RSBO

ISSN:
Electronic version: 1984-5685
RSBO. 2021 Jul-Dez;18(2):317-28

Literature review article

COVID-19 pandemic: brief recommendations in dental practice

Liana Cristina Melo Carneiro[1]
Patrícia Costa de Souza Sá[1]
Leilismara Sousa Nogueira[1]
Maria das Graças Carvalho[1,2]
Melina de Barros Pinheiro[1]

Corresponding author:
Melina de Barros Pinheiro
Universidade Federal de São João del-Rei, Campus Centro-Oeste Dona Lindu
Rua Sebastião Gonçalves Coelho, 400, Bloco D, sala 308.1 – Chanadour
CEP 35501-296 – Divinópolis – MG – Brazil
E-mail: melinapinheiro@ufsj.edu.br

[1] Universidade Federal de São João del-Rei, Campus Centro-Oeste Dona Lindu – Divinópolis – MG – Brazil.
[2] Universidade Federal de Minas Gerais, Faculty of Pharmacy, Department of Clinical and Toxicological Analysis – Belo Horizonte – MG – Brazil.

Received for publication: August 25, 2020. Accepted for publication: April 20, 2021.

Keywords:
COVID-19; security measures; dental care.

Abstract

Introduction: The SARS-CoV-2 virus, which causes COVID-19, can be transmitted directly, by contact and by air. In this context, dental practice presents risks of contamination, as it involves very close communication between professional and patient, frequent exposure to saliva, blood, and other body fluids, as well as aerosols and droplets generated in oral procedures. **Objective:** Aiming to contribute to increase the professionals and their patients' safety, the purpose of this review was to conduct a brief overview of SARS-CoV-2 infection, its pathogenesis, diagnosis, transmission, and control routes in dental practice, in addition to recommendations for clinical care. **Material and methods:** The bibliographic search was performed using the descriptors "COVID-19", "security measures", and "dental care" in the databases: PubMed, MEDLINE, Latin-American and Caribbean Health Sciences (Lilacs) and Scientific Electronic Library Online (SciELO), without language restriction and published between 2000 and 2020. **Results:** The review of the scientific literature revealed that a careful anamnesis of the patient should be performed before any dental treatment. However, in the face of the current pandemic, if it is not possible to postpone dental intervention, procedures should be performed following recommendations that aim to decrease the generation of aerosols and droplets seeking to increase individual protection. **Conclusion:** According to the current context and scenario, the universal measures of infection control must be maintained, reviewed, and reinforced during any dental care. Further studies are needed to investigate and validate additional protective measures not only for dental professionals, but also for their patients.

Introduction

Coronavirus (CoV) are part of a large family of viruses, Coronaviridae [61], and can cause infections in humans of varying severity, three of which are responsible for epidemic diseases: severe acute respiratory syndrome (SARS), caused by the coronavirus of severe acute respiratory syndrome (SARS-CoV) [12], in 2002; Middle East respiratory syndrome (MERS), caused by the coronavirus of the Middle East respiratory syndrome (MERS-CoV) [9], in 2012; and, recently, coronavirus disease 2019 (COVID-19), caused by the coronavirus of severe acute respiratory syndrome 2 (SARS-CoV-2) [70], whose pandemic was declared by the World Health Organization (WHO) on March 11, 2020 [61].

The coronavirus is so named due to its lipoprotein envelope composed of several glycoprotein spikes (protein S) that resemble a crown of spikes [47], which are intimately involved in the interaction with the host cells [67].

As the Coronaviridae family has the largest genome of all RNA viruses, a high frequency of CoV-related recombination leads to the generation of high genetic diversity [47]. However, when comparing the sequence and organization of the SARS-CoV and SARS-CoV-2 genome, more similarities than differences have been revealed. Based on these similarities, it is predicted that the patterns and modes of interaction between SARS-CoV-2 and host antiviral defense would also be similar [14]. However, SARS-CoV-2, in comparison with SARS-CoV and MERS-CoV, shows greater infectivity, but less virulence, being the first virus less pathogenic in terms of morbidity and mortality [17].

Sources of transmission of SARS-CoV-2 currently known include direct transmission (coughing, sneezing and droplet inhalation), by contact (with oral, nasal and ocular mucous membranes) and by air (*e.g.*, aerosols formed during medical/dental procedures) [33, 40]. Although symptomatic patients are primarily responsible for SARS-CoV-2 transmission, the virus can also be transmitted by asymptomatic carriers, as well as by patients with mild and nonspecific symptoms who are usually not diagnosed [14].

Furthermore, common protective measures in daily clinical work are not effective in preventing the virus spread, especially when patients are in the incubation period and do not yet know they are infected, or choose to hide their infection [36].

Therefore, in COVID-19 pandemic context, several aspects of dental care deserve attention, since the provision of such services leads to a risk of SARS-CoV-2 infection when oral health care is required and cannot be postponed.

Thus, the objectives of this review were to explore and present the main findings based on the scientific literature about the necessary care in dental practice, in order to minimize the risks of SARS-CoV-2 transmission. We believe that, by addressing this topic in a brief, simple and concise manner, we will be contributing to facilitate the adoption of protective measures against the spread of COVID-19 in the scope of dental care.

SARS-CoV-2 pathogenesis and clinical manifestations of COVID-19

The development of COVID-19 depends on the interaction between SARS-CoV-2 and the host immune system. The infection begins when virus S protein binds to a human host cell that expresses angiotensin-converting enzyme II (ACE2) receptor. After this binding, the viral envelope fuses with the cell membrane, and viral RNA is released into the cytoplasm [17, 50]. Thus, the distribution and expression of ACE2 receptor in human tissues could signal possible routes of SARS-CoV-2 infection and, consequently, indicate the organs most affected by the disease due to the greater cellular expression of this receptor, such as lung, esophagus, heart, and kidneys. However, there are reports in the literature that the virus ability to bind to the human ACE2 receptor is weak [29].

It is emphasized that the oral cavity mucosa can be a potentially high-risk pathway for SARS-CoV-2 infection, since ACE2 receptor is expressed in it and can vary according to the location, being higher in the tongue than in the oral and gingival tissues [64, 66]. A possible increased risk of SARS-CoV-2 invasion in oral tissues is related to the expression of furin protein in the tongue, which is also highly expressed in the lungs. Furin has been responsible for facilitating virus infection by cleaving glycoproteins from the viral envelope, intensifying infection in host cells [66].

In addition to damage caused by direct action of virus in the body, the response of immune system is also of great importance in the severity of COVID-19 cases. Some patients with COVID-19 have increased plasma levels of pro-inflammatory cytokines and chemokines (IFN-α, IFN-γ, IL-1β, IL-6, IL-12, IL-18, IL-33, TNF-α, TGFβ, etc.), leading to the so-called cytokine storm and inducing a hyperinflammatory state characteristic of the evolution of pneumonia caused by the virus, which can lead to multiple organ failure and even death [28, 43].

Due to SARS-CoV-2 tropism by alveolar epithelial cells, respiratory and nonspecific symptoms are the most common [68, 69]. Fever, non-productive cough and fatigue are often reported and can progress to respiratory distress [11, 65]. Myalgia, headache, hemoptysis and diarrhea are also described as clinical manifestations, in addition to other atypical ones, in relation to other coronaviruses, such as upper airway involvement evidenced by rhinorrhea, sneezing and sore throat [43].

Patients with advanced age and comorbidities (such as diabetes, hypertension, and cardiovascular diseases) have a worse prognosis for COVID-19, confirmed by the fact that they represent the majority of registered deaths [10].

Some patients with COVID-19 also often complain of olfactory disorders (anosmia) and taste (dysgeusia or ageusia) [15, 16, 44], which can be explained, in part, by the wide expression of ACE2 receptor in the epithelial cells of oral cavity mucosa, especially the tongue [64].

Symptoms of COVID-19 appear after an average period of virus incubation of 5.2–6.4 days, but with potential for transmission since the asymptomatic period [4, 27]. In addition to asymptomatic patients, children can also transmit the virus, but they have milder and nonspecific symptoms than adults. Therefore, all patients and parents should be considered possible carriers of SARS-CoV-2 [34].

Diagnosis of COVID-19

To date, the methods for laboratory diagnosis of COVID-19 are real-time reverse transcription-polymerase chain reaction (RT-PCR), considered gold standard, which should be performed during acute phase [6]; and serological tests aimed at detecting specific antibody (IgA, IgM and/or IgG) against SARS-CoV-2 or the viral antigen [8]. The last tests should be performed when the availability of molecular tests is limited or if there are at least 14 days after onset of suspicious symptoms.

However, serological tests are less sensitive than molecular ones [67]. Imaging tests, such as high-resolution computed tomography of the chest, can assist in diagnosis [39].

Due to the low availability of tests in many locations and the fact that some patients are asymptomatic, the number of individuals with COVID-19 is underestimated [38, 51]. For this reason, during pandemic, all patients should be considered as potential infected with SARS-CoV-2. Therefore, additional protective measures should be taken considering the potential for transmission during dental practices [45].

Routes of SARS-CoV-2 transmission in the dental clinic

Dental practice presents risks of SARS-CoV-2 contamination because it involves a very close communication between dental professionals and patients, in addition to frequent exposure to saliva, blood, and other body fluids due to characteristics of their procedures. It should be emphasized that the environment of a clinic where dental procedures are performed is greatly exposed to patients' oral fluids. Many dental procedures requiring use of ultrasonic instruments, slow- and high-speed handpieces, and three-way syringes, produce aerosols and droplets that can contaminate the environment [18].

The main sources of human SARS-CoV-2 infection consist of contact with any contaminated surfaces [51] that can later reach the nose, eyes or mouth [49] or through respiratory droplets from infected people (*e.g.*, sneezing, coughing or physical contact). Studies indicate that some materials may be responsible for COVID-19 transmission. According to Van Doremalen *et al*. [56], SARS-CoV-2 proved to be more stable in plastic and stainless steel than in copper and cardboard, having been detected for up to 72 hours after contamination of these surfaces. Another possible source of infection by SARS-CoV-2 is through aerosols present in the environment where infected people have been since high concentrations of viral RNA have already been detected in it [31].

Solid and liquid phases of aerosols have different composition depending on where they are generated. Thus, in the dentistry field, such aerosols may contain bacteria and viruses, in addition to blood elements and organic particles derived from tissue, tooth, saliva, and debris. Therefore, intensity of aerosol contamination in the dental environment depends on factors inherent to the quality of saliva and nasal secretions, existence of oropharyngeal and blood infections, as well as the presence or absence of dental plaques and/or any dental infection [18, 57].

Veena *et al*. [57] reported the existence, from the dental chair headrest, of areas with variable contamination by aerosols and droplets after the ultrasonic scaling procedure. The maximum aerosol contamination was observed on the operator's right arm and the assistant's left arm, and contamination was also identified in the head, chest and internal surface of the facial mask of both. These authors also reported that aerosol cloud remained in the air for up to 30 minutes after the procedure.

There are several other infectious diseases transmitted by air via droplets and aerosols, such as tuberculosis, *influenza*, measles, Ebola and SARS [18, 54]. In the dentistry and orthopedics fields, in which high-speed instruments are used, even blood-borne viruses (such as the human immunodeficiency virus–HIV and hepatitis B) can remain in the air contained in blood splatters generated by these instruments. However, the fact such splatters cause efficient transmission through this route is questionable [54]. The risk of infection caused by droplet inhalation depends on the amount of pathogen carried by the host, the location where the droplets are deposited in the respiratory tract [60], as well as the pathogen virulence and number of organisms transmitted [47].

A comparison between SARS-CoV-2 virus and SARS-CoV virus showed that the viral load of the first in saliva peaked almost at the time of the onset of symptoms, while viral load of the second is reached about 10 days after the symptoms. High viral load of SARS-CoV-2 suggests that it can be transmitted even if symptoms are mild or not evident [66].

Considering that the transmission of SARS-CoV-2 virus occurs from person to person, both professionals and patients can be exposed to the pathogen during dental treatment [20, 36]. Therefore, it is necessary to adopt additional protective measures in order to minimize the risk of contagion.

Infection control and recommendations for dental clinic care

For dental offices and hospitals, the adoption of a strict and effective infection control protocol is mandatory. However, it is important to emphasize that, due to the characteristics of the dental environment, the risk of infection can be high, both for dentists and patients [36, 41].

The process of decontamination of the environments must be done in a thorough manner between the care of each patient. Therefore, a time spacing between appointments is recommended taking into account the type of dental procedure and the generation of aerosol. It is suggested to wait 30 minutes with the windows open after clinical or surgical procedures with aerosol generation to start to disinfect the surfaces [37].

Regardless of outbreaks time, it is essential that dental professionals assess the patients in order to obtain their complete medical history and update it at each return visit. During infectious disease outbreak such as COVID-19, questionnaires used to assess patients must be supplemented by questions designed to screen positive cases for SARS-CoV-2.

Thus, the dentist may postpone elective treatment until the end of the infection's incubation period or offer emergency treatment reinforcing biosafety procedures [36, 47].

It is important to note that, in areas where the disease spreads, non-emergency dental practices should be postponed and routine dental procedures (elective) should be suspended until additional notification is defined according to the epidemic situation [2, 36]. When the dental procedure cannot be postponed, it must be performed following recommendations that aim to reduce the generation of aerosols and droplets, as well as to increase individual protection.

As aerosols and saliva droplets are considered the main means of spreading SARS-CoV-2, the virus can penetrate the lungs by inhalation through the nose or mouth [36, 40]. In this context, some strategies are suggested in an attempt to decrease the production of aerosols and, consequently, the risk of infection in dental offices/clinics [7, 21, 40], as follows:

accommodate patient in the most appropriate position avoiding the air flow;

- use high-speed evacuation systems (HVEs) to reduce the amount of saliva in the oral cavity and stimulate coughing;
- avoid the use of a triple syringe, especially in its spray form;
- regulate output of water cooling the high-speed dental handpiece;
- avoid the use of ultrasonic scaling and sodium bicarbonate jet;
- use rubber dam isolation whenever possible (Figure 1).

However, it is observed that minimizing aerosols and droplets generation during care is variable according to the dental specialty, which may be easier (*e.g.*, orthodontics, stomatology) or more complicated (*e.g.*, prosthetics, endodontics, surgery).

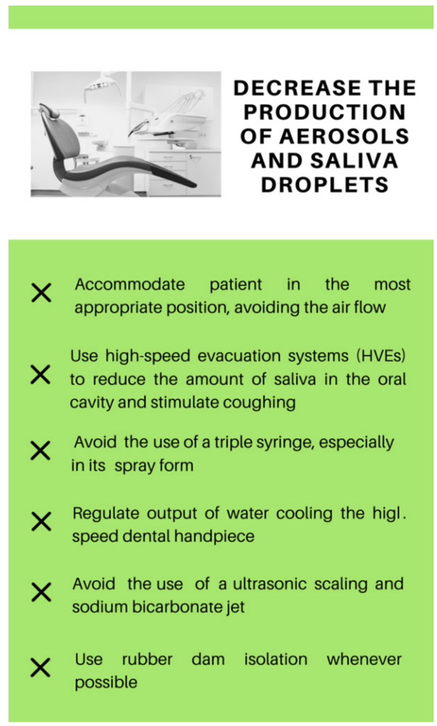

Figure 1 – Recommendations to minimize aerosol production and risk of infection

In the case of individual protection measures, both for health professionals and patients, it is recommended [7, 40]:

- use appropriate personal protective equipment (PPE), sterile or disposable, such as surgical gown, masks/respirators, surgical cap, medical gloves, face shield and/or safety glasses by dentist and his/her assistant;
- provide protection for each patient, such as disposable dental bib;
- use mouthwashes in a rational and individualized way before dental procedures (Figure 2).

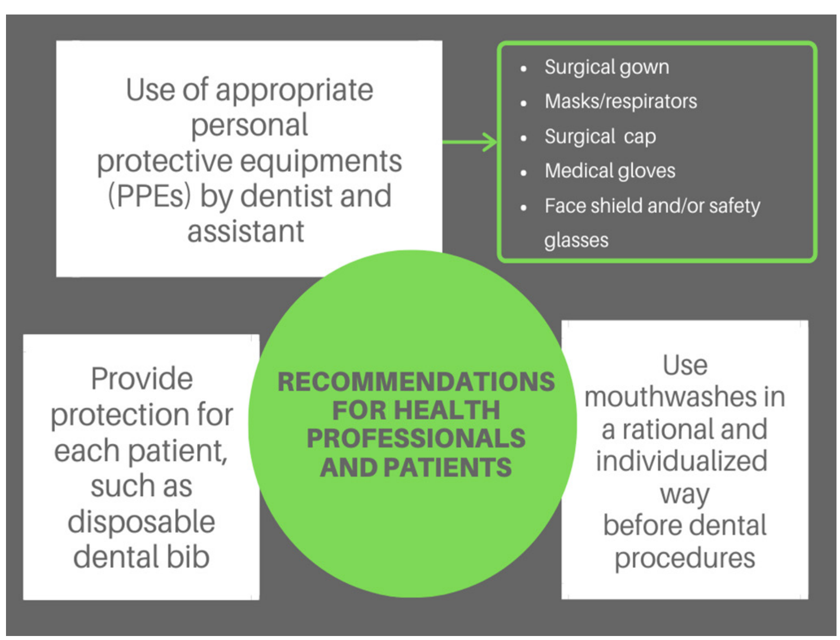

Figure 2 – Recommendations to reduce risk of infection in healthcare professionals and patients

Considering the situation of the COVID-19 pandemic, which has been spreading rapidly in the world and in Brazil, and, therefore, in view of the urgent need to prevent and control SARS-CoV-2 infection, some recommendations for safe care in the dental clinic are very pertinent and will be presented ahead.

Cleaning of the dental environment

SARS-CoV-2 virus at room temperature remains pathogenic for a period of 2 hours to nine days and persists better with 50% relative humidity compared to 30% [24]. Thus, maintaining a clean and dry environment in the dental office contributes to reduce persistence time of the SARS-CoV-2 [40]. Although viral load is not known on inanimate surfaces during an outbreak, it can be admitted that correct disinfection can reduce this load.

Various types of agents such as hydrogen peroxide, alcohols, sodium hypochlorite, povidone-iodine and glutaraldehyde are used worldwide for disinfecting mainly in healthcare services [24]. In this sense, the World Health Organization (WHO) [62] recommends that environmental measures, in addition to cleaning and disinfection procedures, be followed consistent and correctly.

Although SARS-CoV-2 can persist on surfaces such as metal, glass or plastic, it can be inactivated efficiently in just 1 minute, through surface disinfection using alcohol (in concentrations between 62 and 71%), 0.5% hydrogen peroxide or 0.1% sodium hypochlorite [24]. All surfaces that can be touched by patients and/or healthcare professionals must be disinfected [21].

Regarding equipment, WHO recommends that they be single use and disposable. However, if the equipment needs to be shared among patients, it must be cleaned and disinfected before each use [62]. Prior preparation of all instruments and the various materials necessary for the proper care of the patients also contribute to reduce the potential for infection, as well as making the procedure faster [21].

Use rubber dam isolation

If a rubber dam can be used, only the tooth being treated will be a source of aerial contamination, which reduces the potential for infection. However, in certain procedures, such as subgingival restorations, final stages of tooth preparation for crowns, periodontal surgery, bone preparation for implant placement, odontosection or osteotomy during third-molar extractions and hygiene procedures (*e.g.*, routine prophylaxis), it is not possible to use absolute isolation [18]. If rubber insulation is not possible, manual mechanic (dental curettes) and chemical-mechanic are recommended for caries removal and periodontal scaling in order to minimize generation of aerosols [40].

Use of a high-volume evacuator

The use of a high-volume evacuator (HVE) has been shown to be quite efficient in reducing contamination and spreading pathogens resulting from surgical procedures during dental care [3]. In this sense, it is worth remembering that the suction system, to be classified as HVE, must remove a large volume of air in a short period of time. Therefore, the small opening of a saliva ejector used in the routine of dental procedures does not classify it as an HVE [18].

Use of mouthwashes

As oral and oropharyngeal cavities act as a reservoir for a wide variety of pathogenic microorganisms, it is essential the use of antiseptics with broad activity spectrum [25]. In the study by To *et al.* [55], it has been reported that SARS-CoV-2 can be detected in the saliva samples of patients with laboratory confirmation of COVID-19, and that levels of viral RNA in the saliva decrease over time.

Therefore, the use of mouthwashes before dental treatment (Table I) reduces the amount of microorganisms in the oral cavity and also in aerosols, which contributes to the reduction of the risk of contamination of dental professionals and patients [35].

Although chlorhexidine is the most widely used mouthwash in dentistry, its use may not be effective against SARS-CoV-2. This virus is known to be vulnerable to oxidation. Therefore, 1% hydrogen peroxide or 0.2% povidone, which are oxidizing agents, have been recommended as pre-procedure mouthwashes during the COVID-19 pandemic [21, 40].

Table I – Antiseptics used in dental practice

Antiseptic	Concentration	Rinse time	Common use	Warnings
Chlorhexidine	0.1, 0.12 or 0.2% [23]	60 seconds [23]	Action against gram-positive and gram-negative bacteria (aerobic and anaerobic), as well as fungi, including yeasts.	Not suitable for long-term use, as it can cause extrinsic dark brown stains on the teeth, increased stone formation and altered taste [42].
Povidone-iodine (PVP-I)	1%	60 seconds	Action against gram-positive and gram-negative bacteria, bacterial spores, fungi, protozoa and several viruses (*e.g.*, *influenza* A H1N1 and H1N2, SARS-CoV) [25, 26].	It should not be used in people with hyperthyroidism and other thyroid diseases. Short-term use of PVP-I does not demonstrate irritation to the oral mucosa or discoloration of the teeth, tongue and taste change [25].
	0.23%	Minimum 15 seconds	Action against *Klebsiella pneumoniae* and *Streptococcus pneumoniae*. Rapidly inactivates SARS-CoV, MERS-CoV, *influenza* A (H1N1) virus and rotavirus [25].	
Hydrogen peroxide	1.5%	30 seconds	Effective against most bacteria, including aerobic ones [19, 48]	It is associated with mucosal abnormalities. Continuous use is not recommended [3, 48].
Sodium hypochlorite	0.25%	30 seconds	Effective against bacteria, fungi, and viruses.	Sodium hypochlorite is corrosive to chromium-cobalt alloys and can damage removable partial dentures. It should only be used after temporary removal of the prosthesis from the mouth [42].

Information on the effectiveness of mouthwash with 1% hydrogen peroxide to decrease the SARS-CoV-2 spread during procedures that generate aerosols were not found. Studies have reported only the action of 1.5% hydrogen peroxide action for 30 seconds in order to control dental plaque and gingivitis [19, 48]. However, for control dental plaque and gingivitis, chlorhexidine 0.2% was more effective [48].

Povidone-iodine (PVP-I) is considered an antimicrobial with the broadest spectrum of action among mouthwashes because it has a high activity against gram-positive and gram-negative bacteria, bacterial spores, fungi, protozoa, and several viruses such as *influenza* A (H1N1, H1N2) virus. The exposure of the *influenza* virus to iodine led to the degeneration of its nucleoproteins and also to the breakdown of surface proteins, essential for its dissemination [25]. An *in-vitro* study [13] evaluated the bactericidal and virucidal efficacy of 7% PVP-I, at a 0.23% iodine concentration, used in gargle/mouthwash. The authors concluded its effectiveness against all pathogens tested, including SARS-CoV, MERS-CoV and the *influenza* A (H1N1) virus, after a minimum contact of 15 seconds. No irritation or injury to the oral mucosa has been reported, even with prolonged use of oral PVP-I. Another study evaluated the antiviral efficacy of several products containing PVP-I against SARS-CoV and concluded that the treatment, for 2 minutes, completely inactivated the virus [26].

Most studies focusing the use of mouthwashes before dental treatment evaluated their bactericidal action. Therefore, further studies are needed to evaluate the action of these compounds on viruses, especially SARS-CoV-2, and, in this context, PVP-I is promising. At this time, it is suggested, as a pre-dental procedure, the use of routine substances to reduce biofilm and bacterial load in the oral cavity, such as chlorhexidine 0.12% [37].

Enhanced hand hygiene

Hand hygiene is widely known to play a key role in preventing health-associated infections. A basic measure suggested and reinforced by WHO to control COVID-19 transmission is the correct hand hygiene [62]. Although it is a prerequisite in dental routine, adherence to correct hand washing is still relatively low. A two-before-and-three-after hand hygiene guideline, in relation to each dental procedure, was proposed by the infection control department of the West China Hospital of Stomatology, Sichuan University [40].

It is important to pay attention to hand hygiene before and after contact with the patient, before an aseptic procedure, as well as after exposure to body fluids and contact with the environment adjacent to the patient. Hands should be dried on disposable towels, and patients should wash their hands with gel alcohol when entering and leaving treatment area [22].

Use of personal protective equipment

In addition to other recommended protective measures, the use of PPEs serves as a last barrier to individual protection. However, it is not foolproof and only reduces contamination risk [22]. According to international standards, the routine use of a glove besides a surgical cap and mask is recommended, discarding these items after each patient. The use of medical protective goggles is also strongly recommended, especially when high-speed instruments are used. Based on a critical assessment of SARS events in 2003, the use of eye protection was emphatically considered an appropriate and very important measure [52]. Wearing protective face masks can play a vital role in mitigating the spread of bacterial and viral respiratory diseases such as COVID-19 [30]. Clinical professionals are at increased risk of being affected by communicable respiratory diseases. Therefore, the non-use or inappropriate use of a protective mask increases the risk of contagion in the professional environment, which may facilitate the progression of an outbreak or even promote a pandemic [5].

Following the recommendations of international and national health agencies, respiratory protection devices, such as surgical masks and N95/FFP2 masks or equivalent, should be used by healthcare professionals. Surgical masks are indicated to avoid contact with patients droplets and their families, and N95/FFP2 masks are necessary when procedures generating aerosols are performed [7, 62]. However, such equipment must be used correctly, otherwise they may not provide desired protection and even promote involuntary facial contamination [32, 53].

Proper adjustment of the mask to the face, the user's movement, the length of facial hair and voice timbre are factors that directly influence the efficiency of microbial filtration. The filtration efficiency of surgical masks also decreases when they get wet [35]. It is recommended that the operator does not remove the protective barrier immediately after the clinical procedure, in order to reduce the risk of contact with airborne contaminants [57].

The use of a surgical mask is indicated in cases in which there are no procedures that generate aerosols and patients are asymptomatic. For care with the spread of aerosols and / or symptomatic patients, the use of N95 is recommended by the professionals who will provide the assistance. The N95, PFF2 respirator or equivalent without a valve can be used extensively (exceptionally in the event of a shortage) and must be stored in plastic packaging (which allows washing and disinfection) with perforated lid or paper [37].

Financial costs associated with incorrect choice or unnecessary use should also be emphasized, particularly during an epidemic event, as stocks are limited [5].

During COVID-19 pandemic, the use of face-shield has been recommended as PPE for healthcare professionals [21, 37, 62]. The use of this PPE provides greater protection to the face against splatter of patients not only in a hospital environment; it should also be adopted as a protocol during dental care, even after the end of the pandemic.

To protect the trunk and upper limbs from contact with patients' body fluids during dental procedures, it is necessary to use surgical gowns made of reusable or disposable tissue (made from nonwoven fabrics) [58]. Nonwoven materials (NMs) are widely used to protect against biological agents in various health services and can help combat cross-contamination and the spread of infections in clinics or surgical settings.

Disposable nonwoven surgical gowns are becoming the first choice of healthcare professionals, as they are superior to reusable fabrics and composed of nonwoven fabrics weight range of 30–45 g/m^2 [1].

As a rule, in surgical procedures, it is important to maintain the aseptic chain and avoid cross-contamination. It is suggested the use of waterproof surgical gowns, with long sleeves and with a minimum weight of 50 g/m². However, when it is not possible, a minimum weight of 30 g/m² is allowed, provided that manufacturer ensures that this product is waterproof [7]. According to Weber *et al*. [59], when evaluating contamination of surgical kits regarding the use of non-woven fabric at weights 20 and 40 g/m², it was observed that there was less bacterial growth when using 40 g/m². This information is important since professionals have many questions concerning ideal weight for making these non-woven surgical gowns.

For minor oral surgery performed in the dental office, disposable and sterile surgical gowns must be used to protect both clinician and patient from transmission of microorganisms and, thus, reduce the risk of cross-contamination [22]. For routine clinical care, dentists usually wear lab coats, since the use of disposable surgical gowns is not yet a routine practice. It is recommended, therefore, the use of PPE and, necessarily, its exchange for each patient. Such practice, once implemented in dental services, could not only contribute to minimize the COVID-19 spread, but also other infectious diseases protecting health professionals and patients.

However, it is worth mentioning that reusable surgical gowns have less environmental impact than disposable ones (non-woven) [58]. Therefore, it is important to promote a responsible and rational choice regarding the use of these protective measures during dental care. The choice must be made individually for each patient and type of procedure to be performed taking into account production or not of aerosols in order to minimize environmental impact of their discharges.

One of the most critical moments because of the high risk of contamination is the removal of PPEs by health professionals, since pathogen can be deposited on protective clothing / equipment. As an example, the *influenza* A (H1N1) virus contained in droplets can maintain its infectivity on the surface of PPE (lab coats made of Dupont Tyvek, surgical masks and N95/FFP2 respirator) for at least 8 hours. On the surface of rubber gloves, the period extends to 24 hours [46]. Therefore, professionals must be trained in the correct procedure for removing and disposing of PPE in order to protect them.

Although there are policies and protocols for better use of PPEs, observation of these rules by health professionals in general is limited, particularly in times without disease outbreaks or during its early stages. The training of PPEs protocols, often superficial or non-existent, is cited as one of the causes of the misuse of these equipment [5].

Concluding remarks

The peculiarity of the dentist's work implies the frequent contact of these professionals, directly or indirectly, with human fluids, dental materials, or contaminated surfaces, which can contribute to the spread of SARS-CoV-2. Considering that most cases are asymptomatic, these health professionals are among those who are at higher risk of infection because of their degree of exposure and proximity to the patient.

In this context and in view of the COVID-19 pandemic, it is strongly advised that all dental professionals perform a careful anamnesis of the patient before any dental treatment and adopt strict protective measures during the dental practice. In short, such measures include suspension of elective procedures, use of appropriate PPEs, as well as reduction of aerosol production and disinfection of surfaces.

Due to the emergence of COVID-19 and scarcity of studies that correlate the risk of contagion of dentists by SARS-CoV-2, further studies are needed aiming mainly at adoption of additional measures to protect these professionals against infection.

Acknowledgments

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brazil (CAPES) – Finance Code 001.

References

1. Ajmeri JR, Ajmeri CJ. Nonwoven materials and technologies for medical applications. In: Bartels VT, editor. Handbook of medical textiles. Cambridge: Woodhead; 2011. p. 106-31.

2. American Dental Association. What constitutes a dental emergency? American Dental Association; 2020 [cited on Aug 1, 2020]. Available from: https://www.ada.org/en/publications/ada-news/2020-archive/march/ada-develops-guidance-on-dental-emergency-nonemergency-care

3. Avasth A. High volume evacuator (HVE) in reducing aerosol- an exploration worth by clinicians. J Dent Health Oral Disord Ther. 2018; 9(3):165-6.

4. Backer JA, Klinkenberg D, Wallinga J. Incubation period of 2019 novel coronavirus (2019-nCoV) infections among travellers from Wuhan, China, 20-28 January 2020. Euro Surveill. 2020; 25(5).

5. Barratt R, Shaban RZ, Gilbert GL. Clinician perceptions of respiratory infection risk; a rationale for research into mask use in routine practice. Infect Dis Health. 2019; 24(3):169-76.

6. Brasil. Acurácia dos testes diagnósticos registrados para a COVID-19 Brasília: Ministério da Saúde; 2020.

7. Brasil. Agência Nacional de Vigilância Sanitária (ANVISA). Nota Técnica GVIMS/GGTES/ANVISA n. 04/2020 - Orientações para serviços de saúde: medidas de prevenção e controle que devem ser adotadas durante a assistência aos casos suspeitos ou confirmados de infecção pelo novo coronavírus (SARS-CoV-2). Brasil: ANVISA; 2020.

8. Brasil. Guia de Vigilância Epidemiológica – emergência de saúde pública de importância nacional pela doença pelo coronavírus 2019. Brasília: Ministério da Saúde; 2020.

9. Chan JF, Lau SK, To KK, Cheng VC, Woo PC, Yuen KY. Middle East respiratory syndrome coronavirus: another zoonotic betacoronavirus causing SARS-like disease. Clin Microbiol Rev. 2015;28(2):465-522.

10. Chen J. Pathogenicity and transmissibility of 2019-nCoV-A quick overview and comparison with other emerging viruses. Microbes Infect. 2020;22(2):69-71.

11. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. Lancet. 2020;395(10223):507-13.

12. Cheng VC, Lau SK, Woo PC, Yuen KY. Severe acute respiratory syndrome coronavirus as an agent of emerging and reemerging infection. Clin Microbiol Rev. 2007;20(4):660-94.

13. Eggers M, Koburger-Janssen T, Eickmann M, Zorn J. In vitro bactericidal and virucidal efficacy of povidone-iodine gargle/mouthwash against respiratory and oral tract pathogens. Infect Dis Ther. 2018;7(2):249-59.

14. Fung SY, Yuen KS, Ye ZW, Chan CP, Jin DY. A tug-of-war between severe acute respiratory syndrome coronavirus 2 and host antiviral defence: lessons from other pathogenic viruses. Emerg Microbes Infect. 2020;9(1):558-70.

15. Gautier JF, Ravussin Y. A new symptom of COVID-19: loss of taste and smell. Obesity (Silver Spring). 2020;28(5):848.

16. Giacomelli A, Pezzati L, Conti F, Bernacchia D, Siano M, Oreni L, et al. Self-reported olfactory and taste disorders in SARS-CoV-2 patients: a cross-sectional study. Clin Infect Dis. 2020.

17. Guo YR, Cao QD, Hong ZS, Tan YY, Chen SD, Jin HJ, et al. The origin, transmission and clinical therapies on coronavirus disease 2019 (COVID-19) outbreak - an update on the status. Mil Med Res. 2020;7(1):11.

18. Harrel SK, Molinari J. Aerosols and splatter in dentistry: a brief review of the literature and infection control implications. J Am Dent Assoc. 2004;135(4):429-37.

19. Hasturk H, Nunn M, Warbington M, Van Dyke TE. Efficacy of a fluoridated hydrogen peroxide-based mouthrinse for the treatment of gingivitis: a randomized clinical trial. J Periodontol. 2004;75(1):57-65.

20. Ibrahim NK, Alwafi HA, Sangoof SO, Turkistani AK, Alattas BM. Cross-infection and infection control in dentistry: knowledge, attitude and practice of patients attended dental clinics in King Abdulaziz University Hospital, Jeddah, Saudi Arabia. J Infect Public Health. 2017;10(4):438-45.

21. Izzetti R, Nisi M, Gabriele M, Graziani F. COVID-19 transmission in dental practice: brief review of preventive measures in Italy. J Dent Res. 2020:22034520920580.

22. Jakubovics N, Greenwood M, Meechan JG. General medicine and surgery for dental practitioners: part 4. Infections and infection control. Br Dent J. 2014;217(2):73-7.

23. James P, Worthington HV, Parnell C, Harding M, Lamont T, Cheung A, et al. Chlorhexidine mouthrinse as an adjunctive treatment for gingival health. Cochrane Database Syst Rev. 2017;3:CD008676.

24. Kampf G, Todt D, Pfaender S, Steinmann E. Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents. J Hosp Infect. 2020;104(3):246-51.

25. Kanagalingam J, Feliciano R, Hah JH, Labib H, Le TA, Lin JC. Practical use of povidone-iodine antiseptic in the maintenance of oral health and in the prevention and treatment of common oropharyngeal infections. Int J Clin Pract. 2015;69(11):1247-56.

26. Kariwa H, Fujii N, Takashima I. Inactivation of SARS coronavirus by means of povidone-iodine, physical conditions and chemical reagents. Dermatology. 2006;212(Suppl. 1):119-23.

27. Lai CC, Shih TP, Ko WC, Tang HJ, Hsueh PR. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): The epidemic and the challenges. Int J Antimicrob Agents. 2020;55(3):105924.

28. Li X, Geng M, Peng Y, Meng L, Lu S. Molecular immune pathogenesis and diagnosis of COVID-19. J Pharm Anal. 2020;10(2):102-8.

29. Liu W, Li H. COVID-19: attacks the 1-beta chain of hemoglobin and captures the porphyrin to inhibit human heme metabolism. ChemRxiv. 2020.

30. Liu X, Zhang S. COVID-19: Face masks and human-to-human transmission. Influenza Other Respir Viruses. 2020.

31. Liu Y, Ning Z, Chen Y, Guo M, Gali NK, Sun L, et al. Aerodynamic analysis of SARS-CoV-2 in two Wuhan hospitals. Nature. 2020.

32. Long Y, Hu T, Liu L, Chen R, Guo Q, Yang L, et al. Effectiveness of N95 respirators versus surgical masks against influenza: A systematic review and meta-analysis. J Evid Based Med. 2020.

33. Lu CW, Liu XF, Jia ZF. 2019-nCoV transmission through the ocular surface must not be ignored. Lancet. 2020;395(10224):e39.

34. Mallineni SK, Innes NP, Raggio DP, Araujo MP, Robertson MD, Jayaraman J. Coronavirus disease (COVID-19): Characteristics in children and considerations for dentists providing their care. Int J Paediatr Dent. 2020;30(3):245-50.

35. Marui VC, Souto MLS, Rovai ES, Romito GA, Chambrone L, Pannuti CM. Efficacy of preprocedural mouthrinses in the reduction of microorganisms in aerosol: A systematic review. J Am Dent Assoc. 2019;150(12):1015-26e1.

36. Meng L, Hua F, Bian Z. Coronavirus disease 2019 (COVID-19): emerging and future challenges for dental and oral medicine. J Dent Res. 2020;99(5):481-7.

37. Minas Gerais. Governo do Estado de Minas Gerais. COVID-19. Nota Técnica nº 68/SES/COES MINAS COVID-19/2020 - Orientações para o atendimento odontológico no cenário de enfrentamento da COVID-19. Belo Horizonte: COES Minas Covid-19; 2020.

38. Oliveira WK, Duarte E, Franca GVA, Garcia LP. How Brazil can hold back COVID-19. Epidemiol Serv Saúde. 2020;29(2):e2020044.

39. Pan Y, Guan H, Zhou S, Wang Y, Li Q, Zhu T, et al. Initial CT findings and temporal changes in patients with the novel coronavirus pneumonia (2019-nCoV): a study of 63 patients in Wuhan, China. Eur Radiol. 2020.

40. Peng X, Xu X, Li Y, Cheng L, Zhou X, Ren B. Transmission routes of 2019-nCoV and controls in dental practice. Int J Oral Sci. 2020;12(1):9.

41. Pereira LJ, Pereira CV, Murata RM, Pardi V, Pereira-Dourado SM. Biological and social aspects of Coronavirus Disease 2019 (COVID-19) related to oral health. Braz Oral Res. 2020;34(e041).

42. Rich SK, Slots J. Sodium hypochlorite (dilute chlorine bleach) oral rinse in patient self-care. J West Soc Periodontol Periodontal Abstr. 2015;63(4):99-104.

43. Rothan HA, Byrareddy SN. The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak. J Autoimmun. 2020;109:102433.

44. Russell B, Moss C, Rigg A, Hopkins C, Papa S, Van Hemelrijck M. Anosmia and ageusia are emerging as symptoms in patients with COVID-19: What does the current evidence say? Ecancermedicalscience. 2020;14:ed98.

45. Sabino-Silva R, Jardim ACG, Siqueira WL. Coronavirus COVID-19 impacts to dentistry and potential salivary diagnosis. Clin Oral Investig. 2020;24(4):1619-21.

46. Sakaguchi H, Wada K, Kajioka J, Watanabe M, Nakano R, Hirose T, et al. Maintenance of influenza virus infectivity on the surfaces of personal protective equipment and clothing used in healthcare settings. Environ Health Prev Med. 2010;15(6):344-9.

47. Samaranayake LP, Peiris M. Severe acute respiratory syndrome and dentistry: a retrospective view. J Am Dent Assoc. 2004;135(9):1292-302.

48. Sharma K, Acharya S, Verma E, Singhal D, Singla N. Efficacy of chlorhexidine, hydrogen peroxide and tulsi extract mouthwash in reducing halitosis using spectrophotometric analysis: A randomized controlled trial. J Clin Exp Dent. 2019;11(5):e457-e63.

49. She J, Jiang J, Ye L, Hu L, Bai C, Song Y. 2019 novel coronavirus of pneumonia in Wuhan, China: emerging attack and management strategies. Clin Transl Med. 2020;9(1):19.

50. Shereen MA, Khan S, Kazmi A, Bashir N, Siddique R. COVID-19 infection: Origin, transmission, and characteristics of human coronaviruses. J Adv Res. 2020;24:91-8.

51. Singhal T. A review of coronavirus disease-2019 (COVID-19). Indian J Pediatr. 2020;87(4):281-6.

52. Smales FC, Samaranyake LP. Maintaining dental education and specialist dental care during an outbreak of a new coronavirus infection. Part 1: a deadly viral epidemic begins. Br Dent J. 2003;195(10):557-61.

53. Smith JD, MacDougall CC, Johnstone J, Copes RA, Schwartz B, Garber GE. Effectiveness of N95 respirators versus surgical masks in protecting health care workers from acute respiratory infection: a systematic review and meta-analysis. CMAJ. 2016;188(8):567-74.

54. Tellier R, Li Y, Cowling BJ, Tang JW. Recognition of aerosol transmission of infectious agents: a commentary. BMC Infect Dis. 2019;19(1):101.

55. To KK, Tsang OT, Chik-Yan Yip C, Chan KH, Wu TC, Chan JMC, et al. Consistent detection of 2019 novel coronavirus in saliva. Clin Infect Dis. 2020.

56. van Doremalen N, Bushmaker T, Morris DH, Holbrook MG, Gamble A, Williamson BN, et al. Aerosol and surface stability of SARS-CoV-2 as compared with SARS-CoV-1. N Engl J Med. 2020;382(16):1564-7.

57. Veena HR, Mahantesha S, Joseph PA, Patil SR, Patil SH. Dissemination of aerosol and splatter during ultrasonic scaling: a pilot study. J Infect Public Health. 2015;8(3):260-5.

58. Vozzola E, Overcash M, Griffing E. An environmental analysis of reusable and disposable surgical gowns. AORN J. 2020;111(3):315-25.

59. Weber A, CieloII VF, Freitas GC, Favarin AG, Lopes LQS. Análise microbiológica da ocorrência da contaminação bacteriana da mesa cirúrgica comparando o TNT gramatura 20 e gramatura 40. Rev Cir Traumatol Buco-Maxilo-Fac. 2016;16(2):13-6.

60. Wei J, Li Y. Airborne spread of infectious agents in the indoor environment. Am J Infect Control. 2016;44(9 Suppl.):S102-8.

61. Woo PC, Lau SK, Huang Y, Yuen KY. Coronavirus diversity, phylogeny and interspecies jumping. Exp Biol Med (Maywood). 2009;234(10):1117-27.

62. World Health Organization. Infection prevention and control during health care when COVID-19 is suspected. Geneva: World Health Organization; 2020 [cited on Aug 1, 2020]. Available from: https://www.who.int/publications-detail/infection-prevention-and-control-during-health-care-when-novel-coronavirus-(ncov)-infection-is-suspected-20200125

63. World Health Organization. WHO Director-General's opening remarks at the media briefing on COVID-19. Geneva: World Health Organization; 2020.

64. Xu H, Zhong L, Deng J, Peng J, Dan H, Zeng X, et al. High expression of ACE2 receptor of 2019-nCoV on the epithelial cells of oral mucosa. Int J Oral Sci. 2020;12(1):8.

65. Xu J, Zhao S, Teng T, Abdalla AE, Zhu W, Xie L, et al. Systematic comparison of two animal-to-human transmitted human coronaviruses: SARS-CoV-2 and SARS-CoV. Viruses. 2020;12(2).

66. Xu R, Cui B, Duan X, Zhang P, Zhou X, Yuan Q. Saliva: potential diagnostic value and transmission of 2019-nCoV. Int J Oral Sci. 2020;12(1):11.

67. Yin Y, Wunderink RG. MERS, SARS and other coronaviruses as causes of pneumonia. Respirology. 2018;23(2):130-7.

68. Zhao Y, Zhao Z, Wang Y, Zhou Y, Ma Y, Zuo W. Single-cell RNA expression profiling of ACE2, the putative receptor of Wuhan 2019-nCov. bioRxiv. 2020.

69. Zheng YY, Ma YT, Zhang JY, Xie X. COVID-19 and the cardiovascular system. Nat Rev Cardiol. 2020;17(5):259-60.

70. Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, et al. A novel coronavirus from patients with pneumonia in China, 2019. N Engl J Med. 2020;382(8):727-33.