

The Novel Coronavirus (2019-nCoV) Outbreak As a New Challenge in the Dental Field

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Abstract

The pandemic crisis of β -coronavirus (2019-nCoV), originated in China, and became a major public health disaster for not only China but for all countries on the globe. 2019-nCoV causes severe pulmonary condition and even fatal pneumonia. The cross-infection risk is high between dental practitioners and patients due to the unique situation of dental procedures setting as the route of infection transmission throughout air-droplet of cough or sneeze, droplet inhalation transmission, and contact of oral, nasal, and orbital mucous membranes. Restrict infection control measures are essential to prevent the virus from further infection spreading and management of the outbreak situation. In this article, we based on our experience, skills, relevant guidelines and research that provide fundamental knowledge about the infection control of the 2019-nCoV in dental procedures and provides recommended proper management protocols for dental practitioners in suspected and affected areas. Dental professionals should be ready to support the wider 2019-nCoV response by using their professional experience outside the normal range of oral and dental health activities in supporting community safety.

Keywords: 2019-nCoV; Infection Control; Outbreak; COVID19; Transmission; Dental; Viral; Acute Respiratory Syndrome

Introduction

On the 11th of March 2020, the World Health Organization (WHO) announced the rapidly spreading novel coronavirus outbreak as a pandemic viral disease which will be clearly spread to all countries on the globe. This began in the late December 2019 in Wuhan City as an emergent pneumonia outbreak which was originated and considered a major general public health problem crisis for the entire world [1]. On January 8, 2020, (Chinese Center for Disease Control and Prevention) has officially announced novel coronavirus as the causative virus of 2019-nCoV[2]. On January 30,2020 the WHO announced for international concern of this infectious disease as an outbreak

[3]. Initially, the novel coronavirus was named officially as Severe Acute Respiratory Syndrome Coronavirus-2 (SARSCoV-2) On the 11th of February 2020, the novel viral pneumonia was named by WHO as "Corona Virus Disease (COVID19)", while the international Committee on Taxonomy of Viruses (ICTV) reported this novel-coronavirus name as "SARSCoV-2" because of the taxonomic analysis and phylogenetic of this novel-coronavirus [4]. This novel coronavirus clinical symptoms were different from Severe Acute Respiratory Syndrome (SARS) caused by SARS Coronavirus (SARS-CoV) which appeared in (2002-2003), recently reporting that a new human-to-human infectious agent transmission has caused outbreak of this developing viral pneumonia [2,5]. Novel coronavirus has been quickly isolated and sequenced its genome (29,903 nucleotides) [6]. Finally, the viral pneumonia happening in Wuhan was identified as a novel coronavirus (2019-nCoV) [7].

2019-nCoV Characteristics

Corona viruses belong to the Coronaviridae family, of order Iridovirales, their genome comprising single, large, plus-stranded RNA [8,9]. There are currently, 4 generations of coronaviruses: α -CoV, β -CoV, γ -CoV, and δ -CoV [10,11]. According to the phylogenetic analysis based on the viral genome, 2019-nCoV belongs to the β -CoV [7,15]. 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 [8,12-15]. SARS-CoV and the Middle East respiratory syndrome coronavirus (MERS-CoV) caused fatal infection and severe respiratory diseases. In the opposite side the corona virus causes mild respiratory disease in humans [16-18]. Furthermore, 2019-nCoV and SARS-CoV nucleotide similarity sequence is about 79% and between 2019-nCoV and MERS-CoV is about 50% but the 2019-nCoV can be a fatal infection and rapidly spreading more than the other two types of corona viruses [2,7,19-22]. According to updated researches,

2019-nCoV has zoonotic etiology with Chinese horseshoe bats (*Rhinolophus sinicus*) being the most probable origin which is similar to SARS-CoV and MERS-CoV [5,23]. The Chinese Preventive Medicine Association recognized the pangolins as the most properly intermediate host [24]. About 1000 metagenomic samples from pangolins have been investigated in South China Agricultural University, and they reported that 70% of them contained β -CoV [25]. One of these coronaviruses which is isolated from the pangolins comprised a genome-sequence that has 99% similarity with the genome of 2019-nCoV [26]. However, these recorded differences may suggest the presence of more than one intermediate host between the bat and human. 2019-nCoV holds "spike protein" in the membrane envelope with the typical structure of coronavirus [27] and expressed other polyproteins, nucleoproteins, and membrane proteins, as (RNA polymerase, 3-chymotrypsin-like protease, papain-like protease, helicase, glycoprotein, and accessory proteins) [6,7,27]. The spike protein from coronavirus can bind to the receptors (Angiotensin Converting Enzyme 2) (ACE2) of the host to facilitate entry of virus into target cells of human, bat, pig or civet cat but without ACE2 the virus cannot bind to the target cells [7,28-32]. The high affinity between, S-protein of 2019-nCoV and ACE2 proposed that the person with higher ACE2 expression might be highly susceptible to 2019-nCoV as [33,34].

Clinical Symptoms and Manifestations

The majority of 2019-nCoV patients have relatively mild symptoms. Some may experience fever and dry cough, while others have shortness of breath, fatigue, or may have atypical symptoms (such as muscle pain, confusion, headache, sore throat, diarrhea, vomiting and loss of smelling and tasting senses) [35,36]. However, about 15% to 25% of 2019-nCoV patients have severe condition and their chest CT showed bilateral pneumonia, with ground-glass opacity and bilateral patchy shadows which are the most common patterns [36,37]. Around one-fourth to one-third of hospitalized patients have been developed severe serious complications, such as acute respiratory distress syndrome, arrhythmia, and shock therefore they need intensive care unit [35,38,39]. All ages are generally susceptible to this disease, however geriatric, older age and patients underlying comorbidities (e.g., diabetic, hypertension, and cardiovascular disease) are considered high risk individuals with poorer prognosis [37,39,40].

Incubation Period

The 2019-nCoV asymptomatic incubation period has been estimated as an average of 5 to 6 days, but there is another evidence that it could be up to 14-days or more, which is considered now the adopted duration for medical quarantine [2,41].

Route of transmission of 2019-nCoV in dental clinics

As the 2019-nCoV crisis continues to develop, the challenges facing dental professionals are changing. Due to the unique characteristics of dental operations the cross-infection risk is high between dental professionals and patients who can be exposed to pathogenic microorganism that can infect the respiratory tract

and oral cavity where a large number of droplets and aerosols could be generated. Dental procedures invariably carry a high risk of infection by 2019-nCoV because the specificity of its procedures when frequent exposure to infected saliva, blood, body fluid secretion [42] or face-to-face communication, without using a protective mask, through inhalation of suspended airborne microorganisms of patient's cough, breathing and talking [43,44]. Since 2019-nCoV can be transmitted directly through humans by respiratory droplets and developing evidence supported that it may be transmitted through fomites and direct contact [45,46]. It was reported that 2019-nCoV can be spread in asymptomatic incubation period of infected person [36,38,41]. Strict infection control protocols and measures are urgently applied to prevent cross infection especially when patients are in the incubation period. ACE2 cells receptors were found to be profusely existing throughout the respiratory tract, as well as the cells morphologically compatible with salivary gland duct epithelium in human oral cavity which effectively used by 2019-nCoV as a receptor to invade cells as an early target [20,47] which may encourage transmission through humans [7]. Using of a high-speed handpiece or ultrasonic instruments in dental patients with cough or sneeze can drive their saliva, secretions, or blood to aerosolize to the surroundings. Moreover, infections can occur through the puncture of sharp instruments or direct contact between mucous membranes, contaminated hands [48] or indirect contact with contaminated instruments and surfaces [42] which can persist on surfaces up to two days [49,50].

Prechecking clinic of the Patients

Dental professionals should be able to identify a suspected case of 2019-nCoV through precheck triage clinic to evaluate and measure the temperature of every patient as a routine procedure. Prechecking practitioner should ask patients about his medical history (including cough, shortness of breath and/or sore throat) and previous history of previous infected patient contact or travel to infected area [51]. Once patients and their accompanying persons enter the clinic, their temperature should be measured, and surgical masks should be provided to them. Any patients suffer from fever should be referred to designated hospitals [48,52,53].

Recommendations for effective infection control

Hand hygiene has been considered the most critical measure for reducing the cross-infection transmitting risk to the patients [54,55] and disinfection of all surfaces within the dental clinic.

During the dental setting procedure

Routine dental procedures must be postponed until further notification related to pandemics of 2019-nCoV outbreak crisis [52]. Any procedure which may induce coughing should be avoided or performed cautiously. [51] However, only dental emergency cases can be treated with strict application of infection control protocol. On the 1st of April, the American Dental Association (ADA) also published an "Interim Guidance for Management of Emergency and Urgent Dental Care [56]" (1) 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 and trauma involving facial bones, potentially compromising the patient's airway). (2) 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 and biopsy of abnormal tissue). (3) 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 and aesthetic dental procedure)" [56].

- Patients must be seen and treated in a well-ventilated and isolated room.
- The use of full Personal Protective Equipment (PPE), including masks, gloves, gowns, shoe covers, head covers and goggles or face-shields, is highly recommended to protect both skin and mucosa from infected blood droplet or secretion [57].
- Before entering the patient area, the PPE must be worn properly for all duration of work in potentially contaminated areas and PPE should not be adjusted during patient care (e.g., retying gown, adjusting respirator/facemask) [53].



Full personal protective equipment (PPE)

- PPE must be remained in place and removed slowly in a sequence that prevents self-contamination.
- When there is an extensive risk of blood splashing, body fluids or secretions, full-body fluid repellent gowns must be used. The cuffs of gowns worn in the operating theatre should be fully covered by disposable gloves [58].
- Ensure gloves removal does not cause additional hand contamination. Gloves can be removed by more than one technique (e.g., glove-in-glove or bird beak).
- Gowns should be worn as disposable item seven for repeated contacts with the same patient and should be removed/changed after every episode of patient care [59].
- Gowns should be removed by untying the ties at the back and by peeling motion the gown should be pulled down from each shoulder so that the gown is turned inside out.
- Gowns should be rolled into a ball to avoid contact with the body and send to the appropriate laundry or waste-stream [60].
- The main route of viral transmission are the respiratory droplets, so using of particulate respirators (e.g., “N-95 masks which are authenticated by the National Institute for Occupational Safety and Health or FFP2 standard masks which are set by the European Union”) are most recommended for routine dental practice. In UK, they recommend using of FFP3 respirators in areas where high risk Aerosol Generating Procedures (AGPs) are being performed. Respirators’ fit test should be done for all staff and not just fit-checked. The WHO recommends that if FFP3 masks are not available the FFP2 respirators can be used for AGPs [61].



N-95 Particular Respirator and Surgical Mask

- Before any dental procedure the antimicrobial mouth rinse could be used to reduce the microbes’ number in the oral cavity preoperatively [48,62].
- Any procedures generate aerosol should be minimized as much as possible like using of a 3-way syringe. Therefore, extraoral radiographs, as CBCT and OPG, are highly recommended as an alternative during 2019-nCoV outbreak as the use of intraoral X-ray radiographs can stimulate coughing and saliva secretion [63].
- Using extra high-volume saliva ejectors along with regular suction and applying the rubber-dam isolation during dental procedure can significantly minimize generating



FFP3 Respirator Mask

contaminated aerosol or spatter, particularly in cases when high-speed handpieces and dental ultrasonic devices are used[53,59].

- In case of isolation by rubber-dam is not possible chemo-mechanical tooth preparation such as (Carisolv), hand instrumentation for caries removal or periodontal scaling are most recommended, in order to minimize the aerosol generation as much as possible.

- Anti-retraction hand-piece designed with especially anti-retractive valves or other anti-reflux designs are strongly recommended which can significantly reduce the backflow as an extra preventive measure for cross infection [64]. Dental handpieces without anti-retraction function should be prohibited during the 2019-nCoV outbreak which may further contaminate within the dental unit's tubes of air and water and thus leading to potentially cross-infection [53].

- Effective and strict disinfection and cleaning in public areas and appliances where should be done frequently including door handles, chairs, and desks. Elevator disinfection should be done regularly. When People use elevators, they should avoid direct contact with buttons and wear masks.

- The medical waste should be transported to the temporary storage area. The reusable instruments and items should be pretreated, cleaned, sterilized and properly stored in accordance to the dental instrument's Protocol of disinfection and sterilization.

- The contaminated medical and domestic waste of patients with suspected or confirmed 2019-nCoV infection are considered as infectious medical waste which are packed in yellow double-layer package bags and are ligated by "gooseneck" ligation should be done. Package bags should be marked and disposed.

Conclusion and Recommendation

As the 2019-nCoV crisis continues to develop, the challenges facing dental professionals are changing. The importance of effective and strict infection control remains, but that is leading to a rapid reduction in the dental procedures being offered. Dental professionals should be ready to support the wider 2019-nCoV response by using their professional experience outside the normal range of oral and dental health activities while keeping the fundamental need which support community safety. Dental professionals may be asked to provide their advice remotely where patients cannot come to a dental clinic to defer the need of proper treatment through prescribing of pain killer and antimicrobial treatment as well the apparent seriousness of the need for further intervention which it has been possible to make a clinical assessment.

Conflict of interest

The authors declare that we do not have any financial interest, arrangement or affiliation with anyone in relation to this research that could be perceived as a real or apparent conflict of interest in the context of the subject of this study. This study was supported by self-fund of authors.

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