be removed with hand-washing procedures. For routine dentistry, like oral examinations and nonsurgical procedures, plain soap and water or an alcohol-based hand rub could be used for decontamination (Boyce, 2002). The gloves should however be worn on completely dry hands after using an alcohol-based hand rub to prevent the risk of glove perforation (Pitten, 2000). Also, as humidity and moisture causes rapid multiplication of bacteria under the glove surface, the dentist should therefore decontaminate their hands both before and after removing gloves. Only alcohol containing hand rubs may evaporate fast and therefore should not be used solely but can be used in combination with agents such as chlorhexidine, octenidine or triclosan to achieve the needed effect. Team members should refrain from touching their face, eyes or lips with bare hands.

Surface disinfection:

SARS virus is a relatively robust organism and may survive on nonporous surfaces for up to 48 hours. Therefore a thorough disinfection is required of the contaminated surfaces with SARS. Surface barriers should be used to protect clinical contact surfaces, specifically which are difficult to clean (e.g., switches on dental chairs) and the barriers should be changed between the patients. Non-barrier-protected clinical contact surfaces should be cleaned by using an EPA registered hospital disinfectant with a low- to intermediate-level activity after each patient. Walls, blinds, and window curtains in patient-care areas should be cleaned when they are visibly dusty or soiled (Samaranayake, 2004; Kohn, 2003).

Personal protective equipment (PPE):

Personal protective equipments are intended to protect the skin and mucous membranes of the eyes, nose and mouth from exposure to potentially infectious material. It is recommended to wear a surgical mask, face shield, eye protection with solid side shield and protective gowns during procedures likely to generate splashing or spattering of blood or other body fluids. It is advisable to change masks between patients or during patient treatment if the mask becomes wet. Routinely used surgical masks are not designed to provide adequate protection against exposure to airborne infectious agents such as droplet nuclei smaller than 5 micrometers. As COVS is a droplet infection; particulate respirators like N-95 masks, must be used which consists of a thick impervious fabric to provide adequate protection (Samaranayake, 2004; Kohn, 2003).

Rubber dam isolation:

Rubber dams help to minimize the production of saliva and blood-contaminated aerosol or spatter. An up-to-70-percent reduction in airborne particles within a 3-foot diameter of the operational field is reported when a rubber dam is used for isolation (Samaranayake, 1989). A split-dam technique may be used in situations in which gingival areas are involved, like crown and bridge preparations and Class V restorations. If rubber dam isolation is not feasible, aerosol-generating procedures like ultrasonic scaling, root-surface debridement and high- or low-speed drilling with water spray should be avoided as far as possible (Samaranayake, 2004).

High-volume suction:

The use of high-volume suction is highly recommended to prevent release of the infected aerosols from the COV positive patients to the dental operatory and surrounding environment.

Patient Education:

Patients should also be taught about cross infection in dentistry through educational programs to increase awareness. Stress can be given to follow improved personal and hand hygiene.

Saliva and COVS:

Salivary glands and saliva can act as a pivotal source of COV (Sabino, 2020). Some virus strains have been detected in saliva days after infection (Barzon, 2016; Zuanazzi, 2017), indicating that saliva can be used as a biomarker to detect COVS infections. It is non-invasive and cost effective method. Saliva samples can be self-collected thus presenting an advantage of reducing the risk of COVS transmission to the healthcare workers when compared to collecting nasopharyngeal or oropharyngeal samples from the infected patients.

Pathways for COVS to be present in saliva:

1. From the respiratory tract, COVS can enter the oral cavity together with the liquid droplets frequently exchanged by these organs.
2. COVS present in the blood can access the mouth via gingival crevicular fluid.
3. COVS can also enter the oral cavity by major and minor salivary gland via salivary ducts.

Conclusion:-

Inhalation of airborne particles and aerosols produced during dental procedures from the patients infected with COVS can be a high-risk in which dentists are directly and closely exposed to this virus. Therefore, it is incumbent for dentists to follow preventive strategies to avoid the COVS infection by identifying potentially infected COV patients, following proper hand hygiene, using all personal protective equipments, and caution in performing aerosol-generating procedures. The guidelines for healthcare professionals from CDC and WHO has been updated and included additional information on COVS infection and transmission and must be followed in the regular dental practice during this era of disastrous, perilous pandemic of the COV disease.

Table 1:- The major clinical features of SARS-COV infection.

1	Fever, chills and rigor
2	Myalgia
3	Headache
4	Malaise
5	Dyspnoea
6	Sore Throat and Dry Cough,
7	Rhinorrhoea,
8	Sputum production,
9	Nausea and Vomiting,
10	Dizziness
11	Watery Diarrhea
12	Elderly subjects might develop a decrease in general condition, delirium, poor feeding, and fall/fracture.

Table 2:- The clinical features of MERS-COV infection.

1	Fever, chills,
2	Cough, Sore throat
3	Myalgia and Arthralgia
4	Dyspnoea and rapid progression to pneumonia within the first week (in contrast to SARS)
5	GIT symptoms like - nausea, vomiting and diarrhea
6	Asymptomatic to very severe pneumonia with ARDS
7	Septic shock
8	Multiorgan failure resulting in death
9	Neurologic complications such as intracerebral haemorrhage and polyneuropathy
10	Thrombocytopenia, Disseminated Intravascular Coagulation, and Platelet Dysfunction
11	Pregnant women infected with MERS may give stillbirth.

Source of funding:

Nil

Conflicts of interest:

None declared

Acknowledgement:-

Nil

References:-

1. Adalja AA. (2018). Biothreat Agents and Emerging Infectious Disease in the Emergency Department. *Emergency medicine clinics of North America.*, 36(4):823-834.
2. Barzon L, Pacenti M, Berto A, Sinigaglia A, Franchin E, Lavezzo E, Brugnaro P, Palù G. (2016). Isolation of infectious Zika virus from saliva and prolonged viral RNA shedding in a traveller returning from the Dominican Republic to Italy. *Euro Surveill.*, 21(10): 30159.
3. Boyce J.M, Pittet. D. (2002). Centers for Disease Control and Prevention. Guideline for Hand Hygiene in Health-Care Settings: Recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. *MMWR*; 51(16):1-34.
4. Burrell CJ, Howard CR, Murphy FA. (2016). Fenner and White's Medical Virology. PART II Specific Virus Diseases of Humans. Academic Press., pp- 437-446.
5. Hui DS. (2017). Epidemic and Emerging coronaviruses (severe acute respiratory syndrome and middle east respiratory syndrome). *Clinics in chest medicine.*, 38(1):71-86.
6. Kohn W.G, Collins A.S, Cleveland J.L, Harte J.A, Eklund K.J, Malvitz D.M. (2003). Centers for Disease Control and Prevention. Guidelines for Infection Control in Dental Health-Care Settings —*MMWR*; 52(17):1-48.
7. Larson EL, Early E, Cloonan P, Sugrue S, Parides M. (2000). An organizational climate intervention associated with increased handwashing and decreased nosocomial infections. *Behav Med.*, 26:14-22.
8. Pitten FA, Herdemann G, Kramer A. (2000). The integrity of latex gloves in clinical practice. *Infection.*, 28:388-92.
9. Samaranayake LP, Peiris M. (2004). Severe acute respiratory syndrome and dentistry: a retrospective view. *The Journal of the American Dental Association.*, 135(9):1292-302.
10. Sabino-Silva R, Jardim AC, Siqueira WL. (2020). Coronavirus COVID-19 impacts to dentistry and potential salivary diagnosis. *Clinical Oral Investigations.*, 1-3.
11. Samaranayake LP, Reid J, Evans D. (1989). The efficacy of rubber dam isolation in reducing atmospheric bacterial contamination. *J Dent Child.*, 56:442-4.
12. Seto WH, Tsang D, Yung RW, et al. (2003). Effectiveness of precautions against droplets and contact in prevention of nosocomial transmission of severe acute respiratory syndrome (SARS). *Lancet.*, 361:1519-20.
13. Tok TT, Tatar G. (2017). Structures and Functions of Coronavirus Proteins: Molecular Modeling of Viral Nucleoprotein. *Int J Virol Infect Dis.*, 2(1): 001-007.
14. WHO. (2020). Coronavirus disease 2019 (COVID-19) Situation Report – 45.
15. Zuanazzi D, Arts EJ, Jorge PK, Mulyar Y, Gibson R, Xiao Y, Bringel Dos Santos M et al. (2017). Postnatal identification of Zika virus peptides from saliva. *J Dent Res* 96(10):1078– 1084.