

## COVID-19 and endodontic emergencies

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**Paulo Maurício Reis de Melo Junior**

ORCID: <https://orcid.org/0000-0001-9926-5348>  
Universidade de Pernambuco, Brazil  
E-mail: paulo.reis@upe.br

**Sandra Maria Alves Sayão Maia**

ORCID: <https://orcid.org/0000-0003-3172-2332>  
Universidade de Pernambuco, Brazil  
E-mail: sandrinhasayao@hotmail.com

**Luciano Barreto Silva**

ORCID: <https://orcid.org/0000-0002-1508-4812>  
Faculdade de Odontologia do Recife, Brazil  
E-mail: lucianobarreto63@gmail.com

**Heloisa França de Araujo**

ORCID: <https://orcid.org/0000-0002-4028-3573>  
Universidade de Pernambuco, Brazil  
E-mail: heloisaraujo24@gmail.com

### Abstract

Clinical and epidemiological studies suggest that the transmission of COVID-19 between humans may occur through direct or indirect contact, through virus-laden respiratory droplets, from symptomatic, asymptomatic or pre-symptomatic infected people, after coughing or sneezing. Therefore, this study aimed to review in the scientific literature, effective endodontic emergency and urgency protocols applicable during the COVID-19 pandemic. Electronic searches were carried out on governmental websites, manuals and national protocols regarding guidelines related to the adaptations of emergency dental cares (endodontics) indicated during COVID-19 pandemic. The endodontic care emergencies during were considered an essential service for public health and should be performed in the best possible way, in the shortest possible time, reducing the risks of staff and patient contamination during the procedures; the protocol will depend on the patient's health condition, the type of urgency, and the dentist's skill and dexterity. Scientific evidence has shown that asymptomatic individuals can indeed spread the SARS-CoV-2 virus efficiently and, therefore, every patient should be considered potentially infected. In addition, healthcare professionals must keep up-to-date on this disease and provide their staff with adequate training.

**Keywords:** Coronavirus infections; Dentistry; Endodontics.

### Resumo

Estudos clínicos e epidemiológicos sugerem que a transmissão do COVID-19 entre humanos pode ocorrer através do contato direto ou indireto, através de gotículas respiratórias carregadas de vírus, advindas de pessoas que estão infectadas, sintomáticas, assintomáticas ou pré-sintomáticas, quando tosse ou espirram. Por isso, este estudo se propôs a revisar na literatura científica, efetivos protocolos de urgência e emergência endodôntica que sejam aplicáveis durante a pandemia do COVID-19. Foi realizada uma pesquisa nos 'websites' governamentais, manuais e protocolos nacionais acerca das orientações em relação às adaptações do pronto-atendimento odontológico (endodôntico) indicadas durante a pandemia do novo coronavírus. O atendimento das urgências de origem endodôntica durante o COVID-19 foi considerado serviço essencial para a área da saúde e deve ser realizado da melhor forma em menor tempo possível, diminuindo os riscos de contaminação da equipe e paciente durante o atendimento; o protocolo vai depender da saúde geral do paciente, do tipo de urgência e da habilidade e destreza do cirurgião-dentista. Evidências científicas têm mostrado que indivíduos assintomáticos podem espalhar o vírus SARS-CoV-2 com eficiência e, dessa forma, todo paciente deve ser considerado potencialmente infectado por esse vírus. Além disso, os profissionais de saúde devem manter-se atualizados sobre esta doença e fornecer treinamento adequado à sua equipe.

**Palavras-chave:** Infecções por Coronavirus; Odontologia; Endodontia.

### Resumen

Estudios clínicos y epidemiológicos sugieren que la transmisión del COVID-19 entre humanos puede ocurrir por contacto directo o indirecto, a través de gotitas respiratorias cargadas de virus, de personas infectadas, sintomáticas, asintomáticas o presintomáticas, al toser o estornudar. Por lo tanto, este estudio tuvo como objetivo revisar en la

literatura científica, protocolos de emergencia y urgencia endodónticos efectivos que sean aplicables durante la pandemia de COVID-19. Se realizó una búsqueda en sitios web gubernamentales, manuales y protocolos nacionales sobre las guías en relación a las adaptaciones de la atención odontológica de emergencia (endodoncia) indicadas durante la nueva pandemia de coronavirus. La atención de emergencias endodónticas durante el COVID-19 fue considerada un servicio esencial para el área de salud y debe realizarse de la mejor manera posible en el menor tiempo posible, reduciendo los riesgos de contaminación del equipo y de los pacientes durante la atención; su protocolo dependerá de la salud general del paciente, el tipo de urgencia y la habilidad y destreza del dentista. La evidencia científica ha demostrado que las personas asintomáticas pueden propagar eficazmente el virus del SARS-CoV-2 y, por lo tanto, todo paciente debe considerarse potencialmente infectado por este virus. Además, los profesionales sanitarios deben mantenerse al día sobre esta enfermedad y proporcionar la formación adecuada a su personal.

**Palabras clave:** Infecciones por Coronavirus; Odontología; Endodoncia.

## 1. Introduction

COVID-19 disease, caused by the SARS-CoV-2, the “new” coronavirus, was first reported on December 31st, 2019, in the city of Wuhan, China. Since then, this virus has spread exponentially around the world, a fact that led the World Health Organization (WHO), in March 2020, to announce the new coronavirus as a pandemic. As of June 26, 2021, according to the interactive map of global cases of COVID-19 from the Center of Science and Engineering Systems from Johns Hopkins University, there were 180,087,836 confirmed cases of COVID-19 in the world, from which 18,243,483 in Brazil alone (Ren, Rasubala, Malmstrom & Eliav, 2020; Ather, Patel, Ruparel, Diogenes & Hargreaves, 2020; John Hopkins University & Medicine, 2021).

Clinical and epidemiological studies suggest that the transmission of COVID-19 among humans may occur through direct or indirect contact, through virus-laden respiratory droplets, coming from people who are infected, symptomatic, perhaps asymptomatic or even pre-symptomatic, after coughing or sneezing. Nevertheless, the information is still very recent, deserving analysis and daily updating. Until the construction of this article, it is thought that transmission may also occur indirectly, when in contact with fomites handled by the infected patient: counter surfaces, door handles and other objects that have been used or touched by the infected patient. New information has been released about surface transmission, the situation is aggravated by frequent observation of aerosols that remain suspended containing the SARS-CoV-2019 in the environment for up to 3 hours (Silva et al., 2021; Ren, Rasubala, Malmstrom & Eliav, 2020; van Doremalen et al., 2020).

The most common symptoms of COVID-19 have been exhaustively featured: fever, dry cough and fatigue. Some patients may also mention some oral alterations that may be interpreted as early symptoms, such as xerostomia and ageusia. Furthermore, the oral mucosa has been reported as a potential gateway for the SARS-CoV-2 virus. (Ren, Rasubala, Malmstrom & Eliav, 2020).

The New York Times newspaper published, in March 2020, a chart relating the exposure risk to the disease and the professional categories. First, and consequently presenting the highest risk of acquiring the disease, are the dentists, due to the very close contact with the patient's face and oral cavity, which may be contaminated with blood and/ or saliva (Gamio, 2020).

Although dental care has been included by the Ministry of Health in the category of essential services, during the beginning of the coronavirus pandemic, dentists were only able to provide urgent and emergency procedures. Elective treatments in dental offices should be postponed to avoid the high production and dispersion of contaminating aerosols. In addition, it was established that all professionals from the Sistema Único de Saúde (SUS), Brazilian Unique Health System, both in Primary Care and Specialized Care, should be part of the teams that will carry out the actions of 'FAST-TRACK' COVID-19: activities that should ensure that users with signs and symptoms of the flu syndrome are treated in the best and shortest time period possible. Dealing with dental emergencies during the pandemic avoids overcrowding hospital emergency rooms by patients suffering from dental (odontogenic) pain, thus mitigating the spread of the disease. (Bradley, 2020; Ren, Rasubala, Malmstrom & Eliav, 2020). Still according to Technical Note No. 16, SUS dentists will be able to collaborate with

the diagnosis of COVID-19 by rapid testing and collection of biological material in the population with the aid of swabs (Ministry of Health, 2020).

According to the latest bulletin from the State Health Department, there have been 543,564 confirmed cases of COVID-19 in Pernambuco. In Brazil, according to the Ministry of Health, the most affected states are, in order of magnitude: São Paulo (3,648,202), Minas Gerais (1,766,084), Paraná (1,250,398), Rio Grande do Sul (1,199,084) and Bahia (1,112,304) (Government of the State of Pernambuco, 2020; State Health Departments, 2021). Basically the numbers are in correspondence with the populational rate. More than ever, being resolute in dental emergency cares is extremely necessary and logical. Therefore, this study aims to review, in the current scientific literature, effective endodontic emergency and urgency protocols that have been applicable during the COVID-19 pandemic.

## 2. Methodology

A bibliographic and documental search was carried out on the government websites, manuals and national protocols about guidelines in relation to adaptations of the dental emergency cares (endodontics) indicated during the 2020 pandemic, also making a comparison between the adopted protocols in three Mercosur member countries: Argentina, Paraguay and Uruguay.

For data collection, electronic searches were accomplished by using the Pubmed and Scientific Electronic Library Online (Scielo) databases. The descriptors in English adopted were: coronavirus infections, emergencies, community dentistry. Websites from national and international professional organizations, regulators and public administration were also accessed.

For the selection of electronic documents, articles published in national and international journals, in any language, with abstracts or completely available, published between December 2019 and along 2020, were used as inclusion criteria. 67 articles and official documents were identified and after reading the abstracts, 19 that did not match the inclusion criteria and were excluded. To analyze the material, the texts were completely read and the findings were sorted for critical-scientific analysis (Estrela, 2018).

## 3. Results and Discussion

The care of endodontic emergencies during COVID-19 was considered an essential service for the health area and should be performed in the best possible way in the shortest time possible thus reducing the risks of staff contamination as well as the patient during care, and on their way to the hospital dental care unit. Such accomplishment requires competence and skilled professionals involved in the process, mainly because of the incubation period of COVID-19, which is estimated ranging from 2 and 14 days, according to the information published to the writing of this text. Patients without symptoms or during the incubation periods may still have the potential to infect others. Furthermore, positive results of RT-PCR tests have been reported in recovered patients, as well as reported false results. Therefore all the patients should be faced as potential vectors of contamination (Sohrabi et al., 2020; Lan et al., 2020).

According to the American Dental Association (2020), dental emergencies are characterized as conditions that require prompt attention from the dentist to relieve the excruciating pain and/or risks of infection, for example: severe dental pain due to pulpitis; abscesses or bacterial infection resulting in localized or diffuse pain, swelling, cellulitis, temporary restoration replacement in patients with access to the endodontic cavity and who are symptomatic; fractures, dislocation and avulsion due to trauma. These treatments must be performed with some additional care by the dentists and their staff (American Dental Association, 2020).

Before any sort of assistance, a reception questionnaire must be applied, which aims to identify patients with flu-like

illness or symptoms related to COVID-19. In cases of symptomatic patients, they should be referred to the physician in order to understand their priorities in health care and, after consensus, decide if their dental care may or may not be performed in an appropriate facility. Another care that must be taken in consideration is the entrance control of patients, in order to assure a reduction in the flow of people, whether with physical barriers, scheduling with spaced times or even electronic scheduled systems. In addition, there should be an air conditioning system or natural ventilation in the waiting rooms, which must also provide dispensers with alcohol preparations for hand hygiene (70% solution/gel) (National Health Surveillance Agency, 2020; Council Regional Dentistry of Pernambuco, 2020; Thomé, 2020).

According to the Center for Diseases Control (CDC), the patient, upon arriving at the dental office, should have been already instructed as for the appropriate use of a mask, even if made of fabric; if not using it, the barrier must be immediately offered by the staff. Additionally, the patient must be instructed to accomplish hand hygiene before and after touching the mask to adjust it. Before the procedure, it is also recommended to wash the face and oral hygiene with a brush, dental cream and dental floss. The patient's anamnesis should be carried out in a room with a ventilated environment and the less crowded possible, and be allowed to come into the dental office at the time of the procedure. Other measures to be taken by the patient were mentioned by the Regional Council of Dentistry of São Paulo, such as: turning off the cell phone and keeping it in the pocket or purse so that the biosafety chain is not broken; take as few belongings to the office as possible and, if possible, go unaccompanied. Along with all recommendations, the patients should be offered a disposable cap, goggles (disinfected with 1%) sodium hypochlorite, covering their clothing with a disposable field and restricting the use of the cuspidor by the patient, opting for suckers with a wide mouthpiece (Centers For Disease Control and Prevention, 2021; Moraes, Sanchez, Valente, Souza & Nassar, 2020; Ministry of Health, 2020; Regional Dental Council of São Paulo, 2020).

In Brazil, since 2019, there has been the Telehealth Brazil Redes Program, a program of the Federal Government with the Ministry of Health (MS), which allows for teleregulation, telediagnosis, teleeducation and teleconsultation procedures in the health sector through the SUS. It consists of direct patient care with a Dental Surgeon and the possibility of exchanging information and opinions with another Dental Surgeon at a distance, dialoguing and always seeking the best assistance. With the pandemic, the Federal Council of Dentistry, on June 4, published resolution 226/2020 which, in addition to the MS program, provided other actions such as: care for patients who are already undergoing treatment and are unable to return to the office, for some reason; of patients who have doubts about the exact moment to go to the office; telemonitoring during the interval between appointments – remote monitoring of patients undergoing treatment – with mandatory registration in the medical record of any and all actions performed under these terms; as well as teleorientation carried out by a Dental Surgeon with the sole and exclusive purpose of identifying, through a pre-clinical questionnaire, the best moment to carry out face-to-face care. Telles-Araujo (2020) called teledentistry actions during the pandemic in three ways, namely: teleorientation - allows professionals to perform exams, guide and refer patients to face-to-face care, if necessary; Telemonitoring - allows professionals to visually monitor (by photographs) patients who are suspected or positive for SARS-CoV-2 who have oral lesions; Teleconsultation - which allows the exchange of information between professionals, helping in the diagnosis and treatment to be instituted for the patient with greater agility and precision (Portal of the Department of Primary Health Care, 2020; Telles-Araujo, Caminha, Kallás & Santos, 2020).

In several states of the United States of America, Teledentistry has already been authorized, however each state has its own regulations. As an example of this authorization from Teleodontology, is the state of Iowa. At the University of Iowa School of Dentistry, procedures have been implemented to allow all emergency patients to undergo Teledentistry screening prior to appointments at the Clinics. This was possible through the use of “electronic consultation” systems, in which patients receive some options such as: telephone call; phone call and image sharing; or a meeting by apps such as ZOOM. Based on these data, records of subjective symptoms such as pain and clinical findings will be carried out, as well as psychological

aspects such as: patient's level of suffering, expectations and availability of the patient and professional, and then, decisions will be made regarding the scheduling or not of the face-to-face consultation (Poelman, 2020; Gasparoni & Kanellis, 2020).

An epidemiological questionnaire as initial screening should be carried out and, if possible, prior to the face-to-face meeting by telephone or messaging app. There are usually 4 questions: 1- Are you a confirmed or suspected patient of COVID-19 who recovered after treatment? 2- Are you a confirmed patient of COVID-19 with no symptoms? 3- Have you recently shown symptoms of COVID-19 such as fever, cough, fatigue, vomiting, etc.? 4- Have you been in contact with confirmed or suspected patients with COVID-19 recently?

Notably, there are several infections that affect the oral cavity that may present as a sign fever that may mislead the diagnosis of COVID-19. Therefore, fever alone should not be considered a sign and symptom of COVID-19 to be evaluated; and oral disease needs to be accurately diagnosed. On the other hand, most infected people have only mild symptoms. However, a positive answer to any of the questions should raise initial concern and dental care should be delayed for at least 2 weeks (SARS-CoV-2 incubation period can range from 0 to 24 days). These patients should be encouraged to self-quarantine and contact their primary care physician by telephone or by digital devices (Yu, Zhang, Zhao, Haapasalo & Shen, 2020; Chen et al., 2020). If it is indeed and undoubtedly a dental emergency and the patient presents symptoms or positive test for COVID-19, decide if, for the case, pharmacological management with analgesics, corticoids and/or antibiotics and remote monitoring is possible. However, since face-to-face care in an outpatient clinic (office) or hospital is unavoidable and imperative, the care staff must take the appropriate measures to maintain the safety of the procedure.

In face-to-face dental care, the patient's body temperature must be measured by a frontal, forehead, non-contact thermometer or through detector cameras fitted with infrared thermal sensors. The patient must complete a detailed form with his medical history and dental main complaint (Peng, Xu, Li, Cheng, Zhou & Ren, 2020). The dental surgeon's attire with personal protective equipment (PPE) must be performed in the following order: a) disposable dental aprons; b) mask; c) protective glasses; d) cap; e) face shield and f) gloves. Before attire, adornments must be removed and the hair secured, as well as hand hygiene. In the appropriate biosafety guidelines for COVID-19, released by Council Regional Dentistry of São Paulo, it is stated that if aerosol is produced during care and if patients have symptoms of respiratory infection, an N95 respirator should be used, respirators that offer higher levels of protection, such as air filtering facepieces (PFFs) or elastomeric respirators, superimposing a surgical mask to increase its useful life, in times of difficult purchase in the trade and glasses with side protection. In the recommendations of the Ministry of Health, the sequence of attire of health professionals should be: mask and goggles; apron, gloves and between all these steps, hand hygiene should be made. The National Health Surveillance Agency (ANVISA) recommends hand hygiene in 5 moments: before the first contact with the patient; immediately before any dental intervention; after removal of the apron; after removing the goggles and after removing the masks (University of Pernambuco, 2020; Regional Dental Council of São Paulo, 2020; Ministry of Health, 2020; Council Regional Dentistry of Ceará, 2020).

According to the Brazilian Association of Intensive Care Medicine (AMIB), in patient screening and surgical procedures with manual instruments that do not generate aerosols, the use of a surgical masks, in addition to an apron, protective glasses or face shield, gloves, and hand hygiene may be facultative (Brazilian Intensive Care Medicine Association, 2020).

However, in effective dental emergency care, in most procedures, the production and dispersion of aerosols is inevitable and can potentially expose the team to the virus, making the procedures highly risky. If the patient is contaminated with COVID-19, whether symptomatic or not, these aerosols produced by the high-speed turbine handpiece may be contaminated with the Sars-CoV-2. Thus, it is necessary that the dental surgeon and his staff use respirators, thus reducing the risk of inhaling contaminating agents, as the surgical masks used in the daily routine of the office do not protect the user from

infections transmitted by aerosols, simply because their sealing capacity on the face is not efficient. In this case, respirators (N95 or PFF2) are able to filter non-biological particles (dust, mists and fumes) as well as viral particles. Respirators with an exhalation valve allow the air exhaled by the user to leave the respirator and reach the patient and the environment, therefore, ANVISA suggests that this type of respirator is not to be used by health professionals who are working in sterile fields, and also does not provide protection for the patient if the dental surgeon carries the virus. However; they can only be used in a dental environment if combined with a surgical mask (ANVISA, 2020; Council Regional Dentistry of São Paulo, 2020).

Respirators (N95, N99, N100, PFF2 or PFF) have, respectively, 95% and 94% minimum effectiveness for particles up to 0.3 $\mu$ . However, this efficiency is significantly lost when they are dampened or wetted. This protective respiratory equipment (PRE) can also be used in combination with the surgical masks, in order to keep them dry and thus remain efficient. If kept dry they can reach a shelf life of 4 hours of uninterrupted use; if used with the surgical mask over them, they reach 15 or 30 days of useful life. However, the results of a randomized study by Bartoszko (2020) did not provide convincing evidence that surgical masks are inferior to N95 respirators in protecting healthcare professionals against laboratory-confirmed viral respiratory infections, during routine care, and during procedures. that do not generate aerosols (Brazilian Association of Intensive Care Medicine, 2020; Bartoszko, Farooqi, Alhazzani & Loeb, 2020).

Before the emergency procedure begins, it is suggested that the DC ask the patient to rinse the mouth to reduce the salivary viral load. There is still no consensus on the material that should be used in the mouthwash. It is suggested that the mouth rinse be performed with 15 mL of 0.5% to 1% hydrogen peroxide or 0.2% povidone iodine for 30 seconds, after rinsing, one minute should be allowed to begin the dental procedures. The manual published by the Council Regional Dentistry of Ceará recommends the association of 1% hydrogen peroxide with subsequent use of 0.12% chlorhexidine for the patient's mouth rinse before the procedures (Germano & Ribeiro, 2020; Council Regional Dentistry of Ceará, 2020).

The Federal Council of Dentistry suggests using 1% hydrogen peroxide for mouthwash. Although this information is present in the current literature based on the idea that Sars-CoV-2 would be vulnerable to oxidation, Ortega et al. (2020) showed that it is not based on reliable scientific evidence. Technical note No. 16 suggests that consideration should be given to the indiscriminate use of substances such as hydrogen peroxide, due to the possibility of enhancing, together with other substances, the development of pre-cancerous or cancerous lesions (Brazilian Association of Intensive Care Medicine, 2020; Ministry of Health, 2020).

Other measures have been published by the Federal Council of Dentistry, which include using rubber dams for absolute isolation, which is already standard for endodontic procedures; it should be emphasized that it must be applied before the coronary opening, paying attention to the covering of the patient's nose, restricting the diffusion of the viral load in the environment. Ather et al. (2020) reported that up to 70% of airborne particles can be reduced around a diameter of 3 feet (1m) from the operating field, drastically reducing or even eliminating the presence of salivary components in the aerosol. Preference should also be given to manual instruments for removing cavities and calculus, instead of high-speed turbines and ultrasound; use of high power suckers; avoid using the triple syringe spray form and regulate the cooling water output (Brazilian Association of Intensive Care Medicine, 2020).

For complementary radiographic examinations, it is advisable to use extraoral images, such as panoramic radiographs and/or cone beam computed tomography, to avoid vomiting or coughing reflexes that may occur during radiographic taking for intraoral imaging, especially periapical radiographs. When intraoral imaging is mandatory, sensors or films must have a double protective barrier to avoid perforation and cross contamination (Ather, Patel, Ruparel, Diogenes & Hargreaves, 2020).

Correct cleaning of contaminated benches is suggested, as according to the first reports, SARS CoV-2 is able to survive for up to 3 days on inanimate surfaces at room temperature, with greater preference for sites in humid conditions, changing the filters of air conditioning every 30 days and/or use of a negative pressure exhaust system in the service room; and

the renewal of fresh air from the environment, especially in the care of patients with suspected or confirmed infection by COVID-19 (van Doremalen et al., 2020; Council Regional Dentistry of Ceará, 2020).

The emergency care of cases of teeth with vital pulp requires care to relieve symptoms due to dentin hypersensitivity, reversible and irreversible pulpitis. After the correct diagnosis, according to the anamnesis, interpretation of the responses to the semiotechnical tests and clinical examinations, an adequate approach for the treatment of the pulp tissue must be determined, whether conservative or radical. With the exception of dentin hypersensitivity, which usually occurs due to dentin exposure to the oral cavity, stimulating sensory nerve fibers, microorganisms, that is, the biological cause, is the main etiological factor of the problems. The treatment of dentinal hypersensitivity consists in promoting the occlusion of exposed dentinal tubules by a physical (varnish, dentin adhesive, resins or glass ionomer cement) or chemical (oxalates or fluorides) means, but it would not be an emergency in the sense of the term.

In reversible pulpitis, its control (removal of caries) is enough to relieve pain, followed by direct, indirect pulp capping or pulpotomies applying protective layers with calcium hydroxide or using mineral trioxide aggregate (MTA), which in direct capping tests performed on adult human molars with carious pulp exposure showed, in 36 months, a cumulative survival of 85% in partial pulpotomies and maintained a good success rate (85%) over three years of follow-up in mature permanent teeth and in total pulpotomy using MTA, showed a 92.7% success rate, however it is still a high cost material and dressings with zinc oxide and eugenol or glass ionomer cements. For Neuhaus & Connert (2020), if tissue bleeding can be controlled or halted with the formation of a superficial clot, it is possible that tissue damage is reversible. Conservative treatments are especially indicated if the patient is young or if the tooth still has an open apex, which means, incomplete rhizogenesis (Kundzina, Stangvaltaite, Eriksen & Kerosuo, 2017; Taha & Khazali, 2017; Taha, Ahmad & Ghanim, 2017). Generally, pain is acute, fleeting, localized and caused by mechanical, thermal or biological stimuli. Clinical examination reveals the presence of deep or recurrent caries, recent, extensive or fractured restorations, and there is no evidence of pulp exposure, with the exception of trauma cases.

In order to be as resolute as possible, pulpectomy is the procedure of choice for symptomatic or asymptomatic irreversible pulpitis, but conservative therapy, including pulpotomy when correctly indicated, can be useful in terms of reducing the time of care. According to Yu et al. (2020), pulpotomy reduces pain symptoms in almost 90% of emergency dental patients, one day after treatment.

The pulp's irreversibility is clinically verified when it is exposed by caries or the patient feels severe, continuous, spontaneous, sometimes diffuse, reflex or percussion pain. The patient commonly reports use of analgesics. For Ather et al. (2020), if the patient is not using systemic medication, pain control is started through the administration of Ibuprofen 600mg associated with Acetaminophen 325-500mg or Dexamethasone 0.07-0.09 mg/kg or in association with opioids acting on the central nervous system (Tramal - tramadol hydrochloride 50mg; Tylex - paracetamol and codeine phosphate 30mg) (Ather, Patel, Ruparel, Diogenes & Hargreaves, 2020).

As these are symptomatic conditions, anesthesia is imperative for immediate pain relief and dentists should select an adequate technique and anesthetic salt, preferably associated with a vasoconstrictor, as it requires a prolonged action of the drug. After rubber dam isolation, the operative field must be decontaminated starting from the tooth towards the periphery until touching the arch, using gauze soaked in 2.5% sodium hypochlorite, 70 alcohol or 0.12% chlorhexidine. The first choice irrigating solution should be 2.5% sodium hypochlorite: 30ml per root canal. Alternatively, 2% chlorhexidine associated with saline solution or 1% hydrogen peroxide. In cases of conservative treatments, Ather et al. (2020) recommended diluting the sodium hypochlorite solution to 1%.

For pulpectomy and root canal preparation/modeling, the use of single-use nickel titanium rotary systems should be preferable if the operator has the necessary equipment or technical skill and clinical experience in use, with the aim of reducing

the working time and sterilization dispensation, as most of these instruments are sterile by the manufacturer and recommended for single use, avoiding cross contamination. One can also select manual instruments such as K-type and Hedström files for extirpation of the pulp in its entirety or by fragmentation during instrumentation, according to the diameter of the root canal. To determine the measure of penetration of the instruments within the root canal, the use of the electronic apical locator is the most adequate.

When complete chemical-mechanical preparation is performed and there is no pain on percussion, which characterizes inflammation not restricted to the pulp, present in the apical or lateral periodontal tissues, immediate filling of the root canal system is suggested. Also if there is any limitation due to the time available for the procedure, operator skill, lack of material resources or equipment, or anatomical limitations, an intracanal medication must be applied associated with an aqueous vehicle, corticosteroid solution associated or not with antibiotics or gel of 2% chlorhexidine, followed by coronary sealing of the endodontic cavity and prescription of an analgesic/anti-inflammatory.

The prescription of systemic antibiotics is not necessary, because in the case of conservative treatments, despite the presence of microorganisms and their toxic metabolic products in the pulp tissue being the reason for the inflammation, the odontoblasts create the tertiary dentin in the initial stages and later the defense cells arising from the increased vascularization of the area (hyperemia), that is, the cellularized and immunocompetent tissue is effective in controlling microbial invasion. And even with the apical progression of the infection causing tissue degeneration and necrosis, the primary therapy will be the removal of the irreversibly inflamed and necrotic pulp. Not even the presence of pain or suffering of patients justify its use (Nair, 2004).

In cases of symptomatic apical periodontitis, microbial aggression has reached the periapical tissues with an acute inflammatory response, promoting vasodilation in the microcirculation, increased vascular permeability, causing edema and compression of nerve fibers and release of chemical mediators such as chemokines and cytokines, unleashing toxins and increasing the pressure by bacterial gases. The pain is intense on chewing, on percussion and the patient has the sensation of a “grown tooth”, due to its alveolar extrusion, and edema in the apical periodontal ligament. During the coronary opening, we can hold the tooth with the fingers to avoid making pressure on the periodontal fibers and cause even more symptoms.

In these cases, a complete biochemical preparation of the root canal must be carried out, by using crown-down techniques in order to neutralize the septic content within the root thirds and in the apical instrumentation, reach the patency with files with the diameter thinner than the size of the apical foramen, allowing drainage of inflammatory fluids and promote infection control in the region by the chemical-mechanical instrumentation. If more stimulation is necessary, it is important use larger diameter files. The use of intracanal medication is also indicated by moistening a cotton swab with 2.5% sodium hypochlorite in the pulp chamber, if the irrigating solution has been used, and in cases that used chlorhexidine, its presentation in 2%. If the canal has been fully instrumented, calcium hydroxide paste can be used. It is necessary not forget the coronary sealing with glass ionomer cement or resins to prevent recontamination until the root canal system filling session. Analgesic/anti-inflammatory prescriptions are indicated as well as and occlusal adjustments, if necessary. Antibiotic prescription in general will not be necessary as the infection usually affects immunocompetent periapical tissues (Nair, 2004).

When there is no intervention in such conditions, it naturally evolves into an acute apical abscess and, in addition to the clinical conditions already described, it may present itself sore on palpation through the buccal or palatine mucosa, dental mobility and systemic involvement, such as fever, nausea and lymphadenopathies. In the initial stage, there is no edema and the local therapy is the same as for symptomatic apical periodontitis, however, drainage of purulent collection via the canal is evident, especially after the apical patency is reached. The use of siliconized cannulas within the root canal, positioned as close as possible to the apical foramen, coupled to the vacuum pump aspiration outlets, accelerates the suction drainage process. Anesthesia should be made at a distance with appropriate techniques.

When the purulent exudate is found in the intraosseous or subperiosteal region, the pain remains excruciating, because this region is richly innervated and there is consistent swelling in the tissues close to the tooth involved. In view of the intraoral swelling, the mucosal incision in the lower part of the swelling is recommended, even in the absence of a floating point of the purulent collection, to reduce intratissue pressure and to drain chemical mediators and toxic products, in addition to increasing blood vascularization to area, and also to the arrival of immune-competent cells to control the infection. When extraorally, it is recommended not to make any incision, prescribing mouthwashes with a warm solution and cold compresses, externally, on the swelling area, to stimulate intraoral drainage of the abscess. Local treatment is the same as in the initial phase.

Furthermore, when the patient looks for dental health in an advanced phase, the swelling already presents a floating point of the purulent collection and an incision must be accomplished for drainage, whether intraoral or extraoral, debridement of the inflammatory tissue and washing with saline solution. In the latter, a drain must be placed, which can be a flap of disinfected rubber sheet and attached to the edges of the skin tissue with suture, to allow drainage, if there is formation of new products of the inflammatory process, and to request the patient to return after 24h.

Either via the canal or through the swelling, one must wait for the end of drainage, before completing the local therapy: it is not advisable to leave the tooth open between sessions because new microorganisms may invade the root canal space, causing secondary infections. Furthermore, the drainage path will already be established. Antibiotic prescription should only be prescribed when cellulitis is present, which may progress to airway obstruction, progressive infections (rapid course >24h), patients with systemic impairments (fever <37.5°C, lymphadenopathies, trismus), debilitated patients, immunocompromised, with risk of evolution to bacterial endocarditis and in cases of traumatic injury, replantation of the avulsed teeth or soft tissue involvement followed by suture or debridement. The first-choice medication must be the antibiotics, such as penicillin V, which is biosynthetic; semi-synthetic derivatives such as Amoxicillin with or without Potassium Clavulanate, or in use in association with Metronidazole, an antiprotozoan; or as a second choice, bacteriostatics such as Clindamycin or macrolides such as Clarithromycin and Azithromycin, in cases of resistance or allergy to penicillin.

Even with careful infection control during endodontic procedures, there is a possibility of apical extrusion of contaminated debris, which is not a problem in immunocompetent patients, but in immunocompromised patients, bacteremia may occur and cause serious complications, which is why in these cases antibiotic prophylaxis is necessary. In general, this group includes patients with leukemia, HIV/AIDS, hereditary genetic alterations, renal failure, diabetes, transplanted patients, patients under dialysis, chemotherapies, use of glucocorticoids, immunosuppressants, risk of bacterial endocarditis (cardiac defect complex congenital, replacement or valve problems), after a history of joint replacement, before radiotherapy in the jaw region and users of bisphosphonates with intravenous administration, when parentodontic surgery is necessary (Agnihotry, Fedorowicz, Zuuren, Farman & Al-Langawi, 2016 ; Segura-Egea et al., 2018).

In the case of highly evolved acute extraoral abscesses, with difficulties in carrying out local therapy and in patients who are immunocompetent, an oral and maxillofacial surgeon should be contacted to exchange information and receive instructions on the procedure to be adopted, continue treatment or refer the patient to hospital units for antibiotic support, nutritional cares and moisturizing medications. The removal of the coronary seal, access to the endodontic cavity and infection control with the chemical and mechanical maneuvers already described, as well as prescription of systemic medication are indicated, after careful evaluation of each case, when there is exacerbation between sessions and severe pain or swelling occurs.

After the procedures, the dentist must be undressed, removing the barriers in the following order: a) gloves; b) disposable apron; c) face shield; d) cap; e) protective glasses; f) mask/respirator. The undressing must be carried out in an environment different from the one in which the clinical care took place. In the guidelines published by the Council Regional Dentistry of São Paulo, the order of removal of the dentist should be: a) gloves; b) face shield type visor; c) disposable cap; d)

disposable apron; e) respirator and goggles. According to the Ministry of Health, the sequence of removal of health professionals should be: a) gloves; b) apron, c) goggles and mask (Federal University of Pernambuco, 2020; Baghizadeh, 2020; Council Regional Dentistry of São Paulo, 2020; Ministry of Health, 2020).

After the service, the floor of the clinic room must be cleaned with detergent or sanitizer in a damp cloth or mop, surface disinfection with: 1% sodium hypochlorite; 70% liquid alcohol; ammonium quaternary and biguanide or glucoprotamine according to the type of equipment material. For disinfection, the AMIB/CFO recommend the use of 0.1% Sodium Hypochlorite, or 0.5% Hydrogen Peroxide, or 70% alcohol (Council Regional Dentistry of Ceará, 2020; Brazilian Association of Intensive Care Medicine, 2020).

The interval time between patients must be observed, in order to perform a thorough disinfection of the environment and sterilization of handpieces (low, high rotation turbines and similars. Before cleaning the office, after treating a patient without with suspicion or confirmation of COVID-19, it is recommended to wait 15 minutes after the patient leaves for cleaning. In addition, procedures that generate aerosols must be carried out in environments with respiratory isolation and HEPA (High Efficiency Particulate filter Arrestance); in the absence of this environment, the patient must be placed in a room, with a closed door and open windows (Council Regional Dentistry of Pernambuco, 2020; CDC, 2020; Brazilian Association of Intensive Care Medicine, 2020).

The proposed guidelines for care, patient waiting time, personal protective equipment and intra and extraoral antisepsis differ in Mercosur countries. While Brazil, Paraguay and Uruguay advocate that only dental urgencies and emergencies may be accomplished during the period of higher prevalence of contamination, in Argentina, in addition to urgencies and emergencies, care that does not produce large amount of aerosols and those that cannot be postponed for more than 60 days. As for what regards the waiting time, while Brazil does not mention it, Uruguay recommends sufficient time for patients not to be in the waiting room; Argentina suggests at least 1h and 3h for procedures that generate aerosols while in Paraguay the time varies from 1h to 3h depending on the amount of aerosols generated. Within the scope of PPE, Brazil and Uruguay advocate the correct use of PPE and the N95 mask; Argentina, on the other hand, recommends the use of surgical and facial masks, and the N95 respirator only in procedures that produce aerosols. Regarding intraoral and extraoral antisepsis, Argentina and Paraguay agree on the use of 0.2% povidone-iodine or 1% hydrogen peroxide, Uruguay suggests the use of 3% hydrogen peroxide (Silva, Zermiani, Bonan & Ditterich, 2020 ).

If any flu-like symptoms or suspicions of contamination by COVID-19 are observed, the dental professional must be placed in isolation for 14 days (Council Regional Dentistry of Pernambuco, 2020).

Dental injuries may also occur due to traumatic origin and depending on the involvement of the pulp and periodontal support structures, and the degree of root development, endodontic treatment will be determined, whether conservative, radical or surgical. In addition to promoting endodontic treatments according to each cause, endodontists should pay attention to the psychological health of patients during the COVID-19 outbreak (Qu & Zhou, 2020).

#### **4. Conclusion**

According to publications up to the construction of this text, scientific evidence has shown that asymptomatic individuals can efficiently spread the SARS-CoV-2 virus, causing difficulties in controlling the epidemic. Thus, every patient should be considered potentially infected with this virus and all dental practices need to review their infection control policies, engineering controls and supplies. Health professionals must keep up-to-date on this evolving disease and provide their staff with adequate training on measures to prevent spread, while contamination rates are attenuated around the world.

Epidemiological studies and clinical researches are recommended to analyze the implementation of endodontic urgency protocols adopted during the pandemic period.

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