Chapter

# Economic, Health-Care and Teaching-Learning Impact of COVID-19 (SARS-CoV-2) on Dentistry

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## Abstract

The aim of this chapter is to look more closely at the impact that the crisis generated by the SARS-CoV-2 is having on health, the economy and education in the field of dentistry. The considerations that must be taken into account in dental practice will be presented, as well as the usefulness that the use of teledentistry (TD) could have in times of pandemic, reflecting on the different specialties of dentistry that can benefit from this modality, as well as the advantages and disadvantages that its use can present. Likewise, teaching has been condemned to a lack of presence, having to resort to distance learning, both synchronous and non-synchronous, which can cause needs and deficiencies in undergraduate and postgraduate students. We will analyse the health risks in the dental field and the changes and needs for safe dentistry in times of pandemic. We will also break down the effect of the crisis on the medical-dental sector and the economy, from the point of view of patients and professionals, especially in times of increased restriction and confinement worldwide.

**Keywords:** oral health, protection, COVID-19, crisis, education, teledentistry, SARS-Cov-2, pandemics

## 1. Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the causal agent of coronavirus disease (COVID-19), is a 60–140 nm single-stranded RNA virus that belongs to the genus β-Coronavirus, has a corona appearance because of the presence of glycoproteins in the envelope, and it is substantially different genetically from MERS-Cov but similar to SARS-CoV [1]. It can be transmitted between humans and its intermediate host is still under investigation [2]. The Covid-19 pandemic has caused huge changes in all fields, including dentistry.

It is known that several viruses, such as herpes simplex virus, cytomegalovirus and Zika are transmitted through saliva and are able to infect and replicate in the oral mucosa, causing painful ulcers. Currently some authors have reported oral manifestations of COVID-19 disease [3]. These can have a variety of clinical presentations,

presumably supporting the hypothesis of thrombus formation and vasculitis [4]. These include necrotic ulcers and aphthous ulcerations that develop early in the course of the disease, as well as dysgeusia. Awareness of these oral manifestations is important because lesions may precede typical respiratory symptoms by several days, and worsening oral lesions may precede a more severe clinical scenario [3].

Saliva from asymptomatic persons with COVID-19 has also been observed to have potential for viral transmission and a positive correlation between salivary viral load and loss of taste [5]. SARS-CoV-2 utilises host entry factors, such as members of the ACE2 (angiotensin-converting enzyme, the major host cell receptor of SARS-CoV-2) and TMPRSS (TMPRSS2 and TMPRSS4) family that have been expressed in salivary glands and oral mucosal epithelia [5, 6]. These data demonstrate that the oral cavity is an important site for SARS-CoV-2 infection and implicate saliva as a possible route of SARS-CoV-2 transmission.

In addition, it is considered that some oral diseases could be exacerbated by COVID-19, especially those of autoimmune aetiology, as these are related to a compromised immune system or long-term pharmacotherapy, [7], which indicates that we should pay special attention to the dental care of these patients. Patients with oral psychosomatic illnesses are more susceptible to stress and this could be exacerbated in the current pandemic situation, so they may need emergency consultations and psychological counselling. The dentist must provide comprehensive care to patients and to this end, teleconsultation may be useful. [8].

Healthcare workers have a higher rate of exposure to the virus (face-to-face interaction, exposure to body fluids such as blood and saliva) which increases the risk of infection, as we try to illustrate in **Figure 1**. Dental practice presents a potential risk of cross-contamination and staff are at risk of transmission of infections. [9] In this situation, it may be advisable to use teleconsultations. The advantages of teledentistry (TD) during the COVID-19 crisis have been observed through a pilot study, where it was determined that TD allowed a monitoring of all patients, reducing costs and contact, therefore decreasing the risk of COVID-19 spreading [10]. The Australian Dental Association has published the guidelines for TD and it considers that teleconsultation is most suited to patients who require follow up, and, likewise it is very convenient for patients presenting with an acute dental problem that needs to be deal with outside of normal practising hours, for those who are unable to attend the clinic due to illness or quarantine, and for vulnerable patients


**Figure 1.**
*SARS-CoV-2 in dentistry.*

during the pandemic, including those who meet the triage protocol criteria for suspected Covid-19 infection [11].

## 2. Clinical considerations

Dental professionals must examine and detect potential high-risk patients to prevent the dissemination of infectious disease. No routine treatment should be carried out on patients in the early stages of infection [1].

### 2.1 Telephone triage

We will ask the following dichotomous questions over the phone and repeat them when the patient arrives at the clinic.

- Do you have fever or have you had one in the last 14 days (temperature > 37.5°C)?
- Have you had a cough or any other respiratory sign in the last 14 days?
- Have you had or do you have diarrhoea or other digestive problems in the last 14 days?
- Do you have or have you had a feeling of great tiredness or discomfort in the last 14 days?
- Have you noticed a loss of sense of taste or smell in the last 14 days?
- Have you been in contact or living with someone suspected or diagnosed to have coronavirus?
- Has COVID-19 disease passed?
- If so, are you still in quarantine?

In order to make a decision, we must act as follows:

- In the case of the 8 negative responses:
  - Patient with more than 37.5° (99.5°F) do not treat unless it is urgent, postpone 14 days to see evolution.
  - Patients with less than 37.5° will be treated with the indicated protocols
- At least one affirmative answer
  - Patient with more than 37.5° do not treat except as a matter of urgency
  - Patients with less than 37.5°, it is advisable to postpone the treatments for 14 days.
- If it is an emergency (cellulitis, abscess, haemorrhage, severe trauma…) the patient will be attended under maximum safety conditions.

When the patient is summoned by telephone, he/she must be informed of the recommendations for coming to the clinic:

- The patient should go alone (unless he/she is a minor or a person in need of help).
- Bracelets, rings, earrings, watches, etc. should be removed. The patient should arrive at the agreed time and avoid bringing bags and unnecessary personal objects.
- As soon as the patient arrives, his your temperature will be taken by means of an infrared thermometer, he will be asked to rub his hands with hydroalcoholic gel for 20 seconds and to answer the questionnaire. The patient should maintain a distance of 2 metres if he or she crosses someone and should not wander.

The patient must be made aware of the importance of preventive measures. At the same time, we must convey to him/her the feeling that he/she is in a place where all preventive and safety measures are being followed.

### 2.2 Hand hygiene and personal protective equipment (PPE)

The WHO in 2012 recommends that hand hygiene should be performed before touching a patient, before any cleaning or aseptic procedure, after body fluid exposure risk, after touching a patient and after touching a patient's surroundings [12].

In the dental practice, the spread of micro-organisms is mainly radiated to the dentist's face, specifically to the eyes and around the nose [13] therefore personal protective equipment (PPE) should be used. PPE forms an effective barrier against most of the aerosols generated [14].

- Respirators.

Filtering facepiece respirators, also known as disposable respirators, are subject to different rules worldwide. Their use is recommended by dentists as they are continuously exposed to aerosols [15]. Before selecting one, users should consult their local regulations and requirements for respiratory protection.

The standardisation methods used in the different countries are as follows [16].

1. N95 (United States NIOSH-42CFR84).
2. Filtering facepiece particles 2 (FFP2) (Europe EN 149–2001).
3. KN95 (China GB2626–2006).
4. P2 (Australia/New Zealand AS/NZA 1716:2012).
5. Korea 1st class (Korea KMOEL-2017-2064).
6. DS (Japan JMHLW-Notification 214, 2018).

Under no circumstances should they include an exhalation valve, as in this case the air is exhaled directly into the environment without any retention, favouring the diffusion of the virus We must bear in mind that these should not be sterilised and at most can be disinfected through different methods depending on the type, which will not increase the number of times or time we can use it [17, 18].

- Gloves.

  They should always be used as usual in daily clinical activity. It is recommended to use gloves that protect against viruses (EN ISO 374-5) made of nitrile. For cleaning and disinfection tasks, it is recommended to use thicker, more break-resistant gloves.

- Eye and face protection.

  The eye protectors certified according to the UNE-EN 166:2002 standard for protection against liquids can be integral glasses or face shields. They should always be used as COVID-19 can be transmitted through eye contact, as infectious droplets could contaminate the conjunctival epithelium [19].

- Protective clothing,

  We should avoid using street clothes or shoes in the clinic, avoiding wearing earrings, rings, bracelets, watches and other elements, as they behave as reservoirs of COVID-19.

In **Table 1** we can see in what order we should put on and take off the PPE. With the PPE on we must keep our hands away from our face and avoid touching surfaces. When we remove the personal protective equipment, we must disinfect it. PPE must be kept in a proper place and different from the place where we leave our street clothes.

## 2.3 The patient in the cabinet

The patient must pass with the mask on and it will be removed at the time indicated by the professional.

### *2.3.1 Rinses*

During dental practice, it is often difficult to avoid the generation of aerosols, which is why it is important to reduce their viral load. To this end, the preoperative use of antiseptic mouthwashes can be useful. SARS-CoV-2 is vulnerable to oxidation, so a pre-procedure mouthwash with oxidising agents such as 1% hydrogen peroxide or 0.2% povidone was initially suggested [1, 9], however, it was recently noted that there is no evidence to support the indication of hydrogen peroxide rinse to reduce viral load of SARS-CoV-2 [20]. A recently published systematic review

| **Putting on PPE** | **Removing PPE** |
|---|---|
| 1. Hand hygiene | 1. Protective gown |
| 2. Protective gown | 2. Gloves |
| 3. Mask or respirator | 3. Hand hygiene |
| 4. Check fit | 4. Eye protection |
| 5. Eye protection | 5. Hat: from the back |
| 6. Hat | 6.Respirator: from the back |
| 7. Gloves | 7. Hand hygiene |

**Table 1.**
*In what order should the PPE be put on and taken off.*

has highlighted the lack of scientific evidence to support the virucidal activity of hydrogen peroxide rinse, associated with its lack of substantivity and and its indication in dental care protocols should be reviewed [21] . As for povidone-iodine, it can be an effective measure, having demonstrated 99.99% activity when used against enveloped and non-enveloped viruses such as influenza, Ebola, MERS and SARS coronavirus [22], and has strong bactericidal and virucidal properties against pathogens, which cause oral and respiratory tract infections.

Regarding chlorhexidine, a rinse often used in dental practice, several studies have suggested that it had little or no effect against the virus compared to other rinses [1, 23], but other authors have noted that its use could be beneficial [24].

With regard to Cetylpyridinium chloride (CPC), it could be effective against enveloped viruses such as Sars-Cov 2 [25].

*2.3.2 Aerosols*

We must bear in mind that any procedure that produces aerosols is potentially risky so high flow suction should be used, as it reduces the dispersion of aerosols, as well as suctioning as close as possible to the treated area. In addition, the cabinet door should remain closed and the cabinet should be aerated between patients.

High-speed rotating instruments must be equipped with an anti-retraction system, which prevents the release of debris and fluids that can accidentally be inhaled during clinical procedures [26]. During the current pandemic, the use of these instruments without an anti-retraction system should be avoided.

The risk of aerosol generation depends very much on the clinical activity performed. The ADA (American Dental Association) classifies the risk into 4 categories:

1. No risk of aerosols (no patient contact)

   - Extraoral radiological diagnosis

2. Low risk of aerosols (contact with patients but no aerosols

   - Diagnosis: clinical examination, intraoral x-rays
   - Prevention: fluoride, atraumatic restorations
   - Surgery: simple exodontia
   - Orthodontics: adjustments

3. Moderate/high risk of aerosols (contact with aerosols, controlled)

   - Prevention: manual tartrectomy, absolute isolation sealant, controlled polishing
   - Restorative: seals with absolute insulation
   - Periodontics: manual treatments
   - Removable prosthodontics: procedures without intraoral adjustments, adjustments after disinfection, prosthodontics on implants
   - Fixed prosthodontics: preparation with absolute isolation, cemented

- Orthodontics: minimum use of rotary

4. Very high risk of aerosols (contact with aerosols, very difficult to control)

- Prevention: ultrasound tartrectomy
- Restorative: seals with high speed or without absolute insulation
- Endodontics: no absolute isolation
- Periodontics: ultrasonic treatments
- Removable prosthodontics: intraoral adjustments
- Fixed prosthodontics: no absolute isolation
- Surgery: surgical extraction
- Orthodontics: with generation of aerosols

*2.3.3 Rubber dam*

One of the easiest and most useful ways to reduce contamination is isolation with rubber dams, especially in those procedures performed with high-speed instruments. This isolation provides a 70% reduction in drops around the surgical field [27]. When its use is not feasible, manual instruments should be used to keep aerosol generation to a minimum [28].

*2.3.4 X-rays*

X-rays are one of the most commonly used complementary tests. Intraoral x-rays are the most common, however they can stimulate saliva secretion and coughing [26]. Therefore, extraoral x-rays, such as panoramic x-ray and cone beam CT, are suitable alternatives [29].

*2.3.5 Disinfection of impressions and prostheses*

Before disinfecting it, it must be washed with water. After disinfecting it, rinse it again. The prints made with alginate must be sprayed with 1% sodium hypochlorite for 10 minutes, those made with elastomers (silicones and polyethers) with the same material for 15–20 minutes. Metal-ceramic prostheses and skeletal prostheses should be immersed in alcohol for 5 minutes, acrylics should be immersed in 1% sodium hypochlorite for 10 minutes.

It should be remembered that solutions prepared with sodium hypochlorite have a 24-hour efficacy and should therefore be prepared daily.

*2.3.6 Surface disinfection*

Human coronaviruses, such as SARS and MERS, can persist on inanimate surfaces for up to 9 days and yet can be efficiently inactivated by surface disinfectants within one minute. Surfaces should be disinfected after each patient visit, especially surfaces near work areas.

Ethanol between 62% and 71%, and sodium hypochlorite between 0.1% and 0.5% are considered to be the most effective [23, 26].

Initially Kampf et al. have suggested that 0.5% hydrogen peroxide applied for one minute could be effective against the virus [23] however a study by our group has observed that this is not the case [20] There is no study in the literature demonstrating its effect at this concentration during that time and the authors portrayed themselves shortly afterwards, indicating that their results can only be attributed to 0.5% hydrogen peroxide in an accelerated form [30].

*2.3.7 Environmental disinfection*

The greatest number of SARS-CoV 2 infections occur in closed spaces, such as the dental cabinet, as the virus can persist viable in the air for hours [31]. Transmission of the virus through aerosols is affected by many factors, such as the physical parameters of the particles, properties of the virus and environmental factors [32]. It has been observed that the aerosols generated in the clinic are kept in the air for 30 minutes and that the procedures that produce the most contamination are those where ultrasound is used [33] and the turbine [34].

In these cases, ventilation is essential to produce a renewal of the air. Ventilation consists of providing outside air to an enclosed space and is a key factor in the elimination of virus-laden air, since it reduces the concentration of the virus and thus reduces the possibility of contagion [35]. It can be done through natural methods, such as opening windows (which has proved effective in the current pandemic [36]) or mechanical methods such as air conditioning and can be complemented by air filtration and disinfection systems.

If natural methods are used, an estimate of the external flow rate must be made in each case as it depends largely on specific local conditions (such as the size of openings and weather conditions). If the temperature in the clinic is unpleasant because it is too low, additional heating methods should be used. In addition, air recirculation should be avoided, as well as overcrowding in the room [35]. Filtration of contaminated air can also be useful, there are different methods, the most used being HEPA [37]. HEPA is an acronym for "High Efficiency Particulate Air Filter" which can remove at least 99.97% of any airborne particles with a size of 0.3 micron (μm), the most penetrating particle size. Particles that are larger or smaller are trapped with even greater efficiency [38]. If filtration systems are used, the manufacturer's maintenance recommendations must be followed.

Different methods have been used to disinfect the air in the current pandemic, including ultraviolet radiation and ozone. Ultraviolet (UV) germicidal radiation can damage microbial DNA and RNA, prevent the reproduction of infectious organisms and reduce the harmful effects they cause [39]. Ultraviolet germicidal irradiation (UVGI) uses UVC radiation to inactivate microorganisms by causing DNA damage and preventing replication. It has been noted that UVC can inactivate coronaviruses [40]. Ozone is a natural gas and an effective environmental sanitation system that provides highly reactive free radicals capable of oxidising bacteria, viruses and organic and inorganic compounds [41].

If there is no natural or artificial ventilation, wait half an hour for the aerosols to settle and then clean the surfaces.

## 3. Applications of distance dentistry

Although there is a need to reduce face-to-face visits to decrease the risk of infection, dentists must ensure continuity of care and "teleodontology" or

"teledentistry" (TD) is a solution of choice [42]. In periods of pandemic, in many medical specialties as well as in dentistry, teleconsultation can be an effective alternative to office visits in many oral diseases, (as shown in **Figure 2**) while in a normal setting, this system could be used as a complement.

In the case of patients with COVID-19, or those who suspect they may be infected, TD can assist in remote assessment (triage) and continuity of care. For people who are not infected with the virus, particularly those at higher risk of being affected, TD can provide rapid access to care [43].

Teledentistry (TD) could be described as the combination of telecommunications and dentistry that involves the exchange of clinical information and images over remote distances for dental consultation, diagnosis and treatment planning. There are two main types of teleconsultation: real-time or synchronous and store-and-forward or asynchronous.

Real-time consultation requires a video conference in which the dentist and patient can see, hear and communicate with each other despite being in different locations. The benefit of the real-time consultation format is that information is transferred immediately, so patients and dentists are able to interact with each other regarding dental health issues.

The store-and-forward format enables a patient to store data in a local database that is subsequently forwarded to the dentist. In this system the patient's relevant information and images are collected and stored before being reviewed by the dentist at a later stage. After reviewing the information, the dentist is able to present their diagnosis and subsequent treatment plan. This methodology has several advantages over real time telemedicine systems; the most important being the fact that it is not necessary for the patient and the consultant to coincide in time and space, and furthermore, this system makes it possible for the technological and organisational difficulties that are commonplace during consultations via videoconference to be avoided. It also allows for a greater number of patients to be evaluated per session, and it is also cost-effective as it makes use of already-existing elements, such as e-mail and the upcoming digitalisation of radiology in the hospital.

There is a growing interest in adopting telemedicine systems given that these contribute to the reduction of inequalities in health care [44]. In general, TD can be a useful tool in practically all fields of dentistry, especially during a pandemic in which social distancing is of the utmost importance, given that it saves time for both the patients and the health-care practitioner and it is also more cost-effective.

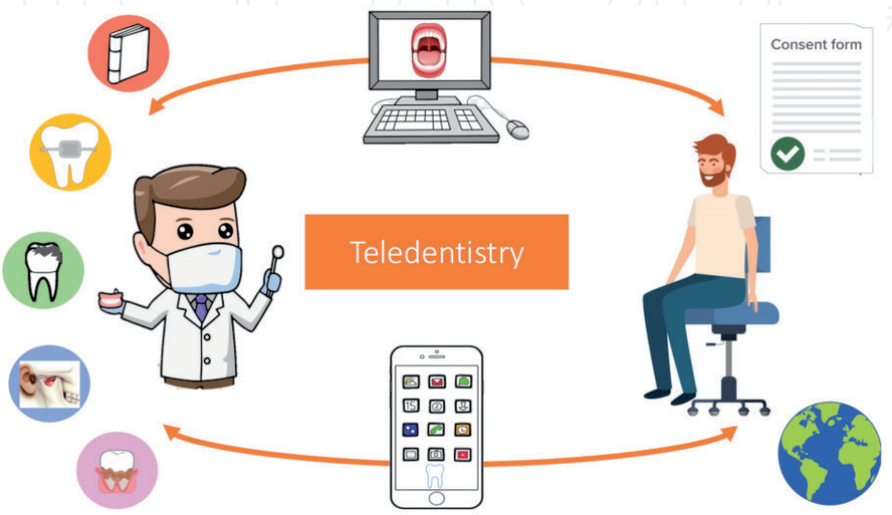


**Figure 2.**
*Teleconsultation in dentistry.*

| | |
|---|---|
| Oral Medicine | Diagnosis, treatment, follow-up |
| Maxillofacial | Diagnosis, referrals, follow-up |
| Orthodontics | Diagnosis, emergencies, follow-up |
| Traumatology | Diagnosis, follow-up |
| Periodontics | Diagnosis (mucositis, periimplantitis, tartar detection, mobility...) |
| Caries | Diagnosis (detection) |
| Endodontics | Diagnosis, recognition of root canal, follow-up |
| Paediatrics | Diagnosis (caries, anomalies, fluorosis, MIH...) |
| Prosthodontics | CAD-CAM, diagnosis, treatment plan, follow-up, urgencies |
| Gerodontology | Diagnosis, follow-up |
| Education | Professionals and students (training and updating) |
| | Patients (Instruction) |

**Table 2.**
*Main uses of teledentistry.*

| PROS | CONS |
|---|---|
| It saves time | It requires access to a software, hardware and the necessary skills to use it |
| There is a financial saving | People may feel uneasy about using technology |
| It reduces inequalities (geographical barriers) | Certain clinical tests such as palpation or radiographs cannot be performed |
| It improves communication between professionals | Privacy related problems may exist |
| It reduces patient anxiety | |

**Table 3.**
*Advantages and disadvantages of using teledentistry.*

Although visits to the dental surgery are still necessary for many procedures, TD opens new horizons for the diagnosis, treatment and follow-up of many patients, as we can see in **Table 2**.

In almost all of the fields, referrals by teleconsultation are considered very useful in reducing other unnecessary referrals. Several studies have shown that telemedicine consultations are as reliable as those performed by traditional methods [45].

Teleconsultation offers many advantages, including it can reduce a patient's dental anxiety, which can be important for people who have an irrational fear of dentists, for children and for patients with special needs. Although it also has limitations (**Table 3**), its use is widespread and there are a growing number of applications for mobile phones and videoconferencing programmes being developed for this purpose. In general, the perceptions of professionals and patients are positive, although in many cases they receive limited training about this technology.

## 4. Education

This pandemic has also led to changes in education all over the world due to the social distancing measures. The impact of the COVID-19 pandemic greatly affected dental education, with smart technology showing certain benefits in the learning process [46]. The training of future health science professionals is changing thanks to this digital age. Mariño et al. discovered that the field in which TD was used

most was education [47]. It can be an excellent tool for dentistry students, keeping dentists continuously updated.

E-learning offers advantages for students such as eliminating travel time and encouraging student-teacher interactions. Online education connects students and teachers geographically, making the university more universal and accessible [28, 48]. Some disadvantages of online courses for the student may include a sense of isolation and difficulty in adjusting, and may also lead to misperceptions and misunderstandings between students and teachers [49]. Although these virtual tools were previously available, their use and exploitation in the Covid-19 crisis has changed substantially. Recent studies confirm that training based on digital tools can improve the learning and clinical decision-making skills of dental students [50–53] especially in the pre-clinical setting [54]. According to Mardani et al. [55], in a study among dental students divided into virtual (intervention) and face-to-face (control) training, the mean clinical decision-making score in the intervention group was higher than the control group ($p < 0.001$), indicating that the application of virtual patient-based training can enhance students´ skills.

In a previous study carried out by the group studied the perceptions of teachers in Galicia, Spain with regards to online teaching, it was observed that prior to the Covid-19 crisis, 49.2% of teachers did not use any of the available online tools, but as a result of this health crisis their usage has increased [56]. However, the synchronous method is seldom used.

It can also be used for teaching patients. The effectiveness of a mobile phone app in educating mothers of children aged below 6 years of age about oral hygiene has also been studied, and it was discovered that using this app significantly improves the knowledge of mothers towards their child's oral health [57].

## 5. Health and economic impact

In Beijing, China, 2,537 participants evaluated how the pandemic influenced the use of emergency dental services and noted that the distribution of dental problems has varied significantly. Oral infections increased from 51.0% before COVID-19 to 71.9% during COVID-19, and injuries decreased from 14.2% to 10.5%. Meanwhile, non-urgent cases decreased to three tenths of pre-COVID-19 cases [58].

Costs of dental care may increase in the future for a number of reasons, including the need for additional resources such as personal protective equipment, changes in dental practice and the fact that the number of patients we will be able to see each day will decrease due to the measures taken. There may also be an increased demand for electronic consultations in the near future [59].

A study of 400 dentists in Galicia, Spain to determine the economic and health impact of SARS-CoV-2 found that the economic impact appeared to be greater for male participants than for female participants (OR = 3,121, $p < 0.001$). These losses appear to have contributed to the requests for financial support, with 29.5% of respondents who requested financial support recording losses of more than 15,000 euros. The number of patients treated was reduced, although it was noted that more urgent patients were seen per week in the public sector than in private clinics. In terms of health, only four professionals tested positive [60].

To date, we have not found any other document that addresses the economic impact of COVID-19 in dentistry, however, the impact on patient loss and income from SARS CoV-1 in Taiwan has been studied between 2000 and 2003. Significant reductions in dental care (16.7%) have been observed, so fears of COVID-19 significantly affected people's care-seeking behaviour and this fear compromised their accessibility to quality care [61].

Anxiety and fear of becoming infected with COVID-19 among dentists has also been studied in a cross-sectional study with 669 participants from different countries around the world. More than two-thirds were found to be frightened by the effects of the virus and 90% were aware of recent changes in treatment protocols. Dentists around the world, despite their high level of knowledge, are in a state of fear while working due to the impact of the virus [62]. A multi-country study found that in general, most dentists had good knowledge and practice scores with respect to SARS-CoV-2 [63]. As fear among the population to visit dentists after the outbreak of COVID-19 could decrease the demand for conservative dental treatment and increase emergency treatment [59].

## 6. Conclusions

The SARS-CoV-2 virus outbreak has had many immediate complications for dentistry, some of which may have more long-term repercussions in the clinic. COVID-19 forces oral health care personnel to understand the implications of the outbreak in their clinical setting and to be aware of possible changes and updates to protocols. New approaches such as teleconsultation could be very useful. Teledentistry will help to assist patients without the need for contact, reducing consultation time and costs. Modern forms of online information-based education have also seen increased use during the current pandemic. Negative oral health and economic impacts have been observed in the dental sector, however more global studies are needed to examine the health and economic impact that the virus is having on both public and private dental clinics.

## Conflict of interest

The authors declared that there is no conflict of interest.

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## References

[1] Peng X, Xu X, Li Y, Cheng L, Zhou X, Ren B. Transmission routes of 2019-nCoV and controls in dental practice. International Journal of Oral Science 2020 -03-03;12(1):1-6.

[2] Wang N, Shang J, Jiang S, Du L. Subunit vaccines against emerging pathogenic human coronaviruses. Front Microbiol 2020;11.

[3] Brandão TB, Gueiros LA, Melo TS, Prado-Ribeiro AC, Nesrallah, Ana Cristina Froelich Alo, Prado GVB, et al. Oral lesions in patients with SARS-CoV-2 infection: could the oral cavity be a target organ? Oral Surg Oral Med Oral Pathol Oral Radiol 2021 -02;131(2):e45-e51.

[4] Cruz Tapia RO, Peraza Labrador AJ, Guimaraes DM, Matos Valdez LH. Oral mucosal lesions in patients with SARS-CoV-2 infection. Report of four cases. Are they a true sign of COVID-19 disease? Spec Care Dentist 2020 -11;40(6):555-560.

[5] Huang N, Pérez P, Kato T, Mikami Y, Okuda K, Gilmore RC, et al. SARS-CoV-2 infection of the oral cavity and saliva. Nat Med 2021 -03-25.

[6] Xu J, Li Y, Gan F, Du Y, Yao Y. Salivary Glands: Potential Reservoirs for COVID-19 Asymptomatic Infection. J Dent Res 2020;99(8):989-989.

[7] Dziedzic A, Wojtyczka R. The impact of coronavirus infectious disease 19 (COVID-19) on oral health. Oral Dis 2020.

[8] Qu X, Zhou XD. [Psychological intervention for patients with oral disease during the pandemic period of COVID-19]. Zhonghua Kou Qiang Yi Xue Za Zhi 2020;55(4):235-240.

[9] Fallahi HR, Keyhan SO, Zandian D, Kim S, Cheshmi B. Being a front-line dentist during the Covid-19 pandemic: A literature review. Maxillofacial Plastic and Reconstructive Surgery 2020 Dec;42(1):12.

[10] Giudice A, Barone S, Muraca D, Averta F, Diodati F, Antonelli A, et al. Can Teledentistry Improve the Monitoring of Patients during the Covid-19 Dissemination? A Descriptive Pilot Study. Int J Environ Res Public Health 2020;17(10).

[11] The Australian Dental Association. 2020; Available at: https://www.ada.org.au/Covid-19-Portal/Cards/Dental-Profesionals/Practice-Policies/ADA-Guidelines-for-Teledentistry. Accessed Aug 29, 2020.

[12] Your 5 Moments for Hand Hygiene Dental Care. 2012; Available at: https://www.who.int/gpsc/information_centre/es/. Accessed Nov 8, 2020.

[13] Nejatidanesh F, Khosravi Z, Goroohi H, Badrian H, Savabi O. Risk of Contamination of Different Areas of Dentist's Face During Dental Practices. Int J Prev Med 2013 -5;4(5):611-615.

[14] Baghizadeh Fini M. What dentists need to know about COVID-19. Oral Oncol 2020 06;105:104741.

[15] Checchi V, Bellini P, Bencivenni D, Consolo U. COVID-19 dentistry-related aspects: A literature overview. Int Dent J 2020 Jul 05,.

[16] Comparison of FFP2, KN95, and N95 Filtering Facepiece Respirator Classes. 3M Science. Revision 4. Techn Bull 2020 May:1-3.

[17] CDC. Implementing Filtering Facepiece Respirator (FFR) Reuse, Including Reuse after Decontamination, When There Are Known Shortages of N95 Respirators. 2020; Available at: https://www.cdc.gov/

coronavirus/2019-ncov/hcp/ppe-strategy/decontamination-reuse-respirators.html. Accessed Nov 7, 2020.

[18] Strategies for Optimizing the Supply of N95 Respirators. 2020; Available at: https://www.cdc.gov/coronavirus/2019-ncov/hcp/n95-other-respirators.html. Accessed Nov 7, 2020.

[19] Lu C, Liu X, Jia Z. 2019-nCoV transmission through the ocular surface must not be ignored. The lancet (British edition) 2020;395(10224):e39.

[20] Ortega KL, Rech BdO, Costa ALF, Sayans MP, Braz-Silva PH. Is 0.5% hydrogen peroxide effective against SARS-CoV-2? Oral Diseases 2020;n/a(n/a).

[21] K.L. Ortega, B.O. Rech, G.L.C. El Haje, C.B. Gallo, M. Pérez-Sayáns, P.H. Braz-Silva. Do hydrogen peroxide mouthwashes have a virucidal effect? A systematic review . 2020;0(0).

[22] Eggers M. Infectious disease management and control with povidone iodine. Infectious Diseases and Therapy 2019 Dec;8(4):581-593.

[23] Kampf G, Todt D, Pfaender S, Steinmann E. Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents. The Journal of hospital infection 2020;104(3):246-251.

[24] Yoon JG, Yoon J, Song JY, Yoon SY, Lim CS, Seong H, et al. Clinical Significance of a High SARS-CoV-2 Viral Load in the Saliva. Journal of Korean medical science 2020 May 25,;35(20):e195.

[25] Vergara-Buenaventura A, Castro-Ruiz C. Use of mouthwashes against COVID-19 in dentistry. Br J Oral Maxillofac Surg 2020 -10;58(8):924-927.

[26] Villani FA, Aiuto R, Paglia L, Re D. COVID-19 and Dentistry: Prevention in Dental Practice, a Literature Review. Int J Environ Res Public Health 2020 06 26,;17(12).

[27] Samaranayake LP, Reid J, Evans D. The efficacy of rubber dam isolation in reducing atmospheric bacterial contamination. ASDC J Dent Child 1989 Nov-Dec;56(6):442-444.

[28] Samaranayake LP, Peiris M. Severe acute respiratory syndrome and dentistry: A retrospective view. J Am Dent Assoc 2004 Sep;135(9):1292-1302.

[29] Meng L, Hua F, Bian Z. Coronavirus Disease 2019 (COVID-19): Emerging and Future Challenges for Dental and Oral Medicine. Journal of Dental Research 2020 05;99(5):481-487.

[30] Kampf G, Todt D, Pfaender S, Steinmann E. Corrigendum to "Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents" [J Hosp Infect 104 (2020) 246-251]. J Hosp Infect 2020 Jun 17,.

[31] van Doremalen N, Bushmaker T, Morris DH, Holbrook MG, Gamble A, Williamson BN, et al. Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1. New England Journal of Medicine 2020 April 16,;382(16):1564-1567.

[32] Zhang Y, Leung NHL, Cowling BJ, Yang Z. Role of viral bioaerosols in nosocomial infections and measures for prevention and control. Journal of aerosol science 1970;117:200-211.

[33] Veena HR, Mahantesha S, Joseph PA, Patil SR, Patil SH. Dissemination of aerosol and splatter during ultrasonic scaling: A pilot study. Journal of infection and public health 2015 May;8(3):260-265.

[34] Allison JR, Currie CC, Edwards DC, Bowes C, Coulter J, Pickering K, et al. Evaluating aerosol and splatter

following dental procedures: Addressing new challenges for oral health care and rehabilitation. Journal of Oral Rehabilitation ;n/a(n/a).

[35] Morawska L, Tang JW, Bahnfleth W, Bluyssen PM, Boerstra A, Buonanno G, et al. Environment international. Environment international 1978;142:105832.

[36] Howard-Reed C, Wallace LA, Ott WR. The effect of opening windows on air change rates in two homes. J Air Waste Manag Assoc 2002 Feb;52(2):147-159.

[37] Ge Z, Yang L, Xia J, Fu X, Zhang Y. Possible aerosol transmission of COVID-19 and special precautions in dentistry. Journal of Zhejiang University. B. Science 2020 May;21(5):361-368.

[38] US EPA O. What Is a HEPA Filter? 2019; Available at: https://www.epa.gov/indoor-air-quality-iaq/what-hepa-filter-1. Accessed Nov 6, 2020.

[39] Qureshi Z, Yassin MH. Role of ultraviolet (UV) disinfection in infection control and environmental cleaning. Infectious Disorders Drug Targets 2013 Jun;13(3):191-195.

[40] Hamzavi IH, Lyons AB, Kohli I, Narla S, Parks-Miller A, Gelfand JM, et al. Ultraviolet germicidal irradiation: Possible method for respirator disinfection to facilitate reuse during the COVID-19 pandemic. J Am Acad Dermatol 2020 -6;82(6):1511-1512.

[41] Martinelli M, Giovannangeli F, Rotunno S, Trombetta CM, Montomoli E. Water and air ozone treatment as an alternativesanitizing technology. J Prev Med Hyg 2017 -3;58(1):E48-E52.

[42] Maret D, Peters OA, Vaysse F, Vigarios E. Integration of telemedicine into the public health response to COVID-19 must include dentists. International Endodontic Journal 2020;53(6):880-881.

[43] Smith AC, Thomas E, Snoswell CL, Haydon H, Mehrotra A, Clemensen J, et al. Telehealth for global emergencies: Implications for coronavirus disease 2019 (COVID-19). J Telemed Telecare 2020 June 1,;26(5):309-313.

[44] Bhanushali P, Katge F, Deshpande S, Chimata VK, Shetty S, Pradhan D. COVID-19: Changing Trends and Its Impact on Future of Dentistry. International journal of dentistry 2020 May 29,;2020:1-6.

[45] Alabdullah JH, Daniel SJ. A systematic review on the validity of Teledentistry. Telemed J E Health 2018;24(8):639-648.

[46] Chang T, Hong G, Paganelli C, Phantumvanit P, Chang W, Shieh Y, et al. Innovation of dental education during COVID-19 pandemic. Journal of Dental Sciences 2020 Aug 19,.

[47] Mariño R, Ghanim A. Teledentistry: A systematic review of the literature. J Telemed Telecare 2013;19(4):179-183.

[48] Bigony L. Can you go the distance? Attending the virtual classroom. Orthopedic Nursing 2010 Nov-Dec;29(6):390-392.

[49] Swartzwelder K, Clements P, Holt K, Childs G. Confronting Incivility in the Online Classroom. Journal of Christian Nursing: A Quarterly Publication of Nurses Christian Fellowship 2019 Apr/Jun;36(2):104-111.

[50] Thilakumara IP, Jayasinghe RM, Rasnayaka SK, Jayasinghe VP, Abeysundara S. Effectiveness of procedural video versus live demonstrations in teaching laboratory techniques to dental students. Journal of Dental Education 2018 Aug;82(8): 898-904.

[51] Abdul-Razzak S. Evaluation of the first year of Dental Health Partnerships: a web-based distance learning partnership between UK dental educators and students from low-resource countries. British Dental Journal 2018 08 10,;225(3):252-256.

[52] Chen Y, Hsue S, Lin D, Wang W, Chen J, Lin C, et al. An application of virtual microscopy in the teaching of an oral and maxillofacial pathology laboratory course. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontics 2008 Mar;105(3):342-347.

[53] Broudo M, Walsh C. MEDICOL: Online learning in medicine and dentistry. Academic Medicine: Journal of the Association of American Medical Colleges 2002 Sep;77(9):926-927.

[54] Towers A, Field J, Stokes C, Maddock S, Martin N. A scoping review of the use and application of virtual reality in pre-clinical dental education. British Dental Journal 2019 03;226(5):358-366.

[55] Mardani M, Cheraghian S, Naeeni SK, Zarifsanaiey N. Effectiveness of virtual patients in teaching clinical decision-making skills to dental students. Journal of Dental Education 2020 May;84(5):615-623.

[56] Sayáns MP, Petronacci CMC, Reboiras D, Gándara P, Torreira MG. Percepción por los docentes de la Facultad de Medicina y Odontología de la USC sobre la docencia virtual y sincrónica tras la crisis del Covid-19. Rev Esp Edu Med 2020 /10/19;1(2):53-64.

[57] AlKlayb SA, Assery MK, AlQahtani A, AlAnazi M, Pani SC. Comparison of the effectiveness of a Mobile phone-based education program in educating mothers as Oral health providers in two regions of Saudi Arabia. J Int Soc Prev Community Dent 2017;7(3):110-115.

[58] Guo H, Zhou Y, Liu X, Tan J. The impact of the COVID-19 epidemic on the utilization of emergency dental services. Journal of Dental Sciences 2020 March 16.

[59] Barabari P, Moharamzadeh K. Novel Coronavirus (COVID-19) and Dentistry–A Comprehensive Review of Literature. Dent J (Basel) 2020 -5-21;8(2).

[60] Chamorro-Petronacci C, Martin Carreras-Presas C, Sanz-Marchena A, A Rodríguez-Fernández M, María Suárez-Quintanilla J, Rivas-Mundiña B, et al. Assessment of the Economic and Health-Care Impact of COVID-19 (SARS-CoV-2) on Public and Private Dental Surgeries in Spain: A Pilot Study. Int J Environ Res Public Health 2020 -7;17(14).

[61] Chang H, Huang N, Lee C, Hsu Y, Hsieh C, Chou Y. The Impact of the SARS Epidemic on the Utilization of Medical Services: SARS and the Fear of SARS. American Journal of Public Health 2004 Apr 1,;94(4):562-564.

[62] Ahmed MA, Jouhar R, Ahmed N, Adnan S, Aftab M, Zafar MS, et al. Fear and Practice Modifications among Dentists to Combat Novel Coronavirus Disease (COVID-19) Outbreak. International Journal of Environmental Research and Public Health 2020 04 19,;17(8).

[63] Kamate SK, Sharma S, Thakar S, Srivastava D, Sengupta K, Hadi AJ, et al. Assessing knowledge, attitudes and practices of dental practitioners regarding the COVID-19 pandemic: A multinational study. Dental and Medical Problems 2020 Jan-Mar;57(1):11-17.