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Dental Management of Patient with Coronavirus Disease (COVID -19)

A Project Submitted to the Pedodontics and Preventive Dentistry department in the college of Dentistry / University of Baghdad in partial Fulfillment of the Requirement to Award the Degree of B.D.S.

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Certification of the Supervisor

I certify that this project entitled **"Dental management of patient with Coronavirus Disease"** was prepared by the fifth-year student **Mohammed Jouda Flaeeh** under my supervision at the College of Dentistry/University of Baghdad in partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry.

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Date: 28/4/2022

Declaration

I declare that the work in this dissertation has been carried by me and I have faithfully and properly cited all source used in the dissertation.

Mohammed Jouda Flaeeh

2022

Dedication

To my heart family who stand with me at every step and never let me alone till this moment of my life and have the most role in my success, they gave me the power to stay strong and never fall down.

To my father, I want to tell him that I did it, I promise him that I will make him proud of me, thank you for all you have done throughout my life, you raised me, protected me and taught me all you know.

To my mother who always considers me the best.

To my all friends thank you for being by my side today and always.

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List of contents

List of contents

List of figures

List of Abbreviations

CDC…….Center For Disease Prevention andControl

CT scan……Computerized Tomography

E protein…… Envelope protein

HEPA……. High-Efficiency Particulate Air Filter

M protein…….Membrane protein

mRNA…… .messenger Ribo Nucliec Acid

N protein…… Nucleocapsid protein

NIOSH…….National Institute of Safety and Health

PPE……..Personal Protective Equipment

RNA…… Ribo Nucliec Acid

S protein…… Spike protein

SARS…….Severe Acute Respiratory Syndrome

WHO……World Health Organization

μm……micrometer

Introduction

Severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) was initially identified in patients presenting with pneumonia of unknown origin in Wuhan, China, in December 2019 (Zhu et al., 2020) and was later established to be the causative agent of coronavirus disease-2019 (COVID-19). On January 30, 2020, the World Health Organization (WHO) declared the spread of this disease as a public health emergency owing to the high mortality rate of 3.4% (Sohrabi, 2020 ; WHO, 2020).

COVID-19 symptoms range from undetectable to deadly, but most commonly include fever, dry cough, and fatigue. Severe illness is more likely in elderly patients and those with certain underlying medical conditions. Infection mortality ratio is lowest among children aged between 5 and 9 years and increases loglinearly with age (O'Driscoll et al., 2021).

COVID-19 transmits when people breathe in air contaminated by droplets and small airborne particles containing the virus. The risk of breathing these in is highest when people are in close proximity, but they can be inhaled over longer distances, particularly indoors. Transmission can also occur if contaminated fluids reach the eyes, nose or mouth, and, rarely, via contaminated surfaces. Infected persons are typically contagious for 10 days, and can spread the virus even if they do not develop symptoms. It can also happen if contaminated fluids are splashed or sprayed on contaminated surfaces (CDC, 2020).

Maintaining social distance by staying at home, enacting travel bans, washing hands frequently, masks and gloves are all recommended as personal protective equipment for preventive strategies that can help lower the chance of transmission and illness (Lai et al., 2020).

Healthcare professionals are at the biggest risk of infection since they are on the front lines and in close contact with patients. As a result, many health care workers have COVID-19, and several have died as a result (Cascella et al.,2020).

Dental professionals have been practicing increased infection control and taking universal precautions since the 1980s HIV epidemic (Kohn et al., 2003).

Nevertheless, oral health professionals are among those occupations at the highest risk for COVID-19, as reported by The New York Times (Gamio, 2020).

Dental care personnel face challenges because of their proximity to infected patients. These patients' mouths are open and unmasked during treatment, significantly increasing the potential for direct and indirect exposure to infectious materials. The Occupational Safety and Health Administration designates the performance of aerosol-generating procedures on known or suspected COVID-19 patients as "very high risk". Shortages of personal protective equipment (PPE) and the use of instruments and equipment that generate aerosols containing oral and respiratory fluids only compound the risk (CDC, 2020).

Two of the highest aerosol-creating procedures involve inventions that have been considered major advances in dental practice, because they are faster and less painful for the patient: the high-speed handpiece with its water spray coolant and the ultrasonic scaler used by hygienists to remove hard deposits on teeth (Harrel and Molinari, 2004). These dental procedures have become problematic during the pandemic, providing an opportunity to shift to nonaerosolizing procedures and a greater focus on prevention (CDC, 2020 ; Ge et al., 2020).

Aims of the review

This review of literature lights the spot ongoing pandemic COVID-19, focusing on risk management in dental clinic, reflection in dental settings and personal protective equipment (PPE) selection with proper use and measures to be applied in dental office in both public and private practices until the emergency is contained.

Review Of Literature

1- Definition

Coronaviruses are a type of virus. There are many different kinds, and some cause disease. A coronavirus identified in 2019, SARS-CoV-2, has caused a pandemic of respiratory illness, called COVID-19. It was first identified as an outbreak of respiratory illness cases in Wuhan City, Hubei Province, China". Most people infected with the virus will experience mild to moderate respiratory illness and recover without requiring special treatment. However, some will become seriously ill and require medical attention. Older people and those with underlying medical conditions like cardiovascular disease, diabetes, chronic respiratory disease, or cancer are more likely to develop serious illness. Anyone can get sick with COVID-19 and become seriously ill or die at any age (Who, 2020).

Up to 31 January 2020, the outbreak has infected 9720 people in China, resulting in 213 deaths, and 106 persons in 19 other countries, according to (WHO, 2020). Several independent laboratories identified the causative agent of this impenetrable pneumonia as a new coronavirus (Lu et al., 2020).

The World Health Organization has given the causing virus the temporary designation severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and the pointed infected sickness the term coronavirus 2019 (COVID-19) (He et al., 2020).

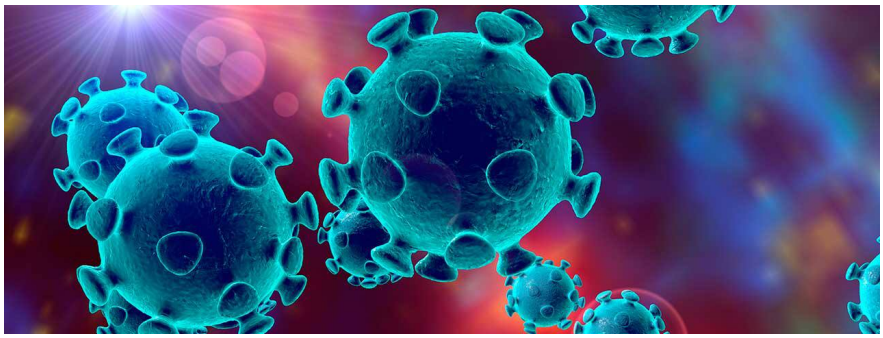

Figure 1 : SARS CO-V-2 (Mirabelli et al., 2021).

2- Structure of the Virus

Coronaviruses are large, roughly spherical particles with unique surface projections (Goldsmith et al., 2004). Their size is highly variable with average diameters of 80 to 120 nm. Extreme sizes are known from 50 to 200 nm in diameter.(Masters, 2006). The total molecular mass is on average 40,000 kDa. They are enclosed in an envelope embedded with a number of protein molecules (Lalchhandama, 2020).The lipid bilayer envelope, membrane proteins, and nucleocapsid protect the virus when it is outside the host cell (Neuman et al., 2011). Under the electron microscope, they resemble a crown, hence they're called corona-viruses. They have a whole length of around 32 kb, and they act as mRNA during duplicate polyprotein translations. SARS-CoV-2 as shown in figure 2 has a similar structure as SARS-CoV-1 as shown in figure 3, with virion sizes ranging from 70 to 90 nm, spherical or pleomorphic enveloped particles containing single-stranded RNA, and spike-like glycoprotein projections on their surface (Pal et al., 2020).

Figure 2 : SARS COV-2
(Huber et al., 2021).

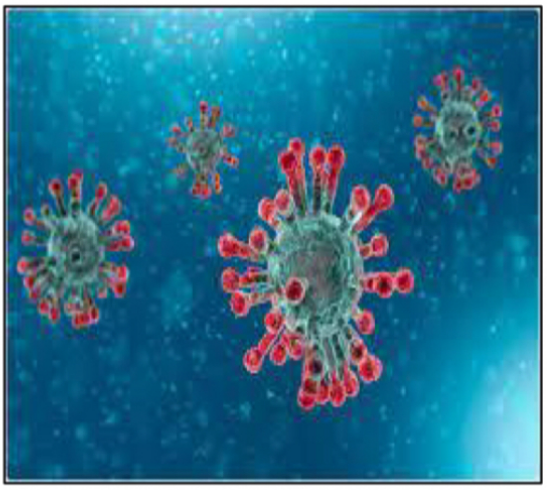

Figure 3 : SARS-COV-1
(Kohmer et al., 2020).

Coronavirus genome encodes several structural and nonstructural proteins as shown in figure 4, the structural proteins are responsible for host infection, membrane fusion, viral assembly, morphogenesis, and release of virus particles (Da Costa et al., 2020).

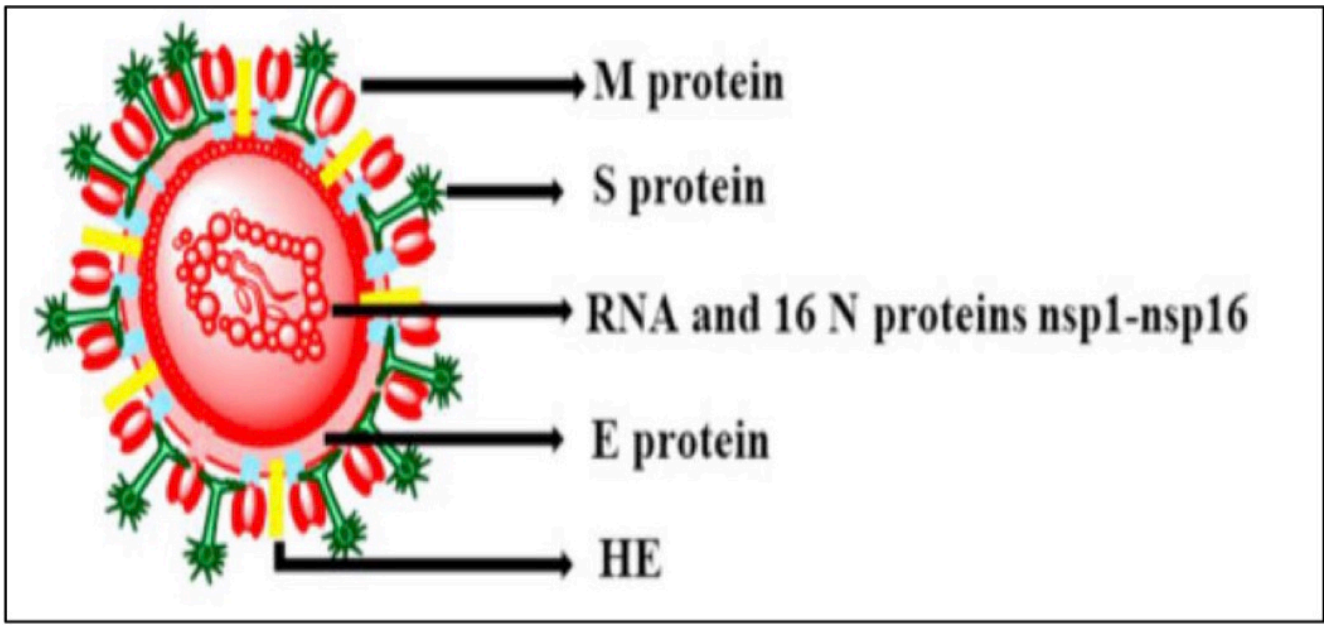

Figure 4 : Virus Structure

(Agrahari et al., 2021).

The spike (S) protein, nucleocapsid (N) protein, membrane (M) protein, and envelope (E) protein are the four primary structural proteins. The S glycoprotein, which is responsible for the virus's spikes, has the ability to bind to receptors and fuse with host membranes (Agrahari et al., 2021).

For viral replication and transcription, nonstructural proteins are essential (Da Costa et al., 2020).

SARS-CoV-2 is unique among coronaviruses in that it has one of the most robust protective outer shells. As a result, it's likely to be highly resistant in saliva and other bodily fluids, as well as outside the body. Due to resistance to antimicrobial enzymes in the body's fluids, an infected body is more likely to discharge more virus particles. These particles are also more likely to persist for extended periods of time. These variables may explain why SARS-CoV-2 is more contagious, and they may have ramifications for efforts to stop it from spreading (Goh et al., 2020).

3- Signs and symptoms

Symptoms are variable, ranging from mild symptoms to severe illness (CDC, 2021). Common symptoms include headache, loss of smell (anosmia) and taste (ageusia), nasal congestion and runny nose, cough, muscle pain, sore throat, fever, diarrhea, and breathing difficulties. People with the same infection may have different symptoms, and their symptoms may change over time. Three common clusters of symptoms have been identified: one respiratory symptom cluster with cough, sputum, shortness of breath, and fever; a musculoskeletal symptom cluster with muscle and joint pain, headache, and fatigue; a cluster of digestive symptoms with abdominal pain, vomiting, and diarrhea (CDC, 2020). In people without prior ear, nose, and throat disorders, loss of taste combined with loss of smell is associated with COVID-19 and is reported in as many as 88% of cases.(Paderno et al., 2020).

People who show symptoms, 81% develop only mild to moderate symptoms (up to mild pneumonia), while 14% develop severe symptoms (dyspnea, hypoxia, or more than 50% lung involvement on imaging) and 5% of patients suffer critical symptoms (respiratory failure, shock, or multiorgan dysfunction) (CDC, 2020).

At least a third of the people who are infected with the virus do not develop noticeable symptoms at any point in time.These asymptomatic carriers tend not to get tested and can spread the disease.(Goa et al., 2021). Other infected people will develop symptoms later, called "pre-symptomatic", or have very mild symptoms and can also spread the virus (Furukawa et al., 2020).

In the lungs, a CT scan may detect uneven shadows as well as ground glass opacity (Chinese CDC, 2020; Guan et al, 2020). Chest X-rays are the most common and economical because the lungs are the principal organ involved (Chamorro et al., 2021) as shown in Figure 5.

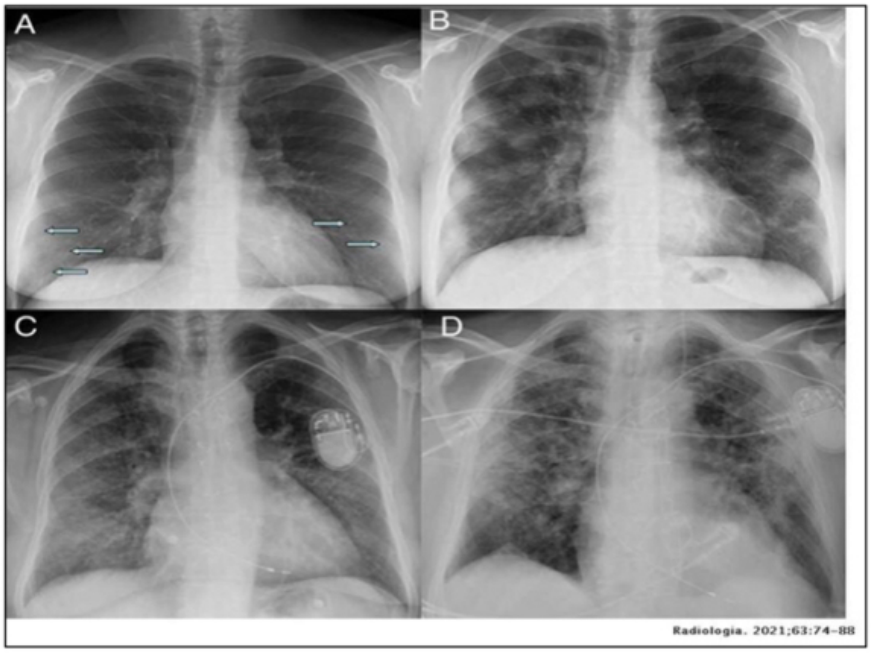

Figure 5 : Lung X-ray of COVID-19 patient

A, Bilateral peripheral mid and lower air spaces B, Peripheral bilateral opacities C, Paches of consolidation D, Bilateral air space consolidation

(Jacobi et al., 2020).

The severity of COVID-19 patients is linked to their tongue appearance, mild and moderate COVID-19 cases usually had a light red tongue with a white coating, whereas severe COVID-19 cases had a purple tongue with a yellow coating and a greasy coating. The percentage of critical patients having a painful tongue has risen to 75% (Pang et al., 2020).

4- COVID 19 Linkage to Oral Health

The oral cavity is well known as a potential reservoir for respiratory pathogens. It houses more than 700 bacterial species or phylotypes (Aas et al., 2005). Viral respiratory infections predispose patients to bacterial super-infections. It was found that severe COVID-19 cases were significantly associated with secondary bacterial infections(Feng et al. , 2020). Moreover, several trials have linked COVID-19 severity to high SARS-CoV-2 viral load in the nasal and oral cavity(Fajnzylber et al., 2020).

Coronavirus has led to closure and reduced hours of dental practices except for emergency and urgent services, limiting routine care and prevention. Dental care includes aerosol-generating procedures that can increase viral transmission. The pandemic offers an opportunity for the dental profession to shift more toward nonaerosolizing, prevention-centric approaches to care and away from surgical interventions. Regulatory barrier changes to oral health care access during the pandemic could have a favorable impact if sustained into the future (Zachary and Jane, 2020).

Researchers discovered that COVID-19 patients with gum disease were 3.5 times more likely to be admitted to the intensive care unit, 4.5 times more likely to need a ventilator, and 8.8 times more likely to die when comparing to those without gum disease. Until now, no other research has been published about the destructive effects of gum disease in patients with COVID-19 (Nadya et al., 2021).

5- Risk Factors

Populations at higher risk for many chronic diseases are similar to those at higher risk for developing oral diseases. Common risk factors include stress, poor diet, alcohol and tobacco use, substance misuse, behavioral health issues, domestic violence, and poverty. Many of these factors have been heightened during the pandemic. These and other social determinants of health lead to both exacerbation of chronic disease and poor oral health outcomes (Watt and Sheiham, 2012).

Populations vulnerable to COVID-19, including those in low socioeconomic groups, minority groups, older adults, low-literacy individuals, those in rural areas, and the uninsured are also at increased risk for oral disease and associated systemic health problems. (Zachary and Jane, 2020).

Minority populations are especially at risk during the COVID-19 pandemic. The Centers for Disease Control and Prevention notes that “non-Hispanic blacks, Hispanics, and American Indians and Alaska Natives generally have the poorest oral health of any racial and ethnic groups in the United States,”and these same

populations have disproportionately higher incidence of COVID-19–related infection and death (CDC, 2020).

Among those hospitalized with COVID-19, diabetes and cardiovascular disease are 2 of the most prevalent underlying comorbidities (CDC, 2019).

Periodontal disease is associated with diabetes and cardiovascular disease, although causality is difficult to ascertain because of confounding evidence, and few randomized trials or longitudinal studies have been conducted on the effects of treatment (Winning and Linden, 2017).

Researchers note, “The COVID-19 pandemic has alarming implications for individual and collective health and emotional and social functioning” and that “health care providers have an important role in monitoring psychosocial needs and delivering psychosocial support to their patients” (Pfefferbaum and North, 2020).

Research suggests a strong association between oral health conditions like erosion, caries, and periodontal disease and mood conditions like stress, anxiety, depression, and loneliness (Kisely, 2016).

There are other potential connections downstream between COVID-19 and oral health. The COVID-19 pandemic’s impact on mental health, pandemic-related increases in oral health risk factors, and anticipated declines in per capita dental visits, increasing integrated practice and referrals between dental providers and behavioral health providers will be prudent. Similarly, increased efforts to more effectively integrate dental programs focused on prevention, screening, and risk assessment within primary care, obstetrics and gynecology, and pediatric offices should be pursued to expand access to oral health services for vulnerable populations (Atchison et al., 2020).

6- Coronavirus Transmission and Dental Practice

Biologic risk of COVID-19 inhalation transmission is extremely high when performing dental procedures due to the use of handpieces under irrigation, which favors the diffusion of aerosol particles of saliva, blood, and secretions. Moreover, this production of aerosol facilitates the contamination of the environment and instruments, dental apparatuses, and surfaces (Meng et al. 2020; Peng et al., 2020).

Given the direct contact transmission, the mucosa of the oral cavity has been recognized as a potentially high-risk route of SARS-CoV-2 infection, as well as contaminated hands, which could facilitate virus transmission to patients (Xu et al., 2020).

SARS-CoV-2 is mostly transmitted through respiratory droplets and close contact. Virus particle transmission is caused by respiratory droplet dissemination (droplets having a diameter of 5-10 μm). When a person is in close proximity (less than 1.5 meter) to a COVID -19 patient with respiratory symptoms (e.g., coughing or sneezing), the droplet is transmitted, increasing the risk of infection of the oral, nasal, and eye mucosae and eyes (Vukkadala et al., 2020 ; WHO, 2020). SARSCoV-2 can also be spread through the eyes; the microbe enters the eye via droplets, then move along the nasolacrimal ducts and into the respiratory pathways (Lu et al., 2020).as shown in Figure 6.

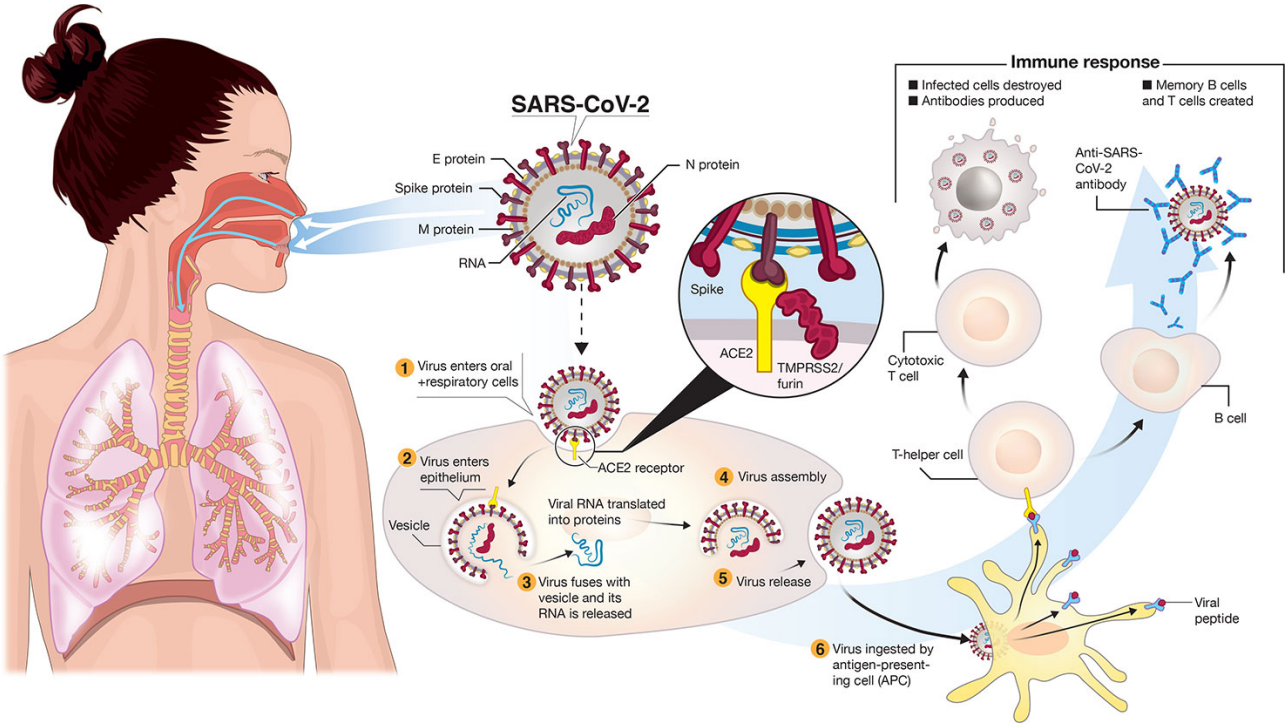

Figure 6: COVID 19 Transmission

(Colin et al., 2020).

Transmission may also occur through fomites in the immediate environment around the infected person (Ong et al, 2020). Therefore, transmission of the COVID-19 virus can occur by direct contact with infected people and indirect contact with surfaces in the immediate environment or with objects used on the infected person (e.g., stethoscope or thermometer) (WHO, 2020). Due to long-term exposure to high concentrations of aerosols paired with certain variables that promote aerosol generation, aerosol transmission in a restricted space produces environmental contamination (Vukkadala et al., 2020 ; WHO, 2020).

In this way, different studies remarked that dental clinics might be a possible contagion source of viruses. These viruses can be transmitted to the patients and also the practitioner during dental practice. In a dental setting, the risk of acquiring infection from the micro-droplets of an infected patient is high, because the dentist and their equipment are in close vicinity to the patient (Parvaie et al., 2018 ; Alharbi et al., 2021).

7- COVID 19 and Dentistry

Coronavirus thought to spread via close contact through respiratory droplets and aerosols. Owing to specific characteristics of dental care such as aerosol generation as well as close proximity to patients, dentistry is thought to be associated with the nosocomial spread of infection. The risk of bidirectional spread of infection between patient and dental care providers makes it critical to take additional precautionary measures to mitigate the spread of COVID-19. It is essential to understand that the guidelines for providing dental treatment during the COVID-19 pandemic will vary across the globe, and dental practices should be in compliance with their regional guidelines (Tonkaboni et al., 2021).

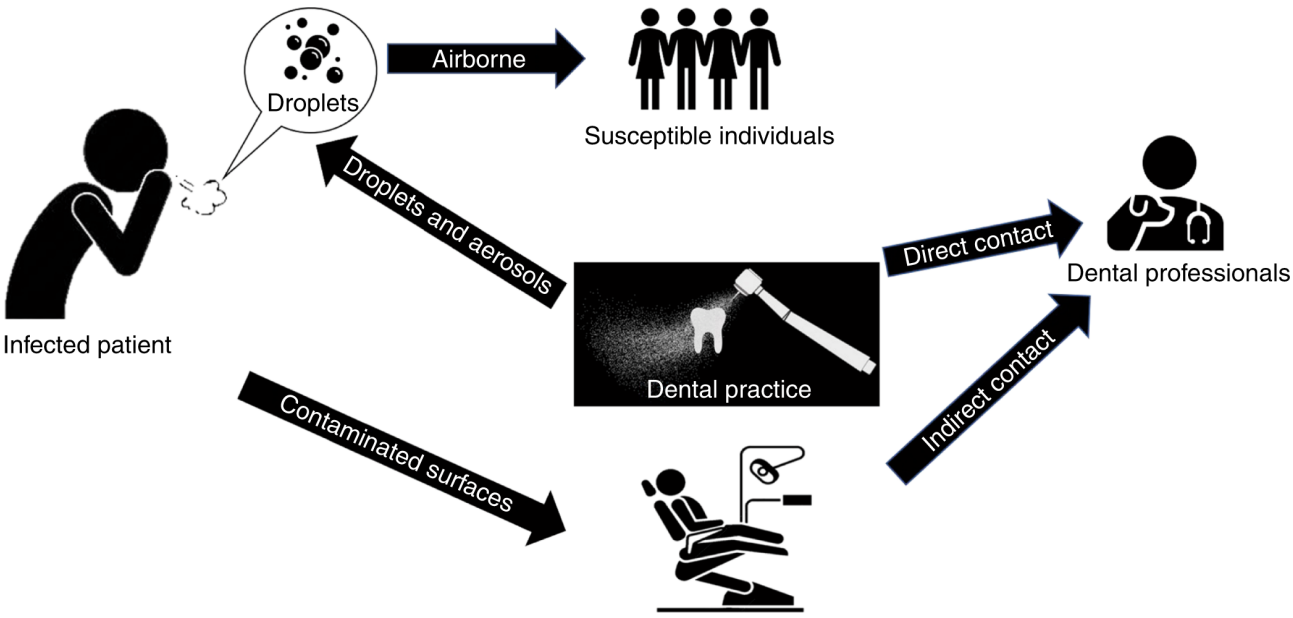

Figure 7: Transmission routs of COVID-19 in dental clinic.
(Peng et al., 2019).

As a result, the use of disinfectants beside personal protective equipment is still necessary for dental profession's proper development, according to American Dental Association (ADA, 2020). The rapid spread of SARS-CoV-2 has necessitated changes to dental practice's preventive with treatment strategies.

During the incubation period, the patients show no signs or symptoms, but they are potential carriers of the SARSCoV2 virus, which means they can spread the disease to others. As a result, effective disease control is extremely difficult (Rothe et al., 2020).

Dentists, even more than nurses, physicians, and pharmacists, are at the highest risk of exposure (Gamio et al., 2020). In such circumstances, dental management of patients requires certain precautions that have not been practiced before. Precautions must be taken not only during the management phase and at the peak of the disease, but also during the remission period to avoid reinfection (Falahchai et al., 2020).

8- Dental Practice and Infection Control

Before, during, and after dental operations a possible droplet and aerosol transmission of COVID-19 can occur, thus infection prevention and control measures for dental professionals will be indicated (CDC, 2020).

The given suggestions are based on WHO (2020) and the American Dental Association (ADA) interim guidelines for decreasing the risk of COVID-19 transmission, as well as guidance for healthcare professionals for infection prevention and control during healthcare when COVID-19 is suspected (CDC ; ADA, 2020).

During the COVID-19 epidemic, the American Dental Association suggested three algorithms as temporary advice to help dentists and dental offices make educated judgments about patient triage, evaluation, and treatment:

(1) Triaging patients for emergency and urgent dental care (ADA, 2020).

(2) COVID-19 infection screening in emergency and urgent dental patients in order to determine whether they can be treated in the dental office (ADA, 2020).

If feasible, use virtual/remote technologies or the telephone to assess patients prior to their visits. Otherwise, triage should be at the service or should be done on arrival to the service (ADA, 2020).

The goal is to guarantee that only individuals who require immediate or emergency treatment are treated, and that they do not have any symptoms that might indicate COVID-19 infection or past risk exposure. It's essential to remember that not everyone infected with SARS-CoV-2 develops symptoms, and even those who don't can spread the virus to others (WHO, 2020).

3) Assessing patients' pandemic risk (ADA2020).

9- Precautions to Take in the Event of a Dental Emergency

9-1 Precautions in Waiting Areas

In dental clinics, waiting areas are common sites where there is a higher risk of cross infection between patients and accompanying individuals or dental team employees. As a result, reducing the number of people in or near the waiting rooms is critical, as is socially isolating them by advising patients to either attend for their dental appointments unaccompanied or to wait outside in a car until the dental staff is ready to fulfill the patient's needs. Second, because SARSCoV2 may live for long periods of time on a variety of surfaces, significant adjustments to the design and setup of the waiting room are necessary to prevent cross-contamination (Van Doremalen et al., 2020).

These include removing any superfluous objects from waiting areas, such as undesired furniture, periodicals, and toys, all of which might contain virus particles on their surfaces. In the waiting room, social separation must also be enforced, with the seating places being 2 m apart. Dental clinic attendants should be reminded to use face masks properly and to not contact surfaces at all times as shown in Figure 8.

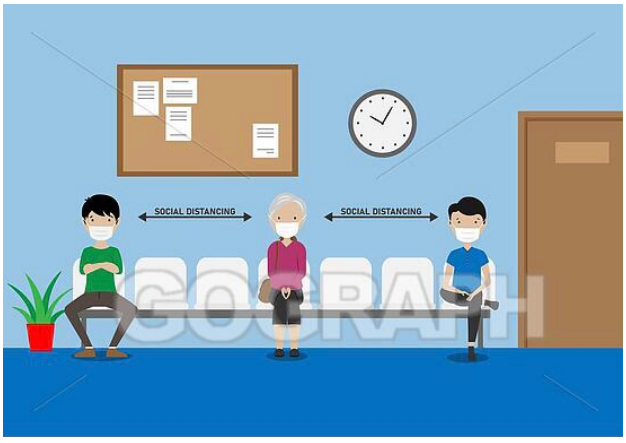

Figure 8: Dental waiting area (Cicciù et al., 2020).

Cleaning "high-touch" surfaces on a regular basis is also recommended (reception counter, toilet doors, door knobs and handles etc.) employing a neutral pH detergent (Ge et al., 2020).

Patient-related info graphic pictures exhibiting optimum hand hygiene practices, controlling cough etiquette, the idea of “social distancing” that are clearly intelligible should be presented in the common spaces (New Zealand Dental Association, 2020).

Furthermore, because elevator buttons may lead to infection transmission, all patient arriving for treatment or advice should be disinfected on a regular basis according to local requirements (Kandel et al., 2014).

9-2 Equipment for personal protection

One of the most common ways for SARSCoV2 to spread is inspiration of virusladen aerosols (Nejatidanesh et al., 2013). Furthermore, contaminated droplets infecting the eyes conjunctival epithelium have been linked to viral transmission (Lu et al., 2020).

As a result, to provide an effective and efficient barrier against the aerosol hazards created by the working site, personal protection equipment (PPE) must be worn. Protective eyewear, a face mask, and a shield, as well as a disposable working helmet, appropriate gloves, gowns, and impervious foot covers, are all advised (Lu et al., 2020).

When a dentist must undertake aerosol-generating operations for an unavoidable cause, a specific respirator with at least as much protection as an NIOSH-certified N95, European Standard Filtering Face Piece 2 (EU FFP2), or similar must be worn in conjunction with high volume suction (Kohn et al., 2003).

9-3 Mouthrinse before surgery

Preoperative antibacterial mouth rinse has been shown to decrease microorganisms count in the oral cavity and aerosols produced during dental operations (Eggers et al., 2018 ; Ather et al., 2020).

As a result, numerous organizations have advocated for using a pre-operative mouth disinfectant to reduce the risk of SARSCoV2 spread during dental procedures.

The New Zealand Dental Association advises 30 seconds of one of the following :

- 0.2 percent chlorhexidine (CHX),
- 1 percent hydrogen peroxide,
- 2 percent povidoneiodine or
- 2 percent Listerine before operations.

When mouth rinsing is not possible pre-operatively, soaked swab in 1 percent hydrogen peroxide or CHX can be used instead (NZDA, 2020).

While, the Indian Endodontic Society and the People's Republic of China's National Health Commission have both said that 0.2 percent CHX is ineffective against SARSCOV2, and have advised using 1 percent hydrogen peroxide or 0.2 percent povidoneiodine instead (Indian Endodontic Society, 2020). Pre-procedural mouth rinses with 0.2 percent povidoneiodine are recommended by the American Association of Endodontics (Ather et al., 2020).

9-4 Isolation via rubber dam

Due to viral loading in human saliva is rather high, a pre-procedural mouth rinse may not be enough to minimize the risk; extra precautions, such as dental rubber dam usage, may be required (Spagnuolo et al., 2020).

Rubber dam isolation has been claimed to decrease airborne particles by up to 70% within a 3-foot diameter of the operative place (Peng et al., 2020). As a result, numerous organizations advocate employing a rubber dam for nearly all aerosol-generating dental treatments, not only endodontic operations (ADA, 2020 ; Ather et al., 2020 ; Indian Endodontic Society et al, 2020 ; NZDA, 2020).

During aerosol producing operations, some have advocated rubber dam isolation as well as the usage of large volume saliva ejectors , In the early post pandemic aera, it is strongly recommended to employ dental rubber dams, large volume saliva ejectors, and fourhanded dental aid to eliminate SARS-CoV-2 transmission risk posed by both symptomatic and asymptomatic patients(Indian Endodontic Society, 2020).

9-5 Instruments and materials

As previously stated, dentistry includes the use of rotating dental/surgical tools, which produce a large volume of aerosols containing a combination of saliva, blood, water, bacteria, and other debris. Triplex syringes (3:1), high and low speed hand pieces, ultrasonic scalers, air abrasion devices, and intraoral sandblasters are examples of such equipment. (American Centers of Disease Control & Prevention, 2020).

The New Zealand Dental Association, as well as more dental organizations, advised against utilizing these machines as much as possible, instead emphasizing the use of hand instruments and low-speed hand pieces without water spray to minimize dental aerosols. When utilizing aerosol-generating equipment is inevitable, high-volume saliva ejectors, in addition to the other measures manifested earlier are suggested (Ather et al., 2020; NZDA, 2020).

During pandemic and postpandemic periods, handpiece using with an anti retraction valve or another anti reflux pattern is also advised. Disposable equipment should be used wherever feasible, according to the recommendations (Peng et al., 2020).

9-6 Oral health care environments need to be ventilated

In closed spaces, sufficient ventilation is essential to reduce the risk of transmission in oral health care facilities. Improve ventilation and air exchange in the room as much as possible (door closed, appropriate exhaust ventilation, negative pressure or mechanically ventilated equivalent air exchange capacity in room - an average of 6-12 air exchanges per hour) depending on the type of ventilation available (mechanical or natural). Instead of split air conditioning or other types of airflow technology, consider installing filtration systems. Exhaust fans, whirlybirds , and high-efficiency particulate air (HEPA) filters are some of the options (WHO, 2020) as shown in Figure 9.

a. b. c.

Figure 9: Ventilaton systems a.exhaust fan, b. whirlybirds, c. high-efficiency particulate air (HEPA) filters
(a. Mehta et al., 2021,b. Farook et al., 2020,c. Sabherwal et al., 2020).

9-7 Procedures for cleaning and disinfection in between patients

The coronavirus disease 2019 (COVID-19) pandemic forced public health around the world to implement measures to slow the spread, presenting unprecedented challenges in infection control (Cowling and Aliello, 2020).

Disease transmissions in healthcare facilities can occur in several ways including indirect contact with contaminated high-touch surfaces that have been improperly sterilized (Feng et al., 2021).

The high-speed drill instruments used in dental practices can generate large amounts of aerosols and droplets potentially contaminated that can settle on surfaces presenting a significant danger to spread viruses. Aerosols are smaller particles that can remain suspended in the air for hours and over long distances contaminating the surrounding environment and surfaces when they fall (Peng et al., 2020).

As well as other common nosocomial pathogens, human coronaviruses can persist viable for up to 72 h on surfaces but they can be efficiently inactivated by manual cleaning using validated (Van Doremalen et al., 2020 ; Kampf et al., 2020).

Enveloped viruses, such as the COVID-19 virus, are susceptible to a variety of disinfectants.

- 70% ethyl alcohol for disinfecting tiny areas and articles in between the procedures, like renewable specialized equipment or those that cannot withstand chlorine, according to the (WHO, 2020).
- In health-care facilities, sodium hypochlorite at 0.1 percent (1000 ppm) for cleaning surfaces and 0.5 percent (5000 ppm) for disinfecting significant blood or bodily fluid spills.
- Chlorine solutions that have been freshly produced should be used. In case that this is not practicable and the chlorine preparation should be used for many days, the chlorine concentration should be checked daily (WHO, 2020). All patient-care articles (tools, devices, and equipment) must be sterilized or otherwise treated to high-level disinfection in accordance with Spaulding's standards or the producer guidance for the required periods and heat. (CDC, 2003 ; WHO, 2016).

After cleaning and disinfecting, employees should put on suitable Personal protection equipment. After each patient, junk respirators, surgical masks, gowns, and gloves.

Prior to using, reusable protective eyewear and face shields must be washed, decontaminated. Masks and respirators cannot be reprocessed using any conventional or evidence-based approach. When there is a serious shortage of Personal protection equipment, reprocessing should be explored (WHO, 2020).

10- Specific Therapeutic Considerations in Dentistry

10-1 Oral and maxillofacial surgery

The use of high-volume saliva ejectors during tooth extraction is critical, especially while the patient is in a supine posture. If a suture is necessary, it is recommended that absorbable material be used (Negahdaripour et al., 2020).

For patients with severe toothaches and extensive caries, extraction of the pathogenic teeth instead of restorative therapy may be considered, since this would shorten the

treatment period and lower the risk of infection (Dave et al., 2020 ; Shamszadeh et al., 2020).

10-2 Prosthodontics

To reduce the risk of cross-contamination in prosthodontic laboratories, better disinfection processes of prosthetic materials and impressions are greatly stressed for prosthodontic treatments. Salivary suction is indicated to avoid gag stimulation. At the event that a cemented crown becomes loose, a temporary cement that can be obtained in a medicine shop can be used to reduce discomfort while also preventing the interocclusal and mesiodistal spaces from closing. When a detachable prosthesis causes discomfort, an over-the-counter soft removable liner can temporarily help the patient maintain function and appearance (Ogimi et al., 2019).

10-3 Endodontic and restorative dentistry

The ADA COVID-19 Dental Emergency paper advises that chemomechanical caries removal and manual instrumentation be prioritized over rotary systems if emergency treatment is required (Dutil et al., 2008). In the treatment of symptomatic irreversible pulpitis, a pulpotomy and pulpectomy, or vital pulp therapy, is preferred above standard root canal procedures if possible (Dave et al., 2020 ; Shamszadeh et al., 2020 ; Meng et al., 2020).

10-4 Periodontics

Manual scaling and polishing should take precedence over ultrasonic methods for periodontal therapy (WHO, 2020).

10-5 Radiographs

According to published guidelines, intraoral radiography should be avoided since it might produce a gag reflex, increased saliva production, and coughing in many people. Extra oral radiography techniques like as panoramic and cone beam computed tomography can be used as alternatives during the COVID19 pandemic (Ather et al., 2020 ; Indian Endodontic Society, International Federation of Endodontic Associations, 2020).

11-COVID-19 and pediatric dentistry

Pediatric dentists act as part of the health-care system, deferring elective procedures and responding to emergencies such as cellulitis, severe tooth pain, and oral trauma. Being aware of the symptoms and risks of a new disease, as well as changing office processes to decrease the risk of transmission while checking and treating patients as safely as possible (WHO, 2019).

In terms of COVID-19 infection in children, these infections might be completely asymptomatic or cause mild to moderate symptoms (Ogimi et al., 2019).

COVID-19 infection in children is characterized by fever, dry cough, fatigue, upper respiratory tract infection (runny nose), and gastrointestinal symptoms (anorexia, diarrhea, nausea, and vomiting) (Panahi et al., 2020).

The most common symptoms are fever and a dry cough, and unlike adults, infection of the inferior respiratory tract (the area of the larynx below the vocal folds, as well as the trachea, bronchi, and bronchioles) is unusual in children (Wu and McGoogan 2020 ; Zhou et al., 2020).

Dentists must take additional precautions to decrease the risk of transmission at the dental office due to the infection's weak symptoms in children, the likelihood of aerosol transfer, and the extended period of incubation without symptoms (Bahramian et al., 2020).

The emergency treatments are divided into three levels in this guideline (Bahramian et al., 2020):-

1. Relieving pain in patients (pulpotomy, dry socket, extraction, root canal treatment, removal of sharp fractured restorations or teeth, avulsed teeth).
2. Infection control in advanced or progressive stages (abscess drainage).
3. Hemorrhage control for the patient (bleeding after extraction, suturing laceration)

12- After the Dental Procedure

Following the completion of a dental appointment, professionals should reinforce instructions on social distance and infection control etiquette, according to the ADA (hand and respiratory hygiene). Cleaning and disinfecting the dental office, reusable PPE (goggles and facial shields), and non-disposable and nonsterilized equipment all require special attention (dental x-ray equipment, dental chair and light). Autoclave sterilization is required for all other instruments that come into direct contact with fluids or the oral cavity (ADA, 2020).

13-Going forward opportunities

13-1 Concentration on prevention, promoting non aerosol-producing dental work:

The foundation of public health is prevention. As a result of the COVID-19 pandemic, the dental profession now has the opportunity to shift from a surgical focused approach to one that emphasizes prevention. In this effort, nonsurgical, non-aerosolizing caries prevention and control will be judged (ADA, 2020).

Instructions have been drawn up to shift the dental care paradigm to one that is more preventative in nature (Urquhart et al., 2019).

The main strategies are to reduce well-known risk factors like tobacco, alcohol addiction, and good nutrition with minimal sugars, as well as to use topical fluorides, community water fluoridation, and improve oral hygiene for everyone. These oral health information and interruptions should be used in conjunction with medical settings such as primary care and pediatrics (Urquhart et al., 2019).

There are numerous options for nonsurgical caries prevention and management. Evidence-based materials in dental clinics include dental resin sealants, glass ionomers as sealants, non-traumatic restorative dentistry using hand tools, silver diamine fluoride, sodium fluoride varnish, and other self-applied and topical fluorides (Cianetti et al., 2020).

13-2 Communication Improvement

Communication is critical between patients and healthcare professionals (CDC, 2020).

Surveillance and monitoring are necessary to evaluate whether COVID-19 transmission might occur in the dentistry field. There is no evidence available to estimate the risk of SARS-CoV-2 spreading through dental treatments (Griffin et al., 2016).

The accessibility of PPE for dental treatment, as well as the efficacy of various forms of PPE, should be examined. Most oral health care professionals are hesitant to return to work, and many patients are afraid of going to the dentist. Communication and clarity are especially important with loweducated groups. The approach should include massages on the importance of proper dental health management and its influence on overall health (Brian et al., 2020).

13-3 Advance teledentistry to address access gaps

In today's circumstances of ongoing COVID-19 pandemic, with increasing likelihood of it becoming endemic, the main aim is to avoid person-to-person contact. The word 'tele' means 'distant', and therefore teledentistry satisfies the need for social distancing as has been advocated by the health authorities all across the globe to contain the spread of SARS-COV-2 virus (Ghai, 2020).

Teledentistry (a subunit of telehealth along with telemedicine) is the remote facilitating of dental care, guidance, education or treatment via the use of information technology rather than through direct face-to-face contact with any patient (Khan and Omar, 2013).

Teledentistry is not a new concept and one of the earliest teledentistry projects was started by USA military in 1994 to serve the USA troops all around the world (Rocca et al., 1999].

Over the years teledentistry has proved to be beneficial for remote dental screening, making diagnosis, providing consultation, and proposing treatment plan. It is found to be comparable to real-time consultations in areas with limited access to facilities, in

school children, and in long-term healthcare facilities (Alabdullah and Daniel, 2018 ; Estai et al., 2018).

Teledentistry can be incorporated into routine dental practice as it offers a wide range of applications such as remote triaging of the suspected COVID-19 patients for dental treatment and decreasing the unnecessary exposure of healthy or uninfected patients by decreasing their visits to already burdened dental offices and hospitals (Ghai, 2020).

Teledentistry can be used for education, consultation, and triage, allowing practitioners to advise patients whether their dental problems require immediate or emergency attention, whether a condition can be managed at home temporarily, or whether treatment can be postponed. When many dental offices are closed and most people are remaining at home, teledentistry can assist reduce the strain of individuals seeking dental treatment at overburdened emergency departments and urgent dental care settings. Teledentistry may also be used to expand access to preventative care and oral health education in more traditional settings, such as when dental teams can provide these services in community settings like schools without the need for onsite dentist supervision (Brian et al., 2020).

14-Global concerns of dental and oral health workers during COVID-19 outbreak.

Dentists and other dental and oral health workers are allied members of the frontline healthcare workforce at extreme risk of COVID-19 infection due to generation of aerosols as part of providing dental care (Meng and Hue, 2019).

During previous pandemics, spreads of contagious respiratory diseases such as SARS and the Middle East respiratory syndrome (MERS) were contained following development of protective protocols and enhanced infection control guidelines that enabled provision of dental services in a safe manner (Samaranayake, 2003 ; Eggers et al., 2018).

With the COVID-19 pandemic, various dental associations have taken important steps against the disease. The American Dental Association has set up various ways to

answer dentists' questions about personal protection and safe practice, for example, the recommendation that dentists use PPE and evacuate patients' saliva using a high-volume suction device to minimize aerosol production (Rajeev et al., 2020).

Providing clear and convenient guidelines for managing dental patients by reputable journals and dental associations is essential to ensure lowering risk from dental procedures. A basic concept is that the transmission of the virus occurs mainly through inhalation, eating and drinking and direct mucosal contact with salivary droplets. The virus can also survive on dental equipment for up to 9 days (Peng et al., 2020).

Because viral load in human saliva is high, the use of mouthwash can only reduce the microbial load in the mouth and does not have the potency to completely eliminate COVID-19 (Eggers et al., 2018 ; Mayer, 2020).

Therefore, most guidelines recommend that dentists should not accept a new patient in the current situation, sparing an emergency. This significantly reduces interpersonal contact and patient waiting times and minimizes exposure of patients to the infection. Also, dentists should check patients' fever and ask questions about the patient's general health before attempting any treatment (Alharbi et al., 2020 ; Ge et al., 2020 ; Sabino-silva et al., 2020).

The effects of this crisis on dental services, such as the restriction of dental practices to emergencies, the shutdown of many dental centres and the risks of infection transmission, can be major concerns of dental care providers (Yang et al., 2020).

14-1 Economic concerns

Many dental facilities either shuttered or only provided restricted emergency services during the outbreak since many basic dental operations were almost difficult to perform, generating major financial problems. Oral and dental health workers may hope for government financial aid to continue dental procedures during the COVID-19 outbreak in such tough circumstances (Consolo et al., 2020).

14-2 Ethical concerns

According to the existing data, there are significant ethical considerations for oral and dental health workers during the COVID-19 outbreak. The obligation to limit dental health care to emergency cases at the expense of preventive procedures was the key sub-theme that came up repeatedly. Those in excruciating pain (Caprioglio et al., 2020) or in need of hospital-based treatments may be deemed emergency cases (Yang et al., 2020).

Other concerns include tele-effectiveness dentistry's and the absence of patient privacy while using tele-consultation procedures (Mascitti et al., 2020).

14-3 Social concerns

Social concerns as the psychological concerns of oral and dental workers, such as feelings of anxiety and fear of becoming ill (Ahmed et al., 2020).

Dental workers with high levels of perceived stress or anxiety are thought to have a negative impact on COVID preparation (Ramachandran et al., 2020), hurting their psychological, mental health, and well-being (Sa et al., 2020).

Another component of social concerns is oral and dental health professionals' social responsibility to help members of the public who may lack adequate computer literacy, are old, or originate from rural, distant, or otherwise disadvantaged locations (Mascitti et al., 2020).

14-4 Professional concerns

The immediate impacts of COVID-19 on the oral and dental health profession (Kinariwala et al., 2020) as well as the profession's future are of concern (Consolo et al., 2020). Many factors can influence the future of the oral and dental health profession, including the usage of telehealth, tele-dentistry consulting, and other new technology that dentists may employ (Ghani et al., 2020).

Among other professional considerations, managing patients with special needs must be considered (Dziedzic et al., 2020 ; Wiwanitkit et al., 2020).

Children and people with intellectual and developmental difficulties may have limited cooperation, necessitating longer visits. This is against COVID recommendations/guidelines, which advocate for minimal patient interaction, and could make it difficult to re-establish practices (Peres et al., 2020).

15-Psychological impact of COVID 19 on dental health professional

The SARS-CoV-2 pandemic put a strain on all healthcare workers and has had an impact on how health care is delivered around the world. Health workers and patients have been reported to experience increased anxiety and stress-related symptoms as a result of highly infectious diseases (Boyraz et al., 2020).

Health workers around the world are under constant stress as a result of the COVID-19 pandemic, which includes fear of infection, frustration, exhaustion, and social isolation (Kang et al., 2020).

As a result, it's plausible to suppose that the pandemic's health effects extend beyond those immediately tied to one's personal infection (Holmes et al., 2020).

It is vital that this element of dental health services be recognized due to the high risk of infection when performing routine dental operations and the tight link between infection risk and psychological stress and anxiety (Kang et al., 2020).

The psychological impact of the epidemic on dental professionals is critical for both optimal patient treatment and professional well-being (Uhlen et al., 2021), including feeling discriminated against by others and being socially isolated from family and friends due to employment commitments (CDC, 2020).

Dental professionals who agreed or strongly agreed that their workplace had adequate equipment to handle the current situation as well as any future escalation of COVID-19 were less likely to express feelings of insecurity, however having appropriate equipment in their workplace or working in an environment that could handle both the current situation and any potential COVID-19 escalation did not prevent loss of control (Uhlen et al., 2021).

Conclusion

The purpose of this review is to provide direction to boards of health regarding surveillance, inspection, investigation, education, enforcement, and reporting requirements, with the goal of reducing the risk of contracting blood-borne and other infectious diseases.

Patients should be asked about their symptoms during reminder calls and non-urgent appointments should be rescheduled until the situation stabilizes. To prevent nosocomial infection, the dental operatory should be well prepared, and strict infection control and waste management protocols should be followed. Although the outbreak is currently catastrophic, even after the critical peak has been contained, management is required because cases may remain in the community for months, if not years.

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