

Coronavirus Pandemic

Preparing dental schools to refraction safely during the COVID-19 pandemic: an infection prevention and control perspective

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Abstract

In late 2019 a novel coronavirus named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) emerged in China and spread throughout the world over a short period of time causing a pandemic of a respiratory disease named coronavirus disease 2019 (COVID-19). SARS-CoV-2 is easily transmitted from person to person through respiratory droplets and direct contact. The scarce available data indicate that dental healthcare personnel are at increased risk for acquisition of infection. Following the lockdown lifting, dental schools should be prepared to refraction safely and provide essential educational and healthcare services while protecting their students, patients, and personnel. The generation of aerosols in dental practice, in association with the high-transmissibility of SARS-CoV-2 through aerosol-generation procedures, the simultaneous provision of dental services to patients in the same areas, and the fact that asymptomatic and pre-symptomatic infected persons may transmit the virus, render the implementation of specific infection prevention and control measures imperative for dental schools. Herein we review the few evidence-based data available to guide infection prevention and control measures for COVID-19 in dental schools.

Key words: SARS-CoV-2; COVID-19; aerosol; dentists; healthcare personnel; students.

J Infect Dev Ctries 2021; 15(1):22-31. doi:10.3855/jidc.14336

(Received 09 November 2020 – Accepted 14 December 2020)

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Introduction

In late 2019 a novel coronavirus named severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) emerged in China and subsequently spread globally causing a pandemic of a disease named coronavirus disease 2019 (COVID-19) [1]. As of December 6 2020, nearly 66 million cases and 1,5 million deaths have been notified globally [1]. During the pandemic healthcare systems in several countries faced a considerable surge demand and healthcare personnel were disproportionately affected [1-4]. Although there are cases of inadvertent aerosol exposure to COVID-19 cases in dental settings [5], to the best of our knowledge, there is only one report of dentists being occupationally infected with COVID-19 [6]. In this report dentists accounted for six out of 24 fatalities due to COVID-19 that occurred among healthcare personnel in Indonesia [6].

The practice area of dental schools has characteristics that necessitate enhanced infection prevention and control measures to limit the

introduction, spread and exposure to SARS-CoV-2 of patients, dental students, academic, and supportive personnel. Considering, first, the aerosol-generating procedures (AGPs) that are common in many dental procedures [7]; second, the high risk of transmission of SARS-CoV-2 virus through AGPs [8-10]; third, the frequently simultaneous examination and treatment of dental patients in the same practice area; and forth the fact that both symptomatic and asymptomatic infected persons can transmit SARS-CoV-2, the issuance and implementation of specific guidelines to prevent and minimize the risk of the spread of infection is necessary. Healthcare academic schools have the ethical and legal duty to protect their students, patients, staff and personnel, based on the principal of “do not harm” but also on the principal of “zero tolerance to healthcare-associated infections” that should embed the modern healthcare services [11].

The aim of this article is to provide an evidence-based overview of infection prevention and control of COVID-19 for the safe operation of dental schools,

having as priority to protect the students, patients, and personnel.

Methods

The websites of international and national public health organizations were assessed through July 6 2020 for data relevant to infection prevention and control for dental schools during the COVID-19 pandemic. A PubMed search was performed using combinations of the words “COVID-19”, “SARS-CoV-2”, “dentistry”, “dental school”, “dentist”, “student”, “infection control” and “AGPs”. The articles were selected based on their relevance. As SARS-CoV-2 emerged recently, evidence to guide the refunction of dental schools is scarce or non-existent. Much of the current recommendations are based on the latest information regarding SARS-CoV-2 transmission, detection and survival in the environment, and infection prevention and control in healthcare settings. The list of references was updated after the first round of review.

Environmental and infection control aspects of SARS-CoV-2

COVID-19 is easily transmitted through respiratory droplets and direct contact. Asymptomatic and presymptomatic persons can also transmit the virus [12-14], while the highest viral load is near the onset of symptoms [15]. Although there are data highlighting the transmission dynamics of SARS-CoV-2 in various healthcare settings [3,12], to the best of our knowledge, there are scarce data about the transmission of SARS-CoV-2 in dental healthcare settings. Dental practice is a profession at high-risk for exposure to SARS-CoV-2, given the close face-to-face contact with the patients’ oral and nasal cavities, his saliva, blood and upper respiratory tract fluids, the handling of sharp instruments, and the frequent AGPs in many dental procedures [16].

SARS-CoV-2 particles can remain infectious on various materials and in aerosols in indoor environments [17], with the duration of infectivity depending on temperature and humidity. Although, transmission through fomites has not been documented, a relevant possibility exists [17,18]. The common practice of simultaneous performance of AGPs and subsequent exposure to aerosols within the same confined area during dental practice, may render all engaged persons (patients, students, academic and supportive personnel) at risk for infection. A study by Rautemaa *et al.* showed a significant contamination with bacterial-contaminated aerosols from the oral cavity at distances up to 2 m from the patient, and

practically in the whole dental room [19]. In this study, the dental rooms had 6 and 12 air changes per hour (ACH), according to their dimension (medium and large), respectively. The bacterial density was higher in the more remote sampling points [19].

A recent comprehensive review of 11 studies of oral surgery explored the risk of contamination (microbiological, visible and imperceptible blood) to patients, dental personnel and/or clinical environment and found that the risk of contamination and spread was increased by proximity to the operator site, longer duration of treatment, higher procedural complexity, non-use of an extraoral evacuator and areas involving more frequent contact during treatment [20]. However, viruses were not considered in these studies [20]. In another systemic review of 62 studies on bio-aerosols in healthcare, including the dental environment showed that dental hand pieces generate aerosols, along with other healthcare interventions and cleaning procedures [21]. In particular, 17 studies analyzed the microbial composition in dental settings by using various culture techniques, and found a heterogenous microbiological composition, consisting of 16 bacterial and 23 fungal species; none of the studies on dental settings looked for viruses or parasites [21]. Overall, only few studies found that AGPs in a dental setting resulted in transmission of infectious diseases. In one case study a patient infected with *Legionella pneumophila* developed septic shock and died [22]. Lastly a study in a dental clinic reported the acquisition of herpes simplex virus (HSV) type-1 by dental healthcare personnel during the treatment of a patient with active HSV-1 infection [23].

Regarding SARS-CoV-2 in aerosols, there is scarce available data. In a recent study investigating the transmission dynamics of aerosols by measuring viral RNA in aerosols in different areas of two Chinese hospitals during the COVID-19 epidemic, found very low concentrations of SARS-CoV-2 RNA in aerosols in isolation wards and ventilated patient rooms, but higher in the toilet areas used by patients [24]. Also, some medical staff areas initially had high concentrations of SARS-CoV-2 RNA however these levels were almost unnoticeable after meticulous cleaning and disinfection procedures [24]. Although the infectivity of the virus detected in these hospitals has not been proved, the transmission of SARS-CoV-2 through aerosols is possible. The study also showed that appropriate room ventilation, open space, cleaning, and disinfection procedures effectively limit the concentration of viral RNA in aerosols [24]. In a study conducted in a hospital in Iran, air samples collected at a distance 2-5 m from

the bed of patients with COVID-19, were tested negative for SARS-CoV-2 [25]. Nevertheless, the researchers suggest further experiments using actual patient cough, sneeze, and breath aerosols in order to investigate the possibility of generation of the airborne size carrier aerosols and the viability fraction of the embedded virus in those carrier aerosols [25]. In contrast, another study with experimentally generating viral aerosols, compared the short-term efficiencies of SARS-CoV-2 to SARS-CoV and Middle East respiratory syndrome coronavirus and found that SARS-CoV-2 generally maintains infectivity at a respirable particle size over short distances and virion integrity for up to 16 hours, in contrast to the other two coronaviruses [26]. These data indicate that SARS-CoV-2 is resilient in aerosol form, and aerosol transmission of SARS-CoV-2 may be a more important transmission route than previously considered, given the continuous production of aerosols by humans [26]. As until now, air sampling in hospitals with COVID-19 patients showed virus RNA in some studies but not in others, the possible airborne transmission of SARS-CoV-2 is a field of continuous active research, considering not only the presence of viral RNA but also its infectiousness and its ability of sufficient inoculum to initiate invasive infection [25,27-29].

Furthermore, studies have highlighted the role of ventilation in COVID-19 transmission. In three COVID-19 outbreaks investigations revealed the spread of respiratory droplets carrying SARS-CoV-2 via the airflow generated by the air-conditioning [30].

Continuous training to infection control practices is necessary to achieve adherence to guidelines. A recent systematic review on barriers and facilitators to healthcare personnel' adherence with infection prevention guidelines for respiratory diseases, highlighted that lack of training regarding infection prevention and control practices and how to use personal protective equipment (PPE), contribute to poor implementation of infection prevention and control guidelines [31]. In addition another recent Cochrane review points out the need for PPE training as mean to reduce self-contamination [32].

Principals for preparing dental schools during the COVID-19 pandemic

Considering the risk of exposure to SARS-CoV-2 in dental settings, dental schools should run under a holistic Action Plan which will concern infrastructures, human resources, institutional mechanisms and procedures. The following goals should be fulfilled simultaneously:

- Competency of essential educational and healthcare services
- Prevention and control of transmission of SARS-CoV-2
- Safety of students, patients and dental school personnel

In practice, the safe operation of the dental school will rely on the following:

- Set up of a local task force to manage scientific and operational issues and share decision-making.
- Continuous vigilance to early detect and properly manage a COVID-19 case in the school
- Implementation of dental AGPs with the appropriate procedures to reduce the production of aerosol
- Strict compliance with infection prevention and control measures focusing on hand hygiene, appropriate use of PPE and cleaning/disinfection
- Training of students and personnel in infection control practices
- The Heating Ventilation and Air Conditioning (HVAC) system should fulfill at least the minimum requirements for SARS -CoV-2 in dental settings.

It should be noted that new operative and clinical dental procedures and risk-scoring systems of safety protocols are being currently developed by university dental clinics and hospitals in an attempt to reduce risk for dentists, dental personnel and patients [33,34]. Similarly, there is an increasing number of publications about the benefit of specific interventions on aerosol contamination, however further studies are needed on focusing on respiratory agents such as SARS-CoV-2 [35].

Recommendations for the safe operation of the dental school

General recommendations

A distance of 1.5-2 meters should be maintained for all persons and all settings in the school [36,37]. Patients should strictly come to their appointments at the scheduled time [8]. In order to safeguard social distancing in the waiting room [37], it is recommended that patients remain in the courtyard or in their car, at a mobile phone accessible point, and be notified to enter the facility when the previous patient leaves [8].

Patients should wear a mask upon arrival and during their stay in the school, when entering the school dental

procedures are not performed in them [9,36]. Students and personnel in contact with patients, should wear a surgical mask when they are not in areas where AGPs are performed [8,9,36,37]. Administrative personnel in contact with patients should wear a cloth mask, if a surgical mask is not available [9]. All persons entering the school should be trained about hand hygiene, respiratory hygiene and the proper use of a mask [8,9,36,37]. Patients should be advised to keep their mobile phone in their bag or pocket [10]. All persons should sign an attendance list upon arrival and departure daily in order to facilitate contact tracing, in case a COVID-19 case occurs [8].

Alcohol-based hand rubs (60-95% alcohol) in permanent dispensers, tissues and non-touch receptacles for disposal should always be available at key points in the school (entrance, waiting areas, corridors, workplaces, library, rest areas, etc.) [8,9,36,37]. Frequently touched surfaces (knobs, remote controls, keyboards, monitors, etc) should be covered with disposable membranes and disinfected frequently during the day using a suitable disinfectant [10,36,37]. The membrane should be replaced at the end of the day, from outside inwards [10,36]. Printed material should be removed from the waiting areas [8,10,37].

Limiting the possibility of introduction of SARS-COV-2 in the dental school

Entrance and exit signs should be used for all persons upon entering the facilities of the school [9,37]. The number of persons entering the facilities should be reduced to the minimum [8,37]. Posters informing all persons entering the facilities of the dental school for the COVID-19 pandemic and the appropriate infection prevention and control measures taken, should be placed at key points of the school [8,37].

All patients should be screened by a telephone interview using a standardized questionnaire before attending the dental school (Table 1). In case a patient

needs to be evaluated based on existing imaging tests, it is recommended to send them through e-mail [8,9,37]. In addition, triage for COVID-19 associated symptoms should be implemented for all patients upon entering the school. In case of onset of symptoms compatible with COVID-19, patients should be placed in a separate waiting area, healthcare should be sought and their visit should be postponed [8,9,37,38]. As a rule, all scheduled dental treatments/surgeries of suspected or confirmed COVID-19 cases should be cancelled or postponed [8,9]. In case of a suspected or laboratory-confirmed case of COVID-19 in a student, personnel, or patient, the task force and the public health authorities should be notified immediately in order to trace contacts and implement appropriate control measures to prevent the transmission of infection [8,37]. For the management of people with suspected or confirmed COVID-19, it is recommended that personnel already infected with the SARS-CoV-2 virus be involved [8].

If possible, patients attending the dental school should be tested for SARS-CoV-2 infection by real-time polymerase chain reaction regardless of symptoms, within 72 hours before entering the school. Priority should be given to patients undergoing AGPs [8,37]. It is recommended that molecular testing is repeated, based on the duration of dental treatment of the patient and the current epidemiological trends in the community.

The personnel and the students of the school should monitor their health daily and immediately inform the school officials in case of onset of any symptom compatible with COVID-19 [8,9,37]. In case of onset of symptoms while being in the school, respiratory hygiene measures should be implemented immediately (use of a surgical mask [36,37], coughing or sneezing on a tissue or against the elbow and implementation of hand hygiene after contact with respiratory secretions [32]) and instructions should be given for their immediate removal from the school and their referral to

Table 1. Template for recording medical history information regarding potential exposure to SARS-CoV-2 [8,9,37].

Have you had any of the following symptoms in the last 14 days [8,9,37]?	Telephone		Contact in the dental office	
	Date	/ /	Date	/ /
1. Fever	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Yes <input type="checkbox"/>	No <input type="checkbox"/>
2. Dyspnea	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Yes <input type="checkbox"/>	No <input type="checkbox"/>
3. Cough or throat ache	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Yes <input type="checkbox"/>	No <input type="checkbox"/>
4. Tiredness, headache	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Yes <input type="checkbox"/>	No <input type="checkbox"/>
5. Gastrointestinal symptoms	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Yes <input type="checkbox"/>	No <input type="checkbox"/>
6. Taste or smell loss	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Yes <input type="checkbox"/>	No <input type="checkbox"/>
7. Have you come in contact with a confirmed COVID-19 case?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Yes <input type="checkbox"/>	No <input type="checkbox"/>
8. Do you have any co-morbidity? If yes, please describe:	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Yes <input type="checkbox"/>	No <input type="checkbox"/>

SARS-CoV-2: severe acute respiratory syndrome coronavirus 2; COVID-19: coronavirus disease 2019.

a healthcare facility for assessment [8,9,37] and testing for SARS-CoV-2 [8,37].

Patients should be advised to enter the school with no companion, except for children, people with special needs, elderly patients etc [8,9,37]. The companions should be screened for symptoms (Table 1), and not be allowed to enter the facility if they are symptomatic [8]. In addition, they should be prohibited from entering the dental practice area, especially if there have an underlying medical condition [8,37]. Companions should wear a mask throughout their stay at the dental school [36,37].

Protection of dental healthcare personnel and students

Protection of dental healthcare personnel and students from SARS-CoV-2 is the cornerstone of infection control in the school. Of particular importance is the protection of those at high risk for severe or complicated COVID-19 (e.g. elderly, persons with underlying diseases), including students and personnel [8]. The following measures should be implemented:

- Frequent and meticulous hand hygiene should be practiced and promoted by providing antiseptic solutions (60-95% ethanol) [8,9] in containers with a pump located in key and easily accessible points [8,9,37].
- Physical barriers should be placed to minimize the close contact between patients, students, and personnel during screening upon entering the school and other administrative tasks [9,37].
- The dental school should ensure the adequacy and proper use of personal protective equipment (PPE), with special emphasis during dental AGPs [8,9,36,37]. The donning and doffing should be done according to the instructions.

During the examination or assessment of the patient, the following PPE should be used:

- Scrubs
- Surgical mask
- Single-use examination gloves
- Eye protection (goggles or face shield) depending on the risk assessment

For working in the laboratories, the appropriate PPE consists of:

- Scrubs
- Surgical mask
- Disposable gloves, if necessary

When performing AGPs, students and personnel should wear [8,9,36-38]:

- Scrubs

- Clean non-sterile waterproof gown with long sleeves with cuffs
- Respirator (FFP2 / FFP3 / N95 / KN95)
- Eye protection (goggles or preferably face shield).
- Hood
- Disposable gloves (sterile, depending on the procedure)
- Indoor work shoes (preferably plastic surgical shoes) that are cleaned regularly

It is recommended that PPE (except gloves) are not changed from patient to patient, but be used throughout the working hours allotted to the student or personnel. On top of the waterproof gown, the following may be worn:

- Detachable cuffs over sleeves and a disposable plastic apron, which should be changed from patient to patient or
- a non-woven thin gown with long sleeves and a plastic apron which should be changed from patient to patient

The number of people should be kept to a minimum during AGPs [9,36,37].

Training of dental healthcare personnel and students

A survey conducted from March to April 2020 among 2,045 dental academics in 26 countries found significant gaps in knowledge of COVID-19 symptoms (knowledge score: 53.1%) [39]. Moreover, two recent surveys among dental students and faculty members in a Jordan University and a University in Emilia-Romagna, an Italian region highly affected during the COVID-19 pandemic, revealed a high rate of perception of exposure to COVID-19 during clinical training activities, especially when performing AGPs [40,41].

The ongoing COVID-19 pandemic constitutes a unique opportunity for dental schools to provide in-field training about infection control to dental students. This is of utmost importance, given the fact that SARS-CoV-2 most probably will become endemic. Training should be provided to students of all levels at the beginning of academic courses and in particular to those involved in clinical practice, and should be incorporated in the curriculum of the dental school, along with training about other occupational risks (e.g. blood-borne infections). A period of two months for training dental students in advanced safety protocols was needed while reopening the Dental School of the University of Athens in Greece following the lockdown lifting [42]. A recent model-based study showed that,

considering the available evidence on effectiveness of PPE, the annual probability for a dental personnel to acquire SARS-CoV-2 infection, develop symptoms and die from the infection was 1:13,000 (0.008%) for dental personnel working in a medium size United States city during the peak of the pandemic [43]. A prospective study of 2,810 patients treated over a 6-month period under enhanced infection control and appropriate PPE in three dental offices in New York during and shortly after the peak of the pandemic, showed no transmission of COVID-19 to the dental healthcare workers or patients [44]. Such information should be communicated to dental students as well as to faculty personnel and staff.

Infection control measures: general instructions

Standard precautions should be applied in all patients. These include hand hygiene and respiratory hygiene, use of appropriate PPE following risk assessment, proper management of sharp objects, safe waste management, proper linens, environmental cleaning and disinfection and/or sterilization of patient-care equipment [8,9,36,37]. The proper and systematic use of appropriate PPE and hand hygiene are crucial for limiting the spread of microorganisms [8,9,37]. Students and personnel should be trained on the indications and type of appropriate PPE, the process of its donning and doffing, as well as its proper disposal or management, according to the dental work performed and the manufacturer's instructions [8,9,37]. Long or extra nails, jewelry, watches, badges and mobile phones should be avoided during dental work [10]. In case a mobile phone should be used, it should be covered with a transparent film, which should be replaced at the end of the working hours, while in meantime it can be disinfected with alcohol-impregnated wipes (70-90% ethanol) [10].

Personnel and students in contact with patients for assessment or interventions, should apply droplet, contact and aerosol precautions [8], in addition to standard precautions, depending on the intervention and following risk assessment [9,36,37].

Dental treatments

Before a treatment session, it is recommended that the patient's oral cavity be rinsed with a 1-1.5% hydrogen peroxide solution for approximately 30 sec, in order to minimize the viral load [8]. Mouthwashes with solutions that contain chlorhexidine are not effective against SARS-CoV-2 [8,45]. AGPs should be avoided if possible. If such procedures are absolutely necessary, then the use of the rubber dam technique is

strongly recommended [8,9]. The generation of aerosols should be avoided during the removal of fixed restorations. The use of high volume evacuation (suction) is recommended when AGPs are implemented [8,9]. There should be technical maintenance and monitoring of the suction devices as any leakage at the junction could result in environmental dispersal and contamination. The use of the 3-in-one syringe, which makes forcible ejection of water/air, should be minimized [8,9]. If possible, it is suggested that a double surgical suction be used, one for the patient's saliva and one for the ejected water, at least during the use of the air-water syringe [8]. A 4-handed technique should be applied, so that the suction and other dental work are performed faster and the aerosol production and potential exposure time are minimized [8,9]. It is recommended to use resorbable sutures to avoid a follow-up visit for removing them [8]. Panoramic radiographs or cone beam computer tomography scans should be preferred in order to avoid the stimulation of saliva production and cough, which may be caused by the classic intraoral dental radiographs [8].

Ventilation

AGPs should be performed under negative pressure if possible [37,38]. The collaboration of the school task force with engineering/technical services is crucial in order to draft guidelines for the protection of the staff and the patients, in relation to the existing HVAC system [45]. Consider after a HVAC professional consultation the ability to:

- safely increase the percentage of outdoor air supplied through the HVAC system
- increase filtration efficiency to the highest level compatible with the HVAC system [46]

If the HVAC system has no high efficiency particulate absorbance/air (HEPA) filters, it is recommended to use mobile air filtering units with HEPA filters close to patient care areas [47]. Place the HEPA unit close to patient's chair, but not behind the dental healthcare personnel. Ensure that the dental healthcare personnel are not positioned between the unit and the patient's mouth. Position the unit to ensure that it does not pull air into or past the breathing zone of the healthcare personnel [46]. It is not yet known how long the air may remain infectious in areas without negative pressure [37]. The latter depends on several factors, like:

- room size
- number of ACH
- number of people in the room

- time that people spend in the room
- persons with strong cough or sneezing
- intensity and production rate and the quantity of the aerosol produced

The potential infectiousness of the air decreases from 100% to less than 1% within 30 minutes for a space with 10 to 12 ACH and within 1 hour for spaces with 6 ACH [36,48]. In close circuit ventilation systems the air may be recirculated only if continuous filtering and cleaning through HEPA filters has been secured. Otherwise, air recirculation should be eliminated [10,47]. The areas with natural ventilation, where patients are examined, should be aired/ventilated adequately/sufficiently [37].

Cleaning, disinfection of surfaces and equipment and sterilization of dental tools

General recommendations

The systematic and appropriate cleaning of surfaces and objects, using the standard procedures (use of detergent and water and scrubbing) and their subsequent disinfection is crucial [10,36,37,49,50]. Spraying or fogging of spaces for disinfection is not recommended [51].

- The basic cleaning and disinfection practices are valid and should be implemented regarding specifically:
- the method of cleaning and disinfection, including the use of appropriate personal protection, on a case-by-case basis
- the types/categories and quantities of cleaning and disinfection products that are used depending on the application time, t, the surface or the equipment to be cleaned and disinfected and the required level of disinfection (high, medium, low)
- the management of the cleaning equipment
- the training of the staff
- All surfaces that are potentially infected should be first cleaned using a neutral detergent and water and sufficient scrubbing and then, after drying, they should be disinfected, depending on the material's compatibility with the disinfection product, with:
- A disinfection product with demonstrated action against enveloped viruses, which is approved by the relevant competent authorities, in accordance with the manufacturer's instructions and national legislation regarding the appropriate application time and the safe use of the product,

or

- A fresh hypochlorite solution at a final concentration of 0.1-0.5% (1000 ppm - 5000 ppm available chlorine) for at least 1 min, depending on the area, the desired disinfection level and the procedures established in the school.
- In the case that the initial hypochlorite concentration is 5%, the final concentration of 0.1% (1000 ppm available chlorine) can be achieved by a 1:50 dilution (20 mL: 1000 mL). Respectively, the final concentration of 0.5% (5000 ppm available chlorine) is obtained by a 1:10 dilution (100 mL: 1000 mL).
- In case that the initial concentration of the hypochlorite solution is other than 5%, the calculation of the appropriate dilution in order to achieve a final concentration of 0.1-0.5% (1000 ppm - 5000 ppm available) can be accomplished with the following formula [51,52]:

$$\frac{H(i)}{H(df)} - 1 = WT$$

Where: H(i) = % initial hypochlorite concentration; H(df) = % final hypochlorite concentration desired; WT = Total parts of water for each part of initial hypochlorite solution.

or

- Ethanol-based solutions (70-90% ethanol) applied for at least 1 minute [10,51]

Cleaning, disinfection and sterilization of dental tools between patients

After each session, all surfaces that the patient may have touched within a distance of 2 meters should be cleaned and disinfected [8,9]. All instruments and the nozzles of the air syringes should be sterilized after each patient [8,9].

Environmental cleaning and disinfection at the end of the day

All surfaces around the dental desk/ dental operatory should be disinfected and the floors should be mopped using an appropriate cleaning/disinfecting solution [8,9,37].

Cleaning personnel

The cleaning personnel should be trained in the cleaning and disinfection procedures, the rational choice of proper PPE, and donning/doffing procedures [36]. The appropriate PPE should be used in areas

where AGPs are applied. If the area has been aired/ventilated for more than 1-3 hours [10] since the last time an AGP was applied, then the high respiratory protection mask could be substituted with a surgical mask [10,36]. In all other areas the cleaning personnel should wear their regular work uniforms, surgical mask and gloves, as needed [10,36]. Additional PPE, like goggles or a water resistant apron, may be needed during the preparation of cleaning/disinfection solutions, depending on the cleaning/disinfection solutions used and the cleaning/disinfection procedure followed, especially if there is a risk of splashing [52].

Waste management

All patient-related waste should be considered as infectious and should be managed in accordance with the relevant procedures and the national legislation [9].

Returning home after a day in the school

In order to prevent transmission of SARS-CoV-2 to household members and the community, the personnel and the students should remove the scrubs and other clothes should be worn to return home [8]. The work uniform should be removed with gentle movements and should be washed separately at 60°-90°C [8]. The clothes worn from and to their house should also be washed separately. The cleaning personnel should immediately shower after returning home.

Preparedness for the influenza season

Influenza vaccination of healthcare personnel is a major component of the preparation of healthcare facilities for the 2020-2021 influenza season, given the possibility of co-circulation of influenza and SARS-CoV-2 [53]. A campaign to promote influenza vaccination among dental healthcare personnel should be organized in the school and vaccination should be offered on site and free-of-charge [11]. Dental students should be considered as healthcare personnel and therefore should be offered influenza vaccination [11].

Lastly, according to the World Health Organization, the United States Centers for Disease Control and Prevention and other public health authorities globally, healthcare personnel constitute a high-priority group for vaccination against COVID-19. The rationale for this relies on the need first to directly protect them and second to minimize the disruption of healthcare services because of healthcare personnel' absenteeism and outbreaks [54,55]. Dental schools should ensure that all dentists, dental students and personnel involved in AGPs get the COVID-19 vaccine, once it is available. Communication of the expected benefits and vaccine

safety is of utmost importance for achieving high compliance rates with the recommendations to get vaccinated.

Logistic issues

Any requirement for increased storage capacity (i.e. for alcohol solutions, PPE) should be addressed [42].

Conclusions

COVID-19 is an emerging, easily transmitted disease through respiratory droplets and direct contact. Dental schools should protect their students, patients, and personnel while providing essential educational and dental healthcare services. Further research regarding AGPs in dental practices during the COVID-19 pandemic is needed in order to elucidate their role on the occupational transmission of SARS-CoV-2.

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Conflict of interests: No conflict of interests is declared.