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LITERATURE REVIEW

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Oral and Maxillofacial Radiology During the Coronavirus Disease 2019 Pandemic: Recommendations for a Safer Practice

Radiología oral y maxillofacial durante la pandemia por Coronavirus 2019: recomendaciones para una práctica más segura

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ABSTRACT: The Coronavirus 2019 disease (COVID-19), was declared a pandemic by the World Health Organization on March 11, 2020, and registered the first case in Costa Rica on March 6, 2020, and 105 days later reported 2058 cases, with a wide age range (0-92 years). Its etiologic agent is the beta coronavirus SARS-CoV-2 with confirmed human-to-human transmission, mainly by the respiratory route. The presence of asymptomatic carriers of the virus and its transmission even without the manifestation of symptoms challenges health professionals worldwide. For this reason, assuming all patients who need dental care as possible carriers of the SARS-CoV-2 is mandatory and consequently, applying biosecurity measures with strict criteria. In the present literature review, we aim to recommend biosecurity measures to be applied during imaging examinations of dental patients due to the Coronavirus-2019 pandemic. We found that in the absence of treatment for COVID-19 disease and because of its high transmissibility, the most effective measures to prevent its spread are those allowing its containment. Therefore, the authors recommend: 1) acquiring imaging exams just in case of dental urgencies or emergencies, 2) prioritizing the use of extraoral exams, such as panoramic radiography or CBCT, under the principle of ALADAI and 3) the intraoral exams should be used just in case of a lack of extraoral imaging devices, or because of the need to solve diagnostic tasks in which they have a superior diagnostic value than those of the extraoral examinations.

KEYWORDS: COVID-19; Biosecurity; Dental imaging examination; CBCT.

RESUMEN: La enfermedad Coronavirus 2019, fue declarada pandemia por la Organización Mundial de la Salud el 11 de marzo de 2020; el primer caso registrado en Costa Rica fue el 6 de marzo de 2020, y 105 días después reportó 2058 casos, con un amplio rango de edad (0-92 años). Su agente etiológico es el beta coronavirus SARS-CoV-2. La transmisión de humano a humano está bien confirmada principalmente por la vía respiratoria. La presencia de portadores asintomáticos del virus y su transmisión, incluso sin la manifestación de síntomas, desafía a los profesionales de la salud. Por esta razón, es obligatorio asumir todos los pacientes que necesitan atención dental como posibles portadores del SARS-CoV-2 y, en consecuencia, aplicar medidas de bioseguridad con criterios estrictos. En la presente revisión de la literatura, nuestro objetivo es recomendar las medidas de bioseguridad que se aplicarán durante los exámenes de imágenes de pacientes dentales debido a la pandemia de Coronavirus-2019. Encontramos que en ausencia de tratamiento para la enfermedad de COVID-19 y debido a su alta transmisibilidad, las medidas más efectivas para prevenir su propagación son aquellas que permitan su contención. Por lo tanto, se recomienda: 1) adquirir exámenes por imágenes solo en caso de urgencias o emergencias dentales, 2) priorizar el uso de exámenes extraorales, como la radiografía panorámica o CBCT, bajo el principio de ALADAIP y 3) se deben usar los exámenes intraorales solo en caso de falta de dispositivos de imágenes extraorales, o por la necesidad de resolver tareas de diagnóstico en las que tienen un valor de diagnóstico superior al de los exámenes extraorales.

PALABRAS CLAVE: COVID-19; Bioseguridad; Examen dental por imagen; CBCT.

INTRODUCTION

The Coronavirus 2019 disease (COVID-19), first discovered in 2019, in the city of Wuhan, in China, has spread rapidly to most countries in the world and declared a pandemic by the World Health Organization (WHO) on March 11, 2020. Its etiologic agent is a beta coronavirus named by the International Committee on Virus Taxonomy as SARS-CoV-2 (Severe Acute Respiratory Syndrom Coronavirus 2) (1-5).

In Costa Rica, the Ministry of Health registered the first case on March 6, 2020, and 105 days later reported 2058 cases, with a wide age range (0-92 years old). At this moment, 982 people have recovered, and 12 have died (6,7). Although social distancing measures, as well as adequate hygiene, seem to be flattening the contagion curve in our country, it is necessary to maintain and reinforce biosecurity protocols during dental care, since there is no treatment nor vaccine available (2). Thus, dental procedures during the pandemic must be performed only in highly justified cases.

The authors recognize that rapid and efficient transmission of information is one of the effective ways to reduce the spread of SARS-CoV-2 and thus decrease the contagion rate. Therefore, in the present document, we aim to recommend the biosecurity measures to be applied during imaging examinations of dental patients due to the Coronavirus-2019 pandemic.

TRANSMISSION OF THE CORONAVIRUS COVID-19

Currently, human-to-human transmission has been well established, mainly by the respiratory route (direct transmission) through the inhalation of aerosols and droplets from sneezing/coughing or by contact of mucosa (oral, nasal and ocular) with infected secretions present in contaminated surfaces (indirect transmission). Besides, nosocomial infections are crucial in professional practices, particularly in dentistry, which involves contact with salivary secretions and generation of aerosols during some dental procedures (8,9).

The average incubation period ranges from 5.2 days to 12.5 days. However, it is not clear when a patient becomes infectious within this range since it has been possible to document the presence of asymptomatic carriers of the virus and its transmission even without the manifestation of symptoms. For this reason, assuming all patients who need dental care as possible carriers of the SARS-CoV-2 is mandatory and consequently, applying biosecurity measures with strict criteria (8). It is also important to acknowledge the wide variety of infectious agents to which dentists, patients and dental assistants have always been exposed, even before the COVID-19 pandemic, which all require solid biosecurity measures.

PRIORITIZATION OF DENTAL CARE

According to the Costa Rican Ministry of Health in its "Technical Guideline for the prevention and containment of COVID-19 for dentists and auxiliary personnel of Costa Rica", updated on March 27, 2020, the dentists must provide only emergency care or maintain the temporary closure of their offices (10). However, these guidelines do not specify the criteria for defining a dental emergency, transferring the decision making responsibility to the dentists. In this way, the Association of Dental Surgeons of Costa Rica recommends, under the American Dental Association (ADA) criteria and the guidelines of the Costa Rican Ministry of Health, to focus dental care in cases of urgencies and emergencies, which increases the action range of the dental professional (11). Thus, the American Dental Association defined the criteria to prioritize dental care for patients during the COVID-19 pandemic as follows (12):

DENTAL EMERGENCIES

Those conditions with life-threatening potential, and therefore require immediate treatment to stop continued bleeding, relieve severe pain or infection and include:

- uncontrolled bleeding;
- cellulitis or diffuse bacterial soft tissue infection with intraoral or extraoral inflammation with a potential compromise of the patient's airway;
- trauma involving facial bones, with the potential compromise of the patient's airway.

DENTAL URGENCIES

Conditions that require immediate attention to alleviate severe pain or risk of infection and, thus, decrease the need for the use of hospital emergency units. These should be treated with minimally invasive procedures as much as possible, and include:

- severe dental pain (pulpitis);
- pericoronitis;
- post-surgical osteitis;
- localized bacterial abscess or infection, with localized pain and increased volume;
- dental fracture causing soft tissue pain or trauma;
- dental trauma with avulsion or dislocation;
- dental treatment required before critical medical procedures;
- final cementation of fixed prostheses in cases in which the temporary restoration losses, breaks or causes gingival irritation;

- biopsy of abnormal tissue;
- suture removal;
- adjustment of the prosthesis in cancer patients;
- prosthetic adjustments or repairs if compromising function;
- temporary restoration replacement in endodontic access in patients experiencing pain;
- trimming or adjusting orthodontic wires or piercings that ulcerate the oral mucosa.

ROUTINE DENTISTRY PROCEDURES

These are considered neither emergencies nor urgencies, and include, but are not limited to:

- initial examinations or controls, including diagnostic and control radiographs;
- dental prophylaxis and preventive therapies;
- orthodontic procedures (except for those already mentioned);
- exodontia of asymptomatic teeth;
- restorative dentistry, including the treatment of asymptomatic caries lesions;
- aesthetic dental procedures.

According to these considerations, routine dental procedures, and therefore imaging examinations, should not be performed during the COVID-19 pandemic if they are not part of a dental urgency or emergency. However, once the allowance of routine dental procedures is back again, biosecurity measures should not be less than those during the pandemic because a large part of the population would not develop immediate immunity and because of the lack of a vaccine. Both reasons make a second pandemic wave imminent according to statistical models made from the H1N1 influenza pandemic (13).

INDICATION OF IMAGINOLOGICAL EXAMS IN DENTISTRY DURING THE COVID-19 PANDEMIC

During dental care, imaging examinations are essential in different clinical situations, as they complement clinical findings (14). Within the context of the current COVID-19 pandemic, and consequently with the guidelines mentioned above, it is recommended to perform only those imaging exams required as a part of a dental urgency or emergency, and postpone all those examinations associated with routine dental procedures.

Once health authorities allow dental care, imaging exams must involve biosecurity measures to avoid both COVID-19 and other infections, such as HIV (Human Immunodeficiency Virus), HBV (Hepatitis B virus), HPV (Human Papillomavirus), TB (Tuberculosis), among others (15).

Imaging examinations in dentistry include two broad groups: intraoral and extraoral exams. Intraoral exams represent a higher risk of contagion with SARS-Cov-2 than extraoral exams, due to the higher probability of contamination with saliva. (16) Therefore, during this COVID-19 pandemic, the suggestion is to prioritize the use of extraoral exams, such as panoramic radiography or Cone Beam Computed Tomography (CBCT), by choosing the technique under the principle of ALADAIP (As low as diagnostically acceptable being indication-oriented and patient-specific) (17).

On the other hand, intraoral exams should be used in case of a lack of extraoral imaging devices, or because of the need to solve diagnostic tasks in which they have a superior diagnostic value than those of the extraoral examinations (18). As

follows, the description of biosecurity protocols for both intraoral and extraoral exams.

BEFORE THE EXAMS

Before the dental appointment begins, all staff must be ready, for this (19):

- Stay up to date on COVID-19 and share the information with auxiliary personnel; this is a new disease, and new knowledge is generated every day we live with it.
- Provide updates on COVID-19 to your patients, including those related to changes to their appointment policies. Consider using your office official website, email, social media, or phone to share those updates.
- Since COVID-19 infection is clinically indistinguishable from other types of pneumonia, advise each patient that, in case of presenting any respiratory symptoms, they should reschedule their appointment. In case of doubt, they should consult previously before arriving at the dental office. If possible, postpone the dental emergency until the patient has recovered from the respiratory infection (20).
- Ask your patients, as far as possible, not to attend the appointment accompanied, to avoid overloading the physical space (this should not be more than 50% of its capacity) and to apply the distance measures within the clinic (10).
- Remove magazines, toys, and any entertainment items from the waiting room to avoid contamination and possible contagion(10).
- Coronaviruses can remain on inanimate surfaces for up to 9 days while maintaining their infectious capacity. Therefore, disinfect the most significant possible number of surfaces of the office for at the least 1-minute exposure to sodium hypochlorite 0.1% concentration or ethanol 62%-71%, as these significantly reduce the infectivity of the coronavirus present in surfaces (21).
- Disinfect space and work equipment used to carry out imaging exams: computer, intraoral/ panoramic X-ray devices, and cone-beam computed tomography equipment. Follow the manufacturer recommendations for the safest disinfectant (22).
- Sanitary facilities must be clean and have toilet paper, hand soap, disposable paper towels for drying hands, and trash cans with a foot-operated lid. Also, place gel alcohol dispensers at the entrance for each patient to use when arriving and before leaving (10).
- Apply the "Health questionnaire for patient dental treatment in the framework of the SARS CoV2 pandemic" to all patients to be treated. Besides, if the patient meets the criteria to be treated, this must sign the "Informed consent for patient dental treatment in the framework of the COVID-19 pandemic." Both documents are available on the official website of the Association of Dental Surgeons of Costa Rica (11).
- Examine patients for symptoms of acute respiratory illness (cough, shortness of breath, use of an infrared thermometer to detect fever) before entering into your facility. In case of identifying a suspect case presenting to the dental office with respiratory symptoms, offer a surgical face mask to decrease the risk of spreading the virus. If not acutely ill, send the patient home and instruct them to contact a medical service. If acutely ill (shortness of breath, for example), refer to a medical service (20).
- If treatment of a dental emergency is necessary for a suspect or confirmed COVID-19 patient, it must be carried out under hospital conditions, and the use of N95 respirators by personnel is essential.
- Personnel in close contact with patients should wear the appropriate personal protective

equipment (PPE): scrub, disposable coat, gloves, eye protection (screen/safety glasses), hair protection, disposable boots, and N95/FFP respirators or a combination of a surgical mask with face shield (23).

- All personnel must be vaccinated against all preventable diseases, especially against influenza (22).
- Personnel who develop respiratory symptoms (cough, shortness of breath) should be instructed not to report to work. Make sure that your job policies are flexible and consistent with the public health guide and that employees are aware of these policies.
- Since droplets have their highest risk of transmission between 91.44 cm and 183 cm from its source, identify a well-ventilated space that allows patients waiting with a distance between them of 2 meters. If there is not enough space in the office, it is recommended for patients to wait for treatment outside the clinic (10,22).

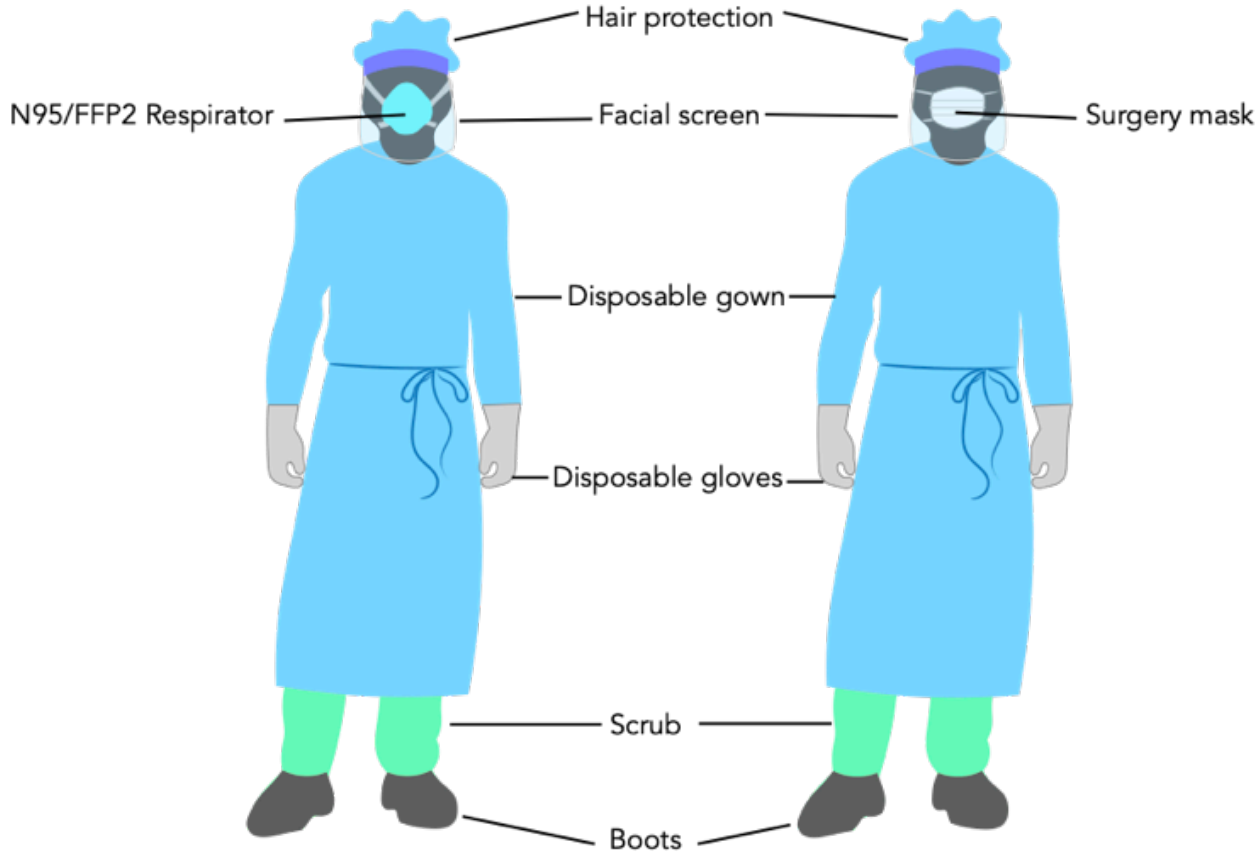

Figure 1. Personal protective equipment for patient care in dentistry. Modified from: https://www.cdc.gov/coronavirus/2019-ncov/downloads/COVID-19_PPE_illustrations-p.pdf

DURING THE EXAMS

During imaging examinations in dentistry, the potential to cross-contaminate equipment and surfaces with saliva is high (15).

Regardless of the examination, the staff must be wearing the PPE before moving the patient to the care module. In addition, it is recommended patient mouths rinses, before the procedure, with 1% hydrogen peroxide concentration (10 cubic centimeters diluted in one liter of water) for 1 minute to decrease the viral load, because COVID-19 is vulnerable to the oxidation promoted by this solution.

INTRAORAL EXAMS

Although making intraoral radiographs should be avoided as far as possible, we recommend:

- Use heat-tolerant sterilizable x-ray positioners;
- Use protective barriers on surfaces that may be contaminated (work area) during the performance of the radiographic technique.
- Clean and disinfect the lead apron and thyroid collar before placing them on the patient.
- Clean and disinfect X-ray equipment (X-ray head tube and control panel) with 0.1% sodium hypochlorite, 62%-71% ethanol, or another disinfectant, according to manufacturer's instructions. Protect them, as well, with surface barriers (15).
- After the exposure of the film/photostimulable plate, and before removing contaminated gloves, dry the package with a disposable paper towel to remove blood or excess of saliva and place it in a container for transporting it to the processing/scanning area (15).
- Put on new gloves once in the processing/scanning area and disinfect the package of the radiographic film/photostimulable plate with alcohol at 70% concentration for 1 minute before processing/scanning.

EXTRAORAL EXAMS

Since contact with salivary fluids during extra-oral techniques is minor, these are highly recommended instead of intra-oral techniques. But it is essential to consider the contact of the patient's skin (mainly of the hands and face) with the equipment. Thus, the recommendations are:

- Clean and disinfect any surface possibly contaminated during image acquisition. Also, place protective barriers on those surfaces the patient has contact with.
- Choose the extraoral technique capable of delivering the diagnostic response, according to its performance, with the lowest possible dose.
- Clean and disinfect the lead apron and thyroid collar before placing it to the patient.

AFTER ACQUIRING THE EXAMS

- It is important to remember that for both intraoral and extraoral techniques, the thyroid collar and the lead apron must be used to reduce the patient's exposure to ionizing radiation, and that after use with each patient, they must be disinfected.
- Correctly remove all disposable barriers used with the patient.
- Sterilize the positioners and any other device that has come into direct contact with the patient.
- Disinfect all surfaces that had contact with the patient: dental chair, x-ray equipment, leaded apron and thyroid collar.
- Perform general office cleaning and disinfection after the end of the workday.
- Clean and disinfect direct digital sensors after removing the plastic barrier by following the manufacturer's recommendations (24). The staff must change uniforms before leaving the workplace. Upon arrival at their homes, they have to remove their shoes, disinfect them and wash their clothes (separately from the clothes

of other family members). Finally, take a shower and thus reduce the risk of contagion within the other family members (24).

CONCLUSION

In the absence of treatment for COVID-19 disease and because of its high transmissibility, the most effective measures to prevent its spread are those allowing its containment. During the COVID-9 pandemic, the authors recommend acquiring imaging exams just in case of dental urgencies or emergencies under strict biosecurity protocols according to the evolution of the pandemic. If imaging exams are needed, prioritizing the use of extraoral exams, such as panoramic radiography or CBCT, under the principle of ALADAIP is a must. Even when the authorities allow routine dental care, the biosecurity protocols must be maintained. Besides, intraoral exams should be used just in case of a lack of extraoral imaging devices, or because of the need to solve diagnostic tasks in which they have a superior diagnostic value than those of the extraoral examinations.

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