International Journal of Advanced Engineering Research and Science (IJARS)
ISSN: 2349-6495(P) | 2456-1908(O)
Vol-8, Issue-1; Jan, 2021
Journal Home Page Available: https://ijaers.com/
Journal DOI: 10.22161/ijaers
Article DOI: https://dx.doi.org/10.22161/ijaers.81.22

Dentistry biosecurity during the SARS-CoV-2 pandemic: What should we know?

Bianca Fernandes Joaquim[1], João Lopes Toledo Neto[1], Juliana Zorzi Coléte[1], Augusto Alberto Foggiato[1], Douglas Fernandes da Silva[1]

Health Sciences Center - Dentistry, State University of Northern Parana– UENP, Jacarezinho, Parana, Brazil

Received: 06 Nov 2020;

Received in revised form:

13 Jan 2021;

Accepted: 19 Jan 2021;

Available online: 24 Jan 2021

***Keywords*— Containment of Biohazards, Coronavirus, Cross Infection, Dental Offices.**

***Abstract*—** *The new coronavirus infection, also known as SARS-CoV-2, affects especially the respiratory tract and it has been a challenge to face it in a lot of countries, since the disease has no specific treatment and leads to a multidisciplinary care for those infected. Health professionals are classified at high risk, as they are in close contact to these patients. Among those professionals, dental surgeons represent the professionals at most risk, due to their work area being in close contact with the respiratory tract and the production of aerosol generated by the office equipment, which dissipates microscopic virulent particles through the air. In this review, instructions issued by health institutions were collected in order to inform health professionals, especially the dental surgeon, about the correct dressing and hygiene that must be performed in the dental office. Finally, it was concluded that professionals are well supported and receive the necessary guidance to continue working during the pandemic. In addition, following biosafety protocols and regulatory guidelines has shown positive results against the spread of the new coronavirus, protecting professional and patients.*

I. INTRODUCTION

In December 2019, cases with clinical symptoms of pneumonia, of unknown origin, were reported in Wuhan, province of China [1]. Analyzes carried out through the collection of biological materials from the respiratory tract of those infected showed that the infection was being caused by a new virus of the Coronavirus family [2].

Coronaviruses form a group of viruses encapsulated with genetic material formed by non-segmented, single-stranded RNA in positive direction, known to cause infections in both animals and humans [3].

SARS-CoV-2, which causes the Covid-19 pandemic, is zoonotic and also pathogenic, making it one of the coronavirus species that can potentially be transmitted from an animal to a human host. These properties, as well as long period of time that humans and animals spend close to each other, allow the virus to spread to different hosts at a rapid rate, resulting in global or regional outbreaks [3].

The first cases identified as caused by the new coronavirus were linked to Wuhan food sector market and, after the collection of biological materials, it was suggested that the city may have been the source of the pandemic or played a crucial role in its spread. After performing the genetic sequence analysis, it was found that SARS-CoV-2 originates from bats, with no evidence of laboratory manipulation, since its genomic sequence would show the fusion of previously known viral elements [1].

Although, in the beginning, the virus was confined only to China, after 3 months it had already spread to 157 countries. Therefore, in order to contain the further spread of the disease, several countries have banned travel, social gathering and ordered the closure of schools [4].

During the onset of the disease, the most common symptoms are fever, dry cough, myalgia of fatigue, in addiction of the appearance of less common symptoms, such as sputum, headache, diarrhea and the presence of blood in the sputum [2]. In more severe cases, organ dysfunction, cardiac and renal damage occurs and, in some cases, the patient dies [5].

Due to the high spread of SARS-CoV-2, health professionals are at a greater risk of becoming infected [6], especially dentists [7]. Dental offices present a high risk of transmission of the virus, as they have high-speed instruments that can generate aerosol [6,8]. Therefore, the dentist and his team are placed in a high category regarding the chance of exposure, as they work close to the respiratory tract [9].

Official institutes, such as the Federal Council of Dentistry (CFO) and Regional Councils (CROs), issued a series of instructions in order to assist the dentist during the service, informing about the personal protective equipment (PPE) that must be used and instructing on the correct hygiene of the instruments and the dental office, in addition to adding new topics to be performed during the anamnesis correlated with signs and symptoms related to the infection by the new coronavirus [10,11].

Thus, this study aimed to review scientific works, handouts and manuals of the Brazilian dental councils, as well as regulations of the Ministry of Health in Brazil, showing the importance of care regarding biosafety in dentistry, targeted care in facing the new coronavirus pandemic and changes in regulations and biosafety of dental clinics.

II. METHODOLOGY

An electronic literature search was performed using PubMed, Google Scholar, Scielo and Lilacs. The search was limited to article published from 2012 to 2020, including articles about other coronavirus and SARS-CoV-2, especially those about dentists and cross infection with SARS-CoV-2, using keywords such “coronavirus origin”, “coronavirus transmission”, “coronavirus and dentistry” and “cross infection dentistry”.

III. RESULTS AND DISCUSSION

SARS-CoV-2 origin

As mentioned before, coronavirus are viruses enveloped with RNA with simple strips and in positive direction [12]. According to the genome structure of each virus in the family, they are subdivided into alpha, beta, gamma and delta, which are the main groups. Thus, alpha and beta coronaviruses are capable of infecting only mammals, with clinical respiratory symptoms common in humans and symptom of gastroenteritis in animals [13].

Of all the coronaviruses, before the start of the pandemic in late 2019, only six of them were known for their ability to cause infections in humans, so HCoV-NL63, HCoV-229E, HCoV-OC43 and HKU1 are capable of causing clinical symptoms similar to colds in patients with immunological chances and the other two viruses were previously known to cause pandemics, namely the Severe Acute Respiratory Syndrome coronavirus (SARS-CoV) and the Middle East Respiratory coronavirus (MERS-CoV) [4].

The first pandemic caused by this group of viruses occurred in November 2002, with SARS-CoV as the etiological agent, which originates in the Chinese horseshoe bat and the civet as an intermediate host and, finally, reaches humans [14]. SARS-CoV has an incubation period of 4 to 6 days, with the appearance of symptoms similar to those of pneumonia, such as fatal respiratory failure and acute respiratory distress syndrome [15]. This virus infects multiple organs, causing systemic disease and the symptoms worsen as the virus is eliminated, which suggests an alteration of the immune system due to the pathogenesis of the SARS-CoV [16].

MERS-CoV, also caused by a coronavirus, emerged in 2012 in Saudi Arabia, with symptoms similar to SARS-CoV, in addition to also originating in bats, it uses dromedary camels as intermediate hosts and, finally, reaches humans [17]. In this case, the transmission from person to person is more limited, however, MERS-CoV caused major outbreaks in Saudi Arabia and South Korea, presenting more than 2,000 cases worldwide and with a mortality rate of 35% [18]. The elderly and patients with some type of comorbidities usually develop more severe and more fatal conditions of the disease [19].

Previously to the Covid-19 pandemic, all other coronaviruses that caused infections in humans had animal origin, usually bats and rodents [20]. SARS-CoV were transmitted from crivet cats to humans, while MERS-CoV was transmitted from dromedary camels to humans [21].

Coronaviruses in the human body spread through the mucosa of the respiratory tract to other cells in the body. SARS-CoV-2, specifically, affects peripheral blood and immune system cells, especially the lymphocyte, as most patients have reduced lymphocyte numbers [22].

SARS-related coronaviruses are covered by spike (S) proteins that contain a variable receptor binding domain (RBD). RBD binds to the angiotensin-2 converting enzyme receptor (ACE-2), which is located in the lungs, gastrointestinal tract, kidneys and heart. Thus, the virus

binds to human cells [21,23]. The phylogenetic evaluation of SARS-CoV-2 showed that spike (S) protein binds weakly to the ACE-2 receptor, unlike SARS-CoV, which binds to the human cell receptor more strongly. And despite that, the link between the SARS-CoV-2 spike protein and ACE-2 is still much higher than the threshold needed to cause the infection [22]. However the RBD present in the SARS-CoV-2 spike (S) protein causes weak connections with ACE-2 receptor of human cells, demonstrating that the virus needs an intermediate host before reaching the human, which causes a reduction pathogenicity and reproduction number [23].

It is believed, therefore, that SARS-CoV-2 also originates from bats, once it has mutated and become unable to use other animals as hosts. This mutation increased the interaction between RBD and ACE-2 enzyme in humans, as well as in animals such as the pangolin. Therefore, it is believed that pangolin is the intermediate host of SARS-CoV-2 [24].

Relation between dentists and cross-infection with SARS-CoV-2

Coronaviruses are usually disseminated through respiratory droplets and there is a difference in relation to the size of droplets and their spreading radius [25]. According to the same authors, larger droplets tend to fall to the group near the individual who eliminated them, being potentially contagious if intercepted by another healthy individual before reaching the ground or surface, their area being limited to a distance of 2 meters. However, as stated by RABI *et al.* [4] smaller droplets can float and move according to drafts.

Transmission through droplets, according to the World Health Organization [1], occurs through close contact of at least 1 meter between individuals and, therefore, there is a great risk of exposure. In addition, there are reports of transmission by indirect contact, that is touching inanimate surfaces contaminated with the subsequent act of bringing the hands to the nose and mouth [26].

The mouth is an environment full of microorganisms that can be transferred, through fluids, for other places and cause infection in other individuals [27]. The pathogen microorganisms route is called cross infection, which will occur by the transference of contaminated blood, saliva and instruments [28]. In dentistry, the infection risk with the new coronavirus is high, since the virulent particles present in the patient's oral fluids can cause infection in other individuals, mainly by spreading through the aerosol [6].

Thus, when performing dental care, numerous saliva particles can come off, such as during friction between the tooth, which makes it necessary to use water cooling [29] and consequently the possibility of a cross infection. GE *et al.* [30] outline the routes of transmission of aerosol particles that can occur during dental care, demonstrating the path that particles potentially contaminated by SARS-CoV-2 can follow (Figure 1).

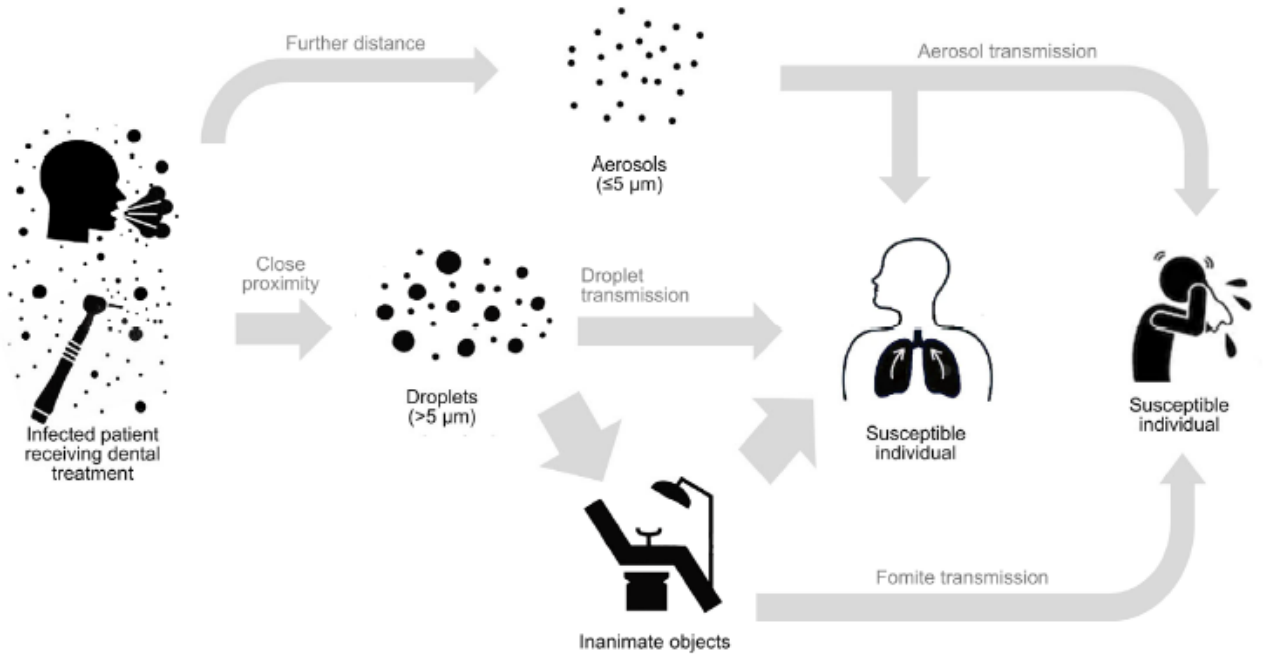

Fig.1: Aerosol droplets routes, coming from oral cavity and instruments, that reach inanimate objects and susceptible individuals [30].

According to Jones and Brosseau [31] water can generate aerosol, which turns to be are suspended in the air and carry pathogens [32]. The greatest sources of aerosol generation in dental clinic are ultrasonic devices, high-speed hand pieces, air turbines, triple syringes and air and water syringes [33]. And all of those can be sources of cross-infection and lead to the spread of the new coronavirus. The study of FEARS *et al.* [34] indicates that the new coronavirus survives 16 hours in the aerosol, which reinforces the need for protection using mask and air filtration.

Thus, dentists during the service are great risk of cross infection, since there is the possibility of virulent particles being floating in the air, which demands even more attention in relation to air filtration and the correct use of personal protection [35]. WU et al. [36] also states that there is a change in the behavior of patients and a change in the need for care in face of the pandemic.

The SARS-CoV-2 incubation period has been reported between 2 to 10 days, which promotes dissemination through body fluids, droplets or contact witch contaminated surfaces [26]. Besides that, studies report that human coronaviruses can persist on inanimate surfaces for up to 9 days [26] and SARS-CoV-2 can remain on contaminated saliva for up to 24 days [37]. In addition, there is the persistence of the virus on patient's saliva, which indicates that the dentist should treat all patients as potentially contaminated [10]. Table 1 shows the average persistence time and survival of the new coronavirus in different locations.

Table 1: Persistence of Covid-19 in different kinds of surfaces, saliva and blood.

Surface and fomites	***Persistence***	***Reference***
Plastic	3 days	van Doremalen *et al.* [38]
Cooper	4 hours	van Doremalen *et al.* [38]
Stainless steel	3 days	van Doremalen *et al.* [38]
Glass	2 days	Chin *et al.* [39]
Cloth	1 day	Chin *et al.* [39]
Surgical mask-inner layer	4 days	Chin *et al.* [39]
Surgical mask-outer layer	7 days	Chin *et al.* [39]
Paper	30 minutes	Chin *et al.* [39]
Cardboard	1 day	van Doremalen *et al.* [38]
Saliva	24 days	Federal Council of Dentistry (CFO) [10]
Blood	16 days	Liu *et al.* [40]

Therefore, it is essential to perform disinfection of surfaces of the clinical environment [8], so that the dental clinic does not become a source of dissemination of the new coronavirus.

Biosecurity protocols in dental office after pandemic

As countermeasures against Covid-19, the regional (CRO) [11] and federal (CFO) [10] dentistry council, as well as the Ministry of Health [41], established a set of biosafety rules, such as use foot and hair protection, surgical masks and N-95 or FFP-2 mask, eye protection and gloves (Figure 2). Barroso Vilarinho *et al.* [42] showed the importance of correct vesting during procedures in health area, covering most of the body and mainly the face, preventing particles from entering in the respiratory tract. N95 and FFP-2 masks contain a particulate filter and it is used to protect the individual from inhalation of particles contained in aerosol [43]. The Federal Council of Dentistry and the Ministry of Health [10,44] point out that it is essential to use the correct attire of all dentists, not only the traditional personal protective equipment, but also including N95 or FFP-2, as well as face shield, goggles, foot protection, lab coat and gloves.

Fig. 2: a: Professional wearing protection for health area service. Mask N95 or FFP-2, gloves, face shield, vestments and foot protection [42]*; b: Mask N95* [45]*; c: Mask FFP-2* [46].

According to CFO [10], dentists must use personal protective equipment (PPE) suitable for any type of care. Therefore, a cap, goggles, gloves, surgical mask and N95 mask, surgical gowns, visors and properly closed shoes are necessary [47]. However, as stated in literature [6,8,30,35,36,48], PPE use is already mandatory in several dental procedures, as they are measures of biosafety and control of various cross-infection.

Hand hygiene is of paramount importance and must be done before and after contact with patients [10]. This measure became the standard biosafety procedure, along with sterilization of instruments and cleaning of inanimate surfaces [6,26]. Using 70% to 90% alcohol-based gel is recommended in addition to cleaning with alcohol-based handrub (ABHR) or soap and water [49].

Another point that was noted by the CFO [50] is that there was a change in the way patients were treated in dental clinics after SARS-CoV-2 pandemic. According to the same council, the new measures adopted must be extended beyond the period of control and eradication of the virus.

For dental care, several rules have been determined by regulatory institutions, such as before they attend the clinic in person, the need for telephone screening was established, to seek as much information about patient's general health and habits, as well as family members [47]. According to PENG *et al.* [37], when a patient arrives at clinic, some initial care is performed, such as the measurement of body temperature and if it is higher than 37.3°C, it is recommended to reschedule the appointment. The Ministry of Health [44] states that the newly cured patients of Covid-19 should wait 10 days for the return of dental treatments and thus avoid the transmission of SARS-CoV-2. This information is collaborative with the guidelines issued by the same agency, which guides the transmission of new coronavirus within 14 days after infection.

The American Dental Association (ADA) [51] recommends that the waiting room remains empty, without magazines and avoiding consultations that allow meeting between patients. To avoid possible disorders, it is important for the patient to sign the agreement of treatment and his/her responsibility regarding the information provided during screening [7].

Another biosafety standard adopted by competent institutions in dealing with pandemic is using mouthwash before treatment, which reduces the amount of oral microorganisms [30]. This procedure has long been advocated in dental care, as stated by KOHN *et al.* [52], that mouthwash is a microbial control measure and it is extremely important to prevent cross-infection. PENG *et al.* [37] presented studies reporting the efficacy of mouthwash made with 1% hydrogen peroxide or 0.2% iodine-povidone against SARS-CoV-2.

As a coping measure, procedures that can stimulate salivation or cough should be avoided, such as using triple syringe and intraoral radiographic examinations [53].

Some chemicals are capable of inactivating SARS-CoV-2 from surfaces. Studies have shown that propanol, sodium hypochlorite and ethanol have an efficiency percentage of 80% to 95% [26]. Besides, other studies cite substances that are also effective but inferior to those previously mentioned, which are 0.05-0.2% benzalkonic chloride and 0.02% chlorhexidine digluconate [54]. QUEIROZ *et al.* [55] carried out a study that states a possible application of photodynamic therapy on decontaminating surfaces and coping with SARS-CoV-2. To remove and filter contaminated air from environment, there is high efficiency particulate air (HEPA) a suppressor

filter that removes 99.97% of particles with 0.3 micrometers in diameter and can be used in dental environment [56].

Therefore, care with dressing and hygiene in dental office are essential to minimize chances of a cross-infection of Covid-19. Dentists must ensure his team and patient's safety, analyzing the needs of each case and advising patients about forms of protection [44].

Involvement of dentists in Covid-19 pandemic: what is happening

A survey carried out in the first half of 2020 by the Federal Council of Dentistry [57], which included around 40 thousand dentists from all over the country, reported that 82% of the professionals interviewed continue to exercise their clinical activities during the pandemic period. In general, of all professionals interviewed, 72% attend according to the guidelines prescribed by the health agencies, 10% of them continued their care without any type of extra restriction and 18% stopped working during this period. The CFO also emphasizes the importance of taking biosafety measures in addition to those already performed routinely to ensure professional, team, and patient's safety, to avoid spreading the virus [57].

In addition, according to CFO, dentists, dental assistants and technicians in oral health are health professionals who work on the front lines fighting against coronavirus who have the lowest rate of infected. In July 2020, Brazil had a total of 1,603,055 people infected, which 2,737 were dentists and 1,852 were technicians and assistants in oral health. This occurred due to issuance of recommendations written by CFO and Ministry of Health, in order to provide information about necessary biosafety, measures and also to instruction to attend only urgencies and emergencies in dental clinic [50].

The dental practice, therefore, puts professionals and patient at risk, since there is an amount of body fluids in oral cavity, such as blood and saliva [58], which can be contaminating sources of the new coronavirus [59]. According to WU et al. professionals must pay attention to the real need to perform procedures that generate aerosol, since these procedures can increase the chances of cross-infection. According to the same author, professionals must keep in mind the possibility of carrying out pharmacological treatment, in cases where there is no seriousness and urgency, to avoid possible sources of contamination [36].

Furthermore, according to MARET *et al.* [60], telemedicine should be applied to dentistry during this period, since professionals in the field are those at most risk of infection. Therefore, according to the author, sending images of photographs of lesions present in patient's oral cavity becomes a way to make a diagnosis and assist the patient, besides this format can assist in more severe treatment due to communication between dentists and referral in urgent and emergency cases.

IV. CONCLUSION

The infection caused by the new coronavirus or SARS-CoV-2 impacts society and scientific world, since there is still no effective therapy for its treatment. Protective measures of social distance and biosafety protocols prove to be fundamental to prevent spreading the virus, especially during clinical and dental treatments. Thus, guidelines from responsible institutions are of paramount importance in guiding dentists and other related professionals.

The dental surgeon, being the professional most exposed to a possible infection during the exercise of his profession, must be well informed about the new rules that must be followed during the service, not only for dressing, but also for cleaning equipment. So that all working professionals pay attention to care that must be taken during clinical procedures and protect themselves, their team and patients. And with all of that, help to interrupt the transmission of SARS-CoV-2.

ACKNOWLEDGMENTS

The authors wish to thank Universidade Estadual do Norte do Parana - UENP, Jacarezinho, Parana.

REFERENCES

[1] WHO, W. H. O. (2020). *Modes of transmission of virus causing COVID-19: implications for IPC precaution recommendations*. https://www.who.int/news-room/commentaries/detail/modes-of-transmission-of-virus-causing-covid-19-implications-for-ipc-precaution-recommendations

[2] Huang, C., Wang, Y., Li, X., Ren, L., Zhao, J., Hu, Y., Zhang, L., Fan, G., Xu, J., Gu, X., Cheng, Z., Yu, T., Xia, J., Wei, Y., Wu, W., Xie, X., Yin, W., Li, H., Liu, M., … Cao, B. (2020). Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *The Lancet*, *395*(10223), 497–506. https://doi.org/10.1016/S0140-6736(20)30183-5

[3] Fung, T. S., & Liu, D. X. (2019). *Human Coronavirus : Host-Pathogen Interaction*. 529–560.

[4] Rabi, F. A., Al Zoubi, M. S., Al-Nasser, A. D., Kasasbeh, G. A., & Salameh, D. M. (2020). Sars-cov-2 and coronavirus disease 2019: What we know so far. *Pathogens*, *9*(3), 1–14.

https://doi.org/10.3390/pathogens9030231

[5] Chan, J. F. W., Yuan, S., Kok, K. H., To, K. K. W., Chu, H., Yang, J., Xing, F., Liu, J., Yip, C. C. Y., Poon, R. W. S., Tsoi, H. W., Lo, S. K. F., Chan, K. H., Poon, V. K. M., Chan, W. M., Ip, J. D., Cai, J. P., Cheng, V. C. C., Chen, H., … Yuen, K. Y. (2020). A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. *The Lancet*, *395*(10223), 514–523. https://doi.org/10.1016/S0140-6736(20)30154-9

[6] Bhanushali, P., Katge, F., Deshpande, S., Chimata, V. K., Shetty, S., & Pradhan, D. (2020). COVID-19: Changing Trends and Its Impact on Future of Dentistry. *International Journal of Dentistry*, *2020*. https://doi.org/10.1155/2020/8817424
ADA, A. D. A. (2020). *ADA releases interim guidance on minimizing COVID-19 transmission risk when treating dental emergencies*. https://www.ada.org/en/publications/ada-news/2020-archive/april/ada-releases-interim-guidance-on-minimizing-covid-19-transmission-risk-when-treating-emergencies#:~:text=The ADA Interim Guidance for,precautions%2C including personal protective equipment%3B

[7] Meng, L., Hua, F., & Bian, Z. (2020). Coronavirus Disease 2019 (COVID-19): Emerging and Future Challenges for Dental and Oral Medicine. *Journal of Dental Research*, *99*(5), 481–487. https://doi.org/10.1177/0022034520914246

[8] CDC, C. for D. C. and P. (2019). *Guidance for Dental Settings - Interim Infection Prevention and Control Guidance for Dental Settings During the Coronavirus Disease 2019 (COVID-19) Pandemic*. https://www.cdc.gov/coronavirus/2019-ncov/hcp/dental-settings.html

[9] CFO, C. F. de O. (2020). *MANUAL DE BOAS PRÁTICAS EM BIOSSEGURANÇA PARA AMBIENTES ODONTOLÓGICOS*. https://website.cfo.org.br/wp-content/uploads/2020/04/cfo-lança-Manual-de-Boas-Práticas-em-Biossegurança-para-Ambientes-Odontologicos.pdf

[10] CRO SC, C. R. de O. de S. C. (2020). *QUESTIONÁRIO PADRÃO CONSELHO REGIONAL DE ODONTOLOGIA DE SANTA CATARINA*. *48*, 4185.

[11] Su, S., Wong, G., Shi, W., Liu, J., Lai, A. C. K., Zhou, J., Liu, W., Bi, Y., & Gao, G. F. (2016). Epidemiology, Genetic Recombination, and Pathogenesis of Coronaviruses. *Trends in Microbiology*, *24*(6), 490–502. https://doi.org/10.1016/j.tim.2016.03.003

[12] Cui, J., Li, F., & Shi, Z. L. (2019). Origin and evolution of pathogenic coronaviruses. *Nature Reviews Microbiology*, *17*(3), 181–192. https://doi.org/10.1038/s41579-018-0118-9

[13] Li, Y., Treffers, E. E., Napthine, S., Tas, A., Zhu, L., Sun, Z., Bell, S., Mark, B. L., Van Veelen, P. A., Van Hemert, M. J., Firth, A. E., Brierley, I., Snijder, E. J., & Fang, Y. (2014). Transactivation of programmed ribosomal frameshifting by a viral protein. *Proceedings of the National Academy of Sciences of the United States of America*, *111*(21). https://doi.org/10.1073/pnas.1321930111

[14] Peiris, J. S. M., Lai, S. T., Poon, L. L. M., Guan, Y., Yam, L. Y. C., Lim, W., Nicholls, J., Yee, W. K. S., Yan, W. W., Cheung, M. T., Cheng, V. C. C., Chan, K. H., Tsang, D. N. C., Yung, R. W. H., Ng, T. K., & Yuen, K. Y. (2003). Coronavirus as a possible cause of severe acute respiratory syndrome. *Lancet*, *361*(9366), 1319–1325. https://doi.org/10.1016/S0140-6736(03)13077-2

[15] Perlman, S., & Netland, J. (2009). Coronaviruses post-SARS: Update on replication and pathogenesis. *Nature Reviews Microbiology*, *7*(6), 439–450. https://doi.org/10.1038/nrmicro2147

[16] De Groot, R. J., Baker, S. C., Baric, R. S., Brown, C. S., Drosten, C., Enjuanes, L., Fouchier, R. A. M., Galiano, M., Gorbalenya, A. E., Memish, Z. A., Perlman, S., Poon, L. L. M., Snijder, E. J., Stephens, G. M., Woo, P. C. Y., Zaki, A. M., Zambon, M., & Ziebuhr, J. (2013). Middle East Respiratory Syndrome Coronavirus (MERS-CoV): Announcement of the Coronavirus Study Group. *Journal of Virology*, *87*(14), 7790–7792. https://doi.org/10.1128/jvi.01244-13

[17] Chafekar, A., & Fielding, B. C. (2018). MERS-CoV: Understanding the latest human coronavirus threat. *Viruses*, *10*(2). https://doi.org/10.3390/v10020093

[18] Graham, R. L., Donaldson, E. F., & Baric, R. S. (2013). A decade after SARS: Strategies for controlling emerging coronaviruses. *Nature Reviews Microbiology*, *11*(12), 836–848. https://doi.org/10.1038/nrmicro3143

[19] Zhu, N., Zhang, D., Wang, W., Li, X., Yang, B., Song, J., Zhao, X., Huang, B., Shi, W., Lu, R., Niu, P., Zhan, F., Ma, X., Wang, D., Xu, W., Wu, G., Gao, G. F., & Tan, W. (2020). A novel coronavirus from patients with pneumonia in China, 2019. *New England Journal of Medicine*, *382*(8), 727–733. https://doi.org/10.1056/NEJMoa2001017

[20] Blier, L., Sarrazin, J. F., Thibault, B., Rivard, L., Gula, L., Sit, P. L., Essebag, V., Ph, D., Nery, P. B., Tung, S. K., Raymond, J. M., Sterns, L. D., Veenhuyzen, G. D., Healey, J. S., Redfearn, D., Roux, J. F., & Tang, A. S. L. (2016). *New England Journal*. 111–121. https://doi.org/10.1056/NEJMoa1513614

[21] Chen, N., Zhou, M., Dong, X., Qu, J., Gong, F., Han, Y., Qiu, Y., Wang, J., Liu, Y., Wei, Y., Xia, J., Yu, T., Zhang, X., & Zhang, L. (2020). Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *The Lancet*, *395*(10223), 507–513. https://doi.org/10.1016/S0140-6736(20)30211-7

[22] Zhao, S., Musa, S. S., Lin, Q., Ran, J., Yang, G., Wang, W., Lou, Y., Yang, L., Gao, D., He, D., & Wang, M. H. (2020). Estimating the Unreported Number of Novel Coronavirus (2019-nCoV) Cases in China in the First Half of January 2020: A Data-Driven Modelling Analysis of the Early Outbreak. *Journal of Clinical Medicine*, *9*(2), 388. https://doi.org/10.3390/jcm9020388

[23] Andersen, K. G., Rambaut, A., Lipkin, W. I., Holmes, E. C., & Garry, R. F. (2020). The proximal origin of SARS-CoV-2. *Nature Medicine*, *26*(4), 450–452.

https://doi.org/10.1038/s41591-020-0820-9

[24] Kutter, J. S., Spronken, M. I., Fraaij, P. L., Fouchier, R. A., & Herfst, S. (2018). Transmission routes of respiratory viruses among humans. *Current Opinion in Virology*, *28*, 142–151. https://doi.org/10.1016/j.coviro.2018.01.001

[25] Kampf, G., Todt, D., Pfaender, S., & Steinmann, E. (2020). Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents. *Journal of Hospital Infection*, *104*(3), 246–251. https://doi.org/10.1016/j.jhin.2020.01.022

[26] Yüzbasioglu, E., Saraç, D., Canbaz, S., Saraç, Y. S., & Cengiz, S. (2009). A survey of cross-infection control procedures: Knowledge and attitudes of Turkish dentists. *Journal of Applied Oral Science*, *17*(6), 565–569. https://doi.org/10.1590/S1678-77572009000600005

[27] Marsh, P. D., Lewis, M. A. ., Rogers, H., Williams, D. W., & Wilson, M. (2016). *Oral Microbiology* (Elsevier (ed.); 6ª).

[28] Farah, R. I. (2019). Effect of cooling water temperature on the temperature changes in pulp chamber and at handpiece head during high-speed tooth preparation. *Restorative Dentistry & Endodontics*, *44*(1), 1–10. https://doi.org/10.5395/rde.2019.44.e3

[29] Ge, Z. yu, Yang, L. ming, Xia, J. jia, Fu, X. hui, & Zhang, Y. zhen. (2020). Possible aerosol transmission of COVID-19 and special precautions in dentistry. *Journal of Zhejiang University: Science B*, *21*(5), 361–368. https://doi.org/10.1631/jzus.B2010010

[30] Jones, R. M., & Brosseau, L. M. (2015). Aerosol transmission of infectious disease. *Journal of Occupational and Environmental Medicine*, *57*(5), 501–508. https://doi.org/10.1097/JOM.0000000000000448

[31] Thompson, K. A., Pappachan, J. V., Bennett, A. M., Mittal, H., Macken, S., Dove, B. K., Nguyen-Van-Tam, J. S., Copley, V. R., O'Brien, S., Hoffman, P., Parks, S., Bentley, A., Isalska, B., & Thomson, G. (2013). Influenza Aerosols in UK Hospitals during the H1N1 (2009) Pandemic - The Risk of Aerosol Generation during Medical Procedures. *PLoS ONE*, *8*(2). https://doi.org/10.1371/journal.pone.0056278

[32] Roberts, K., Hathway, A., Fletcher, L. A., Beggs, C. B., Elliott, M. W., & Sleigh, P. A. (2006). Bioaerosol production on a respiratory ward. *Indoor and Built Environment*, *15*(1), 35–40. https://doi.org/10.1177/1420326X06062562

[33] Fears, A., Klimstra, W., Duprex, P., Hartman, A., Weaver, S., Plante, K., Mirchandani, D., Plante, J., Aguilar, P., Fernandez, D., Nalca, A., Totura, A., Dyer, D., Kearney, B., Lackemeyer, M., Bohannon, J. K., Johnson, R., Garry, R., Reed, D., & Roy, C. (2020). Comparative dynamic aerosol efficiencies of three emergent coronaviruses and the unusual persistence of SARS-CoV-2 in aerosol suspensions. *MedRxiv : The Preprint Server for Health Sciences*, *2*. https://doi.org/10.1101/2020.04.13.20063784

[34] Villani, F. A., Aiuto, R., Paglia, L., & Re, D. (2020). Covid-19 and dentistry: Prevention in dental practice, a literature review. *International Journal of Environmental Research and Public Health*, *17*(12), 1–12. https://doi.org/10.3390/ijerph17124609

[35] Wu, K. Y., Wu, D. T., Nguyen, T. T., & Tran, S. D. (2020). COVID-19's impact on private practice and academic dentistry in North America. *Oral Diseases*, *May*, 1–4. https://doi.org/10.1111/odi.13444

[36] Peng, X., Xu, X., Li, Y., Cheng, L., Zhou, X., & Ren, B. (2020). Transmission routes of 2019-nCoV and controls in dental practice. *International Journal of Oral Science*, *12*(1), 1–6. https://doi.org/10.1038/s41368-020-0075-9

[37] Van Doremalen, N., Bushmaker, T., Morris, D., Holbrook, M., Gamble, A., Williamson, B., Tamin, A., Harcourt, J., Thornburg, N., Gerber, S., Lloyd-Smith, J., de Wit, E., & Munster, V. (2020). Aerosol and surface stability of HCoV-19 (SARS-CoV-2) compared to SARS-CoV-1. *MedRxiv : The Preprint Server for Health Sciences*. https://doi.org/10.1101/2020.03.09.20033217

[38] Chin, A. W. H., Chu, J. T. S., Perera, M. R. A., Hui, K. P. Y., Yen, H.-L., Chan, M. C. W., Peiris, M., & Poon, L. L. M. (2020). Stability of SARS-CoV-2 in different environmental conditions. *The Lancet Microbe*, *1*(1), e10. https://doi.org/10.1016/s2666-5247(20)30003-3

[39] Liu, J., Li, S., Liu, J., Liang, B., Wang, X., Wang, H., Li, W., Tong, Q., Yi, J., Zhao, L., Xiong, L., Guo, C., Tian, J., Luo, J., Yao, J., Pang, R., Shen, H., Peng, C., Liu, T., … Zheng, X. (2020). Longitudinal characteristics of lymphocyte responses and cytokine profiles in the peripheral blood of SARS-CoV-2 infected patients. *EBioMedicine*, *55*(December 2019). https://doi.org/10.1016/j.ebiom.2020.102763

[40] Brasil, M. da S. (2020). *Recomendações de proteção aos trabalhadores dos serviços de saúde*. https://www.sciencedirect.com/science/article/pii/

[41] Barroso Vilarinho, M. T., Oliveira e Souza, C., Schvartz, J., Azevedo, K., Mofati Lima, N., Deco, M., & Martins Santiago, B. V. (2020). General aspects of COVID-19 and its handling by anesthesiologists. *InterAmerican Journal of Medicine and Health*, *3*, 1–6. https://doi.org/10.31005/iajmh.v3i0.105

[42] Oberg, T., & Brosseau, L. M. (2008). Surgical mask filter and fit performance. *American Journal of Infection Control*, *36*(4), 276–282. https://doi.org/10.1016/j.ajic.2007.07.008

[43] Brasil, M. da S. (2020). *Guia de orientações para atenção odontológica no contexto da COVID-19*.

[44] Sickbert-Bennett, E. E., Samet, J. M., Clapp, P. W., Chen, H., Berntsen, J., Zeman, K. L., Tong, H., Weber, D. J., & Bennett, W. D. (2020). Filtration Efficiency of Hospital Face Mask Alternatives Available for Use during the COVID-19 Pandemic. *JAMA Internal Medicine*, *27516*, 1–6. https://doi.org/10.1001/jamainternmed.2020.4221

[45] Hirschmann, M. T., Hart, A., Henckel, J., Sadoghi, P., Seil, R., & Mouton, C. (2020). COVID-19 coronavirus: recommended personal protective equipment for the orthopaedic and trauma surgeon. *Knee Surgery, Sports Traumatology, Arthroscopy*, *28*(6), 1690–1698. https://doi.org/10.1007/s00167-020-06022-4

[46] Luzzi, V., Ierardo, G., Bossù, M., & Polimeni, A. (2020). COVID-19: pediatric oral health during and after the

pandemics. *Appl. Sci*, *10*(April), 1–8. https://doi.org/10.20944/preprints202004.0002.v1

[47] Lammers, M. J. W., Lea, J., Lea, J., & Westerberg, B. D. (2020). Guidance for otolaryngology health care workers performing aerosol generating medical procedures during the COVID-19 pandemic. *Journal of Otolaryngology - Head and Neck Surgery*, *49*(1), 1–8. https://doi.org/10.1186/s40463-020-00429-2

[48] Rabenau, H. F., Kampf, G., Cinatl, J., & Doerr, H. W. (2005). Efficacy of various disinfectants against SARS coronavirus. *Journal of Hospital Infection*, *61*(2), 107–111. https://doi.org/10.1016/j.jhin.2004.12.023

[49] CFO, C. F. de O. (2020). *Cirurgiões-Dentistas são os menos contaminados pela Covid-19*. 08/07/2020. https://website.cfo.org.br/cirurgioes-dentistas-sao-os-menos-contaminados-pela-covid-19/

[50] ADA, A. D. A. (2020). *Coronavirus Frequently Asked Questions*. 11/03/2020. http://www.ada.org/~/media/CPS/Files/Open Files/Coronavirus_FrequentlyAskedQuestions_March11.pdf

[51] Kohn, W. G., Harte, J. A., Malvitz, D. M., Collins, A. S., Cleveland, J. L., & Eklund, K. J. (2004). Guidelines for infection control in dental health care settings - 2003. *Journal of the American Dental Association*, *135*(1), 33–47. https://doi.org/10.14219/jada.archive.2004.0019

[52] Vandenberghe, B., Jacobs, R., & Bosmans, H. (2010). Modern dental imaging: A review of the current technology and clinical applications in dental practice. *European Radiology*, *20*(11), 2637–2655. https://doi.org/10.1007/s00330-010-1836-1

[53] Fallahi, H. R., Keyhan, S. O., Zandian, D., Kim, S.-G., & Cheshmi, B. (2020). Being a front-line dentist during the Covid-19 pandemic: a literature review. *Maxillofacial Plastic and Reconstructive Surgery*, *42*(1). https://doi.org/10.1186/s40902-020-00256-5

[54] Queiroz, G. B., Foggiato, A. A., Toledo Neto, J. L., & Silva, D. F. da. (2020). Photodynamic Therapy and Possible Action Against Sars-Cov-2. *Brazilian Journal of Development*, *6*(7), 52313–52327. https://doi.org/10.34117/bjdv6n7-761

[55] Chuaybamroong, P., Chotigawin, R., Supothina, S., Sribenjalux, P., Larpkiattaworn, S., & Wu, C. Y. (2010). Efficacy of photocatalytic HEPA filter on microorganism removal. *Indoor Air*, *20*(3), 246–254. https://doi.org/10.1111/j.1600-0668.2010.00651.x

[56] CFO, C. F. de O. (2020). *Consulta do CFO revela que 82% dos Cirurgiões-Dentistas entrevistados continuam trabalhando durante a pandemia*. 10/07/2020. https://website.cfo.org.br/consulta-do-cfo-revela-que-82-dos-cirurgioes-dentistas-entrevistados-continuam-trabalhando-durante-a-pandemia/

[57] Segal, A., & Wong, D. T. (2008). Salivary diagnostics: Enhancing disease detection and making medicine better. *European Journal of Dental Education*, *12*(SUPPL. 1), 22–29. https://doi.org/10.1111/j.1600-0579.2007.00477.x

[58] Degasperi, J., AndreBilibio, G., & Cuba, L. D. F. (2020). *Oral implications related to COVID-19: What Can we expect in Times of Pandemic?03*(03), 16–23.

[59] Maret, D., Peters, O. A., Vaysse, F., & Vigarios, E. (2020). Integration of telemedicine into the public health response to COVID-19 must include dentists. *International Endodontic Journal*, *53*(6), 880–881. https://doi.org/10.1111/iej.13312