



ORIGINAL RESEARCH PAPER

Prosthodontics

COVID -19 PANDEMIC JEOPARDY IN DENTISTRY PROSTHODONTIC IMPLICATIONS, CLINICAL CARE AND CONTROL-A REVIEW

KEY WORDS: COVID-19 ,Dentistry, Infection control, prosthodontics.

Janapati Divya	Post Graduate
Dr. C.Ravi kumar	Professor & HOD
Dr.M.Sujesh	Professor
Dr.D.Chalapathi Rao *	Professor *Corresponding Author
Dr.K.Sunitha	Reader

ABSTRACT

This article is intended to collect all information needed for dentists especially for the prosthodontists regarding COVID -19 pandemic throughout the world by reviewing articles published till now . ACE-2 was expressing on oral cavity mucosa and the receptor had been heavily enriched in tongue epithelial cells. Thus there is a potentially huge COVID-19 infectious vulnerability risk for oral cavity. Despite global efforts to prevent the disease spread, the outbreak is still on a rise because of the community spread pattern of this infection. Dental professionals, especially prosthodontists, where there is more probability of contact with oral mucous membranes and saliva will have to provide care as well as prevention from nosocomial infection simultaneously. However there is no definite treatment protocol for COVID-19, We have to follow safety measures during dental practice to block person-to-person transmission routes in dental clinics and hospitals by patient screening, infection control strategies, and patient management protocol. Thus, the aim of this article provides a brief overview of the routes of transmission ,clinical care, prosthodontic implications, safety measures of this novel infection.

INTRODUCTION:

The pneumonia epidemic of unknown etiology occurred in Wuhan, China at the end of 2019, and the causative pathogen was identified as a new coronavirus in 2019, triggering a coronavirus disease in 2019. In mid-January 2020, "World Health Organization" (WHO) named the virus severe respiratory syndrome-coronavirus-2 (SARS-COV-2), introducing it as the main trigger for acute respiratory distress syndrome (ARDS), and the malady was termed "coronavirus disease 2019 (COVID-19)".

COVID-19 reports that it is a zoonotic infection, similar to other corona virus infections, caused by bats and pangolins and subsequently transmitted to humans..

COVID-19 transmits person-to- person through cough, sneeze, droplet inhalation, saliva, touch transmissions such as communication with oral, nasal and eye mucous membranes, as well as fecal-oral routes

Dental experts are exposed to the gigantic danger of 2019-nCoV disease due to near and intimate communication and exposure to salivation, sweat, other body fluids, they assume incredible jobs in forestalling the transmission of 2019-nCoV by following preventive measures



Figure:1 World Wide Statistics Of The Covid-19 New Cases.(<https://covid19.who.int/>)(last) (last accessed on 14th march 2020)

As of May, 2020, as indicated by the World Health Organization (WHO), 2019-nCoV has included 216 nations among which the most contaminated are USA, Italy, China, Spain. This

infection brought about a death pace of 2%¹ and multiplication number (RO) of 1.4–5.5²

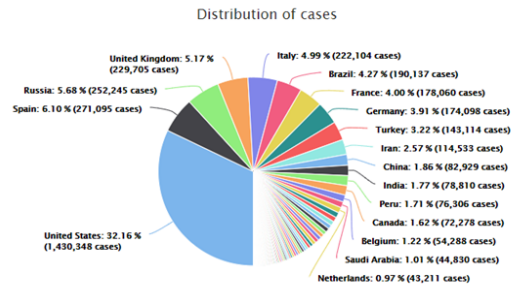


FIGURE :2 Distribution of cases among world wide (Source: **Worldometer** - www.worldometers.info)(Last accessed on 14th march 2020.)

Characteristics of Corona Virus

Corona virus particles range from 60 to 140 nanometers (0.06 to 0.14 micrometers), with an average of 0.125 microns, and have distinctive spikes of nine to 12 nanometers that give the appearance of coronas around the sun

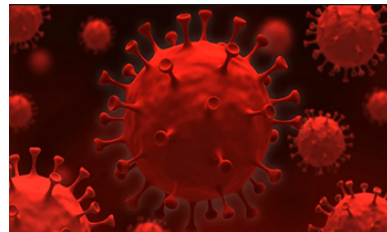


Figure No:3 Morphology Of Corona Virus(ijerph-17-03325-.png)(3722×3808)last accessed on 14th march 2020. Cell death is observed 96 hours after inoculation on the surface layers of human airway epithelial cells. The novel coronavirus belongs to a family of single-stranded RNA viruses known as Coronaviridae^{3,4}

Coronaviruses are divided into four groups^{5,6}: alphacoronavirus, betacoronavirus, gammacoronavirus, and

delta corona virus.

The alpha corona virus and betacoronavirus - infect the respiratory, gastrointestinal, and central nervous function of humans and mammals, gamma coronavirus and delta coronavirus mostly target the birds⁷.

The Huge Expression Of Ace-2 Receptor Of Covid-19 On The Epithelial Cells Of The Oral Mucosa

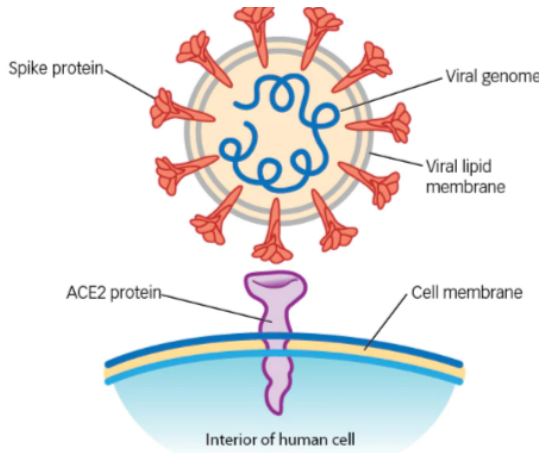


Figure No:5 Expression Of Ace-2 Receptor Of Covid-19 On The Mucosa.

Through spike protein, COVID-19 can enter the cell via human angiotensin-converting enzyme 2 (ACE2) receptor. The S protein may bind to host receptors to facilitate viral entry into target cells, but it cannot bind to cells without ACE2 receptor. ACE2 + cells has been found to be abundant in the respiratory tract. Epithelial salivary gland duct cells have been shown to be early 2019-nCoV targets⁸.

Viruses mutate naturally, and mutations do not translate into a more dangerous or virulent form of the existing virus.

There can, however, be advantages of identifying the mutations within the genome, A primary example being the development of vaccines. Mutations, which are essentially small genetic changes, are not evenly distributed across the virus genome—those invariant parts of the virus could be better targets for drug and vaccine development.

Incubation period

The average incubation period for COVID-19 has been projected to be 5 to 6 days, it can last up to 14 days, the quarantine period for potentially exposed individuals.

The asymptomatic incubation period for individuals infected with 2019-nCoV has been reported to be ~1–14 days, and after 24 days it has been confirmed that those without symptoms can spread the virus⁹.

Viral shedding supposedly begins 2–3 days before symptom onset , after which the viral load decreases monotonically. The virus can be detected after 20 days from symptom onset , however, the live virus can no longer be cultured after 8 days, suggesting a severe reduction in infectiousness

Symptoms:

Most COVID-19 patients are mild cases. In view of the most recent investigations from the National Health Commission of China, the extent of serious cases among the entire COVID-19 patients in China went from about 15% to 25%¹¹.

Most people (about 80%) recover from the disease without needing hospital treatment. Around 1 out of every 5 people who gets COVID-19 becomes seriously ill and develops

difficulty breathing¹¹.

The regular clinical side effects of the patients experiencing COVID-19 are fever, dry cough, , nasal congestion, headache, conjunctivitis shortness of breath, myalgia (muscle torment), tiredness, and irregular chest CT.

The less normal side effects are migraine, creation of sputum, hemoptysis, stomach torment, dizziness, nausea, looseness of the bowels, vomiting , disguisea and anosmia, a rash on skin or discoloration of fingers or toes.

These symptoms are usually mild and begin gradually. Some people become infected but only have very mild symptoms.

Illness beginning can cause progressive respiratory failure dynamic on account of alveolar impairment and even demise. older age and the comorbidities, for example, hypertension, diabetes, cancer, cardiovascular, lung problems and cerebrovascular sickness, renal problems and patients on immunosuppressant drugs are at higher risk of developing serious illness, with worse prognosis.

However, anyone can catch COVID-19 and become seriously ill. In addition, most patients had bilateral pneumonia with ground-glass opacity (GGO) and typical bilateral patchy shadows.

Diagnosis

The diagnosis of COVID-19 can be based on a combination of epidemiological data (i.e. travel history or residency in the infected region two weeks before the onset of symptoms), laboratory tests, clinical symptoms and CT imaging results.

The outcome of a single negative test does not mean that the suspected patient is not contaminated.

Patients' epidemiological history, symptoms related to COVID-19 and positive CT outcomes should be considered clinically.

The outbreak of COVID-19 alerts that all dental / oral and other health professionals must invariably be attentive in their defense against spread of infectious diseases and may be alert to the spread of infections. Theoretically, the diagnosis of COVID-19 can be accomplished via salivary diagnostic platforms

There are at least three different pathways for 2019-nCoV existence in saliva¹² :-

- Infection of major and minor salivary glands with subsequent release of particles into saliva via the salivary tract.
- It should be noted that epithelial salivary gland cells may be affected by SARS-CoV shortly after infection with rhesus macaque, suggesting that salivary gland cells may be a key source of this salivary virus¹³,
- In addition the development of SARS-CoV-specific Secretory Immunoglobulin A (SIgA) in animal saliva models has previously been demonstrated¹².

Taking into account the similarity of both strains, the salivary diagnosis of COVID-19 can also be accomplished through the use of different antibodies to the virus.

As a result, saliva can play a key role in human-to-human transmission, and salivary diagnoses can provide a quick and cost-effective point-of-care platform for infection with 2019-nCoV.

Treatment

To date, no evidence has been given from randomized controlled trials to recommend any particular anti-nCoV medication, and the management of COVID-19 has been

widely supported.

The formulation of azithromycin to 600 mg of hydroxychloroquine was substantially more effective in virus removal.

The convalescent plasma (CP) which is acquired from a person recovered from COVID 19 by producing humoral immunity is the primary treatment but it is not evidence based¹⁴

In present scenario, the strategy for COVID-19 is to monitor the source of infection by preventing infection and regulating steps to reduce the risk of spread, and to provide early identification, quarantine and assistance to infected patients. Several clinical trials are being performed to test potentially more successful interventions.

Vaccines

Vaccination could be the most efficient and cost-effective way to prevent and track COVID-19 with a global spread of 2019-nCoV. Extensive studies are currently underway to enable the development of 2019-nCoV vaccines. In particular, the 2019-nCoV S protein remains the primary objective for vaccine development¹⁵

The Possible Transmission Routes Of 2019-Ncov:

According to the findings of genetic and epidemiological studies, the outbreak of COVID-19 started with a single transmission from animal to human, accompanied by continuous human-to-human spread. COVID-19's usual transmission pathways include direct transmissions such as sneezing, cough, and inhalation of small airborne particles and the transmission indirectly through fomites .

Although standard clinical presentations of COVID-19 do not include eye symptoms, the examination of conjunctival samples from confirmed and suspected COVID-19 cases confirms that COVID-19 transmission is not limited to the respiratory tract, and that eye contact may be a possible route for the virus to enter it.

Possible Transmission Routes Of 2019-ncov In Dental Practise

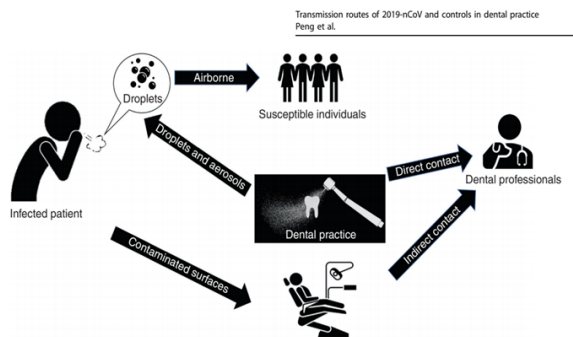


Fig. 1 Illustration of transmission routes of 2019-nCoV in dental clinics and hospitals

Figure No:6 Illustration Of Transmission Routes Of 2019-cov In Dental Clinics

Dentistry is listed as a very high risk group of occupations involving aerosols under OSHA.

Dental patients and dental practitioners may be exposed to pathogenic microorganisms, including viruses and bacteria that invade the oral cavity and respiratory tract, by inhalation of airborne microorganisms that may persist in the air for a long period of time¹⁶ .

Prosthodontists are typically at risk of infection with 2019-nCoV due to the complexity of their procedures, which includes face-to - face contact with patients and repeated

exposure to saliva during denture fabrication procedures such as impression making ,maxilomandibular relations, bite registration and full denture delivery to completely edentulous.

Prosthodontist may encounter covid 19 virus during dental preparations in order to restore the missing tooth in the fixed dental prosthesis. The splatter evaporates, leaving smaller particles called nucleus capable of carrying bacteria and viruses and transmitting nosocomial infections.

Infections may be present in dental clinics hospitals through any of these conditions involving an infected person, particularly during this COVID outbreak

Patient Management And Prevention Of Nosocomial Infection

Patient Assessment And Care Protocol:

- Obviously a patient with COVID-19 who is in the acute febrile phase of the disease is not advised to visit a dental clinic dental professional should be able to recognise a patient suspected of having 2019-nCoV infection and should not be handled in a dental clinic but immediately quarantine the patient and report to the infection control department as soon as possible, in particular. In the first step Primarily the body temperature is measured with a contact free forehead thermometer, every patient was managed remotely (e.g., phone, texts, website) adopting a dental triage that consists of an interview able to identify three parameters
- Have awareness about high risk areas.

Telescreening

Initial screening via telephone to identify patients with suspected or possible COVID19 infection can be performed remotely at the time of scheduling appointments¹⁹ .

A questionnaire should be used to screen the asymptomatic patients which may have any recent travel history to an area with high incidence of COVID-19 or presence of any symptoms of febrile respiratory illness such as fever or cough

Date: _____
 Name (last name, first name): _____
 Date of Birth (mm/dd/yy): _____

Yes	No	COVID-19 Screening Questionnaire
		In the past 14 days, have you or any household member traveled to areas with known cases of COVID-19? If so, please note location: _____
		In the past 14 days, have you or any household member had any contact with a known COVID-19 patient?
		Have you or any household member have a history of exposure to COVID-19 biologic material?
		Have you had any history of fever in the last 14 days?
		Have you had any symptoms such as cough, difficulty breathing, diarrhea, nausea, body ache, loss of smell or loss of taste in the last 14 days?
		Urgent Dental Need Question Do you have uncontrolled dental or oral pain, infection, swelling or bleeding or trauma to your mouth?

Figure No:7 Covid-19 Questionnaire

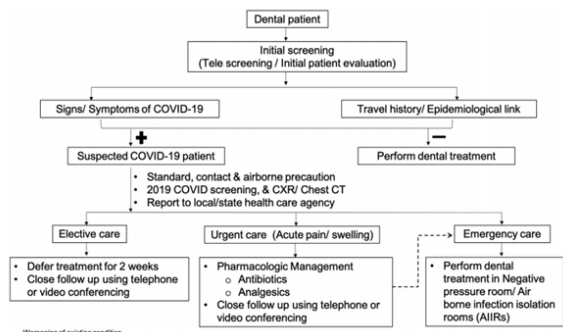


Figure No:8 Dental Treatment Guidelines

progressive fascial space infection or dentoalveolar trauma certainly require emergency dental treatment. For suspected or confirmed COVID-19 cases, dental professionals should consider the following guideline²⁰⁻²³.

PATIENT RISK CRITERIA

- **Low Risk** - Patients under 60 years of age who have not had any COVID related symptoms in the past 14 days, no contact with COVID infected patients. Most dental procedures can be performed.
- **Moderate Risk** - Patients over 60 years of age. Have recovered from a recent bout of fever, cold, cough in the past 14 days and are currently exhibiting no symptoms. Dental procedures except aerosol producing procedures can be done until they move into a low-risk category.
- **High risk** - Patients of any age group who are suffering from the following symptoms

These include, fever in excess of 100 degrees F in the past 14 days, sorethroat, dry cough, malaise but not limited to, or have revealed having come in contact with COVID infected patients.

Dental procedures should not be done on high risk patients until their general symptoms subside and they can be categorized into Low or Medium risk patients.

Chief complaint in order to identify emergencies, urgent, undeferrable and/or postponable dental procedures:

1. "Emergencies" (Category 1 ADA): within 1 h, managed through E.R;
2. "Urgent" (Category 2 ADA): within 24 h;
3. "Undeferrable" (Category 3 ADA): possibly more than 24H
4. "Postponable" (Category 4 ADA): to be treated remotely

The following will help classify what constitutes a dental emergency.

Dental emergencies

- Uncontrolled bleeding
- Cellulitis or a diffuse soft-tissue bacterial infection with intra-oral or extra-oral swelling that potentially compromises the patient's airway
- Trauma involving facial bones, potentially compromising the patient's airway

Dental urgencies

- Severe dental pain from pulpal inflammation
- Pericoronitis or third-molar pain
- Surgical post-operative osteitis, dry socket dressing changes
- Abscess, or localized bacterial infection resulting in localized pain and swelling
- Tooth fracture resulting in pain or causing soft tissue trauma
- Dental trauma with avulsion/luxation
- 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

Non-urgent dental treatments that can be postponed

- Initial or periodic oral examinations and recall visits, including routine radiographs
- Routine dental cleaning and preventive therapies
- Orthodontic procedures other than those to address acute issues (e.g. pain, infection, trauma) or other issues critically necessary to prevent harm to the patient
- Extraction of asymptomatic teeth
- Restorative dentistry including treatment of asymptomatic carious lesions
- Aesthetic dental procedure

Individuals with suspected COVID-19 infection will be seated in a distinct, well-ventilated waiting room at least 6 feet away from patients receiving treatment who are not infected based

on the guidelines of the Centers for Disease Control and Prevention (CDC).

Patients should wear a surgical mask or else use a tissue to cover their mouth and nose when coughing or sneezing, and then throw the tissue away.

Apply 70% ethanol to clean and disinfect the medical kits (blood pressure cuffs, thermometers, etc).

Advise the patients to do self-quarantining and inform their physician to avoid the COVID-19 risk

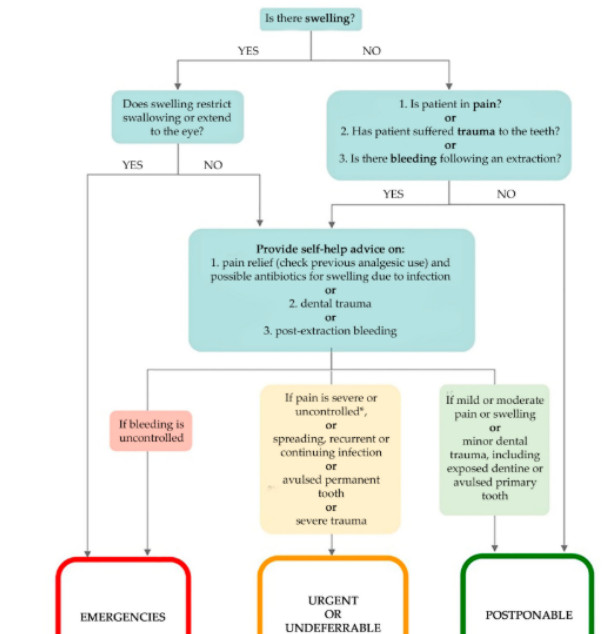


Figure No:9 Flow Chart Of "urgency Of Treatment" Category Assignment

Pharmacologic Treatment

Symptomatic treatment for suspected individuals who need immediate dental treatment for conditions such as swelling or tooth pain. With analgesics and antibiotics to relieve symptoms

The British Medical Journal recommended acetaminophen as analgesia instead of ibuprofen for infected COVID-19 patients because ibuprofen can interfere with immune system function¹⁹.

Hand hygiene

According to WHO, hand hygiene requires either washing hands with an Alcohol-Based Hand Rub (ABHR) or water and soap, One of these formulations uses 80% ethanol, and the other, 75% isopropyl alcohol, otherwise known as rubbing alcohol. all of which have the same effectiveness to prevent acute respiratory infections.

Unless the hands are clearly soiled with dirt, blood and/or body fluids, water and soap should be used; otherwise, ABHR is recommended.

Precisely, oral professionals will wash their hands before the patient is examined, before dental operations, after touching the patient, without disinfecting the surroundings and equipment, and after touching the oral mucosa, broken skin or wound, blood, body fluid, secretion and excreta.

Because airborne droplet transmission of infection is considered to be the main route of spread, especially in dental clinics and hospitals, barrier protection equipment, including eyewear, masks, gloves, caps, face shields and

protective clothing, is strongly recommended for all clinic / hospital health care providers during the pandemic era of 2019-nCoV.

Depending on the risk of spread of 2019-nCoV infection, three-level preventive measures by dental professionals are recommended for different circumstances.



Figure No:10 Rule Of Five Recommended By W.h.o

Primary protection

(Standard Protection For Staff In Clinical Settings) 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.

Secondary protection:

(Advanced Protection For Dental Professionals). Wearing disposable medical hat, disposable surgical mask, protective goggles, face shield and working clothes (white coat) with disposable insulation or surgical outer garments and disposable latex gloves.

Tertiary protection

(Strengthened Protection When Contact Patient With Suspected Or Confirmed 2019-Ncov Infection).

While a patient with 2019-nCoV infection is not supposed to be treated in a dental clinic, special protective equipment is required in the unlikely event that this happens and the dental professional can not prevent close contact. If protective clothing is not appropriate, working clothes (white coat) with extra disposable protective clothing should be worn outdoors.

In addition, disposable doctor cap, protective goggles, face shield, disposable surgical mask, disposable latex gloves, and impermeable shoe cover should be worn

Personal protective equipment (PPE)

Protective glasses and face shields There is clinical evidence that because infectious droplets may easily invade human conjunctival epithelium, COVID-19 can be transmitted by contact with mucous membranes lining the eyes. Protective glasses or face masks should also be used during treatment to protect the eyes from aerosols and debris created during dental treatment, and should also be disinfected between treatments.

Face masks:

A medical mask (surgical or procedure mask) should be worn while operating at a distance of less than 1 m from the patient.

A particulate respirator that is at least as secure as a National Institute for Occupational Safety and Health-certified N95,

European Standard Filtering Face Piece 2 (EU FFP2), or equivalent, was used when running aerosol generation methods.

A higher level of respiratory protection, such as EU FFP3 respirators conforming to European Standard 149 (En149), should be considered when providing emergency dental care with suspected COVID-19 cases. A higher degree of respiratory protection, such as EU FFP3 respirators, is necessary to comply with European Standard 149 (EN 149) if the patient is suspected or reported to be COVID-19 during an emergency.

Types of Masks	Specifics
FFP1	Aerosol filtration percentage: 80% minimum Internal leak rate: Maximum 22%
FFP2 (equivalent to N95)	Aerosol filtration percentage: Not less than 94% Internal leak rate: Maximum 8%
FFP3	Aerosol filtration percentage: Not less than 99% for EN 149-FFP3. And 99.95% for EN 143-P3 Internal leak rate: Maximum 2%

Figure No:11 Aerosol Filtration Percentage And Internal Leak Rate For FFP Masks

Surface Disinfection

Dental chair-side surfaces -i.e., dental light handle,dental chair keyboard keys, connected computers/laptops,oral cameras, dental surgery drawer handles, water taps,stationaries, working desks, telephone sets, doorknobs and so forth- and peripheral surfaces -i.e., floor, walls, washing sink/faucets and so on- should be disinfected in the intervals between patients using ethanol 70%.

Pre-procedural mouth rinse

Pre-procedural oral rinse is one of the most efficient ways to reduce the proportion of microorganisms in oral aerosols.

According to Marui's meta-analysis, pre-procedural oral rinse, including chlorhexidine (CHX), cetylpyridinium chloride (CPC) and essential oils, resulted in a mean reduction of 68.4 per cent of colony-forming units (CFUs) in dental aerosols.

While the pre-procedural impact on coronavirus is still unclear, CHX is effective against certain infectious viruses such as human immunodeficiency virus (HIV), herpes simplex virus (HSV) and hepatitis B virus (HBV). Approximately 0.12 per cent of CHX was used as pre-procedural mouthwash.

2019-nCoV is vulnerable to oxidation, pre-procedural oral rinse containing oxidative agents such as 1 per cent hydrogen peroxide or 0.2 per cent povidone is recommended for the purpose of reducing the salivary load of oral microbes, including the potential for 2019-nCoV transport²⁴.

Pre-procedural buzz will be most effective in situations where the rubber dam cannot be used.

Use of Other Materials/Instruments/Equipment:

list of must-have equipments in the clinic

- 1.Class B Autoclave
- 2.Ultrasonic bath
- 3.Fumigation device
- 4.Air Purifiers with HEPA filter
- 5.coronaoven.

Coronaoven:

Corona oven is a patent protected,33litre UVC chamber that effectively disinfects all types of surfaces contaminated with corona virus, bacteria and other germs Characteristics of coronaoven

- Top open design
- 10 min disinfection

- Based on FDA research paper
- 360° UVC irradiation ensure 100% surface exposure ideal for masks faceshields.

In hospitals coronaoven can play a pivotal role in reducing surface to human infection by decontaminating and sterilizing PPE for reuse by health care teams.

Since most PPE such as masks, eyewear are in severe shortage, coronaoven could provide a viable option for quick sterilization and reuse of such PPE and lower the pressure on PPE inventory.

Used to sterilize PPE kits, flash sterilisation of medical and dental equipment Corona oven works on multiple surfaces such as plastic paper, metal leather and fabric making it a versatile, nonchemical disinfection system



FIGURENO:12 Coronaoven (source <https://economictimes.india times.com/news/int>)

General Safety OfThe Dental Clinic

- Clean and disinfect doorknobs, light switches, cabinet handles, front desk area frequently with 70% Ethanol (Spirit) or Sodium Hypochlorite.
- Wipe down all hard surfaces of the waiting area regularly with disinfectant wipes.
- Fumigation and fogging of dental settings is very important
- While **fumigation** involves spraying formaldehyde and potassium permanganate in liquid form, **fogging uses** the mixture of hydrogen peroxide and silver ion solution to control the contamination. **Fogging** also requires a **fogger** machine, which effectively fills the space with the **fogging** solution.

Rubber dam

Rubber dam, specifically when handpieces and ultra-sonic devices are used, can minimize the dispersion of droplets, secretions, and aerosols. It is recommended to use high volume evacuators (HVE) when rubber dam is to be applied. In these circumstances, four-handed technique is usually practiced.

The role of the spittoon/cuspidor:

A spittoon or cuspidor has been attached to dental chairs for ages. It is responsible for a lot of splatter which can spread potentially infective agents into the dental operatory thus putting the dentist and other clinic personnel at risk. The time is now right to get rid of this attachment. Having worked on chairs with and without spittoons, we believe that its absence does not make much of a difference. Rather, time can be saved by not having the patient get up every few minutes to expectorate. The saliva and other fluids can be eliminated from the patients mouth by asking them to suck on the saliva ejector like a straw.

If the spittoon cannot be removed from the chair, cover it with a cling wrap or barrier tapes and inform the patient about its non-functionality.

Radiographs

Extra-oral imaging, such as panoramic radiograph or cone-beam computed tomography (CBCT), should be used to avoid cough or gag reflex that occurred during intraoral imaging. When intraoral imaging is required, the sensors should be double-covered to avoid cross-contamination and perforation.

Single-use tools

Dentists should apply single-use devices for example syringes, mouth mirror, and blood pressure cuff to avoid cross-contamination.

Reduce aerosol production

Effective treatment should decrease the aerosol generation. Ultrasonic instruments, for instance, can place a higher risk of producing contaminated aerosols. Since hand and ultrasonic instrumentation are both equally successful in eliminating plaque and calculus, it is suggested to manually scale and polish them. Furthermore, the use of high-speed handpieces and three-way syringes should be minimized by dentists during the COVID-19 outbreak. Dentists should minimize utilizing rotary instruments when preparing a cavity and in selective patients, they should try using atraumatic restorative procedures or chemomechanical caries removal.

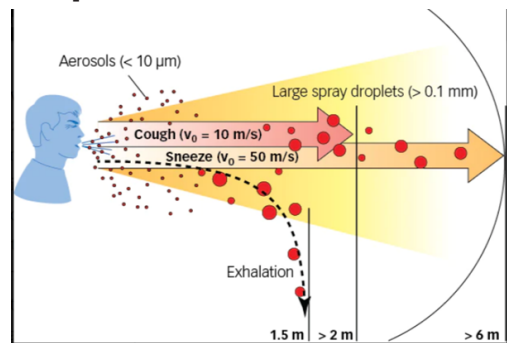


Figure No:13 Aerosol Spread

The problem occurs when viral particles are aerosolized by a cough, sneeze, or dental care. In these instances, particles can potentially travel across far greater distances, with estimates up to 20 feet, from an infected person and then incite secondary infections elsewhere in the environment. These aerosolized droplet nuclei can remain in an area, suspended in the air, even after the person who emitted them has left and thus can infect health-care workers and contaminate surfaces. Here are some examples of the longevity of COVID-19 in various places The virus is viable up to 72 hours after application to plastic and stainless steel surfaces. The virus is viable up to 24 hours on cardboard surfaces. The virus is viable up to nine hours on copper surfaces. The virus is viable in suspended aerosols up to three hours.

Table No:1 Dental Devices And Procedures That Produce Aerosol Contamination

DENTAL DEVICES AND PROCEDURES KNOWN TO PRODUCE AIRBORNE CONTAMINATION.	
Ultrasonic and Sonic Scalers	Considered the greatest source of aerosol contamination; use of a high-volume evacuator will reduce the airborne contamination by more than 95 percent
Air Polishing	Bacterial counts indicate that airborne contamination is nearly equal to that of ultrasonic scalers; available suction devices will reduce airborne contamination by more than 95 percent
Air-Water Syringe	Bacterial counts indicate that airborne contamination is nearly equal to that of ultrasonic scalers; high-volume evacuator will reduce airborne bacteria by nearly 99 percent
Tooth Preparation With Air Turbine Handpiece	Minimal airborne contamination if a rubber dam is used
Tooth Preparation With Air Abrasion	Bacterial contamination is unknown; extensive contamination with abrasive particles has been shown

Table No:2 Methods Of Reducing Airborne Contamination

METHODS OF REDUCING AIRBORNE CONTAMINATION.		
DEVICE	ADVANTAGES	DISADVANTAGES
Barrier Protection—Masks, Gloves and Eye Protection	Part of "standard precautions," inexpensive	Masks will only filter out 60 to 95 percent of aerosols, subject to leakage if not well-fitted, do not protect when mask is removed after the procedure
Preprocedural Rinse With Antiseptic Mouthwash Such as Chlorhexidine	Reduces the bacterial count in the mouth, saliva and air; inexpensive on a per-patient basis	Tends to be most effective on free-floating organisms; it will not affect biofilm organisms such as plaque, subgingival organisms, blood from the operative site or organisms from the nasopharynx
High-Volume Evacuator	Will reduce the number of bacteria in the air and remove most of the material generated at the operative site such as bacteria, blood and viruses; inexpensive on a per-patient basis	When an assistant is not available, it is necessary to use a high-volume evacuator attached to the instrument or a "dry field" device; a small-bore saliva ejector is not an adequate substitute
High-Efficiency Particulate Air Room Filters and Ultraviolet Treatment of Ventilation System	Effective in reducing numbers of airborne organisms	Only effective once the organisms are already in the room's air, moderate to expensive, may require engineering changes to the ventilation system

Table No:3 PPE Under Different Scenarios

DPI	Outside the Operative Area	Non-aerosol Generating Procedures	Aerosol Generating Procedures
Surgical mask	✓		
FFP2/FFP3 mask		✓	✓
Face shield			✓
Protective glasses		✓	✓
Gloves	✓	✓	✓
Cap	✓		✓
Protective waterproof clothing			✓
Shoe cover		✓	✓

Anti-retraction Handpiece

The high-speed dental handpiece without anti-retraction valves may aspirate and expel the debris and fluids during the dental procedures. More importantly, the microbes, including bacteria and virus, may further contaminate the air and water tubes within the dental unit, and thus can potentially cause cross-infection. Study has shown that the anti-retraction high-speed dental handpiece can significantly reduce the backflow of oral bacteria and HBV into the tubes of the handpiece and dental unit as compared with the handpiece without anti-retraction function.

Therefore, the use of dental handpieces without anti-retraction function should be prohibited during the pandemic of COVID-19. Anti-retraction dental handpiece with specially designed anti-retractive valves or other anti-reflux designs are strongly recommended as an extra preventive measure for crossinfection²⁵.

Disinfection of the surface

Human coronavirus may live up to 9 days at room temperature on an inert surface with a higher preference for humid situations. Clinical staff should also check to disinfect inert surfaces using chemicals confirmed against COVID-19 and keep a dry atmosphere to mitigate the 2019-nCoV spread. Such surface sanitizers include 62–71% ethanol, 0.5% hydrogen peroxide, and 0.1% (1 g/L) sodium hypochlorite. After each patient's visit, surfaces should be thoroughly wiped down, particularly around the operating sites.

Prosthodontic implications

If an impression is taken, the impression and other prosthodontic materials (e.g., bite registration and so on) should be properly disinfected prior to the delivery to prosthodontic laboratories.

The disinfection procedure is as follows:

- Initial irrigation using tap water
- Placement of the material in a disinfectant with atleast intermediate level activity, i.e., sodium hypochlorite for 10 minutes.
- Re-irrigation using tap water

Furthermore, the application of rubber dam is an all time necessity for crown and bridge/other prosthodontic preparations. Modification of treatment plans can also be considered; for example, supra-gingival margins for posterior bridges or using split-dam techniques.

Disinfection of the clinic settings

Dental institutions should take effective and strict disinfection measures in both clinic settings and public area.

The clinic settings should be cleaned and disinfected in accordance with the Protocol for the Management of Surface Cleaning and Disinfection of Medical Environment (WS/T 512-2016) released by the National Health Commission of the People's Republic of China.

Public areas and appliances should also be frequently cleaned and disinfected, including door handles, chairs, and desks.

The elevator should be disinfected regularly. People taking elevators should wear masks correctly and avoid direct contact with buttons and other objects.

Medical waste disposal

The medical waste containing disposable protective equipment after use should be promptly delivered to the temporary storage facility of the medical center.

The reusable tools and materials should be cleansed, sterilized, and carefully preserved in compliance with the Protocol for the Disinfection and Sterilization of Dental Instrument.

The medical and domestic waste produced by treating suspected or confirmed COVID-19 cases are infectious medical waste.

Double-layer yellow clinical waste bags with a "gooseneck" knot should be used. The surface area of the waste bags should be labeled and disposed in compliance with the requirements of medical waste disposal.

Other clinical tips

In the case of tooth extraction, do the procedure in a supine position to prevent from operating in the patient's respiratory tract.

During removable partial or complete denture try-in, stop touching other items in the dental workplace after contacting the saliva of the patient. All prosthodontics material such as bite registration an whatever removed from the patient's mouth (e.g., dental prosthesis, impressions, etc.) should be completely disinfected by an intermediate level disinfectant.

- Salivary suction should be carefully carried out to prevent gag reflex.

Choose and modify trays to have the proper size for doing the impression to prevent coughing. Using oral mucosa anesthesia to the throat before performing the impression is a good option for extremely sensitive patients²⁷.

Procedure to wear and discard your PPE (figure no:14)

Wash your hands thoroughly until your forearm using soap and water. The following order should be followed by while wearing PPE

1. Inner gloves
2. Gown
3. Headcap and Foot covers
4. N-95 Respirator and Facemask
5. Goggles/Loupes and Face shield
6. Outer Gloves

To remove PPE after procedure – the following order should be followed

1. Gloves (outer)
2. Goggles/Loupes and Face shield
3. Gown

4. Head and Foot covers
5. N-95 Respirator and Facemask
6. Gloves (inner)

Preferably, the PPE should be removed and discarded in a dirty section of the clinic which can be cleaned later. All staff must remove the PPE in the same area of the clinic.

If possible – the operatories should be separated for aerosol and non-aerosol producing procedures.

HOW TO SAFELY REMOVE PERSONAL PROTECTIVE EQUIPMENT (PPE) EXAMPLE 1

There are a variety of ways to safely remove PPE without contaminating your clothing, skin, or mucous membranes with potentially infectious materials. Here is one example. Remove all PPE before exiting the patient room except a respirator, if worn. Remove the respirator after leaving the patient room and closing the door. Remove PPE in the following sequence:

- 1. GLOVES**
 - Outside of gloves are contaminated!
 - If your hands get contaminated during glove removal, immediately wash your hands or use an alcohol-based hand sanitizer
 - Using a gloved hand, grasp the palm area of the other gloved hand and peel off first glove
 - Hold removed glove in gloved hand
 - Slide fingers of ungloved hand under remaining glove at wrist and peel off second glove over first glove
 - Discard gloves in a waste container
- 2. GOGGLES OR FACE SHIELD**
 - Outside of goggles or face shield are contaminated!
 - If your hands get contaminated during goggle or face shield removal, immediately wash your hands or use an alcohol-based hand sanitizer
 - Remove goggles or face shield from the back by lifting head band or ear pieces
 - If the item is reusable, place in designated receptacle for reprocessing. Otherwise, discard in a waste container
- 3. GOWN**
 - Gown front and sleeves are contaminated!
 - If your hands get contaminated during gown removal, immediately wash your hands or use an alcohol-based hand sanitizer
 - Unfasten gown ties, taking care that sleeves don't contact your body when reaching for ties
 - Pull gown away from neck and shoulders, touching inside of gown only
 - Turn gown inside out
 - Fold or roll into a bundle and discard in a waste container
- 4. MASK OR RESPIRATOR**
 - Front of mask/respirator is contaminated — DO NOT TOUCH!
 - If your hands get contaminated during mask/respirator removal, immediately wash your hands or use an alcohol-based hand sanitizer
 - Grasp bottom ties or elastic of the mask/respirator, then the ones at the top, and remove without touching the front
 - Discard in a waste container
- 5. WASH HANDS OR USE AN ALCOHOL-BASED HAND SANITIZER IMMEDIATELY AFTER REMOVING ALL PPE**

PERFORM HAND HYGIENE BETWEEN STEPS IF HANDS BECOME CONTAMINATED AND IMMEDIATELY AFTER REMOVING ALL PPE

CDC

Figure No:14 Sequence For Putting On Ppe (source: Cdc Centre For Disease Control)

HOW TO SAFELY REMOVE PERSONAL PROTECTIVE EQUIPMENT (PPE) EXAMPLE 2

Here is another way to safely remove PPE without contaminating your clothing, skin, or mucous membranes with potentially infectious materials. Remove all PPE before exiting the patient room except a respirator, if worn. Remove the respirator after leaving the patient room and closing the door. Remove PPE in the following sequence:

- 1. GOWN AND GLOVES**
 - Front of mask/respirator is contaminated — DO NOT TOUCH!
 - If your hands get contaminated during mask/respirator removal, immediately wash your hands or use an alcohol-based hand sanitizer
 - Grasp bottom ties or elastic of the mask/respirator, then the ones at the top, and remove without touching the front
 - Discard in a waste container
- 2. GOGGLES OR FACE SHIELD**
 - Outside of goggles or face shield are contaminated!
 - If your hands get contaminated during goggle or face shield removal, immediately wash your hands or use an alcohol-based hand sanitizer
 - Remove goggles or face shield from the back by lifting head band and without touching the front of the goggles or face shield
 - If the item is reusable, place in designated receptacle for reprocessing. Otherwise, discard in a waste container
- 3. MASK OR RESPIRATOR**
 - Front of mask/respirator is contaminated — DO NOT TOUCH!
 - If your hands get contaminated during mask/respirator removal, immediately wash your hands or use an alcohol-based hand sanitizer
 - Grasp bottom ties or elastic of the mask/respirator, then the ones at the top, and remove without touching the front
 - Discard in a waste container
- 4. WASH HANDS OR USE AN ALCOHOL-BASED HAND SANITIZER IMMEDIATELY AFTER REMOVING ALL PPE**

PERFORM HAND HYGIENE BETWEEN STEPS IF HANDS BECOME CONTAMINATED AND IMMEDIATELY AFTER REMOVING ALL PPE

CDC

Figure No:15 How To Safely Remove PPE

SUMMARY

Since December 2019, the newly discovered coronavirus (2019- nCov) has caused the outbreak of pneumonia in Wuhan and throughout China. 2019-nCov enters host cells through

human cell receptor ACE2, the same with SARS-CoV, but with higher binding affinity.

The rapidly increasing number of cases and evidence of human-to-human transmission suggested that the virus was more contagious than SARS-CoV and MERS. By mid-February 2020, a large number of infections of medical staff have been reported.

We have summarized the possible transmission routes of 2019-nCov in stomatology, such as the airborne spread, contact spread, and contaminated surface spread.

We also reviewed several detailed practical strategies to block virus transmission to provide a reference for preventing the transmission of 2019-nCov during dental diagnosis and treatment, including patient evaluation, hand hygiene, personal protective measures for the dental professionals, mouth rinse before dental procedures, rubber dam isolation, anti-retraction handpiece, disinfection of the clinic settings, and management of medical waste.

Treatment protocols are repeatedly changing, due to mutations of coronavirus. A definite treatment plan is under research.

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