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REVIEW

Dental care management during the COVID-19 outbreak

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Abstract

Aim: The level of preparedness of the healthcare system plays an important role in management of coronavirus disease 2019 (COVID-19). This study attempted to devise a comprehensive protocol regarding dental care during the COVID-19 outbreak.

Methods and result: Embase, PubMed, and Google Scholar were searched until March 2020 for relevant papers. Sixteen English papers were enrolled to answer questions about procedures that are allowed to perform during the COVID-19 outbreak, patients who are in priority to receive dental care services, the conditions and necessities for patient admission, waiting room and operatory room, and personal protective equipment (PPE) that is necessary for dental clinicians and the office staff.

Conclusion: Dental treatment should be limited to patients with urgent or emergency situation. By screening questionnaires for COVID-19, patients are divided into three groups of (a) apparently healthy, (b) suspected for COVID-19, and (c) confirmed for COVID-19. Separate waiting and operating rooms should be assigned to each group of patients to minimize the risk of disease transmission. All groups should be treated with the same protective measures with regard to PPE for the dental clinicians and staff.

KEYWORDS
COVID-19, dental care, dental infection control, occupational health, pandemics

1 | INTRODUCTION

The novel human coronavirus, recently named as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was first emerged in China in December 2019 and turned into a pandemic within a couple of months, leading to a global crisis.[1] The most common clinical features of the coronavirus disease 2019 (COVID-19) include dry cough, fever, and dyspnea.[2] It has an estimated incubation period of 4-5 days, although a time lapse as long as 14 days from the time of exposure to the onset of signs and symptoms has also been reported.[3,4] The patients have no signs or symptoms during the incubation period while they are potential carriers for the SARS-CoV-2 and may transmit the disease to other individuals. This property makes efficient control of this disease extremely difficult.[5] According to the reports by the World Health Organization (WHO), over 200 countries worldwide reported COVID-19 outbreak until March 25, 2020.[6] Since there is no confirmed treatment or vaccine for COVID-19 so far, dental treatments must be provided to those in need until the termination of this global pandemic.

Considering the generation of high amounts of droplets and aerosols during routine dental procedures, the conventional protective measures that are routinely followed by dental clinicians are no longer efficient for prevention of COVID-19 transmission.[7] According to a report by the *New York Times*, dental clinicians have the highest risk of exposure, even higher than that of nurses, physicians, and pharmacists.[8] Under such circumstances, dental management of patients requires some certain precautions, which have not been practiced before. COVID-19 may last for a couple of months in many countries especially those with a poor healthcare system. Thus, the precautions need to be taken seriously not only during the management period and the disease peak, but also during the remission period in order to prevent reinfection. This study sought to provide some safety precautions that need to be followed step by step from patient admission to completion of treatment to prevent COVID-19 transmission.

2 | METHODS

A literature search was performed in Embase, PubMed, and Google Scholar to retrieve relevant articles with the following combination of words: ((((“dent manage” [journal] or (“dental” [all fields] and “management” [all fields])) or “dental management” [all fields]) or ((“dental care” [MeSH terms] or (“dental” [all fields] and “care” [all fields])) or “dental care” [all fields])) and ((((((((“COVID 19 [all fields] or “COVID 2019 [all fields]) or “severe acute respiratory syndrome coronavirus 2 [supplementary concept]) or “severe acute respiratory syndrome coronavirus 2 [all fields]) or “2019 ncov” [all fields]) or “SARS COV 2″ [all fields]) or “2019ncov” [all fields]) or ((“Wuhan” [all fields] and (“coronavirus” [MeSH terms] or “coronavirus” [all fields])). Articles in English with no other restriction were applied for inclusion of the retrieved articles in order to prevent missing of any information. This paper focused on dental management during the COVID-19 pandemic in order to answer the following four questions:

- Which procedures are allowed to perform during the COVID-19 outbreak?
- Which patients are in priority to receive dental care services?
- What are the conditions and necessities for patient admission, waiting room, and operatory room?
- What personal protective equipment (PPE) is necessary for dental clinicians and the office staff?

2.1 | Routes of transmission

SARS-CoV-2 can be transmitted from person to person via direct contact. Person-to-person transmission is very common among the family members and also healthcare workers who are in direct contact with COVID-19 patients and carriers. SARS-CoV-2 can be transmitted via body fluids, salivary droplets, respiratory secretions (fomites), and aerosols. Risk of transmission via these routes decreases by an increase in physical distance, in an orderly fashion.[9] Droplets and aerosols are the most important routes of virus transmission in dental procedures. The reason is generation of aerosols and droplets of saliva and even blood, which is unavoidable in dental procedures. Use of high-speed handpiece in the oral cavity creates significant amounts of droplets and aerosols that remain suspended in the air for up to 30 minutes prior to their deposition on surfaces or being sucked into the air conditioning system, due to their small size.[10,11] Also, dental clinicians are in direct contact with the body fluids such as saliva and contaminated dental instruments. On the other hand, SARS-CoV-2 can remain viable on metal, glass, and plastic surfaces for a couple of days and serve as a source of infection transmission.[12] It has been documented that the human coronavirus can remain viable at room temperature from 2 to 9 days.[10,12] Also, it shows higher resistance in 50% humidity compared with 30% humidity.[13] A similar behavior may be expected from the SARS-CoV-2.[1,12] Evidence shows that this virus may be transmitted by asymptomatic individuals.[5,14,15] These individuals have positive polymerase chain reaction (PCR) test result for the virus nucleic acid but have no symptoms such as pain or respiratory problems. Thus, all dental patients should be considered suspicious for COVID-19.[5,14,15]

2.2 | Dental procedures during the COVID-19 pandemic

According to the American Dental Association, dental procedures can be divided into two groups of emergency/urgent and routine/elective during the COVID-19 pandemic. The American Dental Association added urgent dental care as part of the emergency guidance.[16]

Emergency situations are life-threatening and require immediate attention to stop bleeding, alleviate severe pain, or resolve the infection. These include the following:

- Uncontrolled bleeding, cellulitis or bacterial infection with intraoral or extraoral swelling that can potentially compromise the airways.

- Trauma to the facial bones that can potentially compromise the airways.

Urgent dental treatments include management of conditions that require immediate attention such as alleviation of severe pain with/without the risk of infection and balancing the patient load in the hospital emergency departments. Such treatments should be minimally invasive (as much as possible) and include the management of the following issues:

- Severe dental pain due to pulpitis.
- Pericoronitis or third molar impaction.
- Postoperative osteitis, dry socket dressing change.
- Local bacterial abscess or infection that has caused pain and local swelling.
- A fractured tooth that has caused pain or soft tissue trauma.
- Dental trauma associated with avulsion/luxation.
- Dental treatments required prior to critical medical procedures.
- Cementation of crowns or bridges when the temporary restoration is lost, broken, or has caused gingival irritation.
- Biopsy of abnormal tissue.
- Management of extensive dental caries or defective restorations that have caused pain with interim restorative techniques if possible (silver diamine fluoride, glass ionomers).
- Denture adjustment in patients under radiotherapy/chemotherapy.
- Denture adjustment or repair in case of impaired function.
- Exchange of temporary restoration of an endodontic access cavity in patients complaining of pain.
- Snipping or adjustment of orthodontic wires or appliances that have traumatized the oral mucosa.

Routine/elective or nonemergency dental treatments include the following points:

- Primary oral and dental examinations, periodic examinations, and recall visits that may include routine radiography.
- Cleaning and prophylaxis, and preventive treatments.
- Orthodontic procedures other than cases that may lead to acute complications (such as pain, infection, or trauma).
- Extraction of asymptomatic teeth.
- Restorative treatments such as restoration of asymptomatic carious teeth and cosmetic dental procedures.

TABLE 1 Questionnaire for identifying true emergencies

	Questions	Yes	No
1	Have you experienced dental trauma?		
2	Do you have a fever and swelling on your face or inside your mouth?		
	If yes, when did you first notice the swelling?		
3	Are you experiencing uncontrolled bleeding?		
	If yes, when did it start?		
4	What is your pain level on a scale of 1-10? (0 indicates no pain, and 10 is the worst pain possible)		
	Can pain or discomfort be tolerated or managed at home for 2–3 weeks?		
5	Do you need denture repair or adjustment prior to medical treatment or due to trouble eating?		
6	Do you need dental treatment required prior to medical treatment (e.g., radiotherapy)?		
7	Do you need biopsy of abnormal tissue?		
8	Do you need final crown/bridge cementation if the temporary restoration is lost or broken and the gingiva is irritated?		

During the COVID-19 pandemic, routine dental treatments are contraindicated, and emphasis should be placed only on emergency and urgent treatments in all patients.[16] Thus, dental clinicians should first ensure their own health, and the health of their office staff, and then the first step would be screening of patients, which can be performed in two steps.

2.3 | Patient screening

2.3.1 | Primary screening

Primary screening should be performed when scheduling an appointment online or over the phone. At this time, patient status regarding COVID-19 can be evaluated by using a simple questionnaire. Aside from asking for the routine demographic information and medical history, the main question should be the patient's chief complaint to determine whether he/she is a candidate for emergency/urgent dental treatment. Other questions should be directed to determine the risk of COVID-19. Tables 1 and 2 are the designed questionnaires suggested for this purpose. Different scenarios may be encountered at this phase:

1. The patient does not require emergency/urgent treatment; thus, a dental appointment is not scheduled for him/her.

TABLE 2 Questionnaire for screening patients for COVID-19

	Questions	Yes	No
1	Do you have fever or experienced fever within the past 14 days?		
2	Have you experienced a recent onset of respiratory problems, such as a cough or difficulty in breathing within the past 14 days?		
3	Have you, within the past 14 days, traveled intercity with a public vehicle (airplane, train, bus)?		
4	Have you come into contact with a patient with confirmed 2019-nCoV infection within the past 14 days?		
5	Are there at least two people with documented experience of fever or respiratory problems within the last 14 days having close contact with you?		
6	Do you have confirmed COVID-19 disease?		

2. The patient requires emergency/urgent treatment and is not suspected for COVID-19 or recovered from COVID-19. An appointment is scheduled for such patients for further examinations.
3. The patient requires emergency/urgent treatment and is also suspected for COVID-19.
4. The patient requires emergency/urgent treatment and is confirmed for COVID-19 with laboratory tests.

The patients recovered from COVID-19 based on following criteria can be considered as healthy and receive dental care following standard precautions. According to updated recommendation of Center for Disease Control (CDC), people with mild to moderate COVID-19 are not infectious if at least 10 days passed after their symptoms began and at least 24 hours have passed science resolution of fever without the use of fever-reducing medication and other symptoms have improved. Patients with more severe illness or those who are severely immunocompromised remain infectious no longer than 20 days after their symptoms began. Therefore, resolved patient according to this symptom-based strategy could be considered in the second category.[17,18]

> If the patient has traveled intercity in the past 14 days, it is recommended to postpone the dental visit to an appropriate time after a 14-day quarantine period, given that his/her dental condition can be alleviated remotely (at least temporarily).[7] In the current situation, it is suggested to cancel patient appointments without prior primary screening to prevent close contact of patients in the waiting room and subsequent increase in the risk of transmission.

2.3.2 | Secondary screening

Secondary screening should be performed when patients show up for a clinical in-office visit. A primary examination needs to be performed before the patient enters the operatory room. Also, before entering the clinic, the patients should be requested to wear a surgical mask and follow the hygiene measures for the respiratory system (use of tissue when coughing or sneezing and disposing it in a closed-lid trash bin immediately after use) and hands (washing hands with water and soap or 70-90% alcohol-based hand rubs).[19,20] Since fever is the most common clinical feature of COVID-19 (present in 88.7% of the cases),[2] measuring the body temperature by a noncontact forehead thermometer or infrared cameras with thermal sensors can greatly help for in-office patient screening.[19] At this time, the questionnaires filled out during the primary screening should be verified by interviewing the patients. Dental treatment should only be performed if the emergency/urgent situation is confirmed. According to the data acquired from the screening questionnaires, patients who need emergency/urgent dental treatment can be divided into three groups of apparently healthy, suspected, and confirmed cases. Separate waiting rooms and operatory rooms should be considered for each group of patients. Standard central dental care clinics need to have these separate rooms for treatment of all patients. However, private offices may not be well equipped to provide emergency care to all three groups of patients. Therefore, their services should be limited based on the available separate waiting and operating rooms. It should be noted that normal body temperature does not definitely rule out the disease, and other signs and symptoms as well as the filled out questionnaires should also be scrutinized.

Patients with underlying systemic conditions are believed to be at higher risk of COVID-19. Therefore, the authors believe that it may be preferred to schedule appointments early in a work day for such patients. Some systemic conditions are exception including patients who have nocturnal asthma which should be scheduled for late-morning appointments, when attacks are less likely. Moreover, management of stroke-prone patients or patients with a history of stroke includes the use of short, midmorning appointments that are free of stress and anxiety.[21]

They should be the first patients visited by the dentist to minimize the risk of cross-contamination. Also, procedures involving aerosol generation such as the use

of high-speed handpiece should be preferably scheduled at the end of a work day to minimize the risk of contamination of other patients by the generated aerosols.

2.4 | Patient admission and waiting

Although physical contact is the main route of transmission of COVID-19, some concerns still exist regarding its airborne transmission.[10] Thus, patient appointments should be preferably scheduled such that only one patient waits in the waiting room. Nonetheless, three separate waiting rooms should be considered for apparently healthy, suspected, and confirmed patients. The waiting room for suspected or confirmed cases of COVID-19 should have negative pressure. Alternatively, airborne infection isolation rooms should be allocated to such patients. The waiting room for asymptomatic and apparently healthy dental patients should have adequate ventilation, which is 60 L/s/patient for rooms with normal ventilation.[22] In case of presence of higher number of patients in a waiting room, safe distance between the chairs should be considered (a minimum of six feet) or the patient can be asked to wait in the car or in open spaces till the time of scheduled appointment.[18,23] All surfaces in the waiting room should be considered high-risk due to the possibility of contamination with droplets upon coughing or sneezing of patients or hand contact. Thus, all surfaces should be periodically disinfected.[24] Logically, the patient's chair and its surroundings (by up to six feet) should be disinfected after the patient leaves the waiting room for the operatory room.

2.5 | Operatory room

Although symptomatic COVID-19 patients are the main source of disease transmission, evidence shows that asymptomatic patients and those in the incubation period may also be SARS-CoV-2 carriers.[5,25] On the other hand, the two more efficient diagnostic modalities to rule out COVID-19 infection include multiple reverse-transcription PCR tests and computed tomography (CT), the latter being more easily available.[26] Considering the existing limitations and shortage of diagnostic PCR kits and nonfeasibility of requesting CT for all patients, it would be wise to consider all patients as potential carriers, and additional infection prevention and control practices should be considered during the COVID-19 pandemic, along with standard practices recommended as a part of routine healthcare delivery to all patients. These practices are intended to apply to all patients, not just those with suspected or confirmed SARS-CoV-2 infection. Thus, emergency dental treatments should only be provided to all cases in a negative-pressure operatory room or airborne infection isolation rooms. Also, it should be noted that separate operatory rooms should be considered for the three groups of patients. To enhance normal ventilation, the WHO recommends negative-pressure rooms with a minimum of 12 air changes per hour or 160 L/s/patient. Also, mechanical ventilation should be started prior to treatment of the next patient.[27] Given that air change occurs 14-18 times per hour, elimination of air pollutants and contaminants requires 18 minutes for 99% efficacy and 28 minutes for 99.9% efficacy. Thus, a minimum of 30-minute interval should be considered between treatment of patients.[28]

2.6 | PPE for dental clinicians and the office staff

Dental clinicians should strictly follow the standard precautions for the contact and airborne infections, which include the use of PPE and the hand hygiene protocols.[19] To protect the skin and mucosa against the infected secretions, it is recommended that the operatory room staff wear isolation gowns with surgical gloves, appropriate mask, safety glasses, and face shield prior to entering the operatory room. According to the recommendations of the CDC, the order of wearing PPE includes hand washing, wearing the hospital gown, mask, cap, safety glasses, and surgical gloves. The order of taking off the PPE is the opposite, and hand washing should be performed as the final step.[29]

2.6.1 | Hand washing

The West China Hospital of Stomatology, Sichuan University has recommended the hand hygiene guideline of two-before-and-three-after. Accordingly, dental clinicians should wash their hands prior to patient examination, prior to initiation of a dental procedure, after contact with the patient, after touching the nondisinfected equipment and instruments, and after touching the oral mucosa, skin, wounds, blood, body fluids, or other secretions.[10]

2.6.2 | Hospital gown

A hospital gown is an important PPE required when taking care of patients especially if they are suspected for a contagious disease, and is a critical part of many disease control strategies. Hospital gowns can be divided into two main groups for (a) blood-borne pathogens such as surgical gowns, surgical isolation gowns, and nonsurgical gowns, and (b) for airborne pathogens (coverall gowns and nuclear protective gowns).[30] Thus, it seems that the coverall gowns that protect against airborne pathogens

are the best choice for protection against the COVID-19.[31] The coverall gowns should be disposed after use for each patient.

2.6.3 | Appropriate mask

The standard surgical mask, which is also known as the fluid resistant surgical mask, creates a protective barrier for the nose, mouth, and the respiratory system against splashes, large droplets, and other fluids. It is loose-fitting and not resistant against smaller airborne particles. The respirators, referred to as N95 masks in the United States and filtering facepiece (FFP) in the United Kingdom, protect the user against smaller airborne particles in aerosol-generating procedures.[32] The National Health Service guideline recommends the use of FFP-3 respirators for aerosel generating procedures. FFP-2 respirators are recommended for level 2 PPE during nonaerosol-generating procedures.[32,33] Moreover, according to the CDC guidelines[34]:

- A N95 respirator or a respirator that offers a high level of protection e.g. other disposable filtering facepiece respirators, powered air-purifying respirator, or elastomeric respirators should be used during aerosol-generating procedures on patients assumed to be noncontagious.
- Respirators should be used as part of a respiratory protection program that includes medical evaluation, training, and fit testing. It should be noted that it is not known whether respirators with exhalation valves provide source control.
- If a respirator is not available for use during an aerosol-generating procedure, both a surgical mask and a full-face shield should be worn. Make sure that the mask is approved by the US Food and Drug Administration as a surgical mask. Use the highest level of surgical mask available.
- Aerosol-generating procedures should not be performed if a surgical mask and a full-face shield are not available.

A surgical mask would suffice for the office staff working outside of the operatory room.[35] Ideally, respirators should be changed after visiting each patient. Also, they need to be changed if damaged, or contaminated with blood, respiratory or nasal secretions, or other body fluids.[36] Long-term use of a mask is only allowed when all patients have the same type of virus, and risk of cross-contamination is nonexistent. However, this is not the case in a dental office, since some patients may be healthy. Thus, reuse and extended use of a mask are not recommended in a dental office setting.[37]

2.6.4 | Safety glasses or face shields

Analysis of conjunctival samples of suspected and definitive cases of COVID-19 revealed that the routes of transmission are not limited to the respiratory tract only,[38] and COVID-19 can also be transmitted via contact with the ocular conjunctiva,[39] which can be easily contaminated by droplets. Thus, safety glasses or face shields should be necessarily used during the treatment procedure and cleaned and disinfected between patients.

2.7 | Additional points to remember

2.7.1 | Disinfection of surfaces in the operatory room

Surfaces should be effectively disinfected with appropriate hospital grade disinfectants such as sodium hypochlorite. Regarding the hospital grade disinfectant, there are different concentrations proposed for different uses, and product manufacturer's directions should be followed regarding concentrations and exposure time. For example, a 1:10-1:100 dilution of 5.25-6.15% sodium has been recommended for decontaminating blood spills.[40,41] It is imperative to disinfect the frequently touched surfaces such as the door knobs, tables, and light switches. Several disinfecting agents are used for this purpose including alcohols, hydrogen peroxide, benzalkonium, or sodium hypochlorite. Evidence shows that disinfecting agents containing 62-71% ethanol or 0.1% sodium hypochlorite can eliminate the coronavirus from the surfaces if used for 1 minute.[12]

The standard cleaning protocol should include initial cleaning of contaminated or potentially contaminated surfaces by using a combination of water and irrigating solutions. This is performed to ensure elimination of organic materials from the surface. Evidence shows that presence of organic residues compromises the optimal efficacy of disinfecting agents. After initial cleaning, surfaces should be disinfected with an Environmental Protection Agency (EPA)-registered, hospital grade disinfectant for sufficient time depending on the product.[42,43] The instruments and equipment should be disinfected according to the manufacturers' instructions or the WHO instructions for reuse of medical and dental equipment. Since coronavirus is not able to survive more than 30 minutes at temperatures above 56°C, the common sterilization protocols are still effective for the prevention of cross-infection.[44] These protocols suggest sterilization of critical and heat-tolerated semicritical instrument. Reusable semicritical items that are not sterilized should be processed with high-level

disinfection and cleaning is enough for noncritical instruments; however, when a noncritical item is spattered with blood or touched with a contaminated glove or hand, it should be cleaned and disinfected.[45] The disinfection protocol for instruments and equipment includes the use of antiviral solutions containing 70% ethyl alcohol. However, use of disposable instruments and equipment should be prioritized especially for suspected and confirmed patients. If not possible, all equipment should be disinfected between patients as explained earlier.[42]

2.7.2 | Use of mouthwashes

Rinsing antimicrobial mouthwashes preoperatively can decrease the microbial load in the oral cavity.[46] The mean salivary viral load is reportedly 3.3×10^6 copies per milliliter.[39] Use of antiseptic mouthwashes can only decrease the viral load but cannot eliminate the virus from the saliva.[24] According to the National Health Commission of the People's Republic of China, chlorhexidine, which is routinely used in dental procedures, may not be effective against the coronavirus. Thus, since the coronavirus is sensitive to oxidation, mouthwashes containing oxidative agents such as 1% hydrogen peroxide or 0.2% povidone iodine are recommended to decrease the oral and salivary viral load.[47] Evidence shows that SARS and MERS are highly sensitive to povidone mouthwash.[48]

2.7.3 | Dental radiography

Intraoral radiographs should not be requested due to the stimulation of saliva secretion and coughing. Intraoral radiography can be replaced with extraoral radiography such as panoramic radiography or cone-beam CT.[7]

2.7.4 | Minimizing the aerosols

Dental clinicians are recommended to avoid procedures that generate droplets or aerosols such as the use of three-way syringes, high-speed handpiece, and ultrasonic scalers, as much as possible or minimize their application.[19] Evidence shows that ultrasonic scalers, irrespective of their type, generate much higher amounts of aerosols compared with manual curettes.[49] Also, novel caries removal modalities such as chemomechanical methods are preferred to minimize the generation of aerosols. Use of such painless alternatives has gained the spotlight in the recent years. At present, materials such as Carisolv, Caridex, and Papacarie are used for caries removal. No significant difference has been reported in caries removal efficacy of Carisolv and the conventional rotary method, although the former method takes more time. Considering the fact that children comprise a large portion of emergency cases, these modalities can be considered as the modality of choice for caries removal due to the painless nature of such treatments, and not generating aerosols.[50]

The low-volume or high-volume saliva ejectors and rubber dam can decrease the generation of droplets and aerosols.[7,24] Use of rubber dam in aerosol-generating procedures (such as the use of high-speed handpiece and ultrasonic scalers) can significantly decrease the generation of saliva- or blood-contaminated aerosols. However, it should be noted that in case of placing a rubber dam, a high-volume saliva ejector should also be used along with a conventional saliva ejector.[44] Evidence shows that use of rubber dam during cavity preparation can decrease the spread of microorganisms by 90%.[51] Another effective measure is to use high-speed anti-retraction handpiece,[43] which can significantly decrease the backflow of oral bacteria and Hepatitis B virus into the handpiece tubes and dental unit, compared with handpieces without anti-retraction.[52]

2.7.5 | Pharmaceutical therapy

Pharmaceutical therapy, comprising antibiotics and analgesics, is recommended for patients suspected for COVID-19 who are detected during the screening process to alleviate their symptoms to some extent. Ideally, therapeutic interventions should be postponed until recovery. It should be noted that pharmaceutical therapy should be based on the most recent, updated information to use safer medications. There are some claims regarding the contraindication of ibuprofen for COVID-19 patients due to its interference with the immune function. Acetaminophen is recommended as an alternative for such cases.[19] The correlation of nonsteroidal anti-inflammatory drugs (NSAIDs) and respiratory and cardiovascular syndromes has been well confirmed. However, evidence is inconclusive regarding the contraindication of NSAIDs for COVID-19 patients. Thus, as a precautionary act, care must be taken not to use them as the first line medication.[53] Another important topic is the administration of injectable steroids, which should be avoided as much as possible particularly for the elderly and patients with underlying conditions in COVID-19 pandemic.[54]

2.8 | Dental perspectives in future crises

Great advancements have been made in digital dentistry in the recent years particularly in restorative dentistry.

Digital dentistry has many strength points with regard to infection control as well. For instance, digital intraoral impressions eliminate the need for use of an impression tray or dental impression materials. Resultantly, the risk of gag reflex and coughing of patient would be eliminated. Digital impressions also eliminate the risk of contact with contaminated trays and minimize the risk of infection transmission and cross-contamination as such. Also, they decrease the number of treatment sessions, which also lowers the risk of contracting a disease. During the COVID-19 pandemic, digital dentistry can greatly help in emergency management of dental patients whose temporary restorations are lost. A new restoration can be easily fabricated for such patients within one session with minimal contact with the patient or even by using the previous scan of the patient, if available.

The recent technological advances also led to the advent of robotic dentistry, which has greatly advanced in different fields such as endo micro robot, surgical robot, and robotic dental drilling.[55] In 2001, a teleoperated, human-controlled robot successfully eliminated caries, performed a crown preparation, and performed an endodontic treatment.[56] Also, in 2017, a robot successfully placed two dental implants with 0.2-0.3 mm accuracy for an actual patient under the supervision of a clinician.[56] Some concerns still exist regarding the efficacy of digital technology to offer customized treatments based on individual patient needs. However, it appears promising for later use in certain circumstances such as global pandemics of infectious diseases.

Another promising field is the pharmaceutical treatment of dental pain. At present, NSAIDs are commonly prescribed for dental pain management, which can have side effects for many patients or drug interferences in case of pandemics. Some novel medications such as nociceptive temperature-sensitive receptors-targeting drugs have shown promising results so far but require further clinical investigations.[57]

Thus, occurrence of events such as the COVID-19 outbreak can encourage the dental researchers to focus on novel dental approaches. This can be done by benefitting from the other fields of science to come up with some strategies to provide dental care under such circumstances and minimize the impact of such occurrences on dental care of patients.

2.9 | Summary

This article comprehensively discussed all phases of patient management from admission to completion of treatment in detail. The emergency cases should be detected via a primary interview over the phone or online. Next, the patients should be divided into three groups of (a) apparently healthy, (b) suspected for COVID-19, and (c) confirmed for COVID-19, by screening questionnaires for COVID-19. Separate waiting and operating rooms should be assigned to each group of patients to minimize the risk of disease transmission. Moreover, the same protective measures with regard to PPE for the dental clinicians and staff should be considered for all groups. Therefore, private offices can choose their target group/groups based on their equipment (i.e., separate waiting and operating rooms for each group).

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest that could be perceived as prejudicing the impartiality of the research reported.

AUTHOR CONTRIBUTIONS

Study concept and design: Falahchai and Hasanzade. Drafting of the manuscript: Falahchai, Hemmati, and Hasanzade. Analysis and interpretation of data: Falahchai, Hemmati, and Hasanzade. Critical revision of the manuscript for important intellectual content: Falahchai and Hasanzade.

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