



A Protocol Proposal for Endodontic Appointments to Avoid Contamination and Transmission of Coronavirus Disease (Covid-19)

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Coronavirus (COVID-19) pandemic has increased the utilization of emergency/urgency dental services [1]. As with most respiratory infections, infected droplets from patients with COVID-19 disease are the main source of transmission. Therefore, and during dental appointments, precautions are necessary to ensure safe and efficient treatment for patients, as well as the dental professionals including endodontists and their assistants. Endodontists can play an important role on the frontlines by preventing patients with dental pain from visiting hospitals, which are high-risk areas for COVID-19 transmission [2].

Before physical contact with the endodontist, patients should be enquired over phone or virtual devices about their current/recent general health [3]. Patients, who report previous contact with a COVID-19 positive patient within the past 14 days, should be also rescheduled. This first anamnesis should include questions in order to evaluate possible symptoms of the disease; such as fever, headache, dry cough, running nose, sore throat, sneezing, shortness of breath, and loss of smell/taste. If a patient presents one of these symptoms, elective treatment should be postponed, while emergency/urgency treatment is indicated. The most common situations that necessitate dental treatment during the pandemic period are severe dental pain from pulpal inflammation; pericoronitis, or third-molar pain; postoperative osteitis; localized pain and swelling due to abscess or bacterial infection; dental trauma resulting in pain or soft tissue laceration; dental avulsion/luxation; final crown/bridge cementation, if the temporary restoration is lost, broken, or causing gingival irritation; replacement of temporary fillings on endodontic access cavities for patients experiencing pain; and orthodontic wire or appliances piercing or ulcerating the oral mucosa, which must be snipped

or adjusted [3,4]. According to the American Dental Association, to treat some situations of symptomatic pulpal inflammation, systemic medication may be recommended to patients to avoid direct contact with dental professionals [4]. All patients, including those with asymptomatic cases, should be informed about the risks of COVID-19 transmission during dental procedures.

During the physical appointment for elective and emergency/urgency procedures, the patients should be encouraged to use personal protective equipment (PPE) including head cover, goggles, and shoe cover, which may impede virus contamination. The patients need to perform a mouth rinse with 15 mL of 1% hydrogen peroxide (H₂O₂) or povidone iodine solution for 30 seconds. This helps decrease the load of virus in the oral cavity [3, 5].

Throughout all appointments, endodontists should work with a dental assistant to practice four-handed dentistry. When intraoral examination is performed, all dental professionals have to use PPE (head cover, goggles, face shield, mask, gloves, gown, and shoe cover). The intraoral examination should include apical palpation, vertical and lateral percussions and sensitivity tests (thermal or electric dental pulp testing). Intraoral radiographs may stimulate gag reflex and induce coughing. Therefore, periapical X-rays should be avoided and, if possible, substituted by extraoral techniques such as panoramic radiography and cone-beam computed tomography [6]. Dental professionals should avoid the use of air and water jet together, since they may generate aerosols. Nitrile gloves are preferred over latex because they resist chemicals. The use of half-mask filtering facepiece respirators, e.g. N95 respirators, is essential to prevent aerosol and droplet transmission, providing better protection than surgical masks [7].

Anesthesia procedures, specifically regional block techniques, should be performed in all situations to guarantee a comfortable treatment for the patients. All endodontic procedures, elective or emergency/urgency, should be carried out using rubber dam. In asymptomatic patients, salivary glands may be a potential reservoir of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [5, 8]. Therefore, additional care is recommended to avoid contact with saliva during endodontic procedures.

The pulp chamber access should be performed with rubber dam in place to decrease the risk of contamination by aerosols with saliva. Before access, the teeth and the operative field should be disinfected with 30% H₂O₂ (v/v) and 2.5% sodium hypochlorite (NaOCl) for 30 seconds each. This protocol aims to minimize the possible contamination of the operative field. Microbiological studies have demonstrated that evaluated samples from infected root canals have shown reduction in the microbial load after root canal preparation [9, 10].

Pulp chamber access should be performed minimizing the formation of droplets and aerosols. Thus, dental professionals may choose to use chemo-mechanical caries removal methods, such as papain-based and NaOCl-based gel, associated with manual instruments. In addition, these chemicals will assist in the devitalization of pulp tissue during endodontic therapies [11]. If necessary, access cavities may be prepared with sterile low and high-speed diamond burs under limited irrigation. Before entering the pulp chamber and after removing all the restorative material, the access cavity should be disinfected using the protocol described above. This operatory step aims to reduce the possibility of the spread of contaminated aerosols from the remaining restorative material. However, to the best of our knowledge, there is no information about the mentioned supposition. Further research should evaluate whether SARS-CoV-2 penetrates a restoration with leakage and whether it survives under a restorative material. A powerful suction pump should be used to minimize the risk of transmission during the use of high-speed burs [3]. After completing the access cavity, changing gloves is recommended to prepare the root canal for a safe endodontic procedure.

In general, endodontic treatment does not require any significant changes in protocols. The preparation, irrigation/aspiration, and obturation procedures may continue to be performed according to the common accepted protocols. However, microscopic magnification is encouraged to increase the distance between the endodontist's face and the patient's mouth. Additional protection with acrylic device on the operator's microscope may enhance their safety against aerosol and droplet

transmission [12]. Use of an electronic apex locator is encouraged to optimize the working length and avoid intraoral X-rays. However, if intraoral radiograph is required (in the beginning/end of procedure), a double barrier for intra-oral sensor or films should be used [13]. Only with rubber dam in place, it is assumed that the use of ultrasonic devices, to activate the irrigating solution, is permissible. Single visit treatment may be carried out, however, emergency intervention is recommended in symptomatic patients with confirmed COVID-19 infection and pulpal pain due to irreversible pulpitis and/or pulpal necrosis only. Pulpotomy and other approaches in vital pulp therapy (VPT) are efficient procedures to reduce preoperative pain in emergency situations [14].

Bonded temporary restorative material is preferred to avoid possible displacement. If the patient is asymptomatic, they should be informed about the possibility of postoperative pain, a second visit can be scheduled. Professionals may prescribe systemic medication, according to the patient's condition.

After root canal obturation, the immediate direct bonded restoration with composite resin is recommended, which reduces the number of visits to the dental office. To avoid contamination of the tubes and possible cross infection, the composite resin increments to be used during the restorative procedure must be initially removed from the resin tubes and stored in a light-secure box. All protective measures cited above aim to lower the possibility of endodontists' and their assistants' exposure to saliva.

During the pandemic, elective periapical surgeries should be postponed. Only surgical drainage of acute periapical abscess and surgical management of soft tissues/teeth affected by dental trauma are recommended [4]. After the pandemic, periapical surgeries may resume with original protocols [15]. Therefore, osteotomy should be performed using Ochsenbein manual chisel. Apicoectomy and root-end preparation need additional caution, as they may promote aerosol production with the use of high-speed burs and ultrasonic tips. The PPE used during surgical procedures is similar to that of non-surgical treatments. A powerful suction pump is fundamental to minimize the spread of aerosols during surgical procedures.

After dental appointment, additional care to avoid possible contamination is important when removing PPE [3]. Appropriate measures for cleaning and disinfecting the environment and surfaces must be taken. After performing infection-control procedures in patients with suspected or confirmed COVID-19 disease, concurrent cleaning and disinfection of the dental office surfaces is indicated, preferably using a disposable tissue with a standardized

disinfectant and special attention to the surfaces with intimate contact; such as panels, spotlight, instrument table, and dental chair. No waiting time is required to reuse the room after complete cleaning and disinfection. At the end of the day, terminal cleaning of the entire area must be carried out.

Endodontists should reinforce the best possible practices to permit infection control, including hand hygiene protocols, barrier techniques, PPE, disinfection of surfaces, and sterilization of equipment. After COVID-19 pandemic, endodontists should revise the dental office routine to prevent possible contamination and offer the best and safest treatment.

Currently, many doubts persist, and further research could elucidate the impact of COVID-19 on dental therapy and the important measures required against the threat.

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