

Coronavirus Disease 2019 (COVID-19) Health strategy in dental clinic

¹M. SIDQUI, ²F. EL QUARS

Faculty of Dental Medicine of Casablanca, Abu Al Alaa Zahar Street 21100 B.P. : 9157

Sultan Sultan CASABLANCA

Email – ¹ m.sidqui@yahoo.fr, ² faridelquars@gmail.com

Abstract: Covid-19 is an infectious viral pathology caused by the seventh strain of coronaviruses called SARS-CoV-2. (Severe acute respiratory syndrome). It has been declared a pandemic by the World Health Organization with a high mortality rate of up to 8%.

It has symptoms comparable to those of seasonal flu; although it is more contagious than this last.

Human-to-human transmission of SARS-CoV-2 mainly occurs through the respiratory tract by the inhalation of infectious droplets or aerosols emitted by an infected person or through hand-carrying.

Taking this into account and given the nature of aerosolizing dental care in the majority of cases, dental surgeons are among the health professionals most exposed to COVID-19.

This requires very rigorous protection measures, from the closure of the office and the remote management of oral emergencies, to the implementation of very strict protocol for the individual protection of all medical staff of the dental clinic. All of this is in the aim of keeping the role of the dental office as a care provider, and not a source of disease transmission.

Key Words: COVID-19, Transmission modes, Risk factors of the profession, Dental-oral medicine.

1. INTRODUCTION:

Since November 17, 2019, an epidemic of pneumonia of uncertain etiology has appeared in Wuhan, China. There have been numerous reports concerning a living animal and the seafood market, claiming that the pathogens have been transferred from animals to humans, rapidly evolving into inter-human transmission. The pathogen was classified as a new corona virus 2019 (2019- nCoV) and the disease was named Corona Virus Disease 2019 (COVID-19). (1)

As of March 30, 2020, according to the World Health Organization (WHO), 2019-nCoV involved 201 countries among which the most infected countries are presented in **Table 1 [2]**. This virus caused a mortality rate of 2% and a reproduction index (R0) of 1.4-5.5. (2)

Country	Total cases	Total deaths
World	693,282	33,106
USA	122,653	2,112
Italy	97,689	10,781
China	82,447	3,310
Spain	78,797	6,528

Table 1: Confirmed cases of COVID-19 statistics as of March 30, 2020. (2)

SARS-CoV-2, the virus responsible for COVID-19 (CoronaVirus Disease 2019) is a new coronavirus, it is enveloped (like the Virus Herpes simplex for example).

Coronaviruses belong to the family of Coronaviridae, including large single stranded RNAs more like genome. They are divided into four groups: α coronavirus, β coronavirus, γ coronavirus and δ coronavirus. A coronavirus and β coronavirus primarily infect the respiratory, gastrointestinal and central nervous systems of humans and mammals, while γ coronavirus and δ coronavirus primarily target birds. (3, 4, 5, 6)

The SARS-CoV nucleocapsid N protein contains a sequence rich in basic amino acids which is absent in all other known coronaviruses and which could be a signal for nuclear translocation. (7)

To date, there is no vaccine or specific antiviral treatment against SARS-CoV-2. Coronaviruses survive for up to 3 hours on dry inert surfaces and up to 6 days in a humid environment. Transmission by hand from the environment is therefore possible.

Human coronaviruses such as SARS-CoV and MERS-CoV can be effectively inactivated by surface disinfection procedures with 62-71% ethanol, 0.5% hydrogen peroxide or 0.1% hypochlorite of sodium in 1 minute. We can expect similar efficacy on SARS-CoV-2. (8, 9, 10, 11,12).

Covid 19 is an infectious viral pathology caused by the seventh strain of coronaviruses called SARS-COV-2. (Severe acute respiratory syndrome). It has been declared a pandemic by the World Health Organization with a high mortality rate of up to 8%.

The virulence of the virus lies in its perpetual mutation. In total, the researchers identified 33 mutations in the genome, of which 19 are still unknown.

COVID-19 is far more contagious than the seasonal flu virus. The COVID-19 incubation period generally lasts 3 to 7 days, most often 5 days, with a maximum of 14 days. (13)

According to the WHO, the virus has reached 4.44 million cases since its appearance on May 15, 1.59 million cures and 3 to 2 K of deaths. A total of 6623 cases of COVID-19 have been registered in Morocco up to the same date, including 3380 cases cured and 190 deaths.

As things stand, there is no vaccine to prevent the disease.

One study reported that dentists and anesthetists are the highest risk professionals. Protective measures to prevent the spread of the virus as well as the protection of our patients and caregivers must be put in place. (7)

The purpose of this article is to focus on the voices of virus contamination, the risks involved as well as on the means of prevention within the dental office.

2. Transmission modes:

The virus is transmitted directly by spraying contaminated droplets during a cough or sneeze, or indirectly by contact with an inert contaminated surface. This makes the dental office a potential vector for the viral transmission of SARS-COV-2. (14, 15, 16)

Human-to-human transmission of SARS-CoV-2 occurs by: respiratory or handling:

-Respiratory tract: inhalation of infectious droplets or aerosols emitted during sneezing, coughing or talking by the patient or an asymptomatic carrier, close contact with an infected person is necessary to transmit Covid 19: same place of life, direct contact within three feet of a cough, sneeze, or chat in the absence of protective measures.

-Handling: hand contact with surfaces freshly contaminated with infectious droplets and then with the face. In fact, the mouth, nose or eyes are possible entry points for the virus into the body. (17, 18, 19)

2.1 Survival of the virus on different surfaces

Currently, only one study reports this information on SARS-Cov-2 under controlled laboratory conditions (temperature between 21 and 23° C; air humidity 65% for the test of aerosols and 40% for the test of surfaces). The estimated half-life of the virus (time for halving the amount of virus) in aerosols would be 1.1 hours. Remember that aerosols are defined as very fine particles suspended in the air and that they cannot be compared to the droplets created by a person who sneezes, coughs or talks because they are much more volatile. The half-life of the virus on inert surfaces is reported to be 0.8 hours for wood, 3.5 hours for cardboard, 5.6 hours for steel and 6.8 hours for plastic. The virus could be detected in aerosols after three hours, up to 4 hours on wood, up to 24 hours on cardboard and two to 3 days on plastic and steel. However, it is not known until when the levels of virus observed remain high enough for there to be a risk of infection. (20)

2.2 Routes of contamination

-Spread of the virus

Person-to-person spread is the primary mode of transmission of SARS-Cov-2. It takes place mainly through droplets produced when coughing, sneezing or talking. A person can become infected if these droplets come into direct contact with their mucous membranes or if they touch an infected surface and then touch their eyes, nose or mouth. Since the virus can also be found in stool and conjunctiva, these modes of transmission are not excluded, but probably remain rare. For the medical sector, smear or aerosol infections (microdroplets less than 5 micrometers which may appear during certain procedures such as dental procedures, bronchoscopy and certain surgical techniques) are not excluded either, but we currently don't have evidence that they exist. Finally, scientists have not yet been able to determine whether mother-to-child transmission is possible during pregnancy. To our knowledge, none of the infants evaluated at birth has so far been positive for the Covid-19 reference test (RT-PCR based on the search for the virus genome).

Some, however, had antibodies that could have passed the placenta barrier if the mother became infected during her pregnancy. (21, 22, 23, 24, 25)

-Contagiousness

A spike protein located on the surface of the virus is believed to be responsible for the rapid transmission of the virus. This allows the virus to attach to a cell to release its RNA and infect it. It is more easily cleaved by cells in the human body than other viruses in the same family. The average number of individuals that a person with SARS-Cov-2 can infect (basic reproduction rate of the virus, R0) would reach values between 1.4 and 2.5 according to the World Health Organization .

However, studies report estimates of 1.4 to 6.5. If the R0 of SARS-Cov-2 seems to vary as much from one publication to another, it is that its estimate is based on more or less complex mathematical models. These models consider the number of infected people (whom we never know exactly), likely to be infected or exposed, without symptoms, withdrawn (death and recovery) and sometimes many other parameters. It should also be taken into account in this interpretation of R0 that the barrier measures act on the contact rate and the probability of infection and therefore constantly modify it.

A person is potentially contagious as soon as the viral load (quantity of the virus present in the body) becomes significant, even before the onset of symptoms. Transmission by subjects carrying the virus without symptoms is also possible and has been described several times.

According to current information, the viral load of these people is similar to that of patients with symptoms. Excretion of the virus from the pharynx would be very high during the first week of symptoms (7X10⁸ copies of RNA per throat sample). The appearance of antibodies (seroconversion) would be detectable 6 to 12 days after the onset of symptoms without observing a rapid decline in viral load. The latter could be detected up to 20 days (between 17 and 24 days for 50% of patients) after the onset of symptoms with a reported case of 37 days. (26, 27, 28, 29, 30)

-Vectors of contamination

The common routes of transmission of new coronaviruses include direct transmission, which is the salivary voice and the airborne voice (coughing, sneezing and inhalation of droplets) and indirect or contact transmission (oral, nasal and with the ocular mucous membranes). (31)

The danger of Covid-19 transmission is due to the contagious risk present even in asymptomatic patients or in the incubation period. (32)

+Air:

Based on the available evidence, air diffusion is not one of the main routes of transmission. The main causes of SARSCoV-2 are related to the bio-aerosols released into the air flow.

The predominant mode of transmission in the initial phase of the epidemic appears to be the respiratory tract with "droplet" type transmission. This is supported by the high viral loads in the respiratory secretions shown by Drosten.

The possibility of transmitting aerosols with the ability to move up to 6 meters in air has also been reported in the internal environment of ophthalmologists. As a result, HEPA filters were used for ventilation. However, atmospheric emissions for SARS-CoV-2 have not yet been reported. According to the available evidence, it is not confirmed that air can be one of the main causes of transmission.

The possibility of air stability for SARS-CoV-2, as well as transmission through facial hair SARS-CoV-2 were also discussed. (33)

+Saliva:

The salivary droplets emitted during sneezing, coughing, or speaking are a real transmission factor for Covid-19.

Covid-19 can be transmitted through saliva directly or indirectly, even in patients with no cough or other respiratory symptoms. Saliva samples have a high sensitivity and specificity in the detection of respiratory viruses compared to those of the nasopharyngeal junction.

It has also been shown that the use of saliva in the detection of coronaviruses reduces the time and costs associated with collecting samples. (34)

More studies are needed to assess the potential diagnosis of Covid-19 in saliva and its impact on the transmission of this virus, which is essential for developing rapid diagnostic and prevention tests. (35)

Saliva offers many advantages as a diagnostic fluid because it is easy to collect, store and contains very good DNA. Thus, saliva can be an ideal alternative for the blood.

Recently, researchers from RUCDR Infinite Biologics at Rutgers University reported that saliva is an effective means for the detection of COVID-19 compared to nasopharyngeal or oropharyngeal samples. According to them, the use of saliva to extract viral RNA was in fact a reliable source for the detection of COVID-19. (35)

+Contact surfaces

SARS-CoV can persist on surfaces such as metal, glass or plastic for up to a few days. (36, 37)

The half-life of the virus on inert surfaces is reported to be 0.8 hours for wood, 3.5 hours for cardboard, 5.6 hours for steel and 6.8 hours for plastic. It also remains in aerosols beyond three hours, up to 4 hours on wood, up to 24 hours on cardboard and two to 3 days on plastic and steel.

A study relating to the comparison of SARS-CoV-1 to SARS-CoV-2 in terms of survival on different surfaces has shown that the latter has the capacity to remain alive in aerosols throughout the experiment which lasted 3 hours, with a reduction in viral titer from 103.5 to 102.7 TCID₅₀ per liter of air. (38)

This reduction was similar to that observed with SARS-CoV-1, from 104.3 to 103.5 TCID₅₀ per milliliter. SARS-CoV-2 was more stable on plastic and stainless steel than on copper and cardboard and was able to stay alive up to 72 hours after application on these surfaces, although its viral titer was considerably reduced (from 103.7 to 100.6 TCID₅₀ per milliliter of medium after 72 hours on plastic and from 103.7 to 100.6 TCID₅₀ per milliliter after 48 hours on stainless steel).

This study also reported that on copper, no viable SARS-CoV-2 was detected after 4 hours and no viable SARS-CoV-1 was measured after 8 hours. On the carton, SARS-CoV-2 was detected after 24 hours and no SARS-CoV-1 was detected after 8 hours.

The longest viability of the two viruses was objectified on stainless steel and plastic, the estimated average half-life of SARS-CoV-2 was approximately 5.6 hours on stainless steel and 6.8 hours. on plastic. (38)

-Other vectors

The virus can also be found in the stools, conjunctiva and them, these modes of transmission are not excluded but remain rare.

+The aero-fecal route

Studies have shown that around 2 to 10% of confirmed cases of SARS-CoV-2 have been associated with diarrhea. Two studies have reported the detection of residual viral viruses of SARS-CoV-2 RNA in the stool of patients with SARS-CoV-2.

However, only one study reported the presence of SARS-CoV-2 in a sample of cultured stools. (39, 40, 41)

+Transmission by wastewater

In the latest study, the report of the presence of the SARS-CoV-2 virus in wastewater was confirmed.

+Transmission by insects

Clinical and laboratory waste of SARS-CoV-2 has been detected in suspect individuals, secretions in the blood (1%) and faeces (26%) can also be a major source of virus transmission. But a study has shown the presence of the virus in urine. If this waste is not properly managed, SARS-CoV-2 can be transmitted by insects. (42)

3. Risk factors of the profession:

Given the specific characteristics of dental care, the risk of contamination with SARS-CoV-2 between patient and practitioner can be high. Dental surgeons are among the health professionals most exposed to COVID-19.

The use of certain materials (rotary, ultrasonic, etc.) generate aerosols (air + high pressure water). Under the effect of the pressure, these aerosols projected into the oral cavity become contaminated (blood, saliva, pulmonary aerosols) and are projected outside the oral cavity. Many dental procedures produce aerosols contaminated with various viruses. The aerosolization of the droplets of saliva contaminates the treatment space (chair, work surfaces, floor, etc.).

Certain oral emergencies, in particular painful emergencies (irreversible acute pulpitis ...) require an urgent therapeutic act using these materials to relieve the patient.

The practitioner must not, by himself or through his professional environment, become a vector of transmission. (43, 44, 45)

Close communication with a patient, coughing and sneezing also promotes contamination.

In addition dental professionals are at risk of contact with the conjunctival, nasal or oral mucosa and therefore droplets and aerosols containing microorganisms, but also indirect through contaminated dental equipment and instruments or surfaces within the dental office. which are a factor causing the spread of viruses. (46)

The surfaces of the cabinet (plastic, metal, wood, glass, walls, etc.) and professional attire (blouses, overblouses, gowns, hoes, caps, masks, cash hoes, glasses, visors, etc.) constitute the diversity of materials from which they are made a vector for the spread of the virus within the dental office, putting both the staff and the patient at risk.

A very large proportion of initial cases of SARS occurred among health care workers, following the presence of factors favoring close and prolonged contact. In Lee's study, of 138 patients studied, 112 were secondary and 26 were tertiary (19). The patients were divided into 69 caregivers, 16 students and 54 patients hospitalized in the same unit. (47, 48, 49, 50, 51)

4. Barrier measurements in the dental office:

-Protection of dental structure

Must be cleaned and disinfected at the end of the day:

- Surface and soil,
- The office, the examination table (or dental chair) and the office furniture including computer keyboards, telephone, printer.
- Switches and door handles.

It will also require:

- Provide a hydro alcoholic solution and protective masks
- Display practical advice and barrier measures.
- Display the hydro alcoholic friction protocol.

In the event that a positive Covid-19 patient has been seen in consultation despite screening, it is necessary to ventilate the premises and clean and disinfect all contact surfaces before taking charge of the next patient.

-Protection in the waiting room

- Limit the use of the waiting room. It is preferable that the patient enters directly into the treatment room.
- Appointments must be organized so as to leave a minimum of two meters between two people in the waiting room (limit the number of seats).
- After each patient, the waiting room should be ventilated as much as possible. Disinfect at least twice a day and ventilate regularly, for at least 15 minutes.
- All objects that cannot be disinfected and that are not useful for the care of patients must be removed from the waiting room (remove books, magazines and toys).
- The furniture must be able to be cleaned and disinfected.
- There is access to toilets and a place for washing and disinfecting hands. This place is accessible to patients from the waiting room. Limit access to sanitary facilities as much as possible. (42, 52)

-Protection for professionals in charge of reception

-The professional in charge of reception must wear a surgical mask. It is protected from patients by a transparent protective screen. He respects the rules of hand washing and applies barrier gestures (maintains a distance of at least one meter with patients).

-Payment by bank card, electronic payment method or bank transfer are preferred. Wipe bank cards and other means of payment with a disinfectant solution or rub hands with SHA after handling them. (30, 42)

-Protection for professionals in charge of care

- Nursing staff who are pregnant or suffering from immunosuppression or who have certain comorbidities (respiratory at risk of decompensation, kidney disease on dialysis, heart failure, cirrhosis of the liver, insulin-dependent or complicated diabetes mellitus) must not be on call.

- Limit as much as possible the number of nursing staff exposed.

-Wear a work attire reserved for the care activity. Indeed, the professional follows the rules of hygiene recommended in particular with regard to personal protective equipment (PPE) as well as rules for washing and disinfecting hands. The practitioner must be equipped with the following PPE:

- + Professional attire (including shoes, if not overshoes)
- + FFP2
- + Disposable Charlotte
- + On disposable long sleeve blouse
- + Professional protective glasses
- + Disposable gloves.

-In normal times, you must change the FFP2 mask (when indicated), cap and overcoat between each patient.
-In the current context of lack of PPE, it is possible as a temporary solution:

+ To extend the use of a mask for several patients. It is thus possible to do a 4- hour shift with an FFP2 mask.

+ Disposable overcoats and charlottes will be changed, if possible, between each patient.

-However, if PPE is contaminated (by blood splashes, saliva, aerosolization...) it must imperatively be changed. (30, 53, 54, 55, 56, 57)

-Compliance with basic hygiene rules is essential, before and after each treatment. Hand washing and hydro-alcoholic friction before wearing professional attire is essential. Nail polishes are to be avoided since they constitute a trap for the retention and colonization of germs. The angles must be cut and the jewelry removed. Studies have shown that washing with soap and water is much less effective than hand disinfection. Washing for several minutes could reduce the flora of the skin. Hand disinfection is indicated in almost all interactions of medical personnel with patients. Thus, the rubbing of hands commonly is considerably more effective than washing them with soap. For example, within 30 seconds of hand disinfection, certain bacteria such as *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* or *Staphylococcus epidermidis* are not only greatly reduced, but almost completely eliminated. (58, 59)

-Display information on the measures taken vis-à-vis the coronavirus and the techniques of washing and / or friction of the hands.

-Make the symptomatic patient wait outside the office or in a dedicated room, especially if other patients are present in the waiting room. Have him wear a surgical mask as soon as he enters the office.

-Organize yourself so as not to have several patients present at the same time in the waiting room.

-Limit entry only to the patient. For special situations (children, dependent persons, etc.), limit it to one accompanying person.

-When patients arrive at the office, systematically ask them to wash their hands with soap or to rub their hands with a hydro alcoholic solution (HAS). Ditto for any accompanying persons.

-Avoid contact with patients and work colleagues (do not kiss, do not shake hands...).

-Apart from the act of care, keep a distance of more than one meter between the patient and the practitioner.

-Do not touch your face (average frequency of 60 times a day).

-Clean screens, keyboards and mobile phones regularly.

-The equipment used and the surfaces in contact are cleaned and disinfected after each patient.

-Condemn the use of spittoons.

-Remove all objects and materials present on the work plans.

-At least twice a day as well as at the beginning and end of the consultation:

+Disinfect door handles

+Air the waiting and treatment rooms for 10 minutes.

5. Management protocol:

-A patient must wear a surgical mask from his arrival at the office and until his departure (leaves with the mask at his home). He only removes it for clinical examination or treatment.

-As a precautionary measure, an antiseptic mouthwash must be carried out before any examination or oral care. Before starting the treatment it is recommended to rinse the mouth with a solution of hydrogen peroxide at a concentration of 1% (the virus is vulnerable to oxidation) or providone at 0.2% such as betadine before any intervention.

-Attention: Chlorhexidine 0.2% does not effectively destroy the SARS-CoV-2 virus.

-The use of a dental dam (Kofferdam) is highly recommended.

-During treatment, the 4-hand technique as an example is beneficial in controlling the spread. **(60, 61)**

6. Precautions during clinical examination or treatment

-Avoid intraoral x-rays which can trigger a cough. Favor a panoramic examination

-Avoid other gestures or acts that could make the patient cough

-Limit as much as possible the treatments causing aerosolization (limit the use of rotary presses, do not use ultrasound)

-Promote the use of a powerful suction, if possible in combination with a second suction;

-As soon as possible, use a dike (greatly reduces the projection of saliva droplets)

-If a suture is necessary, favor an absorbable thread

-In order to limit the practitioner's exposure, stand behind the patient

-If a turbine or contra-angle is used: the use of low-speed rotary presses with a minimum water flow rate could reduce the production of droplets and aerosols.

-Perform a complete sterilization procedure for the material before reusing it (autoclaving) or use disposable presses (if available). **(42, 62)**

In practice, between two meetings

- Keep your FFP2 mask, unless soiled, removed or touched → change (for a 4-hour shift).

-Change gloves, clean your protective glasses, if possible change your gown (compulsory if soiled), rub your hands with a hydro alcoholic solution (SHA).

-Aerate the treatment room for 10 minutes.

-Washing hands with soap or rubbing with an SHA before putting on gloves;

-Soiled PPE must be treated as waste from healthcare activities with an infectious risk. **(42)**

7. TAKEOVER AT THE DENTAL OFFICE

-For prescriptions

Serious adverse events related to the use of nonsteroidal anti-inflammatory drugs (NSAIDs) and corticosteroids have been reported in patients with COVID-19, possible or confirmed cases. We remind you that the treatment of a badly tolerated fever or pain in the context of COVID-19 or any other respiratory virosis is based on paracetamol, without exceeding the dose of 60 mg / kg / day and 3 g / day. NSAIDs should be banned [16]. In case of severe pain, it is possible, in the absence of allergy, to prescribe morphine derivatives (codeine, tramadol ...). **(28, 42)**

-CAT if the patient is sick

-If the practitioner presents symptoms suggestive of COVID-19, it must:

+ Stop working.

+ Get tested for COVID-19 (RT-PCR test). Health professionals are tested so as not to be a source of transmission themselves. Depending on the territory, the sample is taken in town and / or at the hospital.

-Depending on the result of the RT-PCR and the clinical state of the practitioner, an activity protocol will be decided with the attending physician (cessation of all activity, reception and sorting of patients with suitable PPE, urgent care provided with PPE adapted...). **(62, 63, 64)**

8. CONCLUSION:

Despite the high practical and theoretical data, dentists around the world are in a state of anxiety and fear in the face of this pandemic which is impacting humanity.

Currently, strict adherence to hygienic and aseptic measures and the scheduling of selective care is the only way to minimize the risk of SARS-Cov2 nosocomial infections occurring in the dental office. Still, dental professionals must remain vigilant in the face of this pandemic as long as diagnostic tests are not yet available to them and thus consider any patient as being an asymptomatic carrier until proven otherwise.

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