Universidad Europea

GRADUATION PROJECT

Degree in Dentistry

IMPACT OF COVID-19 IN THE DENTAL PRACTICE

A review

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ABSTRACT

Introduction: COVID-19 has caused a remarkable impact on dental practices. The main goal was to restrict the transmission of illness to both patients and dental healthcare workers because there was a high danger of cross-infection, but simultaneously it was necessary to treat patients who needed urgent or emergency dental care; **Objectives:** The principal objective is to analyse the recommended measures in dental practices during the COVID-19 outbreak. The secondary objectives are to understand which transmission routes, to assess if digital technologies could minimize the risk, to evaluate if teledentistry could be a good solution; **Material and Method:** The 22 medical publications that were used were found using PubMed, ScienceDirect, and MEDLINE full. Additionally, 10 articles were found in the library of the European University of Madrid. All articles have been published between 2020 and 2023; **Results:** The three areas that best summarized the findings were the prevention of infection, the primary method of virus transmission and the pandemic's psychological effects. Each item in every category is given a complete explanation, along with pertinent statistics, figures, and drawings. There are 11 topics covered in this article, including epidemiology, suggested protocol to diminish the danger of virus in a dental environment, psychological consequences on dental personnel and patients, and teledentistry as a temporary fix; **Conclusion:** The observations confirmed that dental practices handled the COVID-19 pandemic unerringly by following safety instructions at a very quick phase of the epidemic, identifying the three main transmission routes, implementing fully digital workflows to replace the existing workflows, which also helped reduce costs and time, and using teledentistry more frequently than they had before the pandemic.

Keywords

Dentistry; Coronavirus; SARS-CoV-2; COVID-19 and dental practice; Dental aerosol and COVID.

RESUMEN

Introducción: La COVID-19 ha causado un impacto significativo en las prácticas odontológicas. El objetivo principal era restringir la transmisión de la enfermedad tanto a los pacientes como al personal sanitario, ya que existía un elevado peligro de infección cruzada, pero simultáneamente era necesario tratar a los pacientes que necesitaban atención odontológica urgente o de emergencia; **Objetivos:** El objetivo principal es analizar las medidas recomendadas en las prácticas dentales durante el brote de COVID-19. Los objetivos secundarios son entender qué rutas de transmisión, evaluar si las tecnologías digitales podrían minimizar el riesgo, evaluar si la teleodontología podría ser una buena solución; **Material y método:** Las 22 publicaciones médicas que se utilizaron se encontraron utilizando PubMed, ScienceDirect y MEDLINE completo. Además, se encontraron 10 artículos en la biblioteca de la Universidad Europea de Madrid. Todos los artículos han sido publicados entre 2020 y 2023; **Resultados:** Las tres áreas que mejor resumían los hallazgos eran la prevención de la infección, el método de transmisión del virus y los efectos psicológicos. Cada tema de cada categoría recibe una explicación completa, junto con las estadísticas, cifras y dibujos pertinentes. En este artículo se tratan 11 temas, entre ellos la epidemiología, el protocolo sugerido para reducir el riesgo en un contexto odontológico, las consecuencias psicológicas sobre el personal y los pacientes, la teledentalidad como solución temporal; **Conclusiones:** Las observaciones confirmaron que los consultorios dentales gestionaron la pandemia de forma infalible siguiendo las instrucciones de seguridad en una fase temprana de la pandemia, identificando las tres vías de transmisión, implantando flujos de trabajo totalmente digitales para sustituir los flujos de trabajo existentes, lo que también ayudó a reducir costes, tiempo, y utilizando la teledentistería con más frecuencia que antes de la pandemia.

Palabras clave

Odontología; Coronavirus; SARS-CoV-2; COVID-19 y práctica odontológica; Aerosol dental y COVID.

TABLE OF CONTENTS

I. INTRODUCTION

A broad viral family identified as coronaviruses is known to cause individuals to develop superior lung infections. SARS “severe acute respiratory syndrome”, a coronavirus that first developed in November 2002, investigated to produce a severe acute breathing disorder. MERS, a type of coronavirus that initially developed in 2012, produced “Middle East respiratory syndrome”. SARS-CoV-2, a coronavirus infection, all have since appeared late in 2019, so called COVID-19. Due to the virus' extremely contagious nature, it must be remembered that it had spread through civilized society at an alarming rate. The World Health Organization (WHO) termed this new virus cause lung infection "Corona Virus Disease" “COVID-19” in February 2020, whereas the “International Committee on Taxonomy of Viruses” (ICTV) offered the name "SARSCoV-2" (1).

After learning of the large number of infected individuals and fatalities initiated by a coronavirus, which is ubiquitous in animals and can infect humans. The virus itself consists of a lipid layer, an envelope, and a substantial amount of single-stranded RNA (2). The WHO confirmed that COVID-19 was a pandemic on March 11, 2020, since it has spread globally (3).

Four subfamilies have been identified for the coronavirus: alpha, beta, gamma, and delta. It was believed to transmit from animal to people and its origin is still unknown but there was a supposition that it emerged for the first time from Wuhan market in China.

After a mean incubation time of five days (range: 0-24 days), the predominant clinical signs, which are respiratory, start to manifest (2). 80% of infected people are asymptomatic, according to some data, while the number of fatalities and positive asymptomatic cases varies substantially between countries. The earliest signs of upper respiratory infections include fever, cough, nasal congestion, fatigue, and other symptoms. In nearly two-thirds of patients, the infection progressed to a serious disease with dyspnea and severe lung congestion (2).

Some of the strict measures being widely applied to impede the communal increase of virus include social lockdowns, quarantines, travel bans, and the obligation to wear facemasks in public (4).

As of April 26, 2020, there have been more than 205,000 fatalities and more than 2.9 million cases worldwide.

Dental practitioners are one of the sectors most at risk for both transmission and illness due to the coronavirus' ability to spread through aerosols during various frequent dental procedures (2). Clinical signs can be completely absent, mildly flu-like or serious respiratory disease. People who have concomitant conditions such as diabetes, hypertension, and ischemic heart diseases suffer more symptoms than healthy people (5). The majority of infected children and adolescents showed few or no symptoms, however they had high viral loads and potentially spread the infection (6).

COVID-19 transmission is varied and can occur in a variety of ways, including coughing and sneezing, contact with virus-infected surfaces, and breathing aerosols (7). The COVID-19 pandemic, for which there was initially no cure or vaccine, has grown to be one of the largest public health problems of our century due to its high infection rate and mortality (8). It continuously mutates into new versions, some of these novel variations have been proven to be more aggressively transmissible. However, research has demonstrated that all of the available vaccinations are effective at avoiding severe illness brought on by these new variants (6).

Although it is essential and not possible to refuse patients who require emergency dental care, Dentists should be mindful of lowering the spread of infection to both dental teams and patients. Therefore, requirement for personal protection equipment (PPE), which protect medical personnel or other persons from becoming polluted, has increased. PPE basics include gloves, a mask, and a gown (2). It has become vital to update both preventative and therapeutic dental practice regimens (7). Both blood and saliva samples collected from COVID-19 patients were shown to contain the active virus (9).

The infection possibility occurred between patients and dental professionals may be significant due to the diagnostic characteristics of dentistry field. Therefore, hospitals and dental clinics in COVID-19-affected nations urgently required strict and effective infection control procedures.

However, a fuller understanding of the traits of SARS-CoV-2 was essential for developing prevention measures that would eventually stop the disease's spread (10). The health sector, particularly in the supply of dental care, saw the need for the deployment of additional steps to halt the disease's potential spread (8).

Justification of the topic

Covid-19 was identified as a latest species of virus which came to our world making a devastating number of fatalities. The disturbance of our global economy affected by the epidemic was overwhelming, with a big amount of people becoming poor and significantly increased famine around the world.

Now the restrictions and the special rules linked the pandemic are lifted in most of the countries, it would be the best period that we are together to assist the most easily affected nations.

We are not sure that the pandemic is completely over, but we are sure that we still don’t have the adequate medication to treat the disease. The vaccine has been modified to adapt the new variants every day.

Therefore, “Covid-19 and dental impact” is always an important and relevant topic to investigate in our field. We are trying to be ready in case it comes back, and we are also preparing for the next outbreak of a highly transmissible and volatile virus that has no known treatment.

II. OBJECTIVES AND HYPOTHESES

- The principal objective is to analyse the recommended measures in dental practices during the COVID-19 Outbreak.

- The secondary objectives are:

1. To understand which transmission routes of COVID-19 existed in the clinic.
2. To assess if digital technologies could minimize the risk of infection.
3. To evaluate if teledentistry could be a good solution during the pandemic.

III. MATERIALS AND METHODS:

1. Database Search

32 articles published between 2020 and 2023 have been selected by using PubMed, ScienceDirect and MEDLINE complete using the digital portal of the library CRAI DULCE CHARCON from the European University of Madrid. Information on new coronaviruses and dental infection management was provided by the research presented.

2. Inclusion criteria

- Articles in the English language, publication year range between 2020 and 2023, meta-analyses, case reports, cohort studies, systematic reviews.

- Keywords included in the title or abstract, full texts available, and pdf shown.

3. Exclusion criteria

- Studies that were not in English or irrelevant to people and animal studies.

- Titles or abstracts not relevant.

- When full PDF or full texts were not available.

4. List of keywords used for the search strategy

“Dentistry”, “Coronavirus”, “SARS-CoV-2”, “Covid-19 and dental practice”, “Dental aerosol and COVID”.

5. Search equations used

Pubmed is the most well-known descriptors in the health sciences. I prefer to utilize this database because I've used it for a long time, so I know that, there, I can find reliable and accurate references for my thesis and because I could choose the Advanced section and type the keywords one at a time into the query field. Using boolean operators like "AND" and "OR," the search was conducted by entering the terms all at once.

My search criteria on PubMed were as follows: (((dentistry) AND (Coronavirus)) OR (SARS-CoV-2)) AND (Covid-19 and dental practice)) AND (Dental aerosol and COVID).

Methods (search equations) used to search articles through various databases (Table 1).

Table 1: Data base consults for bibliographic searching

DATA-BASE	EQUATIONS	FILTERS	ARTICLES FOUND
PUBMED	(((dentistry) AND (Coronavirus)) OR (SARS-CoV-2)) AND (Covid-19 and dental practice)) AND (Dental aerosol and COVID).	Year: from 2020 to 2023 Species: humans Language: English Full text	100 results
SCIENC-EDIRECT	(((dentistry) AND (Coronavirus)) OR (SARS-CoV-2)) AND (Covid-19 and dental practice)) AND (Dental aerosol and COVID).	Year: from 2020 to 2023 Article type: review articles Subject areas: medicine and dentistry.	71 results
CRAI DULCE CHARCO-N	(((dentistry) AND (Coronavirus)) OR (SARS-CoV-2)) AND (Covid-19 and dental practice)) AND (Dental aerosol and COVID).	Year: from 2020 to 2023 Systematic review Language: English Species: humans	79 results

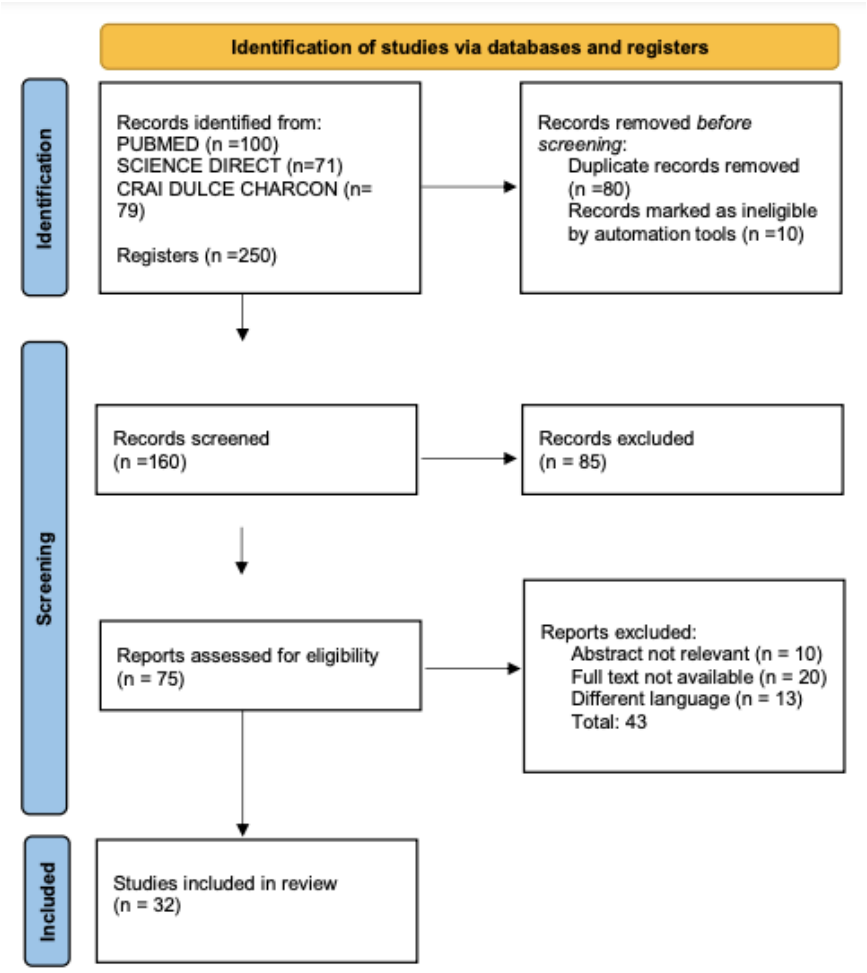
IV. RESULTS

1. Data collection process

First the articles were identified, then duplicate articles were eliminated. All remaining articles were reviewed to assess their eligibility by reading the title, abstract and keywords, by verifying that they met the inclusion criteria and by ensuring that they adjusted to the objectives of the review. In a final screening, the articles were selected or rejected by reading the full text.

2. Flowchart of the data selection among 32 articles

Prisma flow chart displaying the ways to select data from beginning (figure 1)



From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

Figure 1: Prisma flow chart of bibliographic search workflow.

3. Tables of the search results

Out of the 32 articles used, the chosen articles were picked based on pertinent features related to the topic being covered. The three key components of these findings are preventive management (Table 2). The typical virus transmission route (Table 3) and psychological impact are as follows (Table 4).

Table 2. SARS-CoV-2 preventive guidelines in dental clinic.

Authors/ Year	Tele-phonic Quest-ionnaire	Tº Measu-rement	Oral rinses	PPE & Hand washing	Hand-piece	Rub-ber Dam	Intra-oral Xray
Peng et al., 2020 (1)	NR	yes	1% hydrogen peroxide	manda-tory	avoid	yes	NR
Rusu et al., 2011 (3)	yes	yes	chlorhexidine gluconate 0.12%	manda-tory	avoid	yes	NR
Induri et al., 2021 (4)	yes	yes	povidone-iodine	manda-tory	Favour aerosol	yes	mini-mize
Covid-19 and Dentistry, 2020 (7)	yes	yes	1% hydrogen peroxide	manda-tory	Yes	yes	mini-mize
Baghizad eh Fini et al., 2020 (11)	yes	should evaluate	cetylpyridinium chloride (CPC)	manda-tory	Favour aerosol	yes	CBCT advi-sed

Authors/ Year	Tele-phonic Quest-ionnaire	Tº Measu-rement	Oral rinses	PPE & Hand washing	Hand-piece	Rub-ber Dam	Intra-oral Xray
Amato A et al., 2020 (12)	yes	Should evaluate	chlorhexidine show less effect for this virus	manda-tory	Hand-pieces without antire-traction valves should be limited	Re-duce air-borne	Intra-oral radio-gra-phic used less than CBCT

NR stands for "not reported" in the article. The consensus among all authors is that rubber dams effectively minimize aerosol.

Table 3. Transmission routes of COVID-19.

Authors/ Year	Aerosol produced	Direct contact: speaking, cough, sneezing	Indirect contact: contaminated surface.
Amante et al., 2021 (13)	Generated during clinical procedures	yes	Yes: inanimate objects
Amato et al.,2020 (12)	Germ can live until 3 hours.	droplets when patients sneeze or cough	Germ can live on surfaces of steel
Basilicata et al., (14)	Aerosol generated during treatment	Respiratory droplets	Virus stays on surface until 72h
Peng et al., 2020 (1)	Aerosol created by handpiece.	Respiratory droplet	Contact and fomites

Table 4: Different authors have shown psychological effects on dental practitioners and patients.

Authors/ Year	Comments
Ettinger et al.,2022 (6)	Because of the isolation, the stress levels of children with special needs or learning difficulties and their caretakers significantly rose. Adults reported increasing drug, alcohol, and tobacco use. The usage of face masks had an influence on those with hearing impairment since they couldn't hear or read lips, which had a crucial impact on their communication. An electronic survey of adult Brazilians revealed a considerable rise in bruxism (teeth grinding), with 47.8% of respondents expressing myofascial pain as a result of the tension brought on by the lockdown.
Atukorallaya and Ratnayake, 2021 (16)	According to multiple reports, the quarantine has exhibited a serious undesirable influence on mental wellbeing worldwide, contributing to an increase in mouth ulceration. Patients also reported aberrant salivary gland function and insufficient secretions as a result of stress and other psychosocial factors. There were numerous societal implications of COVID-19, particularly in poor socioeconomic demographic groups who previously experienced inadequate healthcare. Dental healthcare providers that experienced significant stress also had lower overall performance.

Authors/ Year	Comments
Coke et al.,2021(18)	8.7% of the total dentists claimed to have felt dread, grief, and worries about their future professional prospects. In addition, failing to pay fees led to corporate failure. To support and manage the mental health of dentists throughout the quarantine, guidelines and questionnaires have been established in Korea. The psychological impact on patients and dentists both reduces patient health outcomes. Dentists' worries include infecting coworkers, infecting family members, and getting sick when attending to coughing patients. Patients may delay therapy because of these worries.
Nijakowski et al.,2021 (20)	Since many patients wanted to cancel appointments during the pandemic epidemic, all dentists surveyed stated that they either wished to close their offices or expected a large decline in patient traffic. The report's findings indicated that fear (42.4%), worry (46.4%), and negative attitudes (70.2%) were prevalent.
Khoury Absowi et al.,2022 (29)	General practitioners experienced more stress as a result of providing dental care for children. Because the new limits negatively impacted their daily lives and collaboration, 75% of those who provided care said they felt stressed out.

Authors/ Year	Comments
Ahmed et al., 2020 (30) Ahmed et al., 2020 (30) cont.	Millions of infected individuals around the world who were subjected to isolation, quarantine, and even death by COVID-19 experienced extreme psychological stress and fear. The characteristic of the illness, which has an extremely long evolution stage of up to two weeks, and the lack of an approved treatment only increased people's fear of contracting the illness. Not to mention that dealing with ill patients on a regular basis increased the risk of infection for medical professionals, greatly escalating the psychological toll. The stress that dentists and other oral health professionals experienced from carrying the infection from their practices was increased by COVID-19's lengthy incubation period and ability to survive on various surfaces for up to a few days. The anxiety of being placed in isolation following a confirmed or suspected infection simply added to the suffering of the family members and the strain on the hospital system, which resulted in increased costs.

V. DISCUSSION

1. What is COVID -19

The coronavirus, also known as SARS-CoV-2 or COVID-19. Given that they are zoonotic, this virus family may cause infection from animal to people. This unique virus and the illness caused were totally unidentified previously the outburst in China. This virus comprises a double layer of lipid that cover a great amount of single-stranded RNA. Coronavirus infections frequently result in mild respiratory symptoms in humans (8).

Clinical manifestations

The typical time for COVID-19 incubation is 5 to 6 days, however there was evidence it can persist up to 2 weeks, which is required the home isolation and officially prescribed time for therapeutic surveillance of those who may have been exposed (11). The most prevalent viral symptoms at the beginning of the infection include difficulty breathing, fatigue, fever, dry cough. The majority of the time, these mild symptoms and signs develop gradually. Some people may experience the adverse effects of headache, drowsiness, nausea, vomiting, diarrhea, and stomach discomfort (8). 88% of patients with COVID-19 positive have fever with a body temperature over 37.5 degrees (12).

Lung's alveolar damage, gradual respiratory failure, and finally mortality could result from COVID-19's first symptoms. The hypertensive, diabetic patients and those suffer cardiovascular disease show bad results. Virus loads may be higher in older individuals (8).

Diagnosis

To diagnose the presence of viral infection, it is generally agreed that a recording travel data, actual clinical signs and symptoms, laboratory tests, and chest radiography should be joined (8,11). Oropharyngeal swabs (OPS) have a lower sensitivity than nasopharyngeal swabs (NPS). Serology have been employed as an additional approach, especially if the nasopharyngeal swab was not obtained accurately (14). In a suspected patient followed a single negative test result,

potentially patient carry virus and to be capable of giving infection. Platforms for salivary diagnostics might theoretically be utilized to diagnose COVID-19 (11).

Platforms for salivary diagnostics may be beneficial in making a diagnosis. After entering patient body, the virus can persist in saliva for various days. Furthermore, collecting saliva is a simple, easy, and cheap procedure that needs minimum tools also it can limit the possibility of spread to medical professionals (13). The salivary test is speedier and does not require the use of experts. However, this approach is constantly being refined and must be validated (14).

Treatment

Due to the absence of curative confirmation of treatment thus far, the disease management has been largely supportive (15). Currently, COVID-19 patients are treated by eradicating the virus's source and taking care to avoid and manage infection, which reduces the risk of transmission. Supportive treatment can recuperate a various number of patients, but those with severe conditions need to be cared in hospital.

The most requested after therapeutics were safe vaccines that booster immune responses against virus (8). The AstraZeneca, Pfizer and Moderna vaccines were the foundation of the world's largest immunization program. We have used antivirals, also some antibiotics to treat patients but we need more studies on the administration of these medications to handle oral ulcers caused as consequence of viral infection (16).

Azithromycin: This antibiotic is usually regarded to be safe for adults, children, and pregnant women to take. It is an antibiotic that is recommended for the first treatment of odontogenic infections, particularly in people who are penicillin allergic (2). Pulmonary destruction frequently is the consequence of viral contamination in persons with established SARS-CoV-2 infection. Nevertheless, some patients who suffer pneumonia, bacterial co-infection has been detected. Aside from antibacterial activity, we always don’t have a clear confirmation that azithromycin has any favorable effects on COVID-19 (17).

Chloroquine: It is an antiparasitic medication used to treat systemic lupus erythematosus, persistent ulcerative stomatitis, and primary Sjogren's syndrome.

According to pharmacological modeling and in vitro drug studies, prophylaxis with hydroxychloroquine (new version of chloroquine) at prescribed doses may prevent SARS-CoV-2 infection. Antiviral drug combinations, such remdesivir and chloroquine, have been demonstrated to be highly effective in in vitro infection control trials. However, the limited randomization of clinical research conducted to date raises concerns regarding the veracity of the findings (2).

Ibuprofen and NSAID: Non-steroidal anti-inflammatory (NSAIDs), analgesics were aimed to lighten the symptoms of oral discomfort as it evolved into mostly supportive therapy. It was advised against using ibuprofen to treat COVID-19 because it is possible that the medication could make the infection worse by speeding the production of the protein ACE-2. The National Institute for Health and Care Excellence (NICE) lately declared that we still don't have data from scientific analyses to show that using NSAIDs increases the chance of developing a more serious illness. In this situation, the WHO advises that paracetamol can be given for the most of cases and ibuprofen used as a second choice (2).

2. Epidemiology

The epidemic, which originated in China and spread to 114 other countries, claimed the lives of about 5 million people. In March 2020, we got official announcement from the WHO about the coverage of SARS-CoV-2 and considered as an international pandemic. Children's immune systems and respiratory systems are strong until they turn 18 years old. A number of 300 million cases have been confirmed internationally, and there have also been more than 5 million fatalities, according to the WHO (14). Only 1% of COVID-19-related fatalities included people younger than 50 (7).

Patients are more than 75 years old have the higher risk of dying once they are infected. Infection with SARS-CoV-2 has a 1.4% death rate but a 98.6% recovery rate. In the United States alone, there have been around 231,988 fatalities from COVID-19 (4 November 2020) (18).

Data showed COVID-19 in United States as of November 4, 2020 (Figure 2):

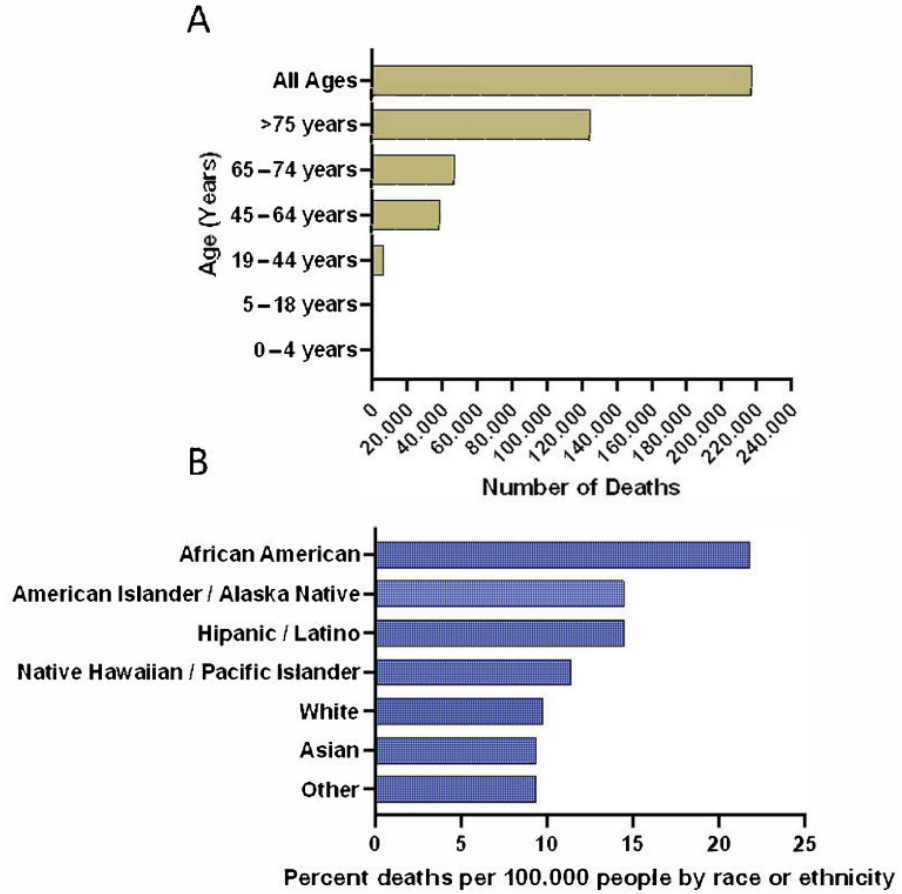


Figure 2: verified COVID-19 instances as of November 4, 2020, in the United States. Age-specific and racial/ethnic group-specific COVID-19 fatality rates are shown in the graphs below (18).

3. Transmission ways of COVID-19

Direct contact: Coughing, sneezing, and droplet inhalation, salivary contact, and close proximity (<1 m).

Indirect contact: whenever we touch contaminated surfaces like doors, tables, or chairs.

Contact with aerosols: it is produced during medical operations; it has additionally been shown to be a reliable source of COVID-19 transfer. Blood samples, which are frequently used for laboratory diagnostic studies, may also transmit SARS-CoV-2 (8,13). Dental workers frequently use rotational instruments like handpieces and air-water syringes. These gadgets' spray

contains sizable drops of saliva, blood, bacteria, and bodily fluids (12). Environmental surfaces or equipment may get contaminated as a result (9,11).

Minor and major salivary gland infection is another route for COVID19 to affect the oral cavity, meaning that our saliva can contain virus that come from salivary gland cells (19).

4. Suggested protocol to decrease the danger of COVID-19 in dental clinic.

The conduction of individual evaluation must be carried out, it is important and critical to reduce the possibility of getting infected, giving us the safety and manage a good treatment (8).

4.1. Patient management

An online survey could be used by conducting a phone call before their entrance (11,12).

A sample questionnaire might contain the following inquiries:

- In the previous 30 days, was COVID-19 diagnosed in you? If YES, swab test results that were negative?
- In the last two weeks, did you have signs and symptoms such as: tiredness, dry cough, nasal obstruction?
- In the last two weeks, have you suffered any alteration of taste? etc.
- One day before coming to clinic, patient must regularly control their body temperature, in case it rises beyond 37.5 C, the visit should be canceled (12).

4.2. Patient's access

An obligation to wear medical masks when seeing the dentist. An assistant with the required tools such as infrared thermometer will take the body temperature for each patient meanwhile the assistant should prevent touching the skin of patients (12). Patients should be in an isolated area with good ventilation, they must respect the social distance from other people. Only when absolutely

necessary should patients bring companions with them to their visits. They will have to use an alcohol-based solution to clean his hands (12).

General guidelines applied for the patient selection who want to assist the urgent treatment amid the epidemic and the internal management in clinic (Figure 3).

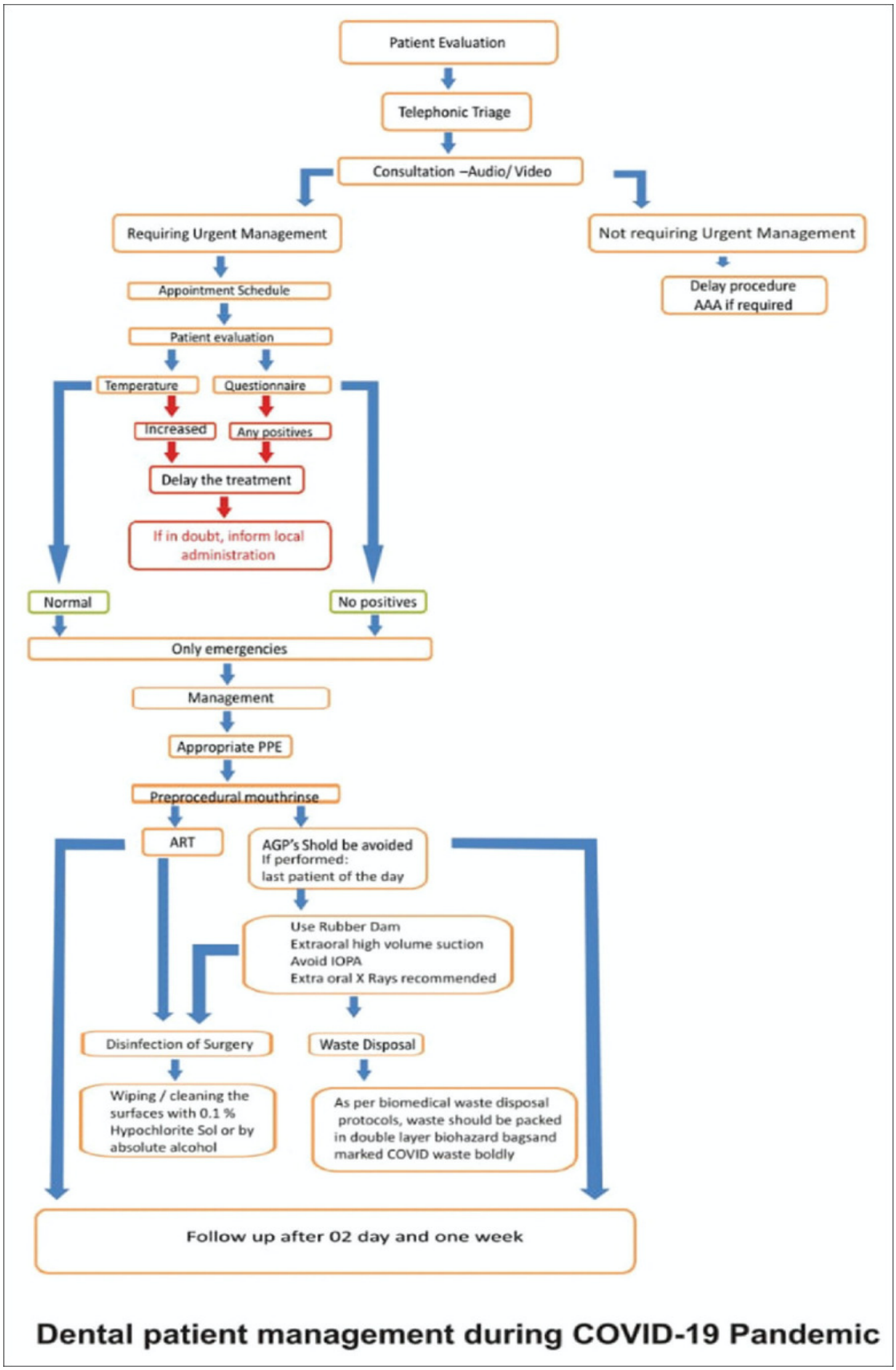


Figure 3: Dental patient evaluation and management during COVID-19 pandemic (5).

4.3. Appointment arrangement and Waiting Room Organization

Patients in the waiting room must respect a minimum 2-meter interpersonal distance, thus appointments are required. Elderly adults or those who have a number of chronic systemic diseases are likely to be more susceptible to COVID-19 infection. It is suggested that they make their appointment early in the workday (12). By advising them to maintain appropriate hand hygiene such as washing hands with alcohol 70% which is set by clinic (21).

4.4. Hand hygiene

To reduce the danger of disease transmission in dentistry practices, the most crucially before and after dental procedures, all dental staff members and patients are strongly advised to use hand sanitizers or antiseptics, preferably administered via a sensor-detected, non-touch technique (12). Peng et al. recommend washing hands before handling patients, after dental procedures after interacting with patients, after contacting non-sterile surfaces, and after touching mucosa or biological fluids (14).

Various steps for handwashing are shown (Figure 4).

Figure 4: Hands washing with hydroalcoholic solution (12).

4.5. Personal Protective Equipment (PPE)

During dental operations, the dentist's face is more likely to become contaminated with oral germs (11). Dental assistants must always wear a face shield, disposable goggles, gloves, and long sleeve gowns as well as other protective gear (8,11,12). Avoid cross-contamination and take precautions against possibly infectious blood or saliva.

High-speed drills and ultrasonic scalers may emit aerosol when conducting dental procedures involving microorganisms, viruses, fungi, saliva, or blood. They are a key source of infection because of this (14). The European authorities encourage dental professionals to use FFP2/ FFP3 typically defined masks or N-95 masks when treating patients, as confirmed by Chinese health services (11,12).

Children usually have much milder symptoms than adults, so dentists caring for children should preserve the highest standards of protection (20).

Recommended personal protective equipment for teamwork (Figure 5).

Figure 5: Equipment for personal protection that dental clinic workers should use when interacting with a probable coronavirus patient (13) and sequence for wearing PPE in dental setting (Figure 6).

Figure 6: The proper technique of clothing on personal protective equipment (PPE) for dental professional (12).

The sequence of removal of Personal Protective Equipment (Figure 7).

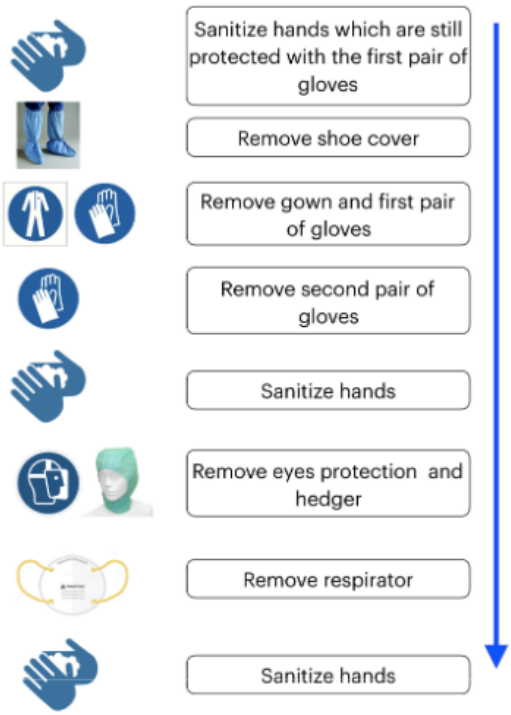


Figure 7: Detailed order removal of Personal Protective Equipment (PPE) for dental professional (12).

All disposable PPE must be placed and covered inside particular waste bags and sprayed with a high-quality disinfectant solution such as 0.5% hypochlorite as soon as potentially infectious droplets and aerosols are produced to minimize or stop their dispersion in the air (12).

4.6. Preprocedural mouth rinses (PPMR)

Research suggests that preprocedural mouth rinses may aid us to lower the number of germs present in the mouth of patient before starting any kind of dental procedure, which may be helpful (13). One of the best techniques is to rinse their mouth out before surgery. The use of PPMR in conjunction with oxidizing agents such as 1% hydrogen peroxide if not we also can use the 0.2% povidone may help to diminish the presence of virus in the patient mouth and, as a result, lower the risk of infection for both patients and dental professionals. Coronaviruses are susceptible to oxidation (13).

4.7. Oral exploration

In dental examinations, bitewing or periapical radiography are widely utilized however, the positioning of the radiography instruments usually results in individuals salivating more and possibly coughing. Cone beam computed tomography (CBCT), panoramic x-ray, and oblique lateral views are suitable substitutes for intraoral dental imaging during the COVID-19 outbreak. All surgical and dental procedures must be done correctly to prevent gag reflexes and sudden coughing (12).

4.8. Dental team accessibility options

Dental practitioners are expected to monitor their body temperatures twice a day. If the clinical operator is considered to have their checking temperature is greater than 37.0 degree, they must stay at home and should not go to work. All members of the dental team are required to wear surgical masks and wash their hands for at least one minute with either running water and soap (Figure 4) or a disinfectant hydroalcoholic solution (12).

Employees should self-quarantine if they have the flu-like symptoms for at least two weeks (22).

4.9. Surface disinfection

The lipid envelope of the COVID-19 virus can be harmed by the wide kind of ordinary disinfectants, which can also render the human coronavirus inactive in less than a minute. The cabinets and chairs must be cleaned with a 0.5% sodium hypochlorite solution (14). In communal zones, all door handles, touchscreens, chairs, workplaces, and monitors should be carefully disinfected (13).

4.10. Aerosol-generating procedures (AGPs)

Before reaching the surface, the small, contaminated droplet can hang out and freely fly in the room for up to three hours (10). AGPs should be avoided wherever possible. It is advised to employ dental rubber dams, high-volume suction, appropriate PPE, and four-handed dentistry (8). Installation of a rubber dam is strongly advocated during therapeutic operations. It is not only to stop the blowout of aerosols but also possibly lower the infectious organic material (12).

4.11. Air management

For patients that we suspect that they could have or confirmed COVID- 19 infection, treatment must preferably take place in an isolation rooms or negative-pressure treatment rooms (13). When performing interventions, the door of the treatment room is recommended to be tightly locked to minimize aerosol spread to nearby areas, particularly when the air conditioning system is running. Hydroalcoholic solutions must be used to routinely clean and disinfect filters while using air conditioning systems. It is advisable to follow the manufacturer's instructions, almost the regular maintenance should be respected in order to prevent potential virus migration to other environments (12).

Some viral aerosols still persist in our office, at any corners after a long working day regardless the air- cooling equipment is switched off. That is why these systems need to be sanitized and cleaned as a result.

4.12. Medical waste

When disposing of household and medical waste created after treating SARS-CoV-2-infected patients, category B infectious clinical waste management practices should be followed (13).

5. Oral signs of COVID-19 patients

Viral infections harm the oral mucosa's epithelial cells, resulting in localized inflammation that frequently appears abruptly and is accompanied by a single cluster of blisters or ulcerations (16).

Tongue epithelial mucosa could appear sores, being related to the increased viral activity. Oral lesions due to SARS-CoV-2 vanished after three to twenty- eight days (16).

Topical or systemic corticosteroids, Systemic antibiotics, antivirals and mouthwashes can all be utilized to treat COVID-19-induced or mucosal lesions. Since they were efficient by diminishing the viral burden in the patient mouth (16,26).

6. Taste and smell loss induced by COVID-19

COVID-19 patients commonly express a loss of taste or smell without nasal congestion as their primary complaint. Between 41% and 62% of COVID-19 respondents claimed to have an STD (smell and taste disorders). Three days after COVID-19 symptoms begin, STD are frequently noted. In COVID-19, STDs are prevalent. Unfortunately, these issues are challenging to resolve. Glucocorticoids, both systemically and locally, have been demonstrated to have certain advantages (24,25).

COVID-19 disrupts the salivary glands, causing a dry mouth and perhaps affecting taste perception. Artificial saliva therapy can help xerostomia patients who have lost their sense of taste. Within two weeks, the majority of patients had recovered from their smell and taste dysfunctions (16).

7. Dental services touched by the epidemic

Dentists are exposed to high levels of viral infections. Several European countries have only allowed emergency dental care (14). Huaqiu Guo et al have realized a study of 2537 patients, the result show that dental infections increased from 51.0% to 71.9% during the pandemic. Lesions of the pulp, cellulitis, and acute abscesses are the most frequent reasons that lead patients go to the emergency services. There is cause to believe that after COVID-19, there will be a major increase in demand for dental services (11).

8. Mouthwash amid COVID-19

Mouthwashes show the capacity to diminish the various germs in patient mouth, that is why they are frequently employed for almost dental procedures, especially before starting surgical treatments. We are not certain regarding specific information on the efficiency and security of antimicrobial rinses in positively infected patients (26).

In dentistry, conventional antiseptic mouthwashes include:

- Chlorhexidine (CHX, antiseptic agent): 0.12% CHX has been commented that it does not demonstrate or just shows a little effect in comparison with other rinses (26).

- Hydrogen peroxide (H2O2): Coronaviruses and influenza viruses have been found in an in vitro study to be vulnerable to 1% hydrogen peroxide. It is advisable to follow the preprocedural mouthwashes with oxidative agents to lower the viral burden in saliva (26).

- Cetylpyridinium chloride (CPC): It has been demonstrated that CPC has an antiviral effect on people who are suffering from influenza. These studies also state that coronaviruses could be controlled by CPC agent (26).

- Iodopovidone (PVP-I): It has been used widely as a mouthwash and a skin antiseptic prior to surgery. Utilizing mouthwash with 0.23% Iodopovidone

prior to treatment, according to recent research, may reduce the number of viruses in the saliva (26).

Conventional mouthwashes of recommendation:

0.12% CHX of 15 ml.

1.5% or 3% H2O2 of 15 ml.

0.05% CPC of 15 ml.

0.2%, 0.4% or 0.5% PVP-I of 9 ml (26).

9. Advantages of digital workflow in dentistry during pandemic in comparison with traditional method

Once the virus has entered the body, the septic saliva secreted by these salivary gland cells can be a significant cause of infection. When administering prosthetic treatments, dentist comes into contact with trays and potentially contaminated prostheses (27). Traditional impression-making techniques might induce the gag reflex, which makes the patient cough and emit more saliva. It is recommended to use alcohol solution diluted to 70% or hypochlorite solution to further sterilize impressions and models before transferring them to the lab (14).

Dental impressions entering a dental laboratory carry a sizable danger of contamination, according to numerous examinations. Traditional prosthetics require a number of complicated stages, because of this reason it can cause cross-infection between laboratory and clinical personals. Dental professionals' hands may become contaminated if dental impressions contain patient biological fluids like blood or saliva.

Dental technicians are increasingly exploiting the new technology called computer-aided design/computer-aided manufacturing (CAD/ CAM): It significantly reduces expenditures and working hours as compared to traditional workflow. Additionally, it requires fewer stages, which reduces the likelihood of

error. The intraoral scanner's Standard Triangle Language format (STL) file is delivered to the dental professional in real-time using only digital technology.

Comparison between conventional and digital prosthetic workflow (Figure 8):

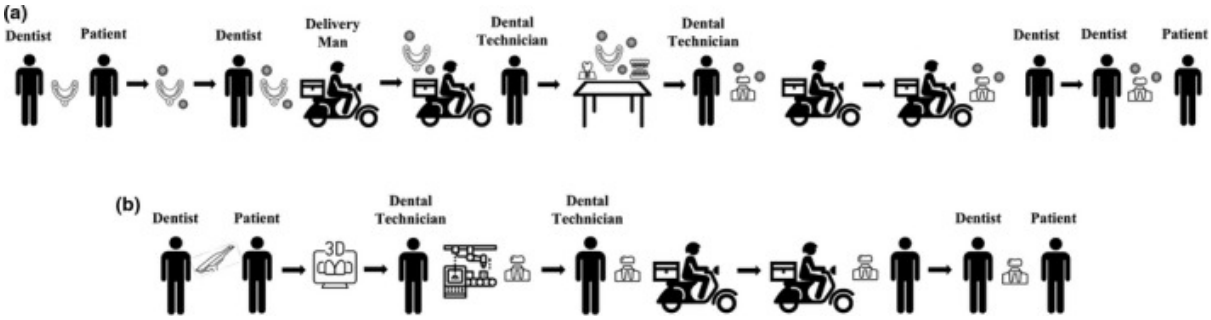


Figure 8: (a) Conventional prosthetic workflow, b) Digital prosthetic workflow (28).

A digital workflow has fewer steps and takes less time to complete than a traditional method. Since there is no need for a physical impression or transportation, there are fewer appointments. A fully digital approach should be utilized to lower the risk of getting infected in prosthodontics during the lockdown (28).

10. Psychological effects on dental professionals and patients

Treatment of the pediatric population causes general practitioners and pediatric specialists to feel more stressed. Unlike adults, children frequently contract COVID-19 with no symptoms. The dentist is therefore unable to identify potential young patients who could serve as a major infection source while undergoing treatment. 428 dentists in total responded to the study, the report stated high levels of stress in 24%. Stress levels have an impact on medical decisions and treatment strategies due to personal and emotional variables. Due to the COVID-19 outbreak, both children and adults were suffering anxiety (29).

Social isolation negatively impacts the emotional, psychological, physical, and financial well-being of pediatric patients. This shouldn't be ignored because it might manifest in how cooperative they are throughout dental care (29).

Furthermore, there is no proven treatment, which makes the idea of catching the disease much more terrifying. Regularly treating sick patients increases a healthcare worker's risk of contracting infectious diseases. A significant portion of dentists reported a wish to close their practices, which could have had a negative financial impact on dentists and other dental healthcare providers (30).

Dentists were concerned about spreading the sickness to their loved ones, getting sick while treating patients who were coughing, and getting sick from their coworkers. Patients who experience these worries may put off starting therapy. A person's outlook could be negatively impacted by quarantine. Dentists also voiced worries about their future careers, describing scenarios in which they might lose their enterprises because of a lack of resources (18). Men appear to express anxiety more physically and verbally, despite the fact that women frequently do so more than men do (31). The COVID-19 outbreak has affected dental schools in a various mode, including labor levels, building occupancy laws, and human resources. If students belonged to specific age groups or had significant medical risks, the institution offered the option to teach remotely (32).

11. Teledentistry considered as a temporary solution.

Teledental care was hardly ever used before the epidemic. During the outbreak, patients who were vulnerable and impossible to come for presential treatments because of a medical condition. Teledentistry was deployed to solve the provisional issues. It became a vital tool for diagnosis and management via telephone and online consultation as well. Any patient who was having excruciating tooth pain may be tested and evaluated using this inexpensive method. These patients may be given analgesics or antibiotics. A decision must be made regarding whether the patient can receive care in the dentist's office or if a hospital emergency department needs to be contacted. Patients who reside in rural areas or who have mobility or transportation challenges may benefit from teledentistry by receiving oral health counseling. In the vast majority of dental issues, a claim has been made that in-person care should not be replaced by teledentistry (6).

VI. CONCLUSIONS

After perusing 32 articles, I have come to the following conclusions in the context of the findings examined and the extensive aforementioned discussion process in this thesis:

Regarding the primary goal

The primary goal was to analyse the recommended measures in dental clinics during the outbreak and, yes, we did have particular precautions that were swiftly approved and helped a great deal to survive the initial wave of the massive instances of infection that can be considered to be the worst period in the history of modern medicine.

The main recommendation was to postpone routine non-emergency cases like obturations or cleaning until further notice of sanitary guidance. Only emergency cases whose patients could prove they were not infected by COVID-19 were treated in the clinic, and those suspected or positive to COVID-19 were sent to the hospital.

Then, cautious guidelines for treating patients who arrived at the clinic for treatment were created to maintain operations despite the lack of a treatment or medication for COVID-19. They included examining the patient for infections, setting up a triage area, keeping a safe distance of two meters, washing hands, donning PPE masks and gloves, using rubber dams during therapy, and more.

Regarding the subsidiary goals

1. Although the transmission channels are still up for question, three main routes were discovered relatively early in the pandemic:
    i. Direct contact, such as when the patient sneezes or coughs.
    ii. Indirect contact or fomite, such as when the medical professional touches a surface that the patient has contaminated, like a door handle or the surface of a table.
    iii. Aerosols produced by handpieces.

2. A fully digital workflow has been implemented and has significantly decreased the risk of contamination by reducing the need for physical direct and indirect contact, while simultaneously improving the quality of care, reducing costs, and speeding up the process, for example, the fully digital prosthetic workflow using CAM/CAD.

3. Teledentistry was used more frequently during the pandemic to replace some procedures, such as diagnosis, although it could only be utilized up until the patient needed treatment and had to be transported to a clinic or a hospital. The outcome is therefore mixed because teledentristry has proven to be only a portion of the remedy.

Finally, we can state that the COVID-19 pandemic has been effectively managed from the perspective of dental practices thanks to the following actions:

a) Application of safety guidance made available at an initial phase of the epidemic.
b) Identification of three main transmission routes.
c) Introduction of fully digital workflow as alternatives to the current workflow with the added benefits of cost and time reduction.
d) Use of teledentristy as a partial replacement for face-to-face consultations.

As a result, dental offices are now well prepared for the next respiratory illness pandemic. Reviews like the one presented here can help in the interim by more precisely identifying the cost-to-benefit ratio of the various actions and recommendations made as well as by introducing additional measures and recommendations as our comprehension of the environment of a coronavirus pandemic improves.

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