

Review Article

COVID-19: A Review on Effect, Crisis, Outcome and Challenges in the Field of Dentistry

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Abstract

With increasing risks and upcoming potential threats to the society, healthcare workers, and doctors, the pandemic may give us no time to think or even reconsider so as to what next?

This pandemic, in this current situation has awakened the people so as to know the exact importance of doctors and the health care workers today. To be more precise as this COVID-19 spreads majorly through aerosol, dentists are at high potential risk. On daily basis dentists has to deal with a patient's oral cavity, to treat them, or even for a routine dental screening. The risk was potentially high, not only for the COVID-19 but to every patient, that dentists attends.

To un-curtain some true facts and Standard Operating Procedures (SOP) to be followed for the dental care during this situation, the review is mainly focused on the crucial role of dentists in this war against COVID-19 with their prospective.

Keywords: COVID-19; The Coronaviridae Study Group (CSG) of the international committee on taxonomy of viruses; SARS-CoV-2

Introduction

Gripping and grasping its rapid spread and challenging the healthcare professional's globally. The novel virus Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) causing Coronavirus Disease (COVID-19) was first discovered in 2019 in Wuhan, a city in the Hubei Province of China. On January 8, 2020, the coronavirus was officially declared as pandemic and causative pathogen of COVID-19 by the World Health Organization (WHO) and the Public Health Emergency of International Concern (PHEIC), Chinese Center for Disease Control and Prevention [1-4].

Continued Global efforts are made to contain the lively spread of this nosocomial infection, but the outbreak is still on the edge. Researchers believe it to be a zoonotic infection, similar to other SARC-Cov-2 diseases [2]. The most probable origin is assumed from Chinese horseshoe bats (*Rhinolophus sinicus*) and pangolins as the most likely intermediate host [3].

It has affected almost every continent in this world, except Antarctica. In February 2020, the World Health Organization designated the disease COVID-19, which stands for corona virus disease 2019 [5].

With rapid spread of the disease, the health care professionals

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are always the first to be involved in national emergency, often day and night. Unfortunately, few of them infected and have lost their life tragically.. Medicine practitioners, Dentists, nurses and paramedical staff are often the first line of diagnosis, as these professionals come in close contact with diseased [1].

An article published by the New York Times graphically depicts where dental professionals are at the highest risk of being exposed to COVID -19 as compared to nurses and general physicians [1].

Simultaneously with this viral outbreak, it is crucial to define the novelty of the virus, as well as role of a dentist in this pandemic. Firstly let us brief about the virus naming and categorization.

As a well known matter of fact Corona-Virus (CoV) belongs to a large family RNA virus. The virus is classified based on its natural genetic variable capacity where they may be regarded as variants of the same virus, which may not be identical but have the similar genome sequences [6].

To do so the viral phenotypic and genomic studies were performed [6,7].

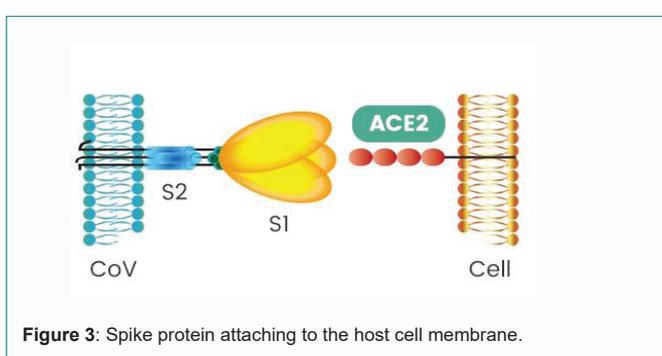
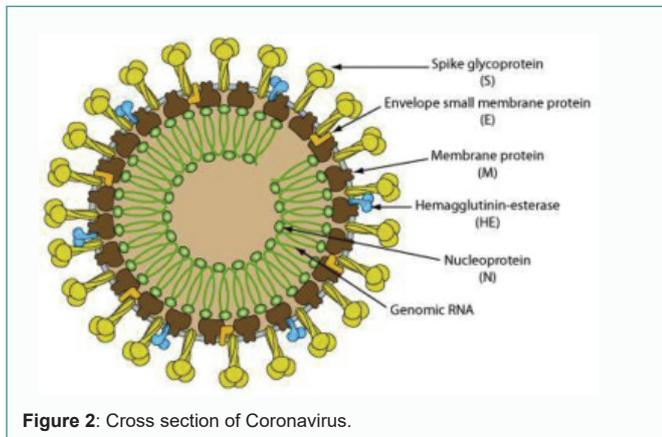
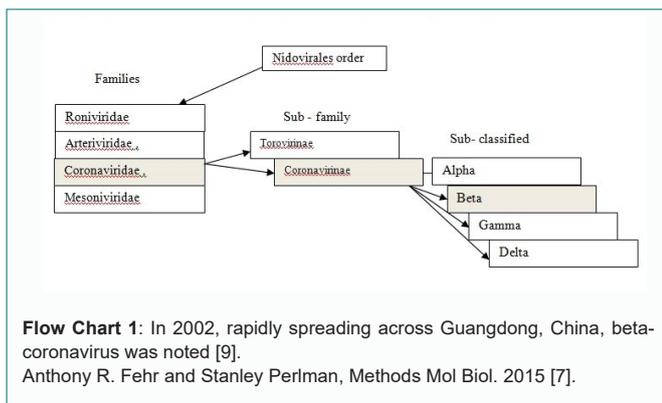
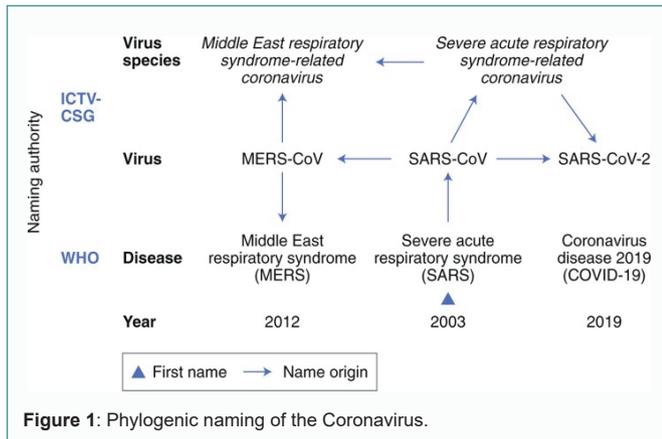
And the CSG (Corona-viridae Study Group) [6-8] decided to follow a phylogeny-based Line of reasoning to name this virus whose ontogeny can be traced in the Figure 1.

In 2002, rapidly spreading across Guangdong, China, *beta*-coronavirus was noted (Folw Chart 1) [9].

Structure & function of the covid-19

Belonging to largest family, COVID-19 genome ranges from 27 to 32 kb, with a helical nucleocapsid protein (N) is surrounded by an envelope containing the genome (Figure 2).

Three structural proteins are associated with the viral envelope: The membrane protein (M) and the envelope protein (E) - spike protein (S) mediate virus entry into host cells (Figure 3).



Some have an envelope-associated Hemagglutinin-Esterase protein (HE). This spike protein forms the protrusions from the virus surface, giving appearance of crowns hence their name; *corona* (Latin means crown) [10].

The spike contains three segments: a large ectodomain, a single-pass transmembrane anchor, and a short intracellular tail. The ectodomain consist of a receptor-binding subunit S1 and a membrane-fusion subunit S2 [10]. During virus entry, S1 binds to a receptor on the host cell surface for viral attachment, and S2 fuses the host and viral membranes, allowing viral genomes to enter host cells [10].

In a study of Zhuo et al. and Xu et al. [11] Angiotensin-Converting Enzyme II (ACE2) is likely the cell receptor of COVID-19 in host, which was also the receptor for SARS-CoV. The RBD (Receptor Binding Domain) of COVID-19 S- protein has strong interaction with ACE2 molecules. Thus proving the high susceptibility of ACE2 expressing cells to the disease.

High ACE2 expression was identified in type II alveolar cells (AT2) of lung, esophagus and stratified epithelial cells. It was also noted that ACE2 expressions were high in oral mucosa, specifically on the tongue [11].

Epidemiology

Starting with its tiny steps as 1-2 cases in late December 2019 in Wuhan, china approximately reported (3.42%) patients have succumbed to the virus [7]. Due to pandemic nature of the disease, cases have emerged in 59 countries through ease of transport facility across the world [7]. Table 1 gives the approximate number of active cases and death rates according to WHO [8]. With increasing spread, USA has faced maximum fatality rate according to the current updates. As compared to adults relatively less number of cases (3092) has been reported and 1412 children were suspected of having been infected with COVID-19 with milder symptoms and better prognosis till date [5,9].

COVID-19 mode of transmission and dental clinic

COVID-19 being a zoonotic virus, it can spread from non-human to humans. Initial stage of the disease, investigations revealed association and spread through either consumption of food or being exposed to seafood, and also from human to humans (Figure 4 and 5) [4].

No cases of COVID-19 are identified yet in a dental setting. However, considering the high transmissibility of disease and those routine dental procedures usually generate aerosols can be attributed to use of high speed ultrasonic instruments 3-way syringes (Figure 6) [2,3]. In a study conducted by [3] SARS-CoV-2 has been isolated from the saliva of COVID-19 patients. It is believed that salivary gland epithelial cells can probably be infected by SARS-CoV and become a primary source of the virus in saliva [3,12]. A significant amount of aerosols are generated during the routine dental procedures, due to the utilization of high-speed types of equipment [4].

Other possible modes of transmission

Vertical transmission from mother to the fetus.

Incubation period

The incubation period of COVID-19 has been estimated by several researchers on an average to be of 5 to 6 days, but there is evidence that it could range from 0 to 24 days, or even be as long as 14 d, which is now the commonly adopted duration for medical observation and quarantine of (potentially) exposed persons [2-5].

Clinical manifestations

The major symptoms of patients were: Other atypical symptoms

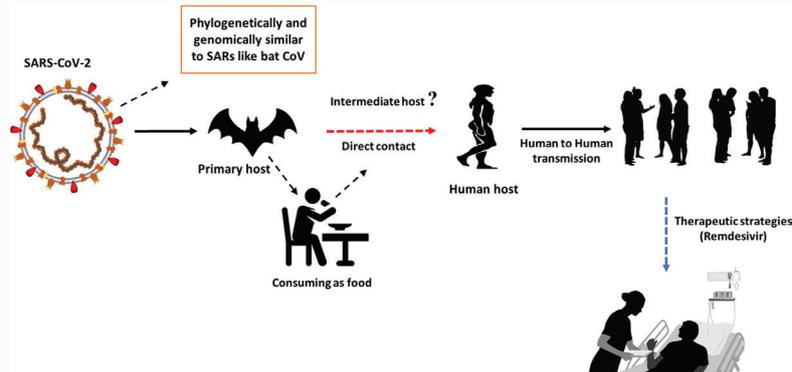


Figure 4: Possible mode of transmission of COVID-19 from animals to humans.

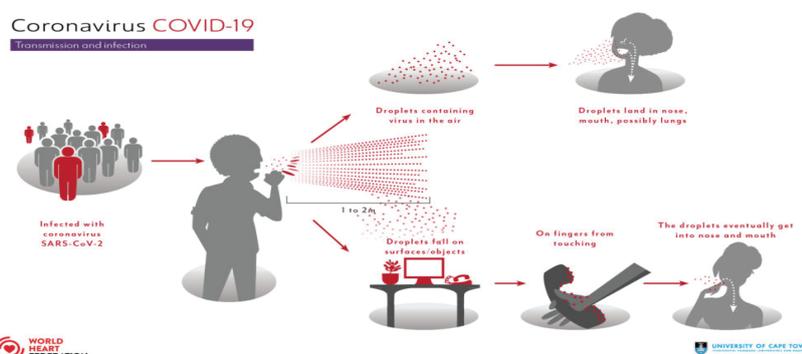


Figure 5: Human to human transmission.

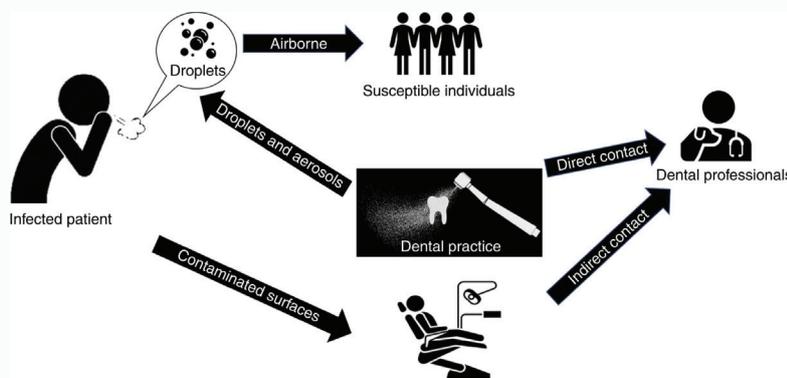


Figure 6: Possible transmission routes of COVID-19 in dental clinics.

Table 1: Current updates on cases of COVID-19 in world & India.

	Total cases	Deaths
World	37,109,851	1,070,355
India	7,053,86	1,08,334

- Fever - 88% Headache, confusion
- Fatigue - 38% Sore throat,
- Dry cough- 67% Rhinorrhea
- Muscle pain- 14.9% Gastro-intestinal symptoms
- Dyspnea -18.7%
- Pneumonia, acute respiratory distress syndrome along with breathing difficulty was the most common and severe manifestation.

One-fourth to one-third developed serious complications unit (respiratory failure, septic shock, and/or multiple organ failure) which were therefore transferred to the intensive care [5].

Who are the people at high risk of infection?

Looking at the current situation, all age groups are equally susceptible.

People at high potential risk are the health care workers who are in either direct or indirect contact with COVID-19 subjects or even who are in quarantine [13].

So how and what has to be done to screen and treat the walk-in patient?

ADA has recognized and best positioned itself, so that the state

governments and state dental associations should set standard protocols and revise them timely. Yet in this situation, if a dental emergency occurs, then here are few guidelines which can be followed [14]. Thorough screening along with detailed medical and travel history, along with COVID-19 screening questionnaire should be filled by the patient (Table 2).

How do we deal with COVID-19 suspect in dental clinic?

After the case history, if any points seem to be positive, professional judgment should be made by dentists to determine the patient's need for urgent or emergency care in Flow Chart 2. ADA has categorized the dental treatments in to emergency and non-emergency [15]. The dental treatment should also be classified according to the severity of the case and the degree of procedure invasiveness and risk [15].

To cease the tissue bleeding, relieve severe pain and infection, dental emergencies pose life-threatening challenges that need immediate attention (Table 3).

Once a patient is categorized under emergency treatment, which may or may not be suspected subject of COVID-19, the below given guidelines can be followed:

- Standard Personal Protective Equipment (PPE) (Figure 7) and hand hygiene practices should be followed by dentists (Figure 8). Centers for Disease Control and Prevention guidelines for donning and doffing of the personal protective equipment.
- To prevent salivary contamination between the patients intraoral imaging should be restricted and extra-oral radiographs should be utilized.
- Giving 0.23% povidone-iodine or 0.5% to 1% hydrogen peroxide mouth rinse for at least 15 s may reduce the load of corona viruses in saliva.
- To reduce the cross-infection risks and to minimize splatter generation of aerosols, disposable and single-use instruments and devices along with rubber damn should be used whenever possible.
- To reduce the droplet infection with ultrasonic instruments, high-speed hand pieces, and 3-way syringes should be avoided.
- Negative-pressure treatment rooms/ Airborne Infection Isolation Rooms (AIIRs) should be built (Figures 9 and 10).
- Pharmacologic management of dental patient in suspected and confirmed COVID-19 cases can be done to postpone the non emergency treatment (Table 4) [2,5].

Discussion

A dentist point of view

The course of the disease is unpredictable and dynamic, due to high potential aerosol transmission. There have been inconstant reactions by the people around the world. Hence considering this outbreak of nature, the risk is posed more on to the medical, dental and health care professionals who are trading their future on an uncertain path [2,3,5].

The World Health Organization (WHO), central and state governments have been putting their endless continuous efforts to contain the disease spread through travel restrictions, quarantines, lockdown, social distancing. Hand hygiene protocol spread by duty

Table 2: COVID-19 Questionnaire for screening of dental patient.

	Yes	No
Do you have any symptoms like fever, body pain, cough, sneezing, sore throat, difficulty in breathing?		
Have you or any of your cohabitants travelled outside state/ country in the past one month?		
Any of your family members have history of fever, body pain, cough, sneezing, sore throat, Difficulty in breathing?		
Have you visited the general physician if your answer is yes for question?		
Do you have any medical issues (if yes mention the details)?		
Do you belong to COVID 19 sensitive area or have visited one such place in past one month?		
Have you come into contact with a patient with confirmed 2019-nCoV infection within the past 14 days?		
Have you recently participated in any gathering, meetings, or had close contact with many unacquainted people?		

(Karnataka state dental council Standard Operating Protocol (SOP) for management of patients in dental clinic/hospital during COVID 19 outbreak) [12].



Figure 7: Personnel protective equipment donning by CDC.

doctors and anganwadi workers, tracing the suspect travel history on an extreme level [1-5,7].

The slogan of 'Stay home Stay safe', (Lockdown) is no doubt implemented not to overload the healthcare system; the goal was to flatten the curve. But this is not completely followed by the people in the society due to lack of awareness of the disease and this has caused a huge impact on the health care workers.

Table 3: Emergency/non-emergency dental treatments [14].

Emergency dental care	Urgent dental care	Non-emergency
<ol style="list-style-type: none"> Uncontrolled bleeding. Cellulitis or diffuse swelling that potentially compromises the patient's airway. Trauma involving facial bones fractures. 	<ol style="list-style-type: none"> Severe dental pain Pericoronitis, dry socket Abscess, or localized bacterial infection Tooth fracture Dental trauma with avulsion/luxation Dental treatment prior to critical medical procedures Final crown/bridge cementation if temporary restoration is lost, broken or causing gingival irritation Biopsy of abnormal tissue 	<ol style="list-style-type: none"> Extensive dental caries or defective restorations with pain Suture removal Denture adjustment or repairs when function impeded Replacing temporary filling on patients experiencing pain Snipping or adjustment of an orthodontic wire or appliances piercing causing ulcerating.

Table 4: Drugs for dental subject with suspected/confirmed COVID-19 [2].

Diagnosis	Primary management	Secondary management with SOP
Symptomatic irreversible pulpitis	PO:ibuprofen 600 mg, Acetoaminophen 325 mg to 500 mg, Dexamethasone 0.07 mg/kg to 0.09 mg/kg Consider 0.5% Bupivacaine for immediate relief	
Acute Apical Periodontitis	Introral swelling: incision and drainage, augmetin 500 mg b.i.d × 5 days/clindamycin 300 mg q.i.d × 5 days Consider 0.5% Bupivacaine for immediate relief Extraoral swelling: augmetin 500 mg b.i.d × 5 days/clindamycin 300 mg q.i.d × 5 days Consider 0.5% Bupivacaine for immediate relief	Call Oral & maxillofacial surgeon for further referral
Avulsion/Luxation	If tooth is replanted, follow pain management protocol. Pain management is based on age. PO:ibuprofen 600 mg, Acetoaminophen 325 mg to 500 mg	If tooth is not replanted,
Tooth fracture with pain	Pain management: PO:ibuprofen 600 mg, Acetoaminophen 325 mg to 500 mg	Vital pulp therapy
Trauma involving facial bones, compromised airway	Call Oral & maxillofacial surgeon for further referral	
Cellulitis/bacterial infection/diffuse swelling leading to airway blockage	Call Oral & maxillofacial surgeon for further referral	

SEQUENCE FOR REMOVING PERSONAL PROTECTIVE EQUIPMENT (PPE)

Except for respirator, remove PPE at doorway or in anteroom. Remove respirator after leaving patient room and closing door.

- 1. GLOVES**
 - Outside of gloves is contaminated!
 - Grasp outside of glove with opposite gloved hand; peel off
 - Hold removed glove in gloved hand
 - Slide fingers of ungloved hand under remaining glove at wrist
 - Peel glove off over first gloved
 - Discard gloves in waste container
- 2. GOGGLES OR FACE SHIELD**
 - Outside of goggles or face shield is contaminated!
 - To remove, handle by head band or ear pieces
 - Place in designated receptacle for reprocessing or in waste container
- 3. GOWN**
 - Gown front and sleeves are contaminated!
 - Unfasten ties
 - Pull away from neck and shoulders, touching inside of gown only
 - Turn gown inside out
 - Fold or roll into a bundle and discard
- 4. MASK OR RESPIRATOR**
 - Front of mask/respirator is contaminated — DO NOT TOUCH!
 - Grasp bottom, then top ties or elastics and remove
 - Discard in waste container

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



Figure 8: Personnel protective equipment doffing by CDC.

How to Hand Wash

Wash hands when visibly soiled. Otherwise, use handrub. Duration of the entire procedure: 40-60 seconds



- 0 Wet hands with water;
- 1 Apply enough soap to cover all hand surfaces;
- 2 Rub hands palm to palm;
- 3 Right palm over left dorsum with interlaced fingers and vice versa;
- 4 Palm to palm with fingers interlaced;
- 5 Backs of fingers to opposing palms with fingers interlocked;
- 6 Rotational rubbing of left thumb clasped in right palm and vice versa;
- 7 Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa;
- 8 Rinse hands with water;
- 9 Dry hands thoroughly with a single use towel;
- 10 Use towel to turn off faucet;
- 11 Your hands are now safe.

Figure 9: Hand hygiene by CDC.

The awareness of the disease can be spread by webinars and educating the society by social media.

After reporting the 1st death of dentist, immediate closures of dental practices were declared. Only providing of emergency dental

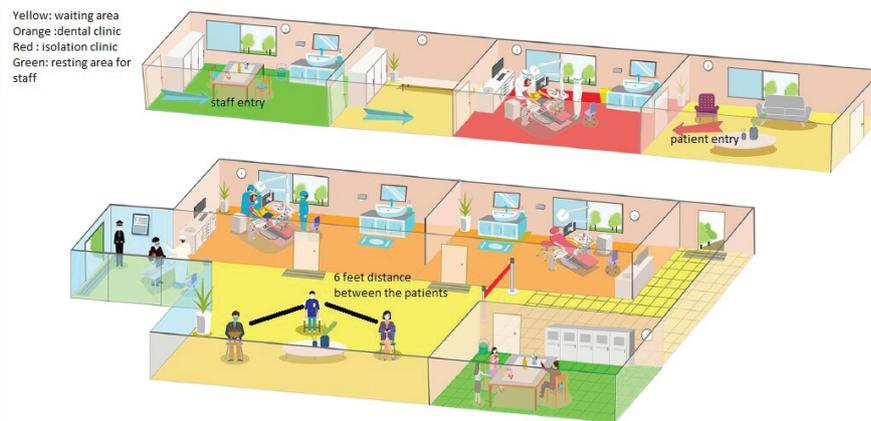
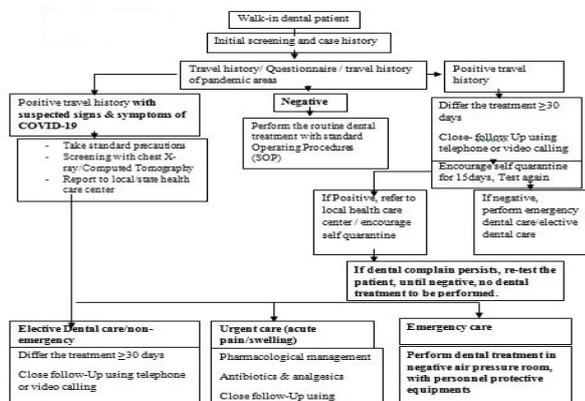


Figure 10: Outline of dental set up for COVID-19 subjects [4].



Flow Chart 2: Flow Chart 2: Screening and decision making: [2].
An overview of patient screening for COVID-19 and dental management [2].

care with strict personal protection equipments and measures to reduce and avoid production of droplets and aerosols. There are published cases where transmission could occur from asymptomatic patients too [7, 9].

But this has not only led to financial consequences but has challenged dentist who are self employed. Now is this all about shutting down the clinics and using personal protection equipments? But the risk still remains the same [16].

Comparing dental and medical offices to beauty salons, even claiming that they unnecessarily charge high prices for even common treatment, offending the duty doctors physically, abusing them, is matter of concern today because even after completely understanding the pandemic state, yet doctors and dentists continue to fulfill the duties assigned to them, and are risking their lives and protecting the society [1-4,16,17].

Of course this is not the time to criticize, but to follow the guidelines set by the global experts universally. To proceed with the high level of dentistry after the crisis it is important that we have to stand united to tackle and make sure we win this war [3,4,7,15,16].

Posting a sign at the entrance to the dental practice, rescheduling the appointments for who have travel history, and any patient walking

in clinic for routine dental check up should be treated as COVID-19 carrier in this current scenario and upcoming future [14].

To reduce the chances of cross contamination, particular number of patients can be scheduled per dentist, with specific timings. And To attend the emergencies, time slots are open throughout the day [17,13].

For quite a while, now that the society has understood as to which professions are really necessary for its survival, their facilities and payrolls of healthcare workers have to be heightened [7,13,17].

To overcome the crisis it is only possible when every citizen acts wisely and also calmly follows the guidelines and fulfils the duties of their specific tasks even more diligently than usual with minimal damage to the society.

Not underestimating our profession and tasks what we perform, and not letting fear and myths ruin it, let us pledge, follow, and secure our future [17].

Conclusion

Take care, be safe, care for family is a must, but stay calm and fulfill your duty as dentist. Don't let false stories cook up your mind. Few questions will remain unanswered, and needs further discussion on how should we improve the current situation? What next for the future of the dentists?

Will everything be back to normal after the pandemic?

Conflicts of Interest

None

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