INTRODUCTION

The novel coronavirus belongs to a family of single stranded RNA viruses known as Coronaviridae. This family of viruses are known to be zoonotic or transmitted from animals to humans. These include Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV), first identified in 2002, and the Middle East respiratory syndrome coronavirus (MERS-CoV), first identified in 2012. On 11th February 2020, WHO named the novel viral pneumonia as “Corona Virus Disease (COVID-19)”, while the International Committee on Taxonomy of Viruses (ICTV) suggested naming this novel coronavirus as “SARS-CoV-2” counting on the phylogenetic and taxonomic analysis of this novel coronavirus. At a media briefing on 11 March 2020, the Director-General of the World Health Organization (WHO) declared coronavirus disease 2019 (COVID-19) outbreak a
pandemic[9] Symptoms of COVID-19 are almost similar to those of human influenza virus and include fever, dry cough, shortness of breath, rhinitis, myalgia, conjunctivitis and fatigue.[10] More than 80% of cases are mild and recover from the disease without the need of any special treatment. However, around 15% of cases are categorised as severely ill and the remaining 5% are categorised as critically ill. In severe and critical cases, acute respiratory disease can lead to pneumonia, kidney failure and even death.[9] Patients with pre-existing medical conditions (such as hypertension, diabetes, heart disease, lung disease, cancer etc.) appear to be at a greater risk if infected with the virus. A challenging factor is that the population has no innate protection against COVID-19 and a vaccine has not yet been developed. Also no specific antiviral therapy has currently proven to be effective against SARS-CoV-2.[10]

**Characteristics of COVID-19**

COVID-19 is a spherical or pleomorphic enveloped particle containing single-stranded (positive-sense) RNA associated with a nucleoprotein within a capsid comprised of matrix protein.[11] Coronaviruses belong to the family of Coronaviridae, of the order Nidovirales, comprising large, single, plus-stranded RNA as their genome.[12,13] Currently, there are four genera of coronaviruses: α-CoV, β-CoV, γ-CoV, and δ-CoV.[14] The α-CoV and β-CoV mainly infect the respiratory, gastrointestinal and central nervous system of humans and mammals, while γ-CoV and δ-CoV mainly infect the birds.[15-18] The 2019 coronavirus is different from SARS-CoV, but it has the same host receptor: human angiotensin-converting enzyme 2 (ACE2).[19]

The temperature dependency of 2019-nCoV may be similar to that of SARS-CoV which loses its ability to survive in higher temperatures, due to the breakdown of their lipid layer at higher temperatures. The number of 2019-nCoV cases detected in a country/state depends on multiple factors including testing, population (density), community structure, social dynamics, governmental policies, global connectivity, air and surface reproduction number and serial interval of the virus.[20]

**Transmission**

Saliva is a potent medium for virus transmission.[21] Human-to-human transmission is now believed to be mainly via saliva associated respiratory droplets and contact transmission. The common transmission routes of novel coronavirus includes direct transmission (cough, sneeze and droplet inhalation transmission) and contact transmission (contact with oral, nasal and eye mucous membranes).[22] The science behind maintaining social distance is that the larger particles from cough droplets are transmitted for less than 1 meter and do not remain suspended in air.[23] Faecal-oral transmission is considered possible as SARS-CoV-2 was identified in the stool of patients. Vertical transmission (from mothers to their new-borns) however, is not yet confirmed.[9]

Although common clinical manifestations of novel coronavirus infection don’t include eye symptoms, the analysis of conjunctival samples from confirmed and suspected cases of 2019-nCoV suggests that the transmission of 2019-nCoV is not limited to the respiratory tract and that eye exposure may provide an effective way for the virus to enter the body.[24] It has recently been alerted by the American Academy of Ophthalmology, that SARS-CoV-2 can cause mild follicular conjunctivitis and possibly be transmitted by aerosol contact when in contact with conjunctiva.[25] Moreover, conjunctivitis may be the first presenting symptom of COVID-19.[26]

**Transmission in Dentistry**

To et al. reported by viral culture method that live viruses were present in the saliva of infected individuals.[24] Aerosols are suspension of particles in air, liquid, or solid, within size ranging from 0.001 to 100 μm.[27] Splatter is a mixture of air, water and/or solid substances (50 μm to several millimetres diameter).[28] Occupational Safety and Health Act (OSHA) has categorized dentistry as a very high exposure risk job with high potential for exposure to COVID-19 during specific aerosol-generating procedures.[29] Aerosol transmission is well accepted in spread of tuberculosis, measles, chickenpox, SARS-CoV, influenza virus and adenovirus.[30,31] It is possible that the 2019-nCoV will spread through airborne transmission if aerosol generating procedures in dental practice is implemented.[32,33]

**SARS-CoV-2 In Salivary Gland**

It was confirmed that SARS-CoV-2 reaches the cell in the same route as SARS coronavirus, i.e. via the cell receptor ACE2 (Angiotensin Converting Enzyme 2). SARS-CoV-2 can effectively use ACE2 as a receptor to invade cells, which can facilitate transmission from human to human.[34] ACE2+ cells have been shown to be prevalent in the respiratory tract as well as cells that are morphologically compatible with the epithelium of the salivary gland duct in human mouth. ACE2+ epithelial cells of salivary gland ducts have shown to be an early target of SARS-CoV-2 infection and same might be the situation with SARS-CoV-2 infection, although no research has been reported so far.[36] Chen et al. analysed saliva directly from the salivary gland opening and found SARS-CoV nucleic acid, indicating SARS-CoV contamination of salivary glands.[37]

**Role of Saliva for COVID-19 Detection**

The detection of 2019-nCoV nucleic acid from the throat swab of patients is considered as a confirmatory test. [38] Throat swabs are relatively invasive, induce coughing and occasionally cause bleeding, which may increase the risk of infection among healthcare workers. With the characteristic of being non-invasive and fewer hazard to healthcare workers, collecting saliva specimen has the benefits of being more acceptable to patients and more secure for healthcare workers for coronavirus diagnosis. To date, three approaches for saliva collection have been identified - coughing out, saliva swabs and collection of saliva directly from the salivary gland duct.[32] Oral swabs are likely to be useful in early detection. By extracting oral swabs and checking RNA among 15 COVID-19 patients, Zhang et al. found that half of them (50%) were positive for 2019-nCoV RNA in oral swabs, four (26.7%) had positive anal swabs, six (40%) had positive blood test and three (20%) had positive serum tests.[39] Medications used in the treatment of COVID-19 patients regularly and experimentally cause side-effects but their benefits outweigh the disadvantages. As a result of intense
pharmacotherapy, even after complete recovery from COVID-19 some patients can suffer from dental/oral problem associated with soft tissues, saliva production, neurological-based oral sensations etc. Nonetheless, COVID-19’s overall effect on oral health appears to be multi-directional, immune-related and most likely indirect, acting via multiple routes, indicating the pathological nature of coronavirus invasion of the respiratory tract through mucous membranes.

Extreme COVID-19 acute infection and associated therapeutic interventions could potentially contribute to adverse oral health outcomes, which could lead to multiple opportunistic fungal infections, xerostomia associated with decreased salivary flow, ulcerations and gingivitis due to compromised immune systems and/or susceptible oral mucosa. [40]

Implications of COVID-19 in Dental Practice

Dental patients and practitioners can be exposed to pathogenic microorganisms, including viruses and bacteria that cause oral cavity and respiratory tract infections. Invariably, dental care settings bear the risk of 2019-nCoV infection due to the complexity of its procedures including face-to-face contact with patients and repeated exposure to saliva, blood and other body fluids and the handling of sharp instruments. [36]

The termination of dental practice during the pandemic will reduce the number of people affected but will increase the suffering of those in need of urgent dental treatment. [9] This calls for the establishment of uniform guidelines for the provision of dental treatment during the global spread of the pandemic and/or local outbreaks. [9] Because of the widespread transmission of SARS-CoV-2 and its dissemination to health care providers, [41,42] dental professionals are at high risk of nosocomial infection and may become potential carriers of the disease. Furthermore, if proper precautions are not taken, the dental office could potentially expose patients to cross-contamination. [43]

Many dental treatments are aerosol generating procedures (AGPs), which have been associated with the transmission of acute respiratory infections. [13] However dental settings are more likely to have a large number of potentially contaminated surfaces such as dental chairs, their handles, the spittoon and dental equipments during treatment which can be possible routes of transmission. [45] The SARS-CoV-2 virus can survive on surfaces for up to 72 hours [46] and all clinic surfaces should be periodically disinfected using chemicals recommended for SARS-CoV-2.

The treatment considerations in dental clinic post COVID-19 is explained in the following 4 stages: Patient triage, Arrival of patient in clinic, Dental treatment and Post-treatment management:

Patient Triage

Dental emergencies need immediate treatment as they can occur and exacerbate in a short period of time. To identify the true need for immediate care (i.e. treatment of acute pain, trauma, abscesses and haemorrhagic events) all dental practitioners are recommended to compulsorily conduct phone triage. Initial telephone screening to identify patients with suspected or possible COVID-19 infection can be performed remotely while scheduling appointments. [43] The three most important initial screening questions should include:

1. Any exposure to a person with a confirmed or suspected presentation of COVID-19?
2. Any recent history of travel to a high-incidence region of COVID-19?
3. Any signs of febrile respiratory disease such as fever or cough?

Patients are only permitted to visit the dental office if the whole questionnaire is negative; otherwise the appointment must be postponed preferably.

Arrival of Patient in the Clinic

Patients should fill out a comprehensive medical history form, COVID-19 screening questionnaire and assessment of a true emergency questionnaire upon arrival in dental practice. Firstly, the patient’s body temperature should be assessed. For thermal screening, it is highly advised to use a contact-free forehead thermometer or an infrared thermometer or cameras with thermal infrared sensors. [47]

Prominently display the following notice in the reception area: [48]

1. Kindly read and fill the medical and dental questionnaires and self-declaration forms appropriately followed by your signature.
2. Do not touch anything in the clinic unless necessary.
3. Keep your mouth covered with a mask.
4. Avoid the use of toilet in the clinic.

Hand disinfection is recommended for patients in the waiting room. Periodic disinfection of the ventilation system and a regular opening of waiting room windows should be ensured. It is recommended that patients should not remain long in the waiting room and that all potentially infected items (i.e. chairs, newspapers, toys) be removed which may promote cross-infection. Limiting the number of patients in the waiting room is also necessary while maintaining the required distance of at least 1 metre between chairs. Accompanying person should be advised to wait outside the dental office. Patients should be advised to leave their shoes, mobile phones and luggage in the waiting room. [49]

A questionnaire should be filled to screen patients with suspected 2019-nCoV infection before they could be led to the dental chair. [36] These questions should include the following:

1) Within the past 14 days, have you experienced fever?
2) Within the past 14 days, have you experienced coughing or difficulty in breathing?
3) Within the past 14 days, have you travelled to areas, or visited the neighbourhood with recorded 2019-nCoV transmission?
4) Within the past 14 days, have you come in contact with a patient with confirmed 2019-nCoV infection?
5) Within the past 14 days, have you come in contact with people who come from COVID-19 affected and its surrounding areas?
6) Within the last 14 days, have at least two people with recorded history of fever or respiratory problems been in close contact with you?
7) Have you recently taken part in any conferences, meetings or had close contact with other unknown persons?
The decision of treatment for dentist should be taken as follows

If the patient responds “yes” to any of the screening questions, and the body temperature of the patients is below 37.3 °C, the dentist can advise the patient for treatment until 14 days after the exposure event. The patient should be requested to self-quarantine at home and report any fever experience or flu-like symptoms to the local health department.

If a patient responds “yes” to any of the screening questions, and the body temperature of the patient is more than 37.3 °C, the patient should be immediately quarantined and the dental professionals should report to the local health department or the infection control department of the hospital.

If a patient responds “no” to all the screening questions, and the body temperature of the patient is below 37.3 °C, the dentist can treat the patient with extra-protection measures (PPE) and avoid spattering or aerosol-generating procedures to the best possible extent.

If a patient responds “no” to all the screening questions, but the body temperature of the patient is more than 37.3 °C, the patient should be instructed to the fever clinics or special clinics for COVID-19 for further medical care.

Based on the assessment of emergency questionnaire (Ather et al 2020), Clinicians may determine the seriousness of the dental condition and decide whether to provide or postpone dental treatment.

1) Are you in pain?
Yes or No
2) What is your level of pain on a scale of 0-10?
3) When did the pain begin?
4) Do you have a dental abscess? (Are your gums and/or face swollen?)
Yes or No
If Yes, when did you first notice the swelling?
5) Do you have a fever?
Yes or No
6) Are you having any trouble swallowing?
Yes or No
7) Are you having any trouble opening your mouth?
Yes or No
8) Did you experience any trauma?
Yes or No
Please describe the trauma

Pharmacologic Management

In suspected or confirmed cases of COVID-19 infections requiring urgent dental treatment for conditions such as tooth ache and/or swelling, pharmacologic management in the form of antibiotics and/or analgesics is an alternative. This approach will provide symptomatic relief to the patient and ample time for dentists to either refer the patient to a specialist or provide dental care with all necessary measures in place to prevent the spread of infection.

Choice of analgesics should be done after patient history and risk assessment.

Analgesics - Any one of the following
1. Diclofenac Sodium [50mg] with or without paracetamol [500mg] TID
2. Ketorolac Tromethamine 10mg QID
3. Acetaminophen [Paracetamol] 1000mg TID
4. Piroxicam 20mg BD

In the present pandemic, WHO has recommended to abstain from using Ibuprofen in its recommendations. Thus, analgesics mentioned above should be of first choice.

Dental Treatment

Hand Hygiene

Reinforcement for good hand hygiene is very essential to restrict the spread of infection through contact transmission. A two-before and three-after hand hygiene guideline has been recommended by the West China Hospital of Stomatology, Sichuan University’s infection control department to improve hand washing compliance. In particular, dental professionals should wash their hands before inspecting the patient, after touching the patient and after touching the surroundings and equipment without disinfection. More caution should be taken for the dental professionals to avoid touching their own eyes, mouth, and nose.

The dental practitioner should perform careful hand washing for at least 60 seconds, employing a 60% to 85% hydro alcoholic solution, prior to wearing gloves.

Personal Protective Measures for the Dental Professionals

There is currently no specific guideline for the safety of dental practitioners in dental clinics and hospitals from infection with 2019-nCoV. Since transmission of infection through airborne droplet is considered as the main route of spread, particularly in dental clinics and hospitals, barrier-protection equipment, including protective eyewear, masks, gloves, head caps, face shields, show cover and protective outerwear is strongly recommended for all dental professionals in the clinic/hospital settings during the period of 2019-nCoV pandemic.

Based on the risk of spreading the 2019-nCoV infection, the dental professionals are prescribed three-level preventive measures for various circumstances.

Primary protection: (standard protection for staff in dental clinic). Wearing disposable working head 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 head cap, disposable surgical mask, protective goggles, face shield, working clothes (white coat) with disposable isolation clothing or surgical clothes outside and disposable latex gloves.

Tertiary protection: (strengthened protection required when contacting patient with suspected or confirmed 2019-nCoV infection). Although a patient with 2019-nCoV infection is not expected to be treated in the dental clinic, special protective outerwear is required in the unlikely event that this occurs, and
the dental professional cannot avoid close contact. If protective overwear is not available, working clothes (white coat) with extra disposable protective clothing outside should be worn.\textsuperscript{[36]}

**Face Masks and Eye Protection**

Oral Health care professionals should be provided with personal protection of the eye, oral mucosa and nasal mucosa. Particulate respirators (N-95 masks authenticated by the National Institute for Occupational Safety and Health or FFP2-standard masks set by the European Union) are recommended for routine dental practice. After completing the dental procedure, face masks should be changed and should be worn by the entire team including non-clinical staff members. Eye protection should be assured with the use of protective safety glasses and shields, which should be disinfected with 70% isopropyl after each procedure.

All the requisite dental instruments should be prepared in advance during dental treatment to minimize contamination and to speed up the procedure.\textsuperscript{[49]}

**Preprocedural Mouthrinse**

Preoperative antimicrobial mouth rinse could minimize the number of microbes in the oral cavity.\textsuperscript{[50]} Previous studies have shown that SARS-CoV and MERS-CoV were highly susceptible to povidone mouth rinse.\textsuperscript{[51]} Since 2019-nCoV is vulnerable to oxidation, it is recommended to use pre-procedural mouth rinse containing oxidative agents such as 1% hydrogen peroxide or 0.2% povidone-iodine to reduce the salivary load of oral microbes, including potential 2019-nCoV carriage.\textsuperscript{[52-55]} Enveloped viruses such as herpes simplex virus 1 and 2, human immunodeficiency virus, cytomegalovirus, influenza A, parainfluenza and hepatitis are vulnerable to virucidal effect of chlorhexidine.\textsuperscript{[52,53,54,55]}

It has been recommended that the patient performs 1 minute mouth rinse with 0.2% to 1% povidone, 0.05% to 0.1% cetylpyridinium chloride or 1% hydrogen peroxide before the dental procedure.\textsuperscript{[49]}

Use of Disposable (Single-Use) Devices such as mouth mirror, syringes and blood pressure cuff to prevent cross contamination is recommended.\textsuperscript{[43]}

**Radiographs**

The most common radiographic technique in dental imaging is intraoral x-ray examination; however, it can stimulate saliva secretion and coughing.\textsuperscript{[56]} Extra oral dental x-rays, such as panoramic radiography and cone beam CT, are therefore suitable alternatives during the COVID-19 outbreak. Sensors should be double-barri ered when intraoral imaging is required to prevent perforation and cross contamination.\textsuperscript{[57]}

**Rubber Dam Isolation**

It has been stated that the use of rubber dam could minimize airborne particles by 70% in ~3-foot diameter of the operating field.\textsuperscript{[58]} When rubber dam is applied during the procedure, extra high-volume suction for aerosol and spatter should be used along with regular suction.\textsuperscript{[59]} It is also important to enforce the implementation of a complete four-hand operation. If rubber dam isolation is not feasible, manual devices, such as Carisolv and hand scaler, are recommended for caries removal and periodontal scaling to minimize the generation of aerosol as much as possible.\textsuperscript{[36]}

**Anti-Retract Handpiece**

Aspiration and expulsion of debris and fluids generated during the dental procedure might occur with the use of high-speed dental handpiece without anti-retraction valves. A study found that the anti-retraction high-speed dental handpiece would substantially 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 feature.\textsuperscript{[60]} Therefore, there should be prohibition of the use of dental handpieces without anti-retraction function during the epidemic period of COVID-19. To reduce the risk of developing toxic aerosols, dentists should eliminate the use of ultrasonic devices, high speed handpieces and 3-way syringes.

Additionally, dental teams should be familiar with treatment options that minimise or eliminate AGPs. Micromotor handpieces can be used which can be a little time consuming but will inhibit the formation of aerosols. Also if possible, caries excavation should be performed with manual excavating instruments. Conservative treatment options in children should include Atraumatic Restorative Treatment\textsuperscript{[61]},\selectlanguage{en} sealing of carious lesions using fissure sealants,\textsuperscript{[62]} silver diamine fluoride,\textsuperscript{[63]} selective caries removal\textsuperscript{[64]} and the Hall Technique.\textsuperscript{[65]}

**Negative-Pressure Treatment Rooms/ Airborne Infection Isolation Rooms (AIIRs)**

It is worth noting that patients with suspected or confirmed COVID-19 infection should ideally be treated in negative-pressure rooms or AIIRs and not in a routine dental practice setting. Anticipatory awareness of health care centres with provision for AIIRs will therefore facilitate dentists in providing emerging dental treatment if need arises.\textsuperscript{[66]} Alternatively, patients could also be treated in an isolated and well-ventilated rooms.

**Treatment of Dental Emergencies**

Urgent dental treatment includes pain caused by pulp involvement, pericoronitis, dry socket management, tooth fracture, care required before surgical procedures, fractured or dislodged definitive prosthesis, painful restorations, modifications of dentures for patients with soreness and oncology patients, adjusting appliances like orthodontic wires or prosthesis causing ulcerations to oral mucosa and biopsy. Each of these should be provided to relieve pain and discomfort by temporary means only without specific treatment goals and, as far as possible, without devices generating aerosols.\textsuperscript{[48]}

The treatment planning of tooth fracture, luxation, or avulsion depends on the age, the severity of trauma to the dental tissue, the development of the root apex and the duration of tooth avulsion.\textsuperscript{[67,68]} If the tooth needs to be extracted, absorbable suture should be preferred. For patients with facial soft tissue contusion, debridement and suturing should be performed. It is recommended that the wound should be rinsed slowly and the saliva ejector should be used to avoid spraying. Patients with life-threatening oral and maxillofacial compound injuries should be admitted to the hospital immediately, and chest CT should be prescribed to exclude suspected infection because the RT-PCR test, besides time-consuming, needs a laboratory
with pan-coronavirus or specific SARS-CoV-2 detection capacity.\textsuperscript{[69]}

Post Treatment Management

Disinfection of the Clinic Settings

At room temperature, SARS CoV-2 can remain viable in aerosol and survive up to 3 days on inanimate surfaces, with a greater preference for humid conditions. A recent study indicated that the virus can survive for 4 to over 24 hours on copper and paper. Steel and plastic can allow the virus to survive on the surface for 48 hours and 72 hours respectively.\textsuperscript{[70]} Therefore, the virus stays longer on steel instruments as compared to the magazine in the waiting room. It was reported that HCoV-NL63 persists better at 50% compared to 30% relative humidity, hence maintaining a healthy, dry atmosphere in the dental office might minimize the persistence of 2019- nCoV.\textsuperscript{[36]} Clinical workers should ensure that instruments are thoroughly cleaned and sterilized and inanimate surfaces are disinfected with chemicals recently approved for COVID-19 and stored in a dry environment.

In particular, due to the high prevalence of the virus in the particles exhaled by coughing or sneezing, any surface in the waiting room must be considered at risk; thus, all surfaces, tables, magazines and doors that come into contact with dental professionals and patients must be regarded potentially contaminated.\textsuperscript{[99]} Disinfection of all surfaces that may be touched by the patients should be performed with sodium hypochlorite 0.1% or 70% isopropyl alcohol.\textsuperscript{[49]}

Since the virus appears to persist in airborne particles, it is recommended that personal protective equipment should not be removed prior to leaving the infected area because immediate removal of protective barrier after dental procedure increases the chances of contact with infected aerosol.\textsuperscript{[49]} The patient consulting chair and the dentist consultation table should also be disinfected after each patient. Three-bucket technique with 1% sodium hypochlorite, plain water and detergent after each patient should be performed for mopping of the operatory floor.\textsuperscript{[48]}

Ventilation of the operating room should be adequate, i.e. natural ventilation with air flow of at least 160 L/S per patient or in rooms with negative pressure with at least 12 air changes per hour.\textsuperscript{[71]} High Efficiency Particulate Air (HEPA), an extra oral evacuation device can be used effectively to monitor the generated aerosol.\textsuperscript{[52]}

Every day before closing down the dental clinic, the operatory room and the reception area should be fumigated with commercial fumigators or with Liquid Formalin and potassium permanganate crystals. Liquid Formalin should be poured on the potassium permanganate crystals and the room should be allowed to close overnight. The next day ventilation of the room should be done 30 minutes prior to usage.\textsuperscript{[48]}

Sterilization of Handpiece

Studies have shown that viral DNA and viable viruses can possibly be retained inside high speed dental handpieces and scaler devices. It is challenging to clean the internal area of the handpiece because of limited access. The proposed disinfection approach is to discharge 20-30 seconds of air and water after each patient, to flush out infected material that may have reached the turbine and the air and water tubes. The manufacturer’s instruction for cleaning, lubrication and sterilization should be performed.\textsuperscript{[48]}

Sterilization of Dental Burs

Dental burs are used for various procedures in clinical dentistry, some involving caries excavation, access cavity preparation and crown preparation.\textsuperscript{[72]} Burs can become heavily contaminated with necrotic tissue, saliva, blood and potential pathogens during these procedures and can be a possible vehicle for cross-infection.\textsuperscript{[74, 75, 76]} Burs are unique because of their complex architecture which makes it difficult to pre-clean and subsequently sterilize. Inadequate sterilization causes cross infection among the patient and transmission of disease between the patient and dental personnel.\textsuperscript{[74, 77]} Under suitable conditions, steam under pressure (Autoclave) can kill all microorganisms including bacterial spores and is considered to be relatively the best method for decontaminating dental burs.\textsuperscript{[73]} In the midst of COVID-19, it is necessary for considering new bur for each patient.

Sterilization of Endodontic Instruments

One of the fundamental phases of sterilization process is the cleaning of coarse debris consisting of necrotic and protein material, blood residue and dentinal mud that is deposited on the endodontic instrument.\textsuperscript{[78]} A study conducted by Popovic et al. compared different methods of disinfection and cleansing of endodontic instruments and reported the use of ultrasonic tray as a method giving efficient results.\textsuperscript{[78]} Most common sterilization techniques used in the last thirty years have been autoclaving, glass-bead sterilization for 45 seconds at 240°C, UV light at 240–280 nm, laser sterilization, and exposure to 2% glutaraldehyde. Steam sterilization in an autoclave does not alter the mechanical and physical properties of most nickel titanium instruments and is considered the most effective method for the sterilization of endodontic instruments.\textsuperscript{[79]}

Disinfection of Impressions and Prosthesis

All dental impressions of only emergency work should be sent to the laboratory after thorough disinfection in the dental office before dispatch. Proposed disinfection protocol (According to ISO1 Guidelines) is-

1. Thoroughly wash the impression in running water after removing it from the mouth. [For all materials including alginites, polyethers and vinyl polysiloxanes.]
2. Gently scrub with a camel hair brush and liquid detergent under running water. [For all materials including alginites, polyethers and vinyl polysiloxanes.]
3. Immerse the impression in a solution of 5.25% Sodium Hypochlorite with 1:10 dilution. The solution should be changed daily. [Only for vinyl polysiloxanes.]
4. Alginites and Polyethers are generally sprayed with an intermediary level disinfectant for required time. Hydrophobic materials should be immersed in disinfectant solution for 10 minutes. There shall be minimal distortion. Hydrophilic silicones and alginites should be sprayed to avoid dimensional changes.
5. Packet containing prosthesis received from the laboratory should be disinfected first with disinfectant spray and the prosthesis be disinfected by
Immersing in glutaraldehyde or any other suitable disinfecting solution for appropriate time. [48]

**Management of Medical Waste**

Waste disposal should be done according to Bio-medical waste management rule, 2016. Waste disposal should be done daily and stored in the premises. The medical waste (including disposable protective equipment after use) should be transported on time to the medical institute's temporary storage area. The reusable instrument and items should be pre-treated, washed, sterilized, and stored appropriately. The surface of the waste package bags should be marked and disposed according to the requirement for the management of medical waste. [36]

**Leave Protocol for Dental Staff**

If any of the clinic staff including the dentists show symptoms or are tested positive for COVID-19, the clinic should be closed down immediately and all the personnel should compulsorily go into a 14-day self-quarantine. If anyone experiences symptoms within the quarantine window, alert the other clinic staff and seek urgent medical advice and care. Once the quarantine period is over, all staff should get screened for COVID-19 and then resume their duties. The dentist should keep themselves updated on the health of their staff and their contact with suspicious people. [48]

**Dental Education During COVID-19**

Dental Institutions and dental hospitals, where patients, students and teachers share the same facilities, are likely to create a source and 'hub' for the spread of virus. [10]

It is challenging for the dental schools to continue the education process. The following are some recommendations for continuing dental education during this pandemic:

First, online seminars, case studies and problem-based learning tutorials should be introduced during the outbreak time to prevent unwanted aggregation of people and the related risk of infection. [80]

Second, encouraging students to engage in self-study, make good use of online tools and learning about the latest trends in education is worth promoting.

Third, students are easily impacted by disease-associated fear and pressure during this time and dental schools should be prepared to offer psychological resources to those in need. [51]

**Post Pandemic Considerations for Dental Clinic**

Essentially, when we get out of this pandemic and resume regular dental treatments, we should consider every patient visiting our clinics to be COVID-19 positive and henceforth take all the above mentioned precautions as Standard Operating Procedures. When the pandemic stops, dental clinics may be one of the most affected facilities in view of patients with fear of acquiring the disease. To ease these concerns and create trust in our patients, the dentist and clinical staff should be tested for COVID-19 and display the results in the reception area prominently. Make the patients aware about the protocols followed by your office for preventing spread of the disease assuring them of a safe environment in your office. We should make goals and policies for the future during this phase when our activities are not running to optimum levels. This time should be used to train ourselves and our staff to follow our office protocols, efficiently schedule appointments and handle biomedical waste. [48]

**DISCUSSION**

The widespread of SARS-CoV-2 worldwide raises the probability that practitioners in dental health care system will treat this subset of the patient population, hence universal precautions are important for minimizing the spread of this virus and its associated disease.

Endodontists are in a unique position because they may be called upon in suspected or confirmed COVID-19 patients to diagnose and treat odontogenic pain, swelling, and alveolar dental trauma. With recent research, it is known that 70% cases may be asymptomatic and a person may be a carrier infecting the healthy individual which is a matter of concern. Any patient should therefore be treated as potentially infected with this virus and all dental practices need to be reviewed for infection prevention procedures. Dental health care professionals must stay up-to-date on this emerging disease and provide their staff with sufficient training. They should provide only emergency dental treatment taking proper precautions to restrict the spread of this novel infection. [63]

To date, there is no standardized protocol or guideline for the provision of dental treatment to active or suspected cases of COVID-19. In addition, during any outbreak, pandemic, national or global disaster no uniform guidelines are available for dental care provision. This lack of guidance may also increase the spread of nosocomial COVID-19 through dental health facilities. [6]

It is therefore of utmost importance to highlight the vital role of dental practitioners in this pandemic crisis in identifying patients with initial symptoms, clinically helping the population even in these desperate times and operating in a healthy environment.

**Basically, there are potentially 4 types of patients who may be presenting dental emergencies**

1. Subjects with known SARS-CoV-2 infection
2. Subjects at potential risk of infection
3. Subjects with unknown risk of infection
4. Subjects who have healed from COVID-19.

In addition, any patient who appears healthy should nevertheless be considered at an uncertain risk of being infectious, because one of the dangerous aspects of COVID-19 is the persistence of the virus in the absence of clinical manifestations. [82]

Guidance cannot ever cover all possible circumstances and professional judgement must be exercised to make decisions around whether or not to provide treatment. Globally, many primary and secondary dental services have been suspended, with many countries providing telephone-based triage systems to identify those patients requiring urgent or emergency intervention. This includes managing the risk from the treatment itself by carrying out the least invasive treatment possible and avoiding AGPs. [83] The guidelines developed in this article are general guidelines and the practitioner should continuously update themselves with recent information regarding the pandemic and the protocols to be followed to counteract it.
CONCLUSION

If COVID-19 follows the same evolutionary pattern of the other coronavirus infections (i.e. SARS-CoV and MERS-CoV), this new emerging virus could become a less pathogenic and more common infection in the worldwide population. Hence to conclude, it is imperative to manage the risk for dental practitioners, dental staff and students by following proper guidelines. Simple laboratory tests to monitor COVID-19 in dental personnel should be carried out. The role of dentists should be redefined in the management and prevention of the novel coronavirus.

References


31. Chinn RY, Schulster L. Guidelines for environmental infection control in health-care facilities;
recommendations of CDC and Healthcare Infection Control Practices Advisory Committee (HICPAC).


How to cite this article:

*******