

Dentistry and COVID-19 pandemic: operative indications post-lockdown

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SUMMARY

A new Coronavirus, the seventh member of the Coronaviridae family, identified as SARS-CoV-2, spread in late December 2019 in the territory of Wuhan in China. CoV-2019 can be transmitted directly from person to person by respiratory drops, direct contact and contaminated material. Furthermore, 2019-nCoV penetrates cells similarly to the SARS coronavirus, i.e., through the ACE2 receptor. This may promote human-to-human transmission. Patients and dental professionals are exposed daily to pathogenic microorganisms, including viruses and bacteria, which infect the oral cavity and respiratory tract. Dental procedures carry the risk of 2019-nCoV infection due to their specificity. Direct transmission regards the distance between operator and patient, exposure to saliva, blood and other body fluids, the use of sharp instruments and “droplet-generating” rotating instruments, contact with the conjunctival mucosa, and finally the contact with droplets produced by coughing and nasal secretion of an infected individual without mask at short distance, increasing the biological risk for the operator. In light of the pandemic linked to COVID-19, although there is no clear scientific evidence in the literature, it is necessary to identify protections with regard to clothing, operating protocols, disinfection of environments and management of waiting rooms and front offices. This paper is a basis for operative indications for dentists and other health care professionals in phase 2 post lockdown for both private and public structures.

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INTRODUCTION

A new Coronavirus, the seventh member of the Coronaviridae family, identified as SARS-CoV-2, spread in late December 2019 in the territory of Wuhan in China (Zhu N *et al.*, 2020; Wang C *et al.*, 2020); the virus generates a human-to-human transmissible parainfluenza syndrome, characterized by mild symptoms such as coughs, colds, headaches, fever, up to pneumonia with severe respiratory distress sometimes associated with acute respiratory distress syndrome (Liu L *et al.*, 2011; Huang, C. *et al.*, 2020) (ARDS). On 11 March 2020, the World Health Organization (WHO) declared that the international outbreak of the new coronavirus SARS-CoV-2 infection was a pandemic.

CoV-2019 can be transmitted directly from person to person by respiratory drops, direct contact and con-

taminated material (To K *et al.*, 2020; Rodriguez-Morales AJ *et al.*, 2019). In addition, the asymptomatic incubation period for individuals infected with 2019-nCoV is 1 to 14 days, and individuals who showed symptoms only 24 days after infection have been reported. It has also been confirmed that positive asymptomatic patients can spread the virus (Huang C *et al.*, 2020; Guan Wj *et al.*, 2020; Backer JA *et al.*, 2020). To *et al.* have demonstrated, through Real Time PCR, that viable viruses were present in the saliva of infected individuals (To K *et al.*, 2020; Lescure FX *et al.*, 2020). Furthermore, 2019-nCoV penetrates cells similarly to the SARS coronavirus, i.e., through the ACE2 receptor (De Wit E *et al.*, 2016). This may promote human-to-human transmission (De Wit E *et al.* 2016). In fact, ACE2+ cells (which have this receptor) are abundantly present in the respiratory tract and in the duct epithelium of the salivary glands; these are an early target of SARS-CoV-2 infection, and it is likely to be the same for covid-19 (Belouzard S *et al.*, 2012).

Patients and dental professionals are exposed daily to pathogenic microorganisms, including viruses and bacteria, which infect the oral cavity and respiratory tract (Harrel *et al.*, 2004). Dental procedures carry the risk of 2019-nCoV infection due to their specificity.

Key words:

COVID-19, oral contamination, oral transmission, aerosol in dentistry, droplets in dentistry. Inflammation.

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Direct transmission regards the distance between operator and patient, exposure to saliva, blood and other body fluids, the use of sharp instruments and “droplet-generating” rotating instruments, contact with the conjunctival mucosa (Belser JA *et al.*, 2013; Lu CW *et al.*, 2020; Rothe C, *et al.*, 2020), and finally contact with droplets produced by coughing and nasal secretion of infected individual without mask at a short distance, increasing the biological risk for the operator (Peng X *et al.*, 2020; Harrel *et al.*, 2004; Cleveland JL *et al.*, 2016). Pathogenic microorganisms transmit through inhalation in the dental environment when transported by aerosol (Kampf G *et al.*, 2020).

When the operator uses rotating instruments in the oral cavity, a large amount of aerosol containing the patient’s saliva and sometimes blood is generated, very small particles that remain suspended for a prolonged period of about 3 hours (Cleveland JL *et al.*, 2016). In addition to be considered the presence of asymptomatic subjects (Rothe C *et al.*, 2020).

In addition, human coronaviruses such as SARS-CoV, MERS-CoV (the Middle Eastern respiratory syndrome coronavirus) or endemic viruses (HCoV) may persist on surfaces such as metal, glass or plastic for a period of 48 hours (Kampf G *et al.*, 2020; Otter JA *et al.*, 2016), and according to a recent study, SARS-Cov-2 may persist on surfaces up to 72h (Van Doremalen N *et al.*, 2020).

The latest experience with the SARS coronavirus has shown a large number of infections acquired by healthcare workers in hospitals (Seto WH *et al.*, 2003). According to a mathematical model of risk calculation for biological exposure, an environment with a

medium-high level of risk has been defined according to the type of worker, the specific unit, the procedures he performs and how often he performs those procedures (legislative decree 2009).

Therefore, different levels of protection are recognized to allow the healthcare worker to work in a safe condition for himself and the patient. In light of the pandemic linked to COVID-19, although there is no clear scientific evidence in the literature, it is necessary to identify protections regarding clothing, operating protocols, disinfection of environments and management of waiting rooms and front offices (Peng X *et al.*, 2020) in phase two post-lockdown for the entire dental team but also for other health workers in public and private structures.

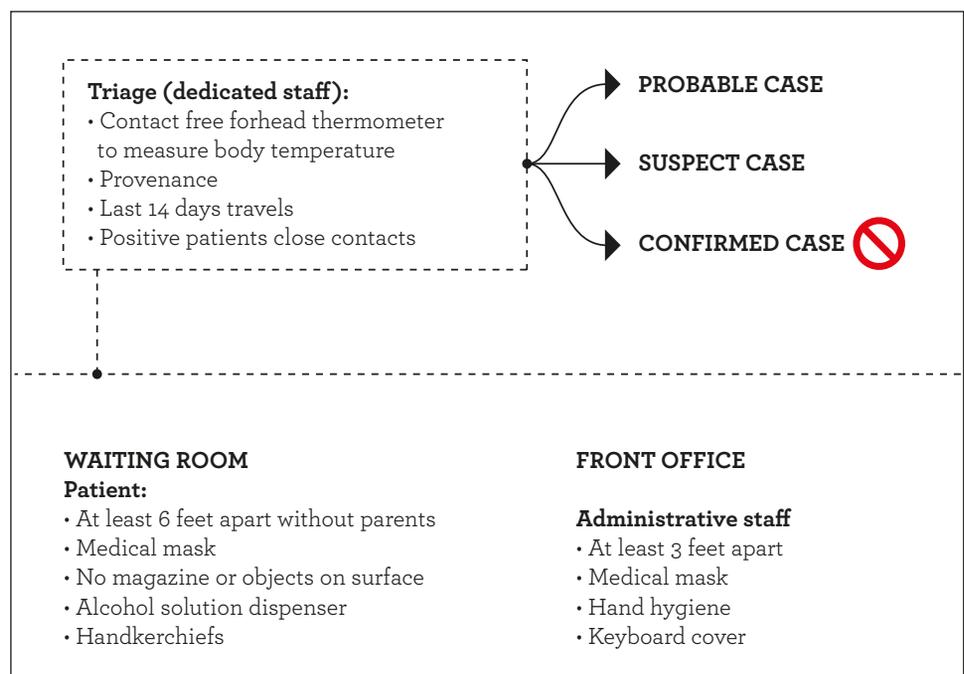
TRIAGE AND CASE DEFINITION

The Italian Ministry of Health and other authors have defined the variables to consider a patient as a suspected, probable and confirmed case (Zhu N *et al.*, 2020; Wang C *et al.*, 2020; Ministry of health 2020) (Figure 1).

Suspected case:

- a patient with one of these sudden symptoms: fever, cough, dyspnea and without another etiology that fully explains the presentation of the clinical case;
- a patient who reports history of travel or residence in a country/area where local transmission is reported (referring to WHO daily reports and bulletins of the Italian epidemiological situation) during the 14 days prior to the onset of symptoms;

Figure 1 - Patient upon arrival in the dental office, emphasizing the importance of the first screening procedures, then triage.



- a patient with one of the previous symptoms who has been in direct contact with a likely or confirmed case of COVID-19 during the 14 days prior to the onset of symptoms;
- a patient with severe acute respiratory infection (fever and at least one sign/symptom of respiratory disease, e.g., cough, difficulty in breathing).

To date there are no direct therapies or vaccines against the new coronavirus, so treatment is only symptomatic and supportive. Furthermore, for this reason and the limitations of scientific evidence, we should consider every patient potentially infected (Ministry of health, 2020).

Probable case

A suspected case is one whose test result for SARS-CoV-2 is doubtful using specific Real Time PCR protocols for SARS-CoV-2 at the identified Regional Reference Laboratories or is positive using a pan-coronavirus test (Gruppo di lavoro ISS Prevenzione e controllo delle Infezioni, 2020).

Confirmed Case

A case with laboratory confirmation for SARS-CoV-2 infection carried out at the National Reference Laboratory of the Istituto Superiore di Sanità (ISS) or by Regional Reference Laboratories, regardless of clinical signs and symptoms (Gruppo di lavoro ISS Prevenzione e controllo delle Infezioni, 2020).

Patient classification is performed through Triage, then by an initial assessment including a summary of the patient's travel, clinical, epidemiological and clinical presentation history to assess the likelihood of SARS-CoV-2 infection.

Triage proposal

In addition to assessment of the case definition, patients must be asked whether they present symptoms compatible with an acute respiratory infection (Ather A *et al.*, 2020). In particular, it is recommended to sudden onset of at least one of the following symptoms:

- fever ($T^{\circ} 37,3$),
- cough,
- sore throat,
- secretion flowing from the nose to the outside or throat (rhinorrhea),
- difficulty in breathing (dyspnea),
- flu-like symptoms/similar COVID-19/pneumonia.

Aside from the symptoms listed above, the most significant clinical findings to consider are: lowered voice or aphonia, asthenia, dyspnea, abdominal and muscular pains, abdominal swelling, pharyngitis, headache, odynophagia, white patinas on the tongue, throat plaques, colds, rales, hoarseness, sneezing, screeching, and drowsiness).

It is necessary to submit an appropriate CONSENT to the patient where he is made aware of the protocols used specifically for the pandemic (Coulthard P *et al.*, 2020).

In addition, the patient must present himself with a mask, wash his hands with gel available in the waiting room, respect the safety distances (6 feet without parents) and contact free forehead thermometer to measure body temperature (Meng L *et al.*, 2020; WHO 2020).

SELECTION OF PPE

According to the mathematical calculation of the variables (Chan *et al.*, 2020), dental procedures have a high probability of contagion, hypothetically attributable to areas in which there are confirmed cases of contraction of the disease or to all the other cases in which it is believed that the probability of diffusion is "high" (CDC USA 2020; Covello *et al.*, 1992; Leiss W *et al.*, 1998; Sandman P *et al.*, 1999; Sjoberg L *et al.*, 1999; Slovic P *et al.*, 1987; Lambert T *et al.*, 2003).

Some studies have shown that dentists have a 50% greater alteration of the nasal bacterial flora than the rest of the population, and on average contract more respiratory infections than other doctors (Cristina ML *et al.*, 2008; Clark A *et al.*, 1974; Davies KJ *et al.*, 1994).

The risk increases when:

- contact is close (<1 meter) and prolonged (>15 minutes) or contact is repeated or continuous, which increases the overall exposure time (WHO 2020);
- procedures at risk of aerosol production are performed (Del Rio C *et al.*, 2020).

Mask

A recent study shows that there are no significant differences between the surgical mask and the ffp2/N95 mask in procedures that do not generate aerosols.

Surgical masks could be used during dental examination with patients who are not part of the suspected, probable or confirmed cases (Peng X *et al.*, 2020; Meng L *et al.*, 2020; Bartoszko JJ *et al.*, 2020; Ma QX *et al.*, 2020; Leung NH *et al.*, 2020)

- reception in the waiting room;
- during administrative procedures with the patient;
- during all phases of environmental sanitation;
- during decontamination, washing and sterilization of reusable devices;
- Management of medical waste;
- between operators when it is not possible to maintain the distance of at least one meter.

WHO recommends the use of FFP2/N95 masks for patients with confirmed respiratory symptoms or suspected COVID disease and for procedures that generate droplets or aerosol (WHO 2020). In addition, filter

masks can be used up to six hours unless there is wear and contamination (WHO 2020). It is suggested to use single-use filter masks: although filter masks are available that can be reused after reprocessing, there is currently no scientific evidence as these reprocessing methods have not yet been validated (WHO 2020).

Eye Protection

Goggles should be used during examinations on non-suspicious/probable/confirmed patients; during environmental cleaning and washing procedures; during administrative phases when it is not possible to maintain a distance of one meter between operators.

Face shields should be used whenever there is production of aerosols containing blood or saliva, or in any case organic material of the patient, on patients with proven infectious or contagious diseases, non-cooperative patients, even if not directly operators (Peng et al., 2020; Meng L et al., 2020; WHO 2020; Yang Y et al., 2020).

Disposable Gowns

Operators must wear gowns whenever the production of aerosols containing the patient’s blood or saliva or any other organic material is foreseeable, for surgical services, with patients with proven infectious or contagious diseases, non-cooperative patients. Change it for each patient that involves a procedure. The characteristic of these gowns is that they must be water-repellent (Peng et al., 2020; Meng L et al., 2020; WHO 2020; Yang Y et al., 2020).

Gloves

Gloves must be worn in every operating procedure. It is recommended to take them off and wash your hands at the end of each procedure. Sterile gloves can be used at the operator’s discretion depending on the procedure (Peng et al., 2020; Meng L et al., 2020; WHO 2020; Yang Y et al., 2020; Farooq I et al., 2020).

To simplify the template of the PPE based on the procedures for the patients, operators and assistant, we propose the strategies outlined in Figures 2 and 3.

Figure 2 - Patient’s path from the waiting room to the dressing area, including recommended PPEs and mouthwash procedures. The patient’s conduct rules apply once he or she has entered the operating unit.

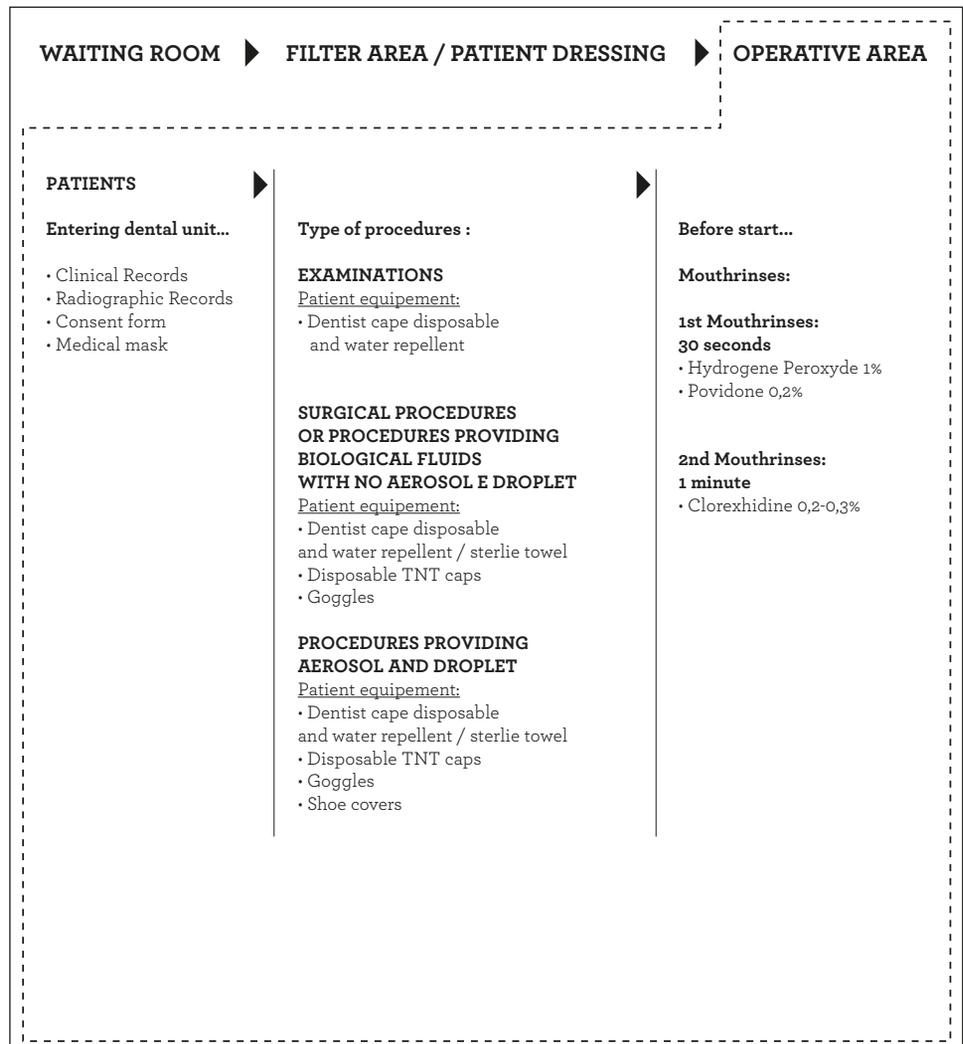




Figure 3 - Recommended PPEs to be worn by operators and assistants in low-risk procedures, i.e., visits and check-ups in medium-risk procedures, i.e., surgery that does not involve the generation of aerosols and droplets and high-risk procedures that involve the generation of aerosols and droplets.

PROTECTION OF SURFACES, WORK EQUIPMENT AND OPERATING ENVIRONMENTS

To prevent or at least reduce the possibility of contamination of the environment, equipment and surfaces it is recommended to leave as few objects as possible on surfaces (Meng L *et al.*, 2020; WHO 2020; Farooq I *et al.*, 2020; Nejatidanesh F *et al.*, 2013). Computer keyboards should be covered with polyethylene as accurate cleaning is impossible (CDC 2020; WHO 2020; Bentley CD *et al.*, 1994) (Figure 4).

Preparation of the operating field and indications during the operating session

- Before the patient arrives, if possible before starting the dental procedure, prepare everything necessary to reduce the risk of contamination of the surfaces, of the environments outside the dental unit, of the other operators as well as of the next patient; leave the furniture surfaces free (Otter JA

et al., 2016; WHO 2020; Farooq I *et al.*, 2020; Nejatidanesh F *et al.*, 2013).

- The operator must prepare patient documentation prior to entry (X-rays, medical devices, models, etc.).
- Leave the instruments covered until the start of the service.
- Flush instruments that generate water and air before dental procedures for about twenty seconds; (CDC 2003; CDC 2003; ISPEL 14/10/2008).

Patient accommodation

The following recommendations should be followed during patient accommodation (Who 2020; ISPEL 14/10/2008) (Figures 4 and 5):

- Recommend that the patient does not touch anything;
- Leave personal items in the dressing area;
- Place the disposable water-repellent cape, preferably without chain but with laces, so as to contaminate as little as possible.

Figure 4 - Organization of dental unit for dental examination.

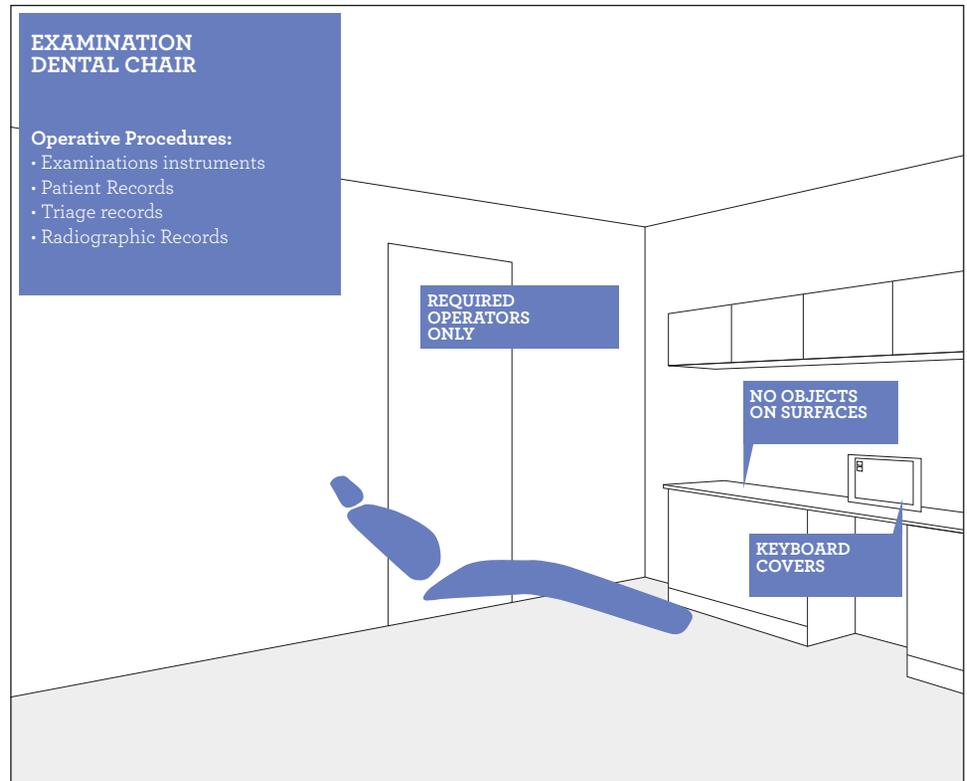
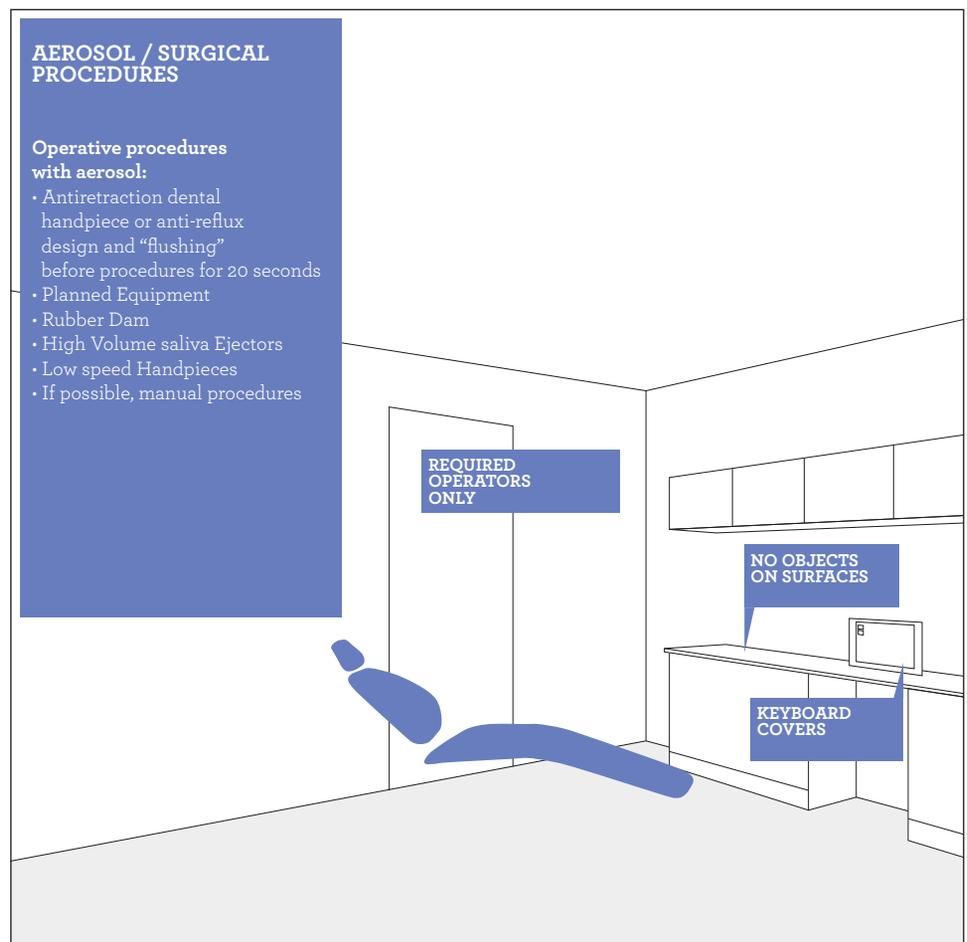


Figure 5 - Layout of the dental unit used for procedures involving aerosol generation and dental surgeries; specific recommendations for the procedures and the organization of the dental unit are detailed in the blue box.



- Before starting dental procedures, the patient should rinse twice:

A first rinse with a 1% hydrogen peroxide solution (one-part hydrogen peroxide at 10 volume/3% and two parts water) or with povidone 0.2% gargling for 30 sec.

Subsequent rinse with 0.2-0.3% chlorhexidine mouthwash for 1 minute: chlorhexidine compared to other disinfectants has lower bactericidal action, but is able to reduce the bacterial load in aerosol (Peng L *et al.*, 2020; Kariwa H *et al.*, 2006).

- Use the rubber dam if the performance allows it: its use can significantly reduce airborne particles for about 1 meter in diameter in the operating field by 70% (WHO 2020; Samaranayake LP *et al.*, 1989).
- Use handpieces equipped with anti-reflux devices to avoid contamination of the dental unit cords with the consequent risk of cross infection (Peng X *et al.*, 2020; WHO 2020; Samaranayake LP *et al.*, 1939).
- Use double aspirator or surgical aspirator (Seto *et al.*, 2003; WHO 2020).
- Use low speed handpieces whenever possible (Ather *et al.*, 2020).
- Use manual procedures whenever possible (Ather *et al.*, 2020).
- If the patient sneezes or coughs during dental pro-

cedures, stop the procedure, ventilate the dental unit and change any contaminated PPE.

Patient dismissal

Recommended procedure for patient dismissal is as follows (Peng X *et al.*, 2020; WHO 2020):

- Remove the disposable cape by not dropping potential contaminated objects.
- Reset the risk of contact with other objects when lifting the patient and ask the patient not to touch anything;
- If, after the procedure, there are bureaucratic acts, provide gloves to the patient;
- At the end of the dental procedure, ask the patient to wear a mask.

Once the patient has been discharged, the operator must sanitize glasses and visors with 70% alcohol solution (Kampf G *et al.*, 2020; Ministry of health 2020).

Reorganization after a dental procedure

Depending on the amount of material used during the dental procedure and the extent of contamination, consider a suitable time for reorganizing the dental unit after each procedure; during this phase, replace PPEs and dispose worn and contaminated ones (WHO 2020; ISPEL 14/10/2008) (Figure 6). It is advisable to ventilate the operating environment during

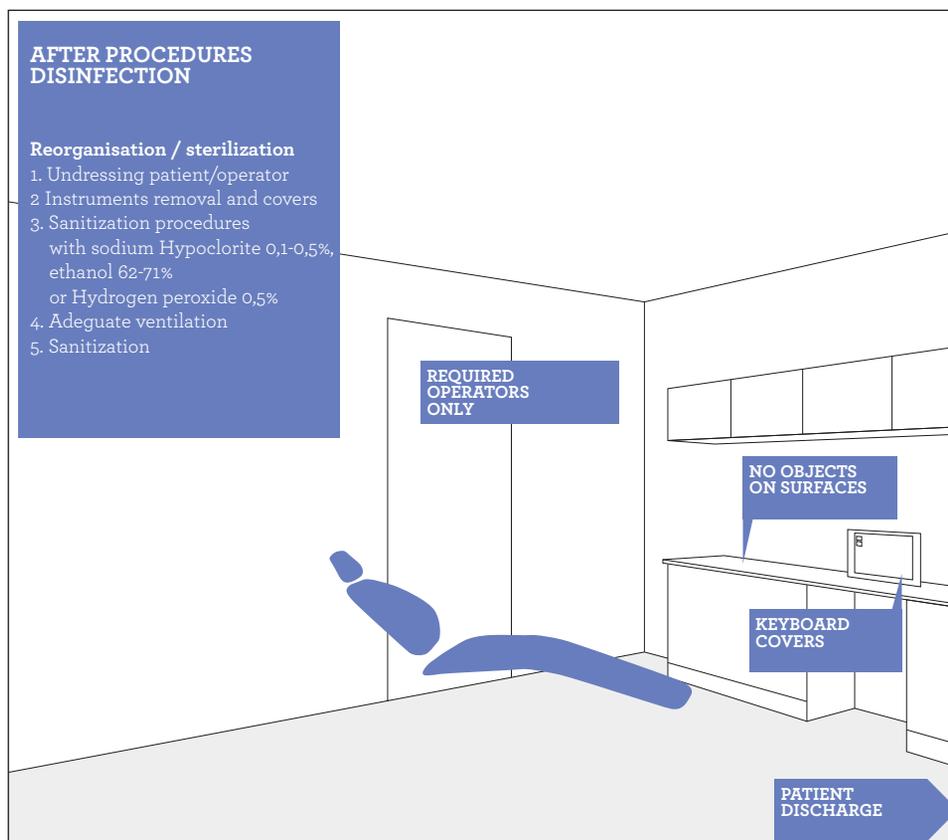


Figure 6 - Recommendations for re-organization, disinfection and sanitation of the environment following the dental procedure.

the reordering phase, as the presence of the virus in the air after the formation of aerosols and droplets is documented (Holshue ML *et al.*, 2020; Li RW *et al.*, 2004; Wax RS *et al.*, 2020).

The tidying-up phases:

- Removal of instruments and pricking and/or unscrewing them from their support.
- Removal of rotary burs and endodontic instruments from the handpieces.
- In addition to the flushing operation mentioned above, water systems must be equipped with an anti-retraction valve (Bentley CD *et al.*, 2004).
- The management and disposal of medical waste according to DPR254/03 is recommended.
- Before environmental disinfection, let water flow both in the spittoon and in the glass reserved for rinsing the patient's mouth.

According to the literature and indications of the Ministry of Health (WHO 2020; Ministry of health 2020), the SARS and MERS coronaviruses are effectively inactivated by sanitation procedures that include the use of common hospital disinfectants, such as sodium hypochlorite (0.1% -0.5%), ethanol (62-71%) or hydrogen peroxide (0.5%), for an adequate contact time (in the above-mentioned article of Kampf the estimated time is 1 minute). Chlorhexidine has not proven effective as a disinfectant (Fiorillo L *et al.*, 2019). There is currently no scientific evidence to suggest increased environmental survival or reduced susceptibility to the above-mentioned disinfectants by SARS 2-CoV.

Impression disinfection

A scientific study has shown that silicone materials are easier to disinfect than are hydrocolloids (Kotsiomi E *et al.*, 2008). Decontaminate with a dedicated and effective product depending on the material used (Berlutti F *et al.*, 2020).

According to a recent study, (Van Doremalen N *et al.*, 2020) the virus can persist on surfaces up to 72 h and the Centers for Disease Control in Atlanta recommends environmental disinfection up to 6 feet (182.88 cm) from the symptomatic patient. Surfaces (all those surfaces contaminated by biological particles) must be sanitized with suitable detergents and personnel must wear the appropriate PPE (WHO 2019).

Waste management

Due to the greater attention required for hand cleaning and aerosol dispersion control, it is advisable to check and empty the baskets in the bathrooms and waiting room several times during the day. This is also in consideration of the fact that facial tissues must never come out of the container itself. Place undifferentiated waste in at least two bags and, before closing them, apply disinfectant. All potentially infected products must be placed in the appropriate containers for

“hazardous health waste at risk of infection”; in particular, they must be treated and disposed of as category B infected material (UN3291) (CDC 2020; WHO 2020). Always close the container after applying disinfectant (Ministry of health 2020; WS 506-2016).

Management and disinfection of Endoral X-rays

At this stage, the patient's protective collar and apron have to be disinfected with appropriate disinfectant (see above) after each use. Use disposable gloves and use the disinfectant on the collar and apron with disposable paper. Before developing the X-rays, disinfect them with suitable disinfectant distributed with disposable paper (CDC 2016; ISPEL 14/10/2008).

Handling of rotating instruments

At this stage, the utmost care is recommended; according to the recent literature on COVID-19 pandemic, it is recommended to use handpieces equipped with anti-reflux devices to avoid contamination of the dental unit cords the consequent risk of cross-infection (Peng X *et al.*, 2020; WHO 2020), as the water circuit supplying the instruments is a critical point in the control of the infectious risk (Huang, C. *et al.*, 2020; To K, KW *et al.*, 2020; Beierle JW *et al.*, 1993). This has also been demonstrated by the publication of Coleman, (Coleman DC *et al.*, 2009) which reported a correlation between oral microbiome of the dental operator and microbiome of the water circuit. If possible, use manual rather than mechanical root instrumentation, as the outcome described is the same (Yue Yan *et al.*, 2020) with adequate training by an experienced operator (Brayer WK *et al.*, 1989).

Sterilization

After disinfection of the dental unit, sterilize and bag the instruments (ISPEL 14/10/2008).

WAITING ROOM

Based on the biological risk calculation, the waiting room and the front office are considered areas with a low to medium risk of exposure to contamination by biological agents (Covello *et al.*, 1992; Leiss W *et al.*, 1989; Sandman P. 1999; Sjoberg L *et al.*, 1999; Slovic P *et al.*, 1987; Lambert T *et al.*, 2003).

Waiting room (*Figure 2*):

- The minimum allowed distance between patients in the waiting room is 2 meters (CDC 2020).
- It is important that no parents remain in the waiting room. In the case of underage patients, the accompanying person is managed in the same way as the patient himself (Mallineni SK *et al.*, 2020).
- All operators must, even during reception in the waiting room, wear suitable surgical mask and in any case maintain a safe distance (WHO 2020).
- Ask patients to wash their hands with alcohol-based solutions.

- Leave coats and bags outside the operating area.
- Do not leave magazines and other objects.

RECEPTION/ADMINISTRATIVE DESK AREA

Even in the administrative area, it is important that there be only one person, who has to wash their hands and keep a safe distance (Peng X *et al.*, 2020; CDC 2020; WHO 2020; Yang Y *et al.*, 2020). Dental operators, even when dealing with administrative aspects, must wear the appropriate PPE.

The Italian Ministry of Health (Ministry of health 2020) recommends the adoption of common measures to prevent the spread of respiratory diseases:

- Pay attention to surface hygiene.
- Avoid close and protracted contacts with people with similar flu symptoms.
- Adopt any further preventive measures dictated by the employer.
- If in the course of work you are exposed to a person who meets the definition of a suspected case, it is necessary to take steps in accordance with the indications provided by the organization - to contact the health services reporting that it is a suspected case of SARS-CoV-2.
- Wait for the arrival of the health services:
- Avoid close contact with the sick person.
- If available, provide him/her with a surgical mask.
- Wash your hands thoroughly. Pay particular attention to body surfaces that may have come into contact with the patient's fluids.
- Have the paper handkerchiefs used removed in a waterproof bag directly by the patient.

CONCLUSIONS

The SARS-COV-2 pandemic is constantly evolving; in fact, some authors have focused on the permanence of the virus in the environment, because especially in hospitality structures, handles, doors, bathrooms, porous surfaces can be possible vectors of contamination, not to mention viral particles of less than 0.1 µm in size may remain in the environment as a secondary aerosol (Fiorillo L *et al.*, 2020). With regard to environmental ventilation, most international guidelines recommend about 12 changes per hour for isolation rooms in case of infections, while INAIL to date recommends 15 minutes minimum replacement after dental procedures (Fiorillo L *et al.*, 2020). Another problem that concerns the dental world is represented by chlorhexidine, for years used as a powerful anti-pathogenic agent in the treatment of periodontal defects (Calderini A *et al.*, 2012) and to date ineffective against the virus (Kampf *et al.*, 2020).

Dental professionals could also use CAD/CAM technology to produce breathing devices and use the technology to inform/train the patient and staff and re-

duce work time, deferred to allow them to perform all safety protocols proposed by the authorities (Cavallo L *et al.*, 2020).

Advanced technological devices, as never before, can help the operator to reduce his working time, to limit invasiveness and to transmit a safety message to the patient, for example in the prosthetic field with digital techniques or in implant rehabilitation with digital paths compared to conventional ones (Cattoni F *et al.*, 2019; Gherlone E *et al.*, 2015; Capparè *et al.*, 2019).

Scientific evidence is still lacking, knowledge of immunity developed by COVID-19-positive patients is partial, no vaccine or specific and sensitive test has been validated, although there are many experimental studies in progress. However, in the post-lockdown period, oral healthcare workers have to restart safely. Our works aims to be a collection of practical instructions in light of available scientific evidence.

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